Uncertainty Framework for empirical Critical Loads of N Deposition

CLAD

21 October 2014

Uncertainty Framework

- OBJECTIVE:
- Develop a systematic way of reporting uncertainty
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  - CL used more broadly in the US for resource management and policy.
  - difficult to compare or evaluate CLs because uncertainty is often not reported or not reported in the same way

Uncertainty rating system

- Rating system used in European CLs:
  - ##-reliable
  - #-fairly reliable
  - (#) expert judgment

- Proposed framework based on 5-point scale
  - 1 most uncertain
  - 5 most robust

Feedback

- General approach
- Other factors affecting uncertainty to consider
- Applications—issues in comparing CLs

- WORKING DISCUSSION:
- this afternoon
- in this room
- 3:45-5 pm

Approach

- developing three approaches of conditions for each rating:
  - Large-scale homogeneous datasets: data collected using similar sampling protocols, methods, parameters measured
  - Large-scale heterogeneous datasets: assembled by combining multiple studies, distribution across landscape varies
  - Small-scale heterogeneous datasets: smaller numbers of studies combined to create dataset

Qualitative vs. quantitative (statistical) approach

Current studies in each category

- **Large-scale homogeneous datasets**:
  - FIA lichen analysis (Geiser and Jovan et al. *in prep*)
- **Large-scale heterogeneous datasets**:
  - herbaceous diversity (Simkin et al. *in prep*);
  - tree CLs in NE and
  - thresholds for impacts of environmental factors on tree growth in the NE (Robin-Abbott et al. *in prep*)
- **Small-scale heterogeneous datasets:**
  - various studies
  - those included in the national assessment of empirical CLs for terrestrial ecosystems (Pardo et al. 2011)

Factors that affect Uncertainty

- Representativeness of study for region
- Sample size, area of study,
- Influence of environmental factors
- Accuracy of N deposition
- Strength of response
- Clarity of threshold

Uncertainty framework

Reliability rating (5 is most reliable)

Criteria	5	4	3	2	1
representativeness of receptor/range of *ecosystem* covered Sampling design					
# observations (samples/sites)					
Influence of other environmental factors					
N deposition					
Strength of response					
Clarity of threshold					

To evaluate an assessment—each criterion is rated

How do we establish the rating categories?

- What defines each rating?
  - How many samples=5?....

- Qualitative approach
- Quantitative approach

Sampling design:
Representativeness of receptor, Range of ecosystem covered

- Sampling is representative—covers the whole area, not biased samples location—can make inferences about the whole study area.
  - FIA—typically strong
  - Exceptions—lichen indicator in Great Plains
- Depends on area of concern
  - Ecoregion vs ecosystem

Uncertainty framework for quantitative assessments

- Use same 5 point scale
- Most FIA data analyses would be rated 5
  - Where sample size is large, response is robust
- Factors which could reduce rating from 5:
  - Weaker response
  - System evaluated is a small fraction of system reported on

Note that CL may be reported for individual tree species, but also alliance, ecosystem, Level II ecoregion etc.

Next steps

- Qualitative rating of several studies
  - Lichens
  - Herbs
  - Species-specific tree CL
- Further refinement of rating framework
- Explore possible approaches for statistical assessment of large-scale datasets to set criteria for rating system

- WORKSHOP THIS AFTERNOON
- 3:45-5 P.M.

Number of observations

- Number of sites
- Number of samples
- Samples/site
- Sites/area

Influence of other environmental parameters on indicator response

- Model error due to climate and ecosystem type variability;
- Collinearity

- E.g., precipitation

N deposition

- Accuracy of N deposition model
  - Climatic
  - Topographic
  - Grid size resolution
- Range of deposition gradient
  - Large gradients are more able to capture thresholds
- Suitability of N deposition gradient
  - Particularly in capturing the low end of the gradient—below detrimental response

Strength of response

QUANTITATIVE ASSESSMENTS

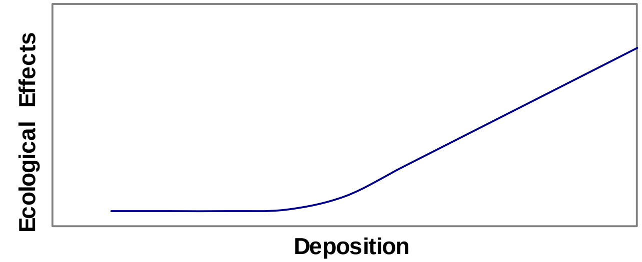
- Fit of best model
  - How well best model differentiates from others
- R^2
  - Variation explained by the model
- p value
  - Significance of model

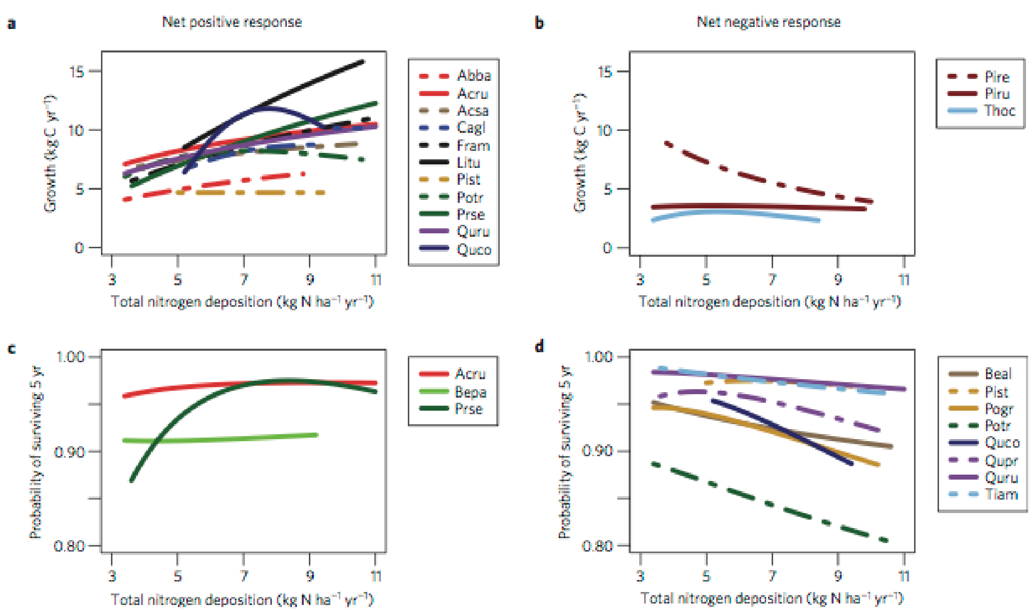
QUANTITATIVE ASSESSMENTS

- Measures of fit, scatter, etc.

Clarity of threshold

- Inflection point
- Threshold in another metric
- Range between detrimental response and no detrimental response





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