Using IKONOS Imagery to Assess Impervious Surface Area, Riparian Buffers and Stream Health in the Mid-Atlantic Region

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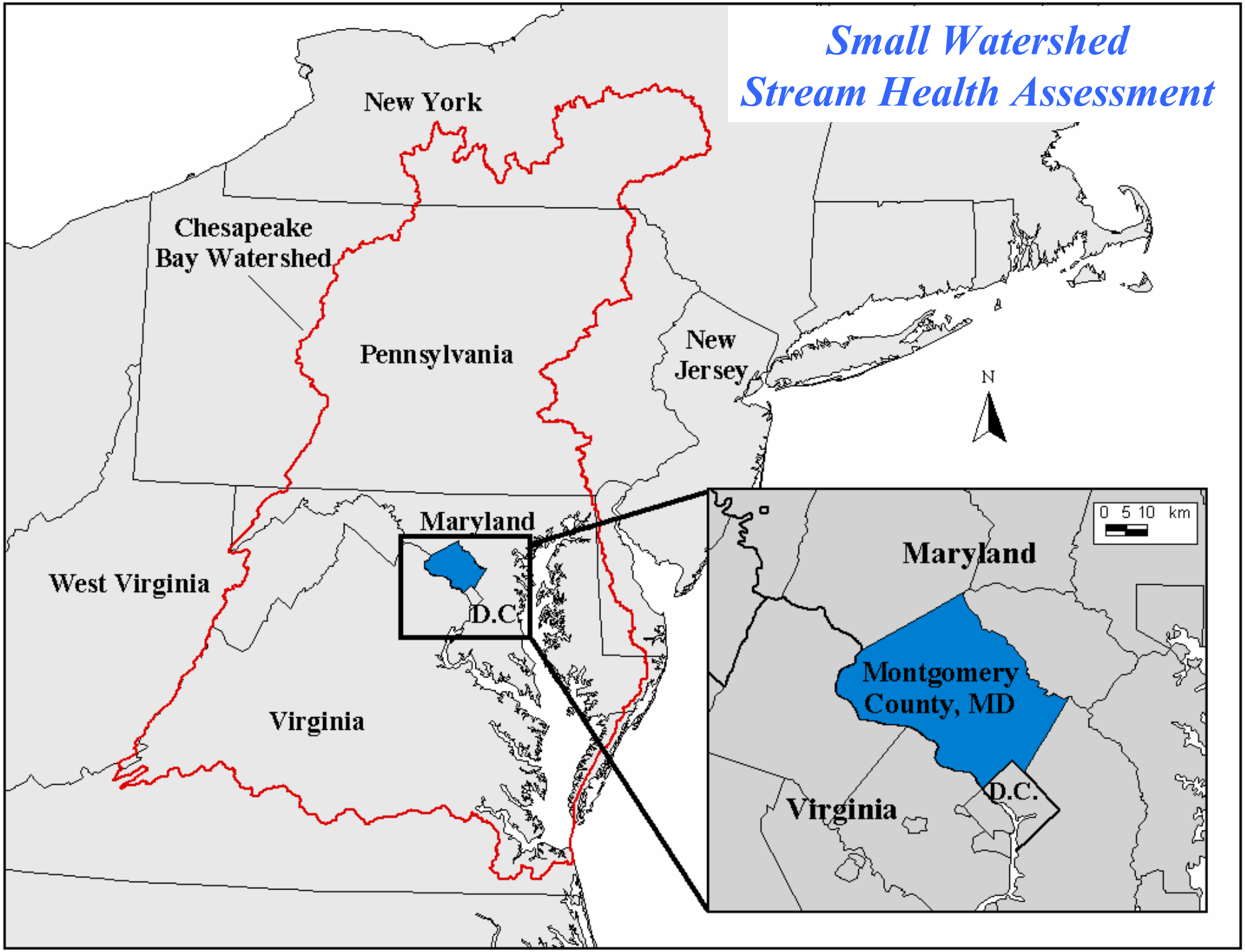
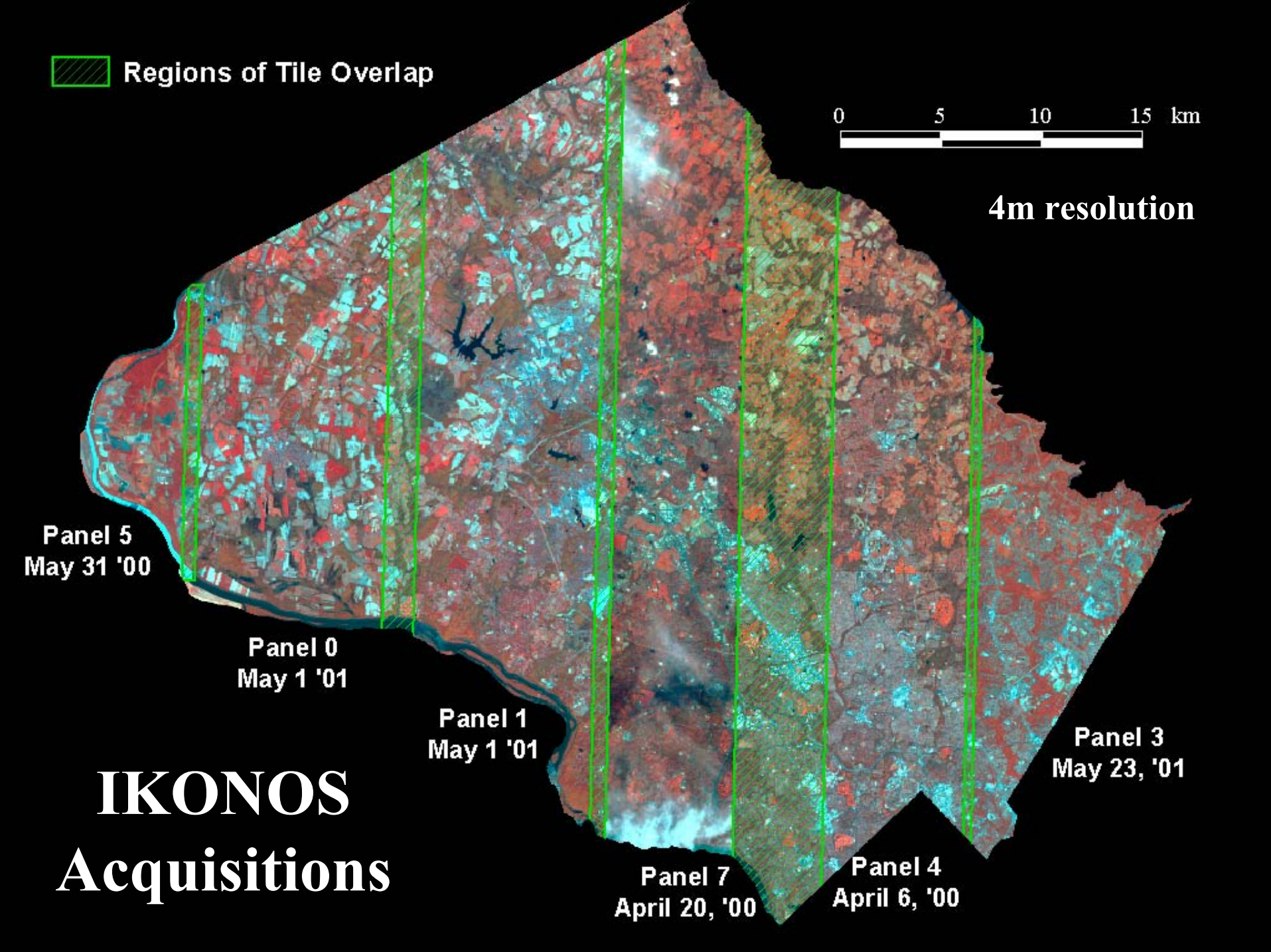
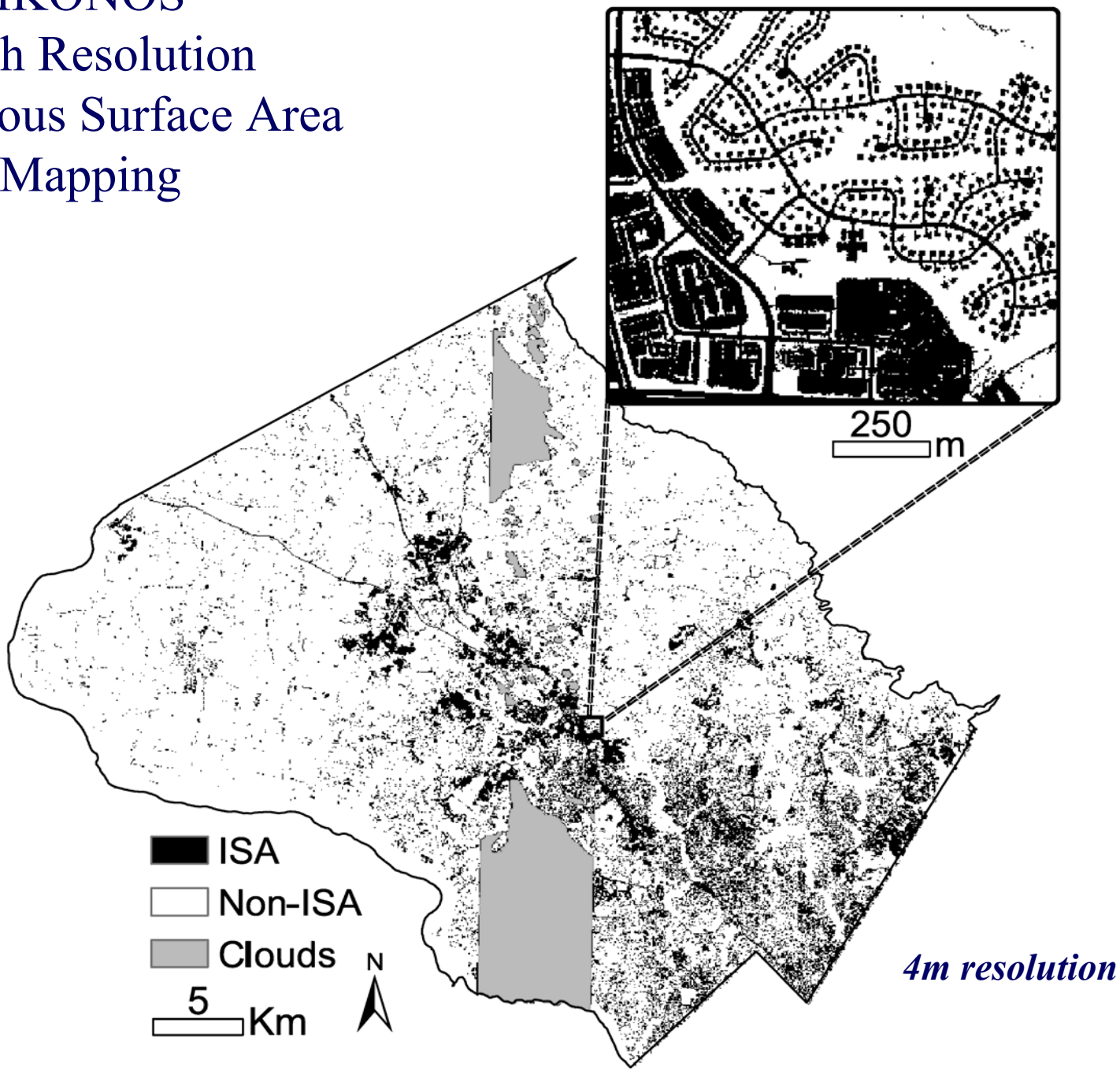

