

# **Are we Currently in a Drought? What can the Instream Flow Study Results and other Drought Indices tell us?**

**March 30, 2008**

**DROUGHT – WATER QUALITY AND WATER QUANTITY**  
**Jennifer L. Krstolic, US Geological Survey**

**Northern Shenandoah Valley  
Regional Commission**

**Central Shenandoah Planning  
District Commission**

**In Cooperation with the US Geological Survey**

# Virginia Drought Assessment Plan

Precipitation Deficits

Streamflow Statistics

Ground-Water Levels

Reservoir Storage

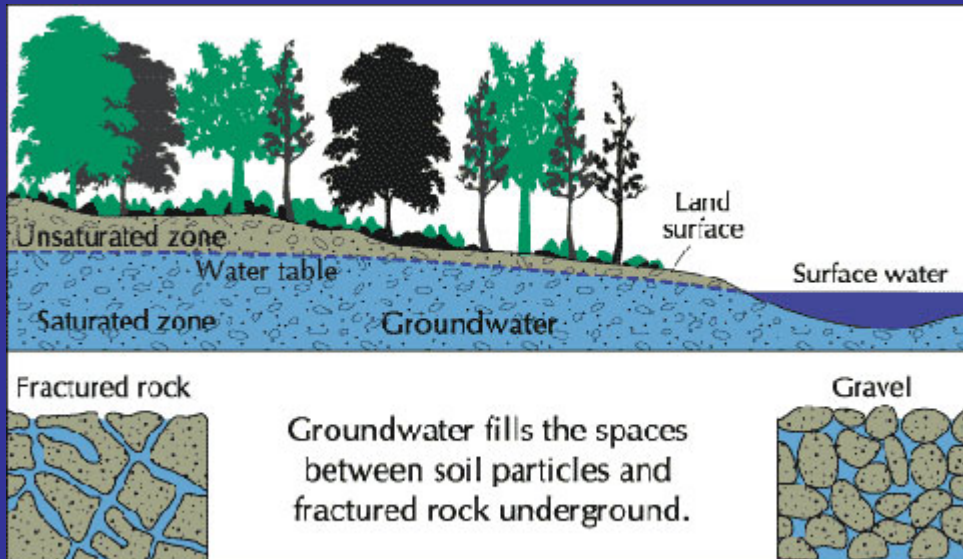
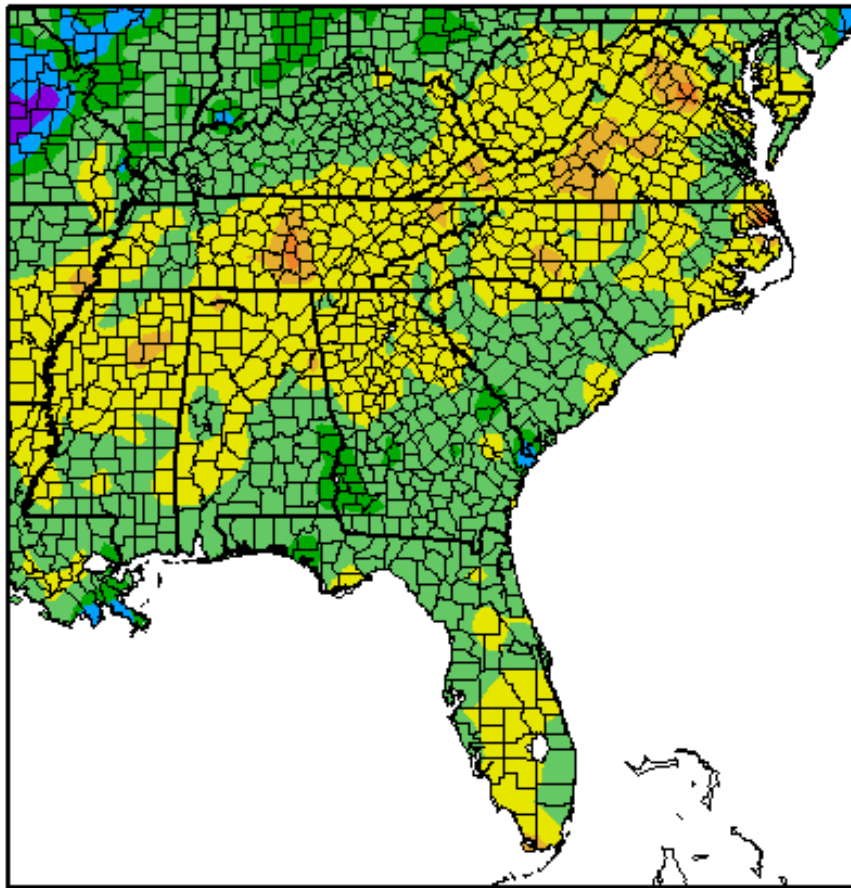


Image compliments of US Geological Survey, adapted by The Groundwater Foundation.

