A Tale of Two Fires

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GGR320-01

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On August 5, 1949, a wildfire overran 16 smokejumpers in Mann Gulch on the Helena National Forest in north central Montana. Of the 16, only 3 survived. At the time of the tragedy, the Forest Service smokejumper program was a decade old and had not yet suffered a fatality. Repercussions from this incident were severe and long lasting. It was hoped that a valuable, although costly lesson had been learned.

That, unfortunately was not the case, and on July 6, 1994, 14 smoke jumpers were overrun and killed by a wildfire on Storm King Mountain just outside Glenwood Springs in south central Colorado.

My Project:

My goal with this project was to analyze each fire and see, if any similarities existed between the two fires.

Specifically I looked at:

- The fuel type(s) at each fire location
- The slope of the area in which the smokejumpers died
- The aspect of the area in which the smokejumpers died
- The elevation of the area in which the smokejumpers died

Why?? Good question

1. Apparently I like to bite of more than I can chew, so to speak.
2. Professor Luna saw no reason to warn me of my folly!
3. I've always had an interest in wildland fires.
4. Ever since I knew what a smokejumper was and did, I wanted to be one. (no, really!)
5. To see if the potential exists for someone to develop a real-time model that might be used in the future to map out potential hazard areas BEFORE crews are put in those areas.

My Data and Methodology

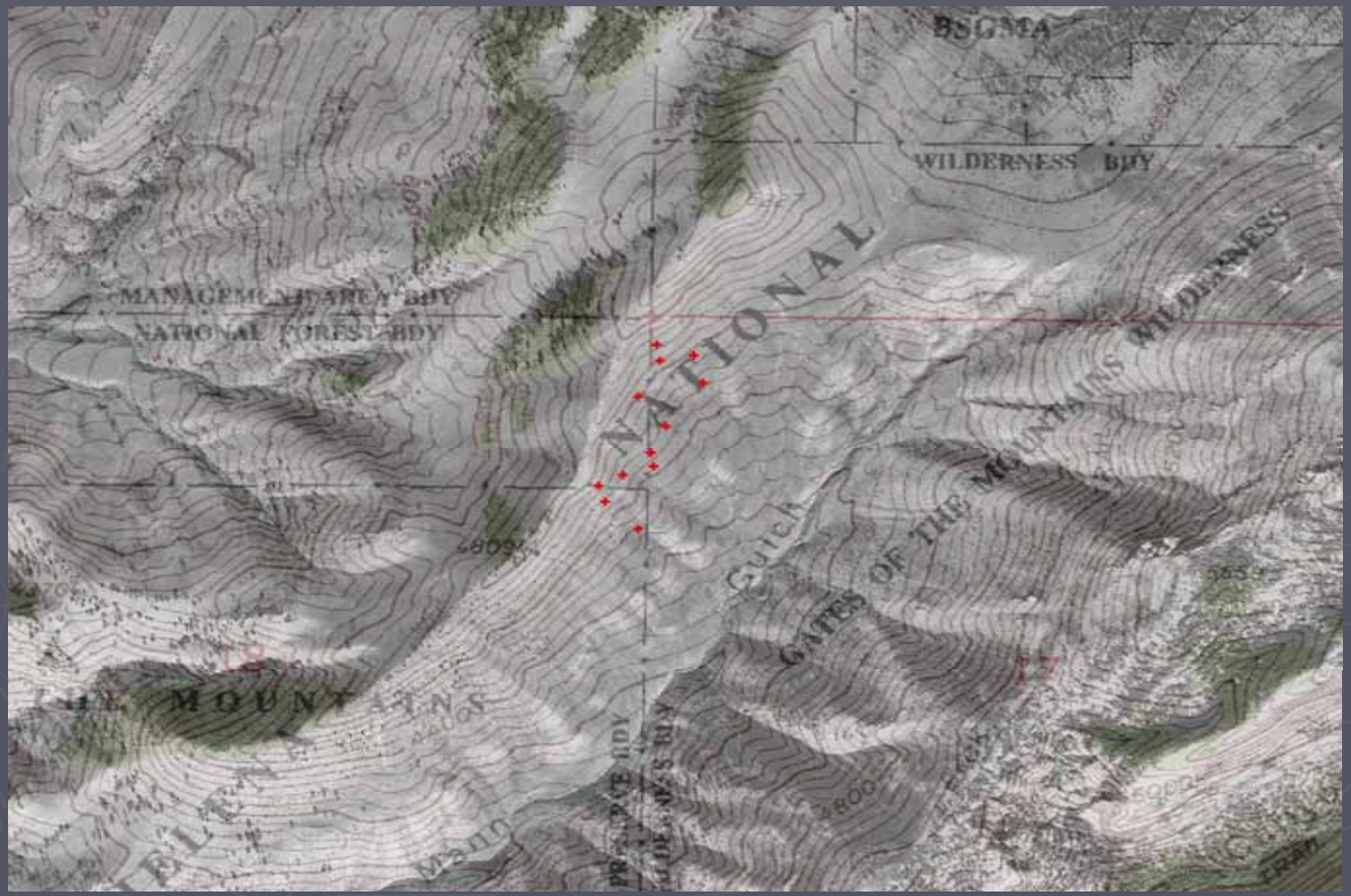
- I used both existing data as well as created some data
  - Existing data I download from GISDATADEPOT.COM; specifically:
    - Digital Elevation Models (DEMs) of both areas
    - Digital Raster Graphs (DRGs) of both areas
  - Data I created included:
    - Point Layer data set of the locations of the fallen fire fighters from each fire
    - Various layers created via reclassifying and converting existing data

