Ten Mile Creek

Montgomery County's Healthiest Waterway

By Diane Cameron

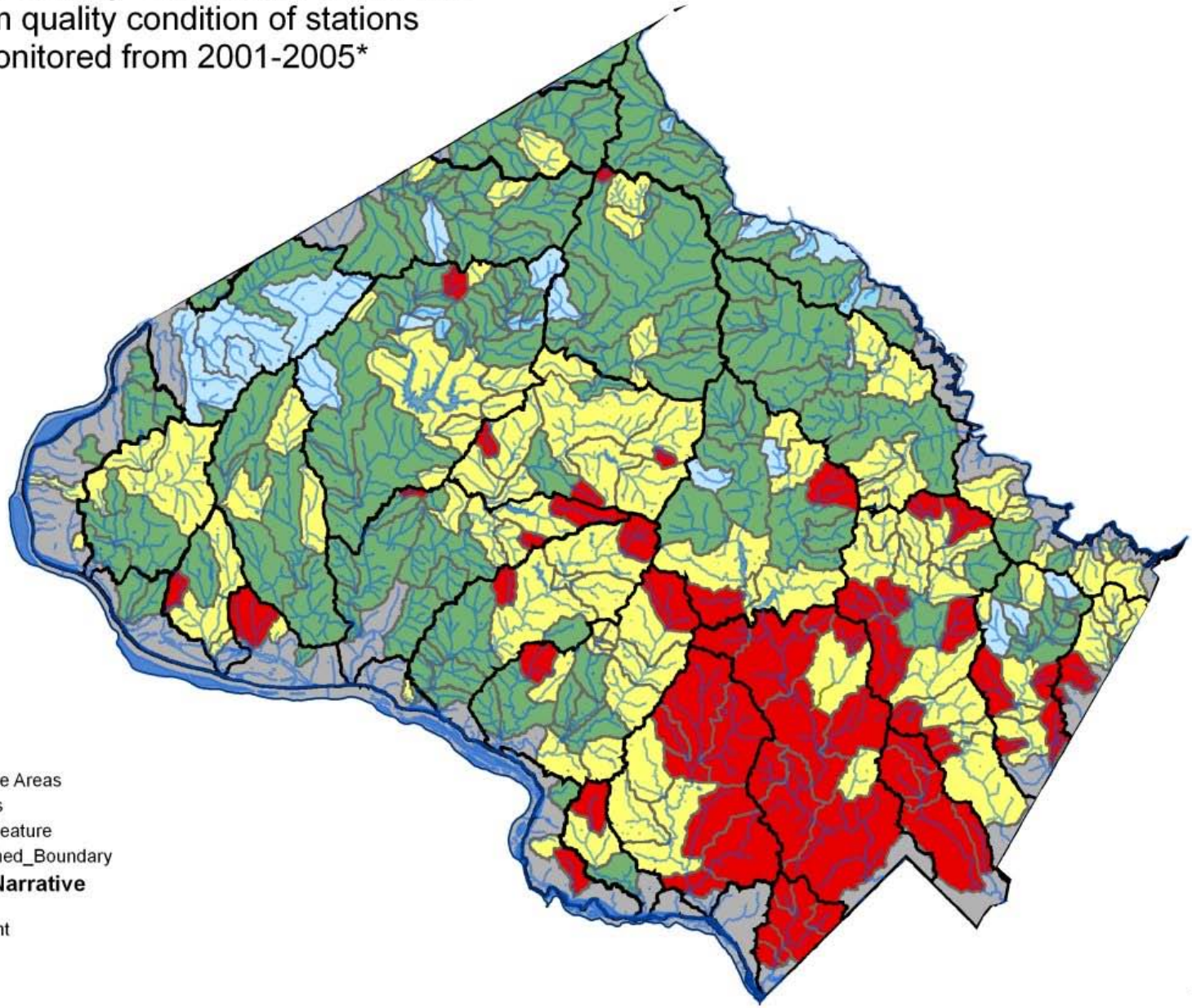
Audubon Naturalist Society 3.2013

Ten Mile Creek

1) Maps
2) Science
3) Policy & Local Experience
    – High Quality Waters Protection
4) Conclusions & recommendations

Stream Quality Conditions 2001-2005

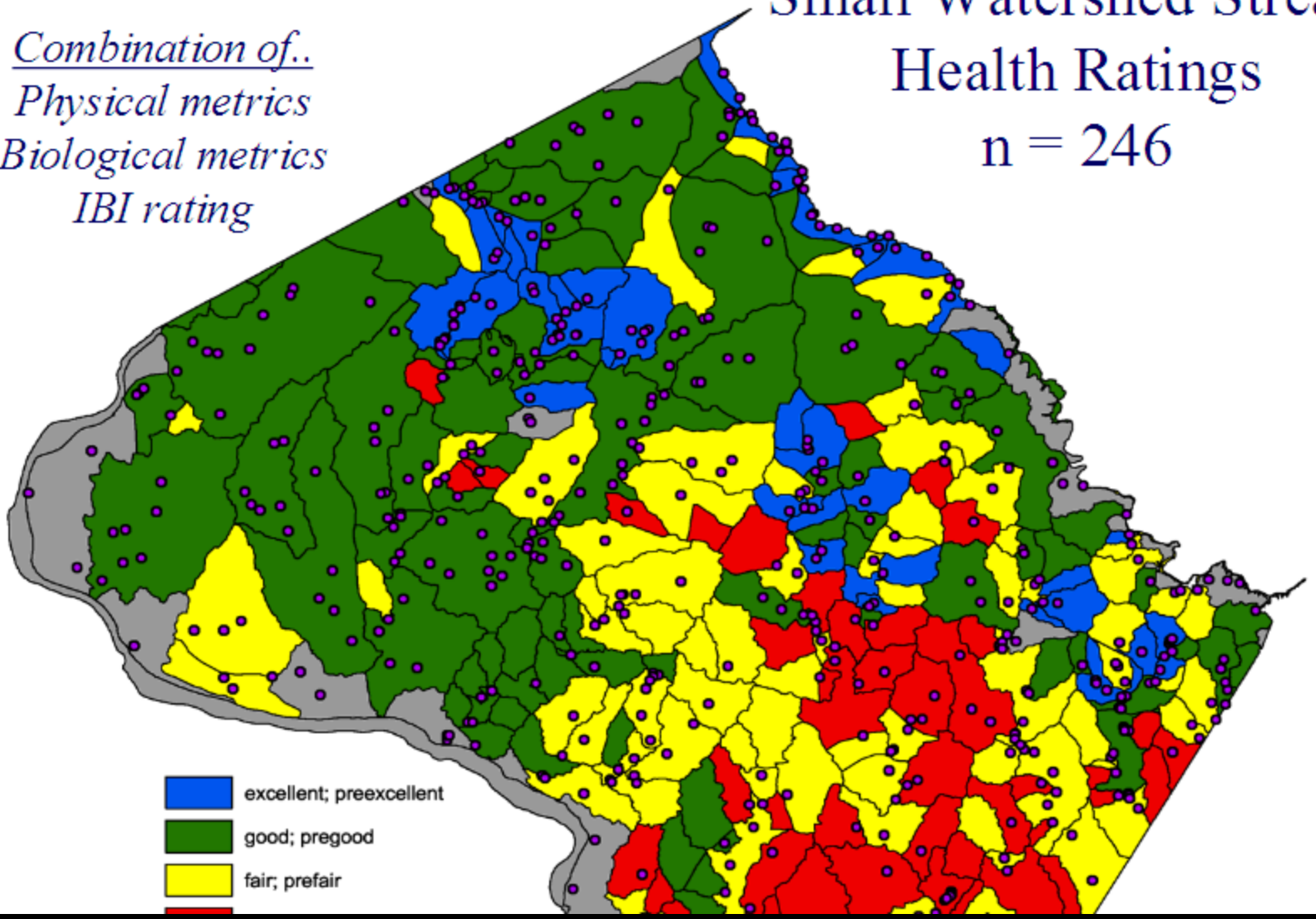
Stream quality condition of stations monitored from 2001-2005*

