

US EPA ARCHIVE DOCUMENT

Least Disturbed Watersheds in Connecticut



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www.ct.gov/dep/imperviouscoverstudies

Why Study Least Disturbed Watersheds ?



Why Study Least Disturbed Watersheds ?



What is Least Disturbed?

- Take away stressors as best we can using GIS and see what streams meet screening criteria.
- What ever lives there is living under least disturbed conditions in Connecticut.
- Stoddard *et al.* 2006. *Ecological Applications*. Least Disturbed Condition category.

GIS Screening Criteria

Parameter	Criterion
Impervious Cover	< 4%
Natural Land Cover	> 80%
Developed Land	< 10%
Diversions	None
Reservoirs / Large Class C Dams	None
Sample Site Distance Below a Dam (included all dams in database)	> 0.5 mile downstream from dam
Streams Stocked with Salmonid Fry	No known stocking
Watershed Size	> 1 Square Mile

Project Goals

- **Document where ??**
- **Document biota** (for BCG/MMI/IBI questions)
- **Obtain Total Phosphorous** (for Criteria Development)
- **Determine wild brook trout densities** (for protection under Streamflow Regulations)

Secondary Goals: AKA Hidden Agenda

Conservation.....

Preservation.....

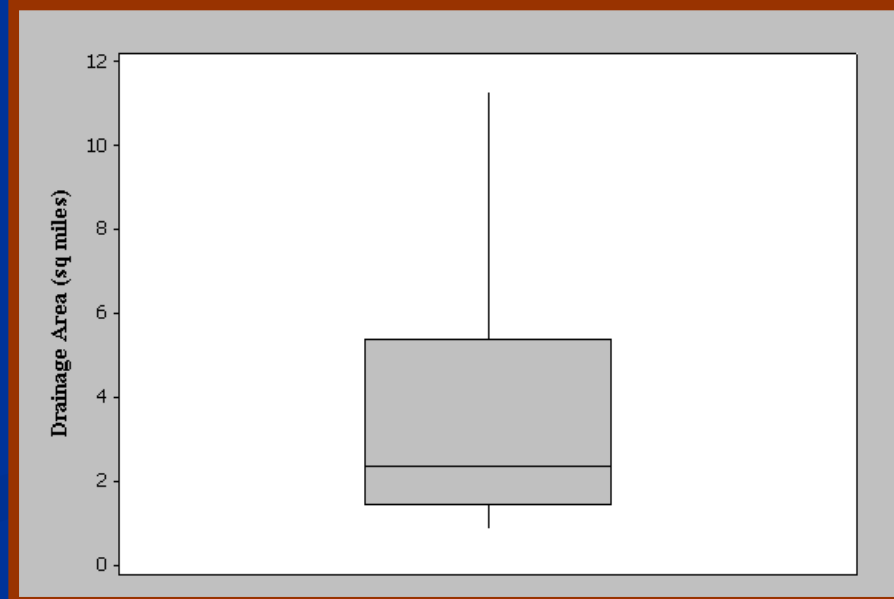
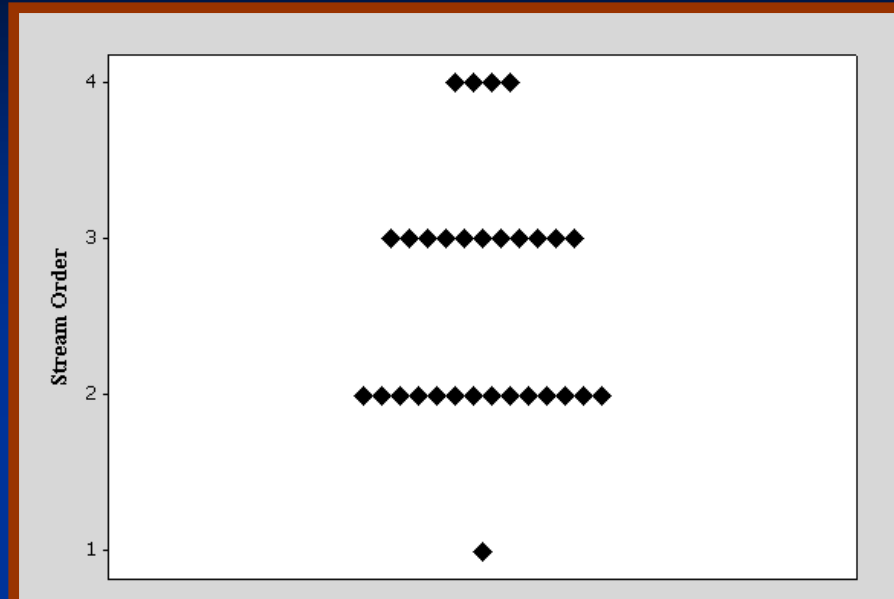
Future generations.....

Least Disturbed Watersheds

60 CANDIDATES



30 SELECTED



Data Collection

- Grab Chemistry (at least 5 times per site)
- Water Temperature
- Fish Community (N= 30)
- Macroinvertebrate Community (N= 24)

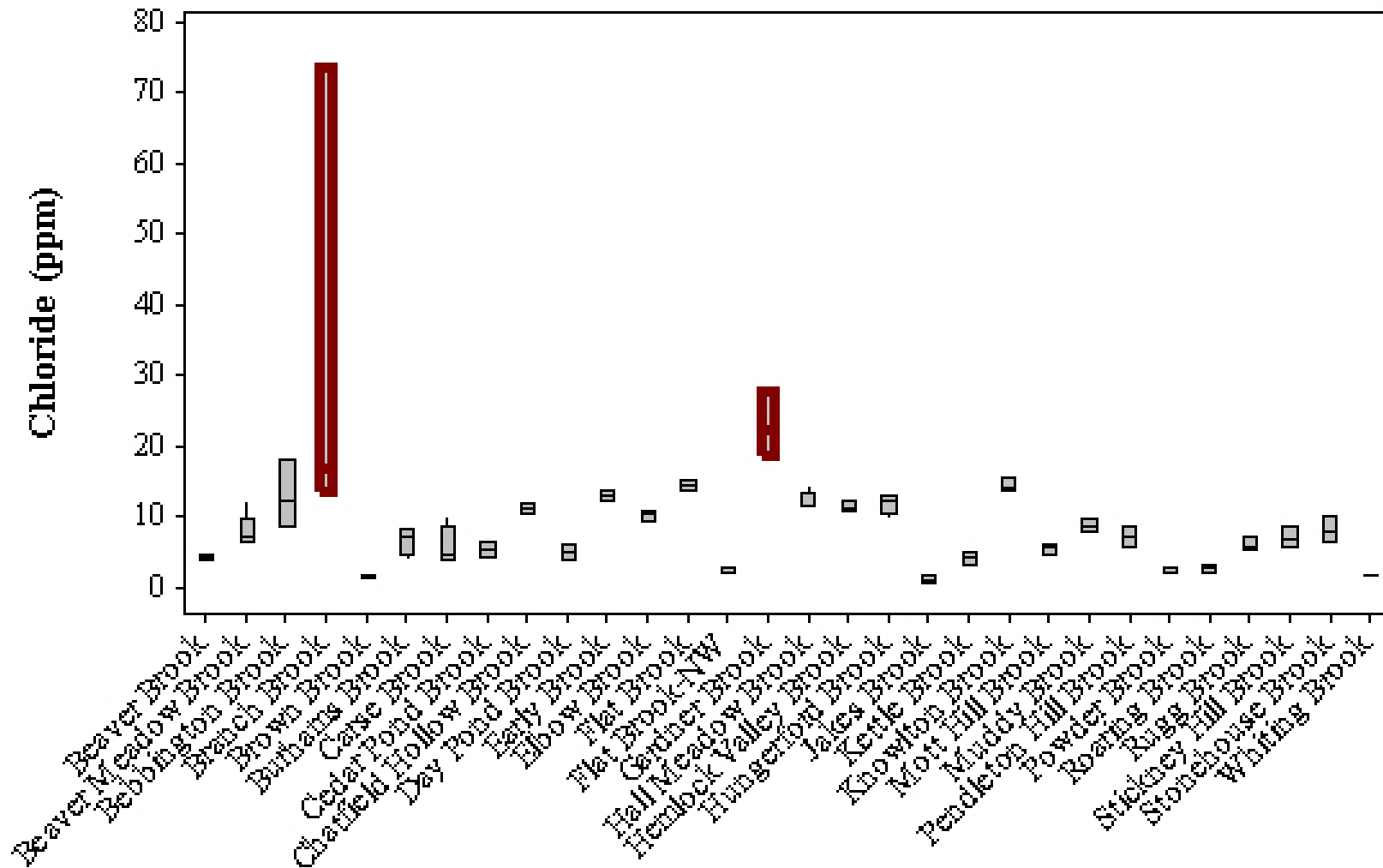
Data Analysis

- Box Plots
- Cluster Analysis (Sorensen w/ flexible beta linkage (-0.25))
- NMS Ordination Plots (Sorensen distance measure)
- Indicator Species Analysis