Small Watershed
Stream Health Assessment
New York
Chesapeake
Bay Watershed
Pennsylvania
New
Jersey
N
Maryland
West Virginia
D.C
Virginia
0 5 10 km
Maryland
Montgomery
County, MD
D.C.
Virginia


Regions of Tile Overlap
0 5 10 15 km
4m resolution
Panel 5
May 31 '00
Panel 0
May 1 '01
Panel 1
May 1 '01
Panel 3
May 23, '01
Panel 7
April 20, '00
Panel 4
April 6, '00
IKONOS
Acquisitions

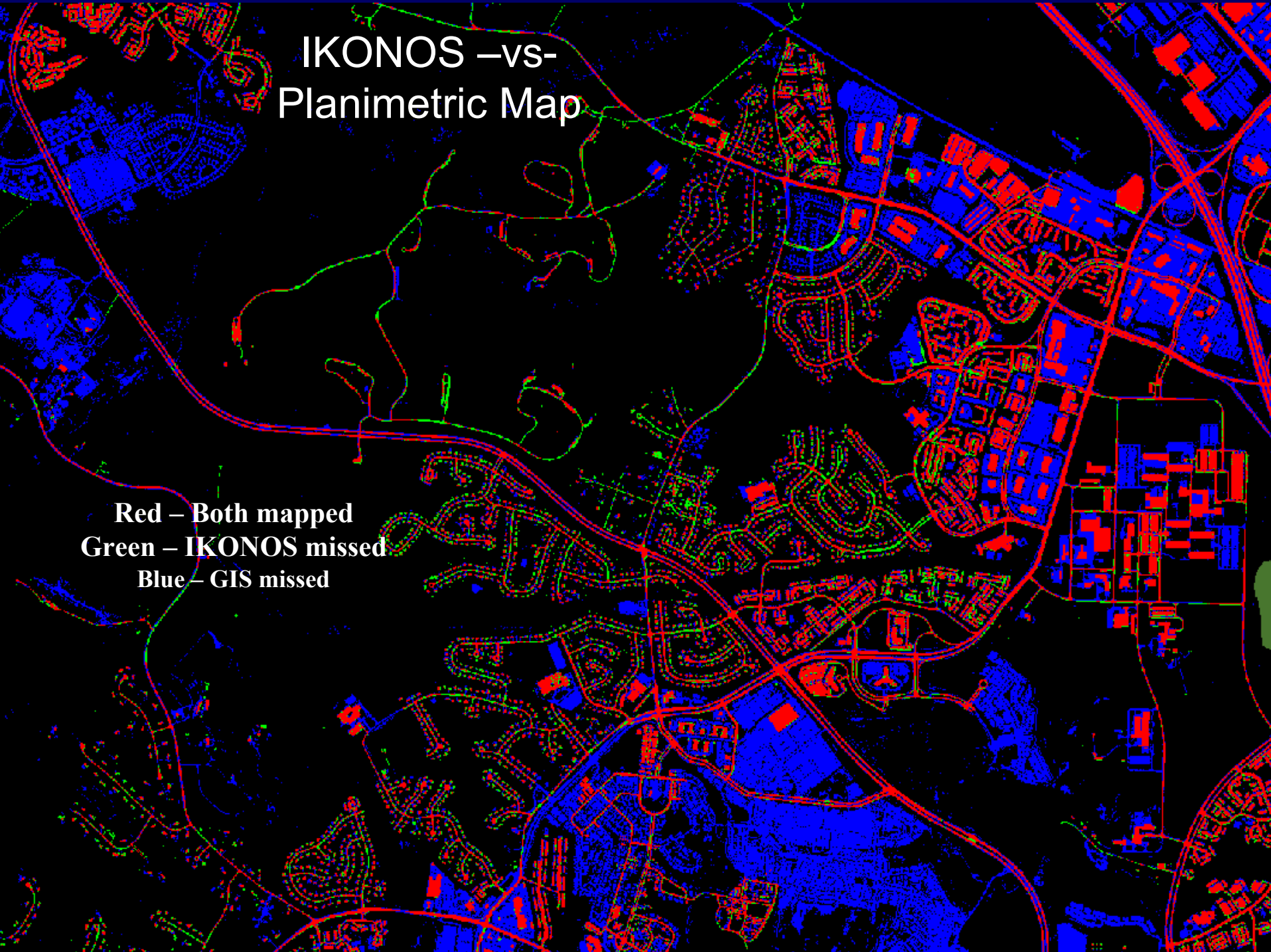
IKONOS Acquisition Information

Panel	Date	Local Time	Solar Zenith	Viewing Angle
1	5/1/2001	10:59	27.9	11.8
2	5/1/2001	11:00	27.8	1.5
3	5/23/2001	11:02	22.6	4.2
4	4/6/2000	10:35	38.7	13.5
5	6/26/2000	10:53	23.0	10.9
6	4/20/2000	10:45	32.8	12.7

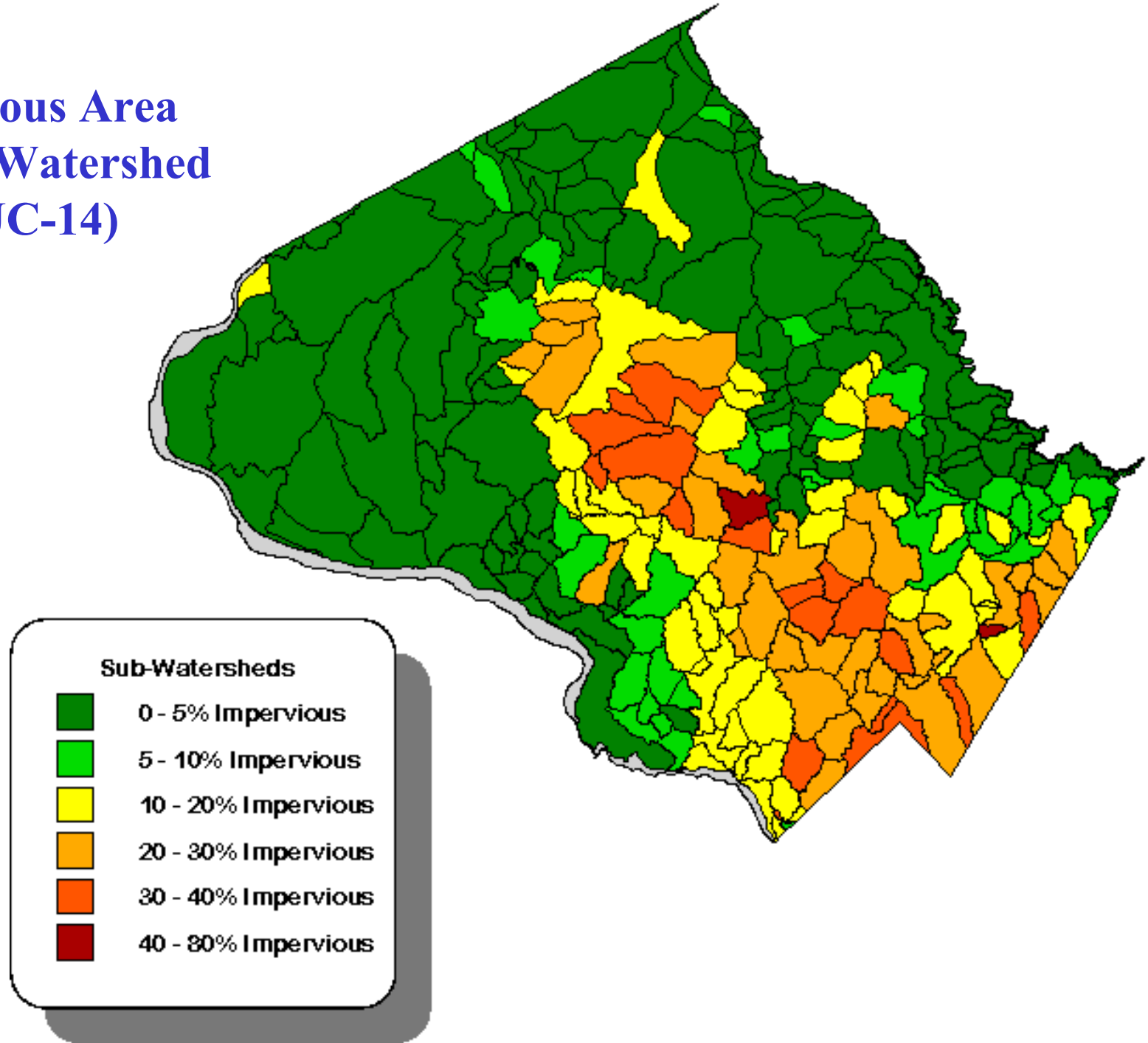
IKONOS
High Resolution
Impervious Surface Area
Mapping