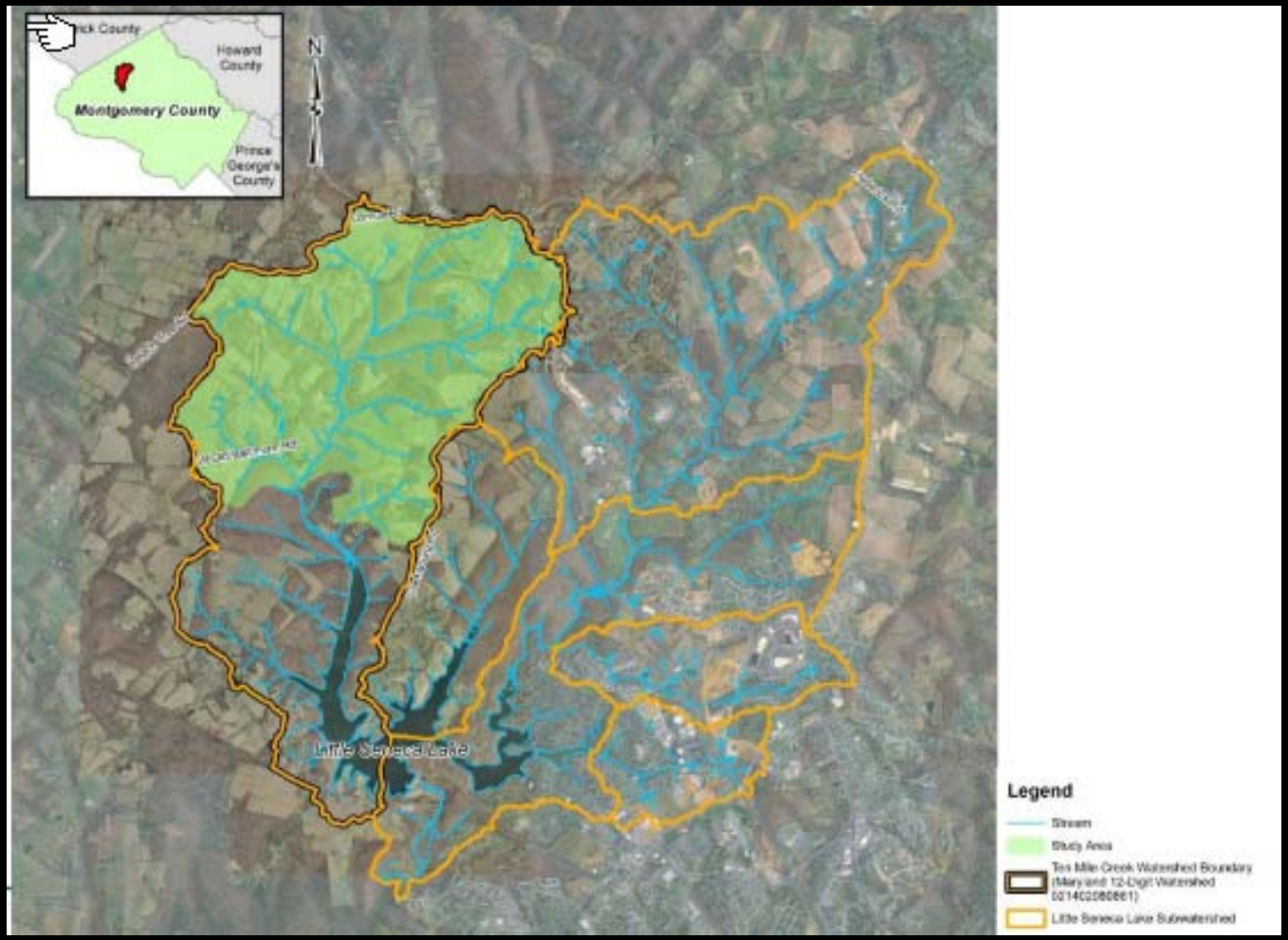


*Horsepen Branch was monitored in 2000

Small Watershed Stream Health Ratings n = 246

Combination of..
Physical metrics
Biological metrics
IBI rating



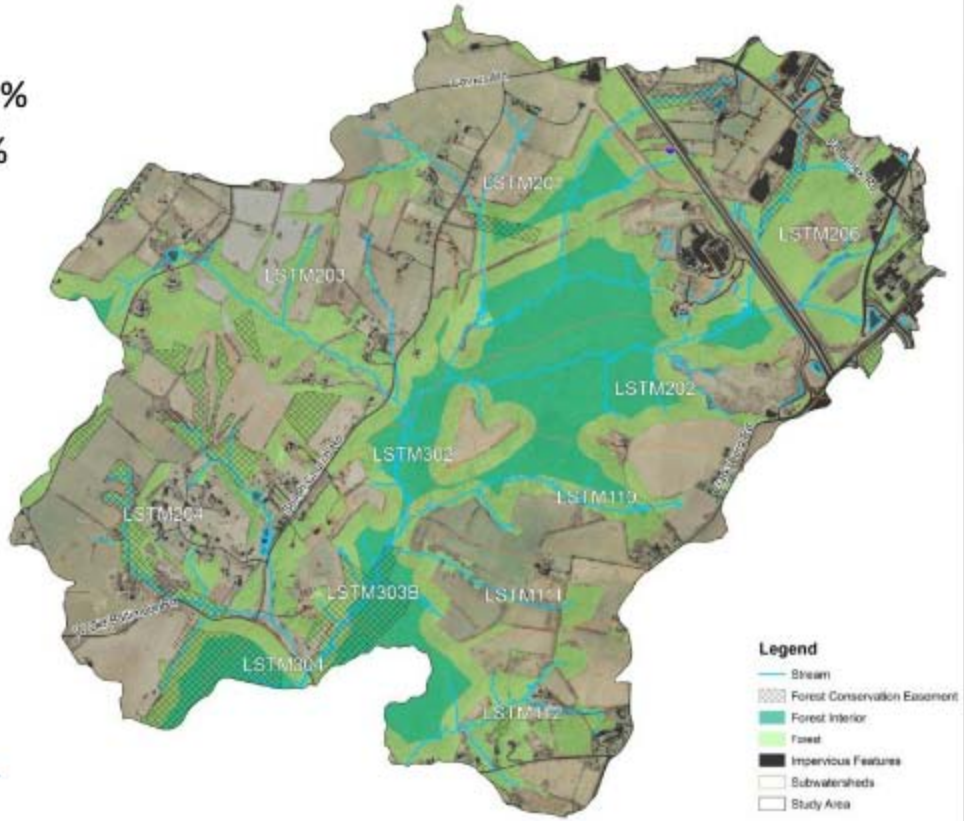

Howard County
Montgomery County
Prince George's County
N
Little Seneca Lake
Legend
Stream
Study Area
Ten Mile Creek Watershed Boundary (Maryland 12-Digit Watershed 021402080661)
Little Seneca Lake Subwatershed