Results: Chemical

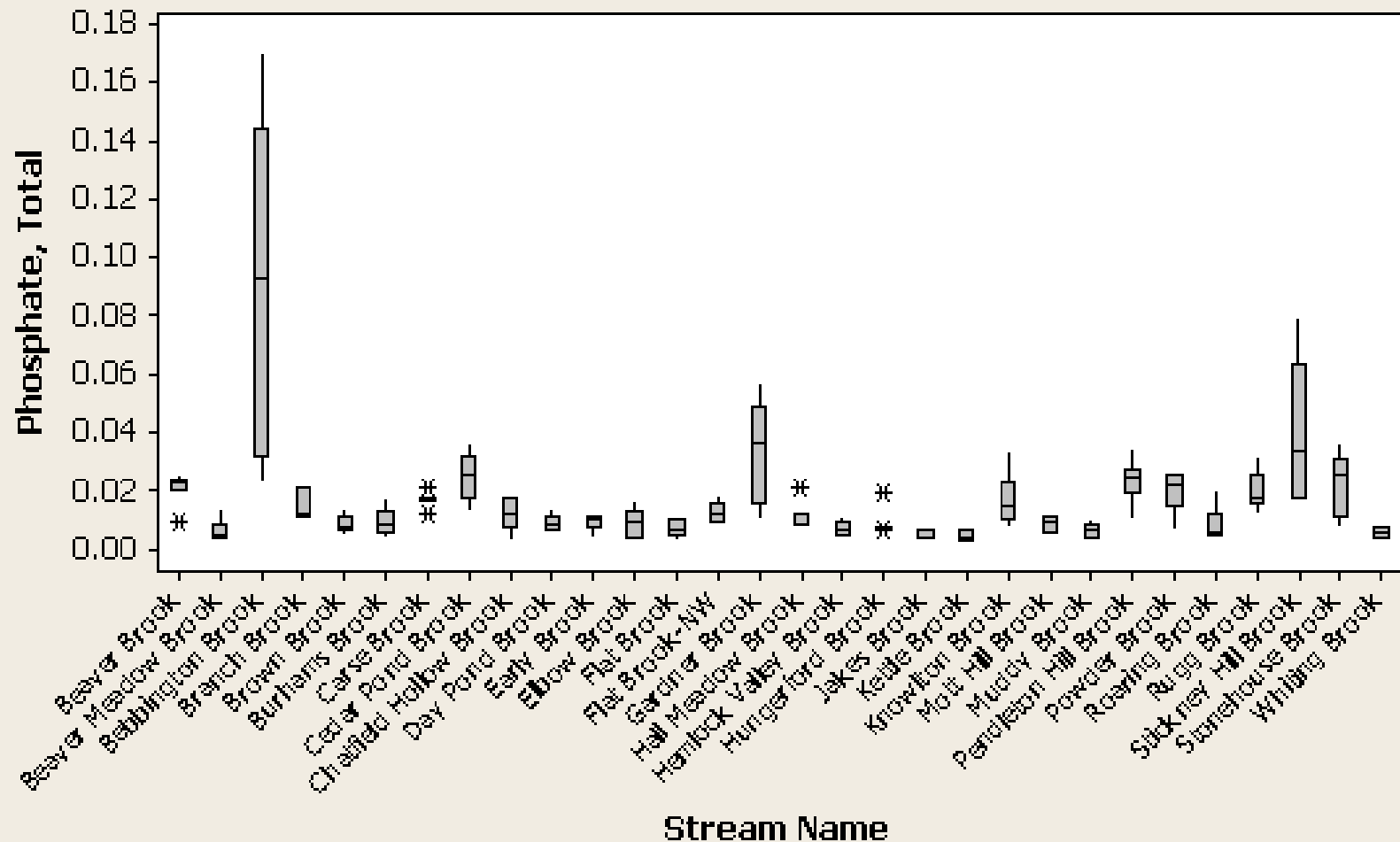
- Human influenced parameters were at lower than statewide median levels (as expected).
- Non-human influenced parameters were variable based on geology (as expected)
- Surprises
 - Chloride in Branch Brook, Eastford
 - Phosphorous in Bebbington Brook, Gardner Brook, and Stickney Hill Brook