Example of existing data I used:

- Digital Raster Graph
- Digital Elevation Model
- Hillshade derived from the Digital Elevation Model

My Methodology

After downloading the existing data, I created a new point layer file using ArcEditor, showing the locations of the fallen smokejumpers for each fire. I used existing maps and reports of each fire to interpolate their location on the digital raster graph of each fire area.

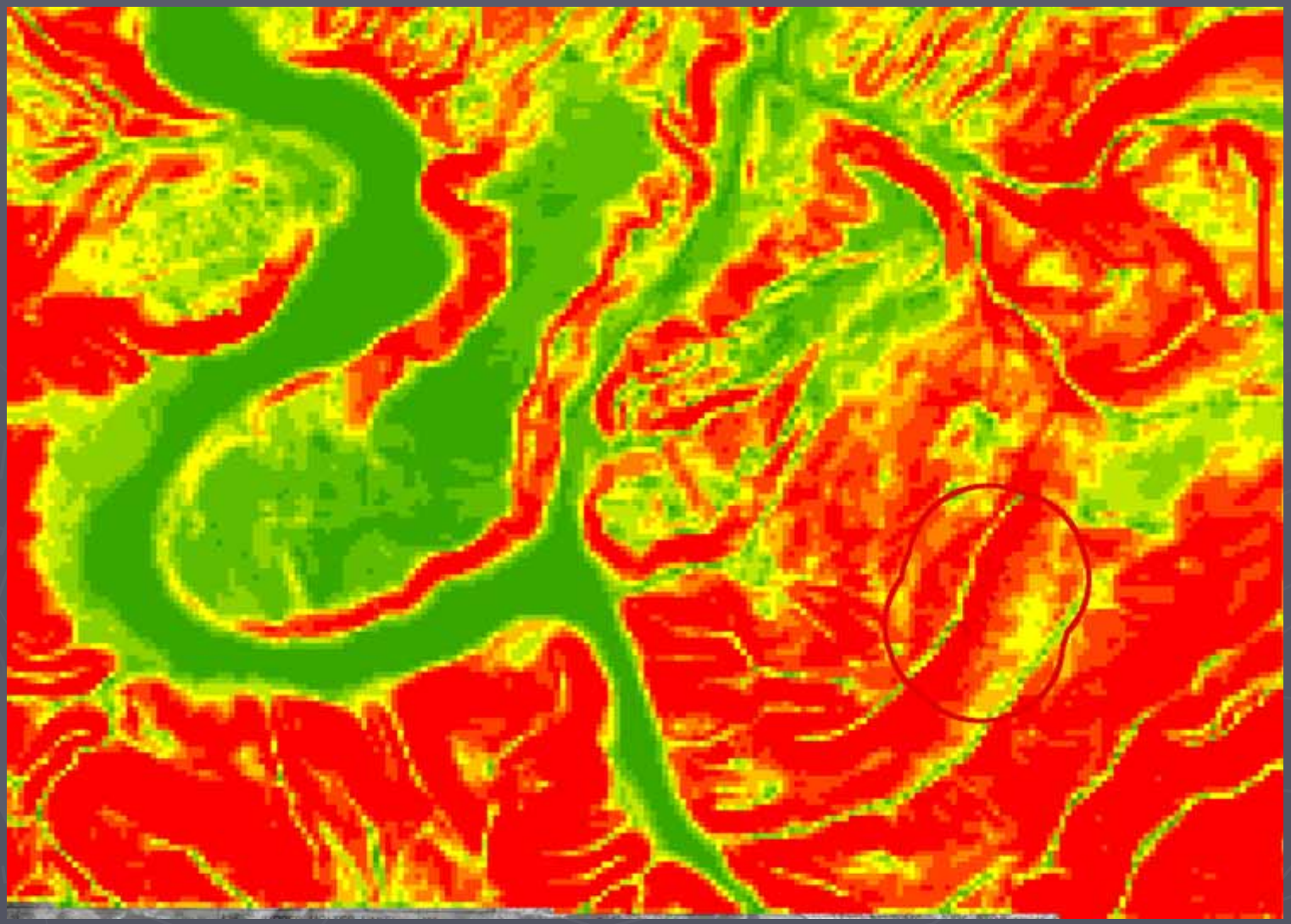


