Surficial Geology and Geologic Hazards of Bonita and Rhyolite Canyons, Chiricahua National Monument, Arizona

Kristin S. Pearthree1 and Ann Youberg2

1University of New Mexico (pearthree@unm.edu), 2Arizona State Geological Survey, University of Arizona

Introduction

Geologic/Geomorphic Framework

- Turkey Creek Caldera erupted 26.9 Ma, creating thick welded rhyolite of the Turkey Creek Formation.
- Basin and Range extension begins 30 Ma lowering the Sulphur Springs Basin relative to the mountains.
- Downcutting continues to modern time, sediment is removed through modern time, sediment is removed through.
- Rhyolite weathered to form “hoodoos.”

Vegetation

- Sky island
- High biodiversity area.
- Madrone mixed conifer-pine-oak forests and woodlands.
- Madrone pinyon-juniper woodlands and grasslands.

Figure showing moisture moving north from the Gulf of Mexico and Gulf of California during the monsoon (from Driscoll, 2010).

Monsoon Climate

- Receives half of total annual precipitation during summer monsoon from June to September.
- Generates thunderstorms that can cause flooding or sparks wildfires.

Rhyolite Creek

- Active channel deposit
- Rhyolite Creek carries much coarser material than Bonita Creek.

View out of the mouth of Bonita Canyon, looking across Sulphur Springs Valley.

Rhyolite Creek

- Active channel deposit
- Rhyolite Creek carries much coarser material than Bonita Creek.

View out of the mouth of Bonita Canyon, looking across Sulphur Springs Valley.

Climate

- Climate data averages
- Minimum annual temperature 43.5°F
- Maximum annual temperature 93.7°F
- Mean temperature 65°F
- Annual precipitation 19.02 in.
- Snowfall precipitation 0.25 in.
- Precipitation on October 109.8 in.

Table: Climate data averages

<table>
<thead>
<tr>
<th>Climate Data Averages</th>
<th>Minimum Annual Temperature</th>
<th>Maximum Annual Temperature</th>
<th>Mean Temperature</th>
<th>Annual Precipitation</th>
<th>Snowfall Precipitation</th>
<th>Precipitation on October</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>43.5°F</td>
<td>93.7°F</td>
<td>65°F</td>
<td>19.02 in.</td>
<td>0.25 in.</td>
<td>109.8 in.</td>
</tr>
</tbody>
</table>

Hazards

Wildfire/Debris Flow

- Horseshoe 2 Fire in 2011 burned 70% of Chiricahua Mountain Range.
- Most inactive alluvial fans are debris flow deposits.
- No evidence for recent debris flows in the monument.
- Post-Horseshoe 2 Fire debris flows occurred throughout the burned area of the Chiricahua Mtns.

Extensive amount of paleo-debris flow deposits indicates there may have been many debris flows earlier in the Holocene.

This may correlate to an increased rate of stream terraces or may be a climate-change signal in the latest Pleistocene to early Holocene.

Unfortunately, a changing climate: it is possible the number of large wildfires could increase, increasing the number of debris flows.

Flooding

- Flshy watershed bed Bonita Creek.
- High risk to park infrastructure, especially during monsoon season.
- Horseshoe 2 Fire impacted soil and vegetation, increased runoff, and flood frequency.

Figure showing moisture moving north from the Gulf of Mexico and Gulf of California during the monsoon (from Driscoll, 2010).

Figure showing moisture moving north from the Gulf of Mexico and Gulf of California during the monsoon (from Driscoll, 2010).


References: