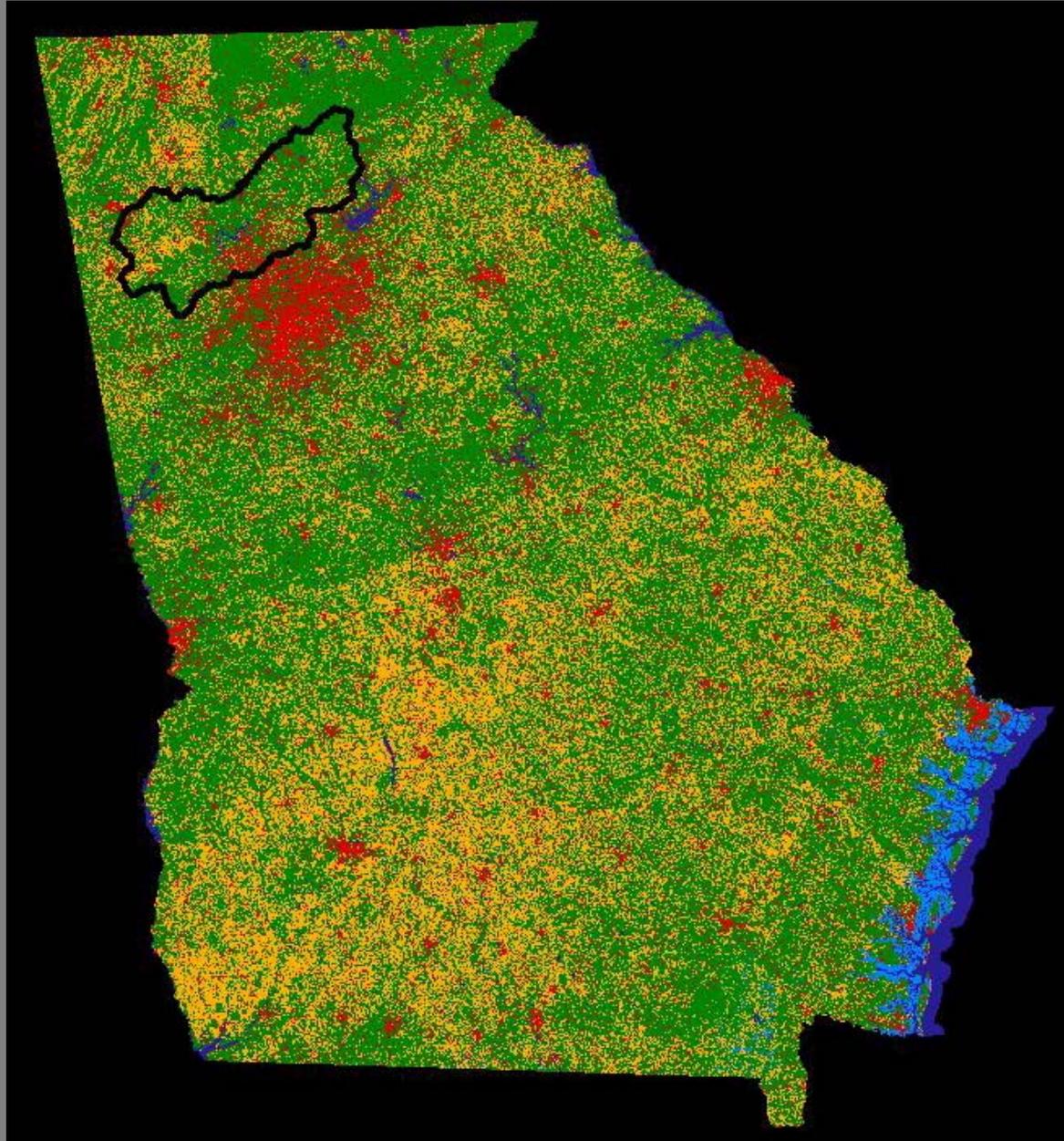


# Stream crossing and culvert design policy

**ETOWAH**  
habitat conservation plan



# Etowah River Basin



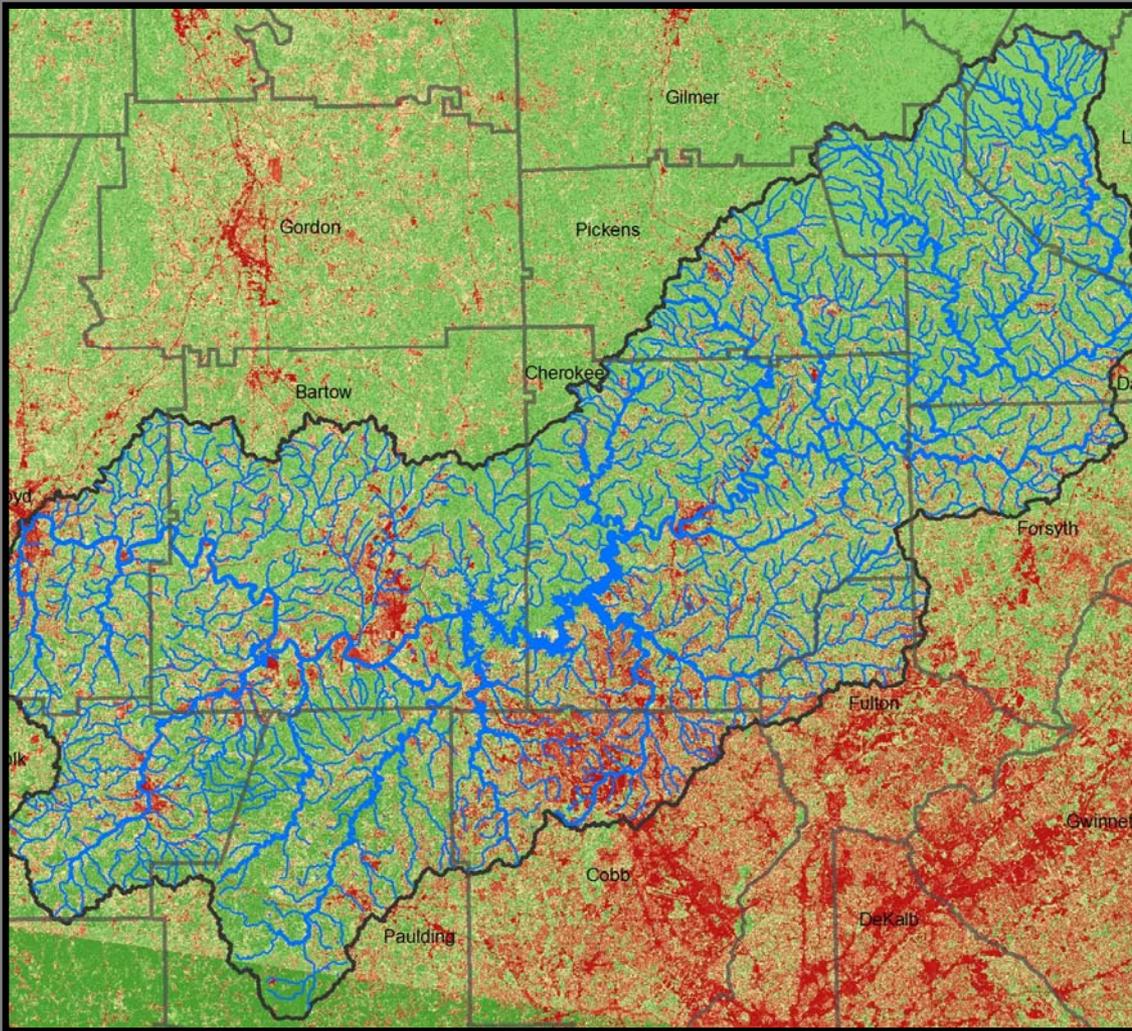
## Etowah River Basin, Georgia

A hotspot of stream fish diversity and endemism:

- ~76 extant fish species, 4 locally endemic fish species
- ~51 extirpated mussel species
- 3 federally listed & 6 additional imperiled fishes



# The Etowah River System



# Etowah Regional HCP

- Nine fish species covered

Scientific Name	Common Name	Family	Status
<i>Macrhybopsis</i> sp. cf. <i>aestivalis</i>	Coosa chub	Cyprinidae	GA E
<i>Noturus</i> sp. cf. <i>munitus</i>	Coosa madtom	Ictaluridae	GA E
<i>Percina antesella</i> (Williams and Etnier)	amber darter	Percidae	Fed. E / GA E
<i>Percina lenticula</i> (Richards and Knapp)	freckled darter	Percidae	GA E
<i>Percina</i> sp. cf. <i>macrocephala</i>	bridled darter	Percidae	GA E
<i>Etheostoma etowahae</i> (Wood and Mayden)	Etowah darter	Percidae	Fed. E / GA E
<i>Etheostoma scotti</i> (Bauer, Etnier and Burkhead)	Cherokee darter	Percidae	Fed. T / GA E
<i>Etheostoma</i> sp. cf. <i>brevirostrum</i> A	holiday darter	Percidae	GA E
<i>Etheostoma</i> sp. cf. <i>brevirostrum</i> B	holiday darter	Percidae	GA E

# Etowah Regional HCP

- 9 counties
- 21 municipalities
- Plan developed by Steering Committee made up of representatives appointed by each governing body w/ assistance from technical committees including regulated community

# Partners

- USFWS
- EPA
- GA DNR
- County Homebuilder Associations
- GA Conservancy
- The Nature Conservancy
- UGA, Kennesaw State, Reinhardt College, Berry College
- Upper Etowah River Alliance
- Cherokee, Etowah, Cobb-Marietta Water and Sewer Authority
- Local stakeholder organizations

# What's in the HCP?

- Building and design solutions to habitat threats:
  - Fragmentation
  - Sedimentation
  - Changes in hydrology
  - Pollutants
- Habitat Protection
  - Priority Area Protection

# What's in the HCP?

- Fragmentation
  - Road stream crossing policy
- Sedimentation
  - E&S SOP
  - Grading policy
  - Utility stream crossing policy
- Changes in hydrology
  - Stormwater ordinance
- Pollutants
  - Stormwater ordinance
- Habitat Protection
  - Stormwater ordinance
  - Stream buffer policy
  - Conservation subdivision policy
- Others
  - Adaptive management

# Approach to developing HCP Road stream crossing policy:

- Estimate extent of problem
  - Millington thesis, UGA, 2004
- Preliminary assessment of culvert effects
  - Dr. W. Ensign, Kennesaw State University
- Survey existing recommendations for “fish-friendly” culvert design
- Develop guidelines and draft ordinances for culvert design in the Etowah

## Heidi Millington, 2003-2004

- Randomly selected 70 crossings to survey, stratified by drainage area (1-3, 3-9, 9-25 and 25-50 km<sup>2</sup>)
- Crossing “impassible” if:
  - baseflow velocity through culvert > 0.4 m/s
  - drop from culvert outlet to water surface > 0.15 m