Chloride



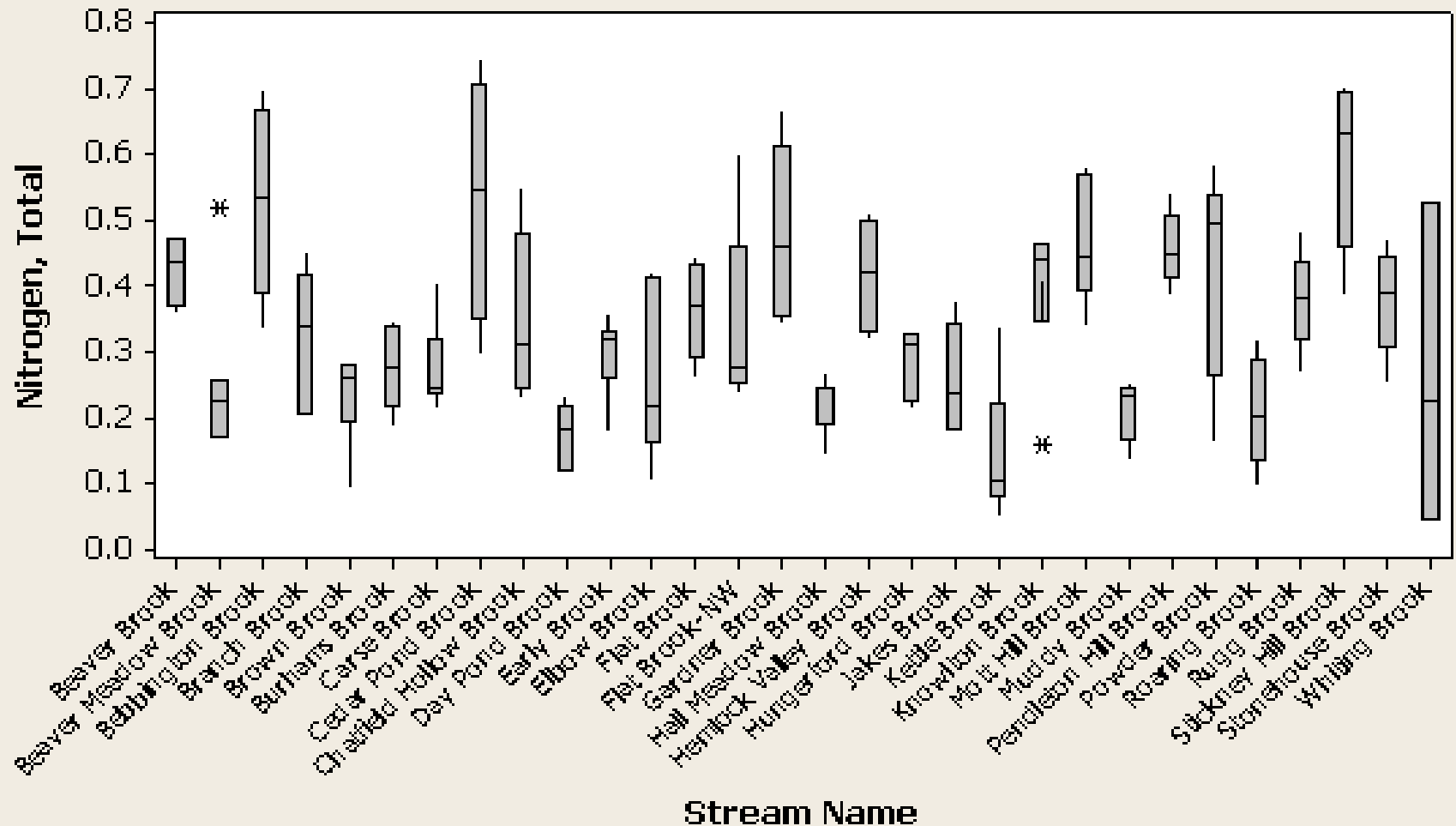
Phosphorus

Boxplot of Phosphate, Total



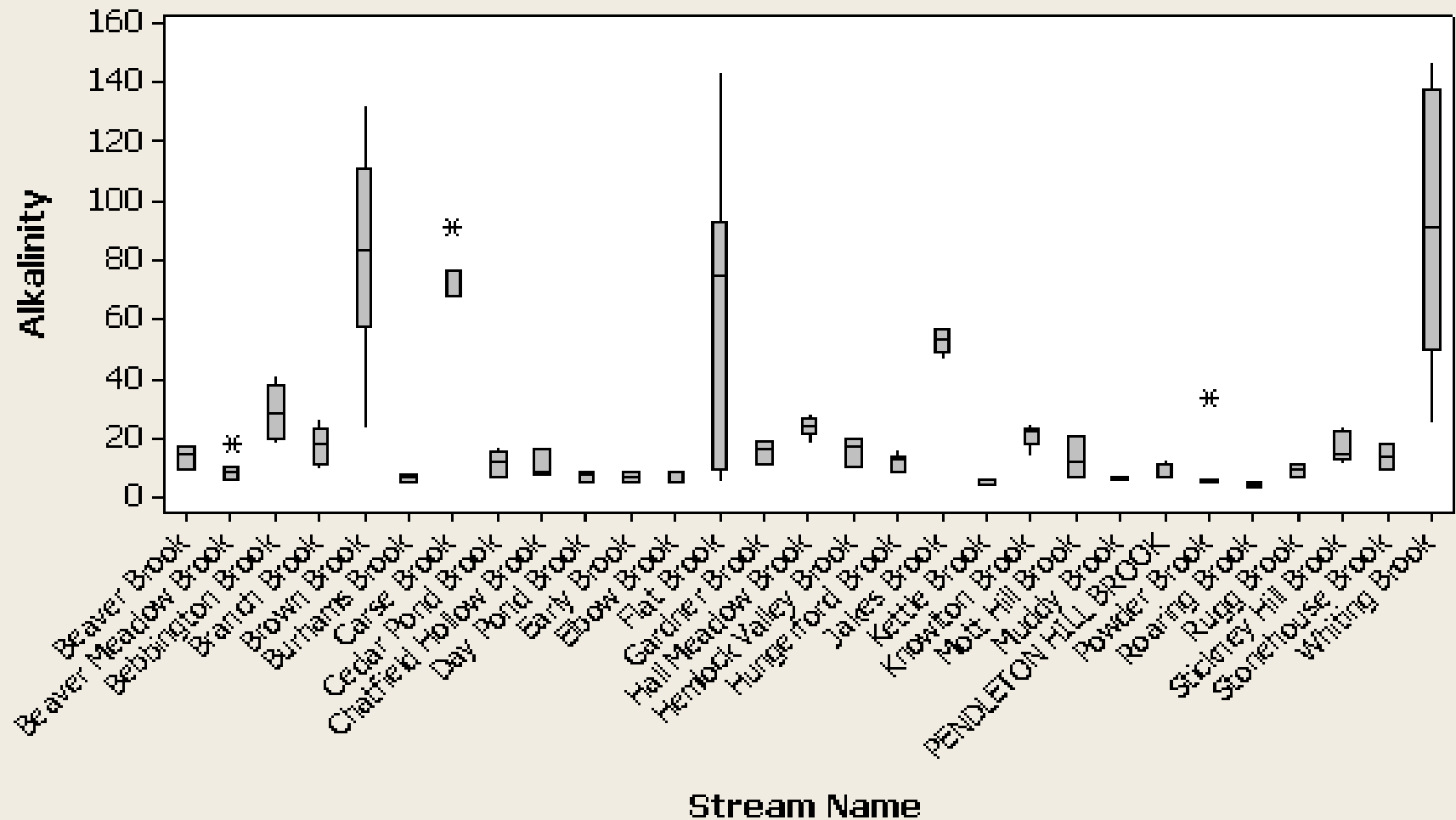
Total Nitrogen

Boxplot of Nitrogen, Total



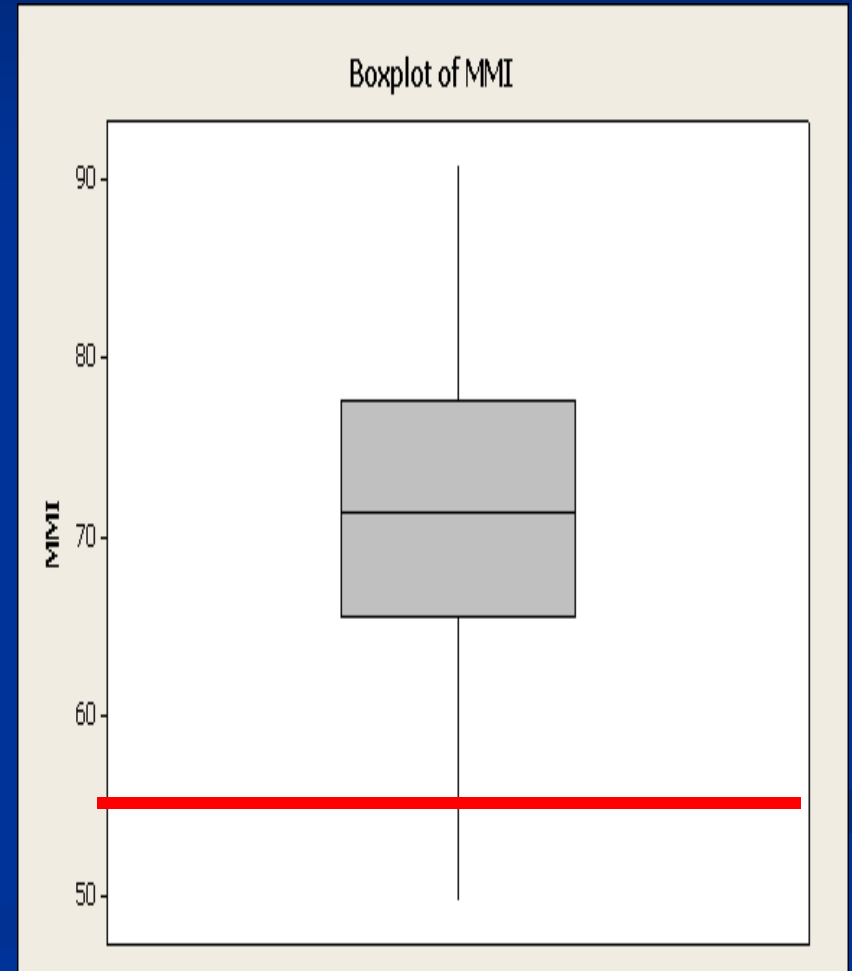
Alkalinity

Boxplot of Alkalinity



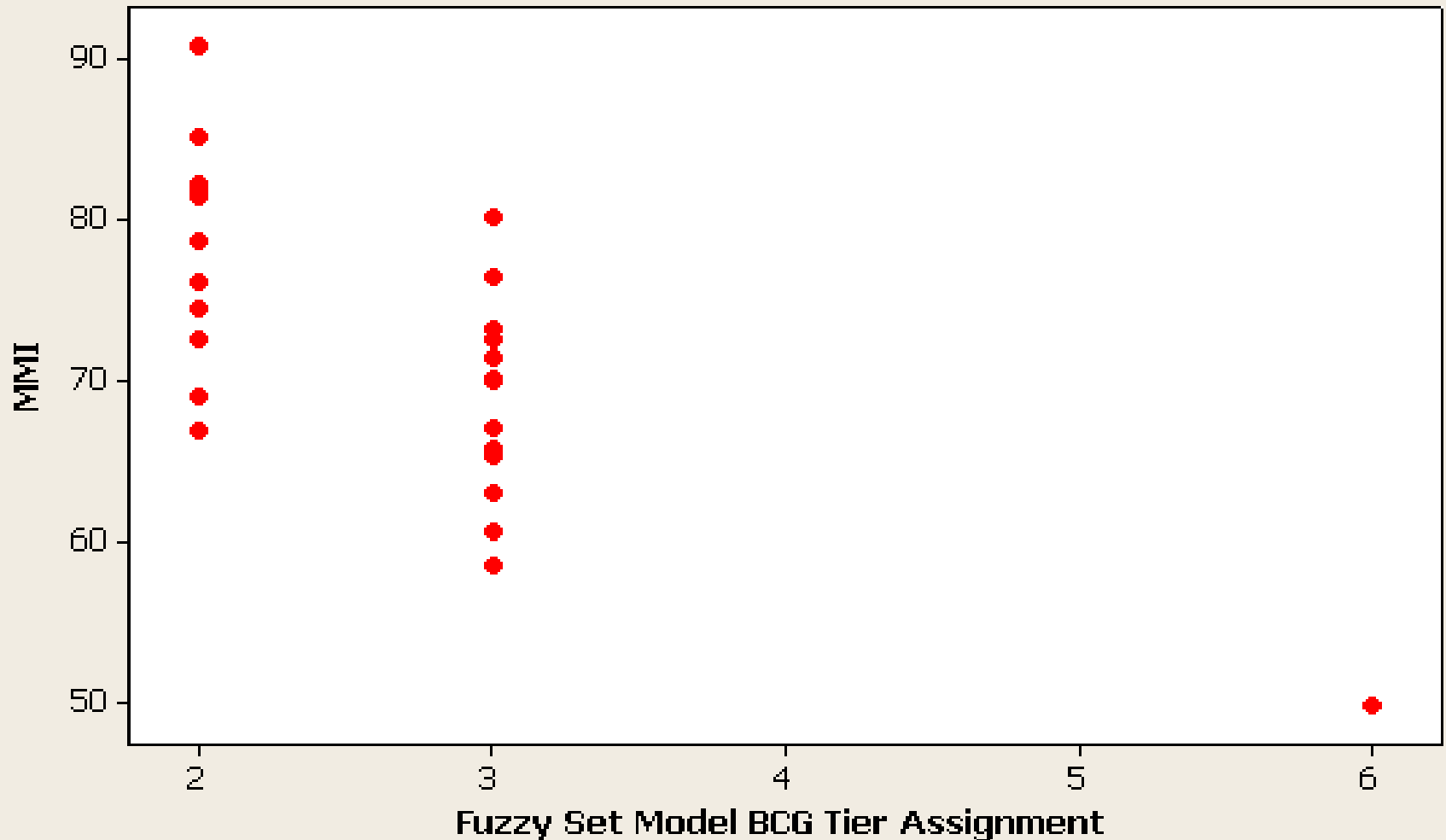
Results: Macroinvertebrate

- 23/24 easily met ALUS goals
 - MMI > 55 points
 - BCG Tiers 2 and 3
