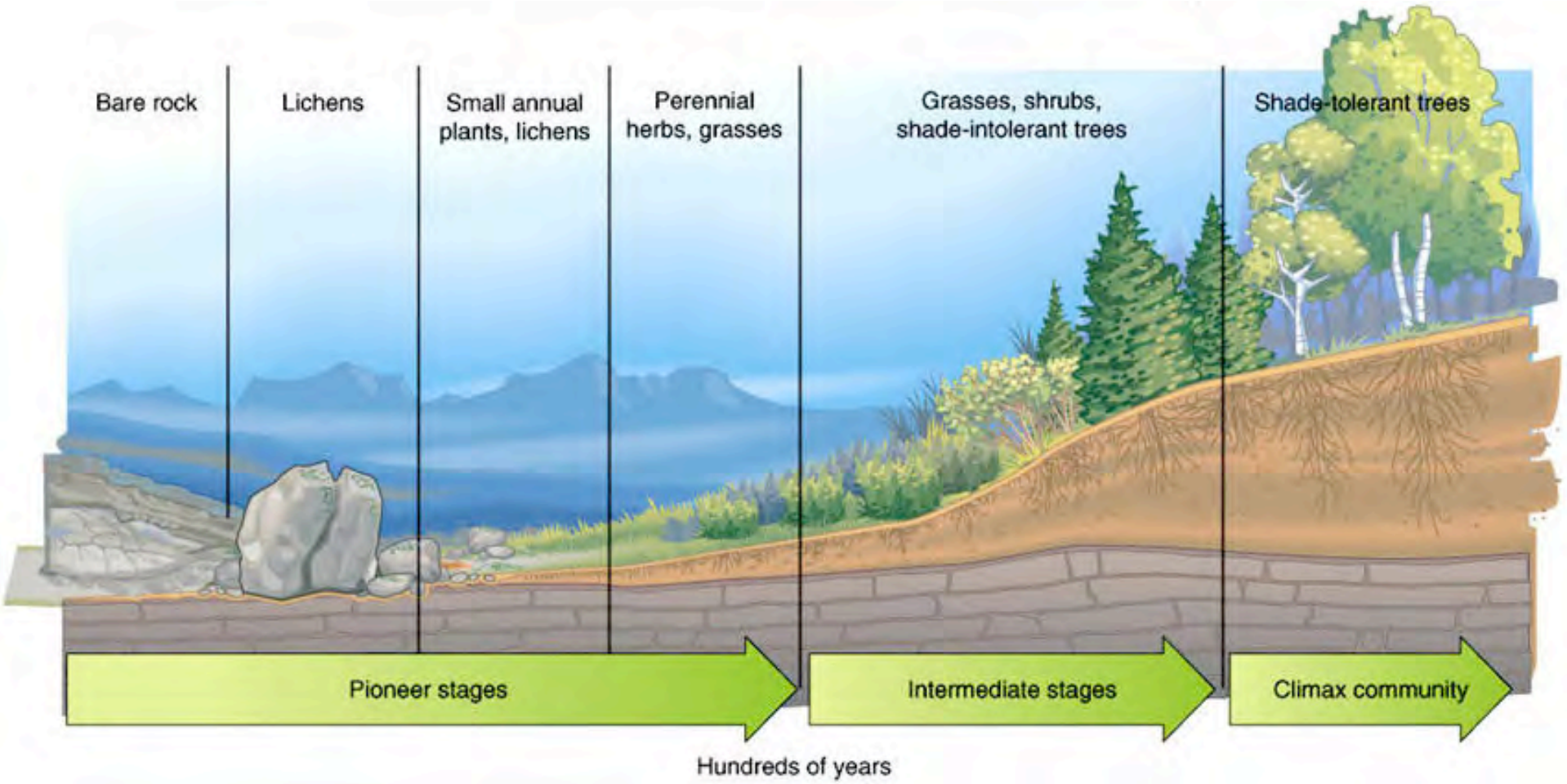
Primary succession



visityellowstonenationalparkyall.weebly.com

Idealized secondary succession

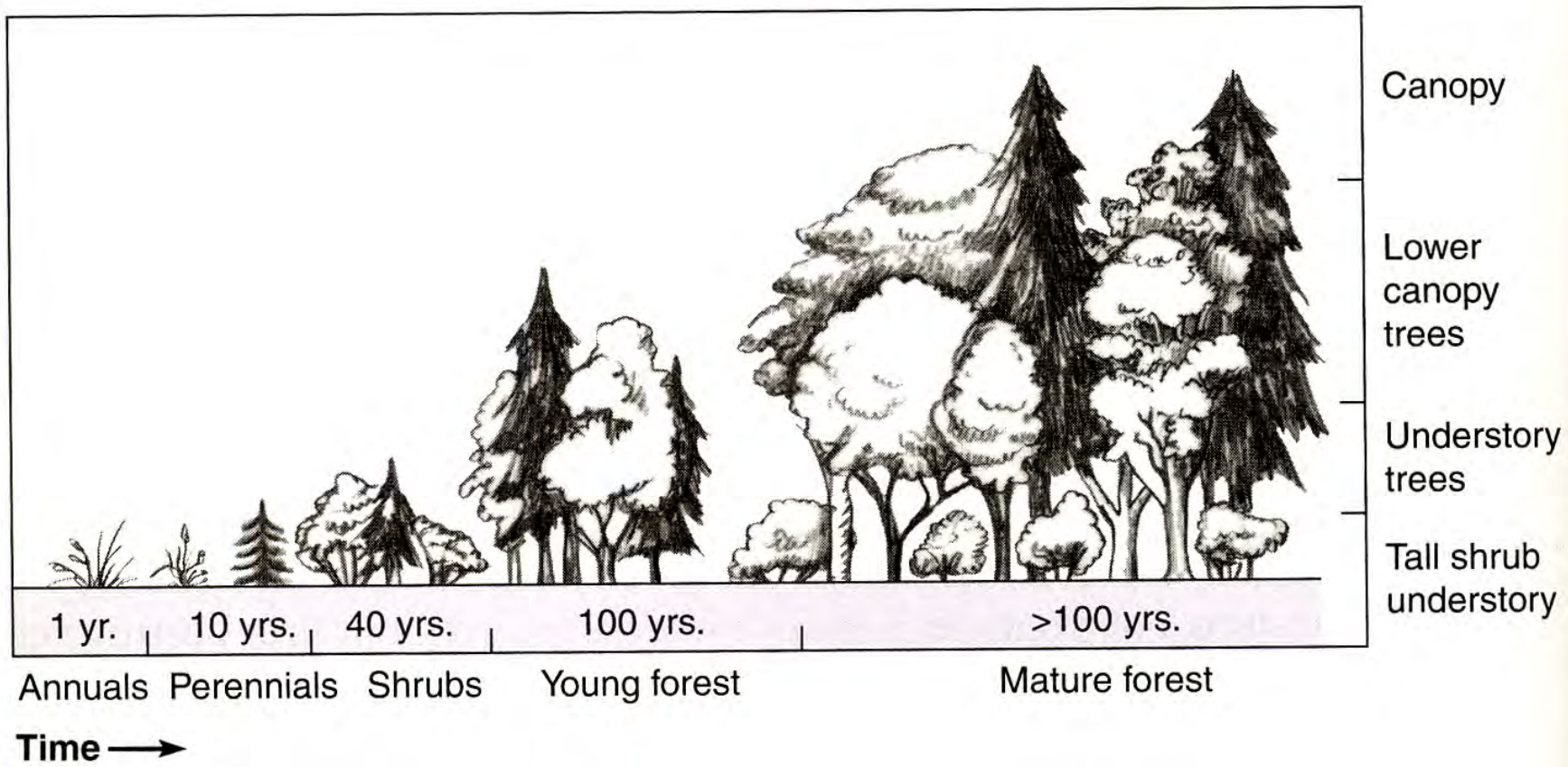


FIGURE 5.1 An idealized "classical" secondary succession on an abandoned agricultural field in the North American Midwest.