Map showing point layer file over digital raster graph and orthopohoto

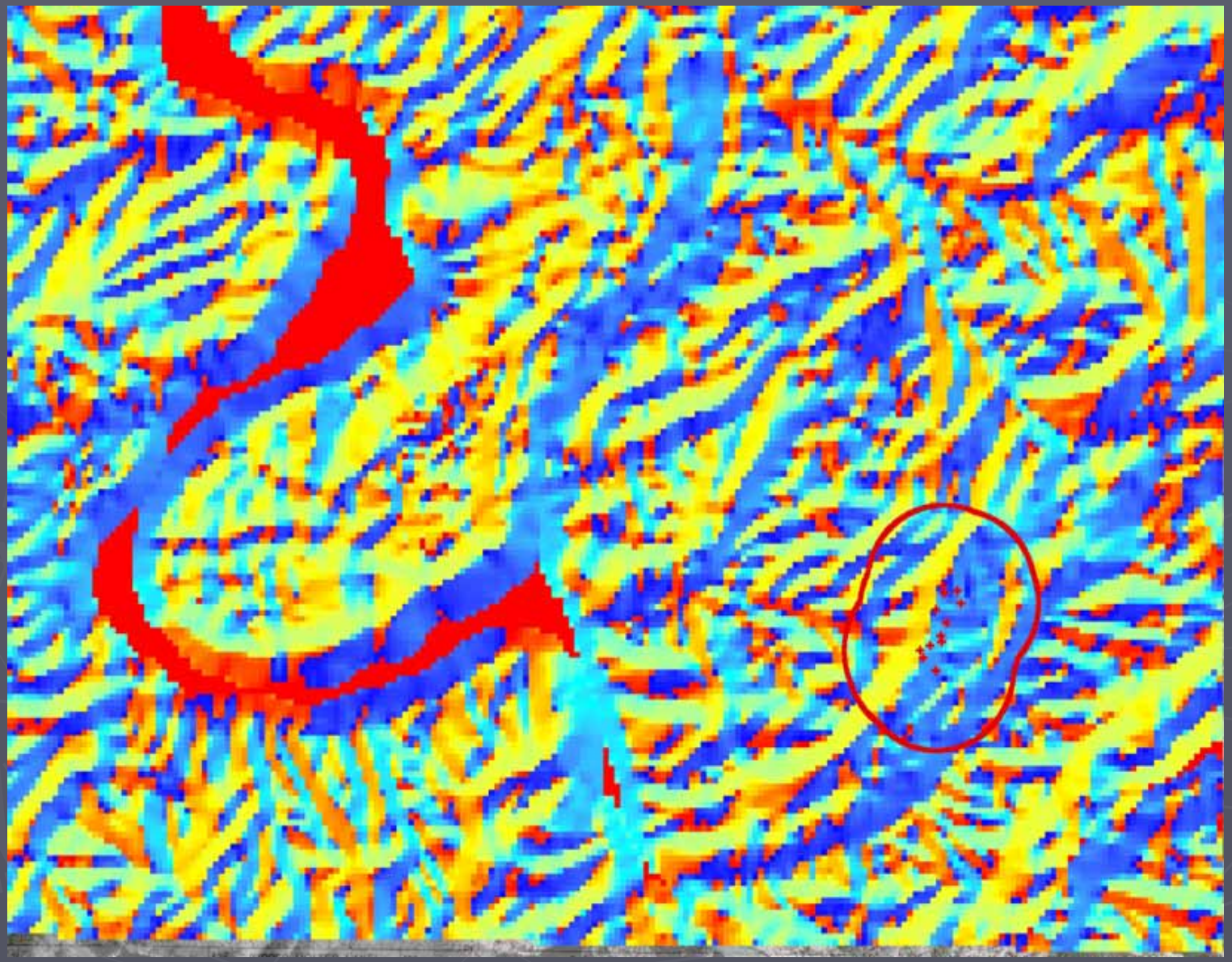
Next I created a buffer of ¼ mile around each point representing the fallen smokejumpers, and used the dissolve all option to create a contiguous area to be used in my analysis

Map showing buffer layer over digital raster graph and orthophoto

Using the spatial analyst surface analysis tool I created a slope layer file from the existing digital elevation model for each fire area.

