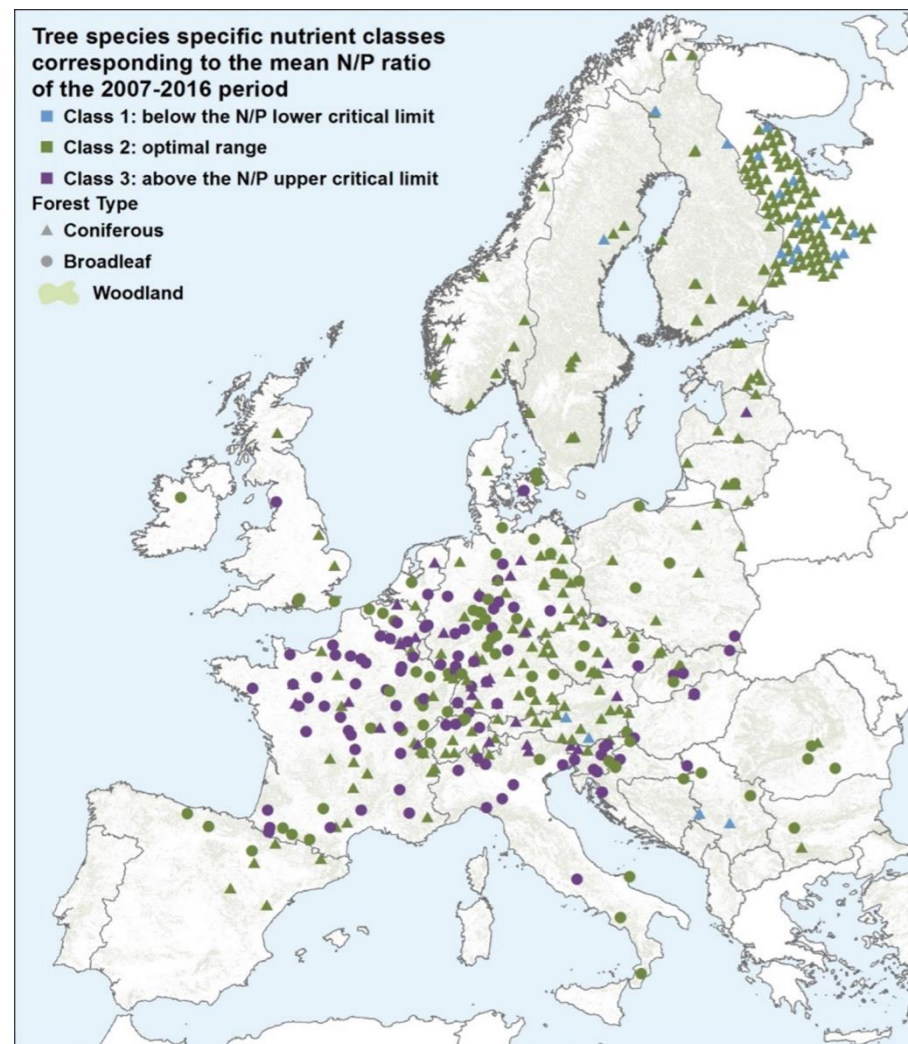


Tree nutrition increasingly imbalanced in European forests

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- ▶ A deteriorated tree nutrition is present on 30% of the intensive forest monitoring sites.
- ▶ In broadleaf forests, this is mostly due to high foliar N concentrations.
- ▶ In coniferous forests, this is due to both high foliar N and low foliar P concentrations.

Background

Element ratios in foliage are used to detect imbalances in tree mineral nutrition. Imbalances occur when the relative availability of nutrients is reduced. Despite emission reductions over the last 30 years, nitrogen (N) deposition is still high compared to pre-industrial levels in most parts of Europe while the relative availability of nutrients other than N is reduced. In forests where the soil offers only limited nutrient supply and where nutrients are removed through tree harvesting, this can result in a deterioration of tree mineral nutrition.

Nutrient imbalances have ecological and economic implications determining the resistance and resilience of forest trees to stressors such as drought or insect infestations and affects the response of forest ecosystems to global environmental change.