Succession can be complex and result in different climax communities

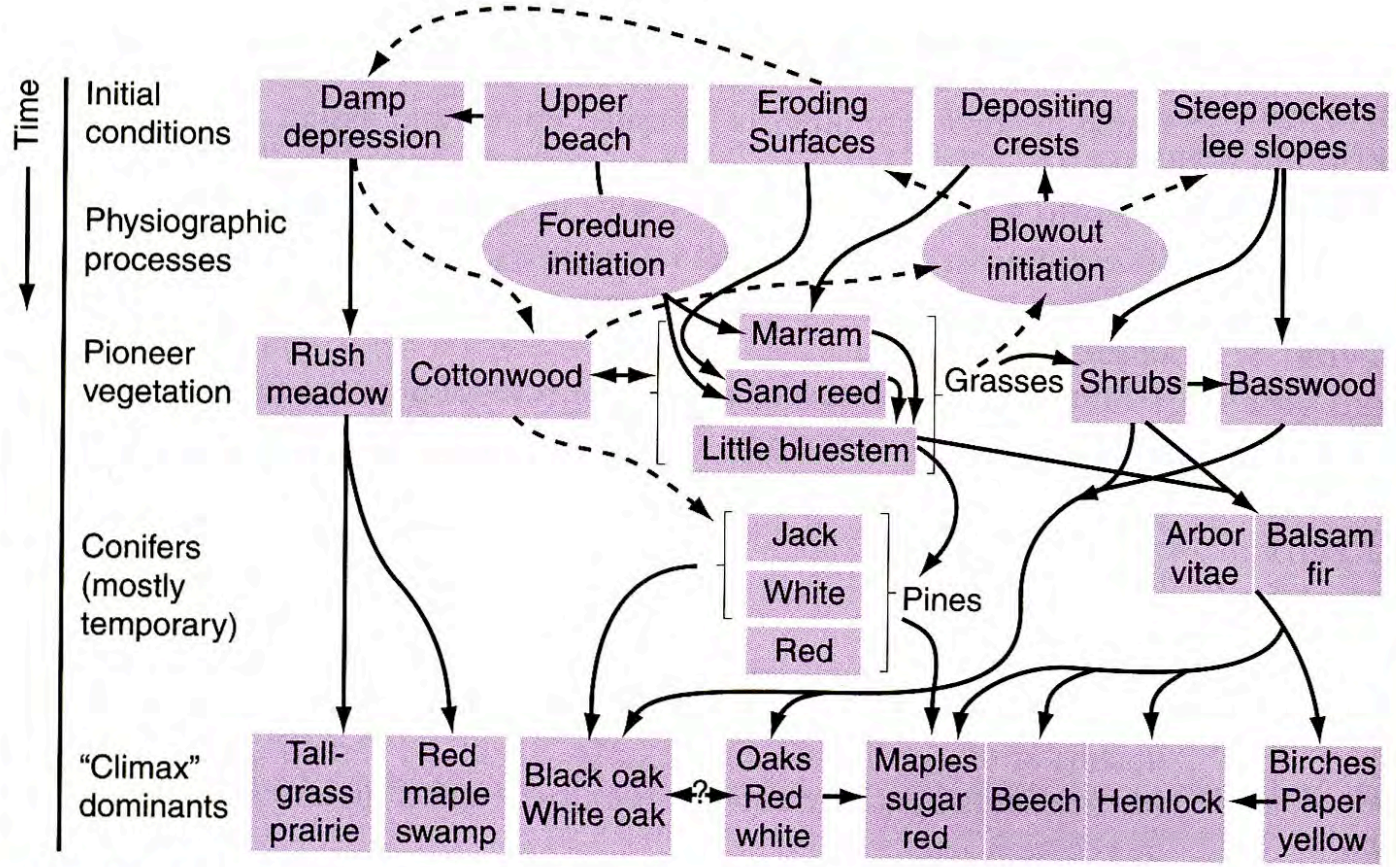


FIGURE 5.2 The multiple successional pathways evident for succession on sand dunes along the shoreline of Lake Michigan (after Olson, 1958; Krebs, 1959, and Krebs, 1994).

Patchwork of disturbances

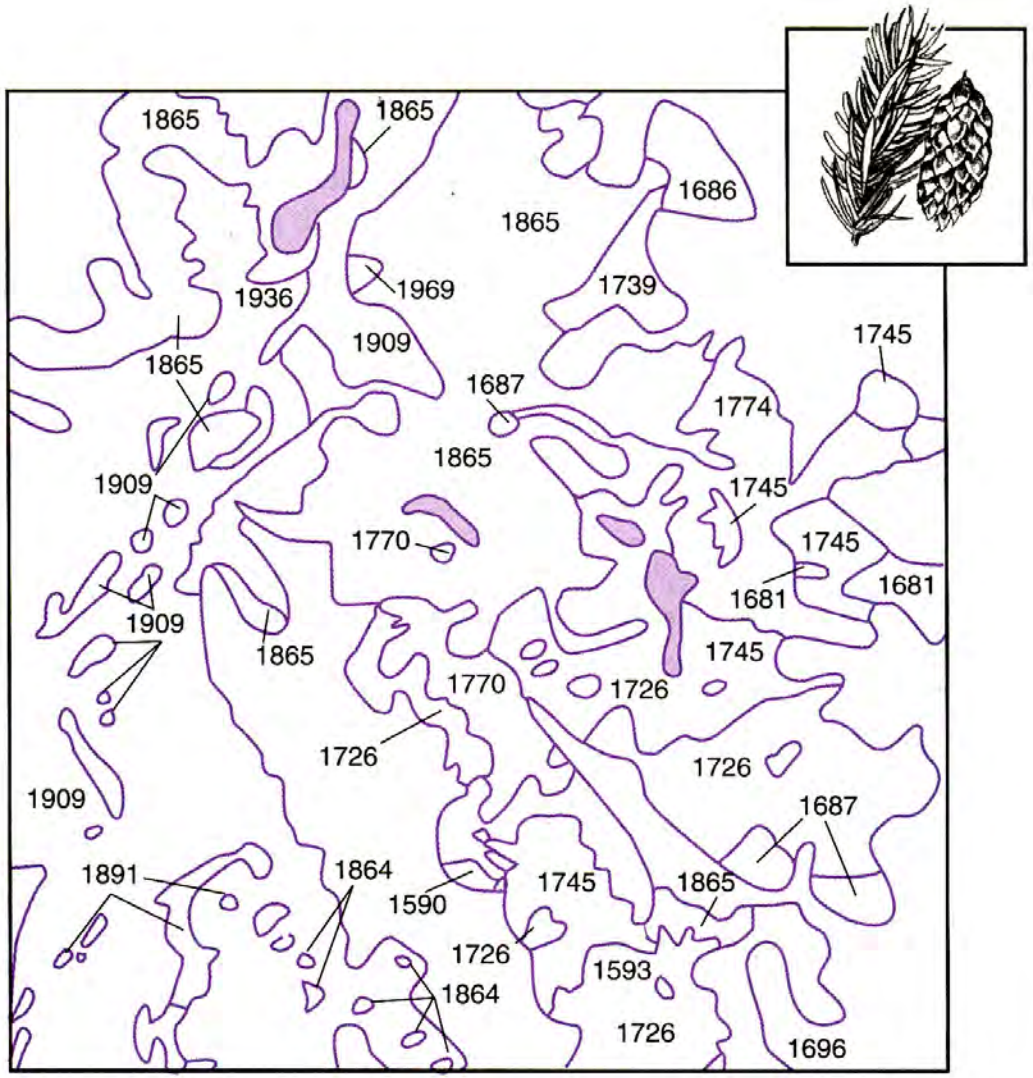


FIGURE 5.3 Different-aged patches that make up a portion of the Rocky Mountain coniferous forest in Alberta. The map shows how the environment is made up of patches of different ages and sizes caused by disturbances. In this case, most of the patchiness is imparted by different forest fires that have occurred over the period 1590 to 1969. The outline of each patch and the age of the fire that created it are indicated on the map. The vegetation and microclimate of a recent patch are very different from those of a site that was burned hundreds of years ago (after Johnson and Larsen, 1991).

Disturbances can be patchy across a landscape

FIG. 1. Aerial view in October 1988 of the landscape mosaic produced by the Yellowstone fires (photo credit: M. G. Turner).