# Regional Precipitation Deficit Map

90 Day SPI  
12/21/2007 - 3/19/2008

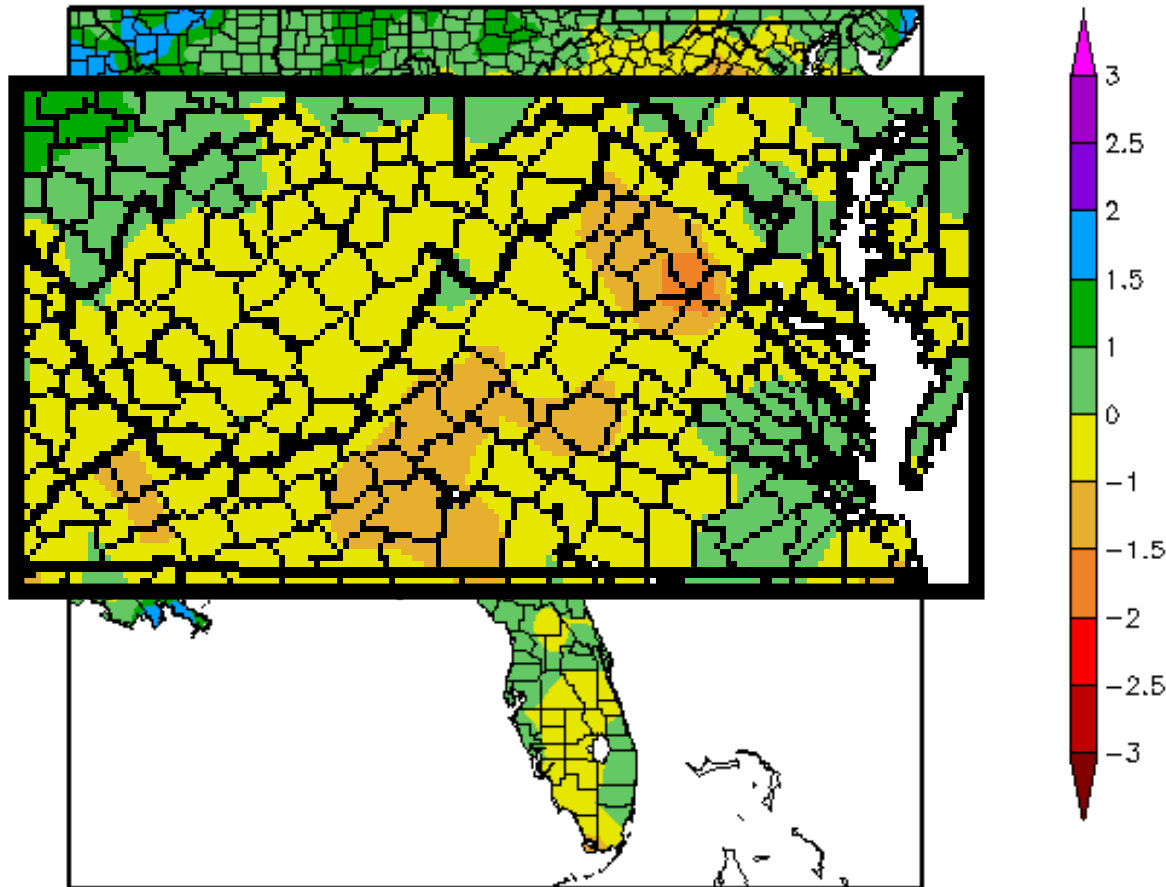


0 to -1.5 deficit

81% of  
normal for  
October to  
March

# Regional Precipitation Deficit Map

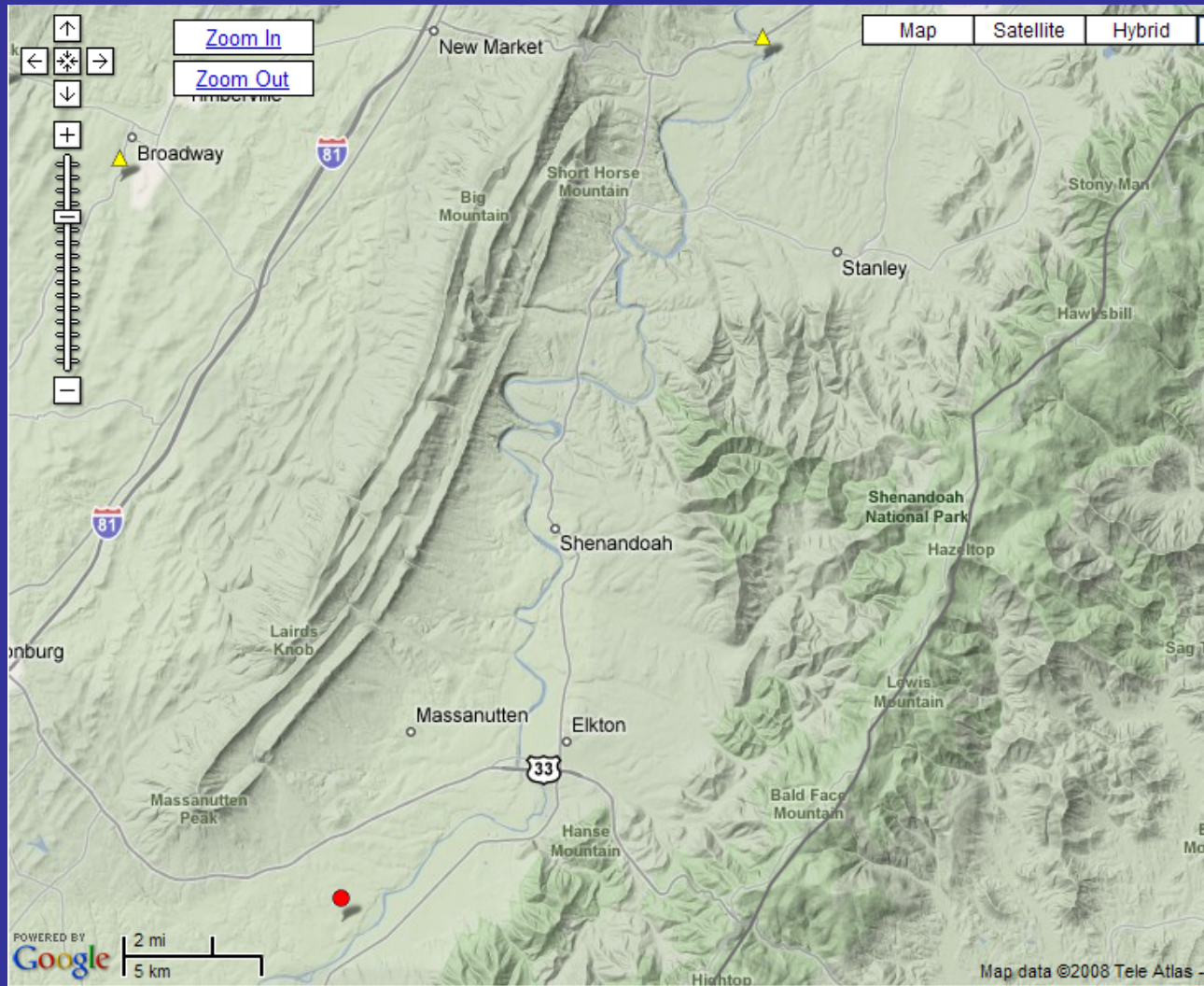
90 Day SPI  
12/21/2007 - 3/19/2008



0 to -1.5 deficit

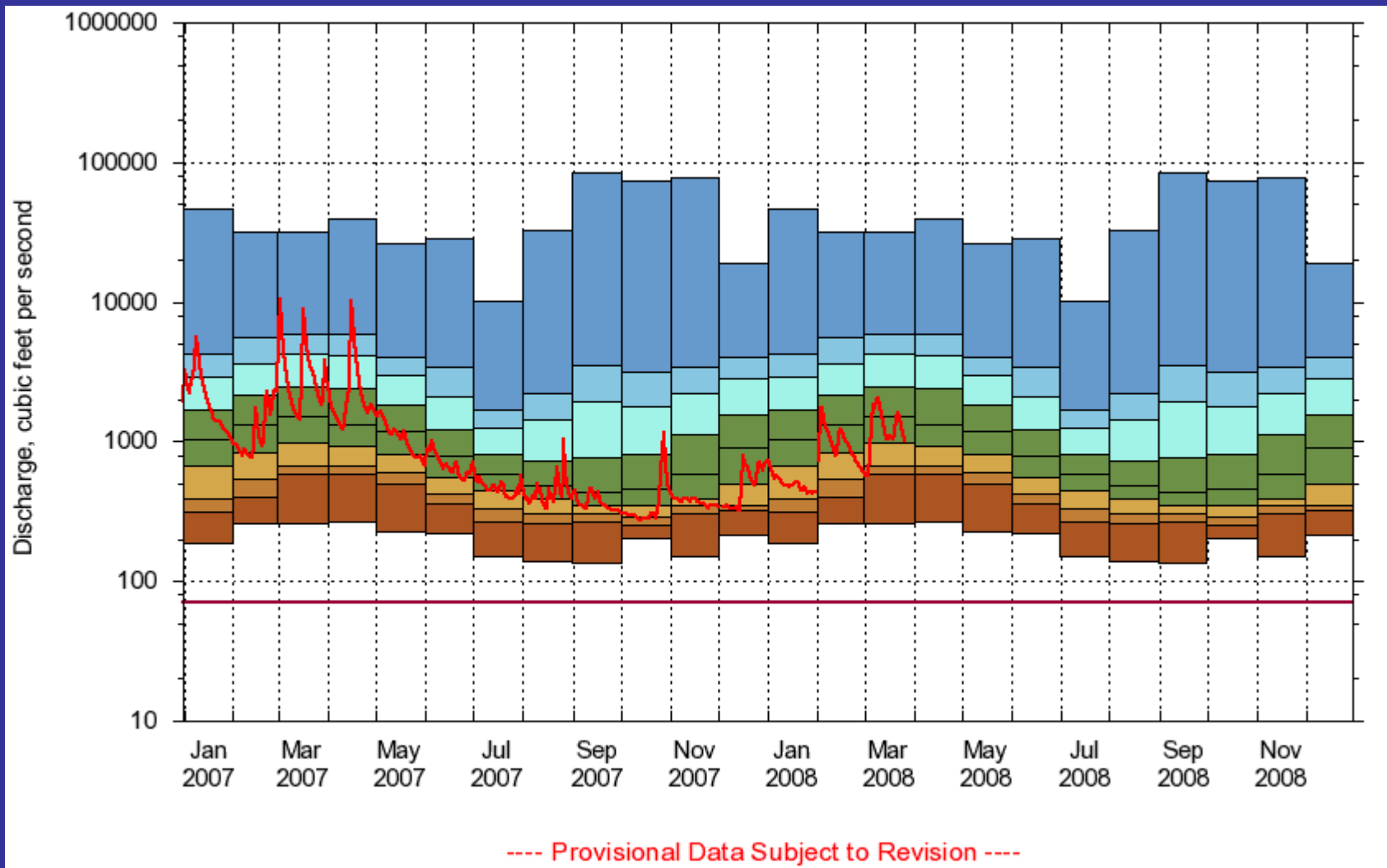
81% of  
normal for  
October to  
March