10 Mile Creek

Limited Amendment

Existing Land Cover

Forest	46%
Imperviousness	4%



10 Mile Creek Limited Amendment

Water Quality

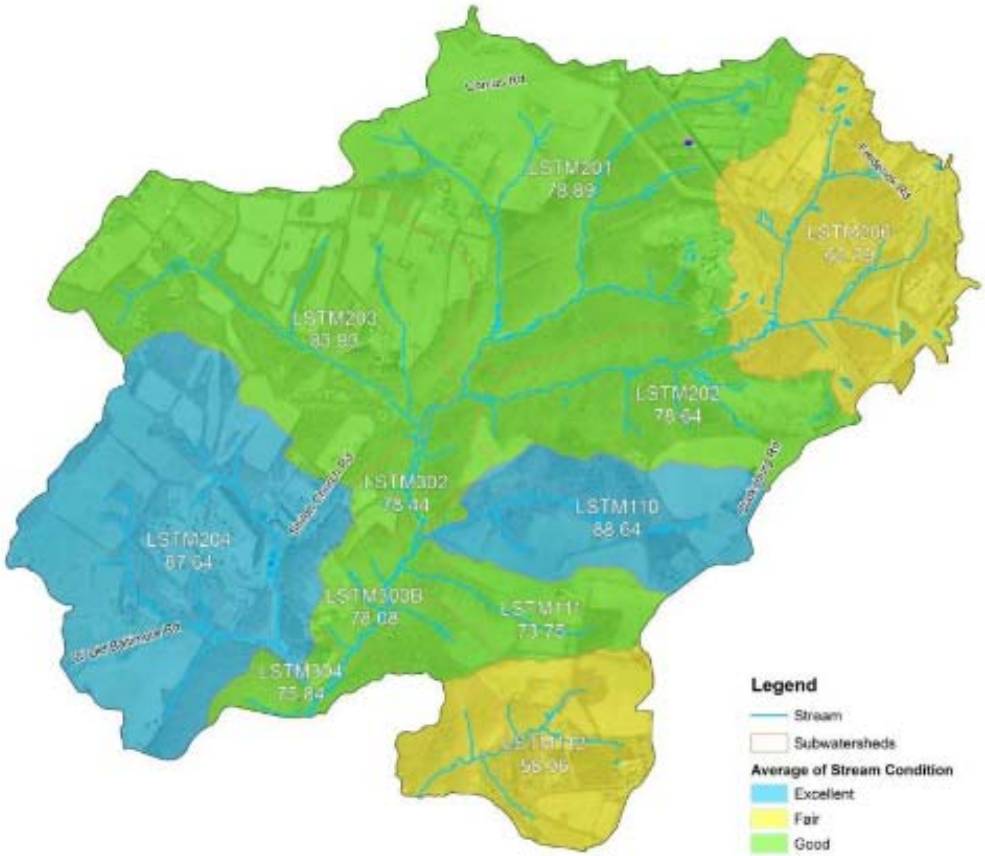
10 Mile Creek Limited Amendment

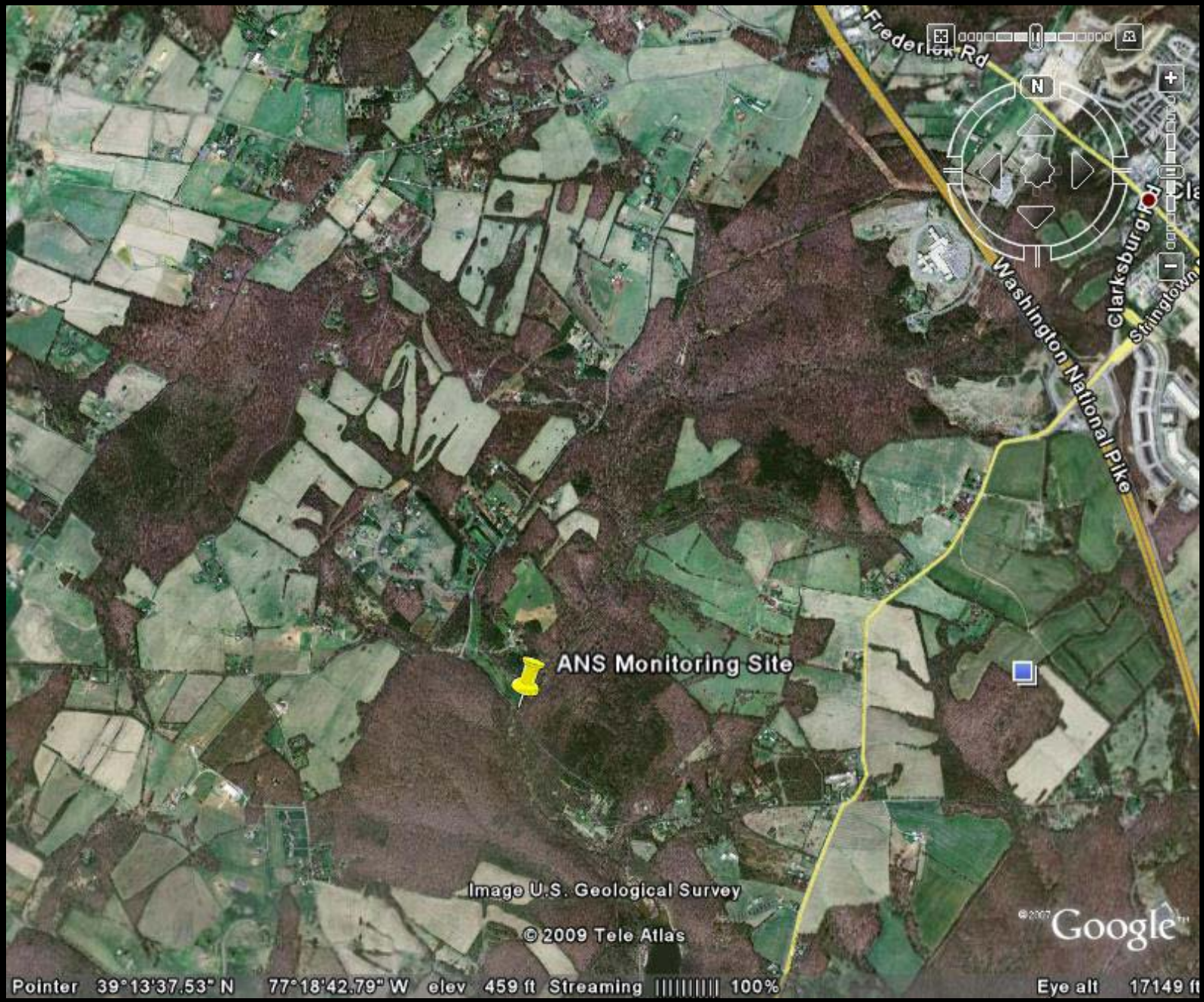
Aquatic Habitat & Biology

Benthic (Bugs)

