Recent Enhancements and Modifications to New Jersey's Ambient Biomonitoring Network (AMNET)

Dean Bryson
New Jersey Department of Environmental Protection

Summary

- Status of AMNET program
- Development of new macroinvertebrate indices
  - High Gradient Macroinvertebrate Index (HGMI)
  - Pinelands Macroinvertebrate Index (PMI)
  - Cases studies with new indices
- Application of Coastal Plain Macroinvertebrate Index (CPMI)

Status of AMNET Program

- Network began in the early-90's and now consists of 822 active sites statewide.
- Sites are sampled once every 5 years, by Water Region, on a rotational basis.
- 3rd Round of all 5 Water Regions completed. 4th Round of sampling completed in the Upper Delaware Water Region in June, 2008.
- Currently, sampling in Northeast Region.

New Jersey's Macroinvertebrate Monitoring Network

- Index originally used, called New Jersey Impairment Score (NJIS), was based on guidance in original USEPA's Rapid Bioassessment Protocols.
- NJIS was used statewide throughout the 1990's and into this decade.
- Scores from 5 metrics are totaled to give the NJIS. A rating category, based on the score, is applied- non-impaired, moderately impaired, or severely impaired.
- Index calculated with 100-organism subsample with family-level taxonomy

Weaknesses of NJIS

- Some nutrient-enriched streams scored higher than expected usually because of an overabundance of a relatively tolerant caddisfly taxa.
- The 3 levels of impairment lacked resolution in the moderately impaired category.
- Data analysis performed on family-level data.
- Moderately enriched streams in Pinelands (higher pH and SC) tended to score as non-impaired.
- Some reference sites in Pinelands, with little or no development and pH readings approaching 4.0, scored moderately impaired.

Seeking Solutions

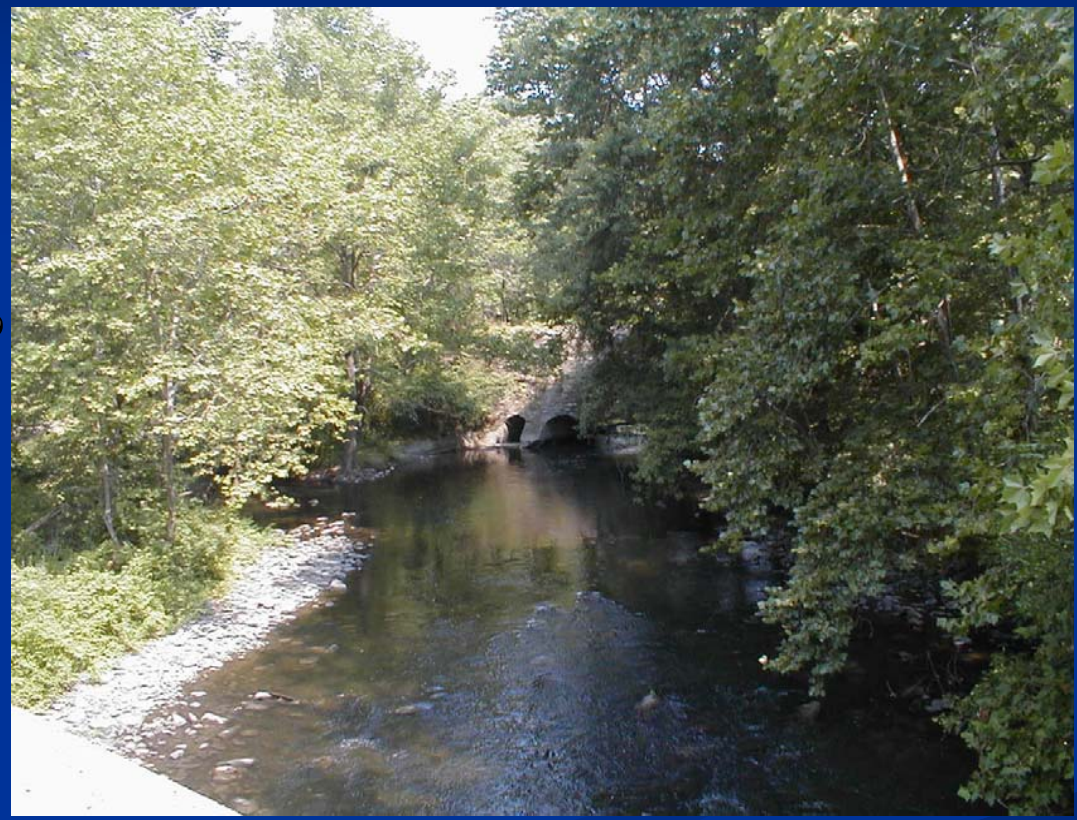
- Funding obtained from USEPA-Region 2 for index development.
- Contracted Tetra Tech to develop a new index for high gradient streams (northern NJ) and a Pinelands-specific macroinvertebrate index.