# Stream Gage and Well Locations in Page and Rockingham Counties

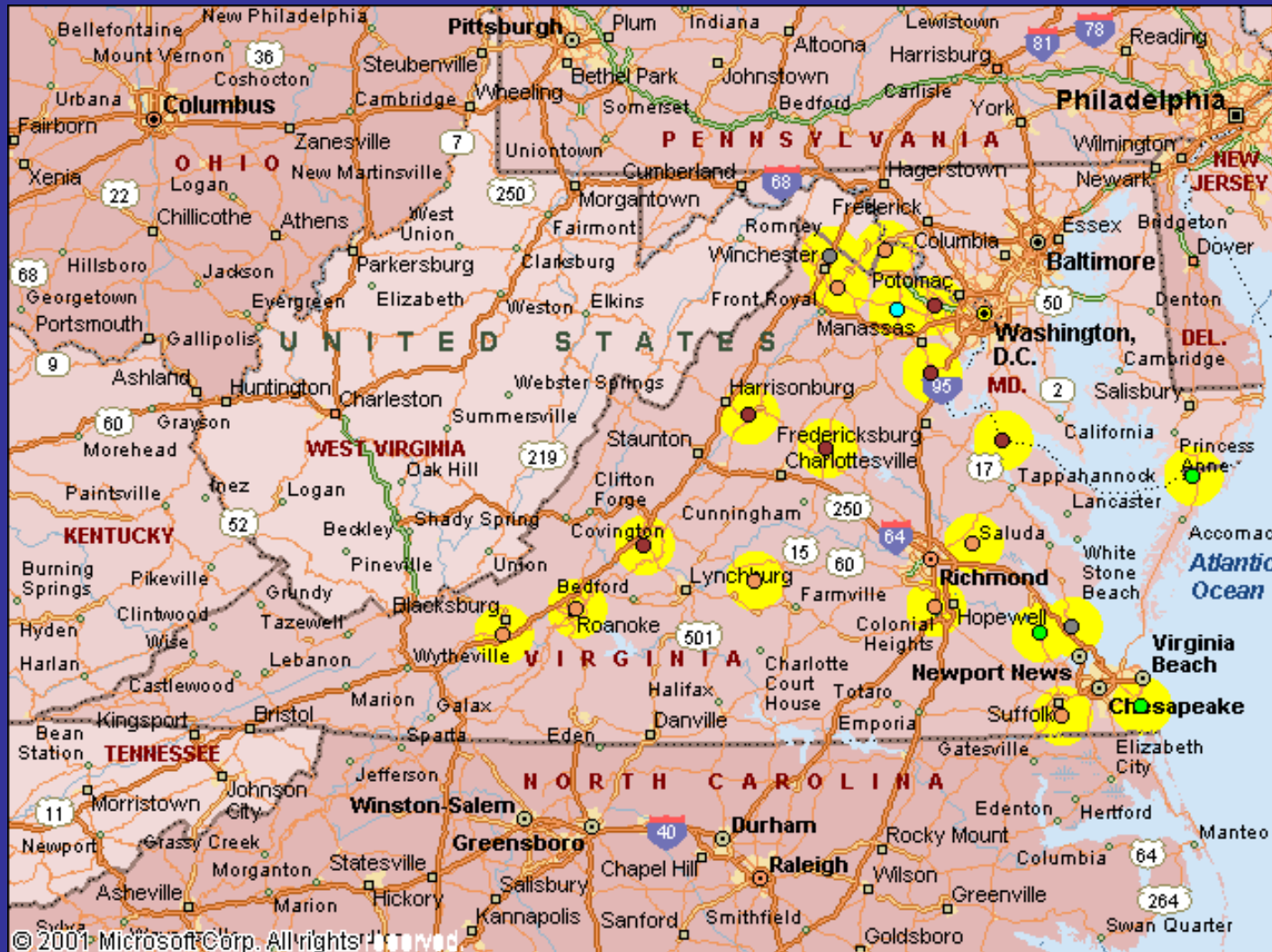


[http://va.water.usgs.gov/clarke/Valley\\_RT1.htm](http://va.water.usgs.gov/clarke/Valley_RT1.htm)