- Surprise
 - Hall Meadow Brook
 - MMI = 49.7
 - BCG = 6



Results: Macroinvertebrate

MMI vs Fuzzy Set Model BCG Tier

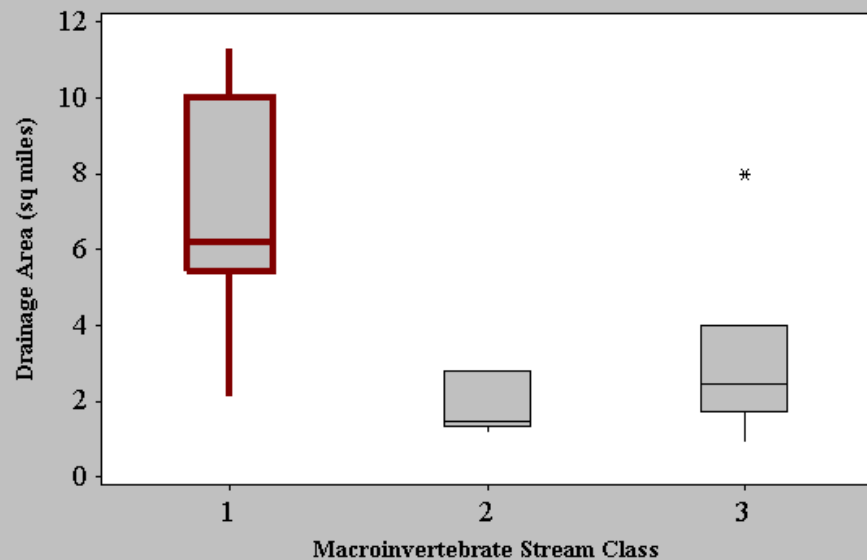


Results: Macroinvertebrate

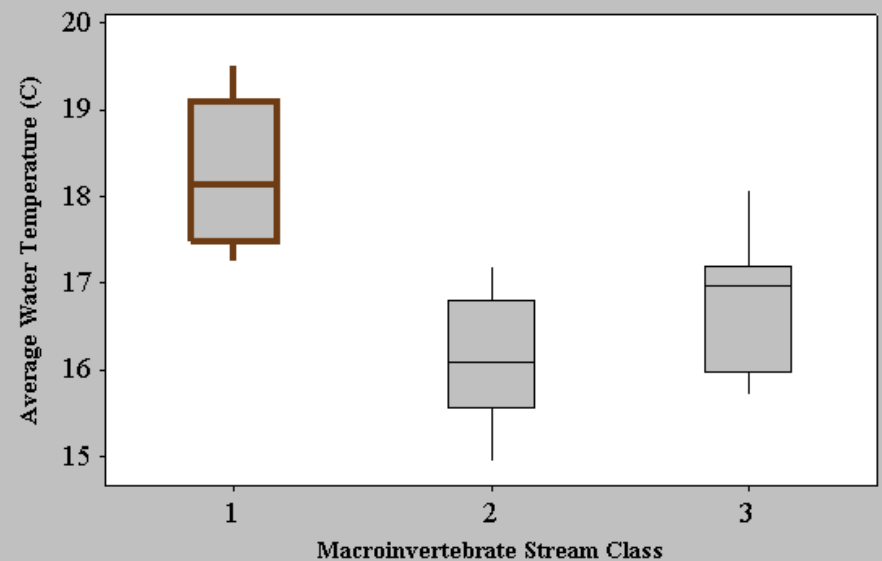
- 3 distinct assemblages
 - Each assemblage's indicator species were pollution sensitive
- Assemblages differed with
 - Watershed size
 - Temperature
 - Forested

