INMS Towards the Establishment of an International Nitrogen Management System
Lisboa 27-28 April 2015

Assessing and attributing Nitrogen impacts in Portugal

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cE3c centre for ecology, evolution and environmental changes

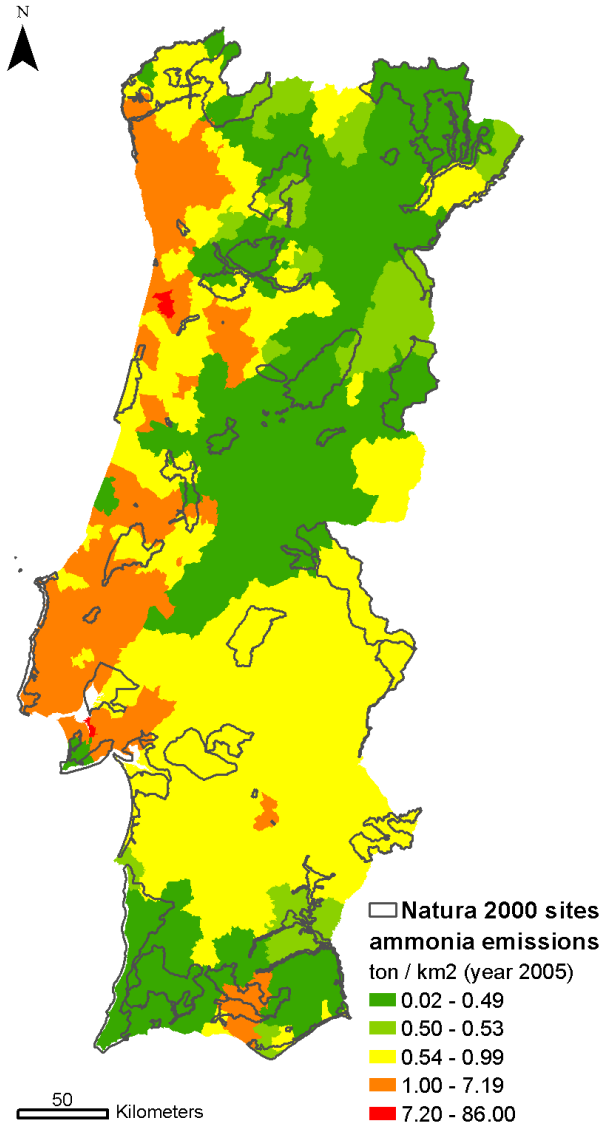
CERENA Centro de Recursos Naturais e Ambiente