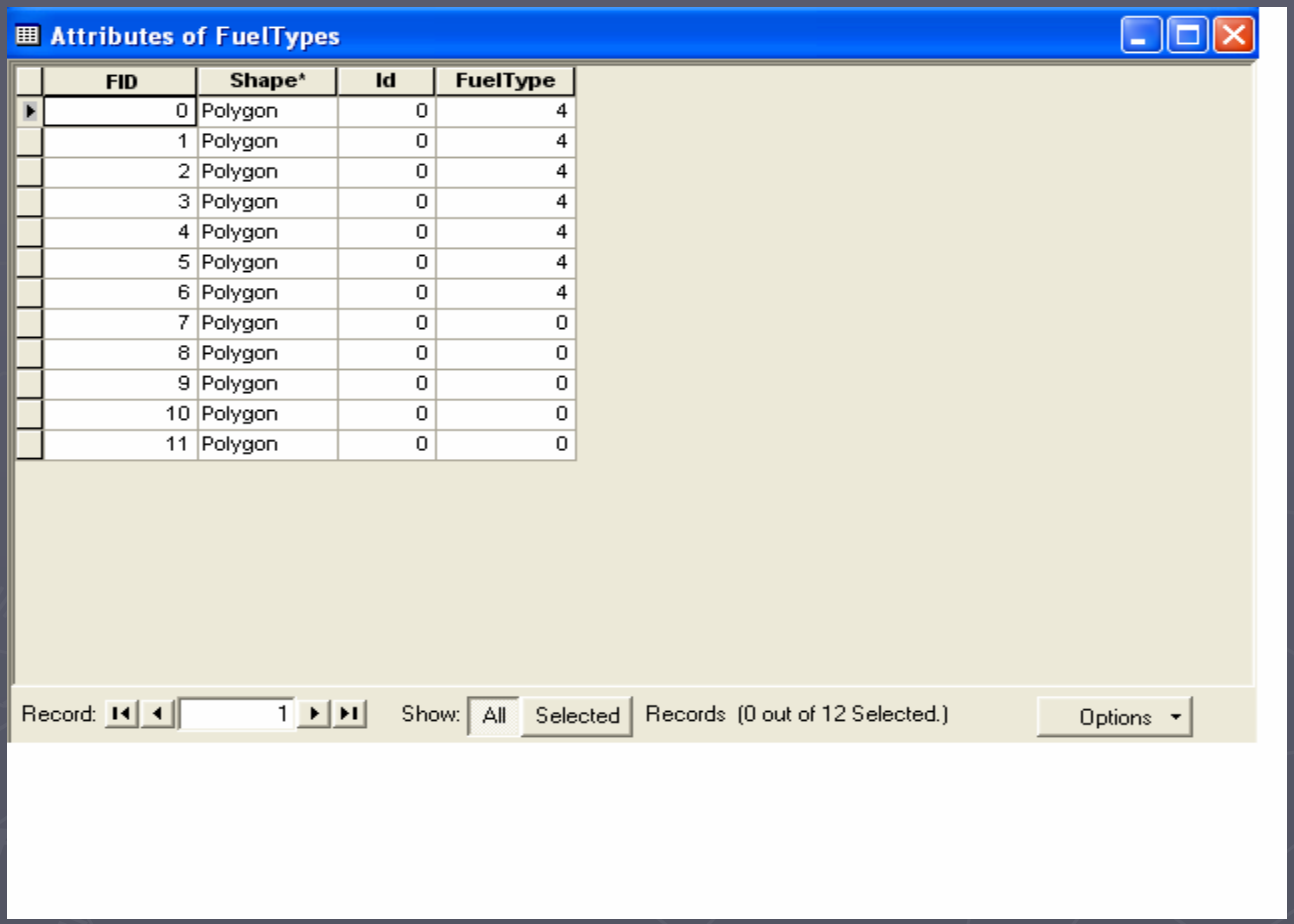


Using the spatial analyst surface analysis tool I created an aspect layer file from the existing digital elevation model for each fire area



Because I was unable to obtain fuel model data layers for either fire area, I digitized areas of obvious stands of timber and from written reports from both fires made the best guess at the fuel model type and ranked it based on its intensity and rate of burning. I then converted the rasters to shape files.

Map showing fuel types in the analysis area


Attributes of FuelTypes
FID
Shape*
Id
FuelType
0 Polygon 0 4
1 Polygon 0 4
2 Polygon 0 4
3 Polygon 0 4
4 Polygon 0 4
5 Polygon 0 4
6 Polygon 0 4
7 Polygon 0 0
8 Polygon 0 0
9 Polygon 0 0
10 Polygon 0 0
11 Polygon 0 0
Record: 1
Show: All Selected
Records (0 out of 12 Selected.)
Options

Using Zonal Statistics on the analysis area of each fire I determined:

- The average slope of the Mann Gulch analysis area is 37 degrees
- The average aspect of Mann Gulch analysis area is 230 degrees (West South West)
- The average elevation of Mann Gulch analysis area is 1419 meters
- The analysis area of Mann Gulch is 944,100 square meters

- The average slope of the Storm King analysis area is 40 degrees
- The average aspect of the Storm King analysis area is 240 degrees (Southwest)
- The average elevation of the Storm King Mountain analysis area is 1985 meters
- The analysis area of Storm King Mountain is 167,797 square meters

Attributes of zstat11 — Zonal statistics of Mann Gulch area slope

OID	VALUE	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM
0	0	1049	944100	0	359.236	359.236	229.58	95.322	240829

Record: 1 Show: All Selected Records (0 out of 1 Selected.) Options

Fuels analysis, or lack there of!

Because of my lack of fuel type data layers, my analysis is based on a simple ranking system I used based on the information I found in Forest Service reports generated after the fires.

There are 13 fuel model types used in calculating wild land fire behavior and for each type specifics of fuel loading, surface area of each fuel type, fuel type depth, and approximate moisture content of the various fuel types, I was unable to perform an actual analysis of the fires based on fuel types. I did determine that each fire area had fuel model types different from each other, but that those different types had Similar characteristics in the rate of spread and their intensity.