Disturbance types vary regionally

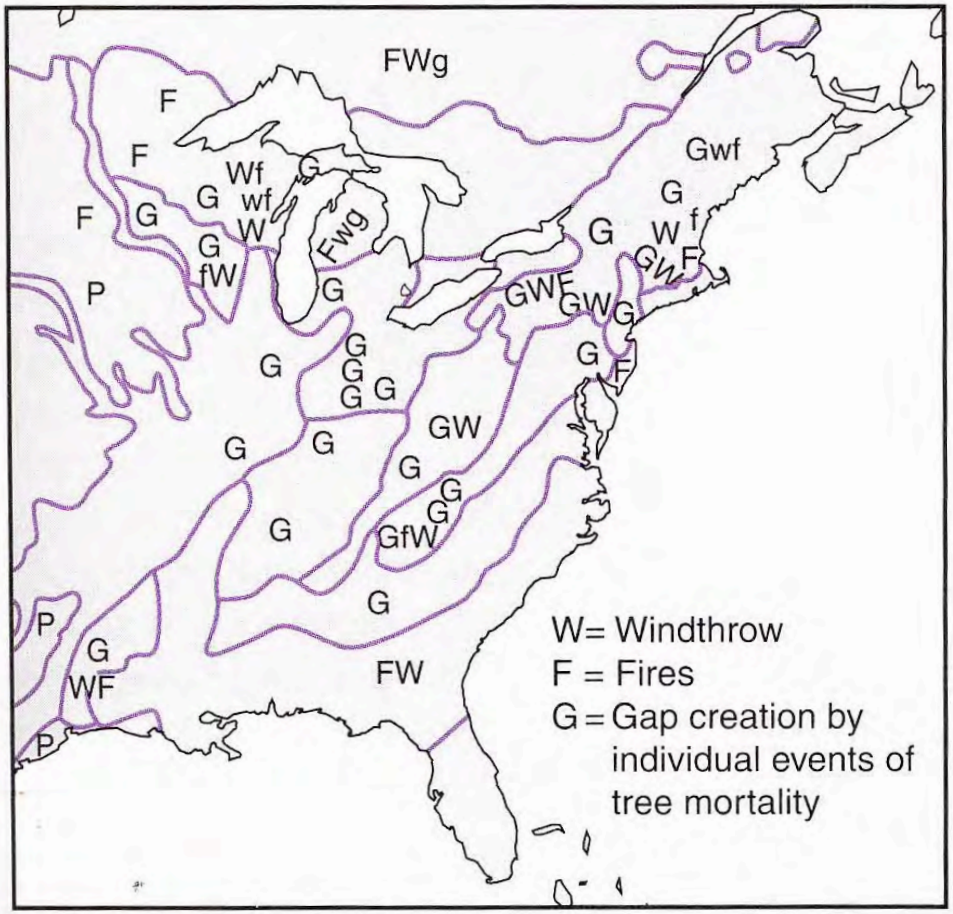


FIGURE 5.9 The major disturbance regimes of eastern North American forest types (after Runkle, 1990).

Disturbance types: Wind

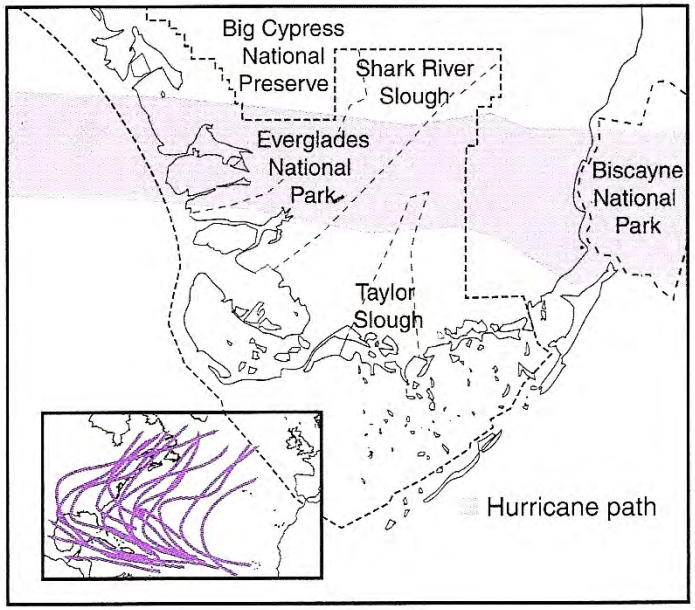


FIGURE 5.11 The path of major destruction due to Hurricane Andrew (1992) in southern Florida and the paths of other historical hurricanes in Florida. The inset maps show some typical hurricane paths apparent from compilations of historical records (after Roman et al. 1994; Strahler and Strahler, 1997).

