

Natural variability and the assignment and use of Minimally Disturbed Sites (MDS) in eco-epidemiology



Rijksinstituut voor Volksgezondheid en Milieu
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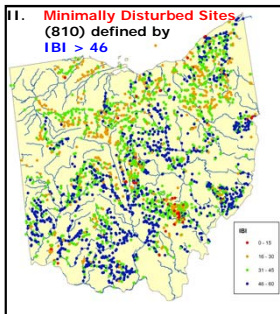
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Introduction

- Diagnostic bioassessment requires "points of departure"
- That is: to express ecological impact compared to some defined status
- Multiple choices are possible for that
- We apply the concept of "Minimally Disturbed Sites", **MDS**, to assess ecological impacts and their probable causes
- We explore the impacts and meaning of major decisions in defining MDS
- We aim to:
 - Explore various realistic ways to address MDS
 - Provide insights into the factors that are of major importance in eco-epidemiological diagnosis

Approach

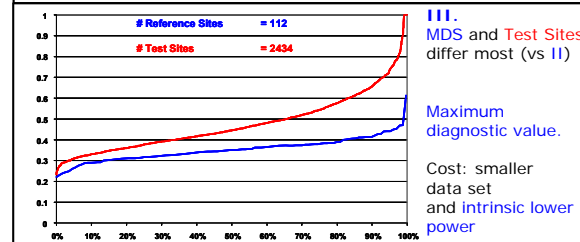
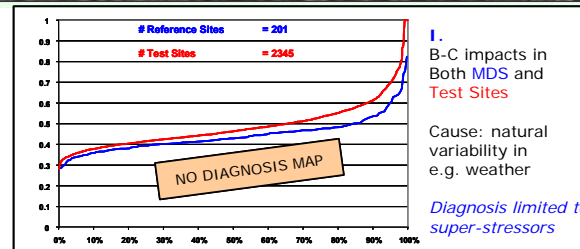
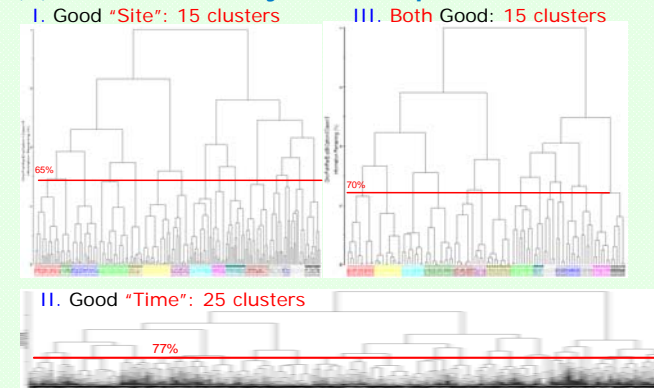
- Basic data are abiotic and biotic (fish census) data for Ohio
 - Years: 2000-2008
 - # of Sites 2546
 - # of Species 92
 - # of Predictors 5 geographical & 30 environmental
- See Poster Dyer et al. (2010) and Holmes et al. (2010)
- MDS-sites** were defined using three strategies
 - Ohio-EPA assigned Reference Sites
 - All sites with high biotic integrity (IBI >46)
 - Combined



Natural variability – RIVPACS approach

- Water bodies naturally differ in species composition
- Hence, **MDS's vary naturally** in observed species compositions
- RIVPACS identified *Classes of similar water bodies*, for **I**, **II** and **III**
- The RIVPACS model based on MDS can predict Expected Species elsewhere, at non-MDS sites**

(1) RIVPACS & Bray-Curtis impacts

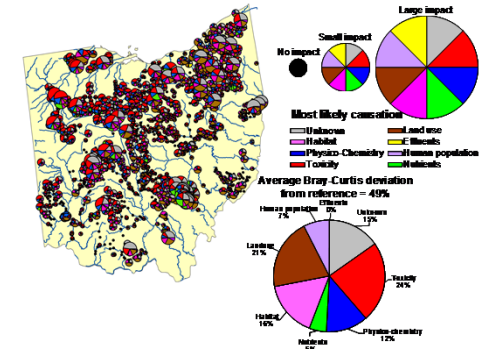


| | How | In fact | Site/year | Classes |
|-----|----------|----------------------|-----------|---------|
| I | Expert | Good "Site" | 201 | 15 |
| II | IBI ≥ 46 | Good "Time" | 810 | 25 |
| III | Both | Good "Site and Time" | 112 | 15 |

Undisturbed RIVPACS predictors: ¹⁰log(Drainage area) in km²; ¹⁰log(Flow) in feet³/second; Latitude and Longitude, in decimal degrees; ¹⁰log(Slope), in %

(2) Diagnosis by EPC: I: bad – II: better – III: good

- The EPC-map was very grey. The question one answers is: "Which stressors have very major impacts, exceeding the variation caused by very wet and very dry sampling events as occurred in the reference set?"
 - The EPC-map was OK, but "wrong". The question one answers is: "Which stressors can be recognized as having impacts, knowing that the reference set contains stressed systems in which IBI is good due to stress-compensation mechanisms?"
 - The EPC-map is shown. The question one answers is: "Which stressors contribute to local species loss and abundance, based on good reference data definition?"
- Bray-Curtis diagnosis looks at both de- and increase of abundances of taxa
 - Big "toxicity" slice can be understood when this stressor causes systematic changes not necessarily large changes in abundance (see Poster "Towards developing...", WP96)



Conclusions

- "The universal SI meter" is lacking in eco-epidemiology
- Reference conditions naturally vary
 - water types → RIVPACS-type modeling
 - over time → Relevant issue!
- Diagnosis of ecological impacts requires good MDS-concept
- ...and good handling of MDS-data
- Diagnosis at (possibly) disturbed sites can be masked (heavily)
 - by natural variability in reference conditions
 - by compensatory stressors in the references

Effect and Probable Cause pies



- Pie size: fraction species expected (RIVPACS) but absent at site
- Slice size: probable causal factor
- Grey slice: "unexplained" loss

rivm Montani Run P&G



Making the "1874-alloy" of the "meter"

The "meter bar" (1889 to 1960), an alloy of Platinum and Iridium

