

ICP Forests

Geo-statistical modeling of bulk deposition of inorganic nitrogen to Italian forests

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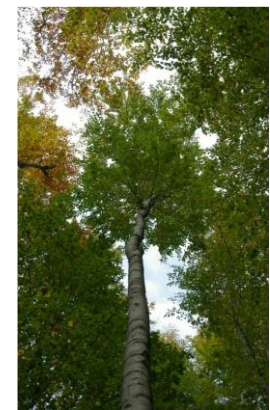


Giovanni Bacaro,



Valerio Amici, Marco Ferretti

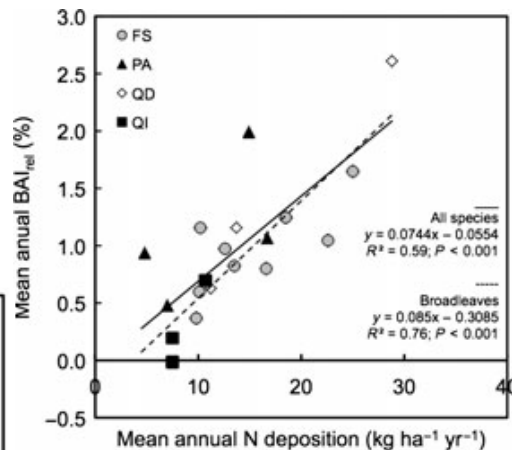
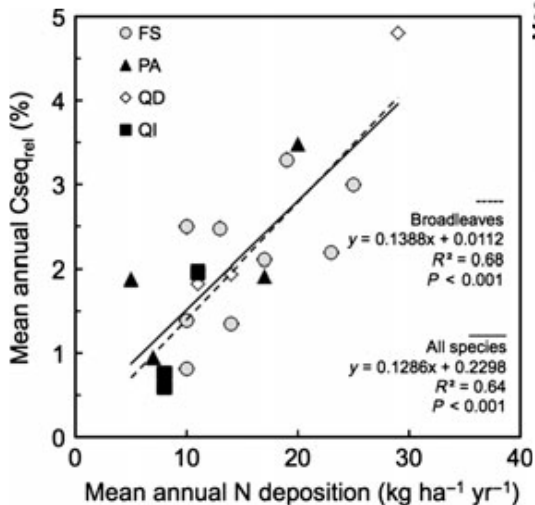
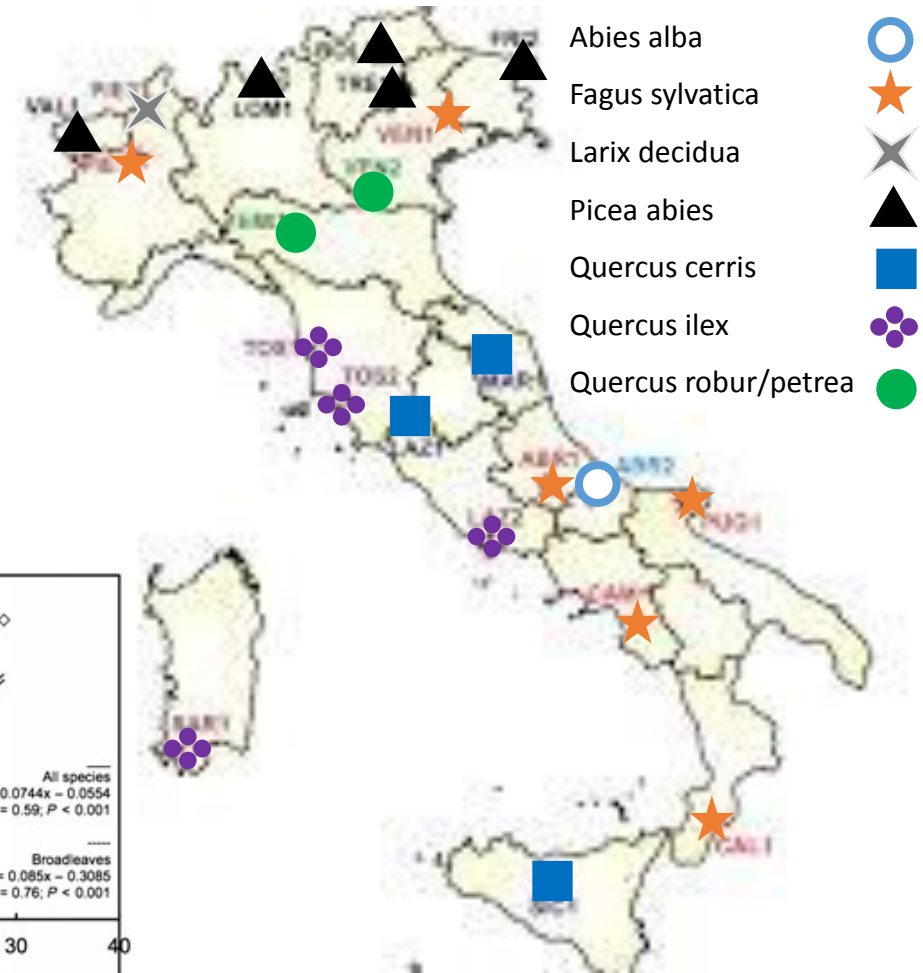
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In Italy, deposition sampling is carried out in up to 22 out of 31 level II plots.

