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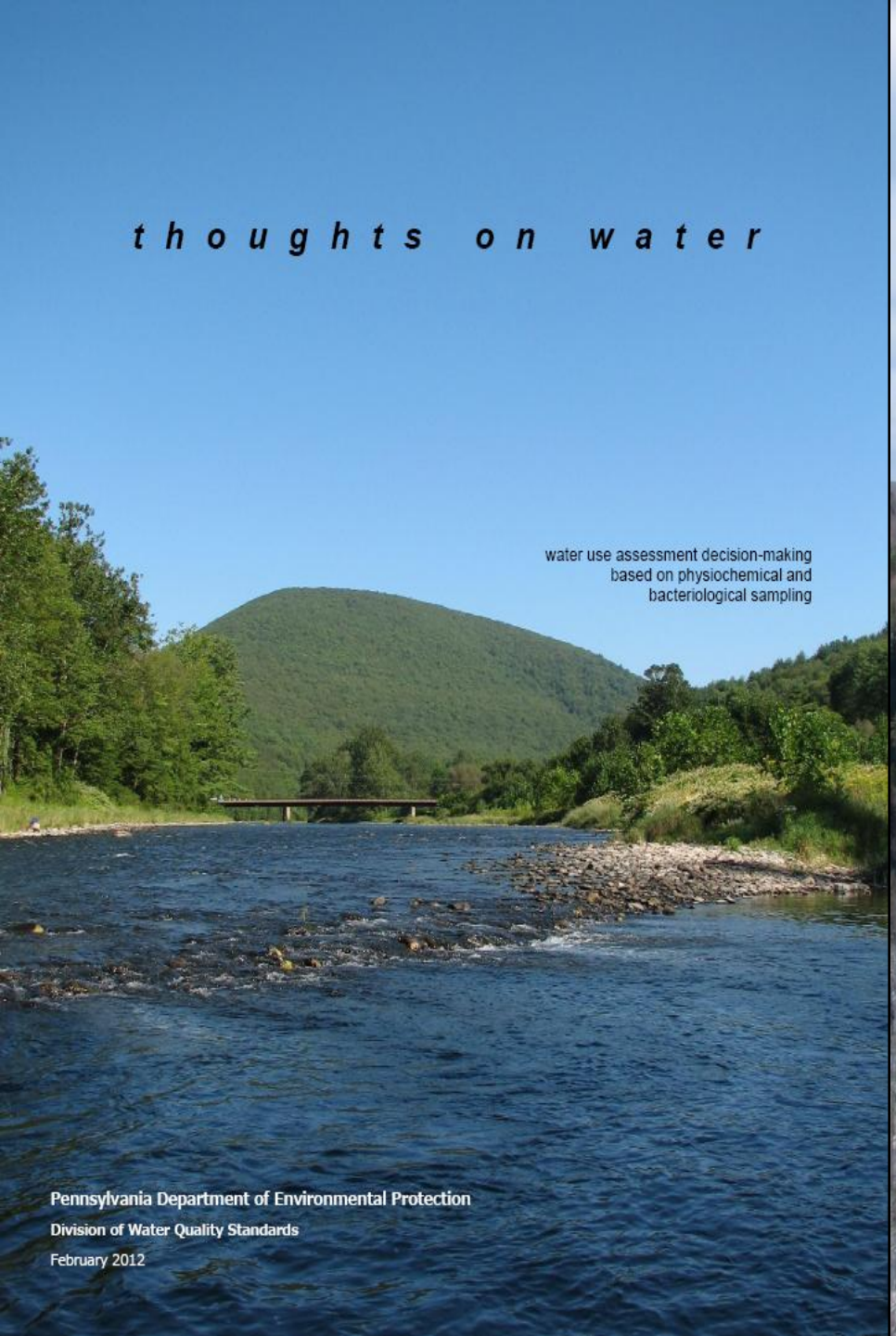
Office of Water Management

