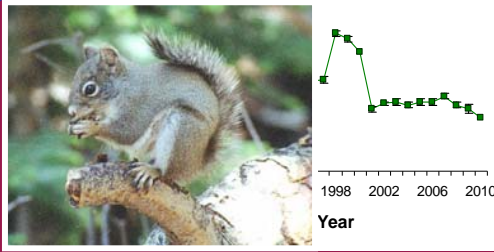


Fire Impacts on Wildlife: Response of Mammals



John L. Koprowski
School of Natural Resources and the Environment
University of Arizona

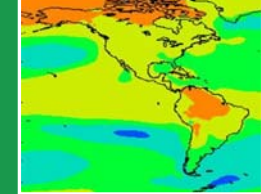
Seeking Science-based Solutions



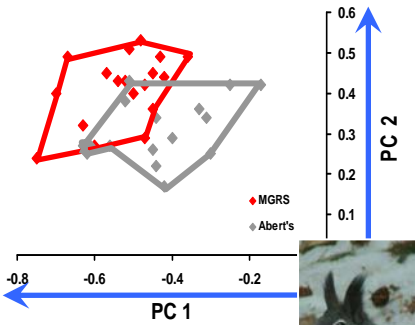
Endangered Species



Forest & Climate



Invasive Species

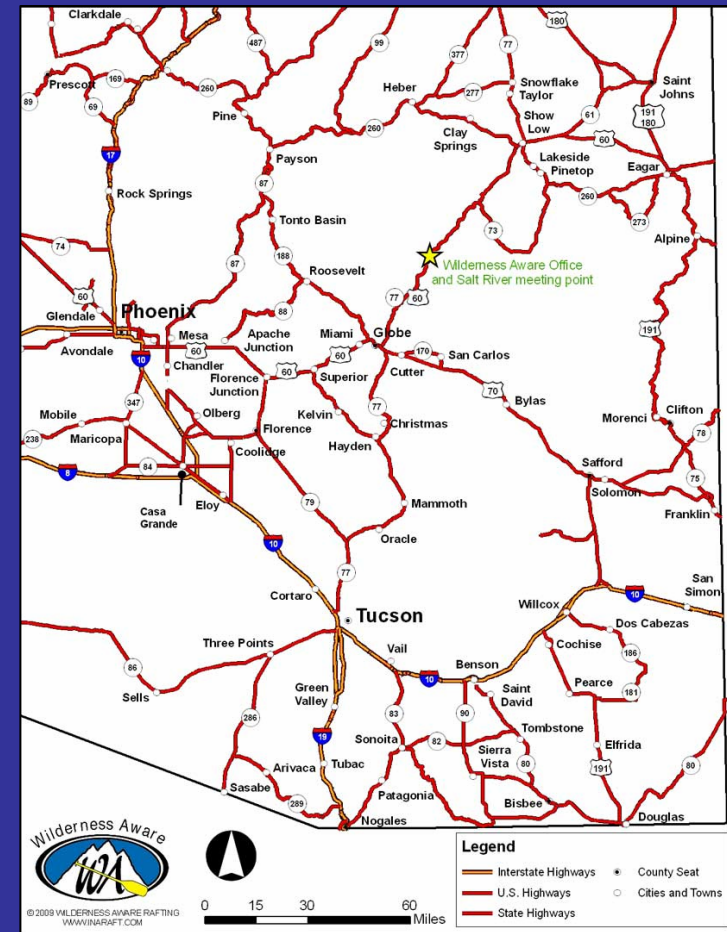


Human Dimensions

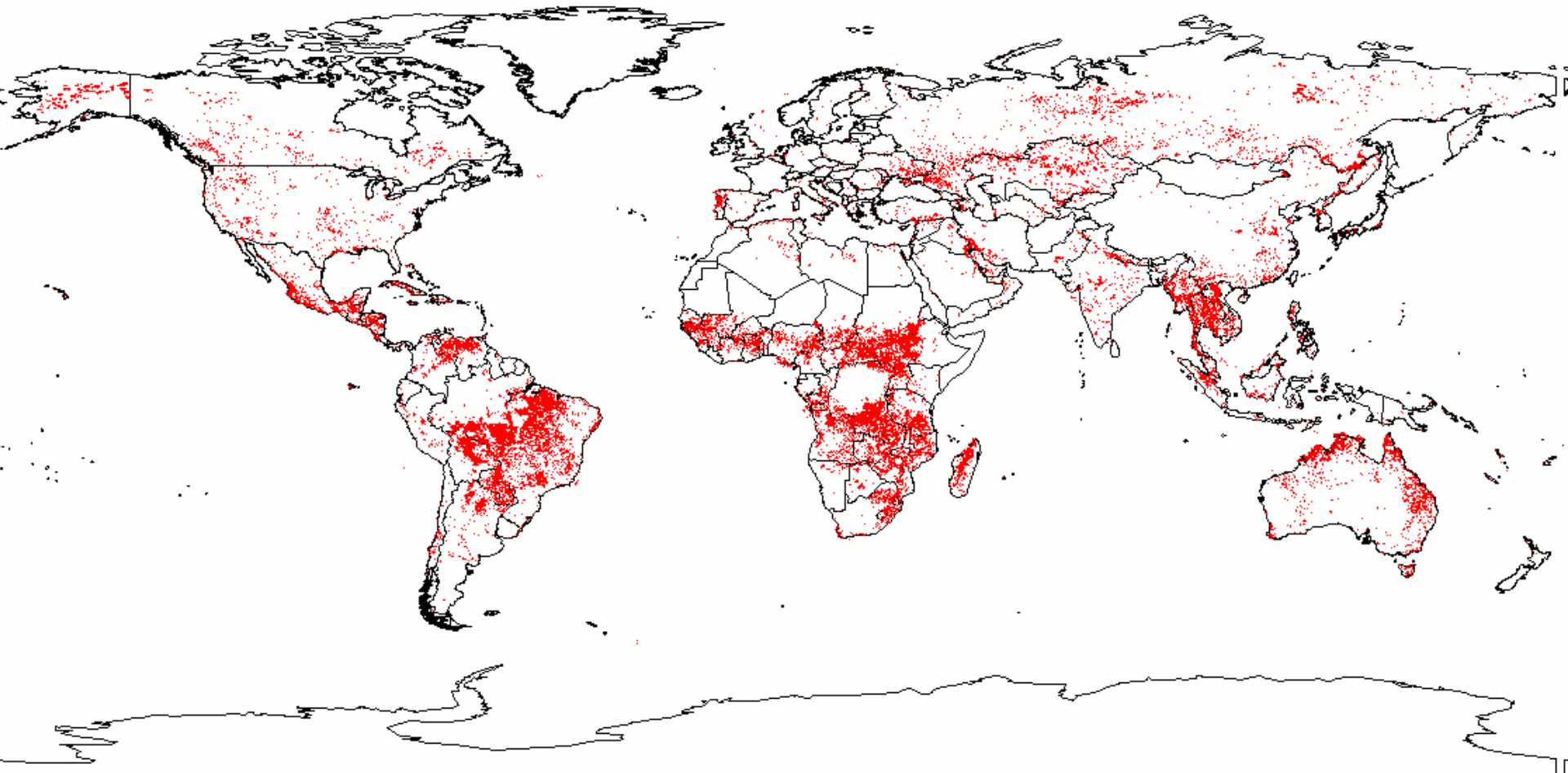


Today's Road Map

- Ecological effects of fire
- Levels of organization & fire
- Direct & indirect effects
- Case studies:
 - Yellowstone
 - Endangered Mt. Graham red squirrel
- Questions



Fire is a global issue



European Space Agency's ATSR World Fire Atlas 2005 Hot Spots

Ecological Effects of Fire

1. Ecosystems change over time
2. Fire is an agent of change
3. Fire is neither innately good nor bad
4. Human perception depends on the resources that are valued and the objectives