Open field nitrogen load ranges between 3.9 and 16.2 kg/ha/a (average 2000-2011)

Positive effects on growth and C sequestration



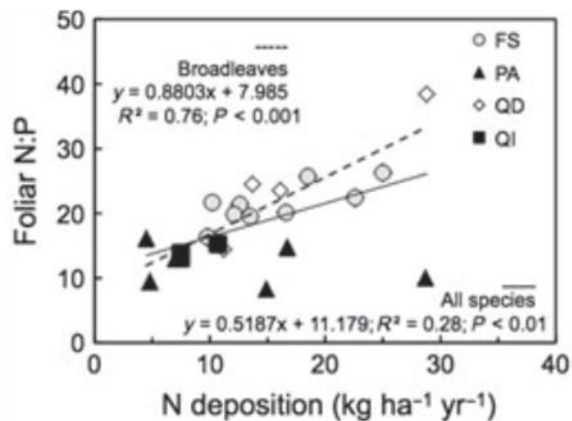
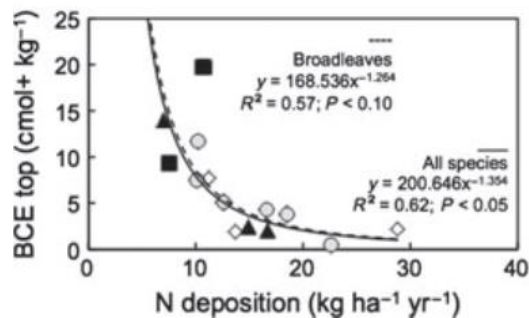
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In Italy, deposition sampling is carried out in up to 22 out of 31 level II plots.

Open field nitrogen load ranges between 3.9 and 16.2 kg/ha/a (average 2000-2011)

Adverse effects on soil and nutrition



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Can we reduce measurement effort using model results?

Which plots can be removed minimizing information loss?