Index Development Steps

- Collect and organize the data, separating calibration and verification data;
- Define reference and degraded sites;
- Stratify natural biological conditions;
- Calculate biological metrics and determine sensitivity of each metric;
- Combine appropriate metrics into index alternatives;
- Select the most appropriate index based on sensitivity and variability, and;
- Assess performance of the index.

High Gradient Macroinvertebrate Index

- Reference criteria
  - %Urban & Ag < 20%
  - Habitat score > 75% of total possible score
  - Not below a dam
  - Reference sites met all criteria



High Gradient Macroinvertebrate Index

- Stressed criteria
  - %Urban & Ag > 80%
  - Habitat score < 50% of total possible score
  - Can be below a dam
  - Site defined as stressed if any one of these is met

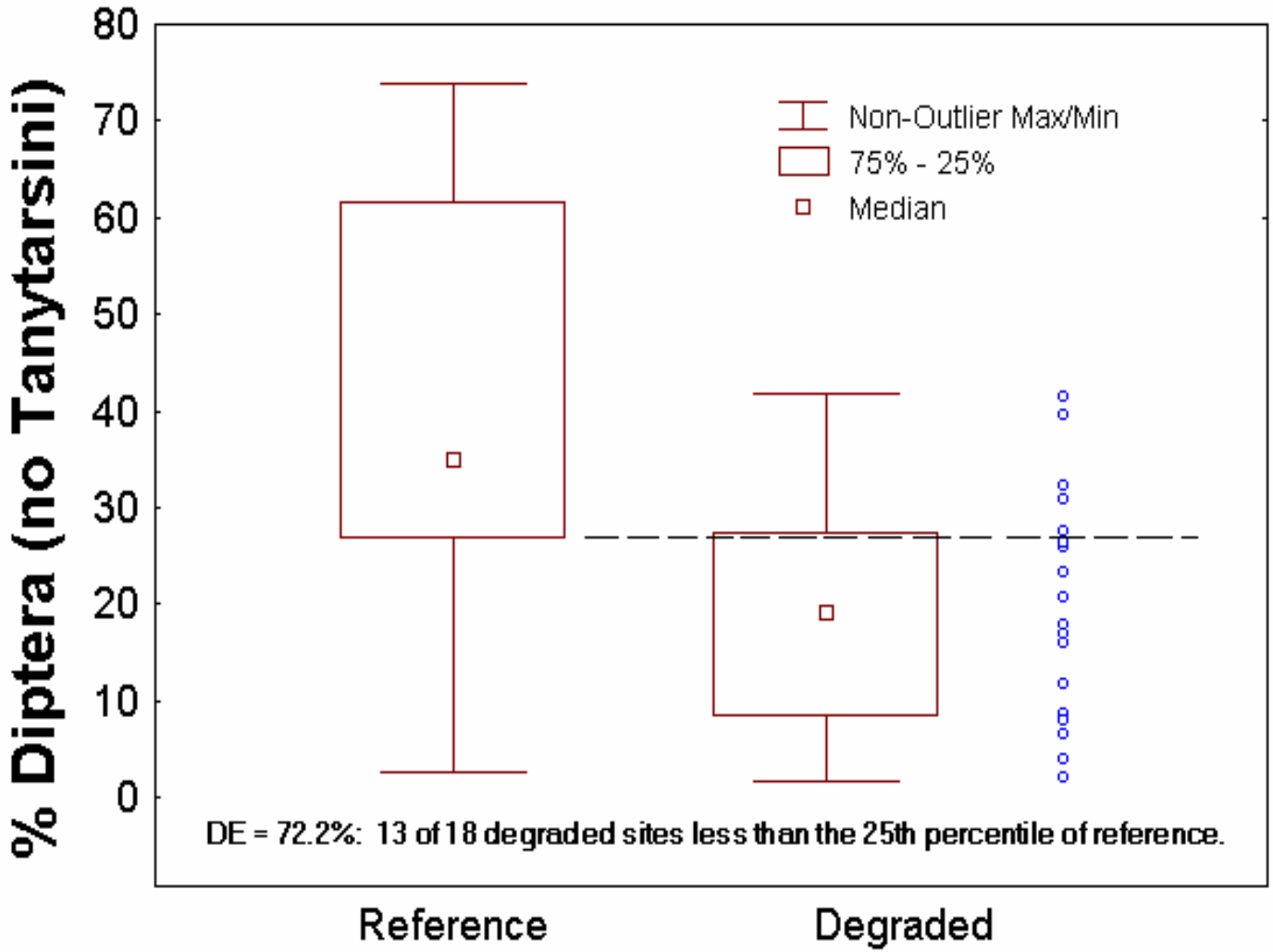
Pinelands Reference and Degraded Site Criteria

Environmental Parameter	Reference Criterion	Degraded Criterion
Predicted intensive land use (PLU%)	< 10%	>25%
Percent agricultural land cover	< 10%	>25%
Percent urban land cover	< 10%	>50%
Below Dam	No	No criterion

$$PLU\,\% = 12\,pH + 61\log(spec.cond.) - 148$$

Dow and Zampella (2000):

Metric Performance



High Gradient Macroinvertebrate Index

- Family-level
  - # of EPT families
  - % of families that are non-insects
  - %EPT (excluding Hydropsychidae)*
  - # of scraper families
  - Family Biotic Index*
- Genera-level
  - Total # of genera*
  - % of genera that are non-insects
  - %EPT[1]
  - # of scraper genera*
  - Hilsenhoff Biotic Index*
  - # of TALU attribute 2 genera
  - # of TALU attribute 3 genera

*- metric is adjusted based on drainage area

[1] Excluding all Hydropsychidae except Diplectrona sp.

High Gradient Macroinvertebrate Index (gen.)

-Thresholds established with 95 percentile of reference values and trisection of scores below.

- Excellent- 63&above

  Good- 42-<63

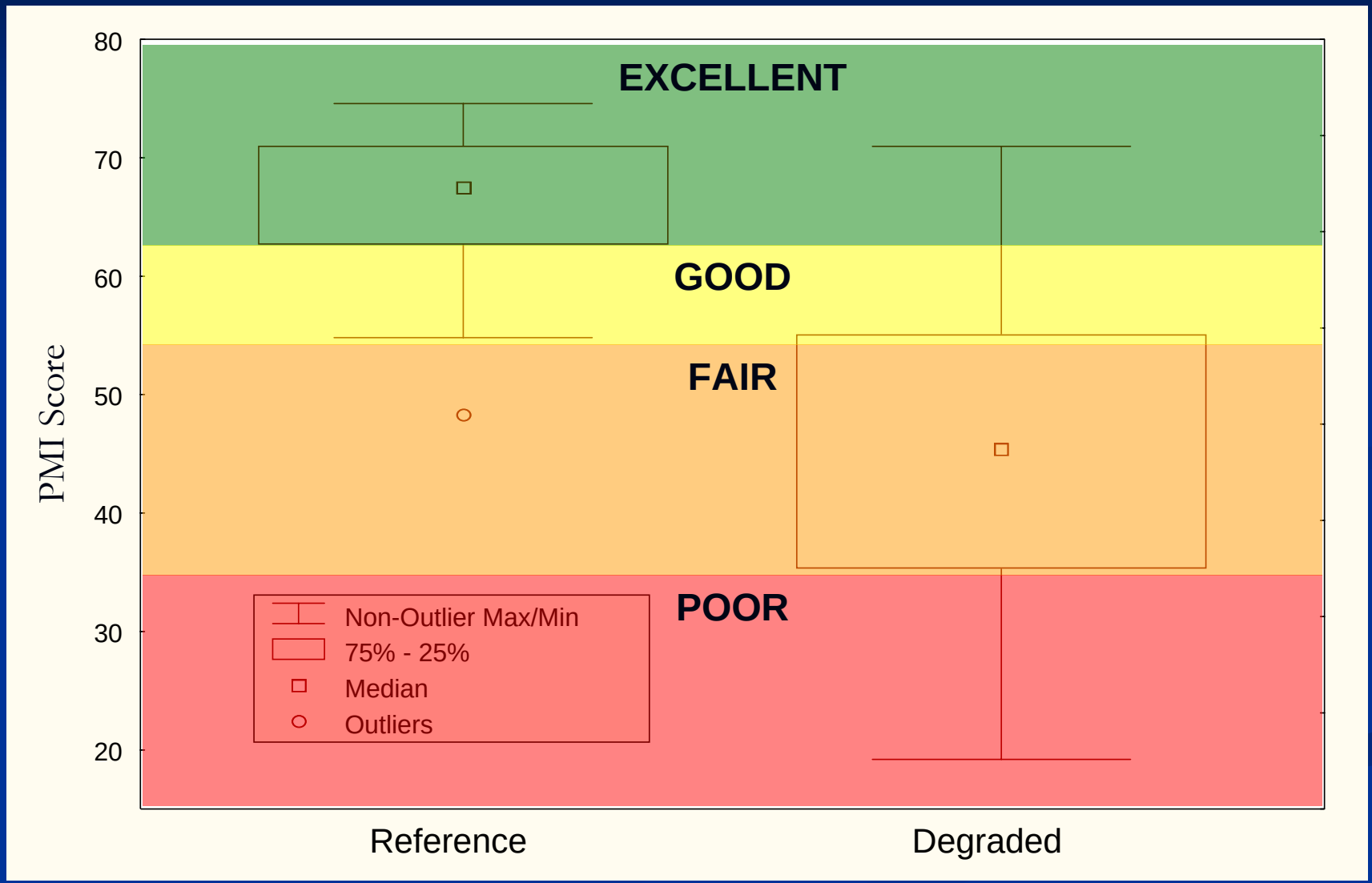
  Fair- 21-<42

  Poor- less than 21

Pinelands Macroinvertebrate Index (PMI)

1. # of Insect Taxa
2. # of Non-insect Taxa
3. % Plecoptera and Trichoptera
4. % Diptera excluding Tanytarsini
5. % Mollusca and Amphipoda
6. Beck's Biotic Index
7. % Filterers

Index Performance



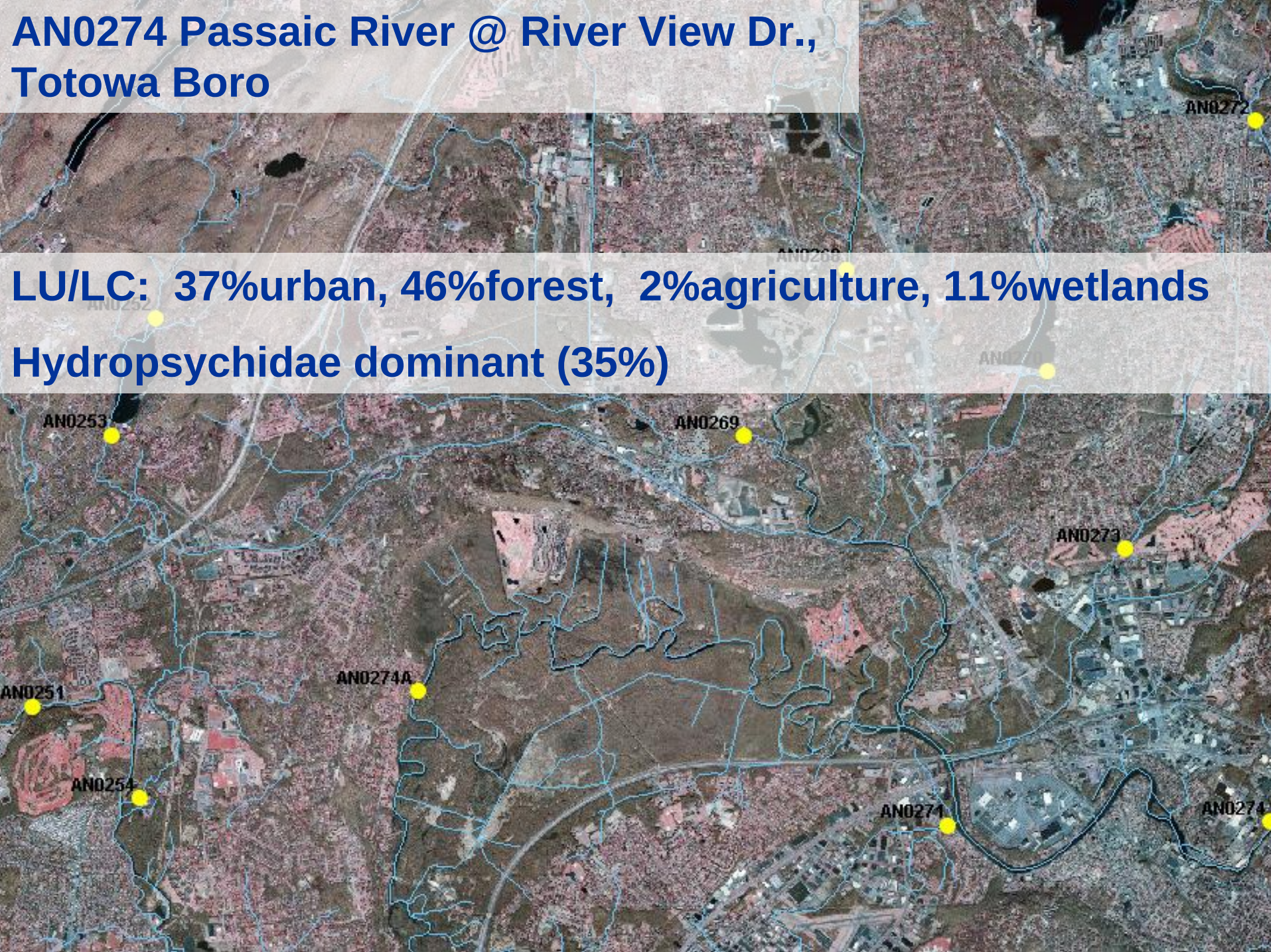
Index Performance

- Using calibration data set, PMI's DE was 94.4%
- With same data set, NJIS had a DE of 44.4%
- May be more sensitive to severe stresses than moderate stresses. Future refinements may be necessary to better assess slight to moderately enriched conditions.

Case Studies

- The following monitoring sites have been assessed using both the NJIS and the new index.