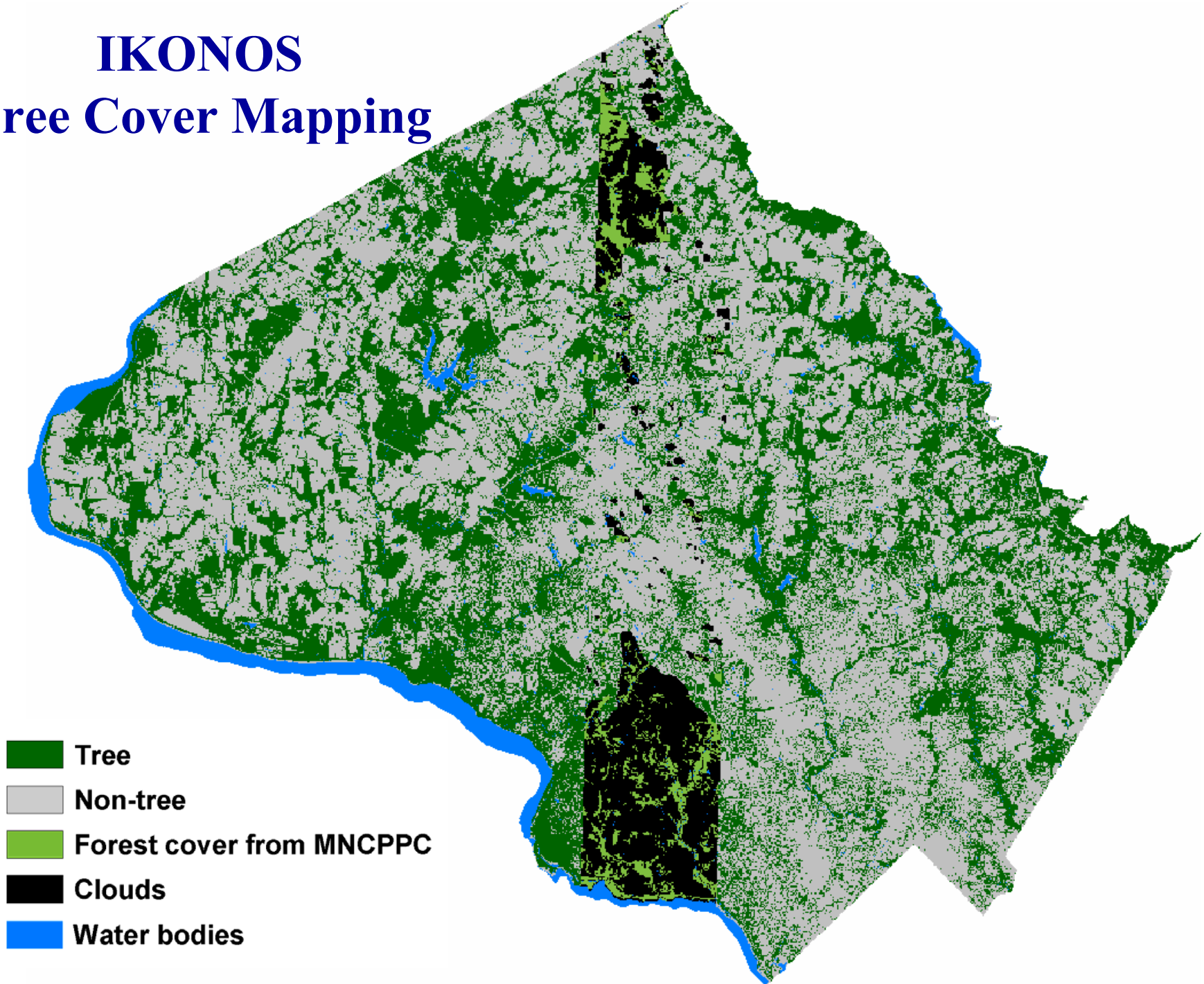
4m resolution


IKONOS –vs-
Planimetric Map
Red – Both mapped
Green – IKONOS missed
Blue – GIS missed

Impervious Area by Small Watershed (~HUC-14)



IKONOS
Tree Cover Mapping



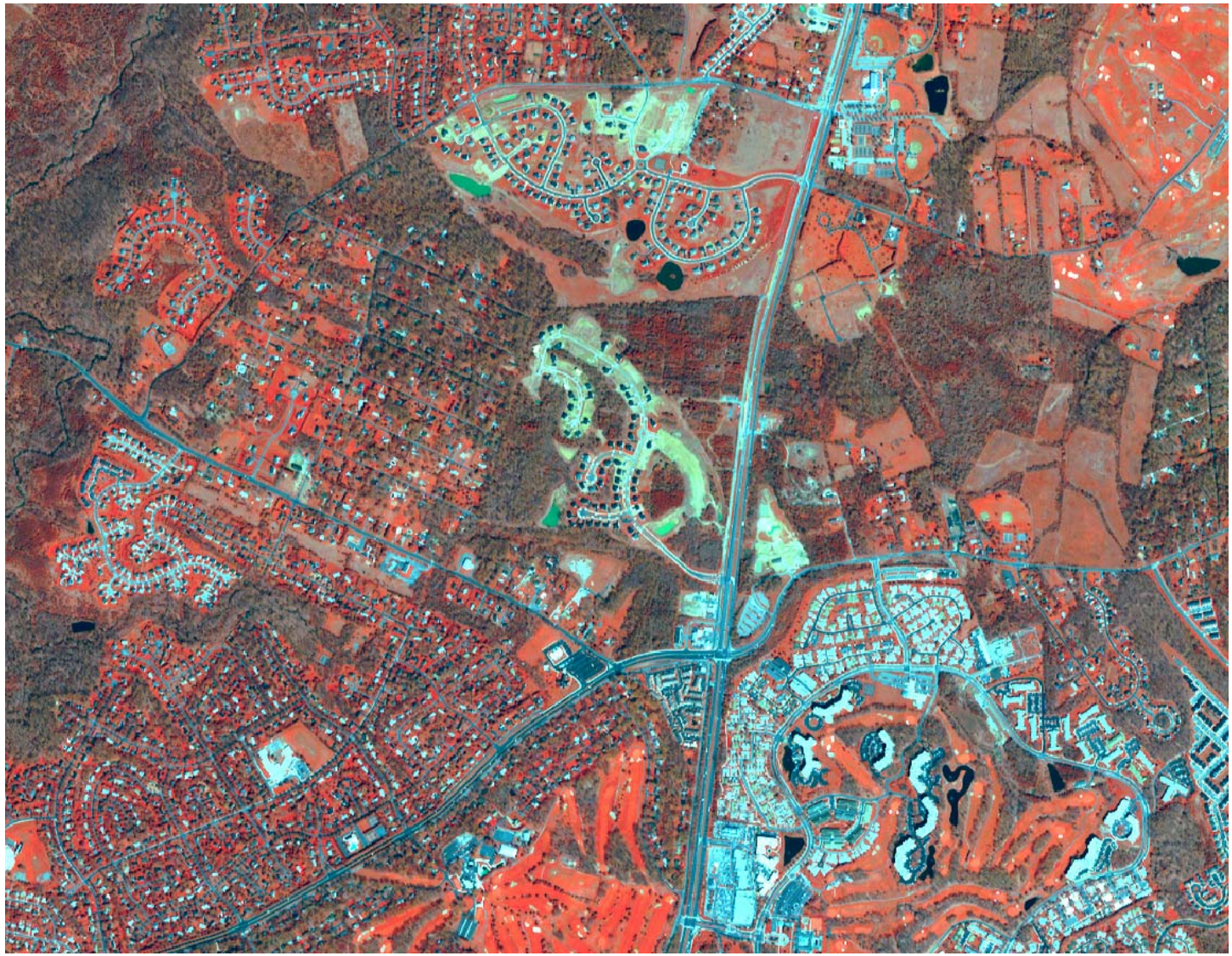
IKONOS Tree Cover Accuracy Assessment

	Validation Sample (N)	Classified (IKONOS)	Number Correct	Producers Accuracy	Users Accuracy
Tree	212,703	217,224	208,351	98.0	95.9
Non-tree	287,297	282,577	278,236	96.9	98.5