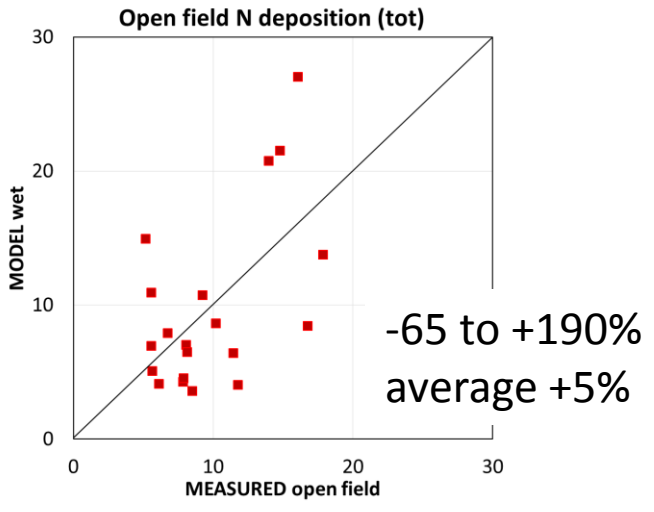
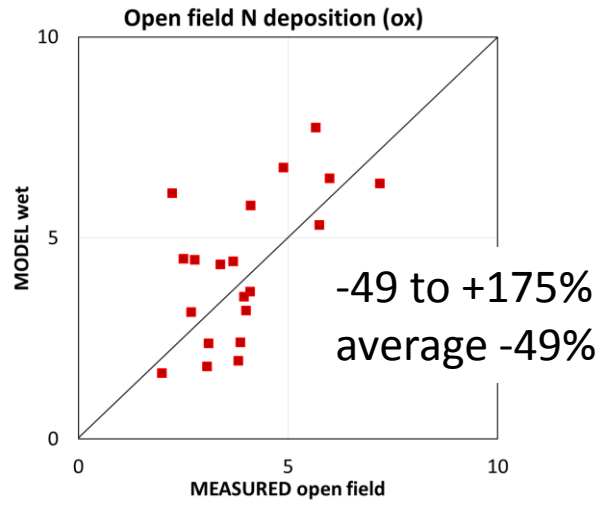
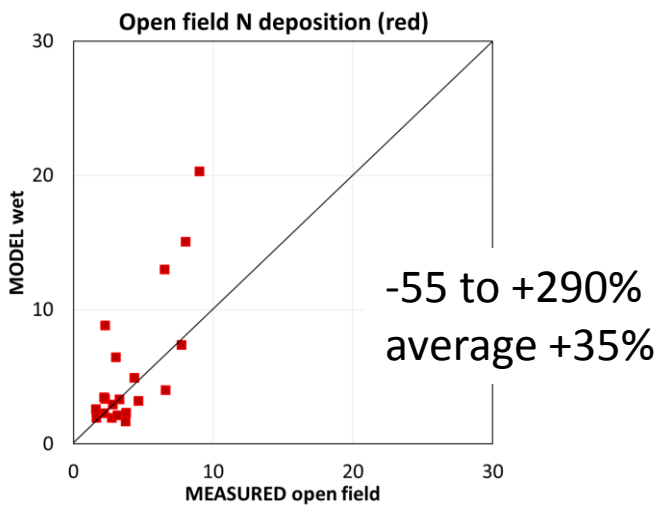
It is possible to downscale the results to the level I network?



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Comparing EMEP (50x50 km grid) emission model with measured data



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Geo-statistical model:

GLSM (generalized linear spatial model)

Response variable: N deposition

Tested predictors: latitude,
longitude,
elevation,
aspect,
annual precipitation,
land use within 3, 16 and 50 km from the plot

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AIC selection of the best predictors in a linear model evaluating all possible combination of predictors

Residual examined for spatial correlation

Trend surface updated using an optimization function and maximum likelihood estimation of the covariance function using the residuals