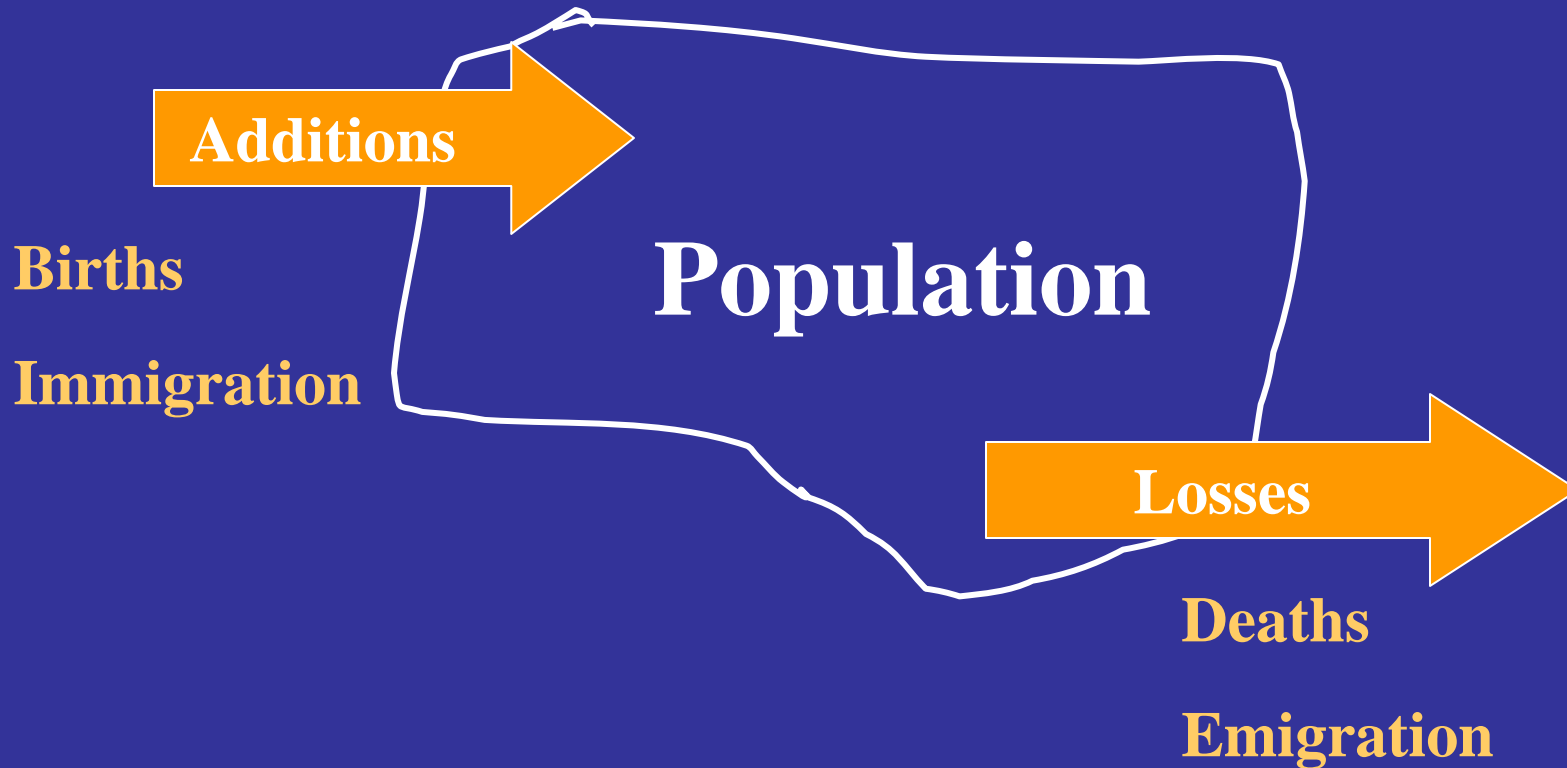
Only you
can prevent
forest fires.
We can't.



The impression
of many about
fire and wildlife



A Focus on Populations



$$\text{Population Change} = \text{Additions} - \text{Losses}$$

Effects of Fire

- Direct Effects

- Injury & Mortality – generally low to modest
- Escape & Emigration – escape vs. avoid
- Immigration & Natality – some species attracted

- Indirect Effects

- Food & Nutrition – early successional stages
flush of biomass, nutrients, seed production
- Shelter – initial loss then cavities, cover, burrows
- Microclimate – xeric conditions
- Habitat Connectivity – increased fragmentation

Direct Effects

- Depend on the:

- scale



- speed



- temperature of fire



Direct Effects

Large mammals – Mortality & Emigration

- use mobility to move around the fire
- low mortality unless very wide fire front, fast moving, & crowning with large amounts of smoke



Direct Effects

Large mammals – Births & recruitment

- Short term effects are often negligible
- Offspring are typically precocial
- Flush of nutrients & early successional stages
 - Increased reproduction in many ungulates & predators
 - Increased carcass availability increase in scavengers



