Brief overview of postfire forest research following the 1988 Yellowstone Fires (Turner)

The 1988 Yellowstone Fires

- Stand-replacing fires natural (100-300 yr fire return interval)
- Fire weather was extreme (driest summer on record in the park)
- 248 fires ignited within the ~80,000 km^2 Greater Yellowstone
- Size and severity surprised managers and scientists
  - ~350,000 ha in Yellowstone National Park (YNP) (Fig. 1)
  - Most (95%) burned area within only 7 very large fires
- Fire-fighting involved 25,000 fire fighters, cost $120 million
- Ushered in the "new era" of fire in the West

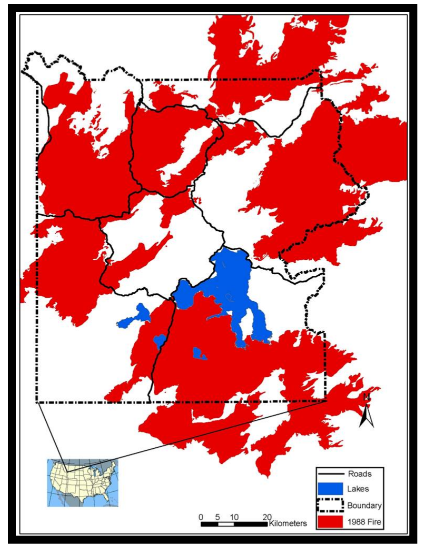

Fig. 1. 1988 fire perimeters in Yellowstone National Park.

Lessons and surprises

- Fire created a complex landscape mosaic, not a "moonscape"
- Vegetation recovery was very rapid
  - Native grasses, wildflowers resprouted, filled in
    - Soils were not deeply burned
    - Many roots, rhizomes survived underground
  - Non-native invasive plant species did <u>not</u> take over
  - Abundant lodgepole pine regeneration in 1989 & 1990
- Tremendous spatial variation in postfire stand structure (Table 1)
  - Range from 0 to >500,000 stems/ha
  - Stand structure/function mosaic persists for 175-200 years
- Seedling aspen established throughout burned lodgepole pine forests
  - Seedlings established 16 km away and at higher elevations than prefire aspen distributions
- Postfire stands strongly conserved (rather than lost) nitrogen
  - Soil microbes immobilize N during the first few years after fire
  - Lodgepole pines then take up and store N as they grow
- *The 1988 fires were not an ecological catastrophe*
  - Yellowstone's forests were very resilient, recovering naturally without active management
  - Natural disturbances structure this landscape

Table 1. Stand structure and function 25 years after the fires[1]

Stand characteristic	Mean	(Min to Max)
Postfire lodgepole pine		
Stem density (stems/ha)	21,738	(0 to 344,067)
Stem height (m)	2.9	(0.4 to 5.7)
DBH (for trees > breast ht, cm)	5.3	(0.86 to 10.1)
Trees with cones (%)	42	(0 to 88)
Trees with serotinous cones	11	(0 to 84)
Stand-level ANPP (Mg ha^{-1} yr^{-1})	5.0	(0 to 16.5)
Plant species richness (per 0.25 ha)	32	(16 to 58)
Postfire aspen		
Percent of plots with aspen present	36	--
Stem density, when present (stems/ha)	310	(33 to 3,933)
Stem height (m)	0.59	(0.3 to 3.2)

[1]*Re-sampled in summer 2012 with funding from Joint Fire Science Program (Turner et al., in review; Hansen et al., in review; Romme et al., in prep); N = 72 plots (see Turner et al. 2004).*

Looking ahead

- Warmer and drier climate expected by mid 21st century, with increased fire activity
    - Climate like 1988 could become the rule rather than the exception
    - What are the implications for number of fires, fire size, severity, return interval?
    - How will this affect postfire regeneration, forest age, type, extent, location?
- Anticipating future fire and landscape dynamics perhaps **the** most pressing research challenge
    - Post-1988-fire research provides important benchmark

Selected references (available at http://landscape.zoology.wisc.edu/Publications.html)

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