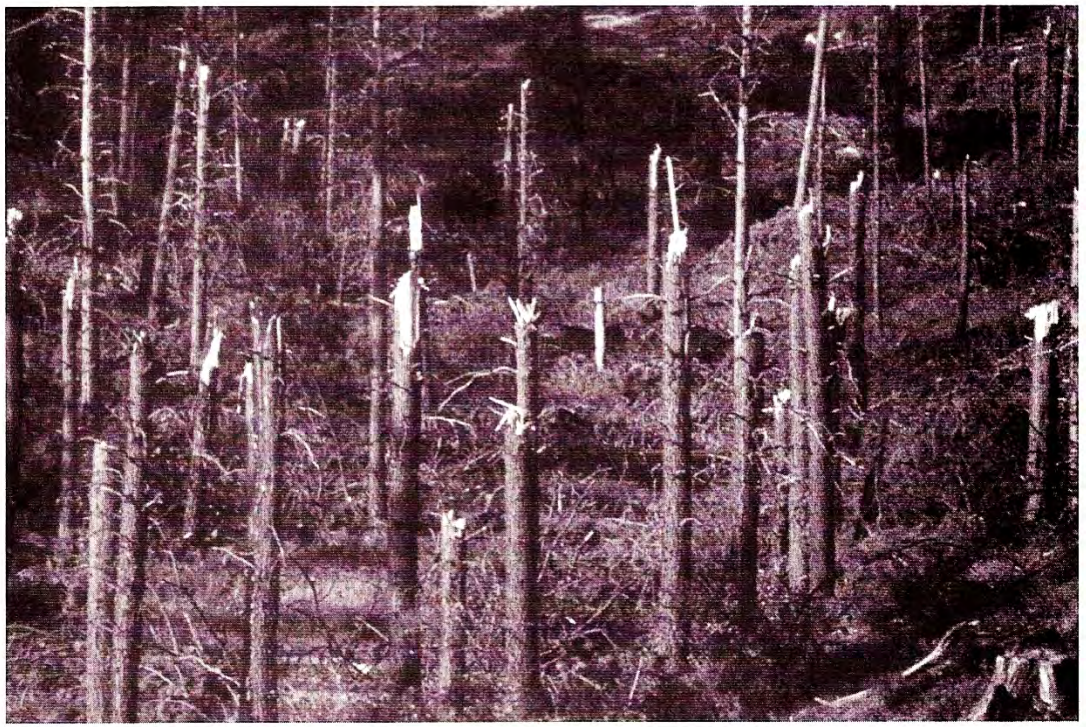


FIGURE 5.10 A wind microblast destroyed the coniferous tree canopy and allowed light-demanding grasses, herbs, shrubs and trees saplings to become established at this site in Idaho.

Disturbance types: Insect/pathogens

mountain pine beetle, CO

Disturbance types: Landslide, avalanche

www.abc.net.au/worldtoday/content/2012/s3415124.htm

en.wikipedia.org/wiki/Avalanche

Disturbance types: Eruption

svs.gsfc.nasa.gov/vis/a010000/a010500/a010550/

Disturbance types: Eruption

www.foxnews.com/scitech/2010/05/18/mount-st-helens-recovering-years-later/

Disturbance types: Flooding

Bald cypress (*Taxodium distichum*)

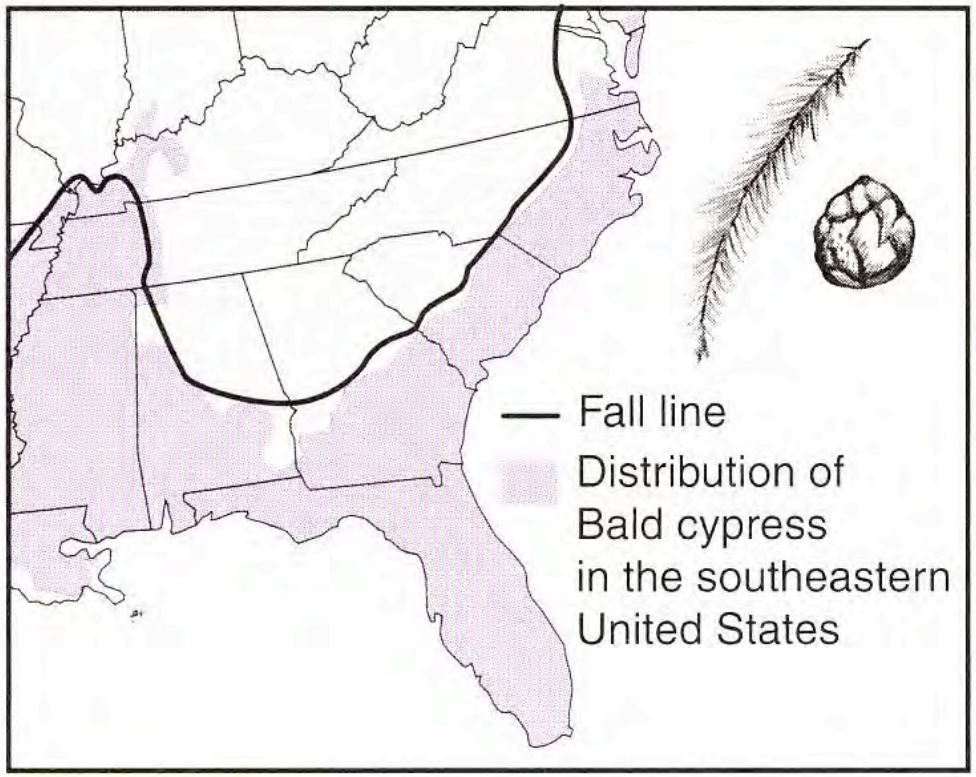


FIGURE 5.13 The correspondence between the northern limits of bald cypress *(Taxodium distichum)* and the boundary of the coastal plain. Seasonal flooding on the coastal plain appears to be crucial for bald cypress regeneration (after Shankman and Kortright, 1994).

www.ucmp.berkeley.edu/exhibits/biomes/wetlandsgallery.php

http://www.dmr.state.ms.us/Coastal-Ecology/preserves/plants/trees/bald-cypress/bald-cypress.htm

Disturbance types: Fire

low severity

www.sierraforestlegacy.org/ FC_FireForestEcology/FFE_FireScience.php

high severity

www.dailycamera.com/ci_21025344/cu-researchers-pine-beetles-not-always-tied-increased