Direct Effects

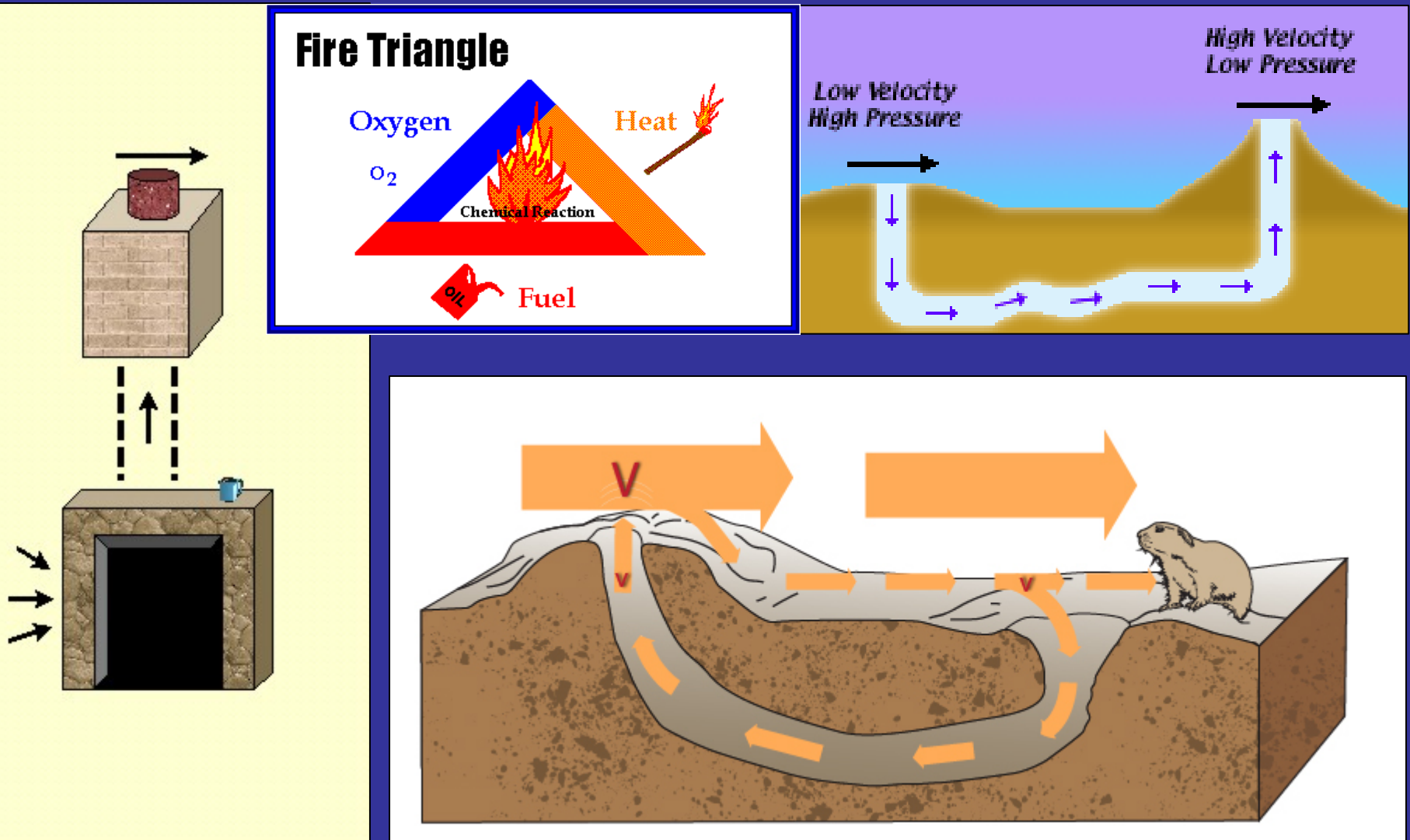
Small mammals, reptiles & amphibians - Mortality

- seek cover
- low to modest adult mortality; high nestling mortality under appropriate conditions
 - a) cavity nests – tree cavities
susceptible to crown fires & chimney
 - b) canopy nests – foliage
susceptible to crown fires
 - c) ground nests – litter on ground
susceptible to ground fires, smoke
 - d) burrows – subterranean
susceptible to ground fires, smoke



Bernoulli's Principle

or Why burrows are bad during fires!