Heidi Millington, 2003-2004

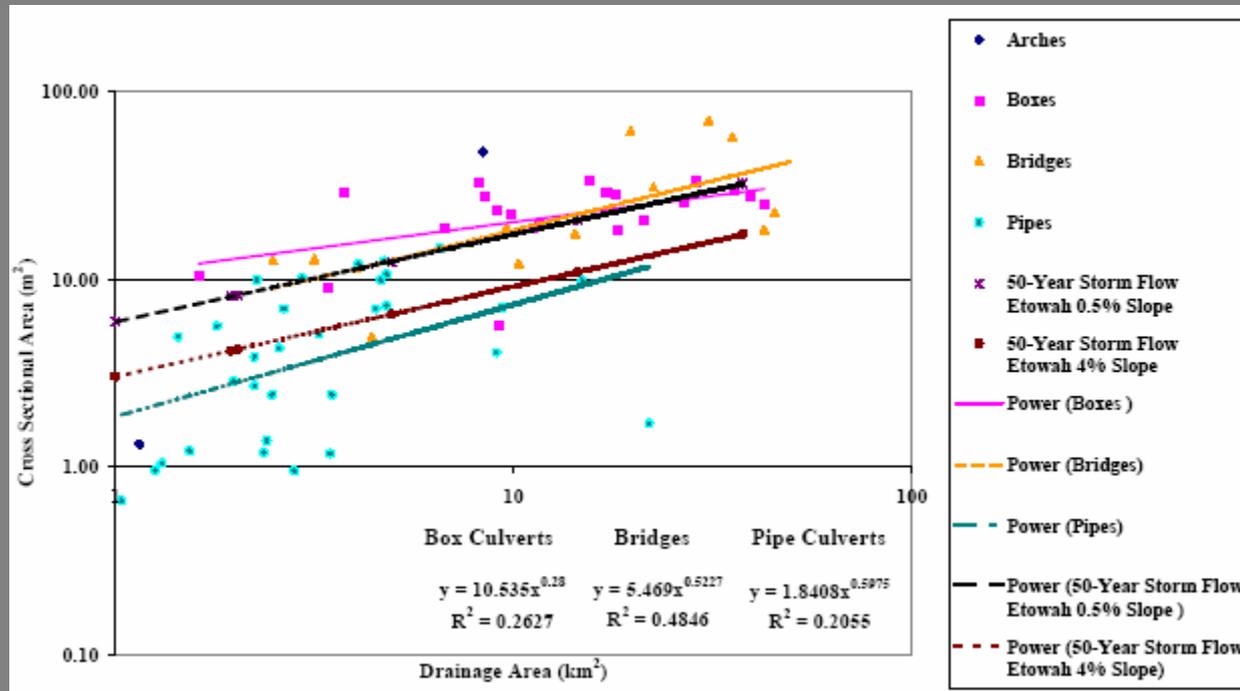
34% of surveyed crossings likely impassable to small-bodied fishes

<u>Crossing type</u>	<u>Number</u>	<u># Impassable (%)</u>
Pipe culvert	29	16 (55%)
Box culvert	22	8 (36%)
Bridge/arch span	18	0

Millington, H.K. 2004. Developing engineering criteria for ecologically sound stream crossings for endangered fish in Georgia. M.S. Thesis. University of Georgia, Athens, GA.

Majority of pipe culverts sized smaller than needed to pass 50-yr storm event

- cause of downstream scour?



Millington, H.K. 2004. Developing engineering criteria for ecologically sound stream crossings for endangered fish in Georgia. M.S. Thesis. University of Georgia, Athens, GA.

# Fish movement study in Etowah streams, Bill Ensign, Kennesaw State University, 2003

- 6 streams; 3 sections above and below each crossing, movements over 1 month

Common name	Genus species	Number marked	Percent recapture	Number recaptured in	
				Same section	Different section
Largemouth bass	<i>Micropterus dolomieu</i>	248	37.1%	41	51
Sculpin species	<i>Cottus sp.</i>	210	31.0%	47	18
Southern darters	<i>Fundulus stellifer</i>	39	15.4%	1	5
Alabama hogsucker	<i>Hypentelium etowanum</i>	90	45.6%	18	23
Sunfishes	<i>Lepomis spp.</i>	465	38.3%	154	24
Basses	<i>Micropterus spp.</i>	49	22.4%	5	6
Mobile logperch and Blackbanded darter	<i>Percina kathae, P. nigrofasciata</i>	46	15.2%	4	3
<b>Total or average</b>		<b>1407</b>	<b>29.9%</b>	<b>286</b>	<b>135</b>

Fish movement study in Etowah streams,  
 Bill Ensign, Kennesaw State University,  
 2003