Overall Accuracy 97.3%

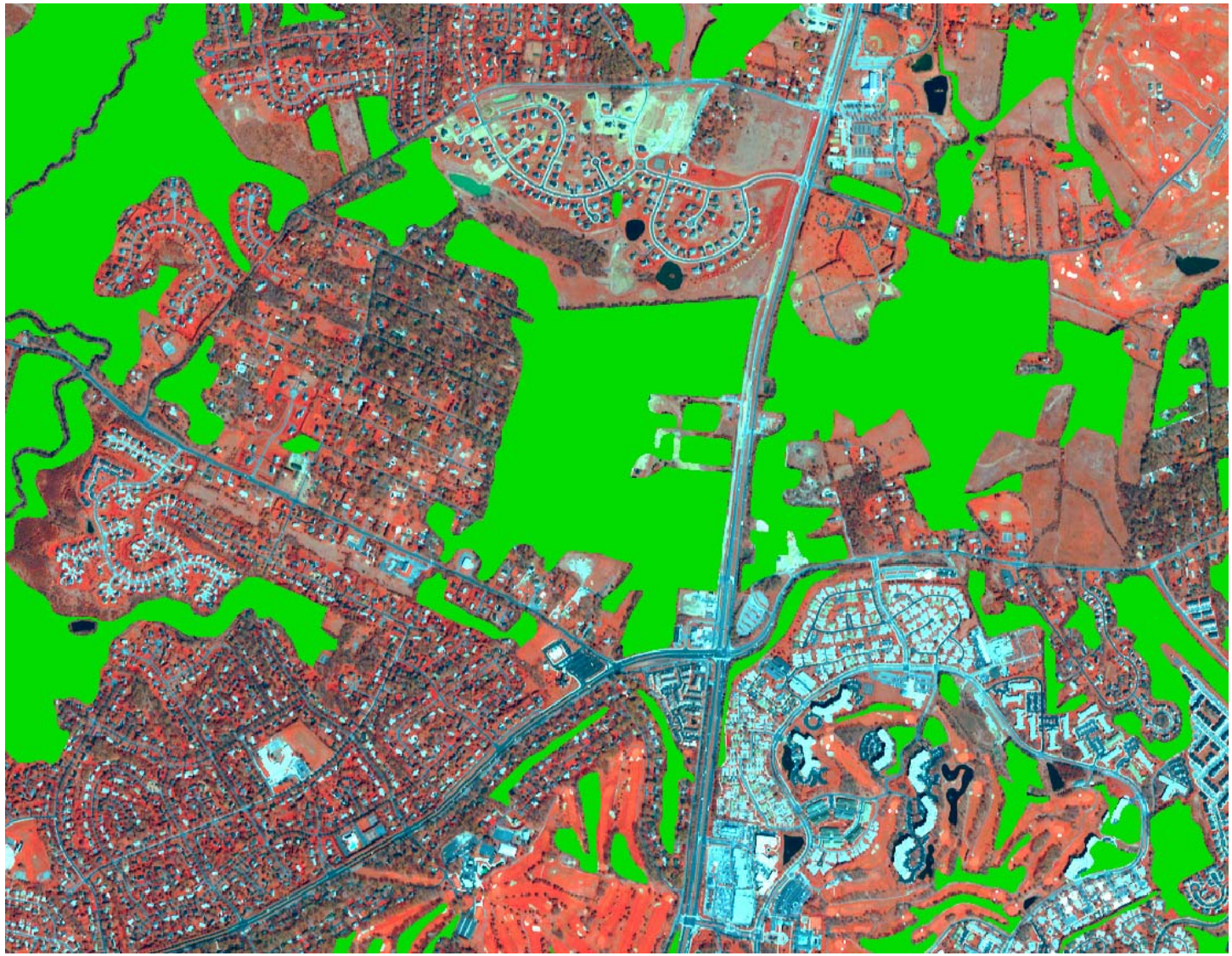
kappa = 0.95

IKONOS Tree Cover compared to Air Photo Forest Cover



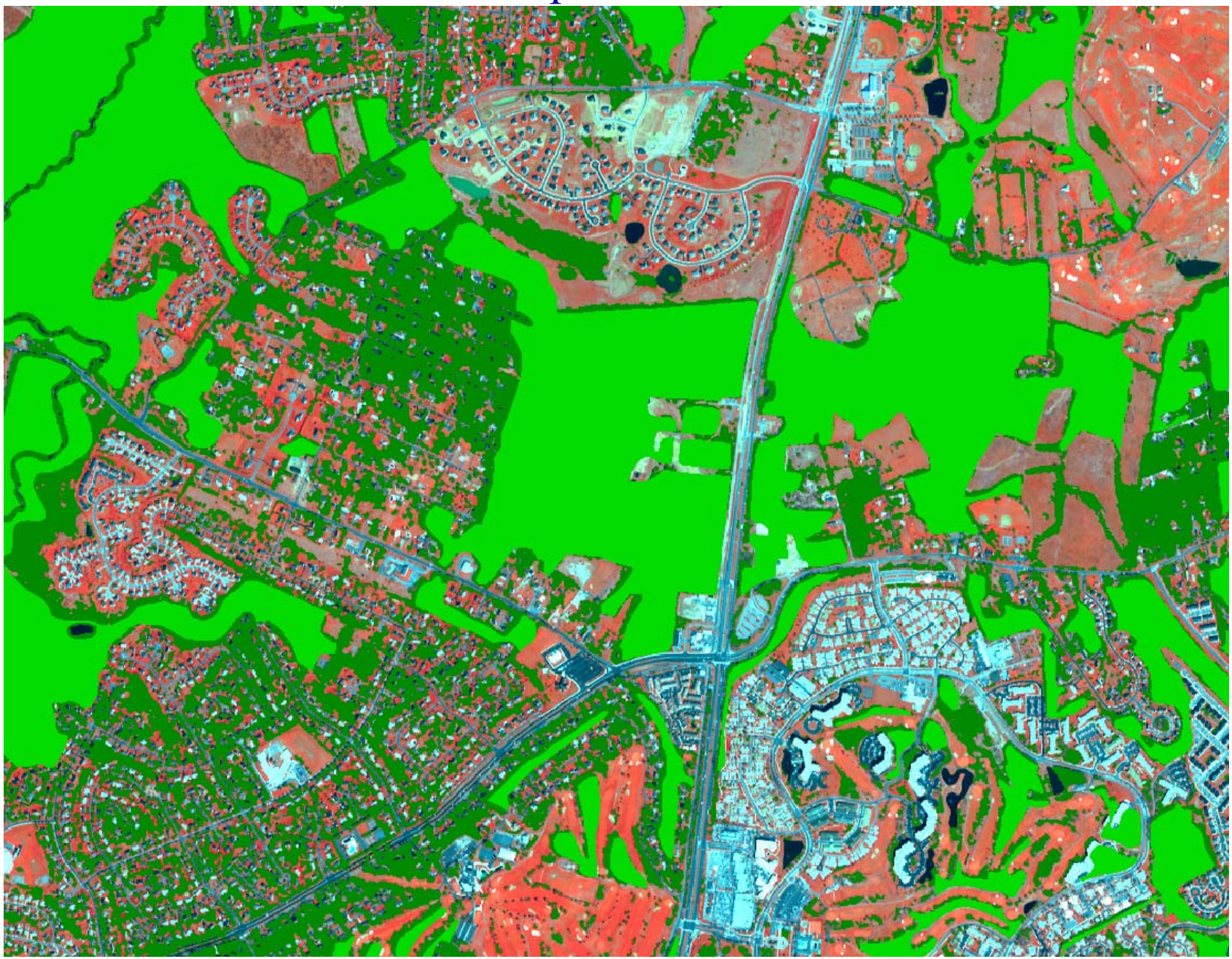
continued

IKONOS Tree Cover compared to Air Photo Forest Cover



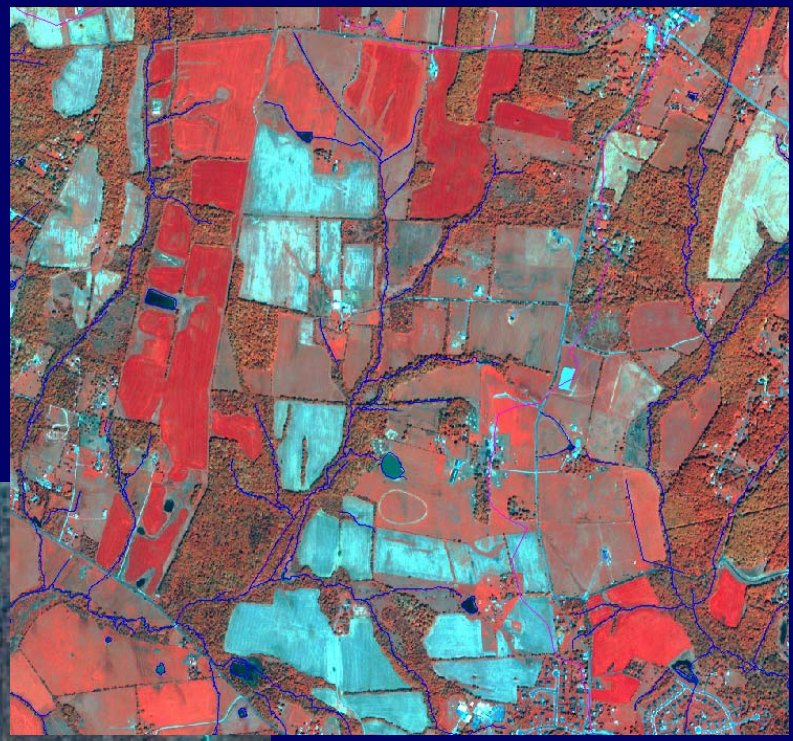
continued