# Flow Duration: Monthly Statistics and Daily Streamflow at Luray

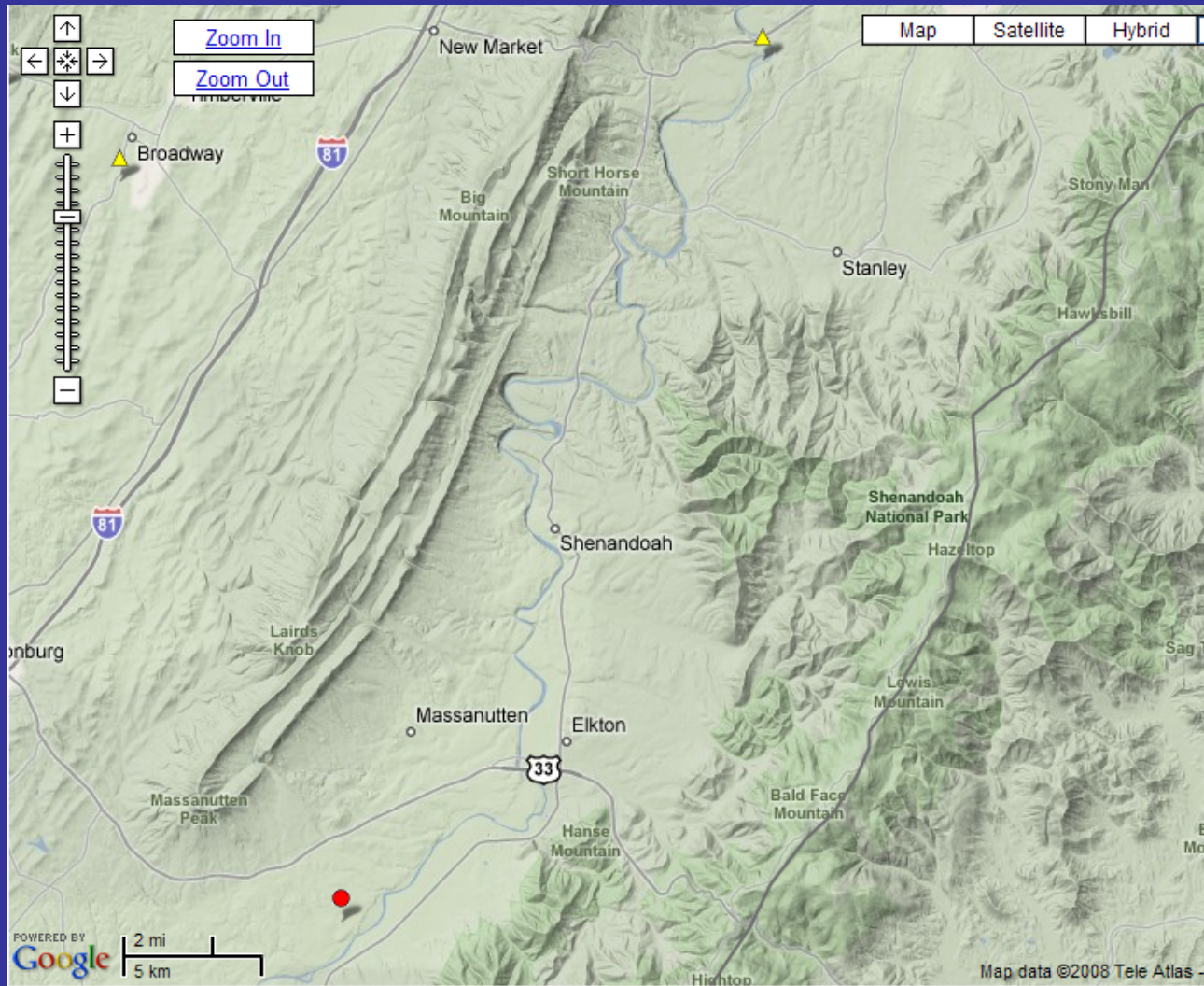


# Virginia Ground-Water Levels



<http://groundwaterwatch.usgs.gov/crn/StateMaps/VA.html>