AN0274 Passaic River @ River View Dr., Totowa Boro



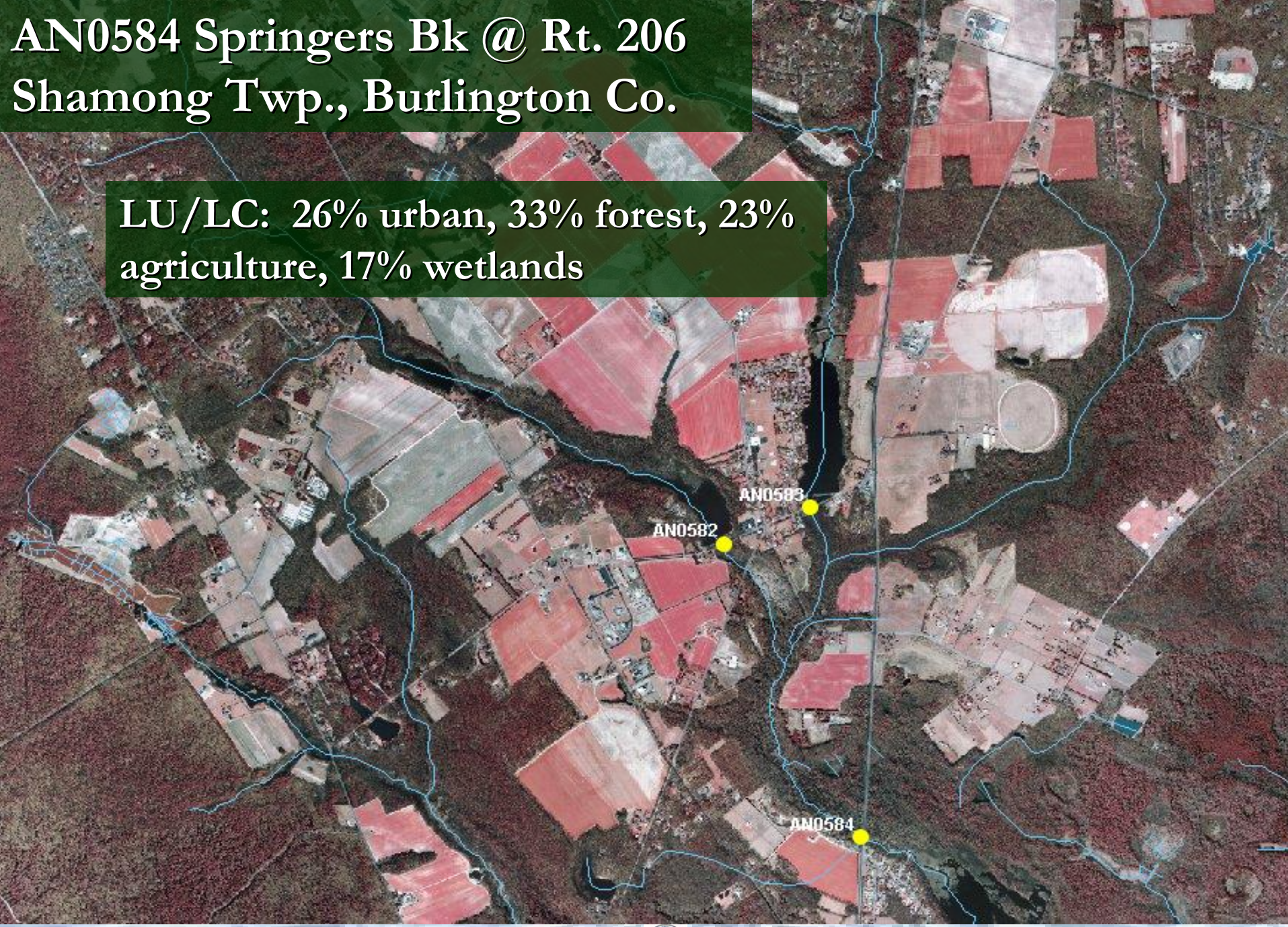
LU/LC: 37%urban, 46%forest, 2%agriculture, 11%wetlands

Hydropsychidae dominant (35%)


AN0274 Passaic River @ River View Dr.,
Sampled: 6/24/04
NJIS: 27, Non-impaired
HGMI(gen): 29.64, Fair

AN0584 Springers Bk @ Rt. 206 Shamong Twp., Burlington Co.

LU/LC: 26% urban, 33% forest, 23% agriculture, 17% wetlands




AN0584 Springers Bk @ Rt. 206
Sampled: 7/27/05
pH: 6.0
SC: 188
NJIS: 24, Non-impaired
PMI: 45.92, Fair

Application of PMI

- To be used for all sites within the boundary of the Pinelands Reserve and sites within a 5 kilometer buffer of the Reserve.
- Currently, PMI is being used to assess 195 of the active network sites in Coastal Plain of southern New Jersey.
- All other sites, 202 sites, in the NJ Coastal Plain are assessed using the Coastal Plain Macroinvertebrate Index.

Coastal Plain Macroinvertebrate Index (CPMI)

- Developed in the 90's by a multi-state workgroup.
- Uses genera-level data.
- Metrics: #Total taxa, #EPT taxa, %Ephemeroptera, HBI, and %clingers.
- 4 assessment categories
  - Excellent 22-30
  - Good 12-20
  - Fair 6-10
  - Poor <6


Questions?
www.state.nj.us/dep/wms/bfbm