Direct Effects

Small mammals – Births & recruitment

- Short-term losses can be substantial
- Offspring are typically altricial
- Some small mammals respond to flush of growth and often increases in tree seed production

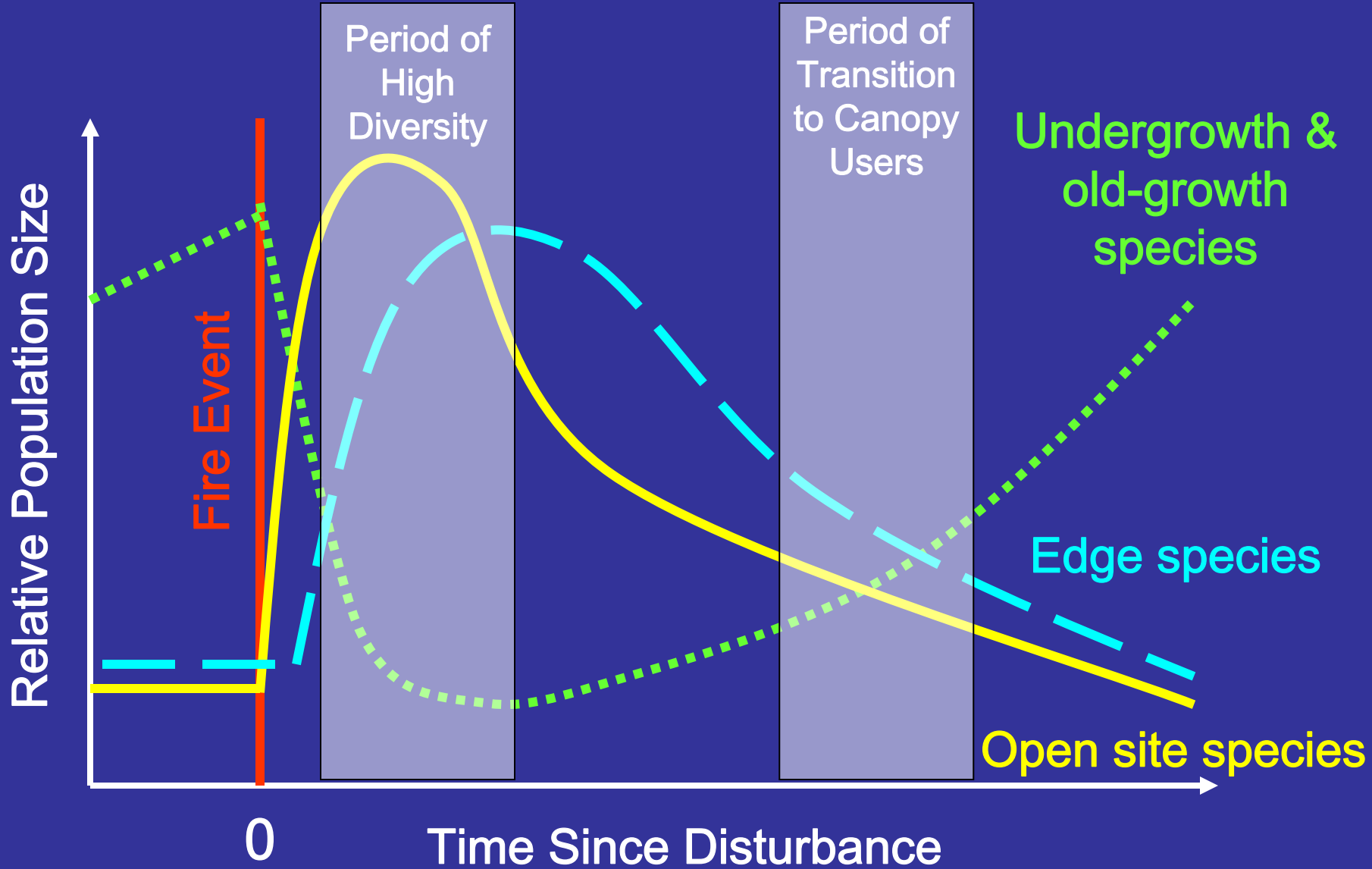


Effects on Animals:

- Many species have evolved with fire
- Direct effects on mortality is generally low
- Indirect effects on food & cover are often generally positive
- Impacts on individuals can differ considerably from effects on populations