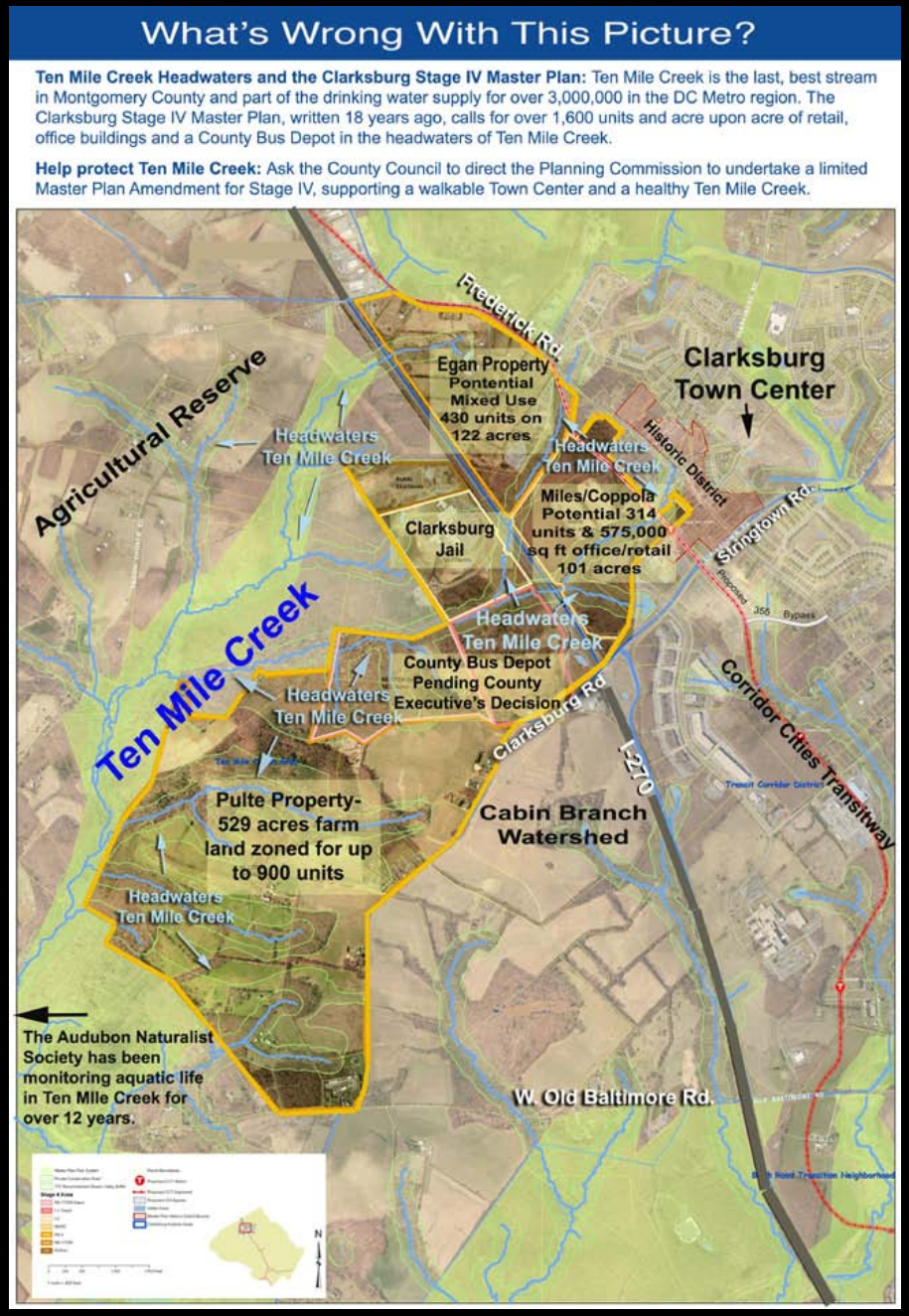
Fish

Stream quality is GOOD overall

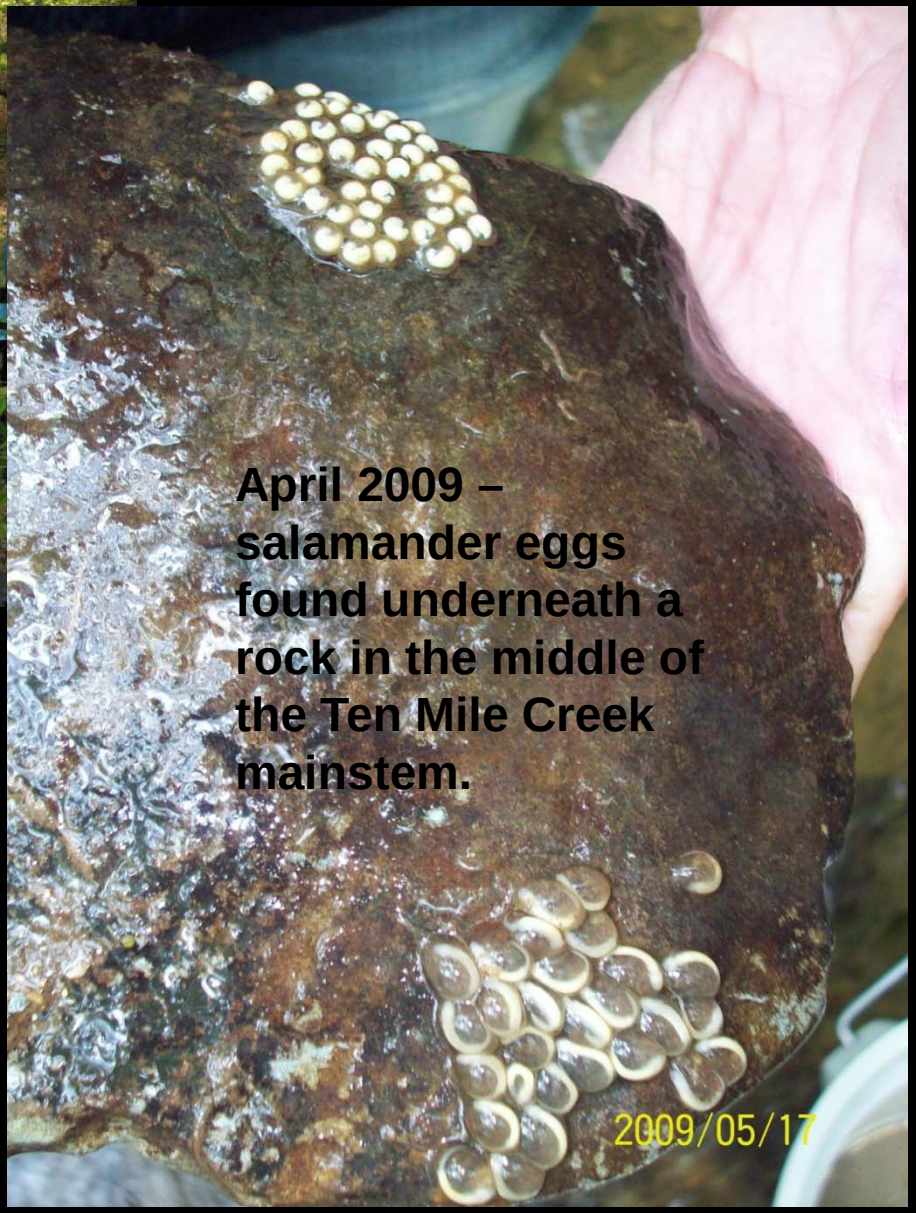



Frederick Rd
Washington National Pike
Clarksburg
Stringtown
ANS Monitoring Site
Image U.S. Geological Survey
© 2009 Tele Atlas
Google
Pointer 39°13'37.53" N 77°18'42.79" W elev 459 ft Streaming 100%
Eye alt 17149 ft

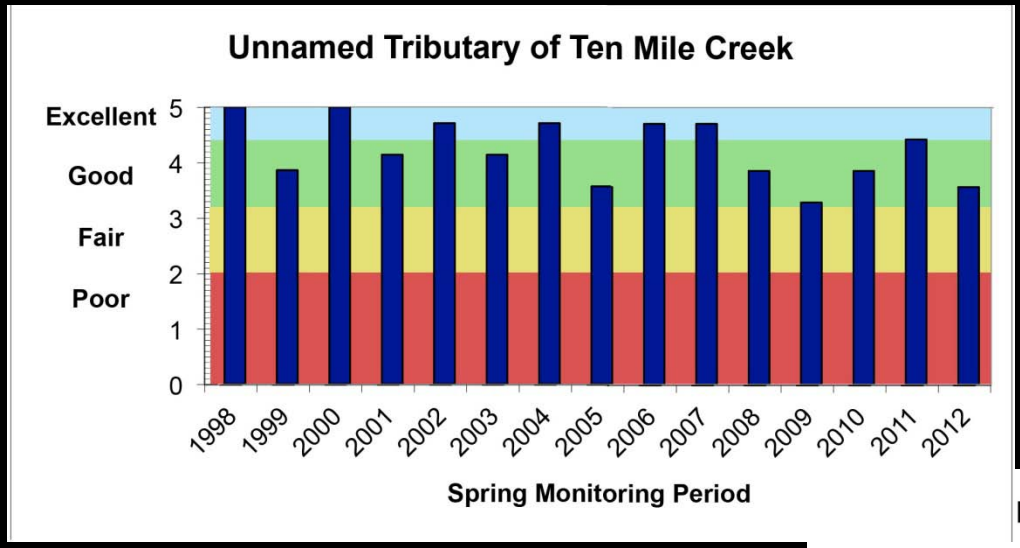
Map by Dolores Milmoe of ANS 2012.

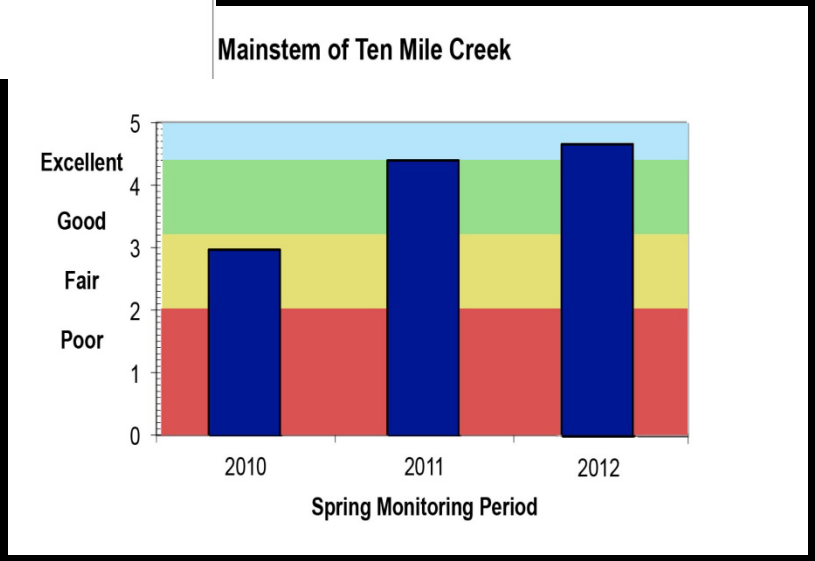


ANS volunteers and staff engaged in monitoring biological indicators of water quality at Ten Mile Creek



April 2009 – salamander eggs found underneath a rock in the middle of the Ten Mile Creek mainstem.


Unnamed Tributary of Ten Mile Creek
Excellent
Good
Fair
Poor
5
4
3
2
1
0
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Spring Monitoring Period


Mainstem of Ten Mile Creek
Excellent
Good
Fair
Poor
5
4
3
2
1
0
2010
2011
2012
Spring Monitoring Period

What does science tell us about how sensitive, biologically diverse streams respond to development?

Conditions in the stream including: hydrology (how the water flows); chemistry; temperature; and aquatic life, respond to 3 Prime Factors:

1. Hard (impervious) surfaces
2. Forest cover – or lack thereof
3. Construction and land alteration

National Research Council: Land Cover and Stream Quality

Scientists have documented the relationship between land cover conditions, especially imperviousness, and stream quality for the past 30 years, with some of the most prominent databases generated in Maryland and Montgomery County. In 2008, the National Research Council stormwater committee found that "**There is a direct relationship between land cover and the biological condition of downstream receiving waters.** The possibility for the highest levels of aquatic biological condition exists only with very light urban transformation of the landscape." (emphasis in the original.)

Klein's 1978 paper was followed by Schueler's 1994 analysis of the available national data on the imperviousness – stream quality relationship; and in 2009 Schueler published a second, updated meta-analysis of 65 published studies, confirming that as imperviousness increases, stream quality decreases. The Impervious Cover Model indicates that as watershed imperviousness increases from 5% to 10%, stream quality transitions from "sensitive" to "impacted."

National Research Council (2008), Committee on Reducing Stormwater Discharges to Receiving Waters. *Urban Stormwater Management in the United States* p. 195.

Additional Key Reports and Papers related to Ten Mile Creek; Urbanization Impacts on Streams; and Low Impact Development Studies
3/2013

Submitted to Mark Symborski and Mary Dolan
by Mary Rojas, Ava Manglik, Cathy Wiss and Diane Cameron for Audubon Naturalist Society

Ten Mile Creek – Studies and Data Reports

Wiss, Cathy (2012). Audubon Naturalist Society Monitoring at Ten Mile Creek. Narrative with data reports on monitoring at Ten Mile Creek, 1997-2012, including macroinvertebrates and temperature.