Disturbance types: Fire

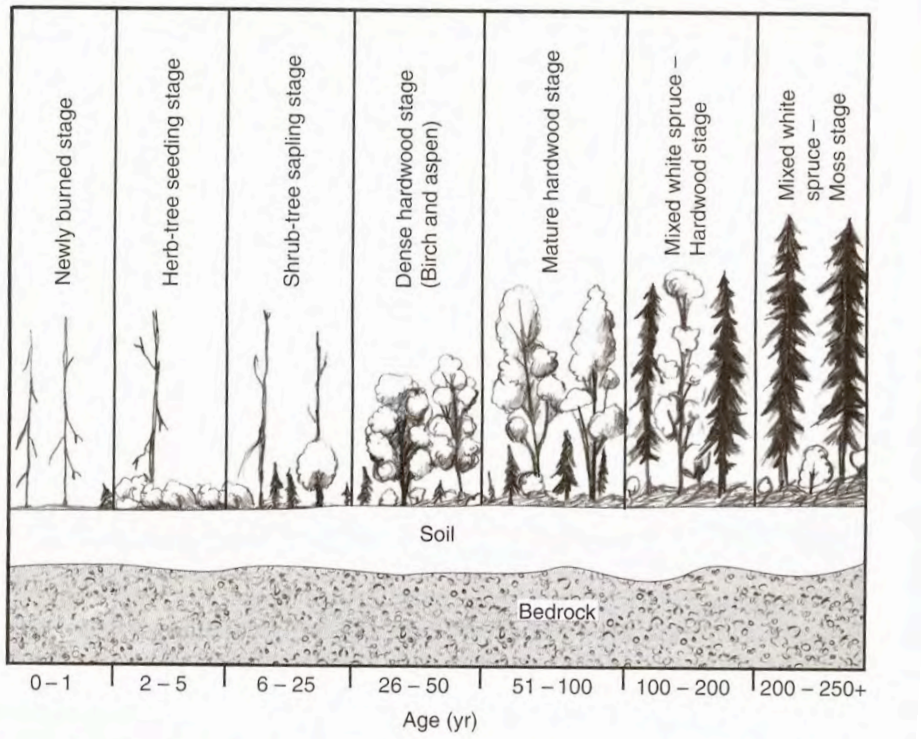


FIGURE 5.7 Idealized post-fire succession in a boreal white spruce *(Picea glauca)* forest (after Van Cleve and Viereck, 1981).

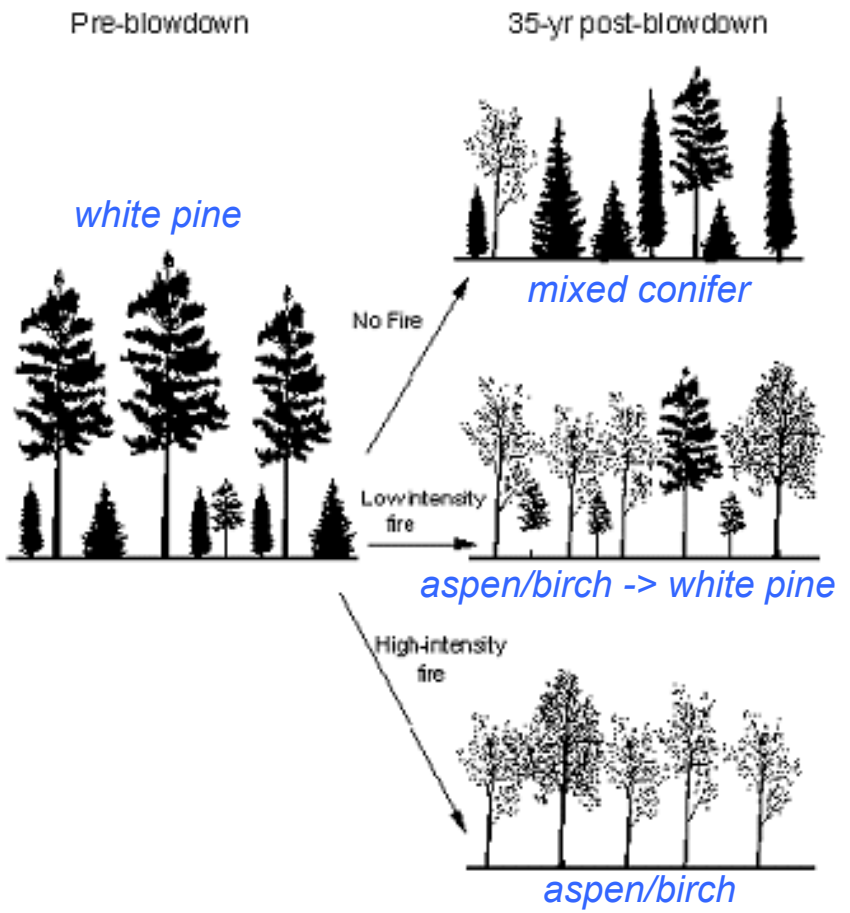


Figure 2. Response of old-growth white pine to disturbance. No fire after the blowdown would lead to a mixed conifer forest, low-intensity natural or prescribed fire would lead to birch and aspen with reinvading white pine, and high-intensity fire would lead to aspen-birch forest.