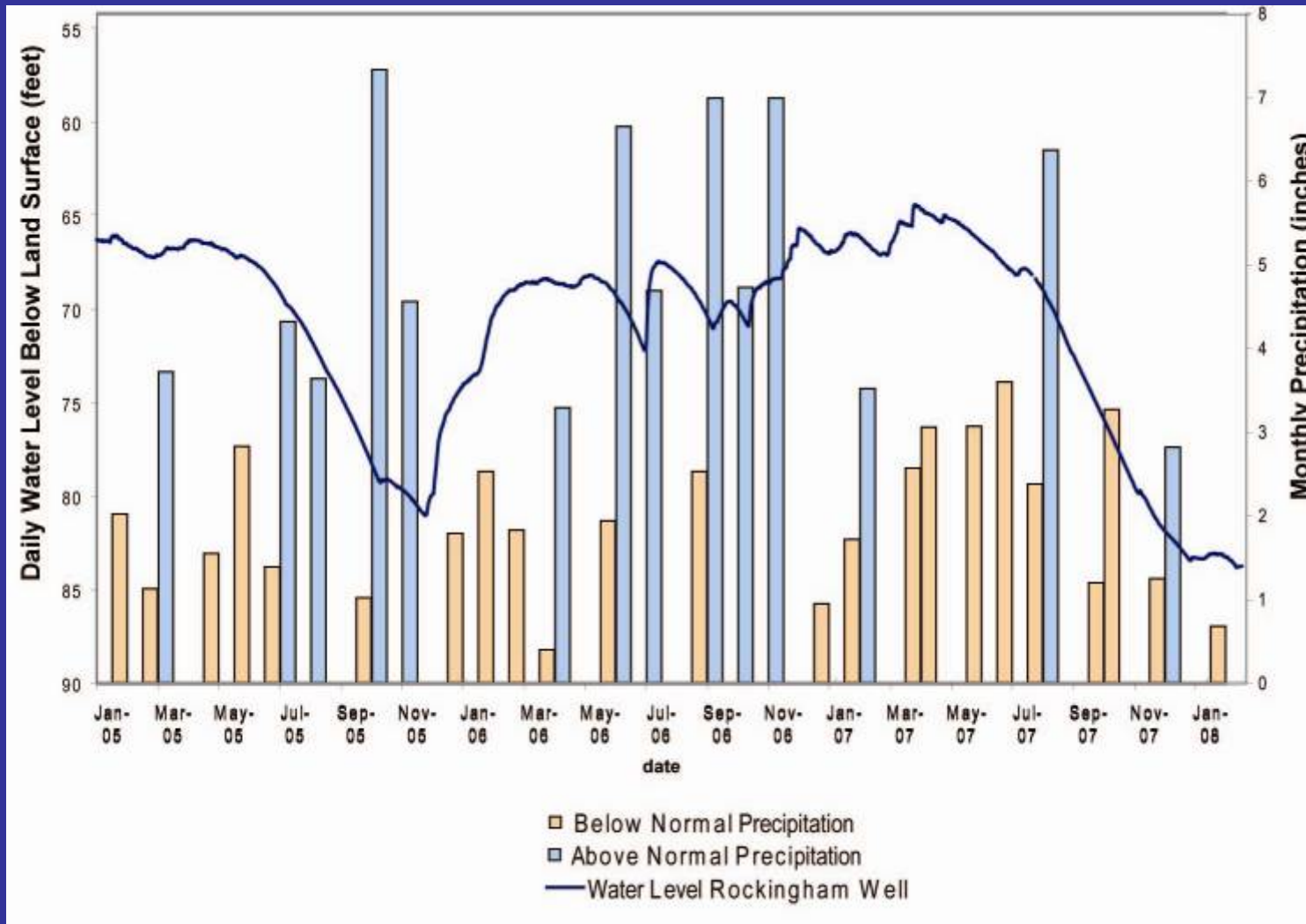
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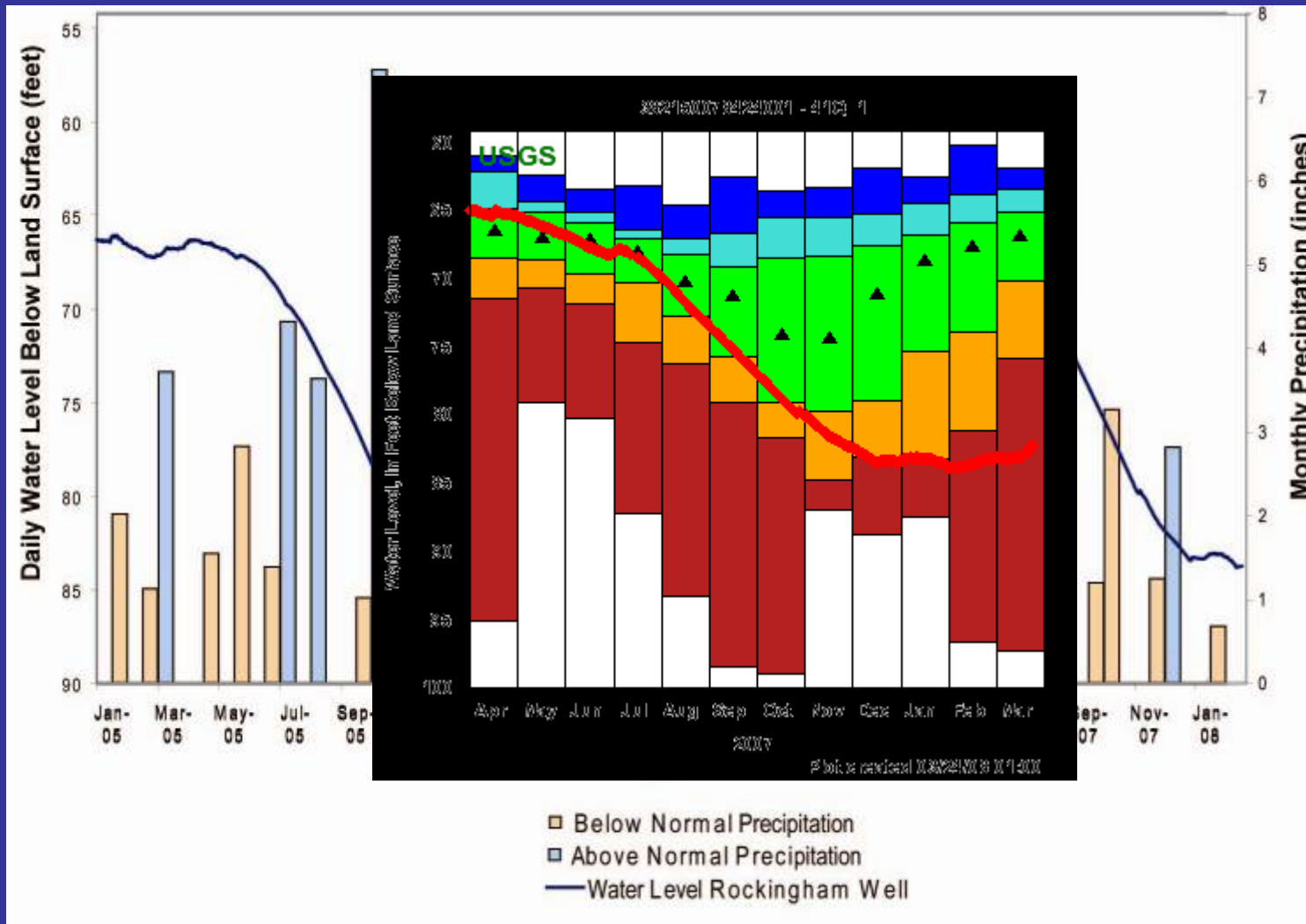
[http://va.water.usgs.gov/clarke/Valley\\_RT1.htm](http://va.water.usgs.gov/clarke/Valley_RT1.htm)