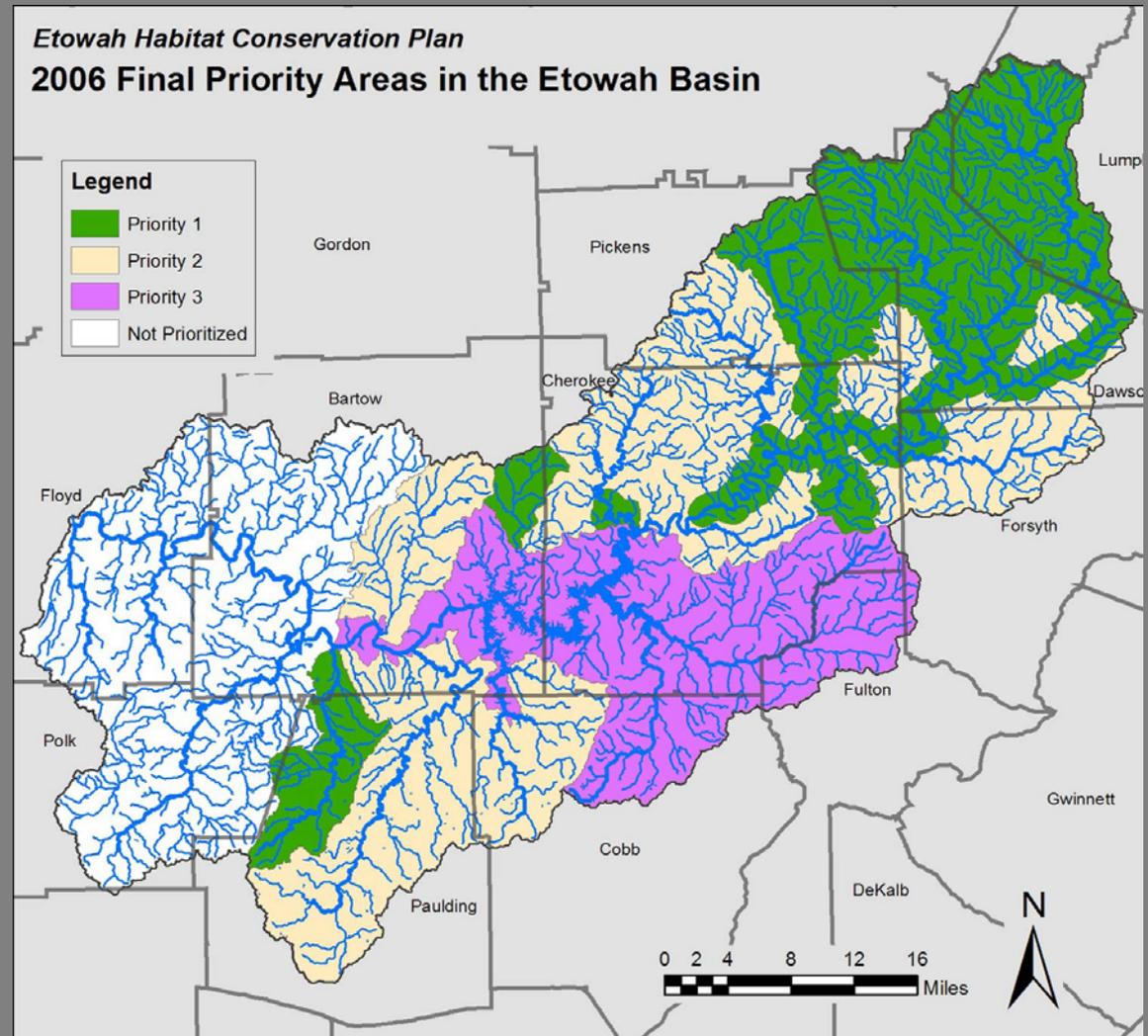
- Movement rates upstream and downstream through culverts lower than through clear span ( $p < 0.05$ )