IKONOS Tree Cover compared to Air Photo Forest Cover



Riparian Buffer Zones

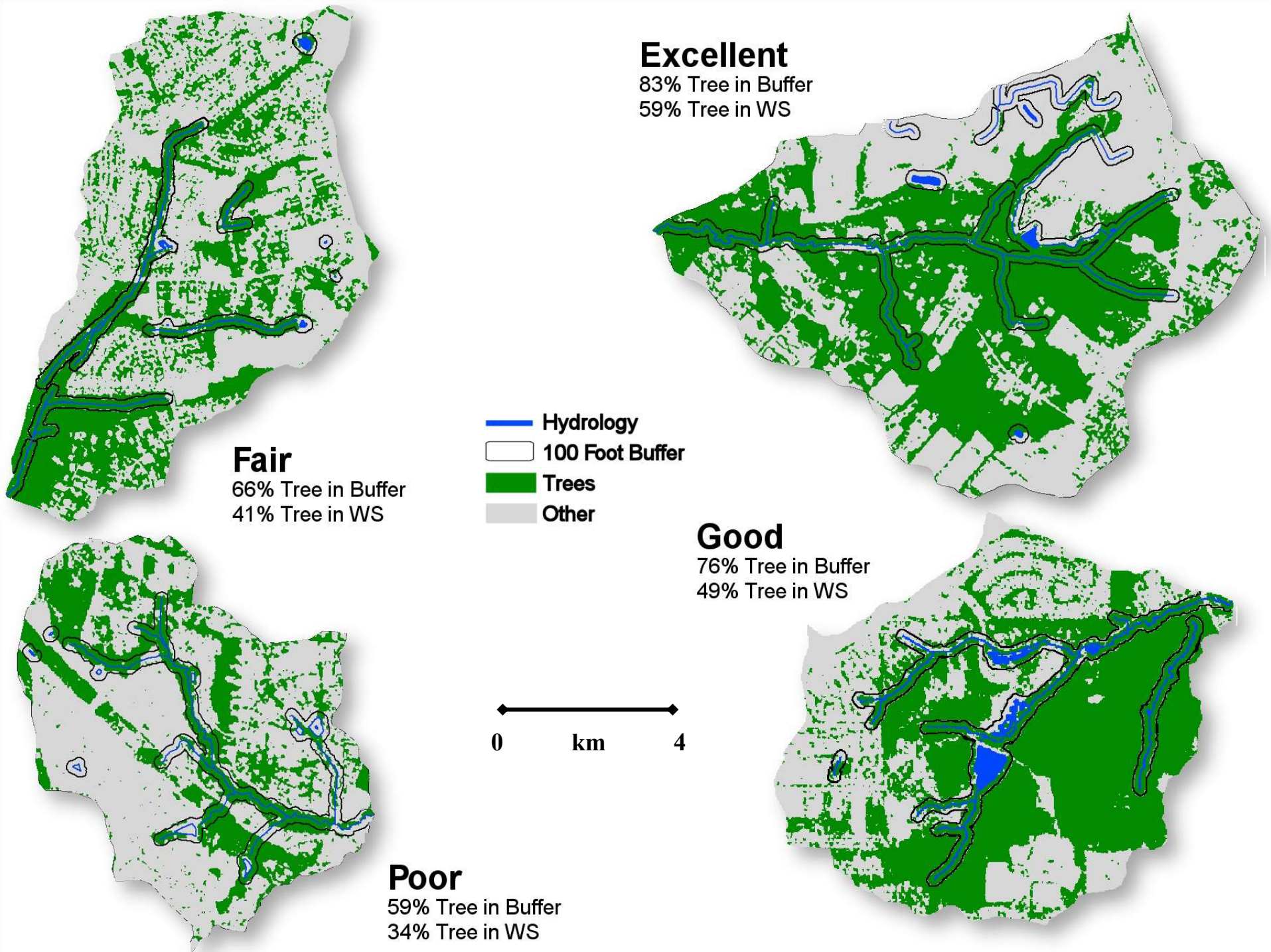
Filter Pollutants in Urban Areas



Sequester Nutrients in Agricultural Areas

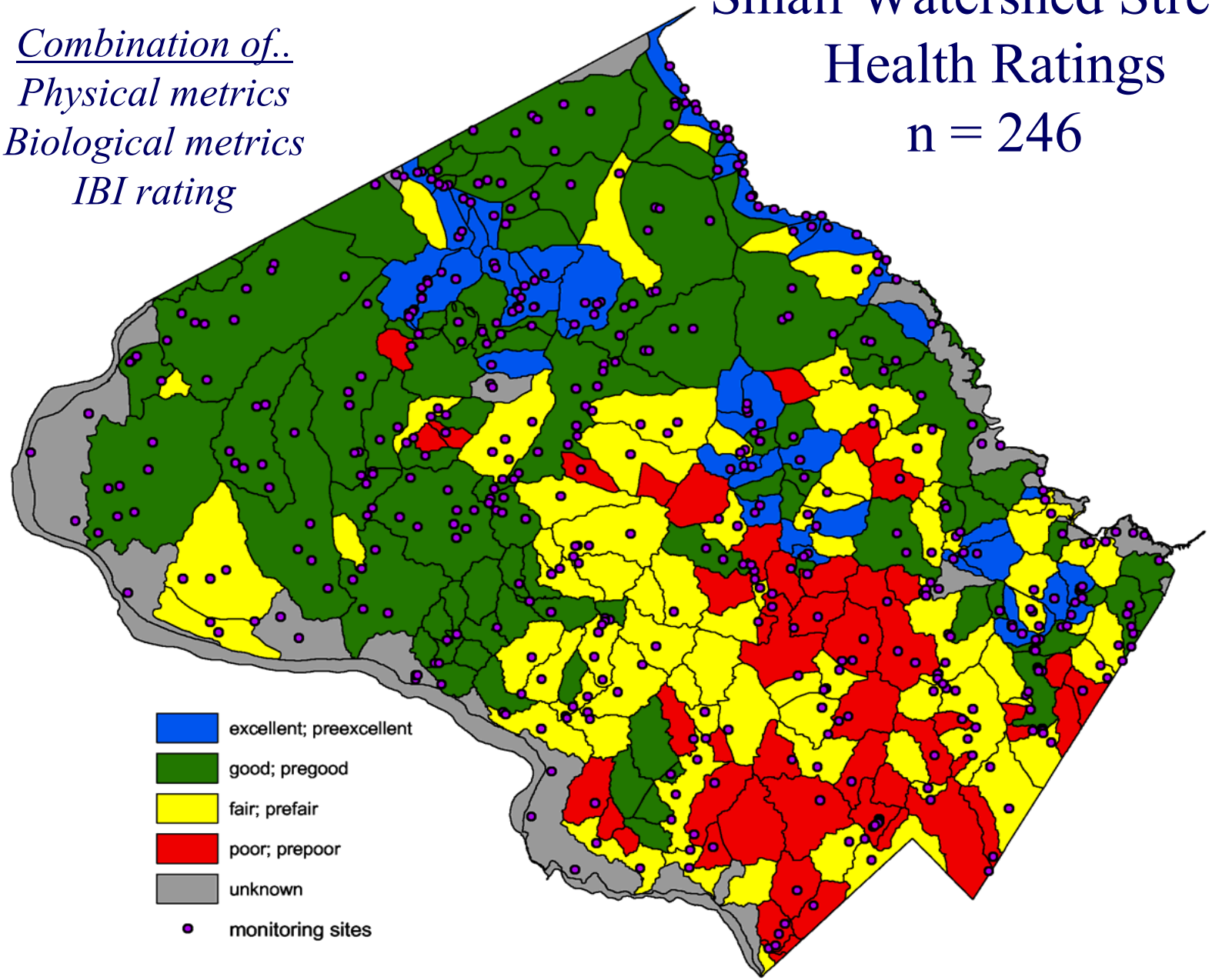
Shade & Protect Stream Habitat

IKONOS permits consideration of narrow buffers (e.g, 100' = 8 pixels)