Macroinvertebrates EPT genera vs

Drainage Area



Water Temperature

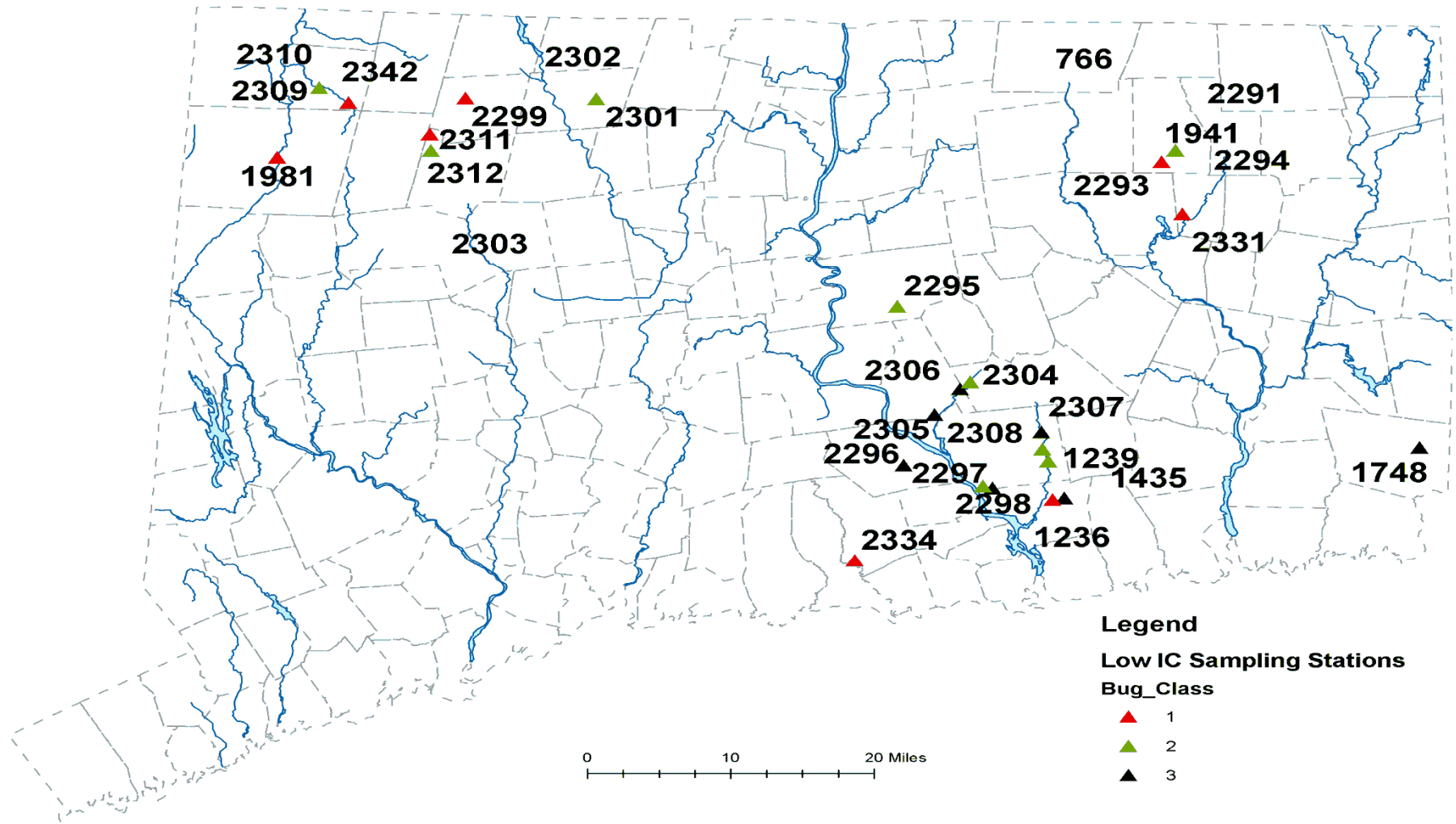




Macroinvertebrate EPT Indicator Species

GROUPING	Taxa	Indicator Value (percent)	p value
1	<i>Isonychia sp.</i>	96.9	0.0001
1	<i>Paragnetina media</i>	55.7	0.0094
1	<i>Maccaffertium modestum group</i>	47.7	0.0482
2	<i>Diplectrona sp.</i>	81.1	0.0002
2	<i>Ceratopsyche ventura</i>	75.2	0.0007
2	<i>Tallaperla sp.</i>	61.5	0.0059
3	<i>Acroneuria abnormis</i>	54.2	0.0295
3	<i>Brachycentrus appalachia</i>	42.9	0.0193
3	<i>Rhyacophila fuscula</i>	35.9	0.0462

EPT Taxa from Least Disturbed Watersheds



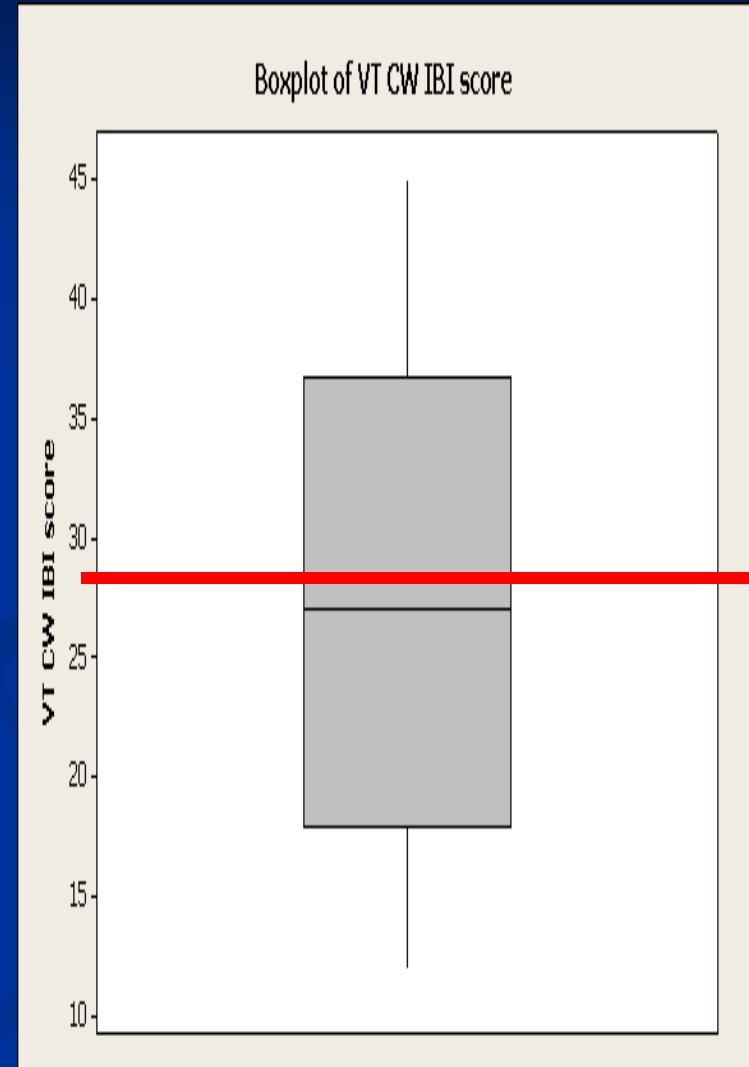
Results: Fish

- 3 distinct assemblages

- Followed work of Kanno and Vokoun 2008
- Assemblages differed with
 - Watershed size
 - Temperature

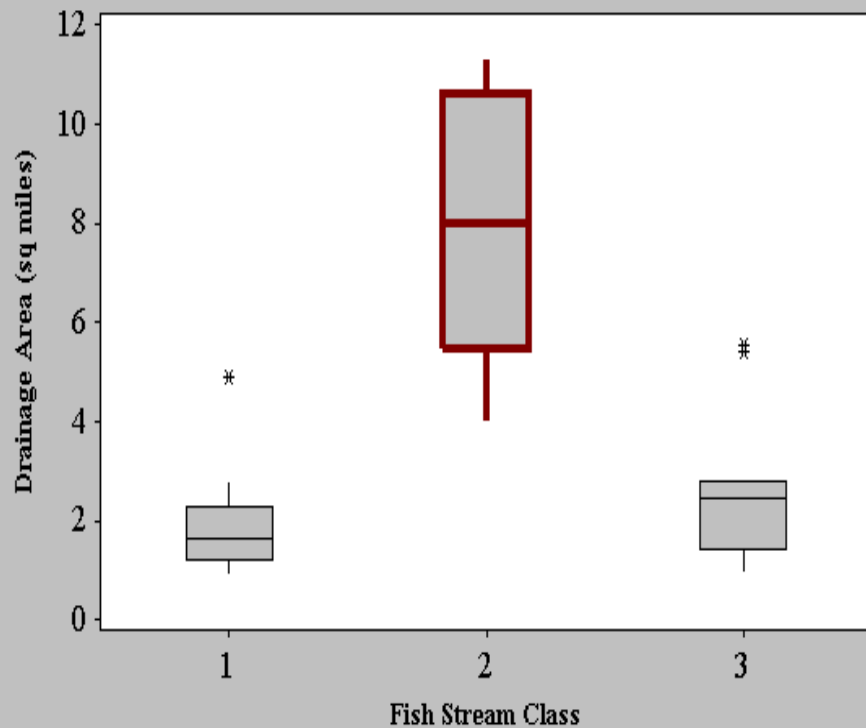
- Surprises

- Pond fishes are everywhere!!!
- VT CW IBI varied
- Glass ½ full??