Land Cover Conditions: Imperviousness

California Environmental Protection Agency (2009) The Impacts of Imperviousness on Aquatic Ecosystems: An Annotated Bibliography of the effects of a key stressor of urbanization on the aquatic ecosystem. Integrated Risk Assessment Branch, Office of Environmental Health Assessment. http://oehha.ca.gov/ecotox/pdf/ICbiblio0309.pdf

Maryland Department of Natural Resources (undated) Impacts of Impervious Cover on Maryland Streams. Stream Health Fact Sheet. http://www.dnr.state.md.us/streams/pdfs/imperviousFactSheet.pdf

Maryland Department of Natural Resources (2012), River/Stream Management Strategy, Guiding Principles. http://www.dnr.state.md.us/streams/pdfs/RiverStream_MgtStrat_GuidingPrinciples_092612.pdf

Schueler, Thomas R, Fraley-McNeal, L. and Cappiella, L. (2009) Is Impervious Cover Still Important? Review of Recent Research, *Journal of Hydrologic Engineering*, ASCE April 2009, pp. 309-315. http://clear.uconn.edu/projects/tmdl/library/papers/Schueler-etal_2009.pdf

Land Cover Conditions: Imperviousness and Forest Cover

Goetz, Scott J, et al. (2004) Integrated Analysis of Ecosystem Interactions With Land Use Change: The Chesapeake Bay Watershed. *Ecosystems and Land Use Change, Geophysical Monograph 153. American Geophysical Union.* ftp://ftp.whrc.org/Mid-Atlantic/GOETZ-PUBS/Goetz-2004-ChapmanBook.pdf

Goetz, Scott J, IKONOS imagery for resource management: Tree cover, impervious surfaces, and riparian buffer analyses in the mid-Atlantic region, (2003), *Remote Sensing of the Environment* 88, pp. 195-208. GoetzRemSensEnv.03

Goetz, Scott J, et al., (undated –estimated 2004-2005) Using IKONOS Imagery to Assess Impervious Surface Area, Riparian Buffers and Stream Health in the Mid-Atlantic Region, powerpoint presentation. http://calval.cr.usgs.gov/JACIE_files/JACIE04/files/3Goetz5.pdf

Land Cover Conditions: Forest Cover and the Hydrologic Role of Forest Soils

Cameron, Diane, Implementing the Stormwater Management Act of 2007: Defining Pre-Development Forest Hydrology in the Maryland Piedmont and Beyond, (August 2011).

Carmean, Willard H, The Structure of Forest Soils, The Ohio Journal of Science, 57(3) (1957), https://kb.osu.edu/dspace/bitstream/handle/1811/4444/V57N03_165.pdf;jsessionid=4F764BB015D37564283DAF853FA155C1?sequence=1

Hursh, Charles R, Water Storage Limitations in Forest Soil Profiles, Soil Science Society of America, Proceedings, Vol. 8, (1944) http://coweeta.uga.edu/publications/797.pdf

Land Use and Land Disturbance: Impacts to Aquatic Ecosystems of Construction Activities, Land and Stream Disturbance and use of Earth-Moving Vehicles.

Cameron, Diane, Protecting Ten Mile Creek Based on Watershed Science and Local Experience, (February 2010), http://www.audubonnaturalist.org/images/conservation/2010FebCameronTenMileCreekRptAdHocWQWrkGrp.pdf

J.H. Gregory, M.D. Dukes, P.H. Jones, and G.L. Miller, *Effect of urban soil compaction on infiltration rate.* Journal of Soil and Water Conservation 61:3, 117-124 (2006) http://abe.ufl.edu/mdukes/pdf/stormwater/Gregor-et-%20al-JSWC-compaction-article.pdf

EPA (Darnell et al) (1976) Impacts of Construction Activities in Wetlands of the United States. Contract No. 68-01-2452. U.S. Environmental Protection Agency, Corvallis Environmental Research Laboratory. http://books.google.com/books?hl=en&lr=&id=m8PCM9cG_yoC&oi=fnd&pg=PR3&dq=construction+impacts+on+sensitive+streams&ots=eArNgzjfzp&sig=oTAhfLMx_TgyTzfq_7OjRA2VDfQ#v=onepage&q&f=false

Felton, G. (circa 2007) Research Review of Nitrogen Losses from Turfgrass. Powerpoint Presentation by Gary Felton, Associate Professor, University of Maryland Agricultural Extension.

Fennessey,L. (undated) Hydrologic Budgets for Development Scale Areas in Pennsylvania. http://www.opp.psu.edu/services/eng-resources/balance-paper.pdf

Kays, E.L. (undated) Relationship of Forest Destruction and Soil Disturbance to Increased Flooding in the Suburban North Carolina Piedmont. conference paper. http://www.ces.ncsu.edu/fletcher/programs/nursery/metria/metria03/m312.pdf

Meyer, J. L., et al., (2003) *Where rivers are born: The scientific imperative for defending small streams and wetlands.* Washington, DC: Sierra Club and American Rivers. http://webspace.ship.edu/cjwolt/main/WRAB.pdf (Pamphlet describing principles for general audience).

O'Driscoll et al. (2010). Urbanization Effects on Watershed Hydrology and In-Stream Processes in the Southern United States. *Water 2010*, pp 605-648. www.mdpi.com/2073-4441/2/3/605/pdf

Public Service Commission of Wisconsin (2011) *Environmental Impacts of Transmission Lines*. See pp. 21-26. http://psc.wi.gov/thelibrary/publications/electric/electric10.pdf

Tullos, D.D. et al. (2009) Analysis of functional traits in reconfigured channels: Implications for the bioassessment and disturbance of river restoration. Journal of the North American Benthological Society. 28:1, 80-92. http://rivers.bee.oregonstate.edu/sites/default/files/tullos_penrose_jennings_cope_2008.pdf

Woltemade, Christopher J., 2010. Impact of Residential Soil Disturbance on Infiltration Rate and Stormwater Runoff. *Journal of the American Water Resources Association* (JAWRA) 46(4): 700-711.

http://onlinelibrary.wiley.com/doi/10.1111/j.1752-1688.2010.00442.x/abstract?deniedAccessCustomisedMessage=&userIsAuthenticated=false

Low-Impact Development/ Environmental Site Design Watershed-Level studies.

King, Ryan S, How Novel is too Novel? Stream Community Thresholds at Exceptionally Low Levels of Catchment Urbanization, Ecol Appl 21.1659-1678 (1)

Lowrance, Richard, Water Quality Functions of Riparian Forest Buffers in Chesapeake Bay Watersheds, Lowrance et al WQ Functions of Riparian Forest Buffers in Chesapeake Bay Watersheds (1)

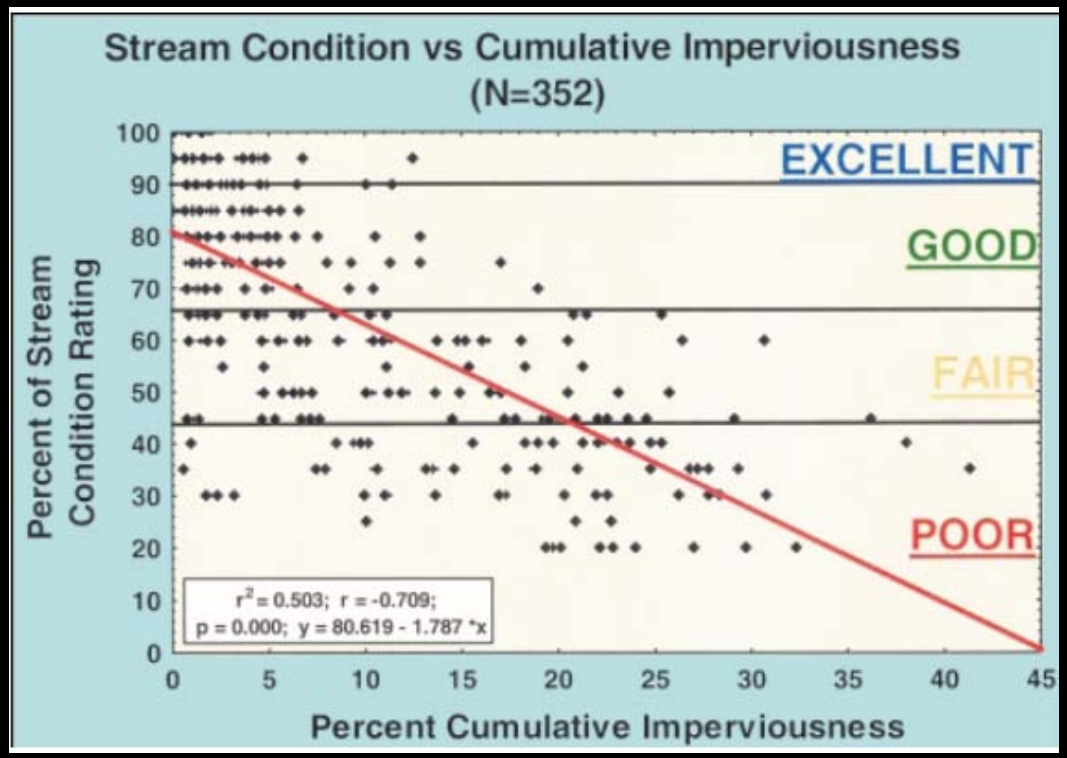
Selbig, S.R. and Bannerman, R.T. (2008) A comparison of runoff quantity and quality from two small basins undergoing implementation of conventional-and low-impact-development (LID) strategies: Cross Plains, Wisconsin, water years 1999-2005: US Geological Survey Scientific Investigations Report 2008-5008, 57 p.