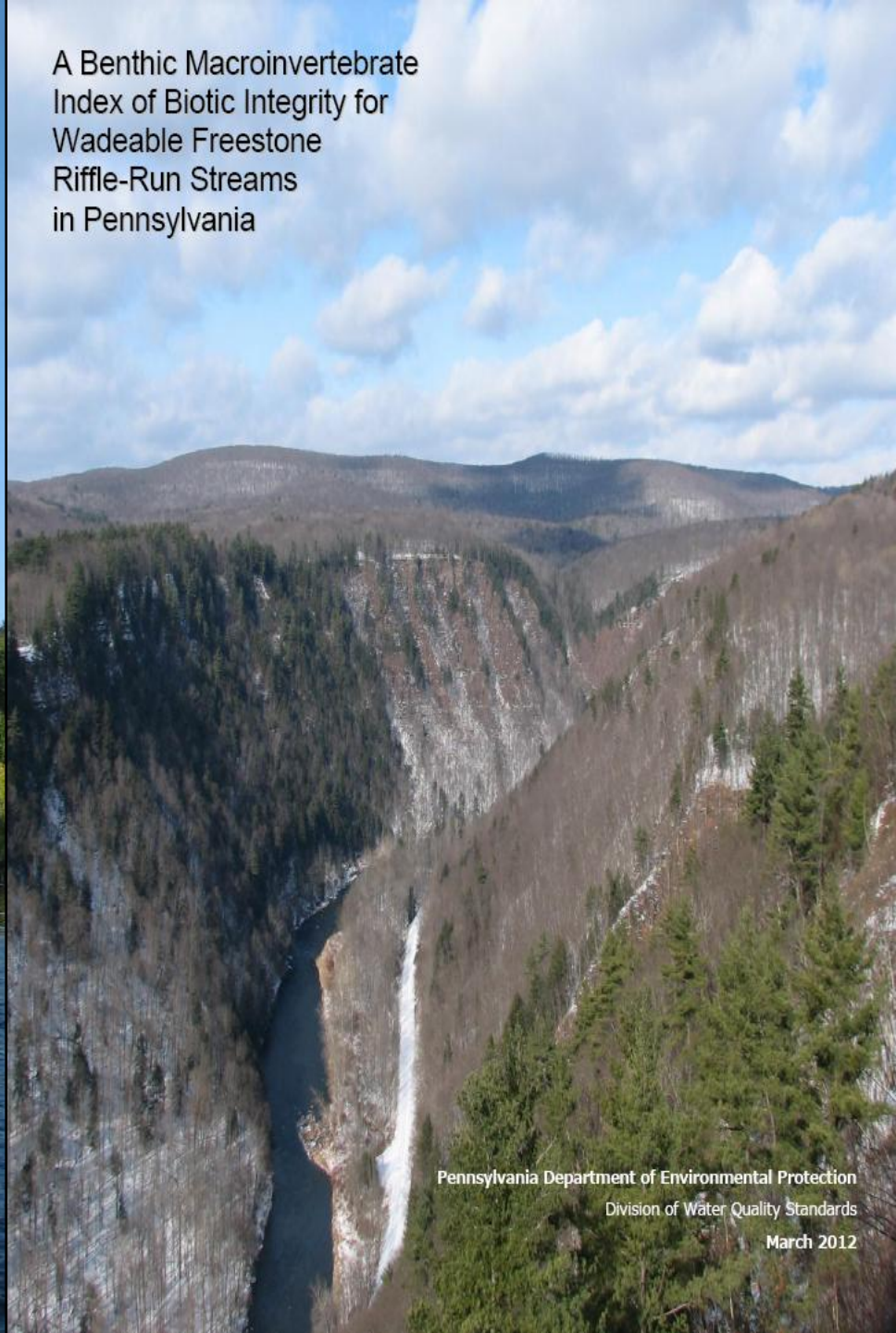
water use assessment methods update

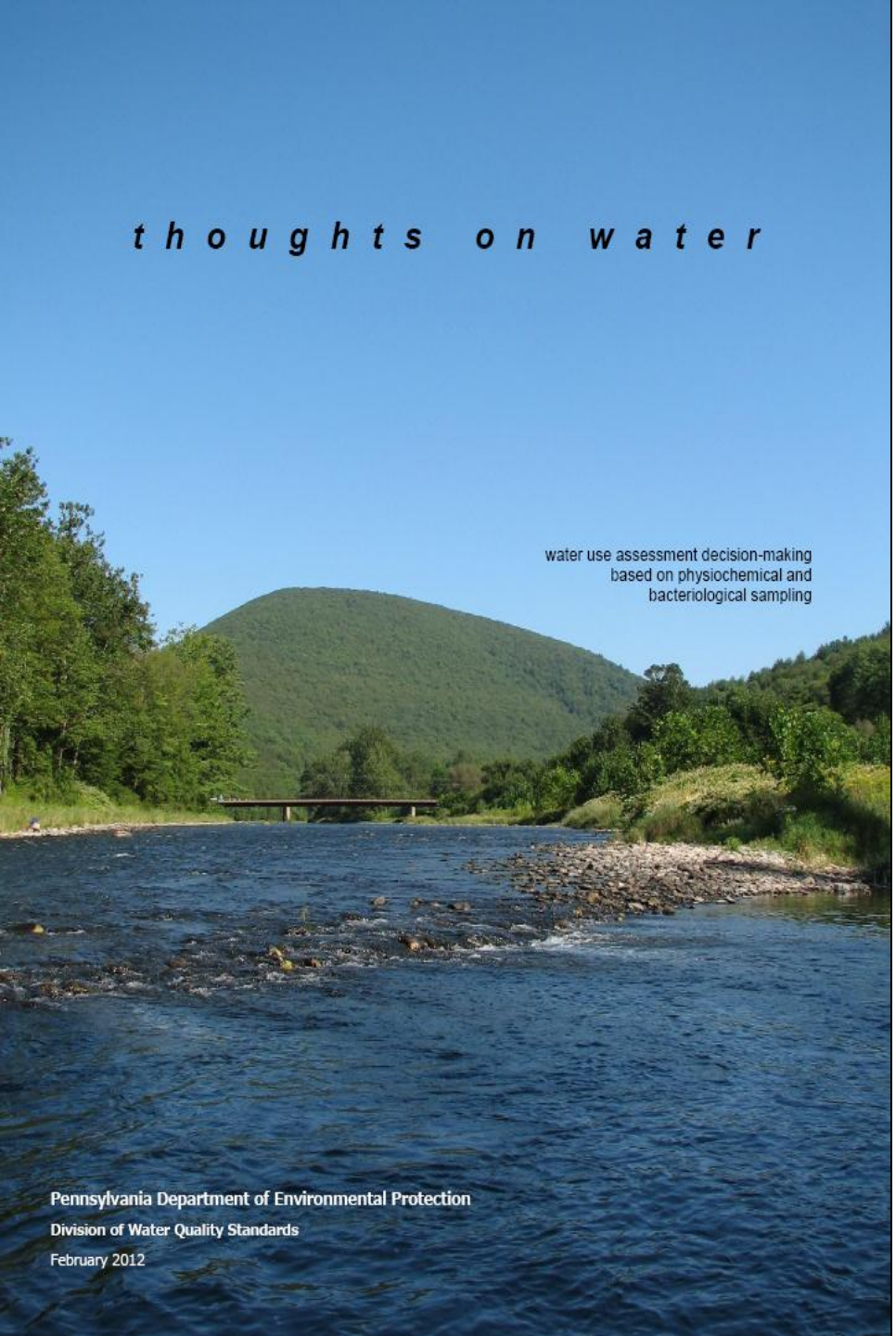
Water Resources Allocation Committee Meeting

July 12, 2012



A Benthic Macroinvertebrate Index of Biotic Integrity for Wadeable Freestone Riffle-Run Streams in Pennsylvania





The following slides present key points of the Department's newly-revised guidance on:

water use assessment decision-making based on physiochemical and bacteriological sampling

water quality

relevant Pennsylvania regulations

… specific, numeric water quality criteria detailed in Chapter 93 must be met "***at least 99% of the time***" …

… general water quality criteria in section 93.6 shall be achieved in surface waters "***at all times at design conditions***."

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standards expressed variously

Instantaneous standards: apply to every "instant" of time

Time-averaged standards: e.g., geometric mean of at least five samples during a 30-day period

Standards based on proportions of samples: e.g., no more than 10% of the total samples taken during a 30-day period

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standards for toxics and Lake Erie

… water quality criteria
for **toxic substances**
appear in section 93.8.

Chapter 93 and Chapter 16
also contain water quality criteria
specific to Lake Erie and other sites.

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this guidance documents…

… how the inherent uncertainty introduced by sampling (sampling error) is addressed in the use assessment decision process for physiochemical and bacteriological water quality sampling data.

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magnitude, frequency, duration

Assessments must consider

magnitude,
frequency, &
duration

of any criteria violations.

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focused monitoring

To assess against the “at least 99% of the time” regulatory stipulation, it will often be the most **resource-effective approach** to focus monitoring at times when violations are likely to occur.

“critical sampling periods”

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assessment implications

Assessment processes based on targeted sampling will necessarily draw less on quantitative statistical tools.

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context-specific assessments

criteria

are expressed in different ways

&

constituents

vary in different ways

with changing conditions

at each particular location

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sampling design considerations

- Diurnal cycles of solar radiation
- Annual cycles of solar radiation
- Annual cycles of precipitation, evapotranspiration, and stream flow
- Conservative and non-conservative substances

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use assessment decision framework

This 10-step framework
aims to document and communicate
the decision process in a clear, consistent manner.

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use assessment decision framework

(1) Describe monitoring effort.
(2) Check data quality.
(3) Gather information on sources of variation.
(4) Explore data.
(5) Evaluate data representativeness.
(6) Describe relevant standards.
(7) Apply appropriate analytical techniques.
(8) Consider other sources of information.
(9) Evaluate all relevant lines of evidence.
(10) Decide.

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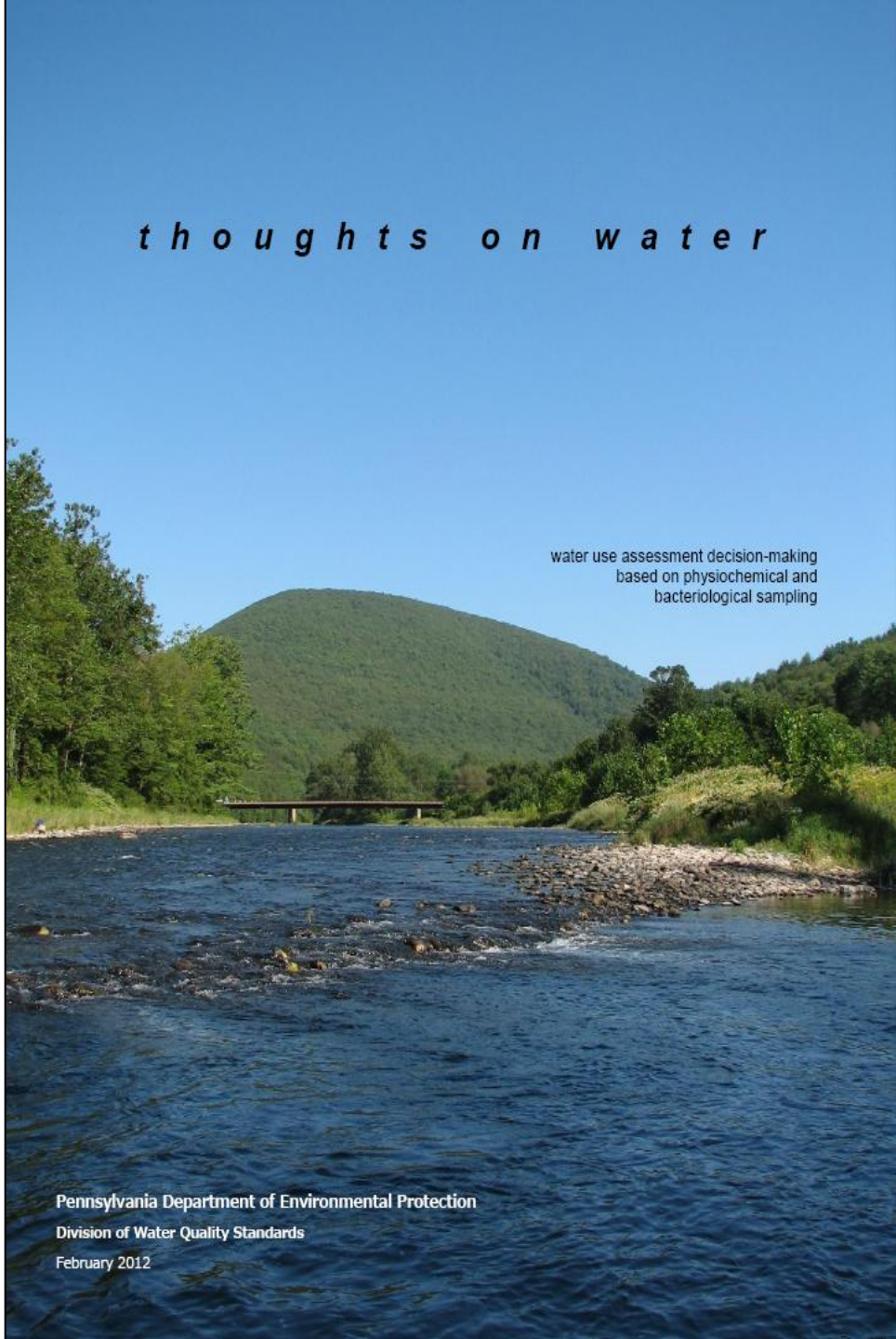
fin.

