Development of the StreamStats Web Application in North Carolina using Local Resolution Data

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What is StreamStats?

StreamStats is Web-based GIS application that was created by the USGS, to provide users with access to an assortment of analytical tools that are useful for water-resources planning and management.

- StreamStats allows users to easily obtain streamflow statistics, basin characteristics, and descriptive information for USGS data-collection stations and user-selected ungaged locations.
- Delineate the drainage-basin boundary for a user-selected stream location and summarize basin characteristics for the delineated basin.
- StreamStats makes the process of computing basin characteristics and streamflow statistics for ungaged locations faster, accurate, and consistent.

North Carolina StreamStats

- Currently StreamStats applications exclusively use 10- and 30-meter Digital Elevation Models (DEMs) and 1:24,000 and 1:100,000 scale National Hydrography Datasets (NHD).
  - NHD is a comprehensive set of digital spatial data representing the surface water of the United States using common features such as lakes, ponds, streams, rivers, canals, and oceans.
- While these datasets are adequate for some state applications, availability of higher resolution elevation data, predominately LIDAR, is promoting demand to incorporate these more accurate data into scientific applications.
- In 2007, the State of North Carolina completed development of a local resolution NHD product for 19 western counties. The best available combination of digital orthophotography, digital terrain models derived from LIDAR and existing hydrography was used to create the local resolution NHD product.

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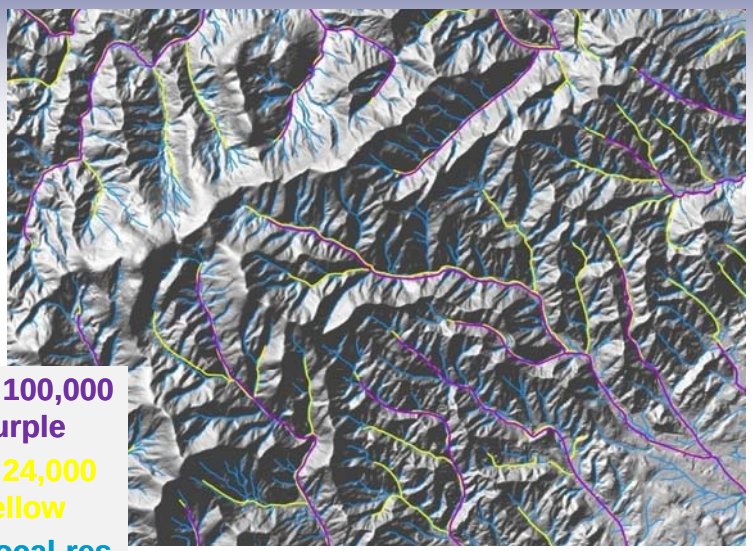
NC Local Resolution NHD



NHD 1:100,000 in purple

NHD 1:24,000 in yellow

NHD Local-res blue

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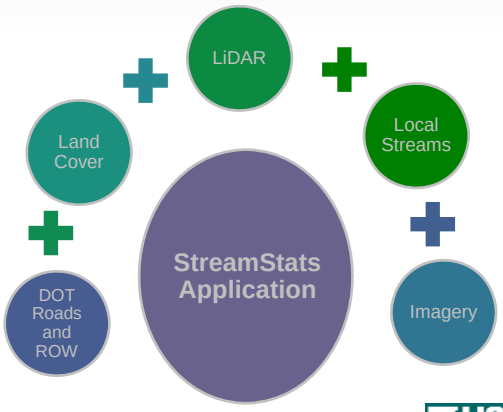
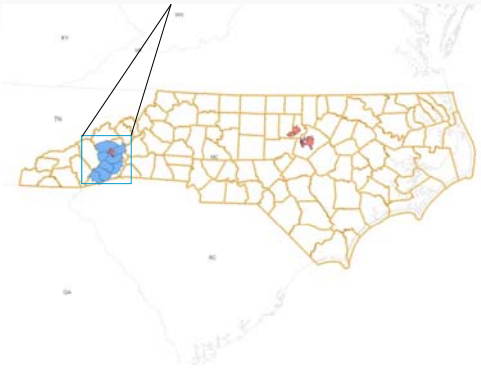
North Carolina StreamStats

The USGS, in cooperation with the NCDOT, conducted a pilot project to develop and implement a practical application to leverage value of local-resolution datasets and help justify completion of local resolution NHD statewide.