Walsh, Christopher J, The urban stream syndrome: current knowledge and the search for a cure, http://clear.uconn.edu/projects/TMDL/library/papers/Walsh_etal_2005.pdf

Hard (impervious) surfaces

Source:

Montgomery County DEP, Countywide Stream Protection Strategy, 2003 Update. at: http://www.montgomerycountymd.gov/content/dep/Publications/pdf/CSPS2003.pdf



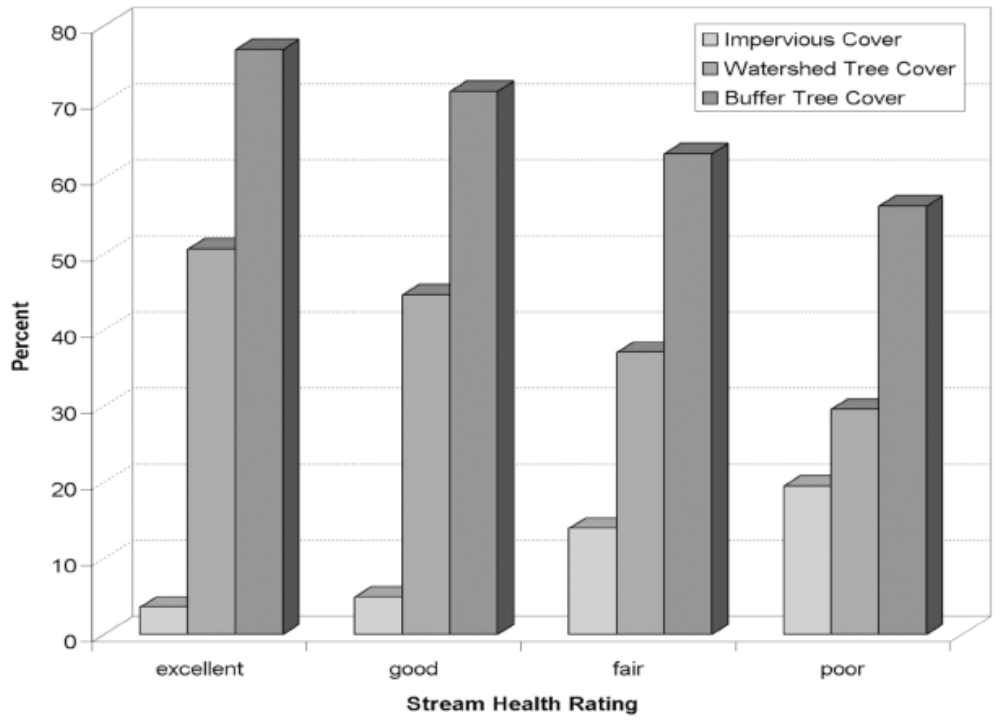
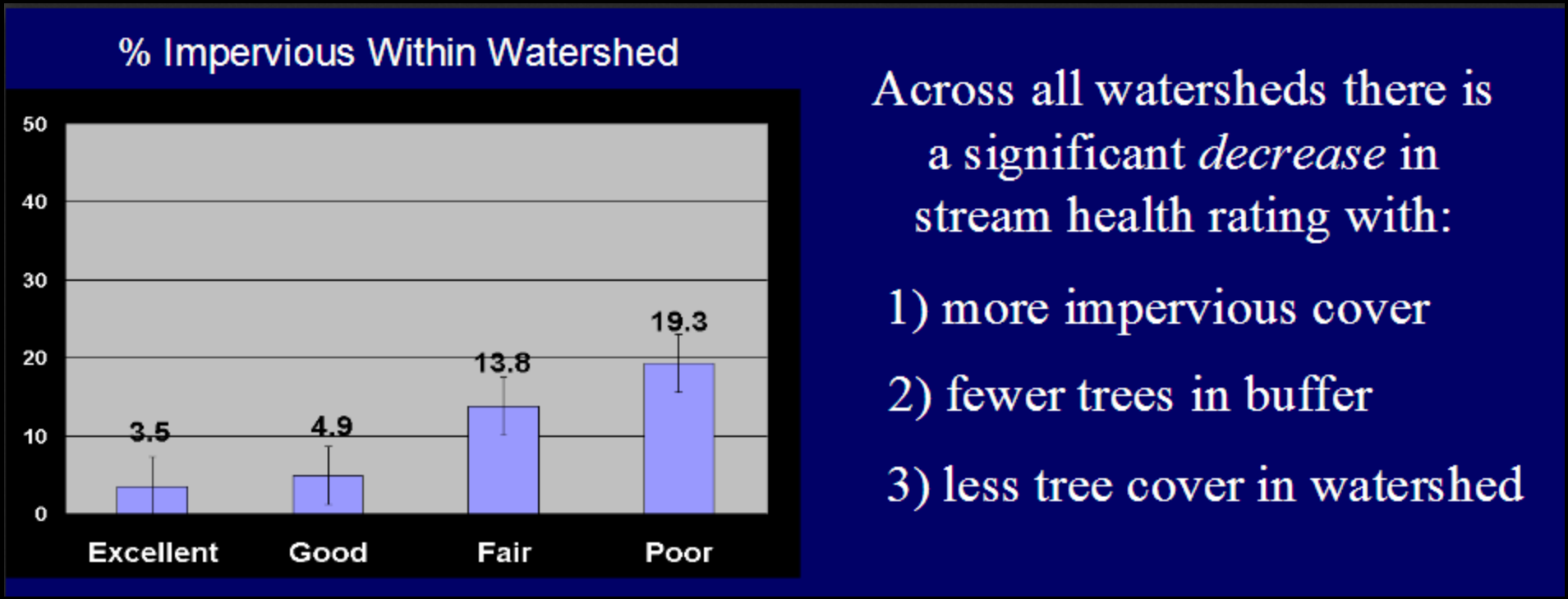


Figure 4. Small watershed stream health rankings in relation to impervious surface cover, watershed tree cover, and riparian buffer zone tree cover.

Goetz, Scott J, et al. (2004) Integrated Analysis of Ecosystem Interactions With Land Use Change: The Chesapeake Bay Watershed. *Ecosystems and Land Use Change, Geophysical Monograph 153. American Geophysical Union*. ftp://ftp.whrc.org/Mid-Atlantic/GOETZ-PUBS/Goetz-2004-ChapmanBook.pdf

Source: Goetz, Jantz et al. ppt. circa 2004

Using IKONOS imagery to assess impervious surface area, riparian buffers and stream health in the Mid-Atlantic Region.



Across all watersheds there is a significant *decrease* in stream health rating with:

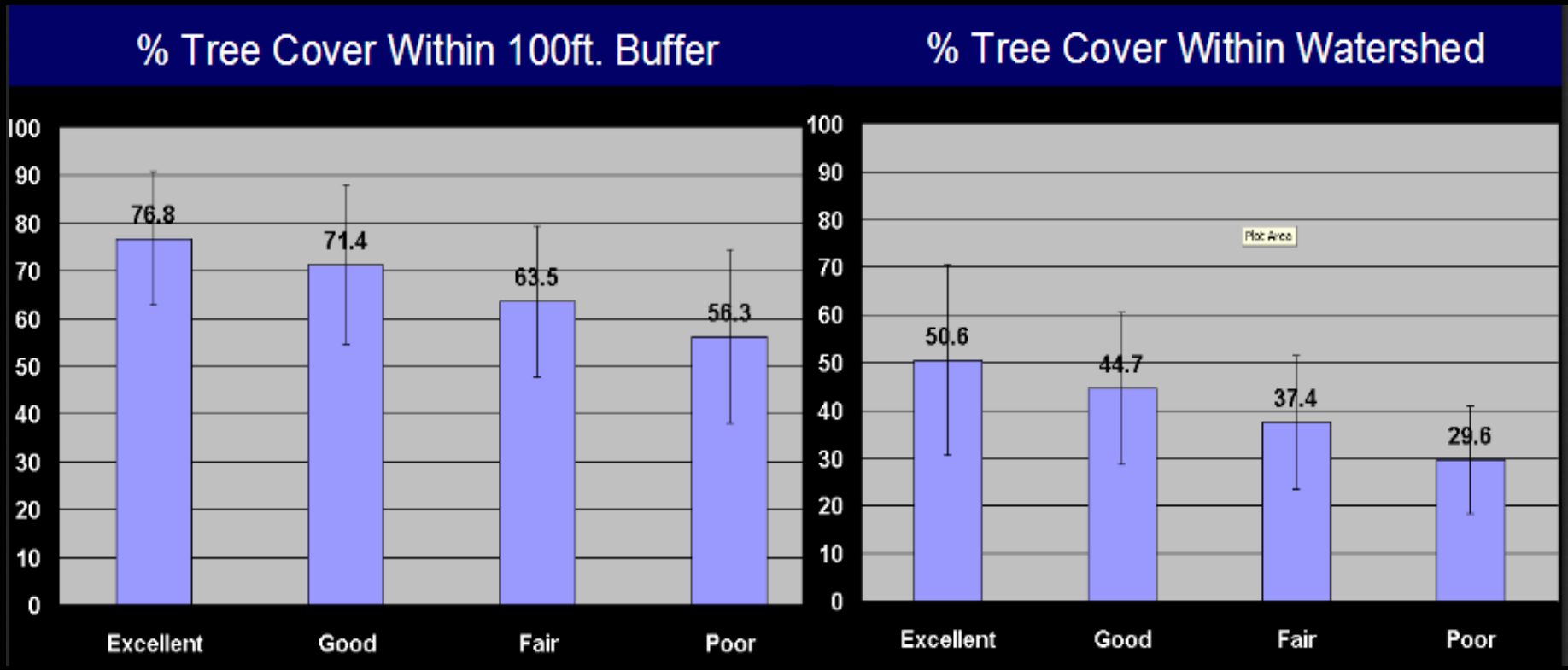
1) more impervious cover

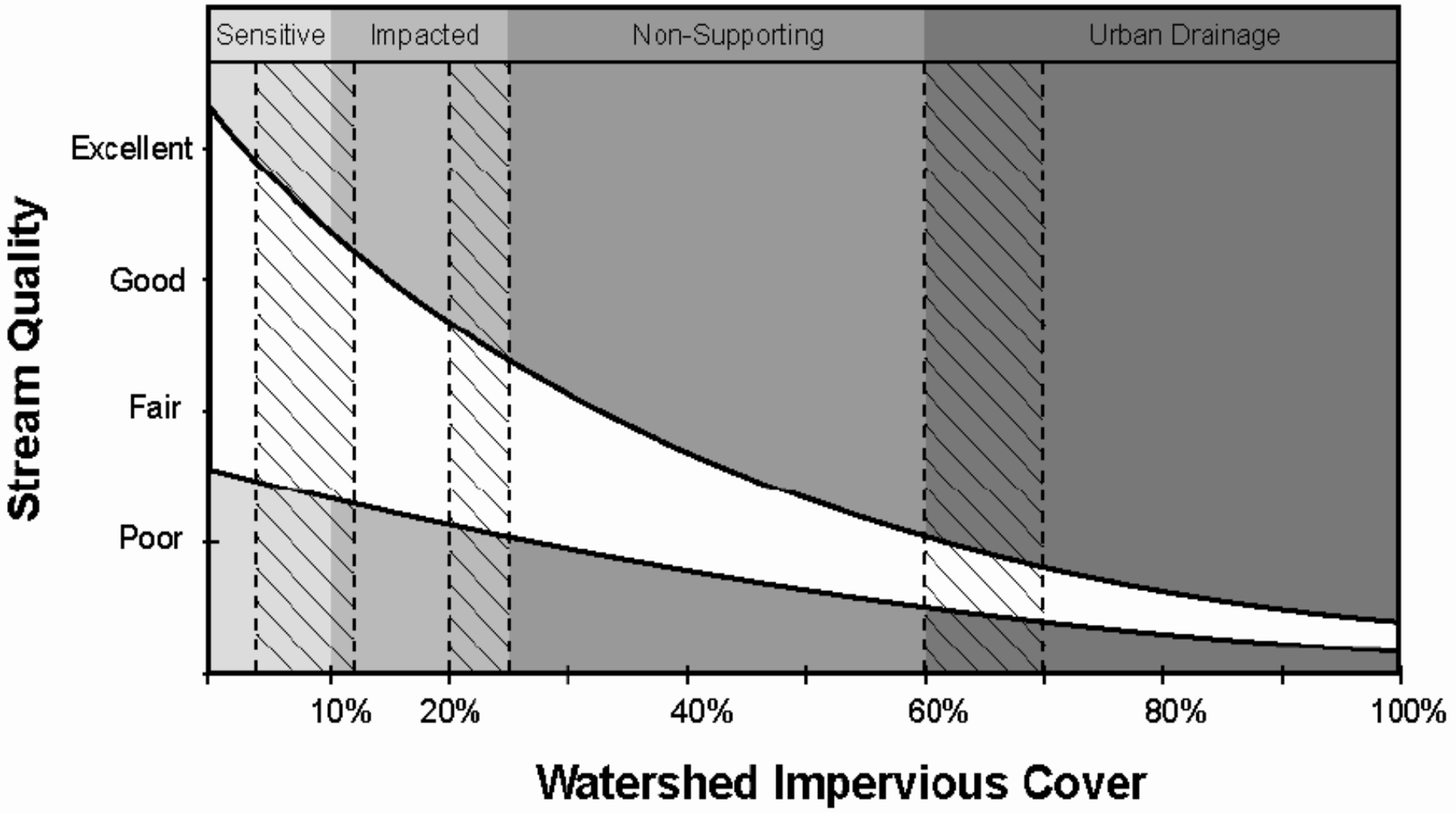
2) fewer trees in buffer

3) less tree cover in watershed

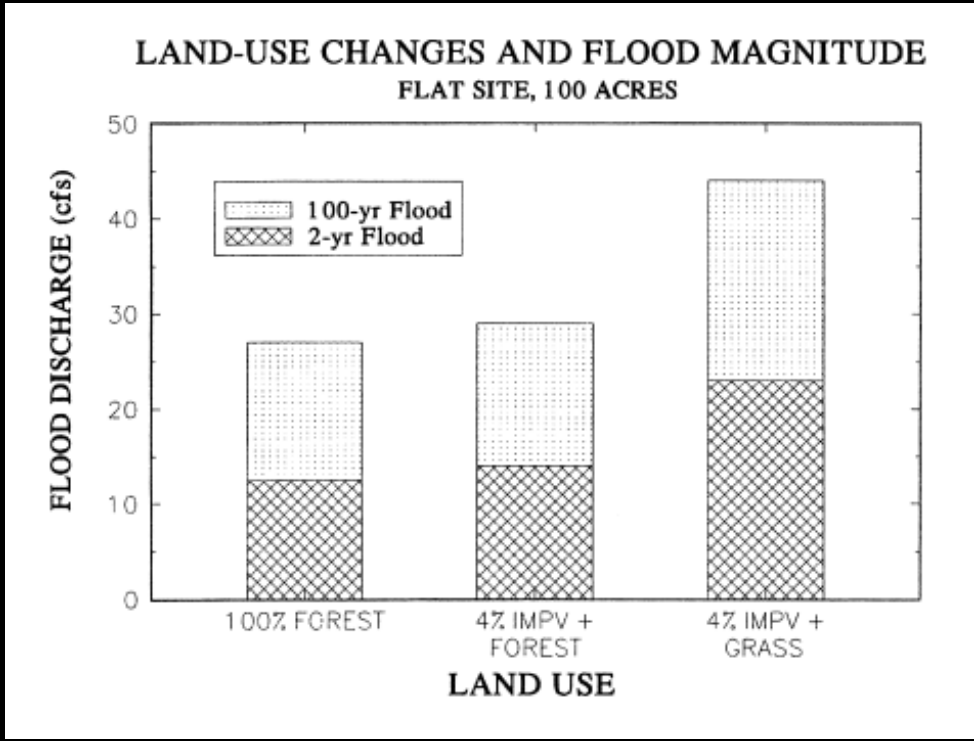
Source: Goetz, Jantz et al. ppt. circa 2004

Using IKONOS imagery to assess impervious surface area, riparian buffers and stream health in the Mid-Atlantic Region.




Sensitive
Impacted
Non-Supporting
Urban Drainage
Excellent
Good
Fair
Poor
Stream Quality
10%
20%
40%
60%
80%
100%
Watershed Impervious Cover

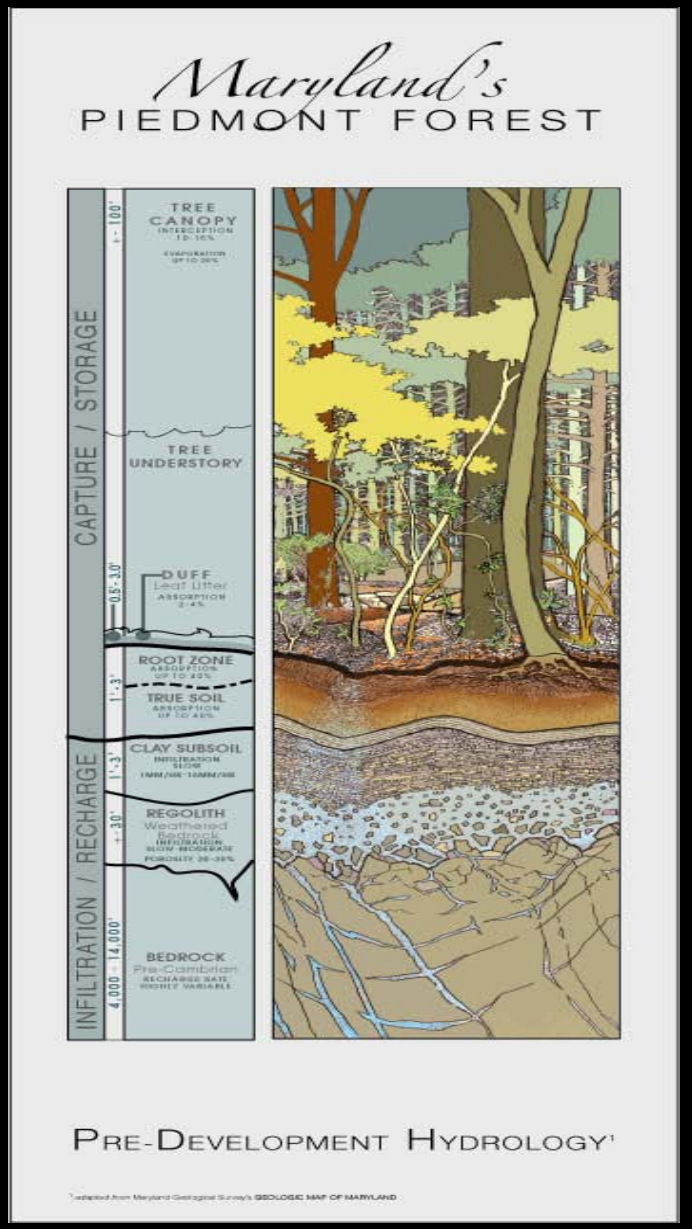
Forest cover – or lack thereof



Booth, Derek B, Forest Cover, Impervious-Surface Area, and the Mitigation of Stormwater Impacts, *Center for Urban Water Resources Management,* (URL)