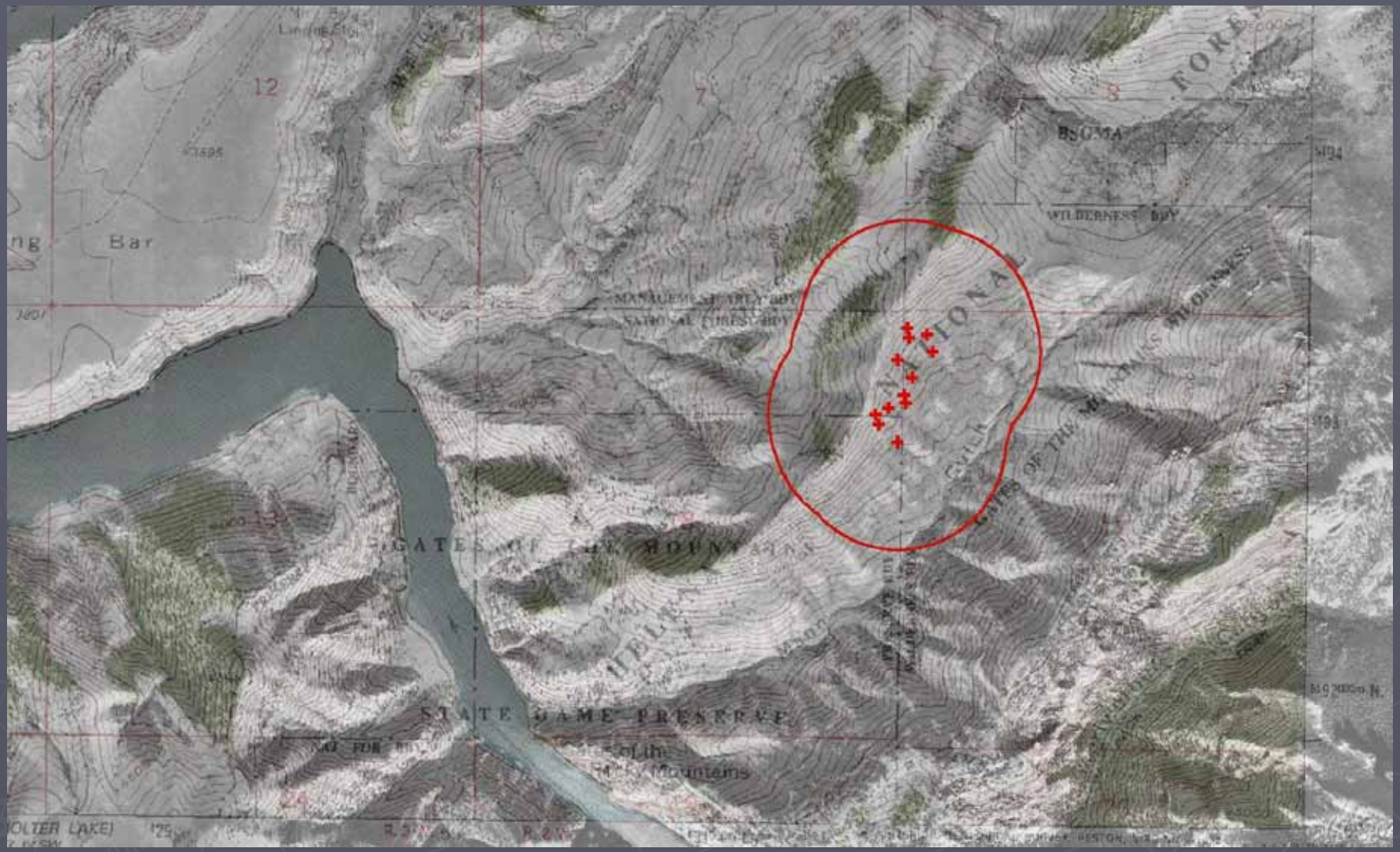
The Bottom Line

While my overall analysis was less than detailed due to the lack of adequate fuel models, I did determine that both the slope and aspect of each fire area are similar to each other. In addition to those similarities, both areas sit above a river canyon which has influencing winds which can drive the fires even faster up canyon.