Stream	Crossing type	Total recaptures	Movement through the clear span or culvert in the		Movement between cells	Total moves
			Downstream direction	Upstream direction		
Clark Creek	Clear Span	91	5	7	9	21
Noonday Creek	Clear Span	85	3	6	28	37
Scott's Mill Creek	Box Culvert	97	0	1	30	31
Unnamed tributary	Box Culvert	82	0	1	27	28
Possum Creek	Pipe Culvert	36	0	1	9	8
Hickory Log Creek	Pipe Culvert	28	0	0	8	8

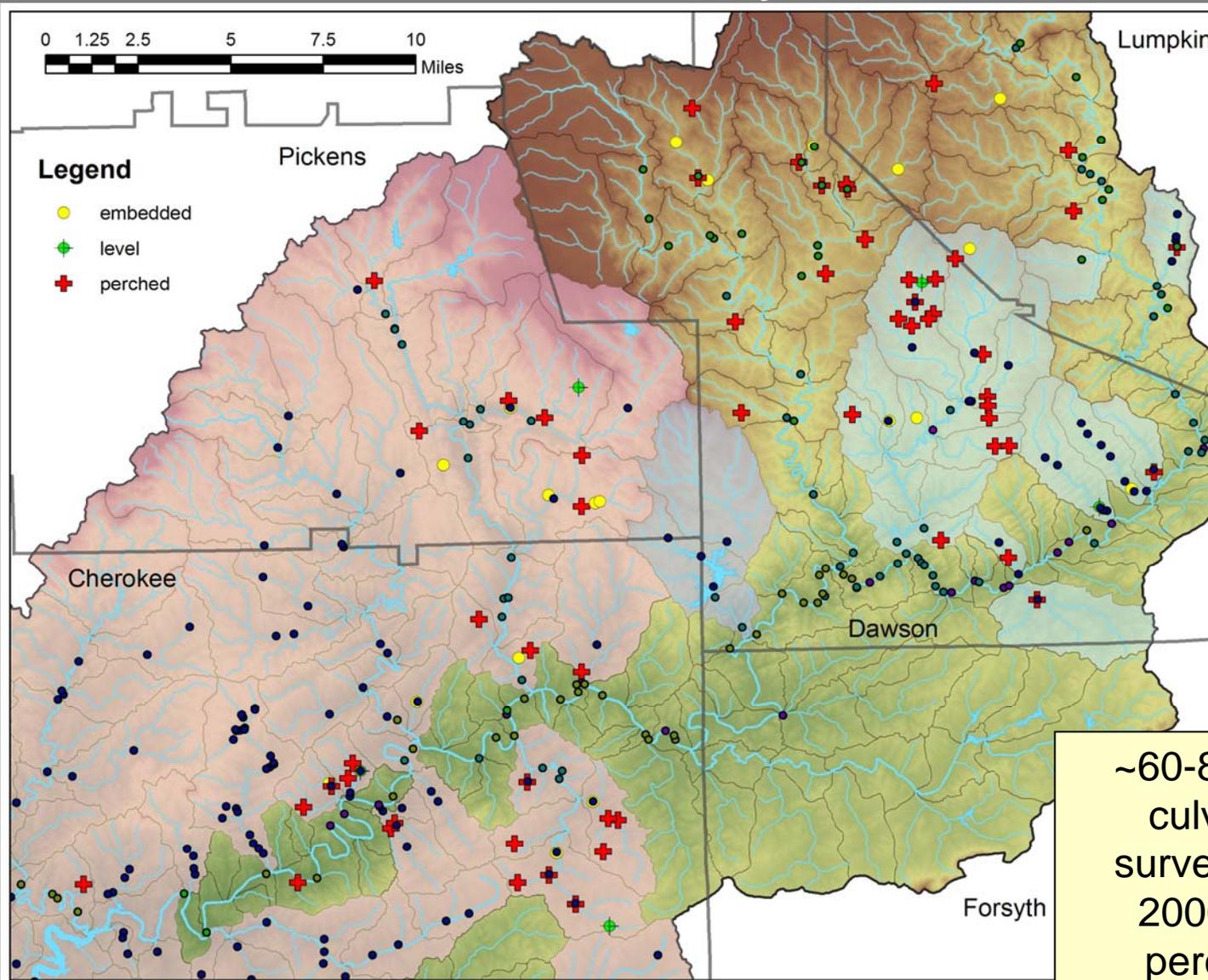
# Continuing work on road stream-crossings as barriers in the Etowah (and upper Coosa system)