North Carolina StreamStats Pilot Study Area

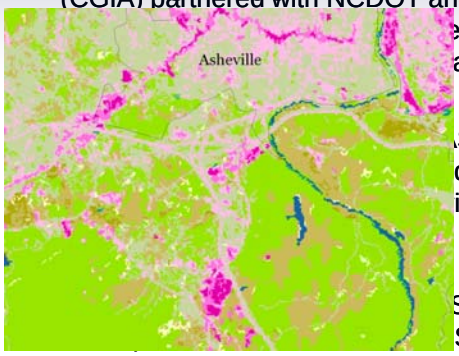
Upper French Broad River Watershed



Land Cover in NC StreamStats

- The North Carolina Center for Geographic Information & Analysis (CGIA) partnered with NCDOT and the USGS on a pilot project to

NLCD 2001

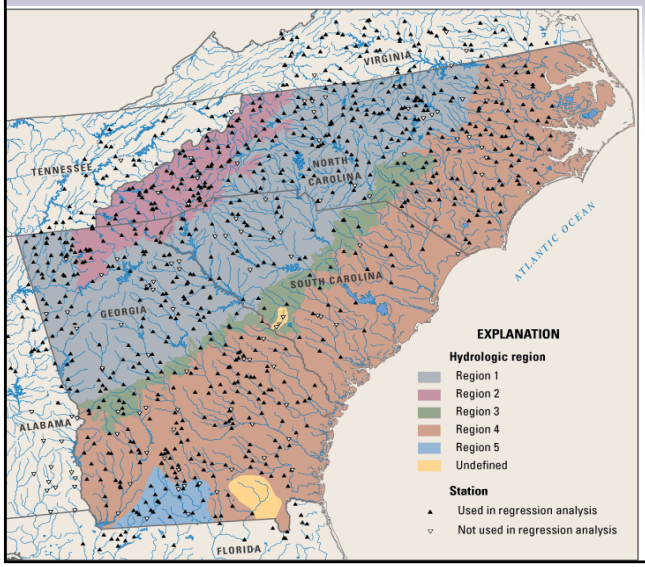


CGIA Land Cover 2005

Integration of StreamStats and NC OneMap

- Imagery and roadway data layers are served on StreamStats by linking to NC OneMap as a WebService
- The most current data will be available and updates to imagery and roadway data will automatically be reflected in StreamStats.

Integration of Multi-state Flood Frequency Equations



- 310 sites in Georgia
- 64 sites in South Carolina
- 303 sites in North Carolina
- 40 sites in Tennessee
- 68 sites in Virginia
- 20 sites in Alabama
- 23 sites in Florida

Total of 828 sites

Shift in flood-frequency terminology

- **What is a recurrence interval or return period?**

  …the expected (or average) length of time between occurrences of floods that exceed a given discharge.

  …the words "recurrence" or "return" do not imply regular predictable occurrence in time.

Percent chance exceedance

- **Percent chance exceedance is the percent chance that the discharge will exceed a given discharge in any year.**
- **It is the annual probability of occurrence times 100.**

  ***Example*: For the 100-year flood or 0.01 annual probability of occurrence, the percent chance exceedance is (1/100)*100 or 1% for any given year.**

Multi-state Flood Frequency Equations

Percent chance exceedance	Hydrologic Region				
	1	2	3	4	5
50	$158(DA)^{0.649}$	$110(DA)^{0.779}$	$25.7(DA)^{0.758}$	$60.3(DA)^{0.649}$	$91.2(DA)^{0.649}$
20	$295(DA)^{0.627}$	$209(DA)^{0.749}$	$44.7(DA)^{0.744}$	$123(DA)^{0.627}$	$200(DA)^{0.627}$
10	$398(DA)^{0.617}$	$288(DA)^{0.736}$	$58.9(DA)^{0.740}$	$174(DA)^{0.617}$	$295(DA)^{0.617}$
4	$537(DA)^{0.606}$	$398(DA)^{0.724}$	$77.6(DA)^{0.736}$	$245(DA)^{0.606}$	$447(DA)^{0.606}$
2	$661(DA)^{0.600}$	$479(DA)^{0.718}$	$91.2(DA)^{0.735}$	$309(DA)^{0.600}$	$575(DA)^{0.600}$
1	$776(DA)^{0.594}$	$575(DA)^{0.713}$	$105(DA)^{0.733}$	$380(DA)^{0.594}$	$724(DA)^{0.594}$
0.5	$891(DA)^{0.589}$	$661(DA)^{0.709}$	$120(DA)^{0.733}$	$447(DA)^{0.589}$	$891(DA)^{0.589}$
0.2	$1,072(DA)^{0.583}$	$794(DA)^{0.704}$	$138(DA)^{0.732}$	$550(DA)^{0.583}$	$1,148(DA)^{0.583}$