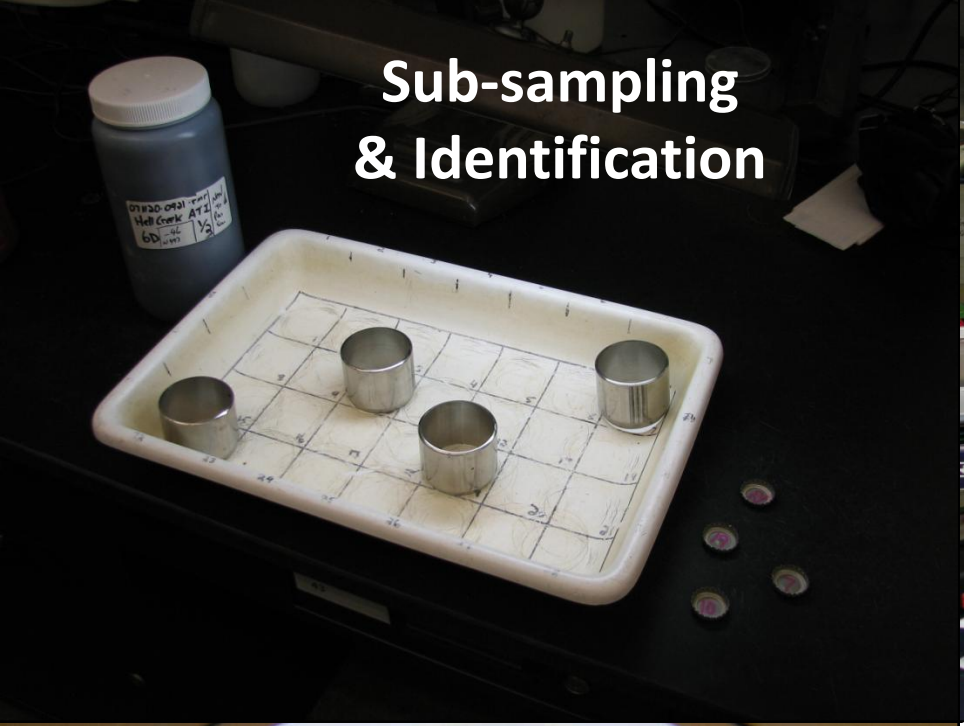

thoughts on water
water use assessment decision-making
based on physiochemical and
bacteriological sampling
Pennsylvania Department of Environmental Protection
Division of Water Quality Standards
February 2012

The following slides present key points of the Department's newly-revised guidance on:

a benthic macroinvertebrate index of biotic integrity for wadeable freestone riffle-run streams in Pennsylvania