# Effect of Precipitation on Ground-Water Levels in Rockingham County



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<http://groundwaterwatch.usgs.gov/crn/StateMaps/VA.html>

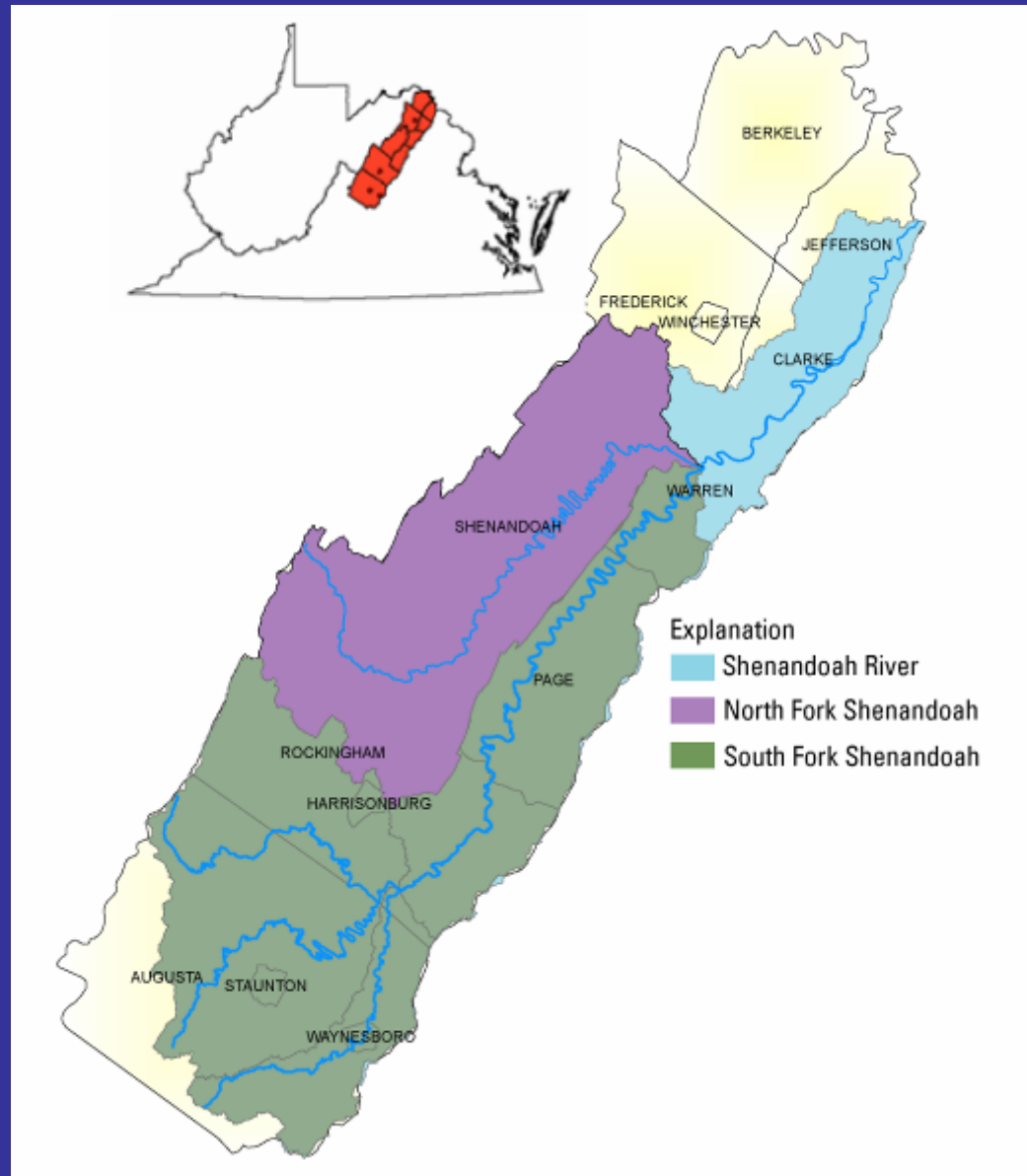
# Major Basins of the Shenandoah Valley

## South Fork Study Area (Green)

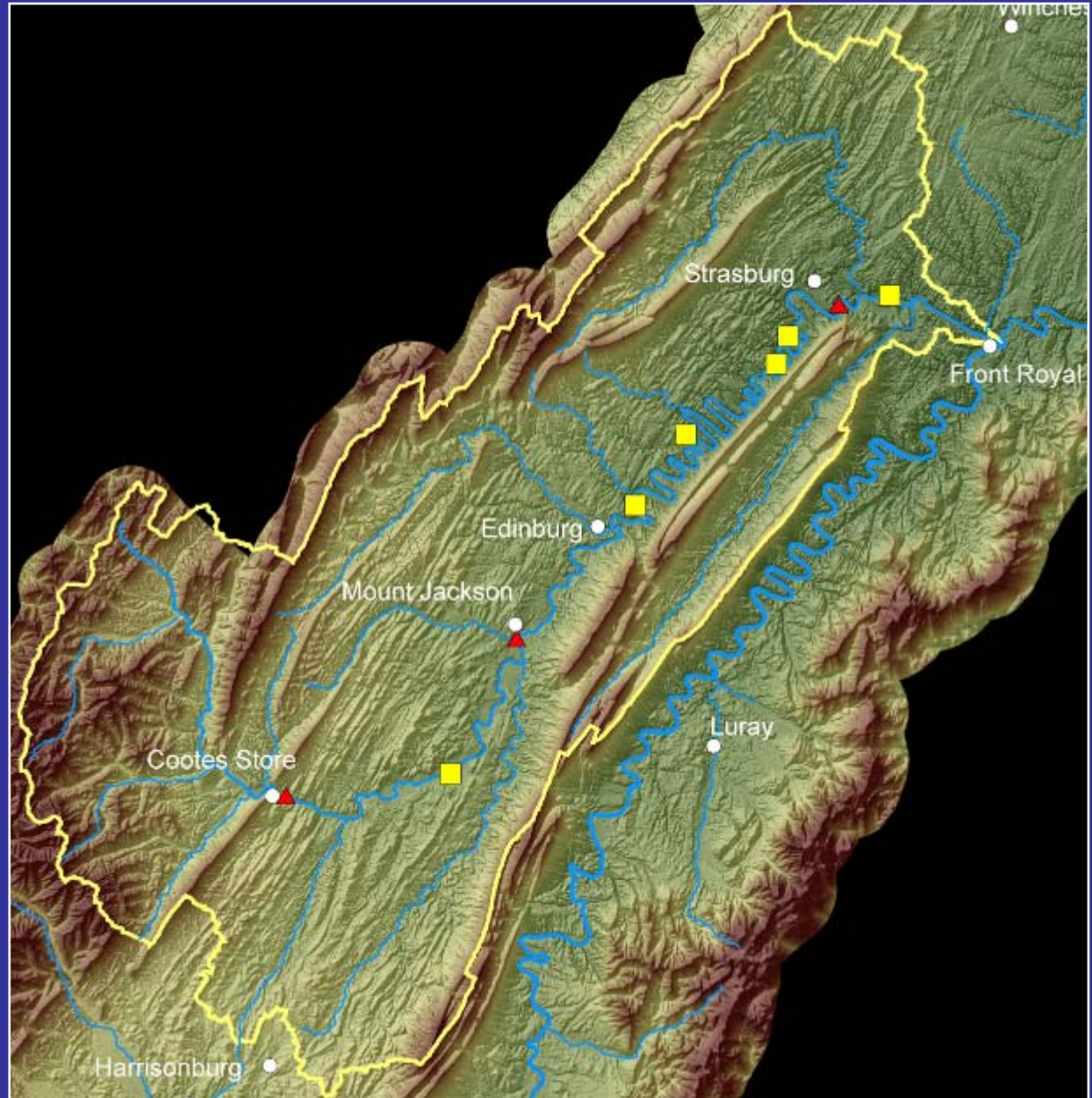


Enhance understanding of low-flow conditions

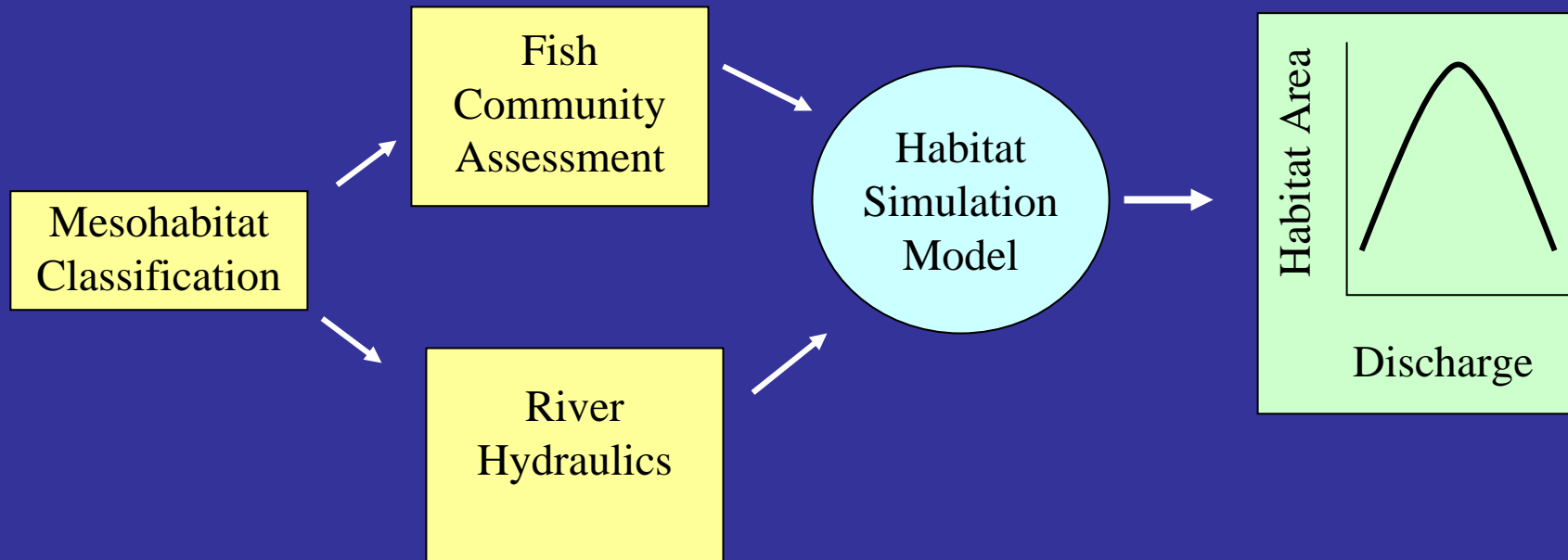
Relate water-availability to habitat needs of fish