Comparison with previous NC study

Average standard error of prediction (percent)

Percent chance exceedance	Updated relations	WRIR 01-4207		
		Blue Ridge - Piedmont	Coastal Plain	Sand Hills
50	34.5	41.2	37.9	38.4
20	34	41.2	35.9	42.6
10	35.1	42.0	36.3	45.6
4	37.5	43.6	38.0	49.8
2	39.6	45.9	39.8	53.1
1	41.9	47.0	42.0	56.6
0.5	44.3	48.9	44.2	60.2
0.2	47.7	51.6	47.3	65.1

Comparison with previous NC study

1-percent chance exceedance peak discharge (cfs)

Drainage area, mi^2	WRIR 01-4207	Updated	Percent difference
1	745	575	-22.8%
10	3,140	2,970	-5.4%
50	8,590	9,360	9.0%
100	13,200	15,300	15.9%
500	36,200	48,300	33.4%
1000	55,900	79,300	41.9%
5000	153,000	250,000	63.4%
9000	221,000	380,000	71.9%

Blue Ridge hydrologic region

Comparison with previous NC study

1-percent chance exceedance peak discharge (cfs)

Drainage area, mi^2	WRIR 01-4207	Updated	Percent difference
1	745	776	4.2%
10	3,140	3,050	-2.9%
50	8,590	7,930	-7.7%
100	13,200	12,000	-9.1%
500	36,200	31,100	-14.1%
1000	55,900	47,000	-15.9%
5000	153,000	122,000	-20.3%
9000	221,000	173,000	-21.7%

Piedmont hydrologic region

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Comparison with previous NC study

1-percent chance exceedance peak discharge (cfs)

Drainage area, mi^2	WRIR 01-4207	Updated	Percent difference
1	468	380	-18.8%
10	1,720	1,490	-13.4%
50	4,280	3,880	-9.3%
100	6,340	5,860	-7.6%
500	15,800	15,200	-3.8%
1000	23,300	23,000	-1.3%
5000	58,100	59,900	3.1%
9000	n/d	n/d	n/d

Coastal Plain hydrologic region

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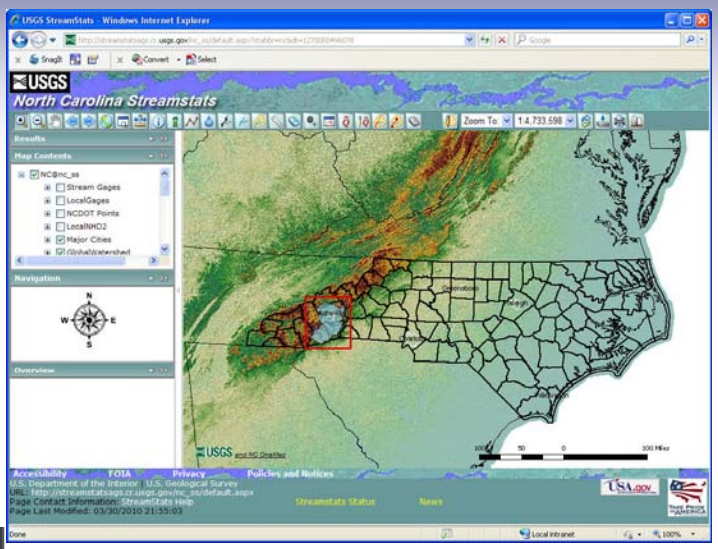
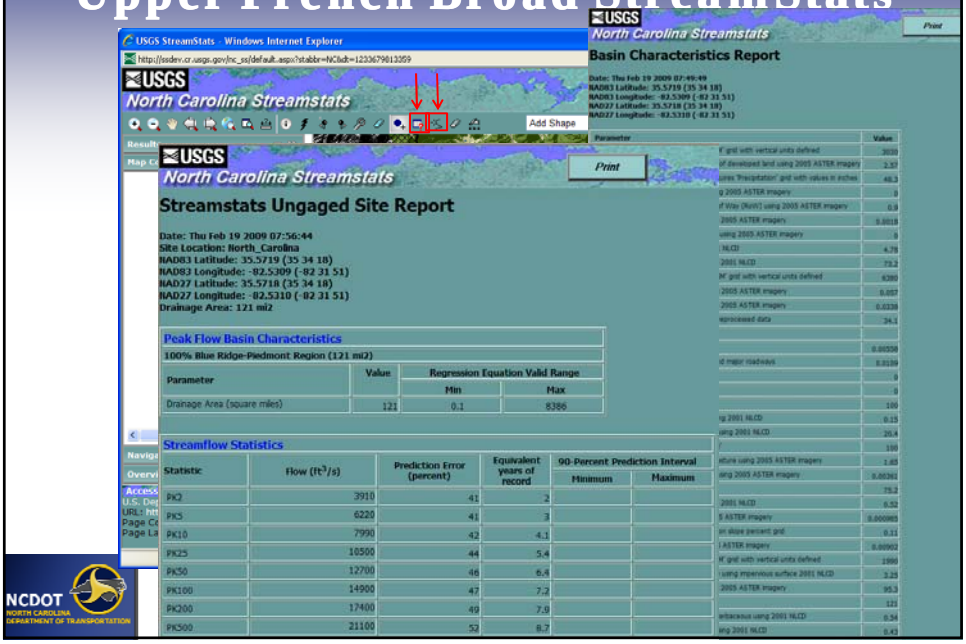
Upper French Broad StreamStats