Animal Community Changes

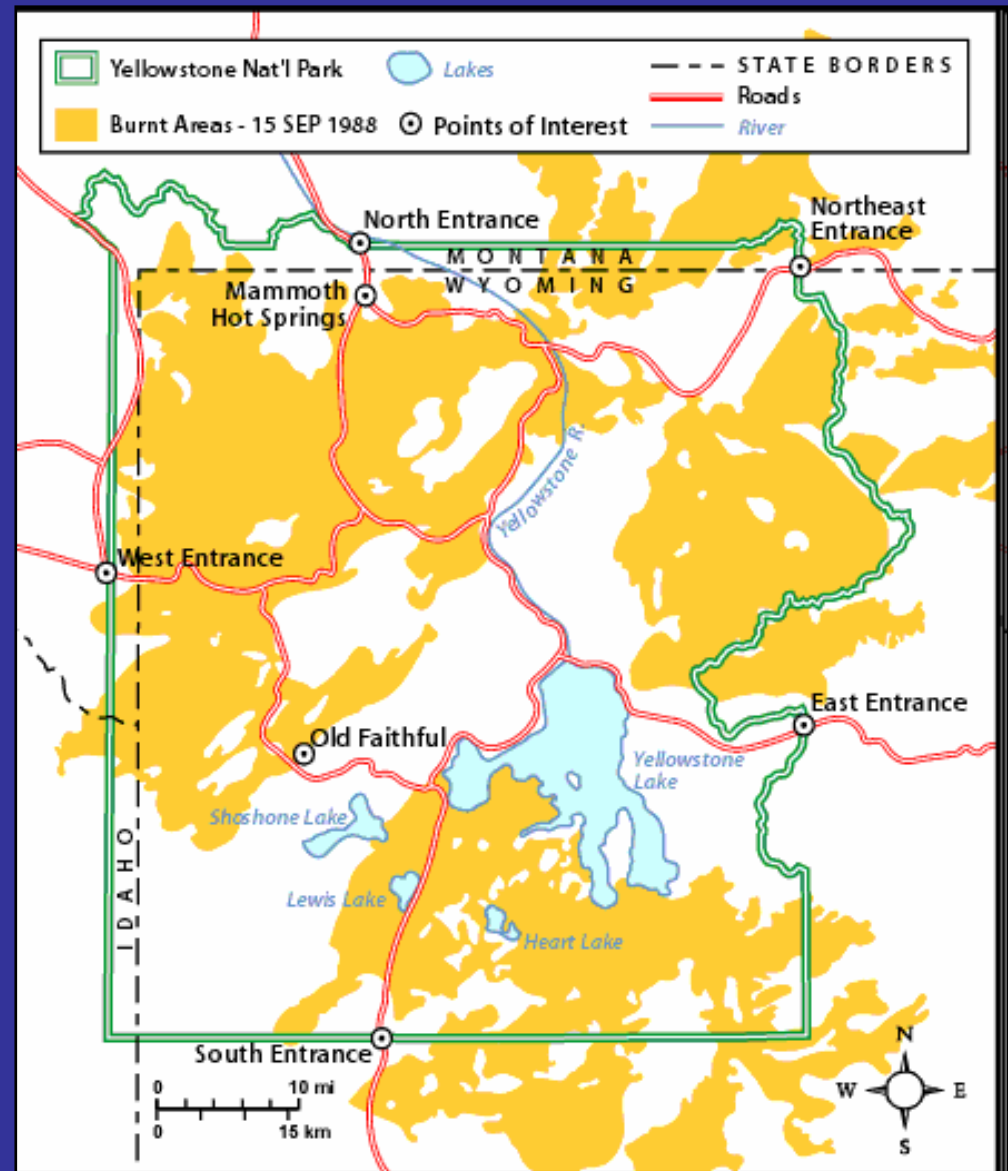
Oliver et al. 1998. J Sustainable Forestry



Yellowstone

The best large mammal study available

- 500,000 hectares in 1988
- Stand-replacing but mixed-severity fires
- On-going studies focused on large mammals (elk, deer, bison, moose, bear)



- Large mammals did not flee and were aware but indifferent to fires
- Deer, elk, bison, and moose continued to feed and bed within sight of flames



Yellowstone

Direct mortality:

- 345 dead elk (of 40,000-50,000)
- 36 deer
- 12 moose
- 9 bison
- 6 black bears
- 1 grizzly