Benthic Macroinvertebrate Field Sampling Methodology

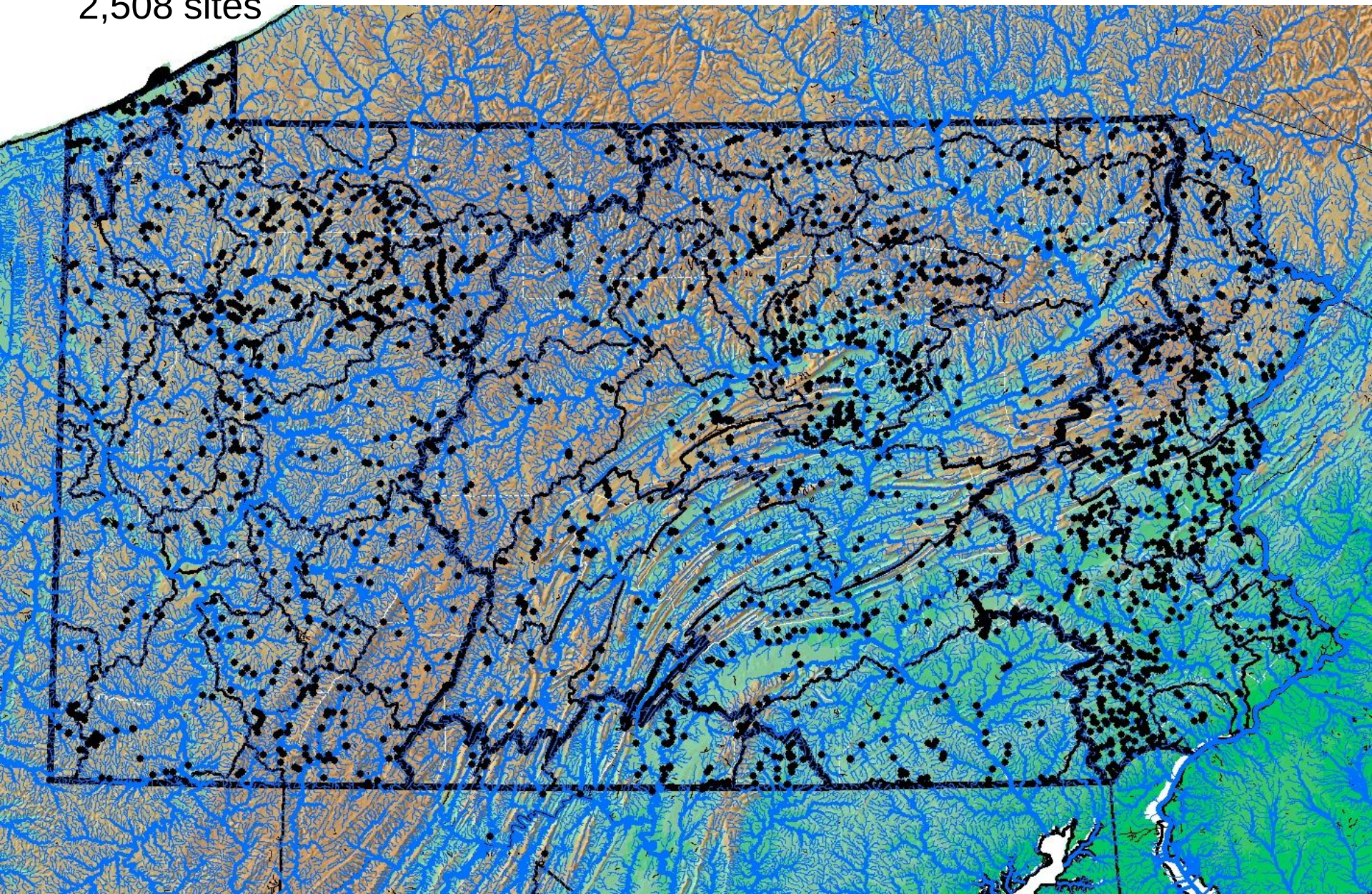
Sub-sampling & Identification



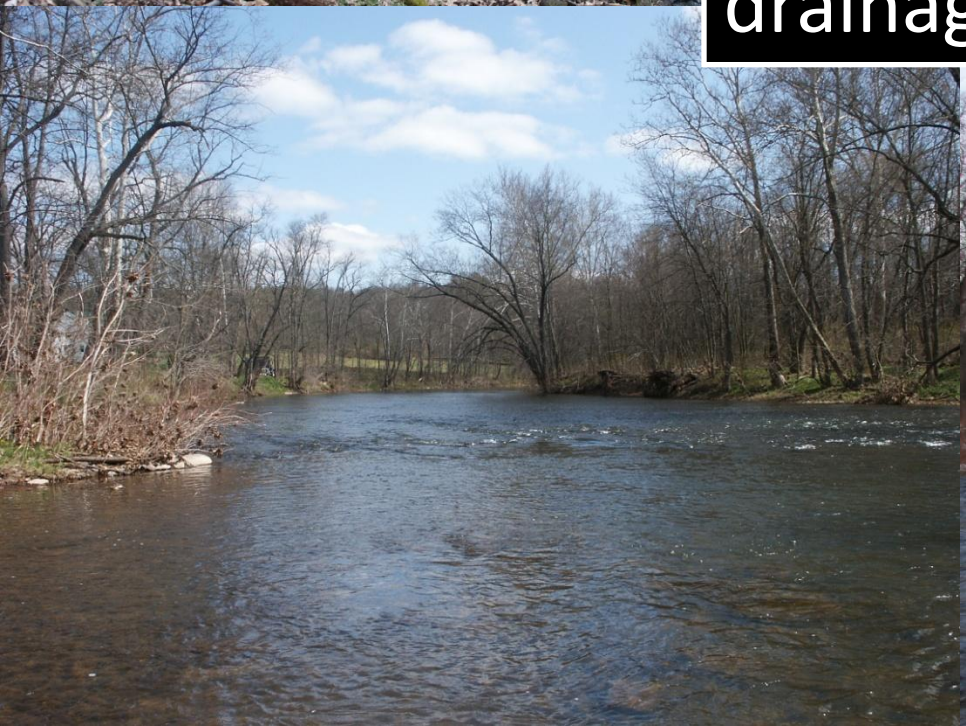
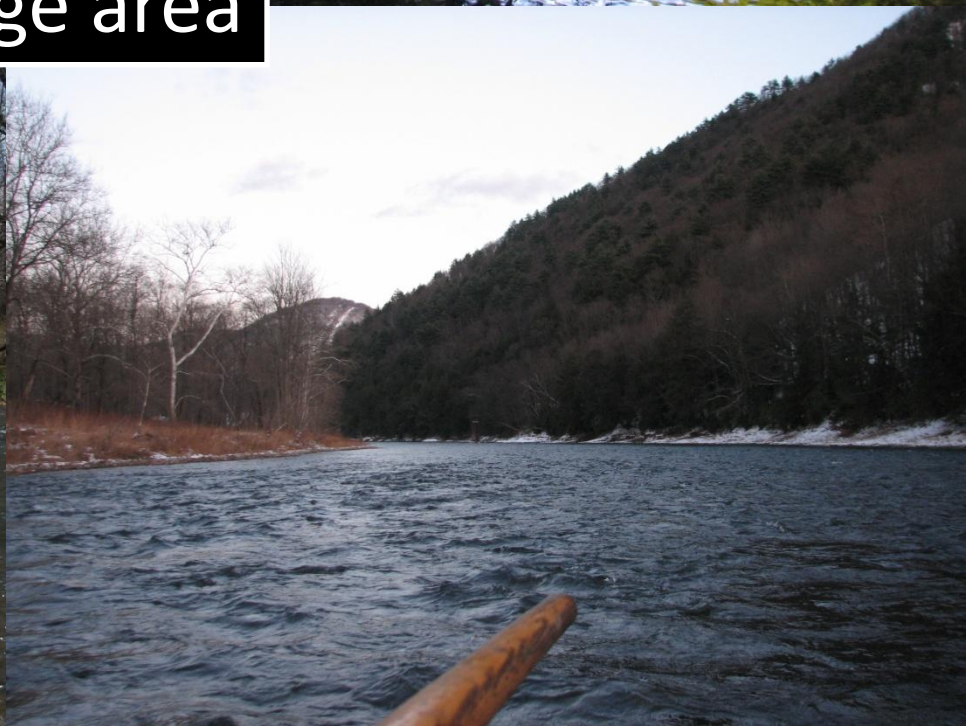
August 2011