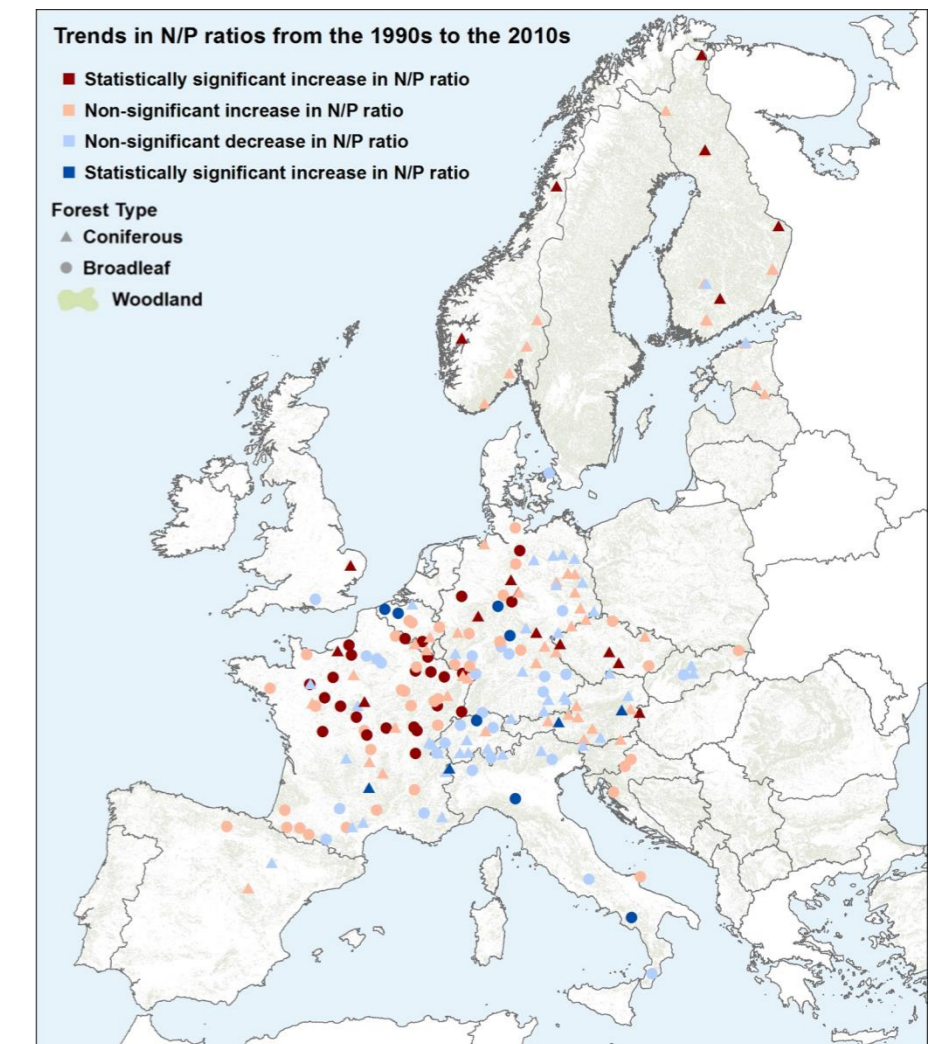
Here we use N:P ratios to assess nutrient imbalances of 469 forest sites across Europe. The sites are part of the intensive forest monitoring network (Level II) under the International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests (ICP Forests).

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Further Reading:

Krueger, I Sanders TGM, Potocic N, Ukonmaanaho I, Ratio P (2020) Increased evidence of nutrient imbalances in forest trees across Europe, *ICP Forest Brief #4 (coming soon)*
Penuelas J, Fernández-Martínez M., Vallicrosa H, Maspons J, Zuccarini P, Carnicer J, et al. (2020). Increasing atmospheric CO₂ concentrations correlate with declining nutritional status of European forests. *Communications Biology*, 3(1), 1-11.



- ▶ Overall, both foliar N and foliar P concentrations have decreased significantly over the past two decades.
- ▶ The rate of decrease in foliar P is more than double that for foliar N, resulting in a shift towards higher N:P ratios.