



ISTITUTO AGRARIO DI SAN MICHELE ALL'ADIGE

Soil hitrogen explanatory factors across a range of forest ecosystems and climatic conditions in Italy

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## Introduction



### Key issues

- The global carbon cycle is affected by N deposition.
- In order to determine the C sequestration potential of soils, N stocks and C/N ratios are essential (de Vries *et al.*, 2009).
- Limited data are available for soil N accumulation and storage in natural ecosystems (Tashi *et al.*, 2016).

### **Objective:**

 Investigate the explanatory factors of the N content and C/N ratio of Italian forests soils.



## Methods



### Data source: Italian NFI (2008-2009). n = 1499 sampling points.





Soil sampling excavation method (mini-pits)





## Methods

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### Data elaboration: Boosted Regression Tree (BRT) Models

Variable	Туре	Unit	Description	Acronym	
SITE			ROADS THE PLAN	210 5.1	
Latitude	Numerical	degrees	degrees from North	Lat	
Precipitation	Numerical	mm year-1	30 year average	Р	
Air temperature	Numerical	°C	30 year average	Т	
Aspect	Numerical	degrees	Azimuth degrees from North	Aspect	
Slope	Numerical	degrees	Avg. slope of the sampling plot	Slope	
STAND Forest category	Categorical		According to the NFI classification	For Cat	
Dominant height	Numerical	m	Avg. height of the 3 largest trees/plot	Dom H	
Trees per ha	Numerical	n ha <sup>-1</sup>	Measured on site	Tr ha	
Basal area	Numerical	m <sup>2</sup> ha <sup>-1</sup>	Measured on site	G	
Wood increment	Numerical	m <sup>3</sup> ha <sup>-1</sup>	Derived from wood cores	WI	
Forest age	Categorical	they the se	Derived from wood cores	Age	
SOIL Surface rocks	Numerical	%	% of sampling plot covered by rocks	S rocks	
Soil type	Categorical	L. Black	According to WRB(1998)	Soil	
FH layer thickness	Numerical	cm	Avg. thickness measured on site	FH depht	
0-10 cm soil bulk density	Numerical	g cm <sup>-3</sup>	Measured	Bd 0-10	
10-30 cm soil bulk density	Numerical	g cm <sup>-3</sup>	Measured	Bd 10-30	

16 plot-related variables were grouped according to: **Site**, **Stand** and **Soil** features.

### Soil C/N ratio (FH layer)

Distribution of the sampling points grouped into three classes according to C/N ratio of the FH soil layer.



# ResultsAverage C/N ratio (FH layer) according to forest category(avg. C/N = $19.3 \pm 4.6$ ; n = 1404)





### Soil N pools for different forest categories (avg. N = 662.8 ± 316.6 gm<sup>-2</sup>)

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### BRT model results for N and C/N ratio

Dependent Variable	1st	2nd	3rd	Ν
and the second	Expl. factor	Expl. factor	Expl. factor	
N, L (g m <sup>-2</sup> )	For Cat (26.3)	FH depth (16.1)	T (14.2)	1404
N, FH (g m <sup>-2</sup> )	S rocks (21.6)	For Cat (19.0)	FH depth (14.5)	1404
N, Mineral $_{0-10 \text{ cm}}$ (g m <sup>-2</sup> )	For Cat (27.8)	S rocks (10.1)	Soil (9.5)	1404
N, Mineral 10-30 cm (g m <sup>-2</sup> )	For Cat (23.7)	Soil (13.2)	S rocks (12.0)	1404
N, total (g m <sup>-2</sup> )	For Cat (24.8)	Lat (12.0)	Soil (11.7)	1404
C/N, L	For Cat (49.1)	Lat (7.7)	Dom H (7.5)	1275
C/N, FH	For Cat (32.2)	Slope (14.6)	Lat (9.3)	1288
C/N, total	For Cat (38.8)	Soil (11.1)	Lat (8.7)	1404

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### BRT model results for N and C/N ratio (conifers vs. broadleaves)

Dependent Variable	R <sup>2</sup> Fit	rRMSE Fit	1st Expl. factor	2nd Expl_factor	3rd Expl. factor	N.
	I'll	110			Expl. lactor	
Conifers, N, Total	0.64	34.6	S rocks (17.5)	Lat (11.5)	Soil (8.4)	426
Broadleaves, N, Total	0.49	41.5	Soil (17.6)	Lat (14.2)	S rocks (11.4)	918
Conifers, C/N, FH	0.53	18.0	FH depth (15.4)	Lat (11.4)	Soil (9.1)	406
Broadleaves, C/N, FH	0.44	19.3	Slope (27.0)	Lat (13.5)	Soil (12.7)	829



## Conclusions



✓ On average BRT models explained about 50% of the N variability.

 Forest category was the main explanatory factor of soil N, followed by latitude and soil type.

 The same factors influence soil N distribution within broadleaves and conifers but with different RI.



# Thanks for your attention!



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Rodeghiero et al. (2018) - Forest Ecology and Management, 408: 25:35.