# North Fork Shenandoah River Study Sites and Stream Gages



# Model Development to Identify Ecological Flows

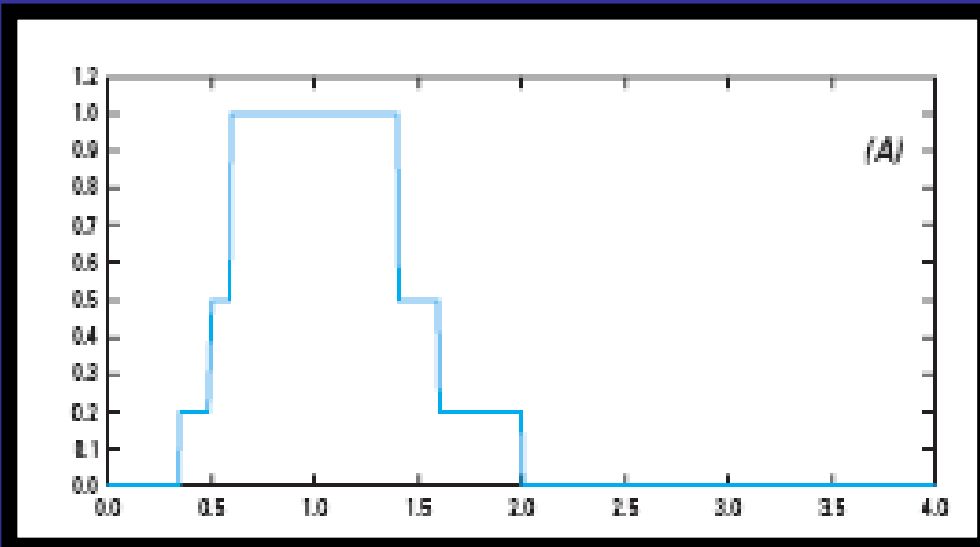


Manning's Equation:

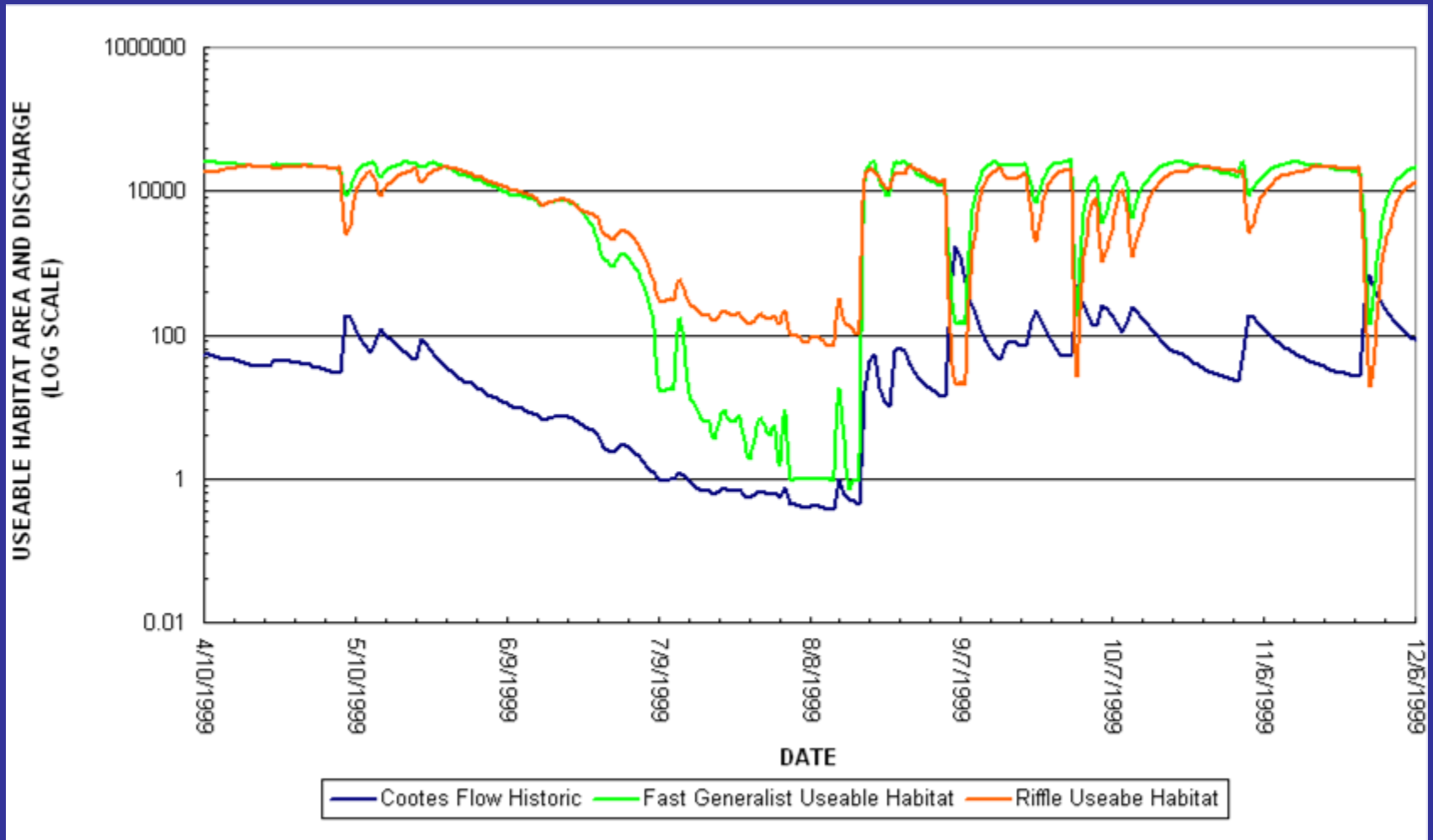
$$V = \frac{1.486 R^{2/3} S_e^{1/2}}{n}$$

# Fish Microhabitat Data Collection & Analysis

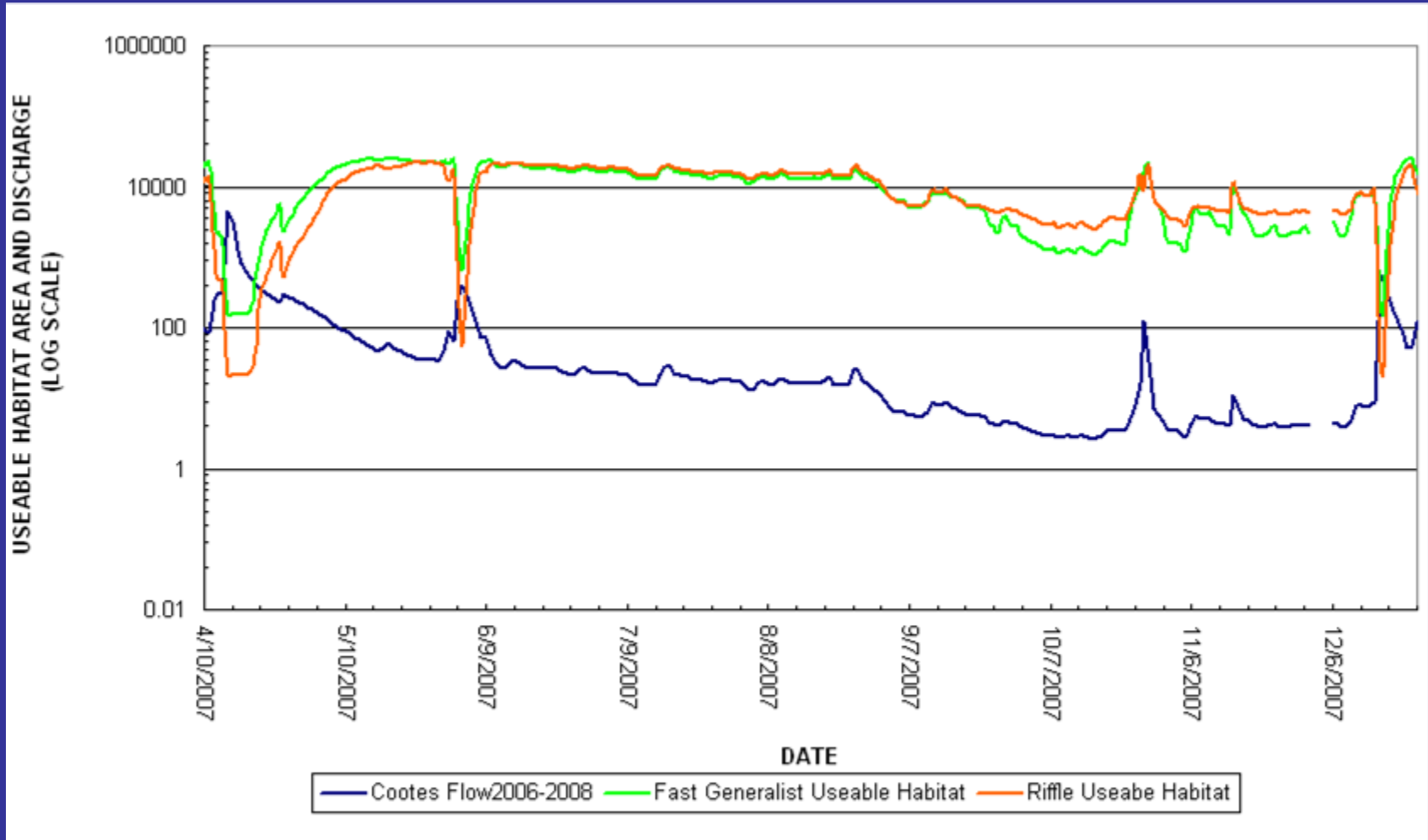
- Snorkeling
- Electro shocking
- Habitat Suitability Curve