Excellent
83% Tree in Buffer
59% Tree in WS
Hydrology
100 Foot Buffer
Trees
Other
Fair
66% Tree in Buffer
41% Tree in WS
Good
76% Tree in Buffer
49% Tree in WS
0
km
4
Poor
59% Tree in Buffer
34% Tree in WS

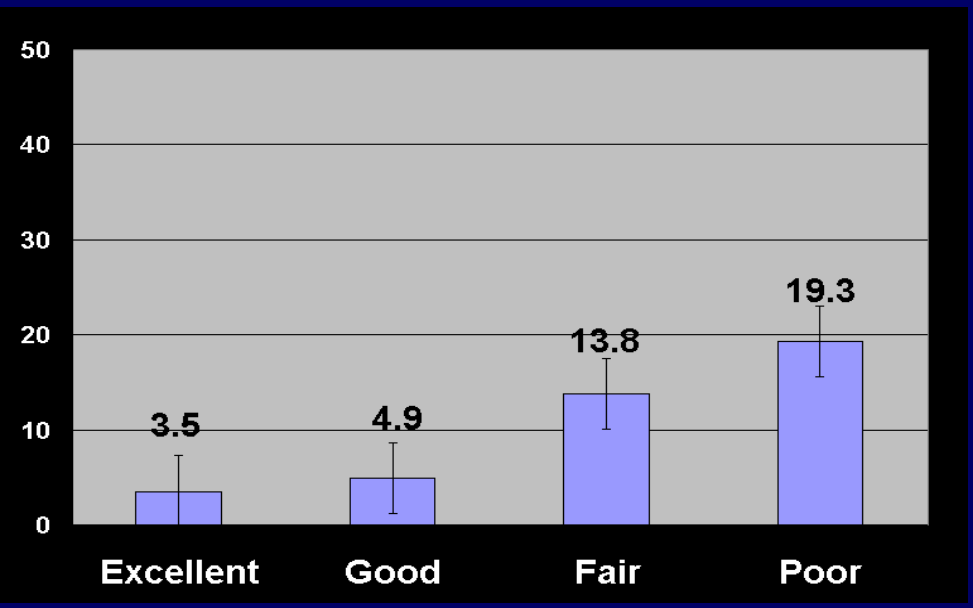
Small Watershed Stream Health Ratings n = 246

Combination of..
Physical metrics
Biological metrics
IBI rating



Source: Mont Co DEP & MD DNR

% Impervious Within Watershed



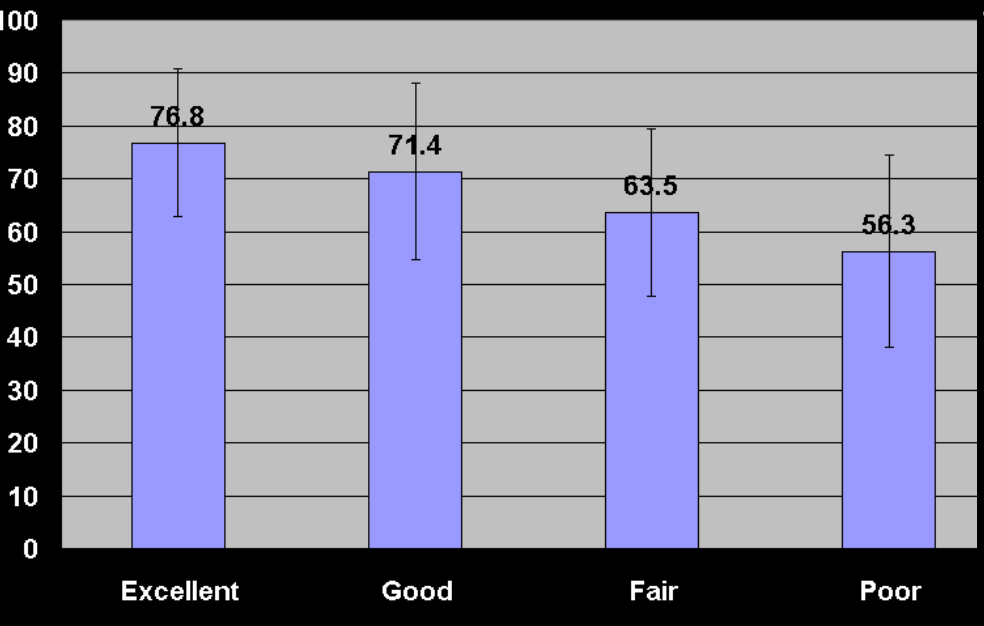
Across all watersheds there is a significant *decrease* in stream health rating with:

1) more impervious cover

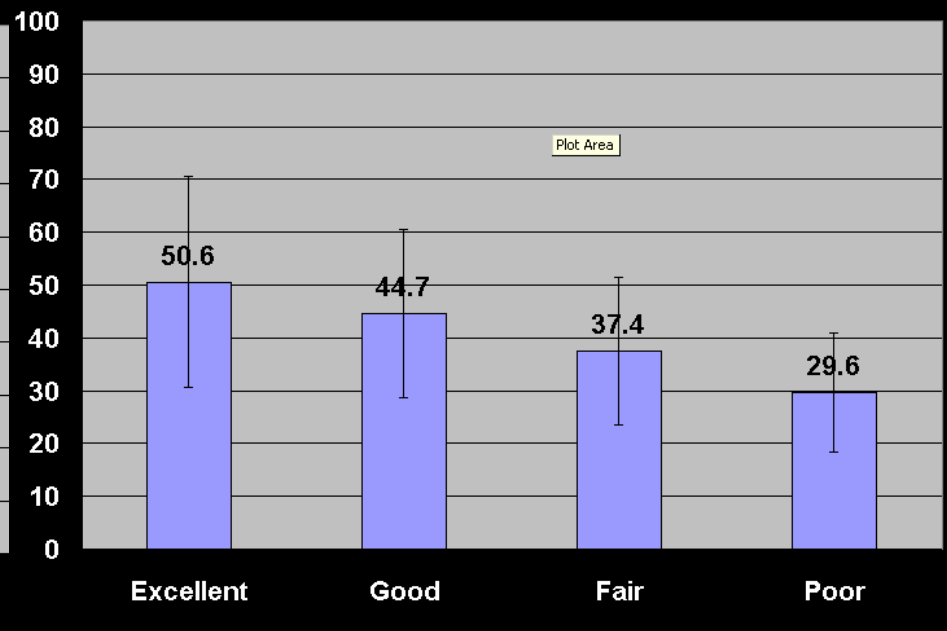
2) fewer trees in buffer

3) less tree cover in watershed

% Tree Cover Within 100ft. Buffer

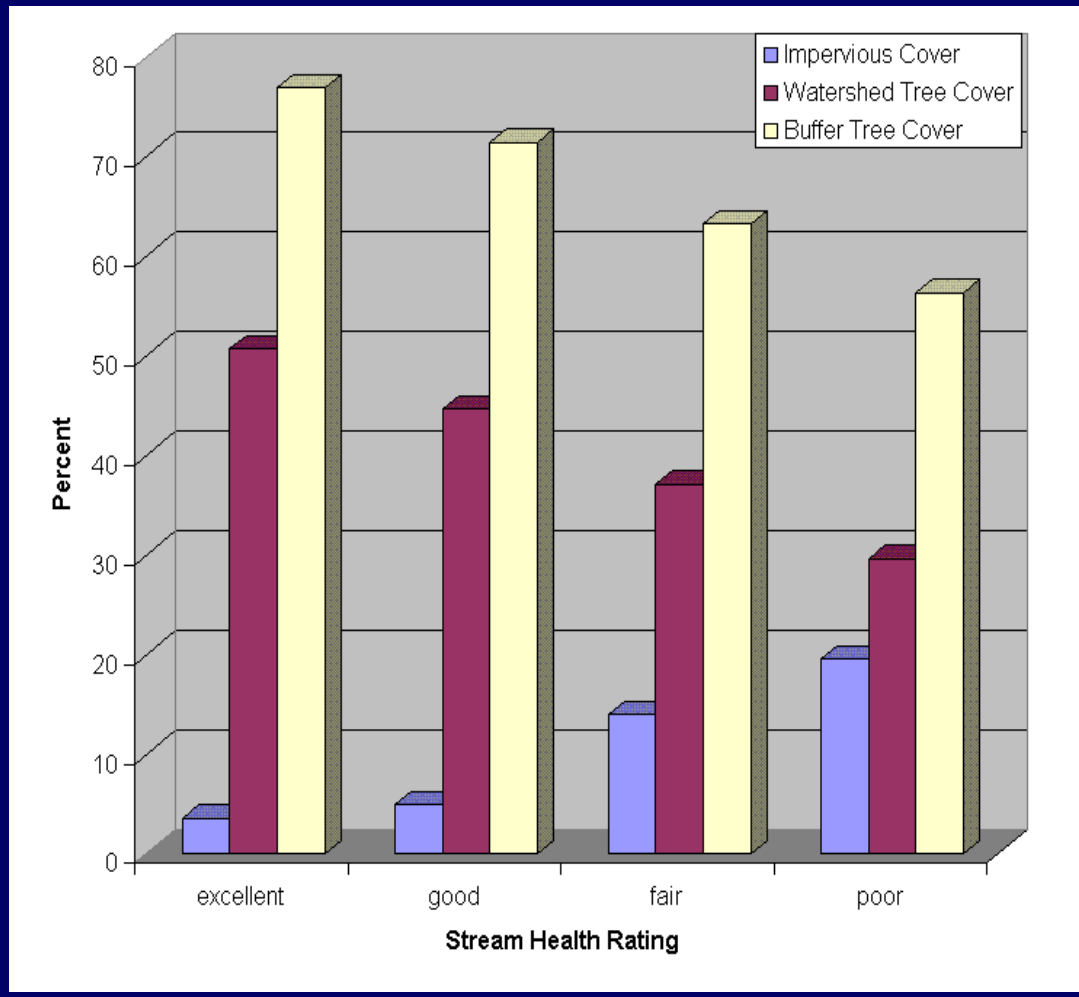


% Tree Cover Within Watershed



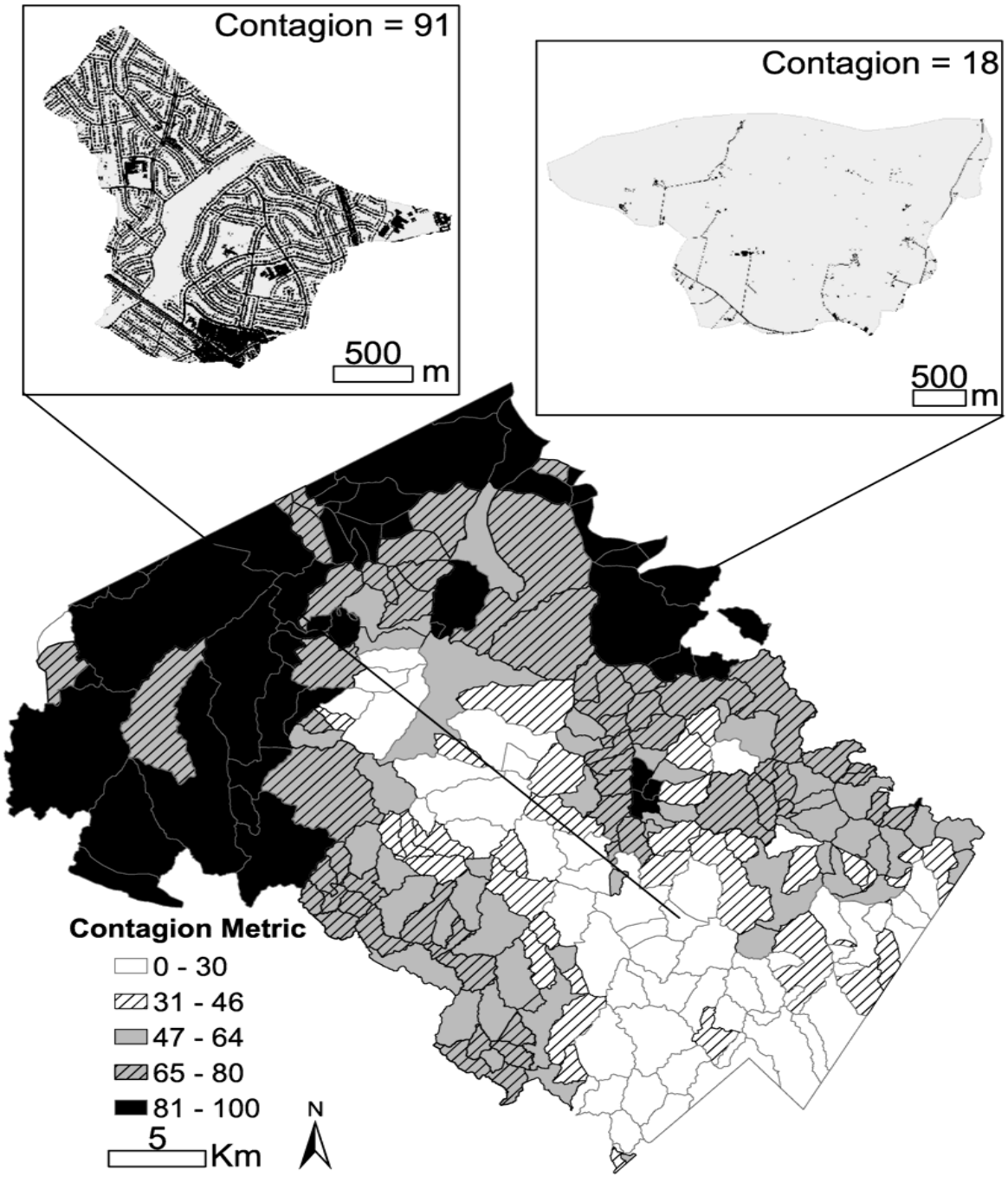
Stream Health predictors:

1) Impervious cover*
2) Tree cover within buffer
3) Total tree cover within watershed



Excellent rating: < 6% impervious, >65% tree buffers

Good rating: <10% impervious, >60% tree buffers



Does Landscape Configuration matter?

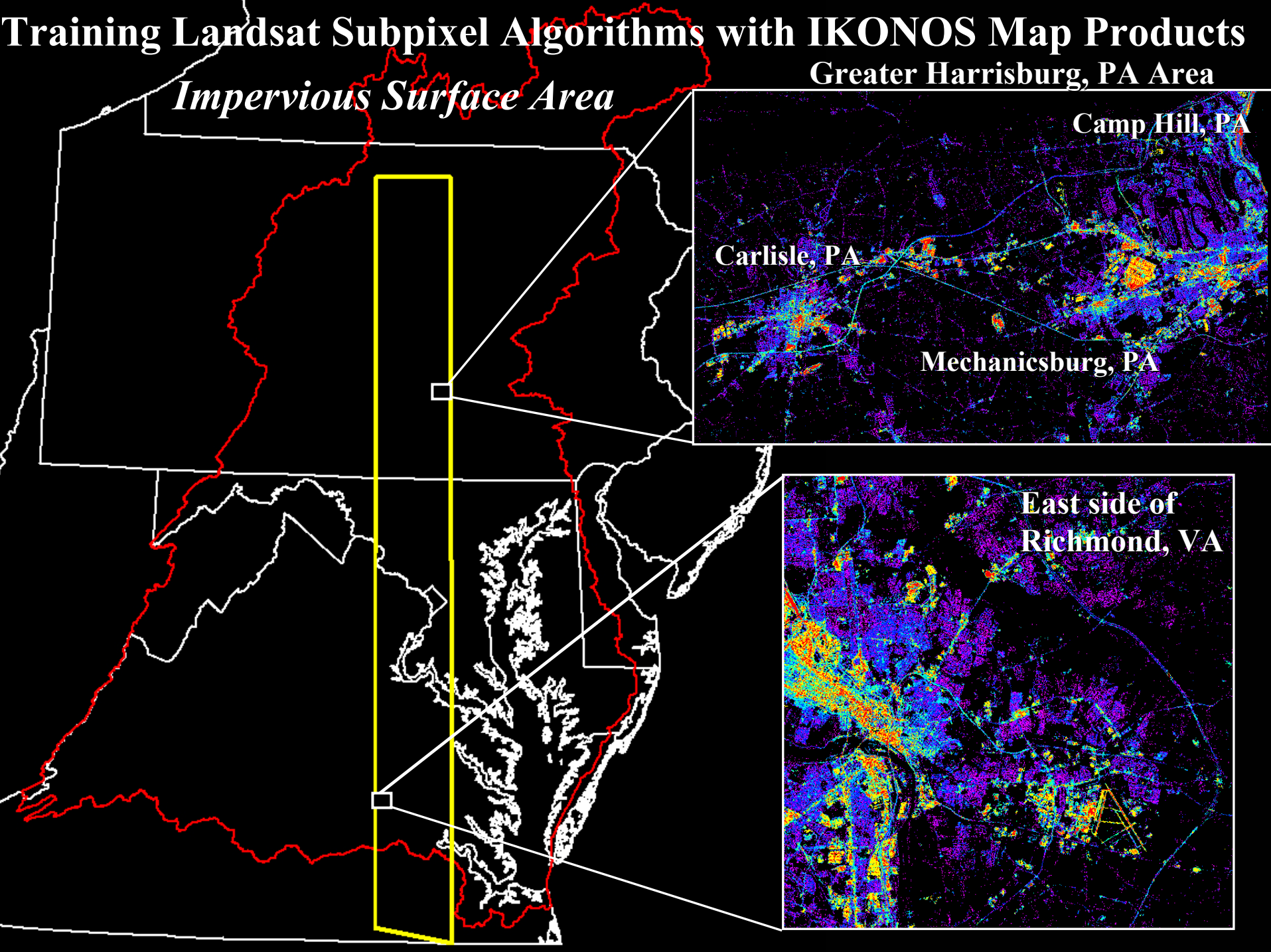
Slope
Distance to Stream (mean, edge)
LC in Flow Path
Contagion (0 – 100)
Clumpiness (-1, 0, +1)