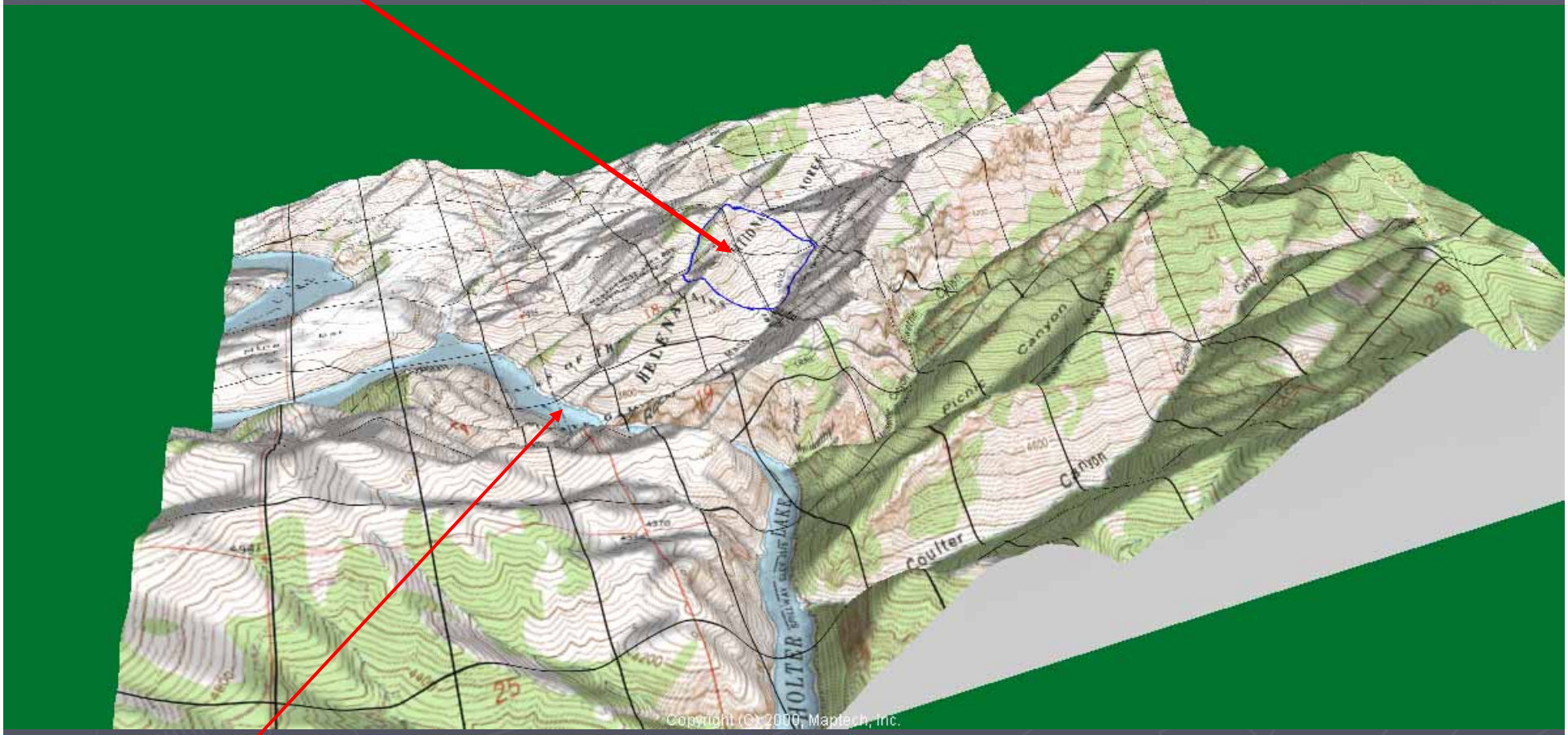
Other factors in common to both fires, which I don't yet know how to show via GIS, include the fact that both areas had experienced unusually high temperatures and insignificant precipitation as well as low relative humidity in the weeks preceding the fires, and that "dry" thunderstorms were known to be in both areas, and could have produced downdrafts, that when reached the surface, would be deflected outward and would also be a factor in the rate of spread of the fire front.

But wait!! There's more.....