197 from 3 firestorms of 500 ha

41% on ridges

82% in coniferous forests

Adult males suffered more

100% in areas with > 2 km wide fire fronts

100% in areas with fire runs of 6-21 km/d

100% in areas with 4.1-6.9 km/hr

Yellowstone

Delayed mortality:

- Elk mortality was high (up to 4%) in the winter of 1988-89
 - Drought of 1988
 - Forage loss on burned winter range



Subsequent increase
in survival:

<2% annual loss

Yellowstone

- Fire-killed carcasses benefited scavengers:
 - grizzly & black bears
 - coyotes
 - bald & golden eagles
- Grizzly populations remained steady or increased due to buffer against drought and fire-reduced food sources
- Increased production of forb and tubers



21 collared

13 followed fire

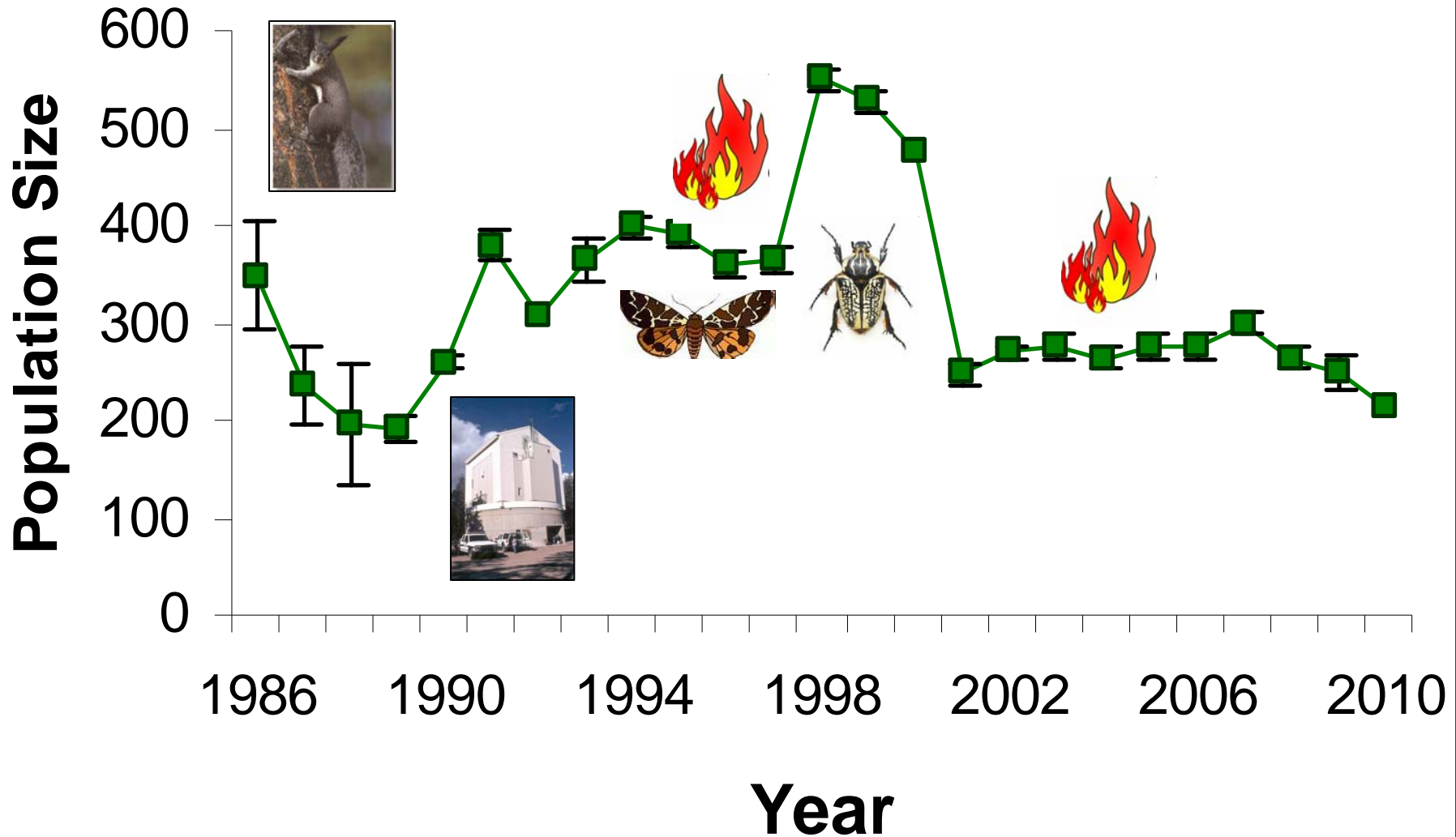
3 avoided

3 stayed

2 unknown

5 years later...no differences in home range size, movements or den site selection