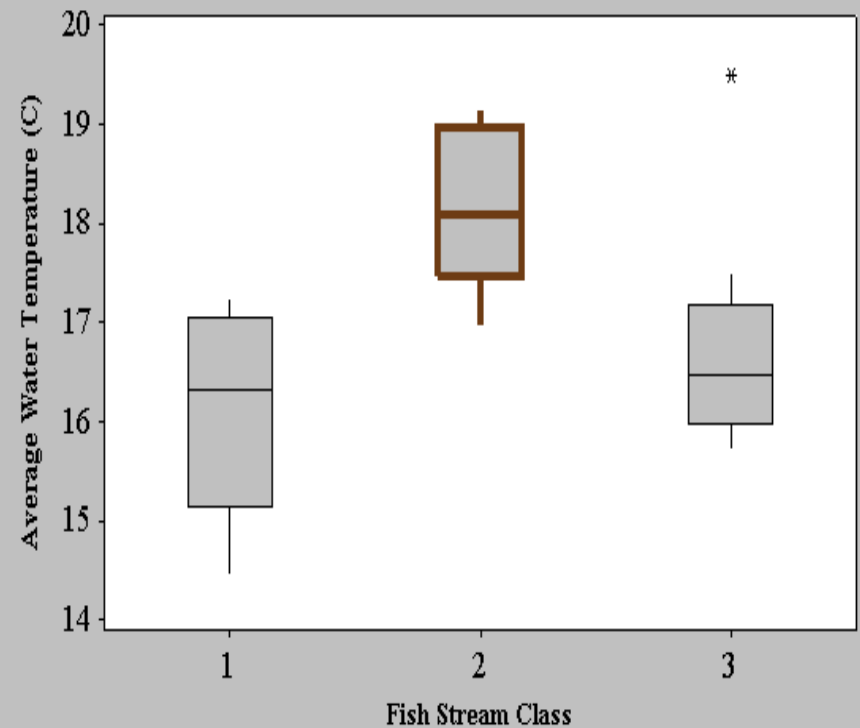


Results: FISH

Drainage Area



Water Temperature

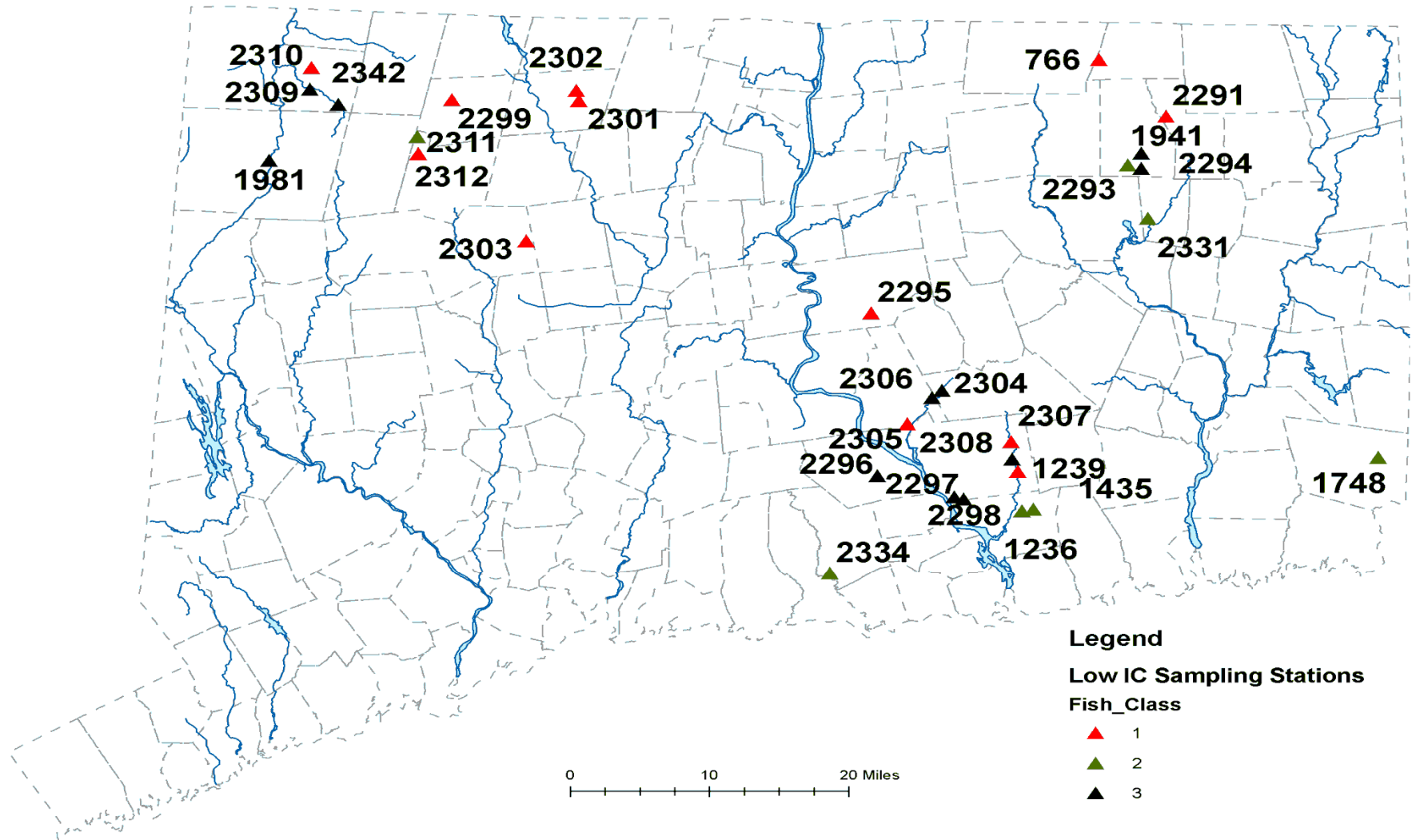




Fish Indicator Species

Grouping	Species	Habitat Use	Indicator Value (percent)	p value
1	Brook trout <i>(Salvelinus fontinalis)</i>	FS	53.7	0.0026
1	Golden shiner <i>(Notemigonus crysoleucas)</i>	MG	41.7	0.0145
2	Chain pickerel <i>(Esox niger)</i>	MG	71.4	0.0005
2	Tessellated darter <i>(Etheostoma olmstedii)</i>	FS	71.4	0.0002
2	Fallfish <i>(Semotilus corporalis)</i>	FS	65.5	0.0005
2	Bluegill <i>(Lepomis macrochirus)</i>	MG	49.3	0.0105
2	Largemouth bass <i>(Micropterus salmoides)</i>	MG	45.9	0.0100
2	Common shiner <i>(Luxilus cornutus)</i>	FD	39.6	0.0316
2	White sucker <i>(Catostomus commersoni)</i>	FD	39.5	0.0693
3	Creek chub <i>(Semotilus atromaculatus)</i>	MG	36.4	0.0372

Fish from Least Disturbed Watersheds



STREAM FLOW REGULATIONS: Brook Trout

- Indicator species for Fish Class 1 streams

1600+ WBK/Ha :

- Gardner Brook in Ashford, Mott Hill Brook in Glastonbury, and Whiting Brook in Canaan could be considered for Class 1 stream flow classification.