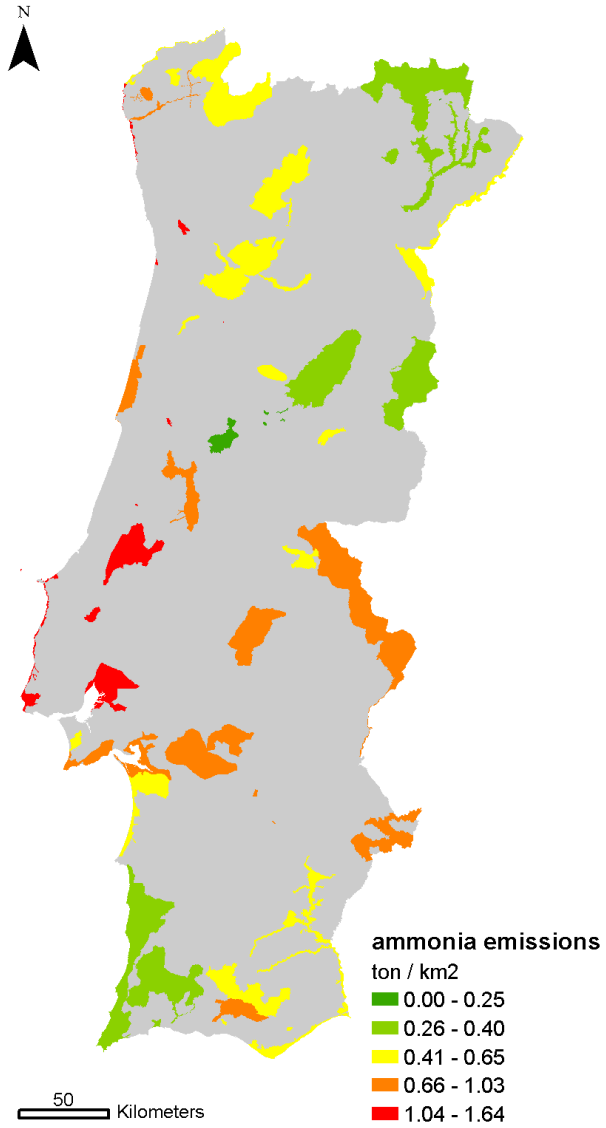
TÉCNICO LISBOA

cE3c
centre for ecology, evolution and environmental changes

research on ecological patterns &processes, studying the divers and impacts of environmental change

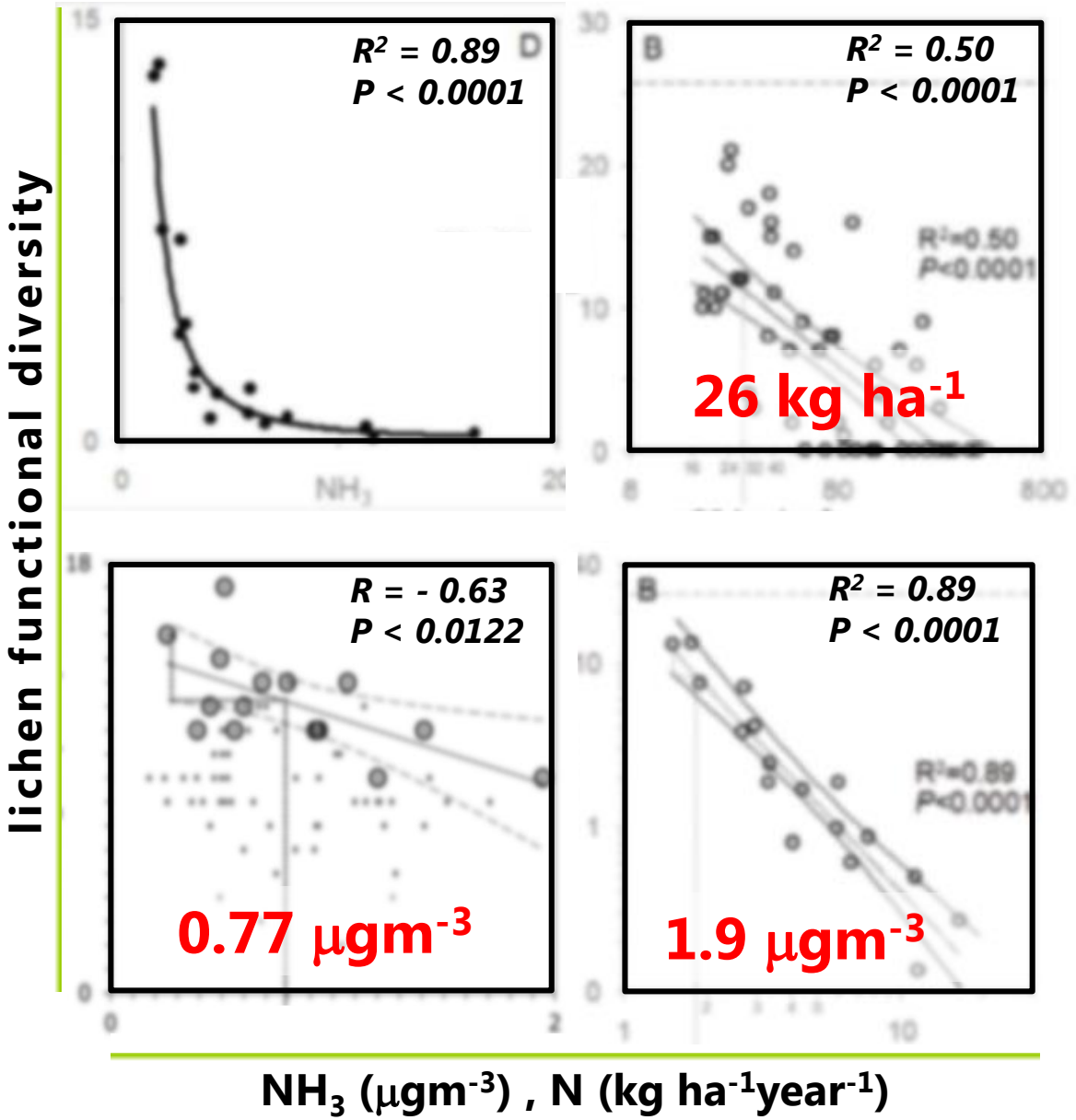
- **agro-forestry systems**
- **urban ecosystems**
- **biological invasions**
- **environmental changes**