# 1999 vs. 2007 Drought Conditions for Riffle and Fast Generalist Fish

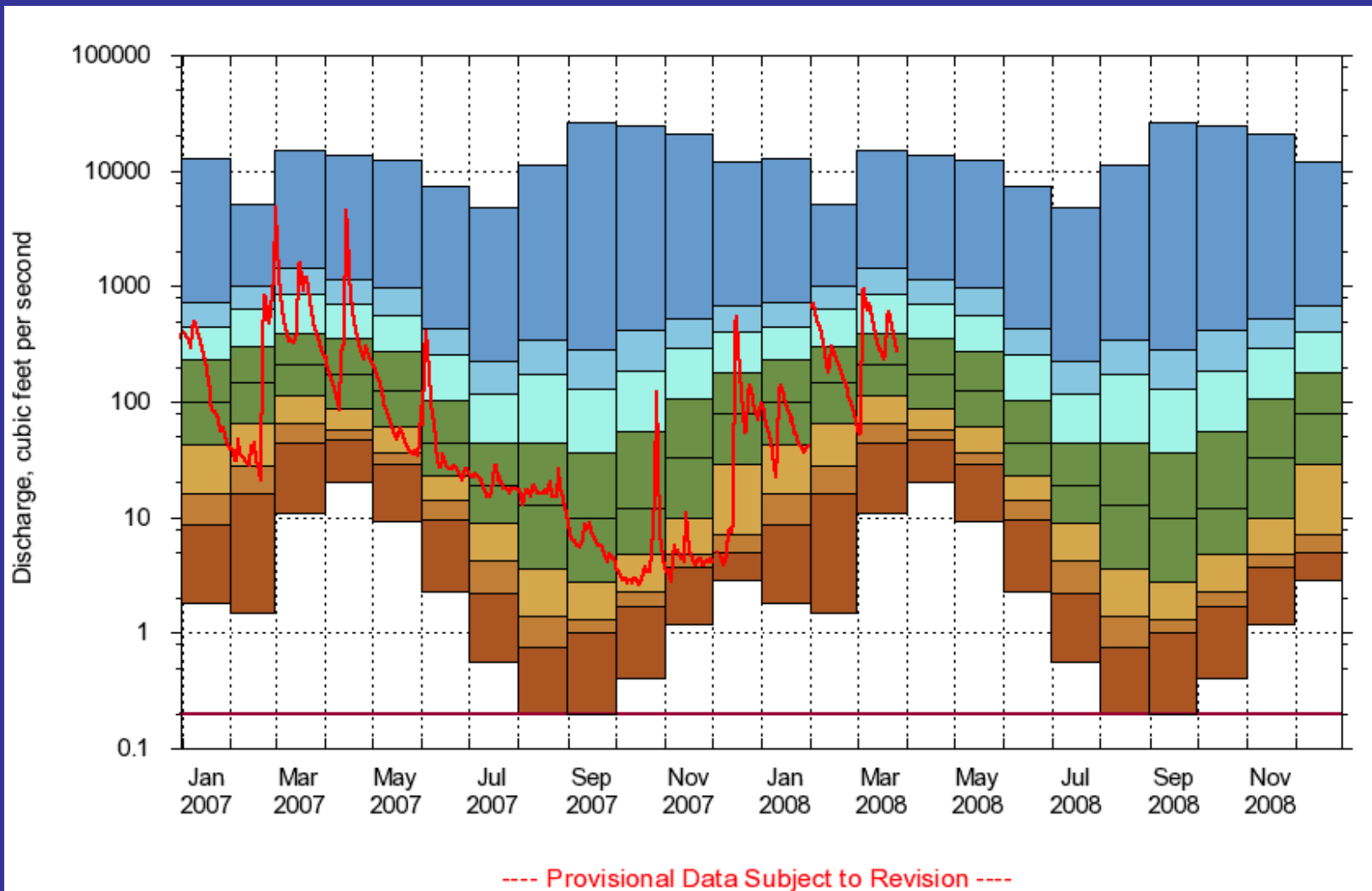


# 1999 vs. 2007 Drought Conditions for Riffle and Fast Generalist Fish





# Flow Duration: Monthly Statistics and Daily Streamflow at Cootes Store



# Drought Stage Levels

Percentiles from habitat simulation modeling results for the North Fork Shenandoah River

Stage	Cootes Store	Mt. Jackson	Strasburg
Normal	62% (>100 cfs)	37% (>120 cfs)	22% (>150cfs)
Watch	62% (< 100 cfs)	37% (>120 cfs)	22% (>150 cfs)
Warning	50% (<60 cfs)	25% (<75 cfs)	5 % (<90 cfs)
Emergency	33% (<25 cfs)	4 % (<30 cfs)	1 % (<65 cfs)

Annual flow percentages for drought evaluation

South Fork Shenandoah Front Royal	
Normal	> 25%
Watch	25%
Warning	10%
Emergency	5%

# Summary: What does the data tell us?

## Are we in a drought?

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- **Precipitation:** 0 to -1.5 deficit January
  - 81% of normal for October to March
- **Ground Water:** Less than 10<sup>th</sup> percentile, drought warning
- **Stream Flow:** 25<sup>th</sup> percentile, normal but heading down
- **Habitat Availability:** NF streamflow and habitat is normal

South Fork Shenandoah	
Precipitation	81 %
Stream Flow	25%
Ground Water	< 10%
Habitat	normal



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**Questions ?**

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