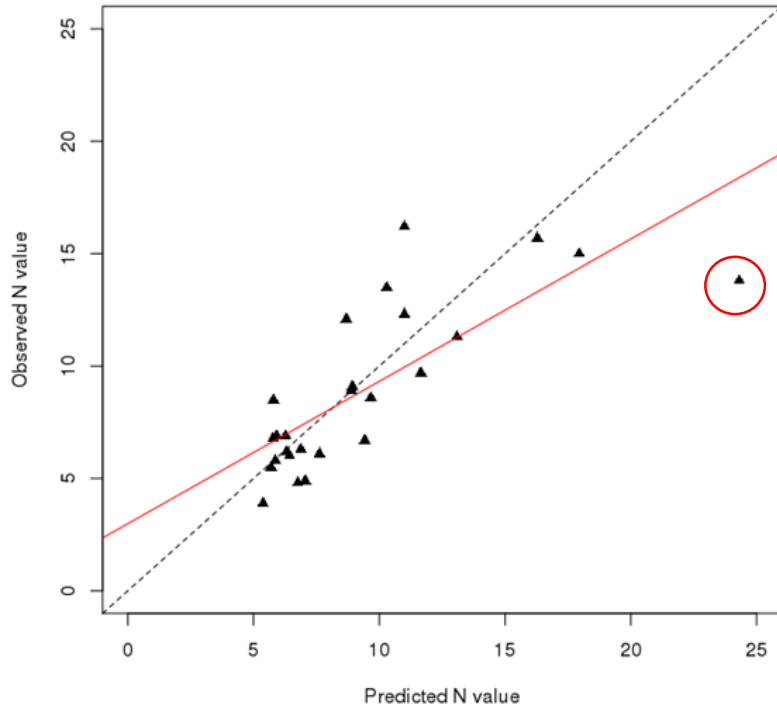
Cross-validation by leave-one-out

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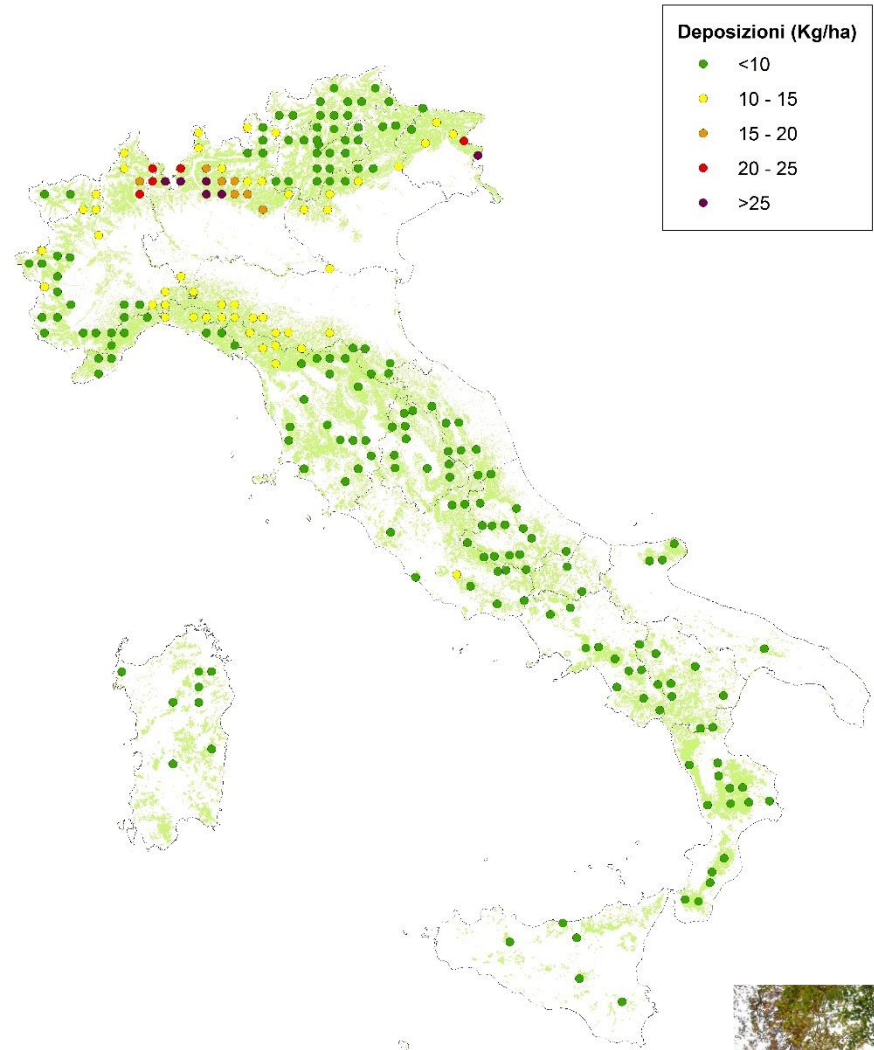
Level 2