- **Mapping cattle atmospheric ammonia emissions for Portugal and Natura2000**

Martins-Loução MA, Cruz C, Pinho P, Dias T, Branquinho C. 2011. Nitrogen deposition and Natura 2000 sites in Portugal. In Hicks WK, Whitfield CP, Bealey WJ, Sutton MA (eds.) Nitrogen Deposition and Natura 2000- Science & practice in determining environmental impacts (Book of Proceedings of the COST729 Mid-term workshop, 19-20 May Brussels), pp. 260-268 (http://cost729.ceh.ac.uk/n2kworkshop)



- **Using functional diversity on Mediterranean evergreen woodlands**
- **Critical loads for nitrogen deposition**
- **Critical levels of atmospheric ammonia**

Pinho P, Dias T, Cruz C, Sim YT, Sutton MA, Martins-Loução MA, Máguas C, Branquinho C (2011) Using lichen functional-diversity to assess the effects of atmospheric ammonia in Mediterranean woodlands. Journal of Applied Ecology 48: 1107-1116 (http://dx.doi.org/10.1111/j.1365-2664.2011.02033.x).

Pinho P, Theobald MR, Dias T, Tang YS, Cruz C, Martins-Loução MA, Máguas C, Sutton M, Branquinho c (2012) Critical loads of nitrogen deposition and critical levels of atmospheric ammonia for semi-natural Mediterranean evergreen woodlands. Biogeosciences 9: 1205-1215 (http://dx.doi.org/10.5194/bg-9-1205-2012).

Pinho P, Llop E, Ribeiro M, Cruz C, Soares A, Pereira MJ, Branquinho C (2014) Tools for determining critical levels of atmospheric ammonia under the influence of multiple disturbances. Environmental Pollution 188: 88–93 (see: http://dx.doi.org/10.1016/j.envpol.2014.01.024).

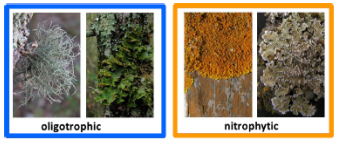
Nitrogen Pilot Survey

http://data.lter-europe.net/ilter_deims/nitrogen-pilot-survey-view

What are the ecosystem responses to excess Nr across global ecosystems?

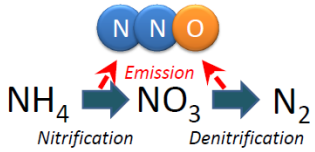
Nr: Reactive nitrogen (all N species except N_2)

Lichen and mosses
- Early warning -



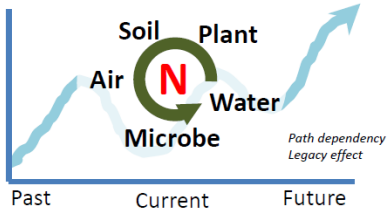
Can we use lichen and mosses as

N_2O emission
- Ecosystem process -



What are regional and global

N cycle & budget
- Legacy impact -



- **downscaling nitrogen emission mapping**
- **critical loads and levels for other Mediterranean ecosystems (Spain)**
- **iLTER nitrogen initiative (lead by Hideaki Shibata)**

FCT
Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA EDUCAÇÃO E CIÊNCIA

These works have been made possible by FCT-MEC funding:

LTERmontado | Long-term socio-ecological research and monitoring in a Mediterranean cultural landscape | LTER/BIA-BEC/0048/2009 | http://www.ltsermontado.pt

DesertWarning | Modeling Ecosystem Structure and Functional Diversity as early-warning indicators of Desertification and Land-degradation | PTDC/AAC-CLI/104913/2008 | http://ecofun.fc.ul.pt/projetos/desertwarning

Grant SFRH/BPD/75425/2010 | Searching for critical thresholds of desertification and land-degradation: from local to global scale

ecofun.fc.ul.pt/Activities/nitrogen

- Tools for determining critical levels of atmospheric ammonia under the influence of multiple disturbances +info
- Can ammonia tolerance amongst lichen functional groups be explained by physiological responses? +info
- Nitrogen tolerance in the lichen Xanthoria parietina: the sensitive side of a resistant species *+info*
- Physiological response of the epiphytic lichen Evernia prunastri (L.) Ach. to ecologically relevant nitrogen concentrations *+info*
- Lichen functional groups as ecological indicators of the effects of land-use in Mediterranean ecosystems *+info*
- Critical loads of nitrogen deposition and critical levels of atmospheric ammonia for Mediterranean evergreen woodlands *+info*
- Impact of an exotic N2-fixing Acacia on composition and N status of a native Mediterranean community *+info*
- Effect of nitrogen supply on the C:N balance in the lichen Evernia prunastri (L.) Ach *+info*
- Nitrogen deposition effects on Mediterranean-type ecosystems: An ecological assessment *+info*
- Using lichen functional-diversity to assess the effects of atmospheric ammonia in Mediterranean woodlands *+info*
- Policies for plant diversity conservation on a global scale: a Nitrogen driver analysis *+info*
- Assessment of Critical Levels of Atmospheric Ammonia for Lichen Diversity in Cork-Oak Woodland, Portugal *+ info*
- Linking N-driven biodiversity changes with soil N availability in a Mediterranean ecosystem *+info*
- Nitrogen deposition effects on Mediterranean-type ecosystems: an ecological assessment *+info*
- Do lichens have "memory" of their native N environment? *+info*
- Intracellular and extracellular ammonium (NH4+) uptake and its toxic effects on the aquatic biomonitor *Fontinalis antipyretica* +info
- Causes of change in nitrophytic and oligotrophic lichen species in a Mediterranean climate: Impact of land cover and atmospheric pollutants *+info*
- Heterogeneity of soil surface ammonium concentrations and other characteristics, related to plant specific variability in a Mediterranean-type ecosystem *+info*

Cristina Branquinho
Maria Amélia Martins-Loução
Margarida Santos-Reis
Laura Aguillaume
Hideaki Shibata