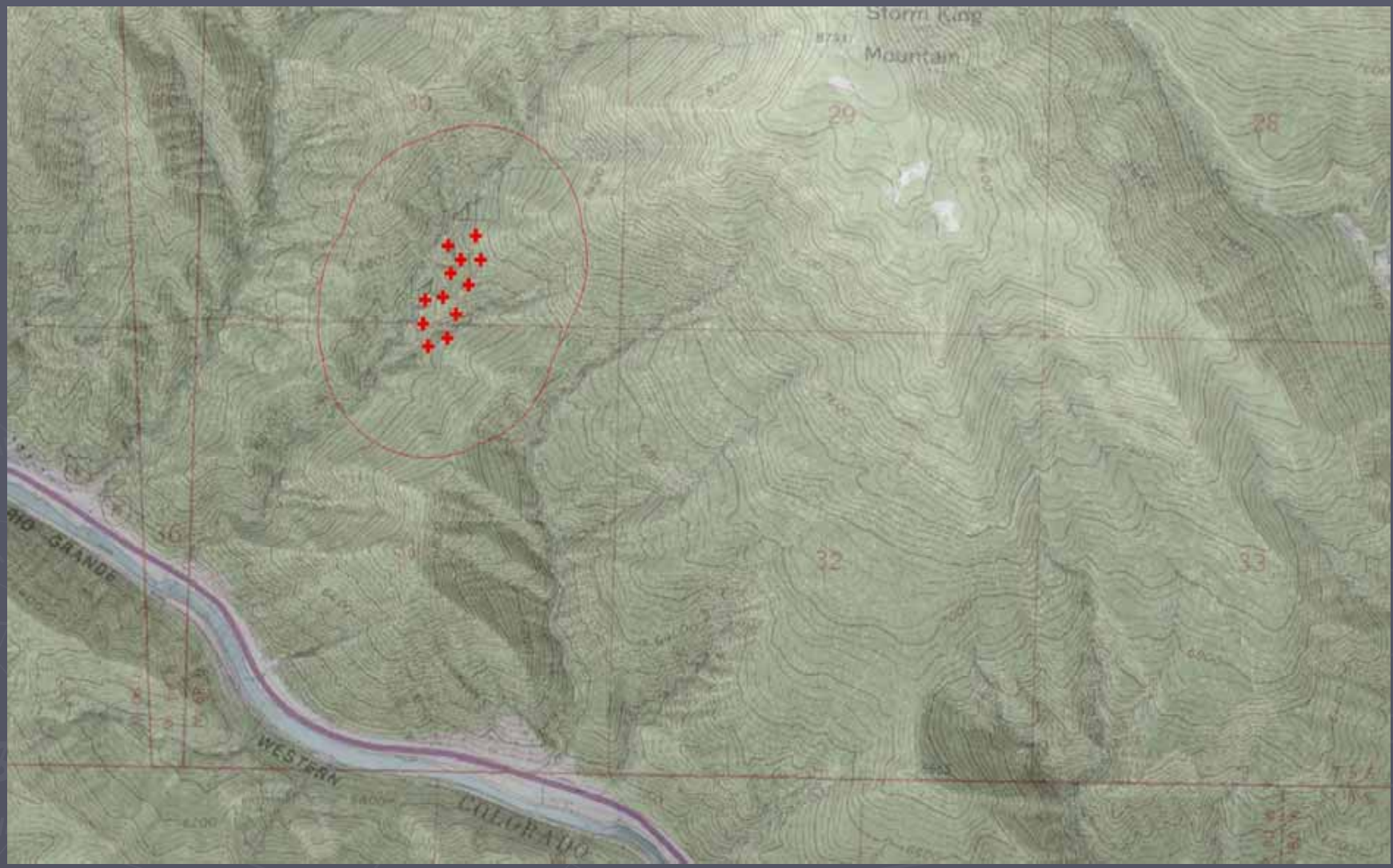
Mann Gulch Fire area



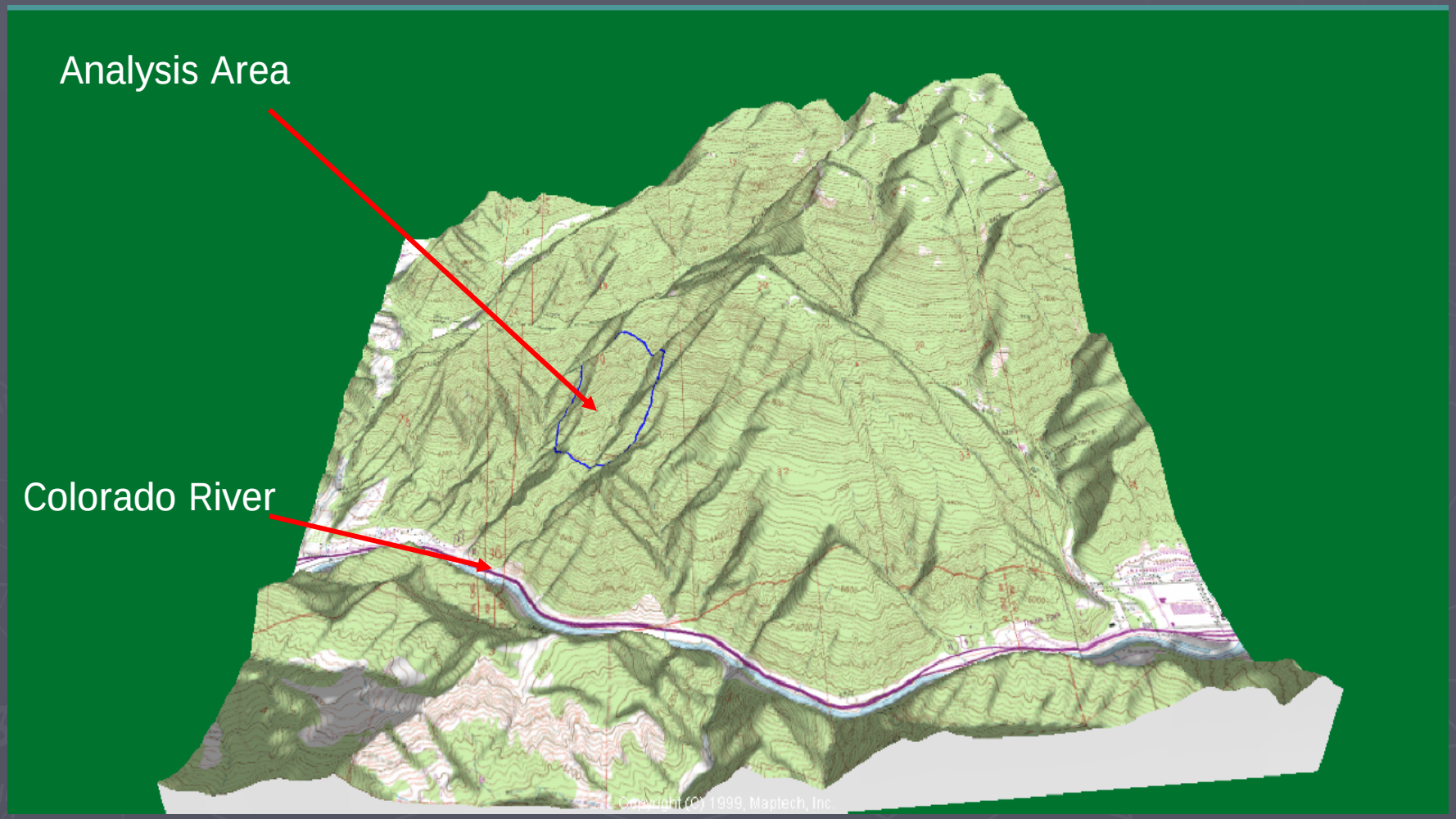
3-D view of Mann Gulch fire area



Storm King Mountain Fire area



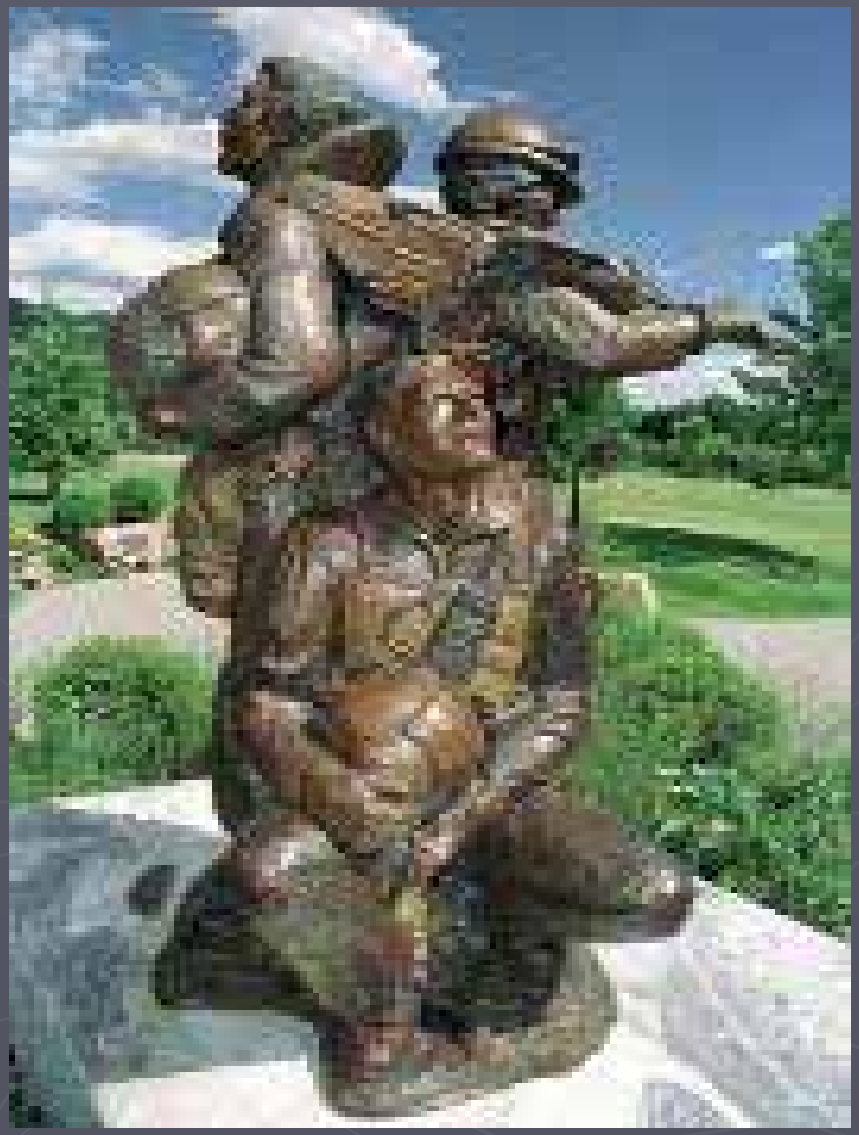
3-D view of Storm King fire area



Bronze plaque to the memory of the 13 firefighters killed at Mann Gulch. It is located at the Meriwether Campground, Helena National Forest, Mont.

The 13 firefighters (Harrison was a fire guard) who lost their lives at Mann Gulch. Earl Cooley Collection

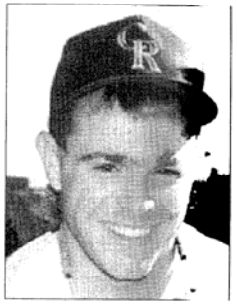
Bronze Storm King Mountain Memorial Statue



Smokejumpers who died on Storm King Mountain


Kathi Walsleben Beck


Scott Alan Blecha


Douglas Michael Dunbar


Bonnie Jean Holtby


Jon R. Kelso


Jim Thrash

We will never forget


Emera Jean Bickett


Levi Brinkley


Robert F. Browning Jr.


Terri Ann Hagen


Rob Johnson


Don Mackey


Roger Roth


Richard Kent Tyler