Preliminary geo-statistical model



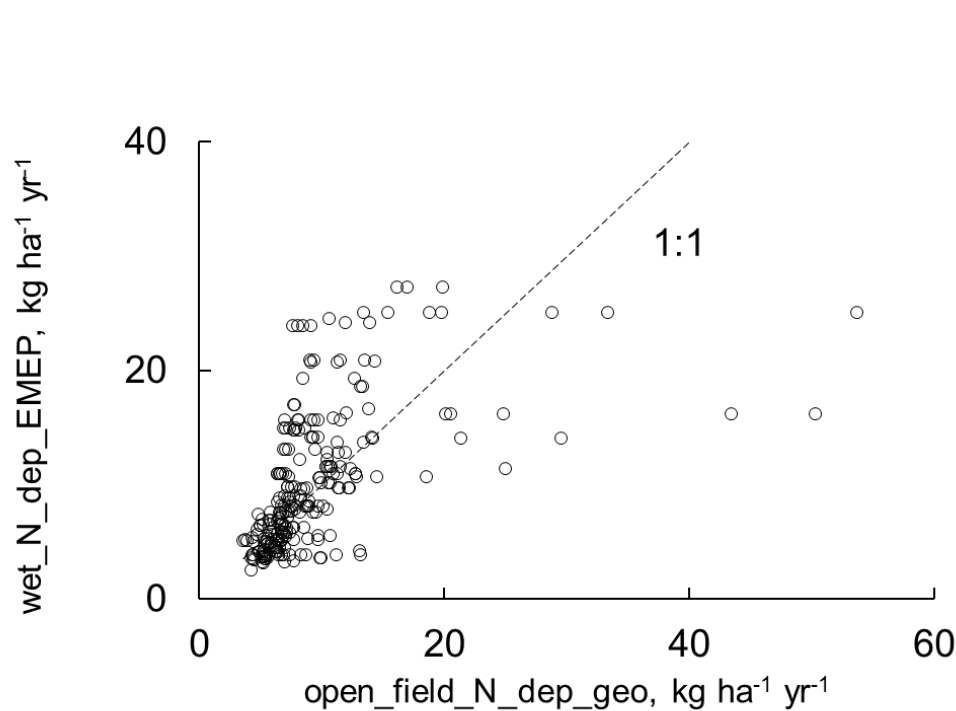
(leave-one-out validation)

an outlier in an area of high density of industry and agriculture



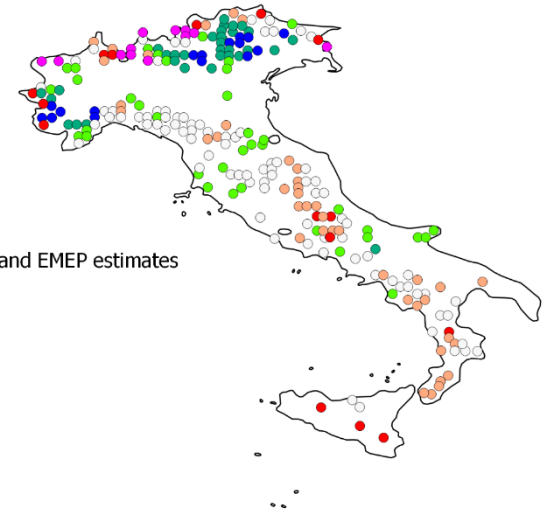
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Comparing geostatistical and EMEP estimates

- EMEP > 100% higher
- EMEP > 50 % higher
- EMEP > 20 % higher
- comparable
- geo > 20% higher
- geo > 50 % higher
- geo > 100% higher



Geostatistical model based on bulk deposition expected
 10-20% higher than wet deposition
 Good comparability at low deposition ($10 \text{ kg ha}^{-1} \text{ yr}^{-1}$)

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Next steps:

improve the model

feed correlative studies on the effect of N deposition on forests;

re-design the Italian deposition monitoring program, in terms of number of sites and their spatial allocation (retrospective design).

Thank you for your attention

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