3,081 samples

2,508 sites




drainage area

canopy cover
trophic dynamics
substrate and habitats
thermal regimes
flow patterns

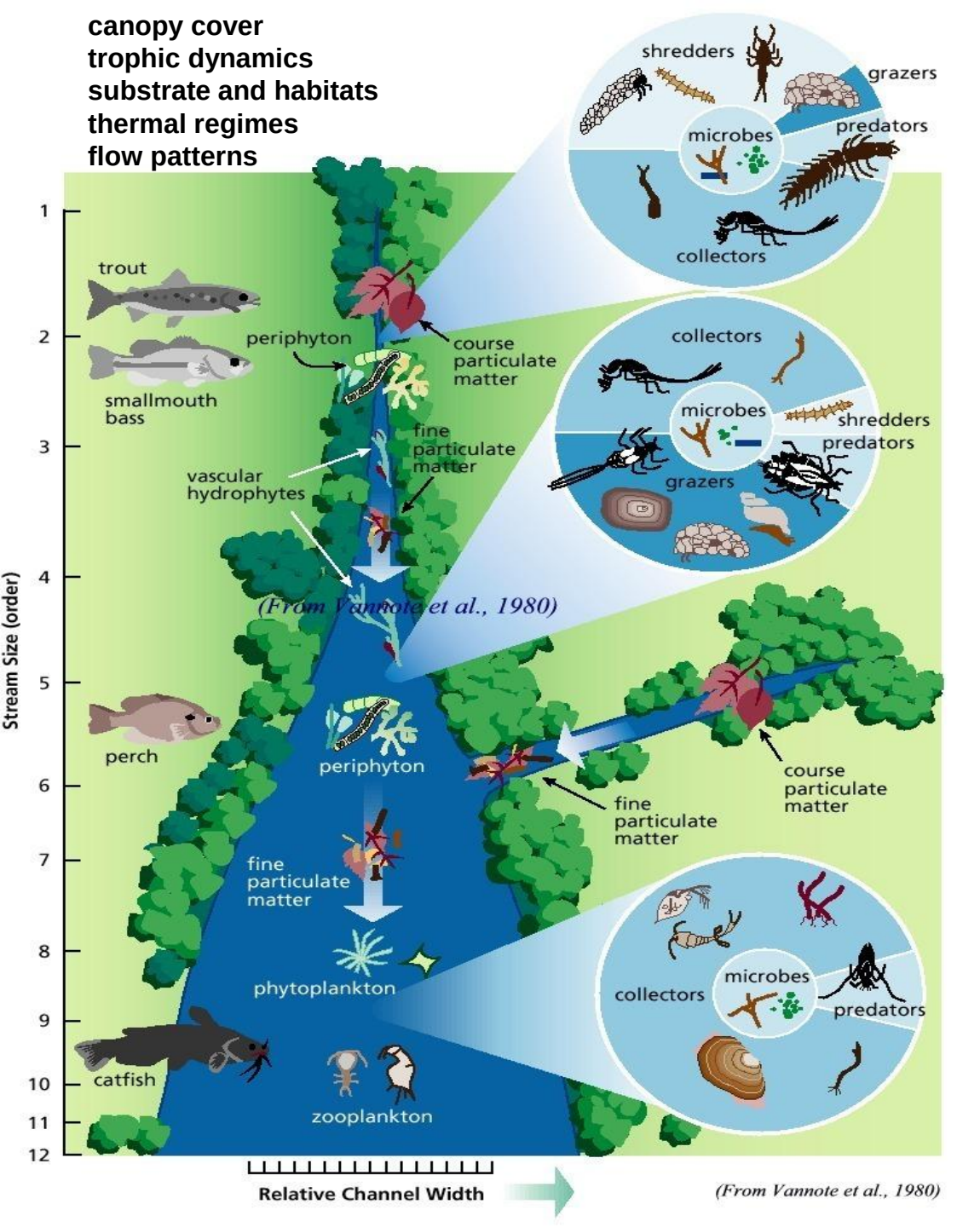
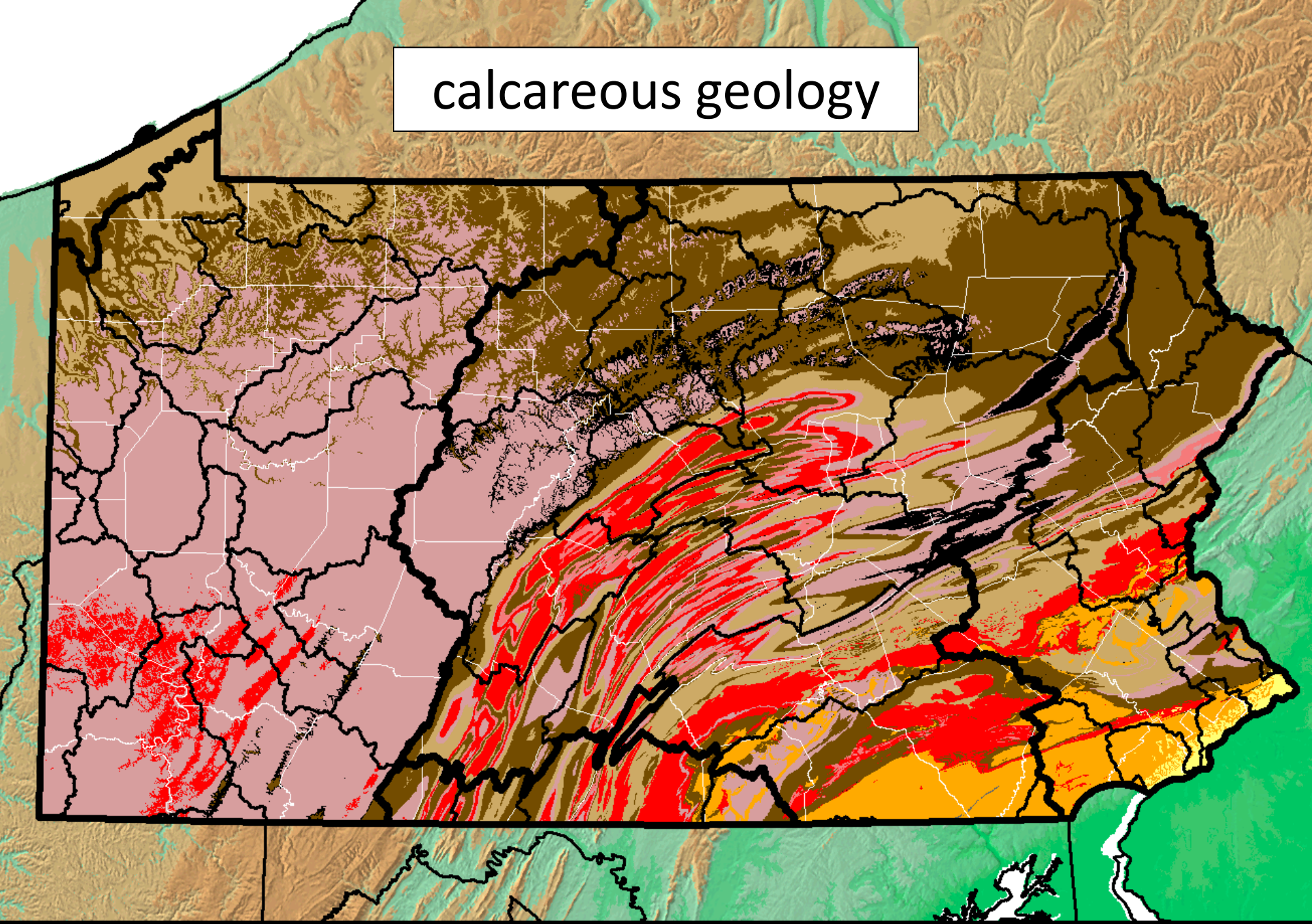