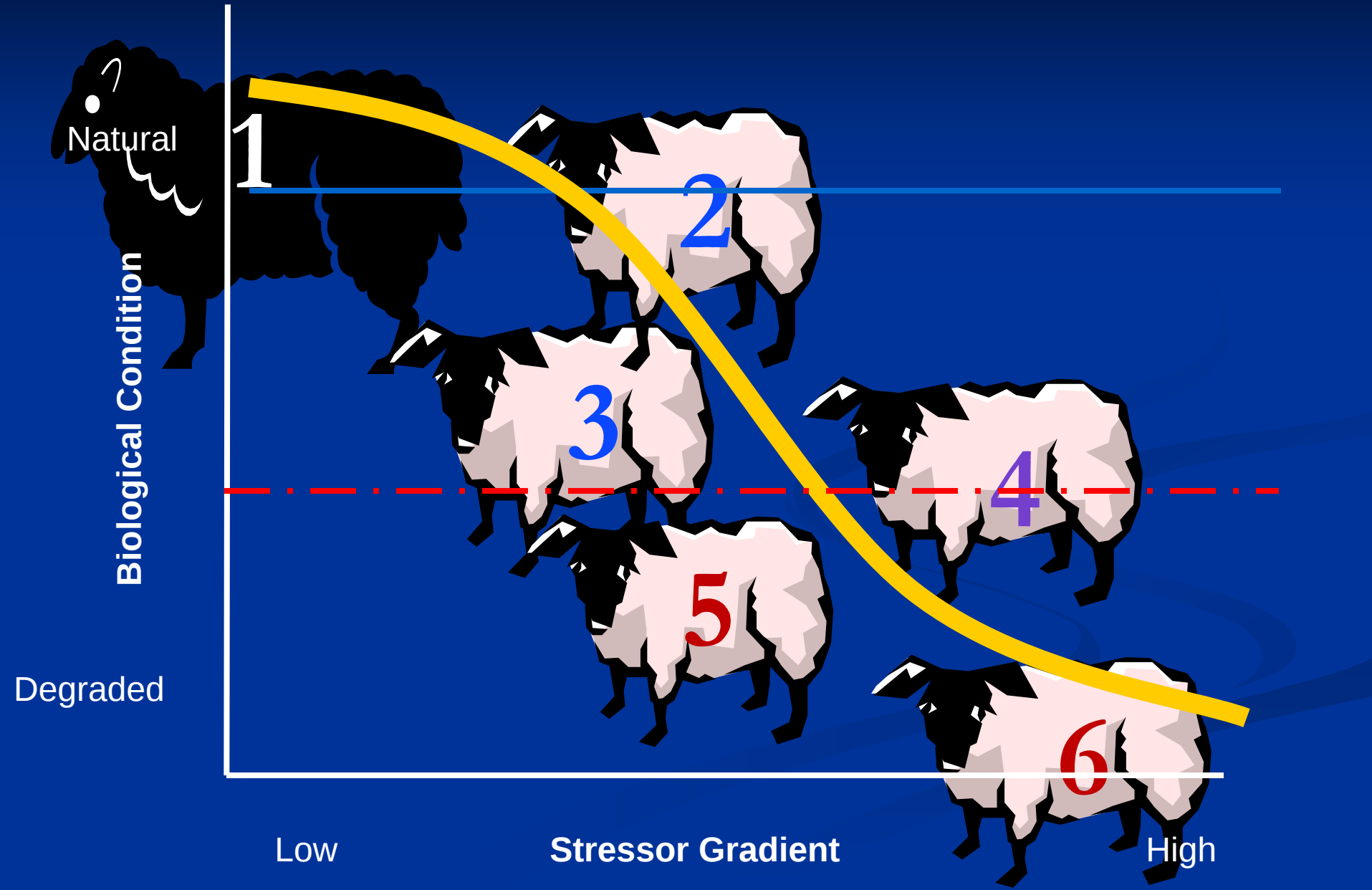


Tier 1

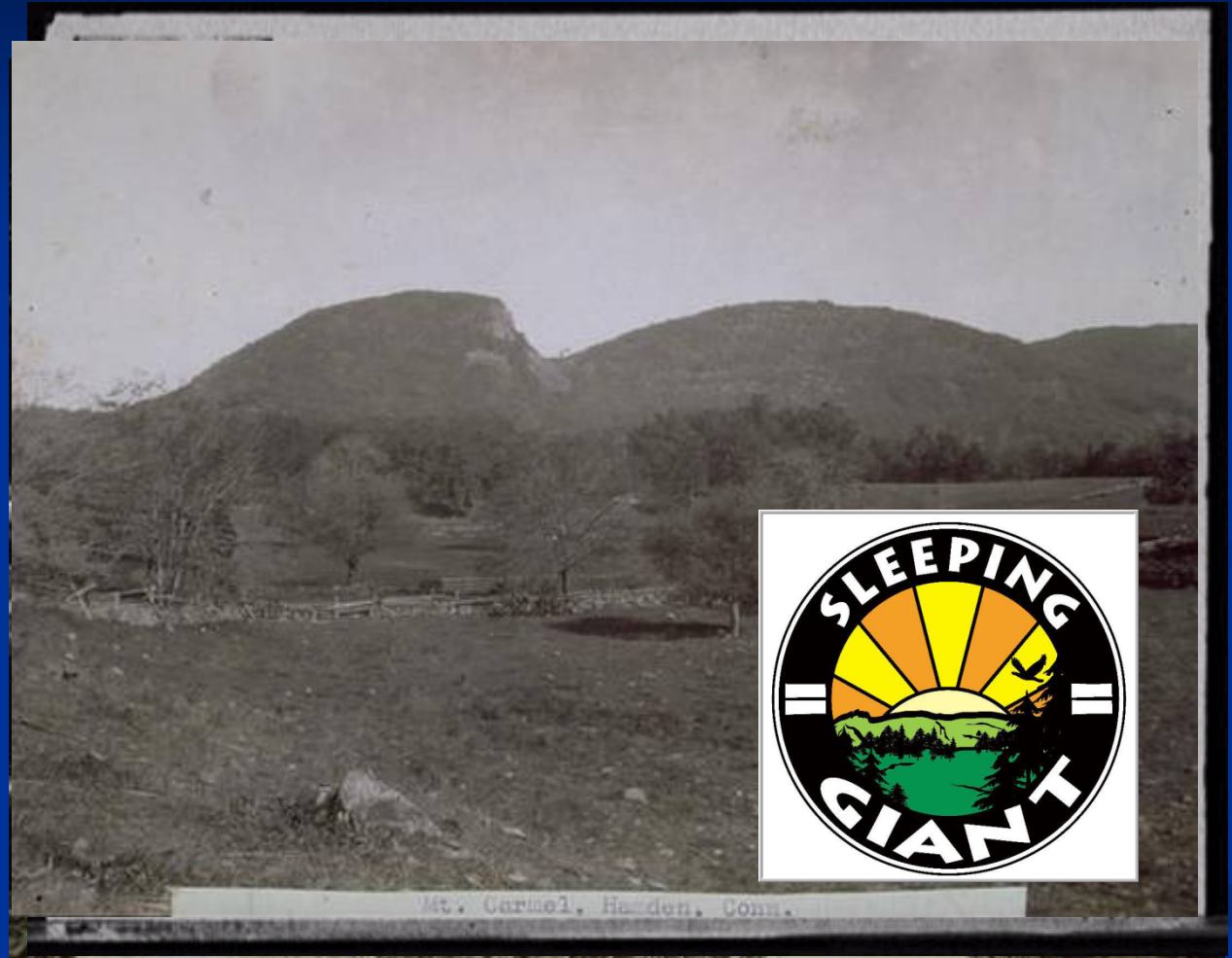


NEAEB, March 18-20, 2009 Westport,
CT

BCG TIER 1?



Least Altered and Past Landuse in CT



CT BCG Tier criteria

Criteria for BCG Level 1 (Minimally Stressed)

Persons per Sq Mi	Urban %	Natural Land Cover %	Chloride
< 5	< 0.5	> 90	< 5 mg/L

Tier 1 in Connecticut?

•Brown Brook

- ✓ 5.57 square miles
- ✓ 99% natural land use cover
- ✓ 1.2% Impervious Cover
- ✓ 1 house, 4 people, 2 dogs, and a llama
- ✓ Average Chloride = 1.56 ppm

98% PRIVATE LAND

Tier 1 in Connecticut?

Brown Brook's Biology

 MMI = 76.4 BCG = 3

 39 taxa, 26 EPT taxa, 6 BCG = 2

 VT CW IBI = 21.0

 6 taxa, 100% native species

 2 Brook trout, mostly blacknose dace

 Burbot !!

CT BCG Tier 1 criteria

Criteria for BCG Level 1 (Minimally Stressed)

Persons per Sq Mi	Urban %	Natural Land Cover %	Chloride
< 5	< 0.5	> 90	< 5 mg/L

Sites that Meet Tier 1 Criteria

Stream Name	People per Sq Mi	Developed %	Natural Land Cover %	Avg Chloride (mg/L)
Brown Brook	<5	0.47	0.99	1.56
Whiting Brook	<5	0.18	0.99	1.76

Sites that are Very Close to Meeting Tier 1 Criteria

Flat Brook	?	4.97	0.88	2.49
Roaring Brook	0	2.10	0.96	2.59
Kettle Brook	0	3.03	0.96	3.96
Beaver Brook	?	4.40	0.87	4.40