Mt. Graham population estimates



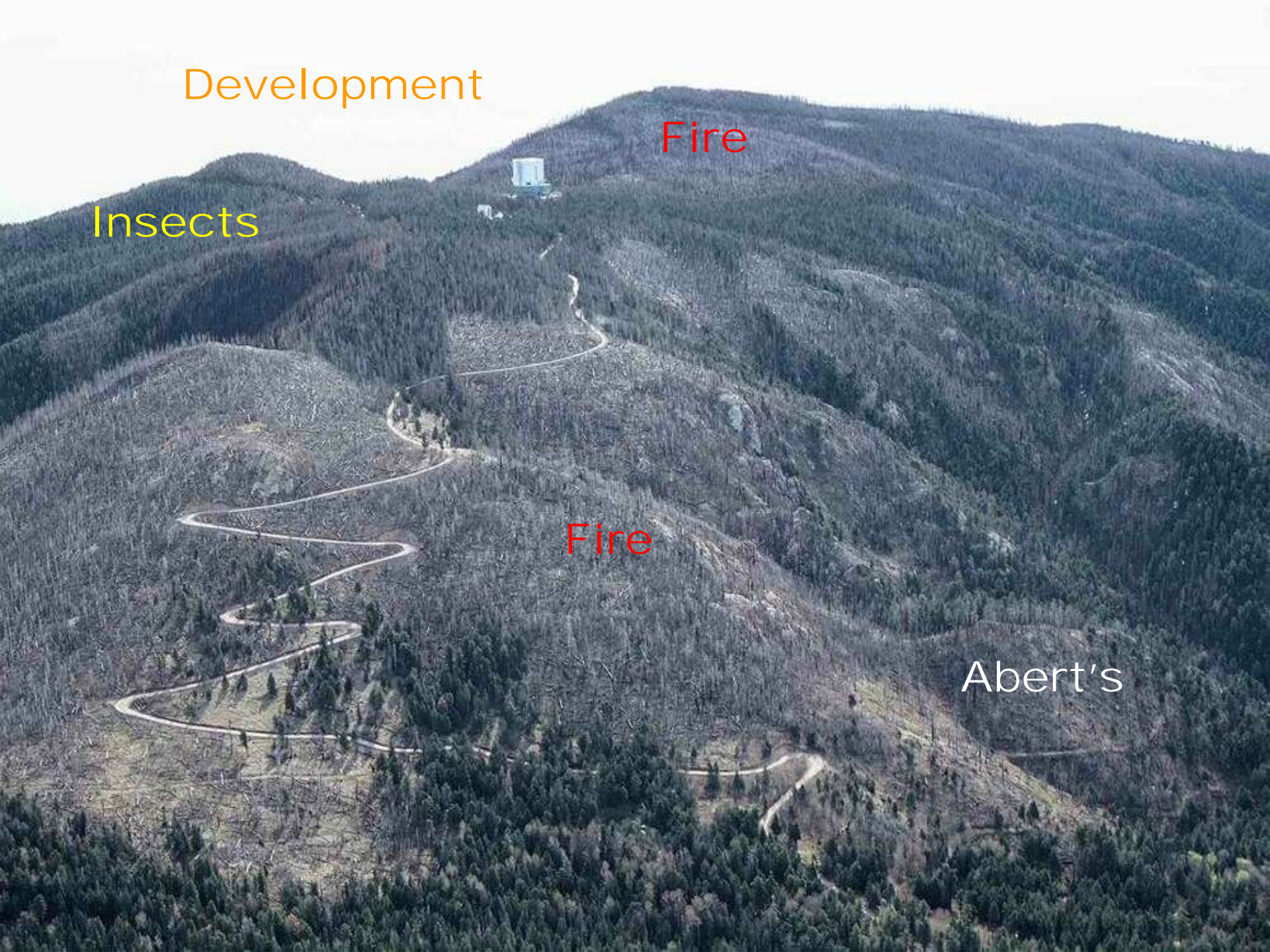
Development

Fire

Insects

Fire

Abert's



Questions?