Upper French Broad StreamStats

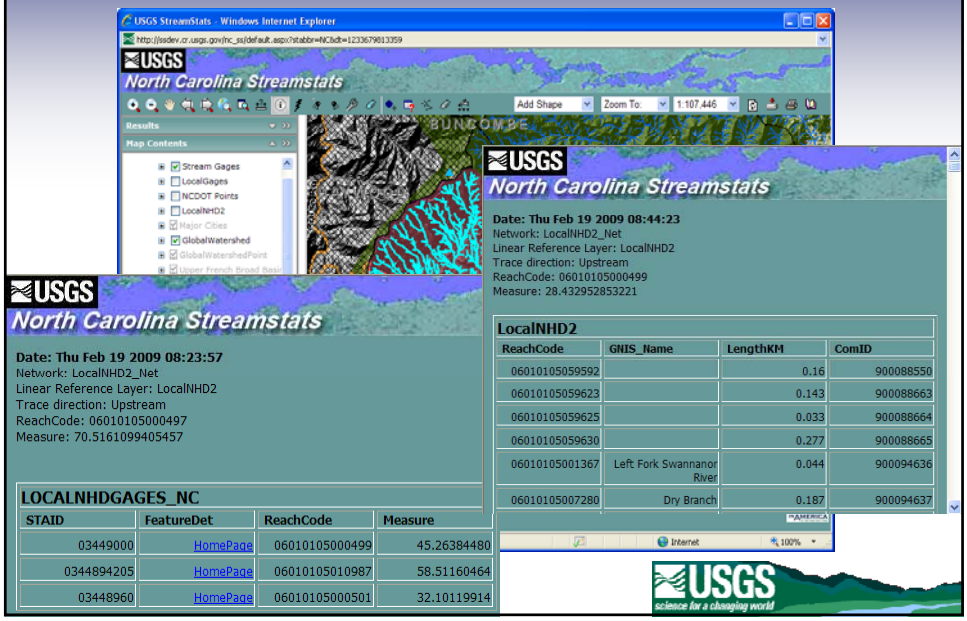
Upper French Broad StreamStats



Stream Network Navigation

- **StreamStats has the ability to analyze the NHD stream network upstream and downstream from a user-selected point and to identify and obtain information for other points of interest that are located along the network.**
- **The primary benefit is to understand how the flow at a particular site may be affected by upstream activities or how downstream flow may be affected by existing or proposed activities at the selected site.**
- **Currently, USGS streamgages is the only layer that is associated to the local-resolution stream network in the North Carolina StreamStats, but additional layers can be added upon request.**

StreamStats Network Navigation



StreamStats Availability and Future Direction in North Carolina

- **The StreamStats application for the upper French Broad River basin and additional details can be accessed from the USGS North Carolina Water Science Center Web site at http://nc.water.usgs.gov/projects/fb_streamstats/**

- **Although 2006 land-cover and local-resolution NHD products are not available statewide, StreamStats can be implemented for the remainder of the State by using LIDAR-based topographic data and the best-available land cover and hydrography, which currently are 2001 NLCD and 1:24,000-scale NHD, respectively.**

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Closing thoughts

Plan effectively.....

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