CT BCG Tier 1 biology

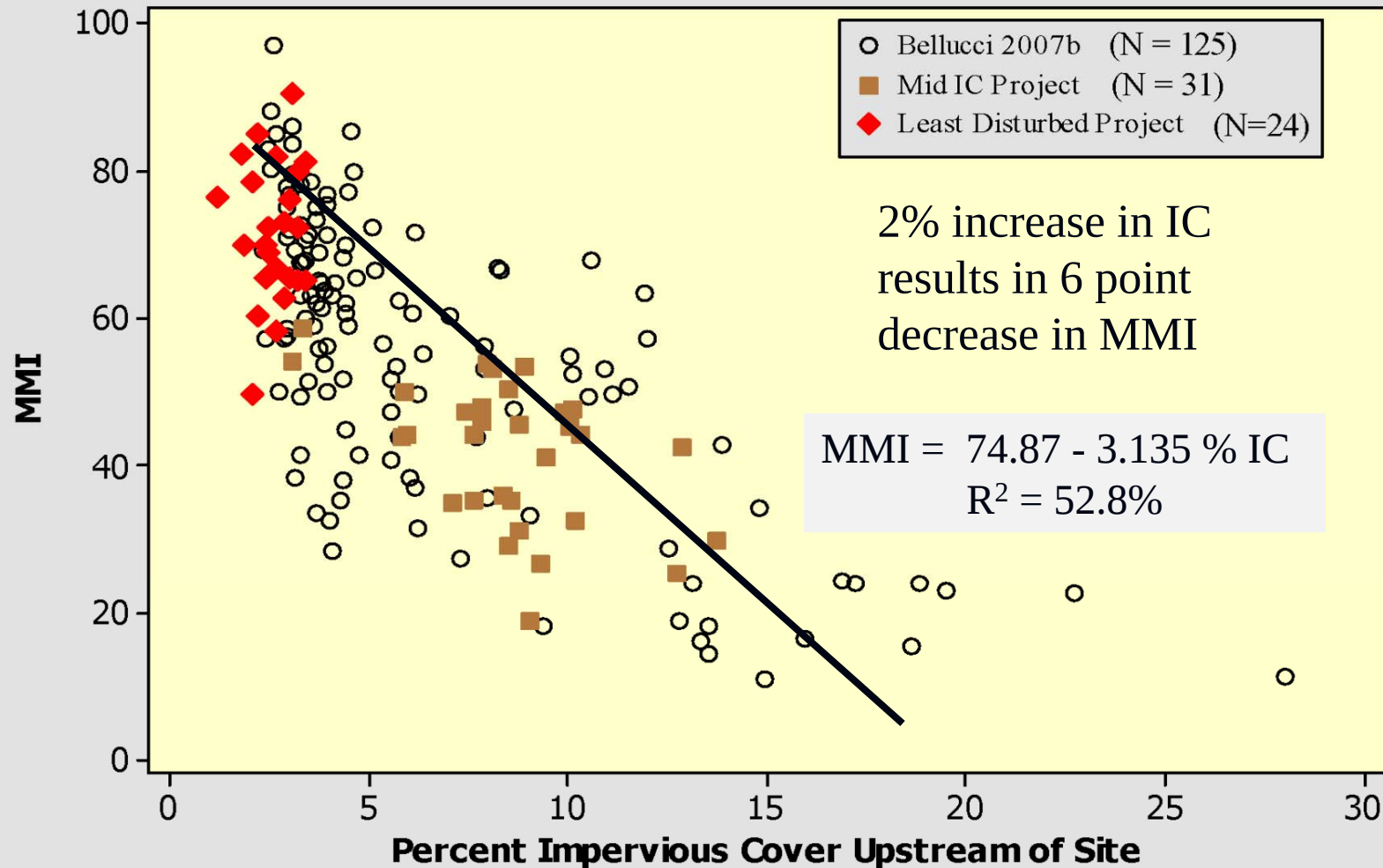
Sites that Meet Tier 1 Criteria

Stream Name	Fuzzy Set BCG	MMI	VT CW IBI
Brown Brook	3	76.4	21
Whiting Brook			42

Sites that are Very Close to Meeting Tier 1 Criteria

Jakes Brook	2	78.7	42
Flat Brook	2	90.8	39
Roaring Brook	2	91.4	42
Kettle Brook	2	82.2	39
Beaver Brook	3	70.1	12

Old plus New Results



TO GO...

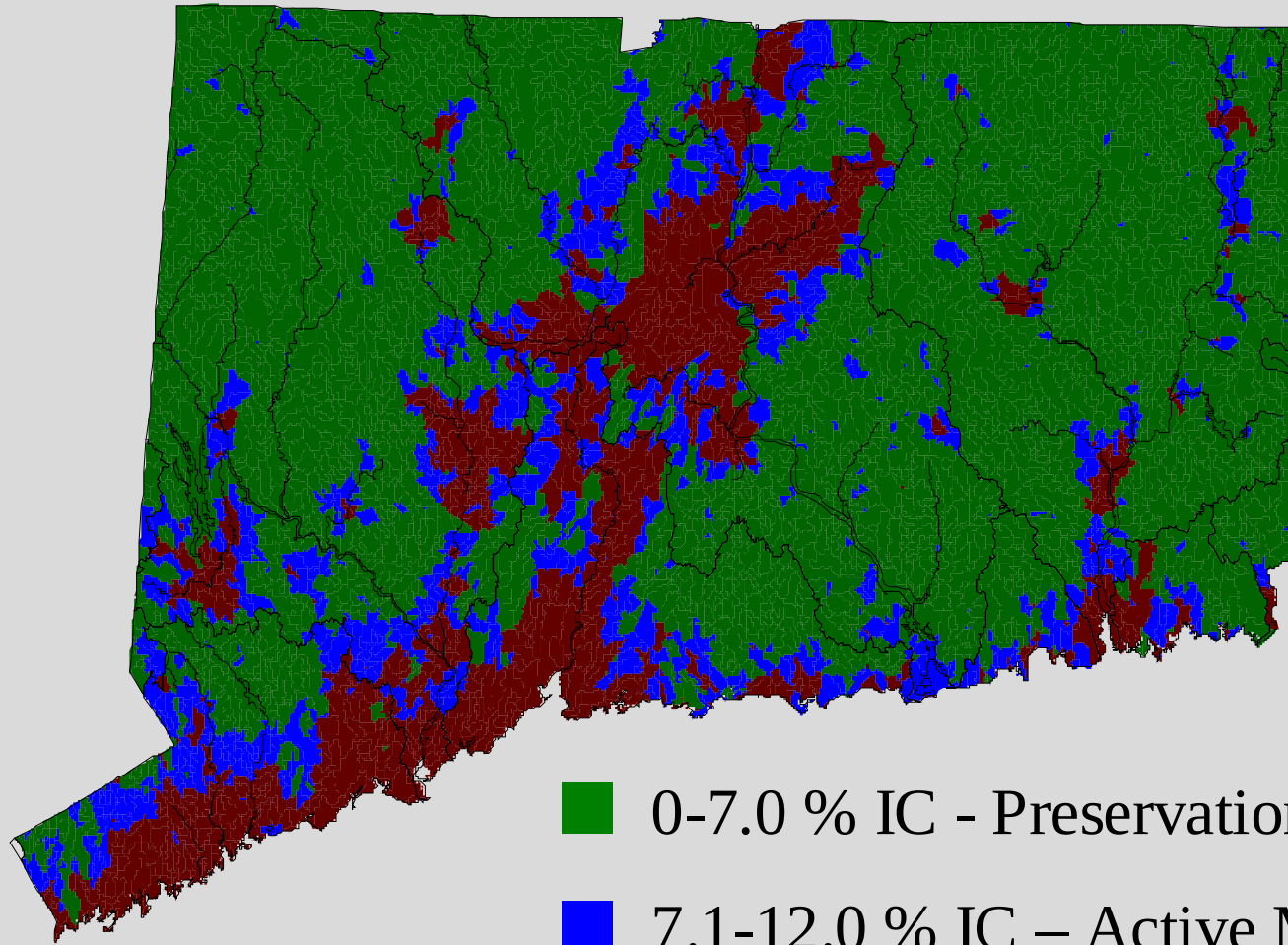
- ✓ **SMALL WATERSHEDS**
- ✓ **CLUMPED DISTRIBUTION**
- ✓ **NOT A LOT AROUND** (according to our criteria)
- ✓ **FOUND VIA MULTIPLE GIS LAYERS AND DATASETS**

- ✓ **BIOLOGICAL RESPONSE SIMILAR TO “BCG 2 & 3”**
- ✓ **LAND USE OF THE “RECENT PAST” MAKES THE DIFFERENCE**
- ✓ **IS THERE A TIER “1”?**

- ✓ **LEAST DISTURBED IS ALSO “VARIABLE”**

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Implications



■ 0-7.0 % IC - Preservation

■ 7.1-12.0 % IC – Active Management

■ > 12.1 % IC - Mitigate

Questions ???

Physical, Chemical, and Biological Attributes of Least Disturbed Watersheds in Connecticut



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Bureau of Water Protection and Land Reuse
Planning and Standards Division

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