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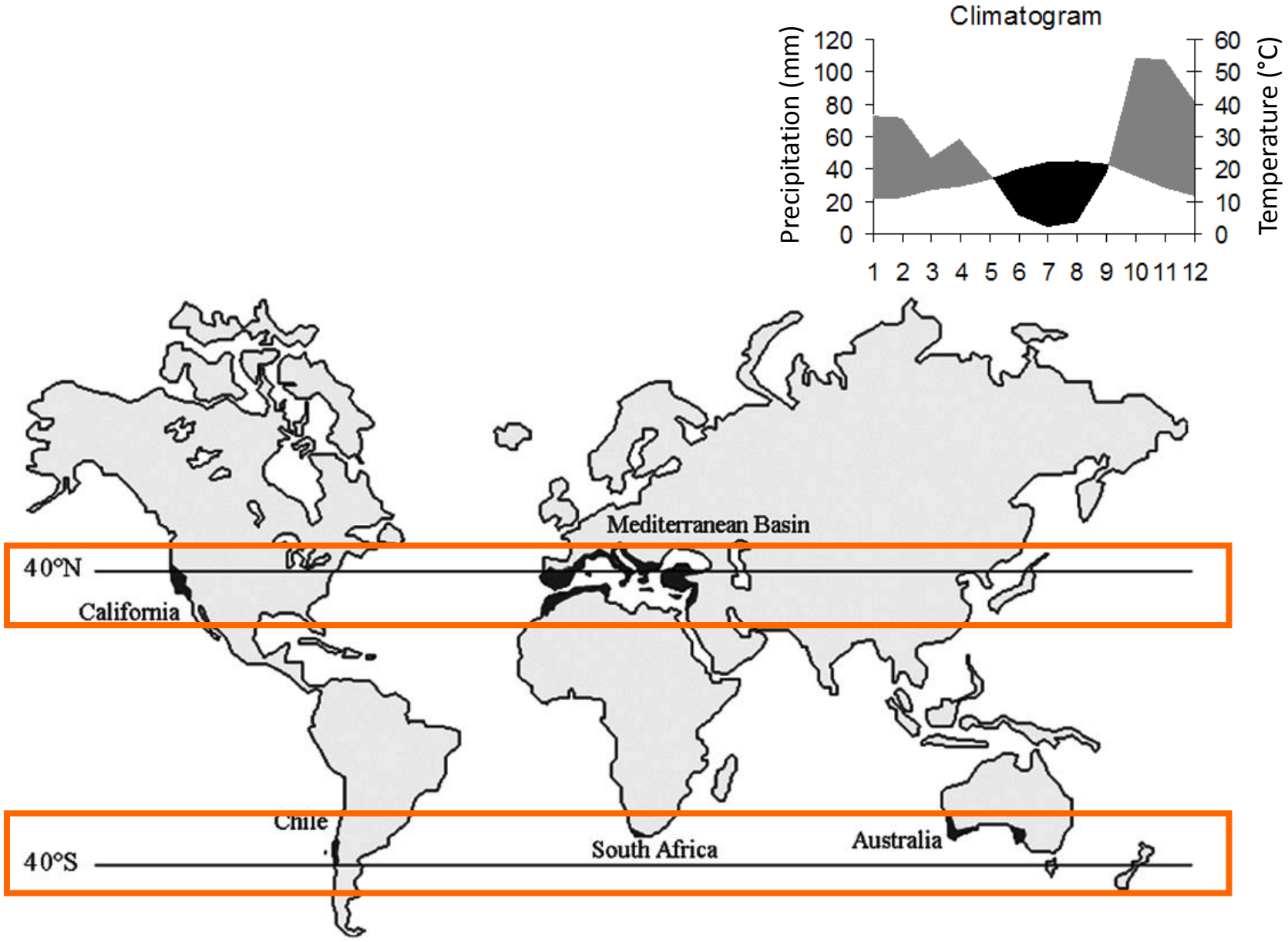
Case 4: Developed countries with excess reactive N loss