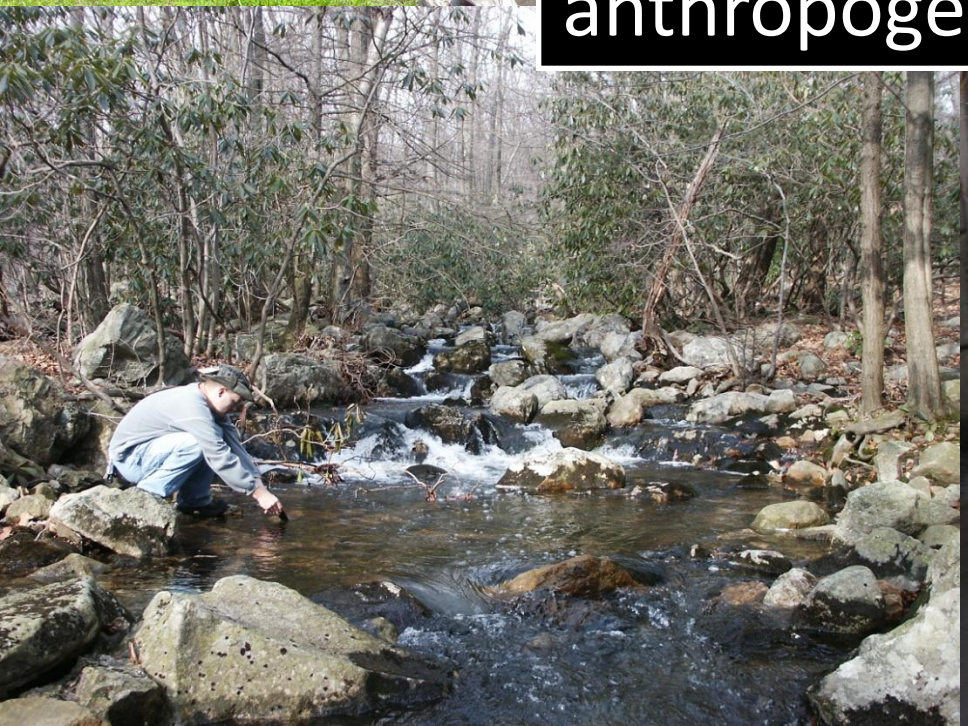
photo credit
Tim Daley

calcareous geology



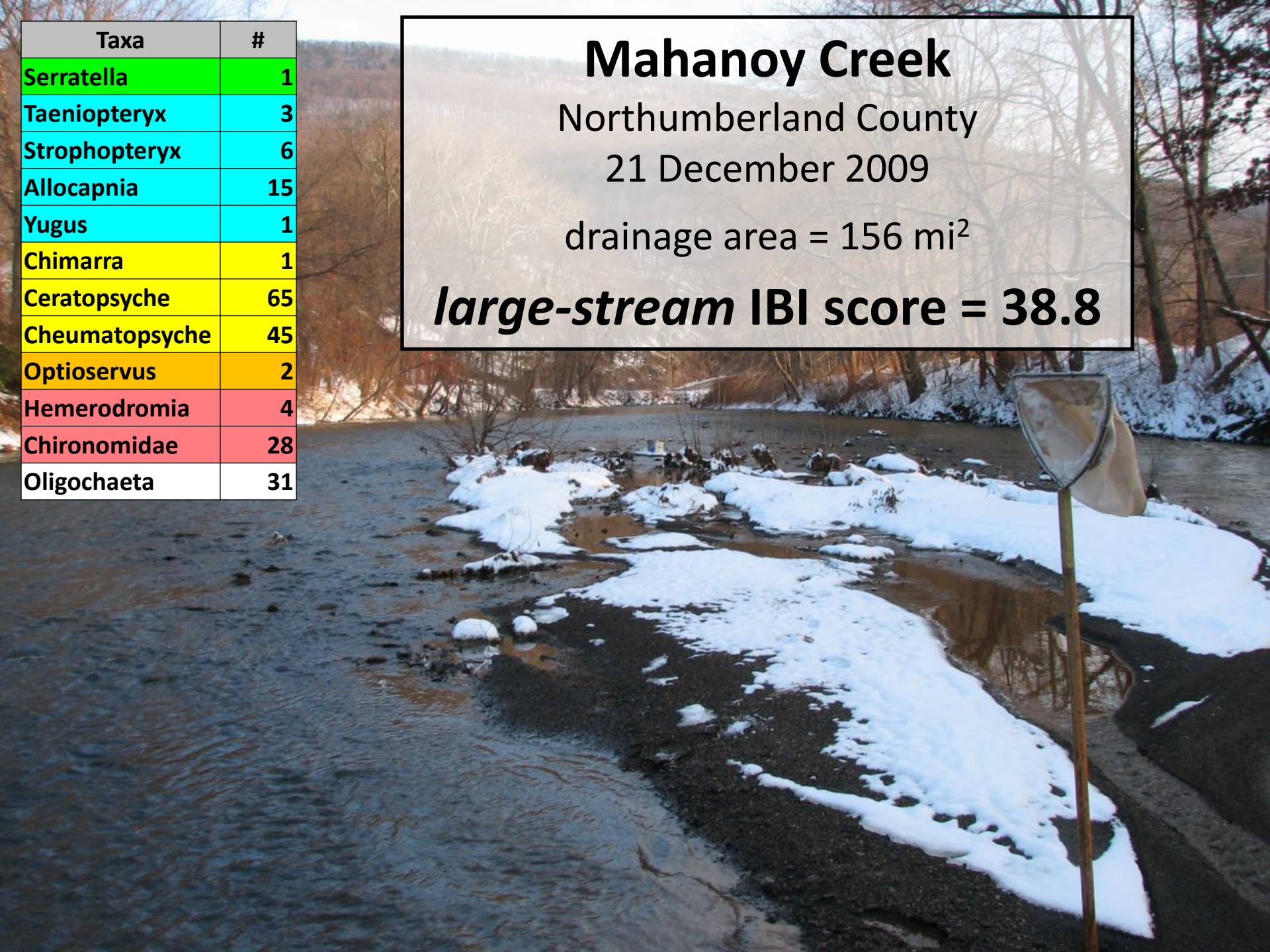
sampling seasons

anthropogenic impacts



Metric	Standardization Values	
	smaller streams most 1st to 3rd order < 25 square miles	larger streams most 5th order and larger > 50 square miles
Total Taxa Richness	33	31
Pollution-Sensitive EPT Taxa Richness	19	16
Beck's Index	38	22
Hilsenhoff Biotic Index	1.89	3.05
Shannon Diversity	2.86	2.86
% Sensitive Individuals	84.5	66.7

Mahanoy Creek
Northumberland County
21 December 2009



Taxa	#
Serratella	1
Taeniopteryx	3
Strophopteryx	6
Allocapnia	15
Yugus	1
Chimarra	1
Ceratopsyche	65
Cheumatopsyche	45
Optioservus	2
Hemerodromia	4
Chironomidae	28
Oligochaeta	31