www.elyminnesota.com/fire_status/bwcawind.php

Human impacts to disturbances

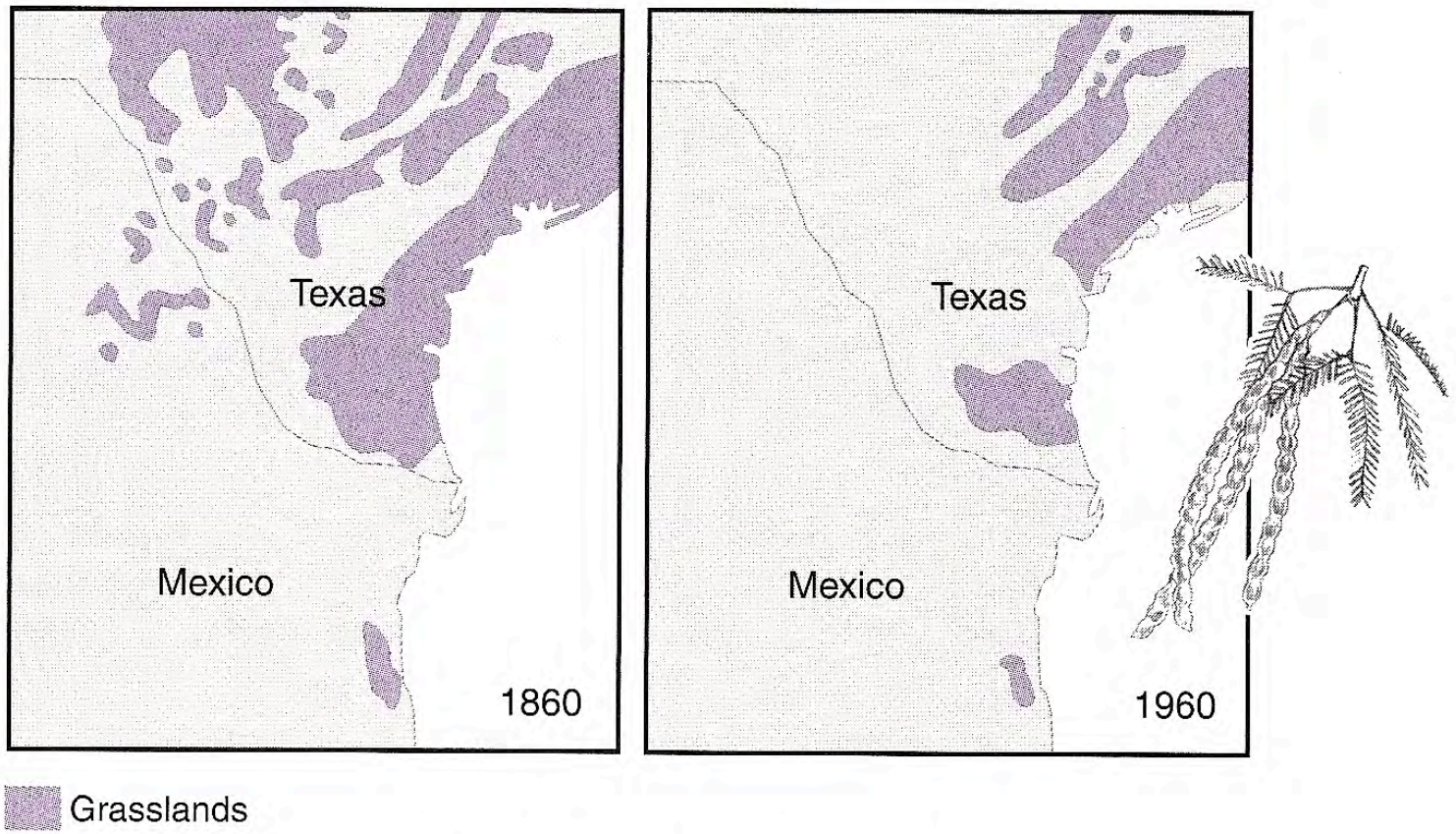


FIGURE 5.8 The expansion of mesquite *(Prosopsis)* shrubland at the expense of grassland between 1860 and 1960. Decreases in burning due to human land-use change and fire control are thought to be a major contributor to the decline in grassland cover (after Johnston, 1963; Brown and Lomolino, 1998).

Human impacts to disturbances

altered fire regimes

blog.conifercountry.com/2011/06/10/sequoia-national-park--monument.aspx

Invasive species example: Buffelgrass as a disrupter of Southwest desert ecosystems

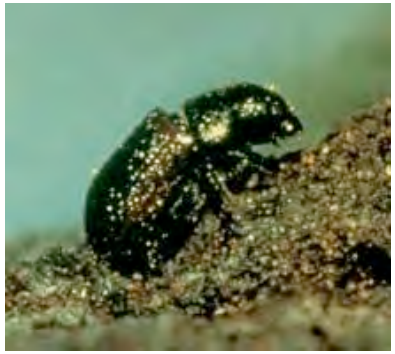
- modifications to disturbance regimes
- elimination of native species
- control by
  - education
  - mechanical removal