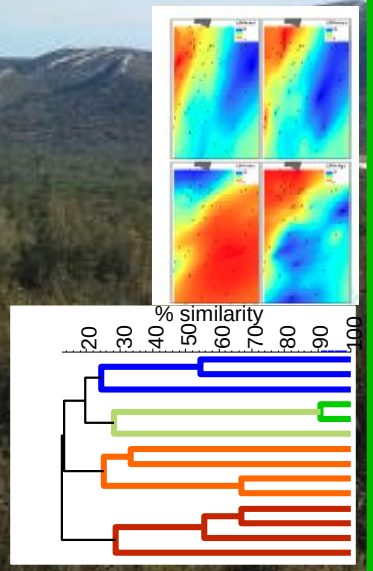
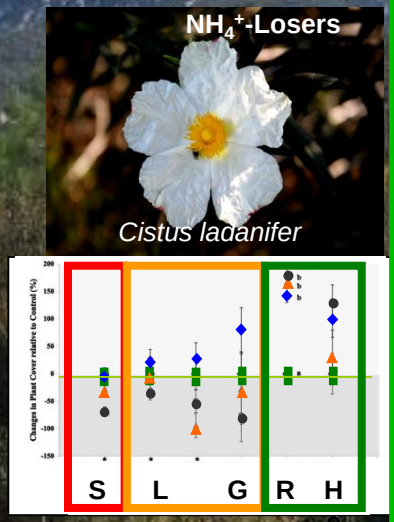
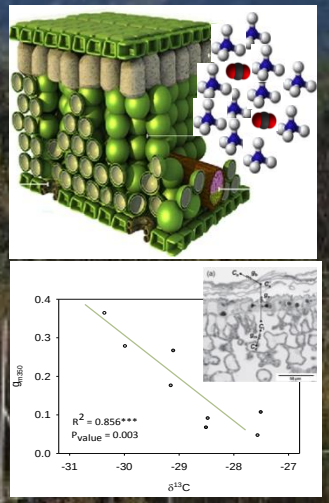
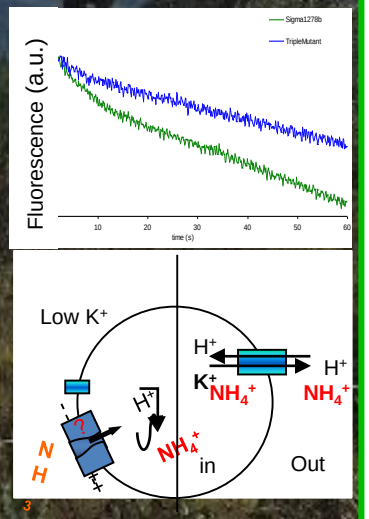
Cody and Mooney 1978, Annual Review of Ecology, Evolution & Systematics, 9: 265-271

Mediterranean landscape heterogeneity

+ NH_y

+ NO_x

EX: AMMONIUM IN THE ECOSYSTEM

Landscape	Community	Individual	Molecular
			
Achievements N CLe for Med.	**Achievements** Unique field site N CLo for Med.	**Achievements** Phsyiol of NH_4^+ toxicity	**Achievements** Mechanisms of NH_4^+ toxicity

Knowledge Integration

EX: AMMONIUM IN THE ECOSYSTEM

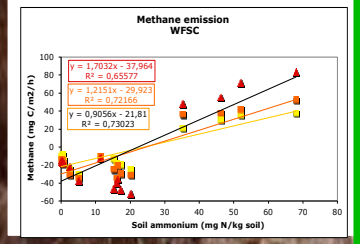
This is aboveground…..

and

BELOWGROUND?

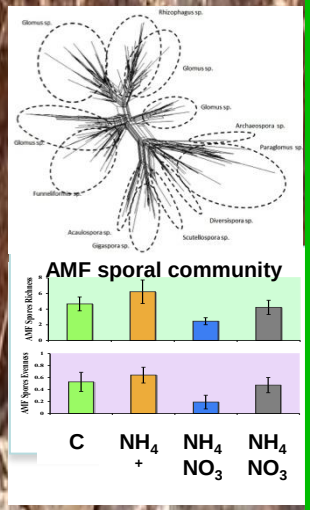
EX: AMMONIUM IN THE ECOSYSTEM

Landscape



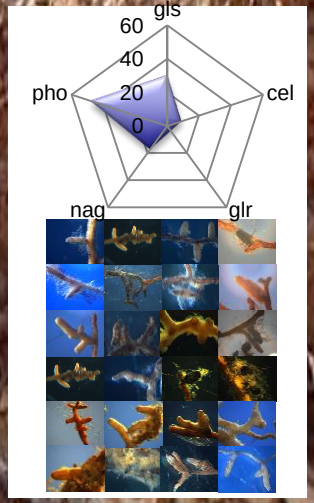
Achievements
Med soil sink of GHG
-BUT……N

Community



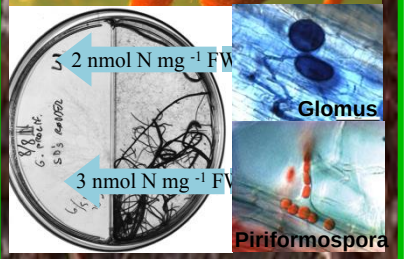
Achievements
Soil biodiversity as an indicator of N status.

Individual



Achievements
Relation between structure and function

Molecular



Achievements
Efficiency of N acquisition

Knowledge Integration

Our approach