The 8 Hydrologic Functions of Forests and Trees

1. Canopy Interception
2. Stem Flow
3. Absorption by Leaf Litter (Duff)
4. Soil Infiltration
5. Evapotranspiration
6. Hydraulic Lift/ Redistribution
7. Groundwater Recharge
8. Conveyance of Large Storms

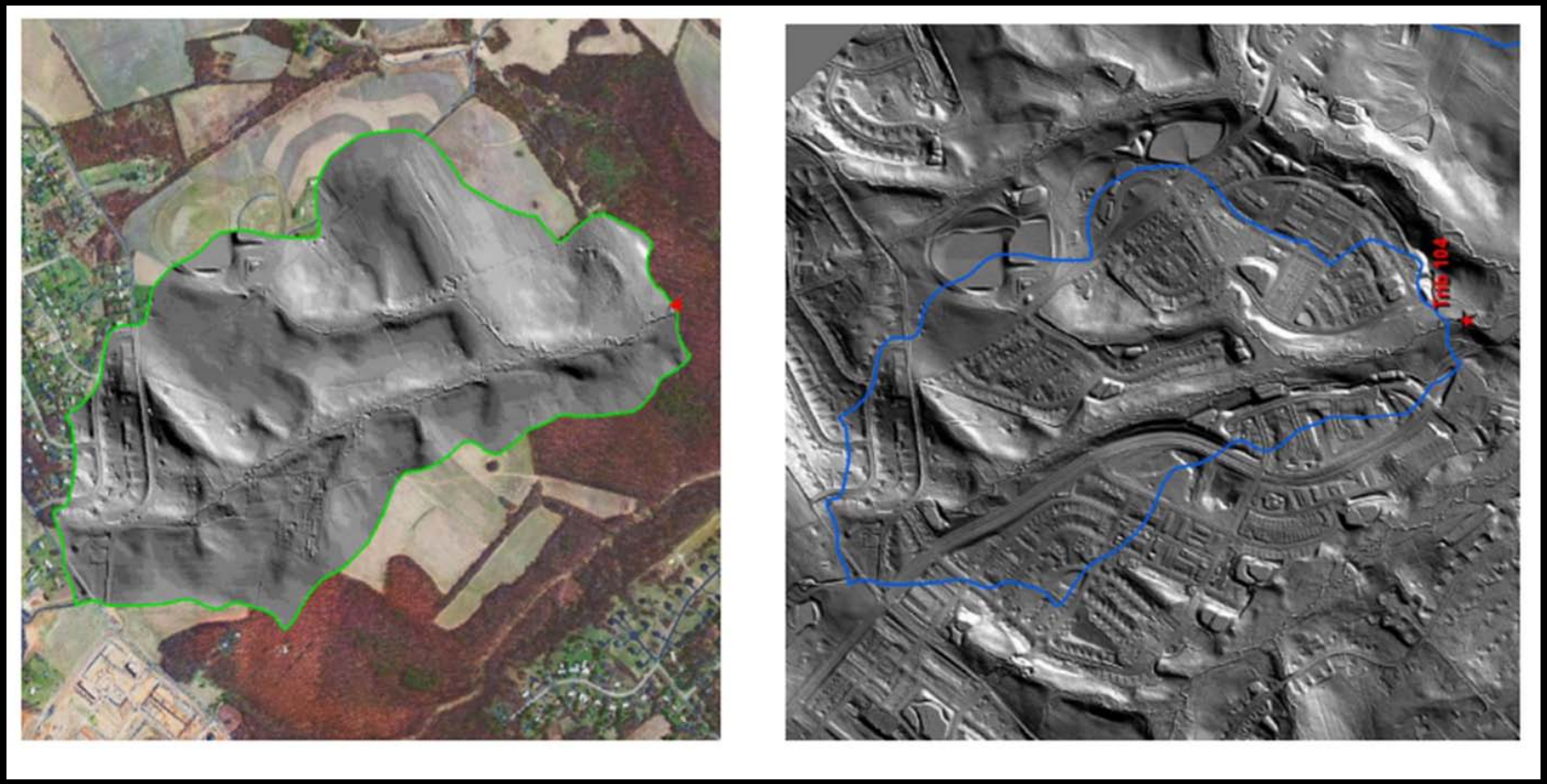


Construction and land alteration

Source: Mont.Co. DEP

Special Protection Area

Report



Ten Mile Creek & High Quality Waters Policy and Local Experience

- 1994 Clarksburg Master Plan
- 2009-2010 Ad Hoc Water Quality Working Group – Majority Report
- Special Protection Areas: Upper Paint Branch and Upper Rock Creek each have Imperviousness Caps of 8% via Environmental Overlay Zones – and Open – Vegetated Space minimum targets ~ 65%.
- 2012 Council Decision to direct the Planning Dept. to do a LMPA for Ten Mile Creek.

- The Montgomery County Council's October 13, 2009 Resolution (# 16-1149) that established the Ad-Hoc Water Quality Working Group included Item 7, which states:

- **Since the approval of the 1994 Clarksburg Master Plan, Montgomery County has gained experience in protecting streams using land cover requirements, including limiting impervious surfaces and maintaining riparian and upland forest cover, in the Upper Paint Branch and Upper Rock Creek Special Protection Areas and in the Sandy Spring/Ashton Rural Neighborhood Cluster Zone in Upper Northwest Branch. Key to the establishment of these land-cover-based watershed protection approaches was the County's recognition of the importance of headwater stream systems. These systems provide the foundation for a stable flow of water, including through maintenance of groundwater recharge levels.**

Ad-Hoc Water Quality Working Group July 2010 Report.
Majority Report: Rick Brush, Mark Pfefferle, Steve Shofar, Diane Cameron, John Cook.

The Environmental Site Design provisions included in the Option 2 report are important and necessary, but not sufficient, to protect the high quality water and sensitive contributing watershed of Ten Mile Creek. They are insufficient because the forest buffer, stormwater and sediment controls included in the Option 2 approach have not been proven to prevent the disruption of infiltration and groundwater flows, and other destructive impacts, associated with the densities currently planned for Stage 4.

- **The only scientifically-proven way to prevent (not just possibly lessen) this host of impairments is to minimize the construction of infrastructure projects in the Ten Mile Creek watershed, and to apply protective conservative land cover requirements through a limited Master Plan amendment.**

Audubon Naturalist Society & Montgomery Countryside Alliance

AUDUBON NATURALIST SOCIETY
OF THE CENTRAL ATLANTIC STATES, INC.

What do we do?

Education

Advocacy

Stewardship

Citizen Science

Montgomery Countryside Alliance

PROMOTING & PROTECTING RURAL MONTGOMERY COUNTY

How Have We Helped Ten Mile Creek?

- 15 yrs. WQ monitoring
- Science Literature Research
- Organizing, outreach, advocacy
- Education of County leaders
- Video – communication
- Leading hikes in TMC

Conclusions

1) Land use and land cover affect water quality.

2) In order to implement the Council's charge to protect Ten Mile Creek while allowing some development, the Limited MP Amendment must specify land cover conditions.

3) ESD measures and practices are necessary, but not sufficient to protect Ten Mile Creek, since ESD practices alone do not accomplish the land cover conditions required to maintain high quality streams.

3)The published science indicates that Ten Mile Creek needs:

- Imperviousness limit set between 4% to 6% total watershed imperviousness
- Specific subwatershed Imp. limits
- Forest Cover Minima: 77% for the stream buffers and 50% for the overall watershed – for maintenance of an Excellent IBI score.
- Limits on construction activities including cut-and-fill and terraforming
- Protections of springs, seeps, zero-order streams

4) The science, policy, law, and experience are there. *What we need is the political will to do the right thing.*

Recommendations to the Montgomery County Water Quality Advisory Group

1. Support protecting Ten Mile Creek through science-based performance standards for development projects, including limits on imperviousness and construction, and minimum levels of forest cover.
2. Express this support via letters to PB, Council.

Acknowledgements

Thanks to:

- ANS Conservation Intern Ava Manglik for her assistance with this project.
- Volunteers Mary Rojas and Melane Hoffman.
- Cathy Wiss for monitoring data, research and Ten Mile Creek observations.
- Dolores Milmoe for her organizing, outreach and graphics.
- Caroline Taylor & MCA for its ongoing support.
- Funding support from Cornell Douglas, Keith Campbell and Wallace Foundations and individual donors.