http://www.npr.org/templates/story/story.php?storyId=5295379

Disturbances interactions windthrow -> beetle outbreaks

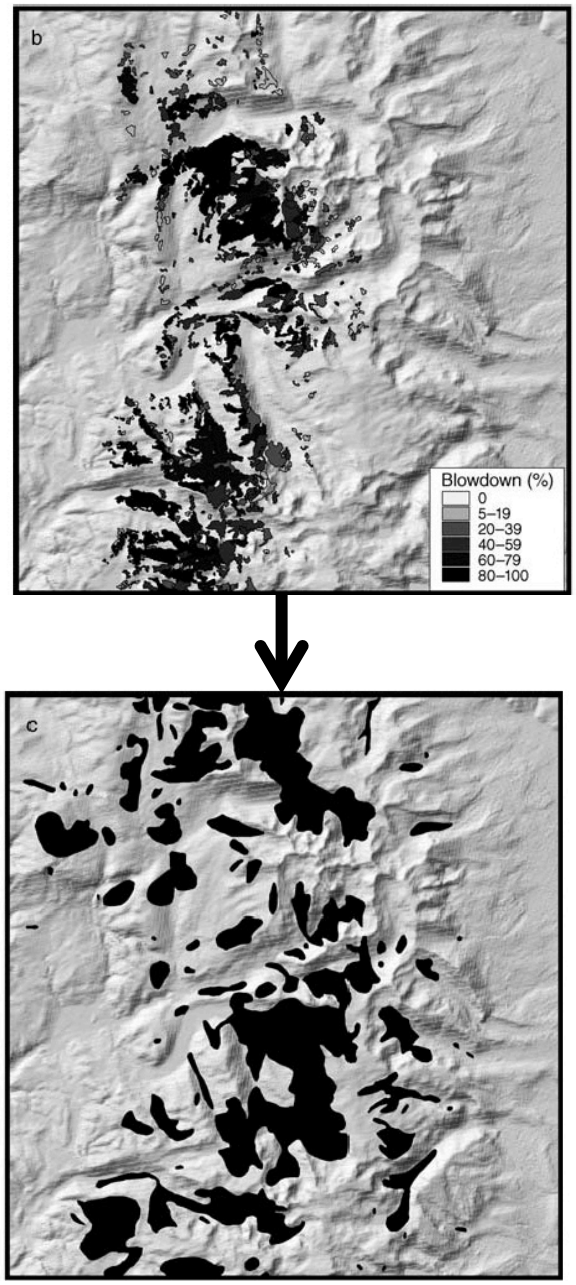
Spruce beetle

www.fs.usda.gov/detail/r10/communityforests/?cid=fsbdev2_038419

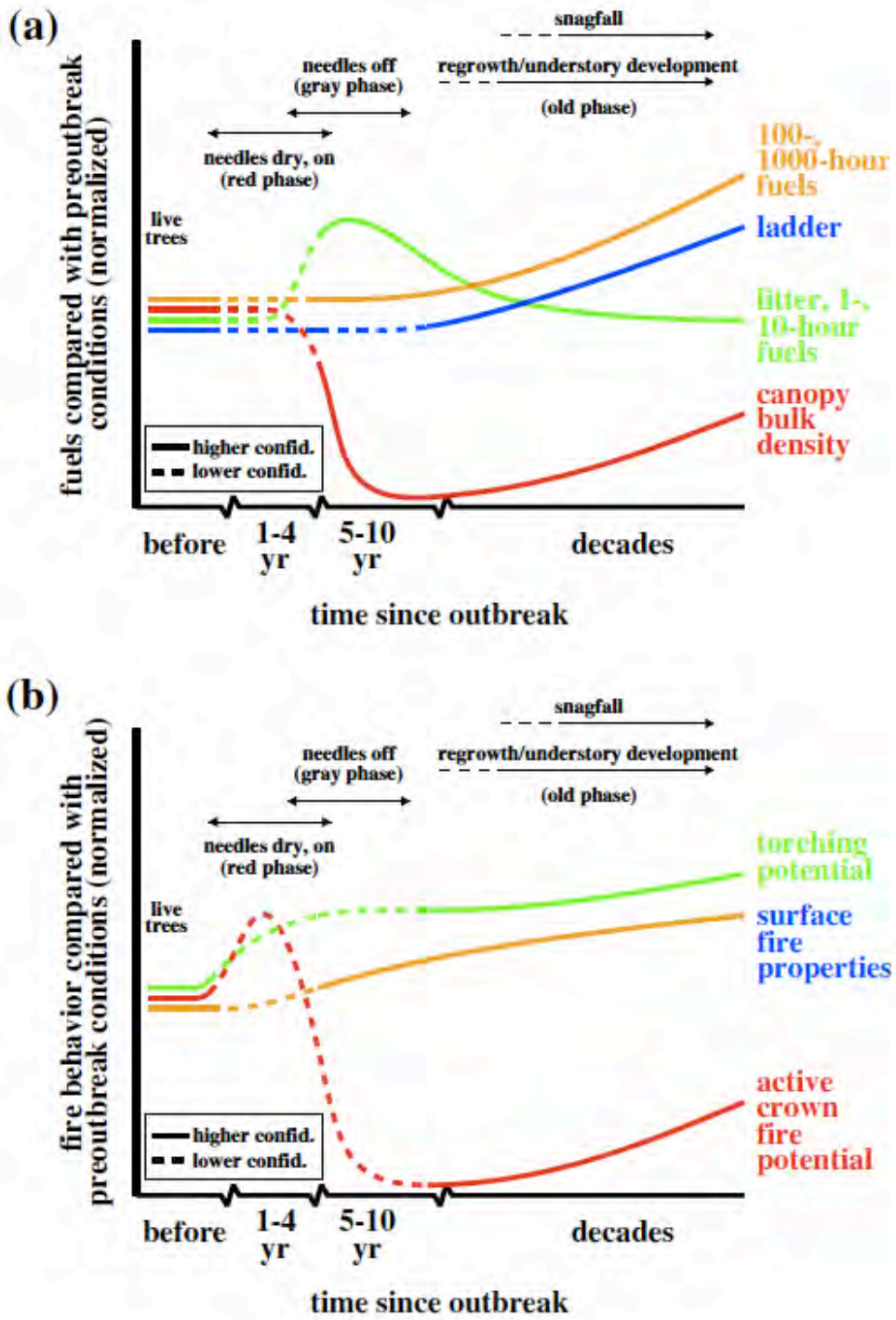


www.fs.usda.gov/detail/r10/communityforests/?cid=fsbdev2_038419

NW Colorado



Kulakowski et al., Ecology, 2007



Disturbances
interactions

beetle outbreaks
->
fire

Fig. 2. Conceptual framework of (a) fuels characteristics and (b) fire behavior relative to preoutbreak conditions for red, gray, and old (snagfall and regrowth) phases. Surface fire properties include reaction intensity, rate of spread, and flame length. For postoutbreak phases, solid lines indicate higher confidence in responses based on Fig. 3, and dashed lines indicate lower confidence (more disagreement, fewer studies, or knowledge gaps).

Prof. J. Hicke