Approx. **686** small (< 50 km<sup>2</sup>) stream crossings in HCP Priority 1 and 2 areas, in ranges of target fishes

*Carrie Straight, UGA;  
1:24,000 NHD and DOT roads*



# 2006 culvert survey results -





*Extent of “perchedness” varies*

*Also:*

*Aging bridges over small streams frequently replaced with culverts*

*New developments may employ culverts*



*Needed: policy to prevent additional stream fragmentation by barriers to passage by HCP-covered fishes*

## Policy for Etowah HCP

- Built on stream simulation design (WDFW 2003)

### *Intended to:*

- maintain depths, current velocities in culvert within range of velocities in the stream
- prevent scour/drops
- maintain appropriate bed sediments in culvert
- provide bank edge within culvert
- provide a diversity of flow paths, velocities within culvert

Massachusetts River and Stream Crossing Standards. 2006

[http://www.streamcontinuity.org/pdf\\_files/MA\\_Crossing\\_Std\\_3-1-06.pdf](http://www.streamcontinuity.org/pdf_files/MA_Crossing_Std_3-1-06.pdf).

Oregon Stream Crossing Restoration Guide: Spring 1999. USA: Northwest Regional Office of National Oceanic and Atmospheric Administration.

<http://www.nwr.noaa.gov/1salmon/salmesa/4ddocs/orfishps.htm>.

Washington Department of Fish and Wildlife. 2003. Design of Road Culverts for Fish Passage. USA: Washington Department of Fish and Wildlife. <http://wdfw.wa.gov/hab/engineer/cm/>.

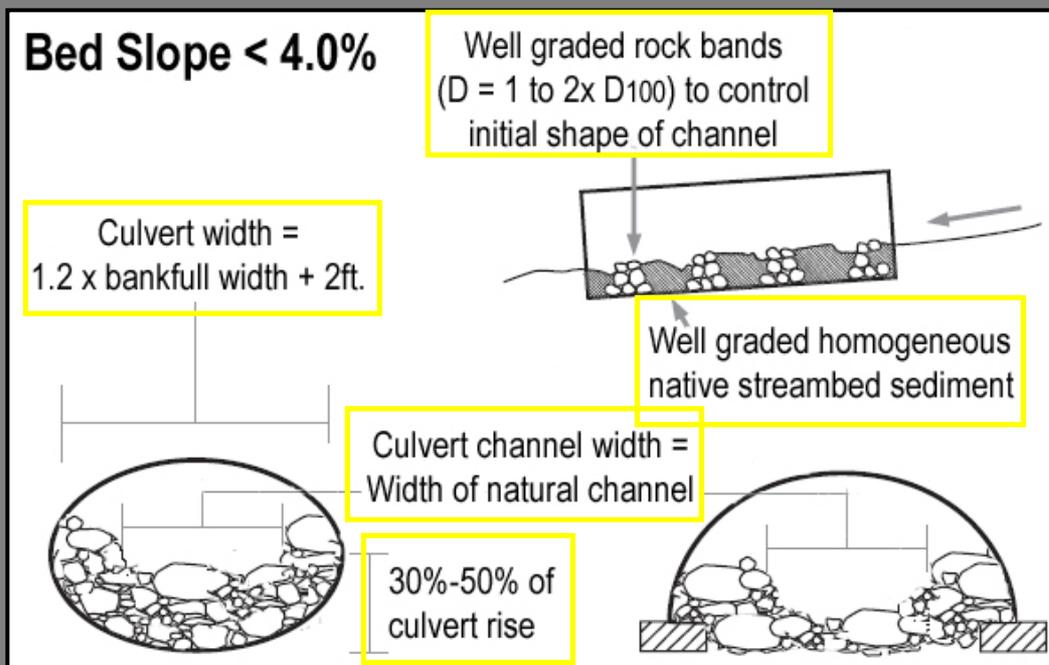
## Etowah HCP Stream Crossing Requirements:

- **Streams draining  $\geq 20$  mi<sup>2</sup>:** Bridges required
  - **Streams  $< 20$  mi<sup>2</sup> but  $> 0.2$  mi<sup>2</sup> :** bridges, bottomless culverts, or embedded box or pipe culverts shall be used; no multi-barrel pipe designs (multi-barrel box OK); non-embedded or perched culverts prohibited
  - **Stream simulation design procedure only acceptable design**

## Etowah HCP Stream Crossing Requirements, *cont.*:

- **Stream crossing construction BMPs must be followed.**
- **Stream crossings must maximize infiltration**, with exception for stormwater originating on bridge itself, which can be drained via scupper drains.
- **Variance** for alternative designs that have no greater impact on fish.
- **Bonding mechanism** releases bond upon final inspection and certification of “as-built” condition.

# Stream Simulation Culverts



Slope of culvert = slope of adjacent channel

Channel form and bank margins reconstructed inside culvert for proper depth and velocity

Not required on bedrock; but culvert bottom *must* be even with bedrock

## Etowah HCP Stream Crossings:

Each jurisdiction participating in the HCP will pass an ordinance setting standards for design and construction of crossings in the Etowah following technical committee recommendations.

## Ordinance applies to certain parties:

- ✓ private entity part of larger common development plan
- ✓ city and county govs and contractors, regardless of whether state/federal funds used

## Ordinance applies to certain situations:

- ✓ construction of new crossings
- ✓ replacement of a bridge with a culvert
- ✓ replacement of old crossing only if original crossing was built after HCP guidelines adopted
- ✓ all streams draining  $\geq 0.2\text{mi}^2$  or  $\leq 20\text{mi}^2$

## Ordinance does not apply to:

- ✓ crossings built by state or federal govs or their contractors
- ✓ replacement of already existing culverts

## Monitoring recommendations:

Culverted stream crossings monitored annually and also after any storm creating flows  $\geq$  5-year storm flow to make certain culverts continue to function properly and ensure goal of fish passage is being met.

# Stream crossing and culvert design policy



## Status:

- Steering Committee approved report/recommendations for inclusion in HCP
- Report includes example ordinance to be adopted by jurisdictions adopting the HCP
- HCP being submitted to US FWS for approval (Nov 06)

# Stream crossing and culvert design policy



## Technical Committee Members

Randy Bowen, *Dawson County*  
Rodney Buckingham, *Pickens County*  
Lou Chastain, *Georgia Department of Transportation*  
Charles Davis, *Georgia Department of Transportation*  
Bob Galante, *Cobb County*  
Jim Garrigus, *Falling Waters*  
Randy Gray, *Bartow County*  
Renee Hoge, *Forsyth County*  
Brandon Kirby, *Georgia Department of Transportation*  
Lamont Kiser, *Bartow County*  
Geoff Morton, *Cherokee County*  
Gary Mullinix, *City of Canton*  
Dan Rothwell, *City of Holly Springs*  
Candace Stoughton, *The Nature Conservancy*  
Charles Trammel, *Lumpkin County*  
Norman Pope, *Pickens County*  
Mike Tuller, *Cobb County*  
Lynn Tully, *Dawson County*  
Jeff Woodward, *Georgia Department of Transportation*

Additional information and assistance provided by Dr. David Gattie, University of Georgia, Dr. Bill Tollner, University of Georgia, and Katie McCafferty, Paul Lyles, and Susie Knudsen, Georgia Department of Transportation.

## Technical Committee Staff

Bill Ensign, Kennesaw State University  
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Megan Hagler, River Basin Center, University of Georgia  
Heidi Millington, University of Georgia  
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