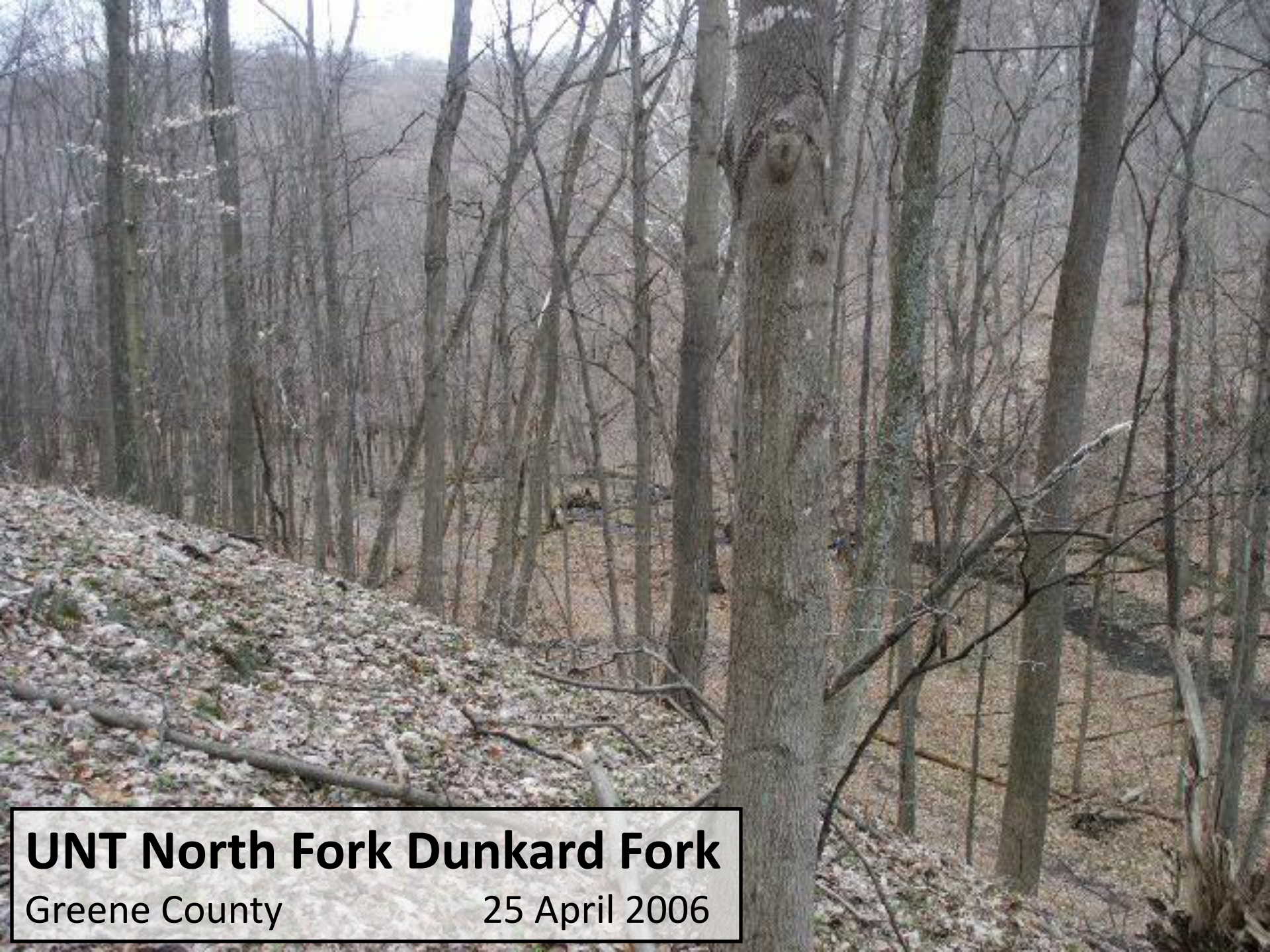
Mahanoy Creek

Northumberland County

21 December 2009

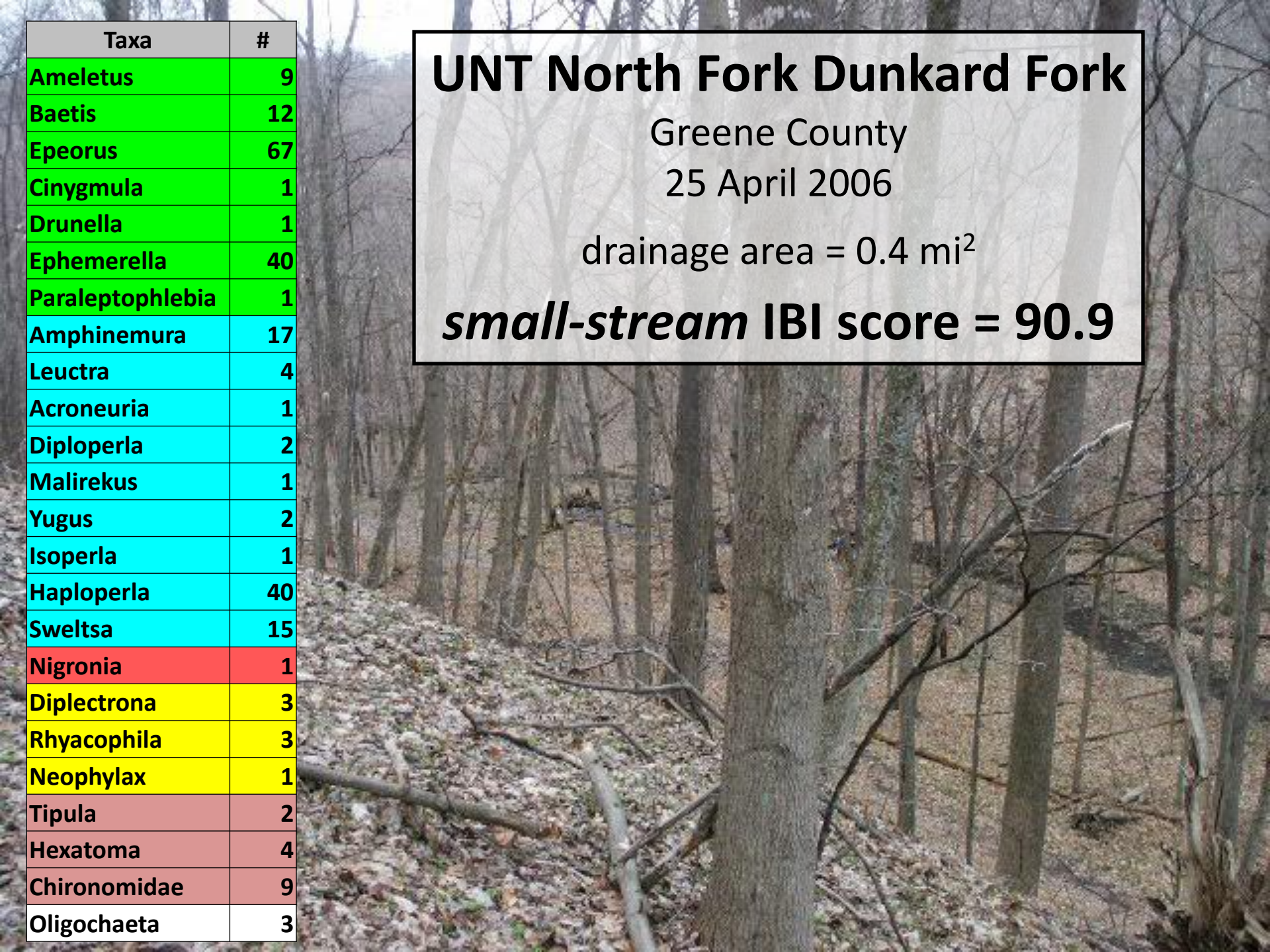
drainage area = 156 mi^2

***large-stream* IBI score = 38.8**



UNT North Fork Dunkard Fork

Greene County 25 April 2006



Taxa	#
Ameletus	9
Baetis	12
Epeorus	67
Cinygmula	1
Drunella	1
Ephemerella	40
Paraleptophlebia	1
Amphinemura	17
Leuctra	4
Acroneuria	1
Diploperla	2
Malirekus	1
Yugus	2
Isoperla	1
Haploperla	40
Sweltsa	15
Nigronia	1
Diplectrona	3
Rhyacophila	3
Neophylax	1
Tipula	2
Hexatoma	4
Chironomidae	9
Oligochaeta	3