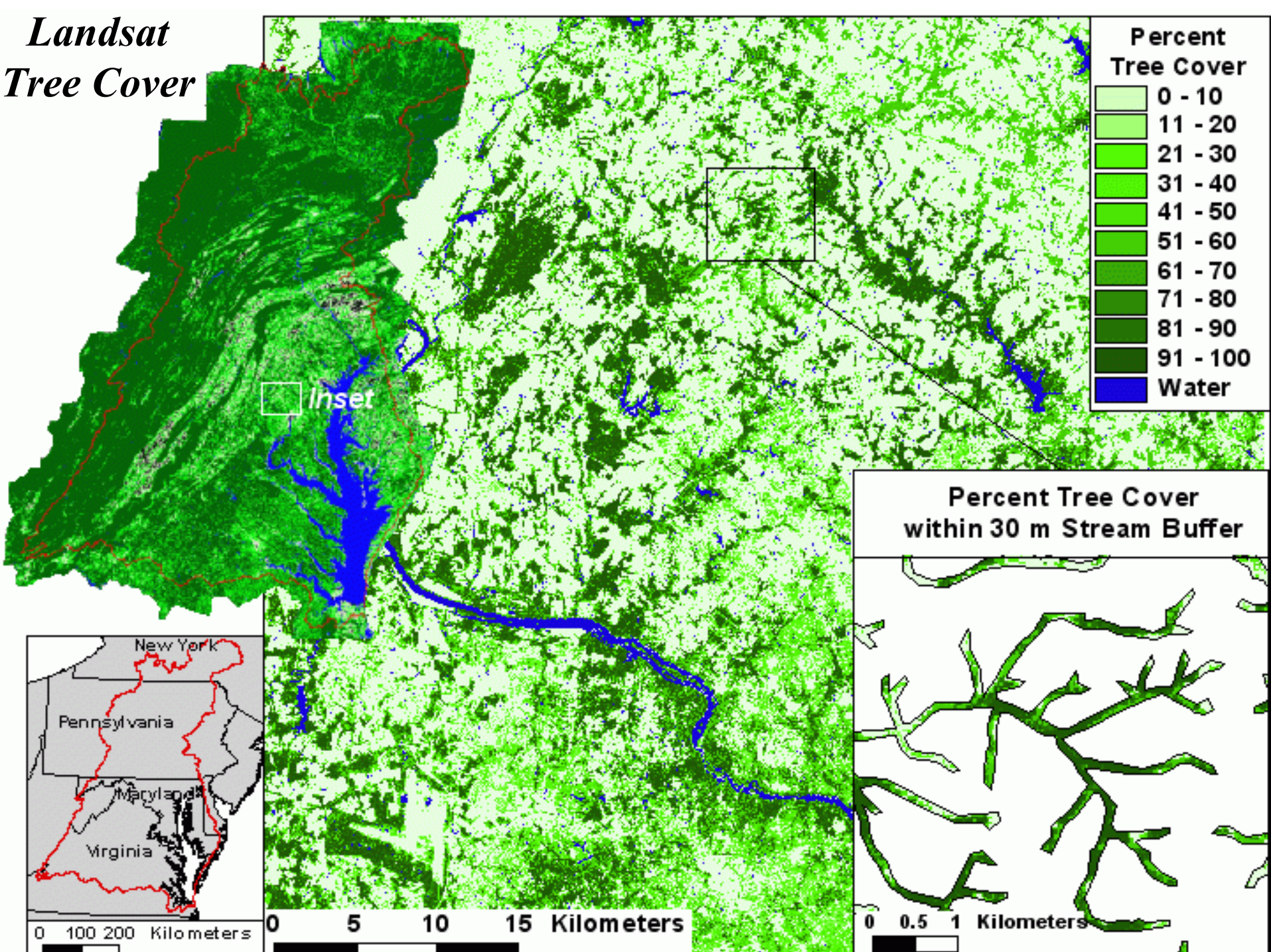
Configuration was a 2nd order effect..

Storm Drains bypass Buffers..

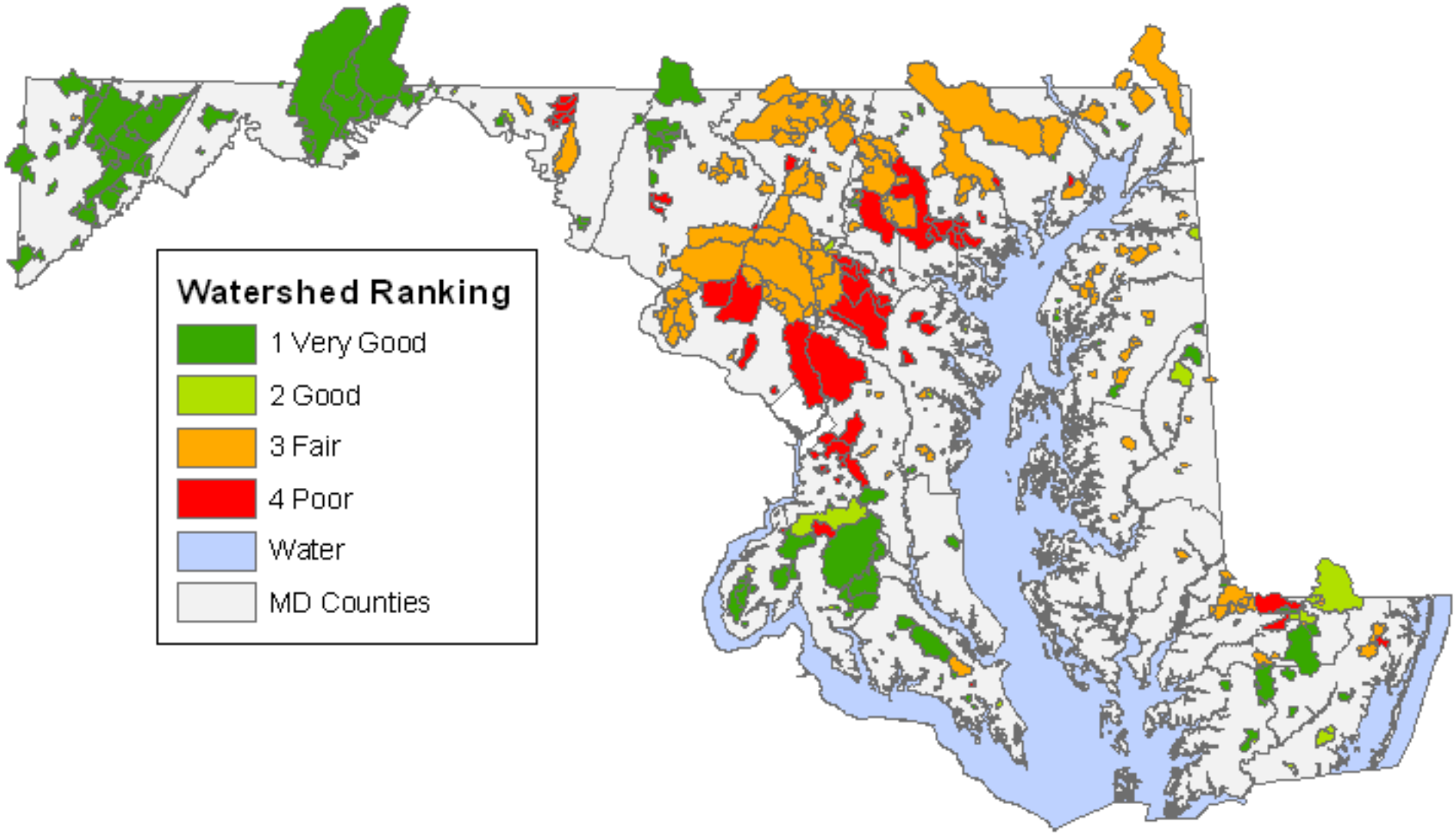
Training Landsat Subpixel Algorithms with IKONOS Map Products

Impervious Surface Area




Landsat
Tree Cover
Percent
Tree Cover
0 - 10
11 - 20
21 - 30
31 - 40
41 - 50
51 - 60
61 - 70
71 - 80
81 - 90
91 - 100
Water
inset
Percent Tree Cover
within 30 m Stream Buffer
New York
Pennsylvania
Maryland
Virginia
0 100 200 Kilometers
0 5 10 15 Kilometers
0 0.5 1 Kilometers

Stream health predictions across Maryland based on statistical models developed for 246 Montgomery county watersheds.



Maryland Biological Stream Survey (MBSS) watersheds (DNR)

Relevant Publications

- Goetz S. J., Wright R., Smith A. J., Zinecker E. & Schaub E. (2003) Ikonos imagery for resource management: tree cover, impervious surfaces and riparian buffer analyses in the mid-Atlantic region. *Remote Sensing of Environment* 88: 195-208.

- Goetz, S.J., Jantz, C.A., Prince, S.D., Smith, A.J., Varlyguin, D. and Wright, R., 2004. *Integrated analysis of ecosystem interactions with land use change: the Chesapeake Bay watershed.* In: G.P. Asner, R.S. DeFries and R.A. Houghton (Editors), **Ecosystem Interactions with Land Use Change**. AGU Geophysical Monograph Series.

Goetz S. J., Remote Sensing of riparian buffers: case studies from the mid-Atlantic region. *Journal of the American Water Resources Association* (*forthcoming*).

The Maryland-National Capital Park and Planning Commission