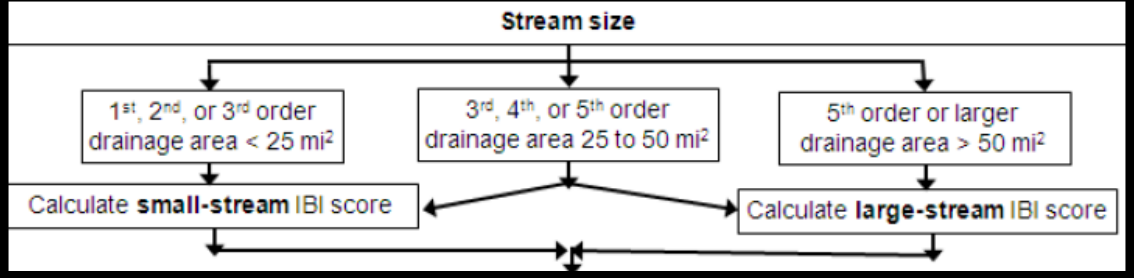
UNT North Fork Dunkard Fork

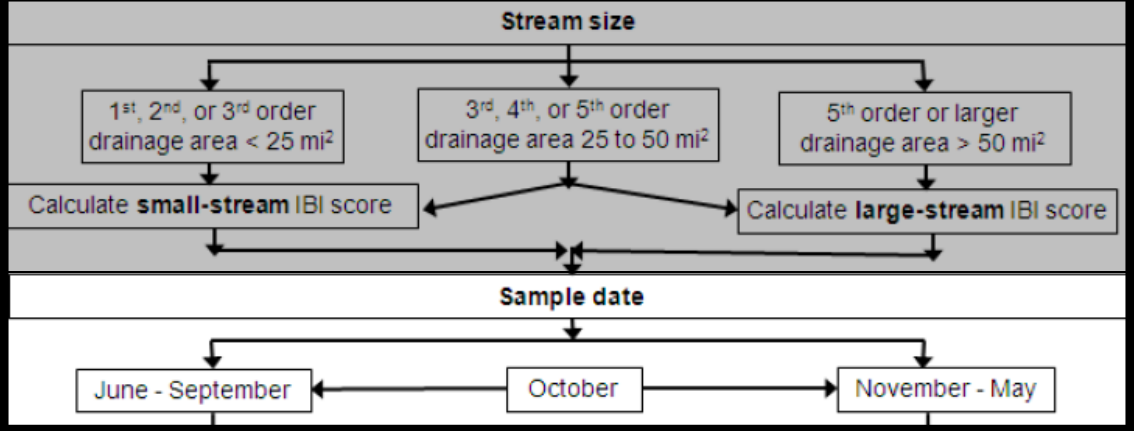
Greene County

25 April 2006

drainage area = 0.4 mi^2

***small-stream* IBI score = 90.9**


Stream size
1st, 2nd, or 3rd order drainage area < 25 mi²
3rd, 4th, or 5th order drainage area 25 to 50 mi²
5th order or larger drainage area > 50 mi²
Calculate small-stream IBI score
Calculate large-stream IBI score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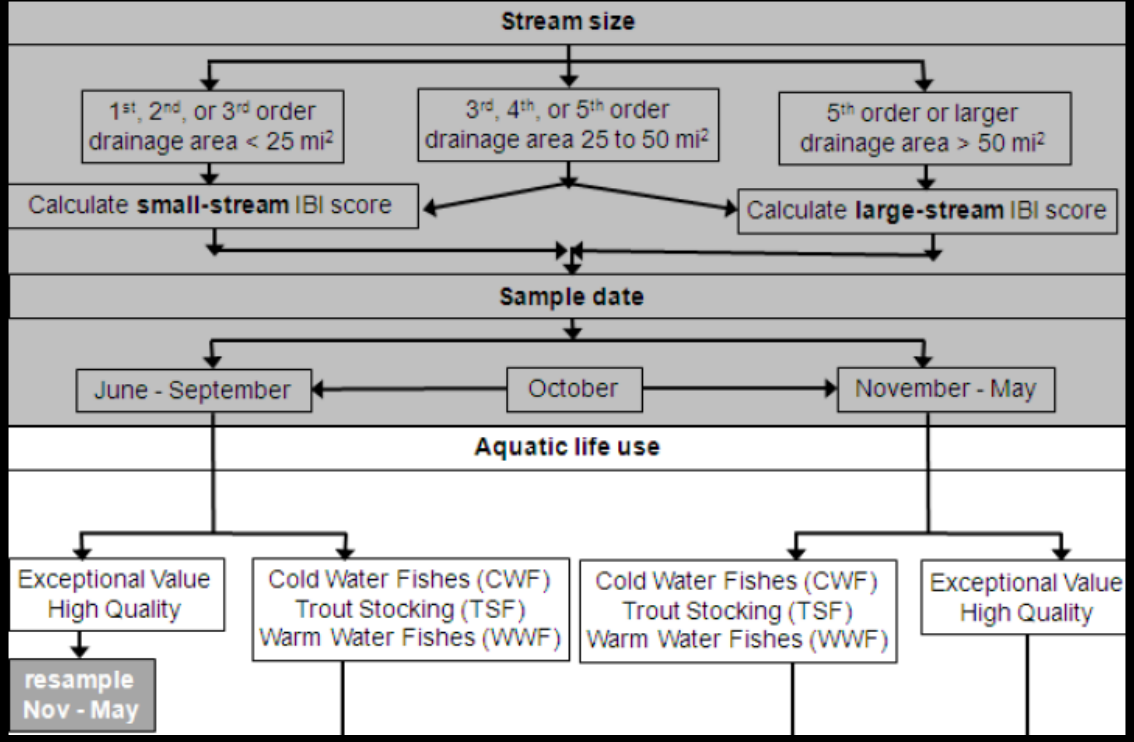
Calculate small-stream IBI score
Calculate large-stream IBI score
Sample date
June - September
October
November - May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Calculate small-stream IBI score
Calculate large-stream IBI score
Sample date
June - September
October
November - May
Aquatic life use
Exceptional Value High Quality
Cold Water Fishes (CWF) Trout Stocking (TSF) Warm Water Fishes (WWF)
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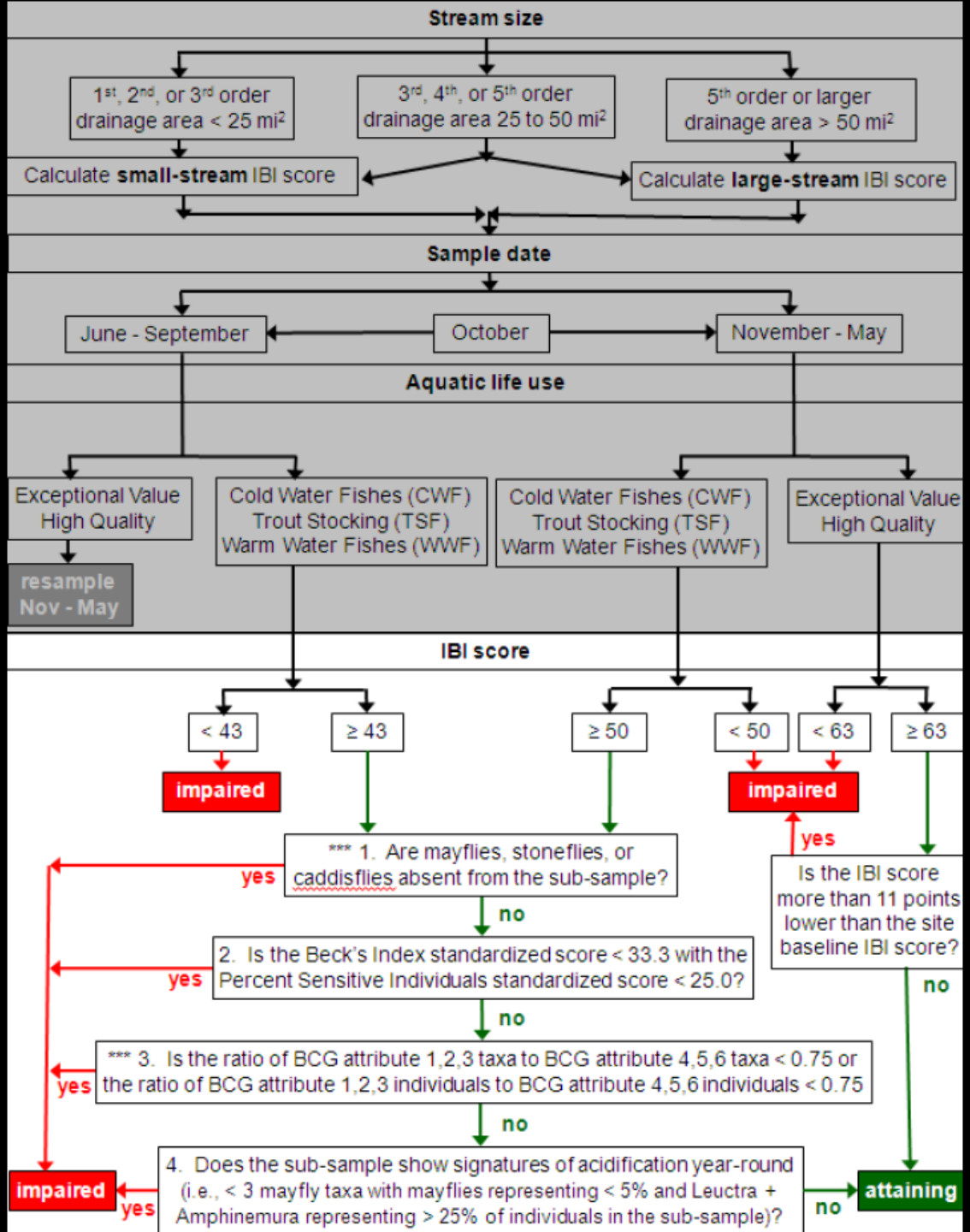
Exceptional Value High Quality
resample Nov - May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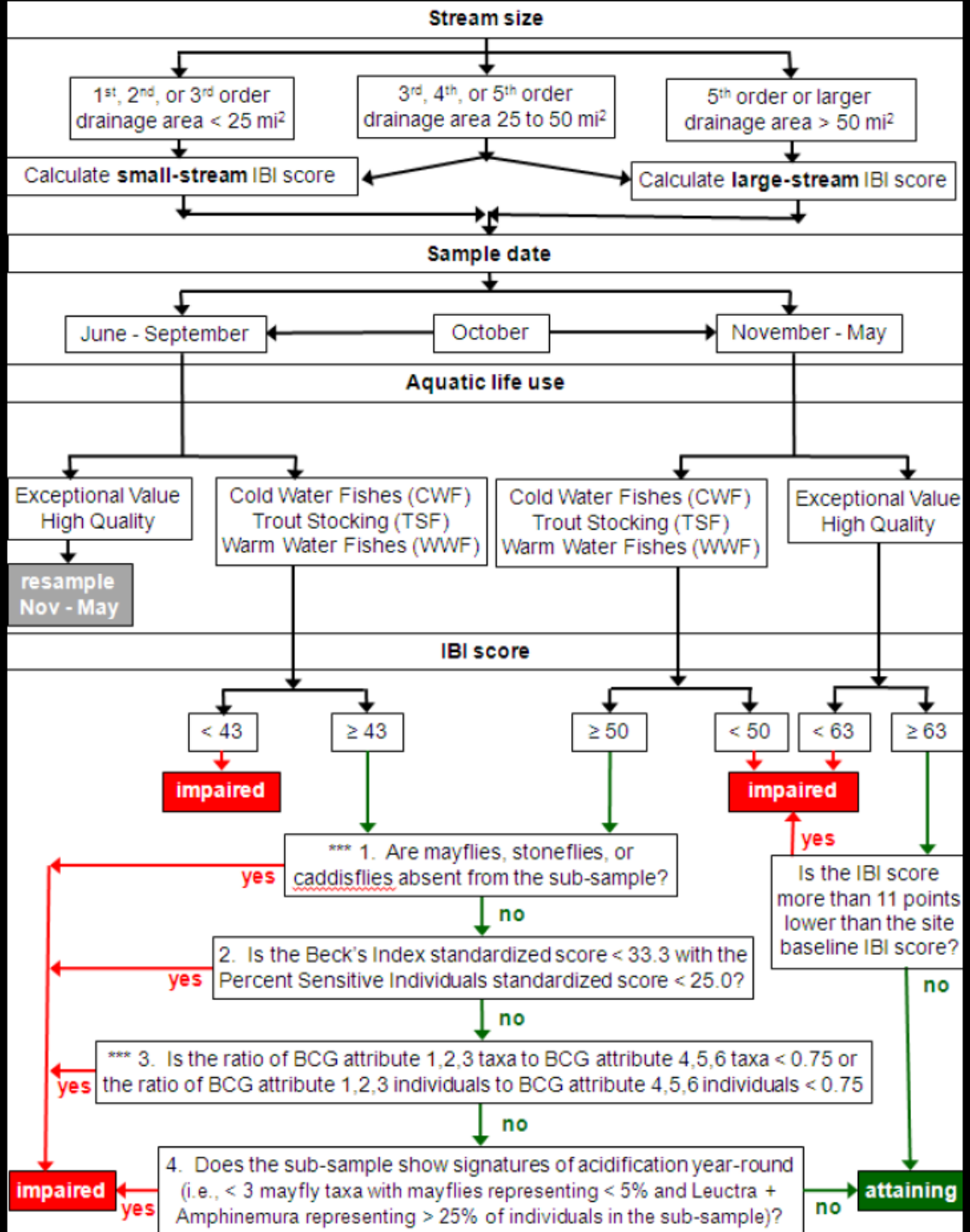
Exceptional Value High Quality
resample Nov - May
IBI score
< 43
≥ 43
≥ 50
< 50
< 63
≥ 63
impaired
impaired
yes
*** 1. Are mayflies, stoneflies, or caddisflies absent from the sub-sample?
Is the IBI score more than 11 points lower than the site baseline IBI score?
yes
no
2. Is the Beck's Index standardized score < 33.3 with the Percent Sensitive Individuals standardized score < 25.0?
yes
no
*** 3. Is the ratio of BCG attribute 1,2,3 taxa to BCG attribute 4,5,6 taxa < 0.75 or the ratio of BCG attribute 1,2,3 individuals to BCG attribute 4,5,6 individuals < 0.75
yes
no
4. Does the sub-sample show signatures of acidification year-round (i.e., < 3 mayfly taxa with mayflies representing < 5% and Leuctra + Amphinemura representing > 25% of individuals in the sub-sample)?
impaired
yes
no
attaining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fin.


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Index of Biotic Integrity for
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Riffle-Run Streams
in Pennsylvania
Pennsylvania Department of Environmental Protection
Division of Water Quality Standards
March 2012


Division of Water Quality Standards
717-787-9637