C⁴ WORKSHOP
CLIMATE CHANGE AND CARBON CYCLE
June 22-24 2022
CNR Research Area, Pisa, Italy

Combining bio-geochemistry, remote sensing and social sciences to assess the effects of land use change within the CZ framework: the ABRESO project

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Istituto di Geoscienze e Georisorse

Consiglio Nazionale delle Ricerche

BELMONT FORUM

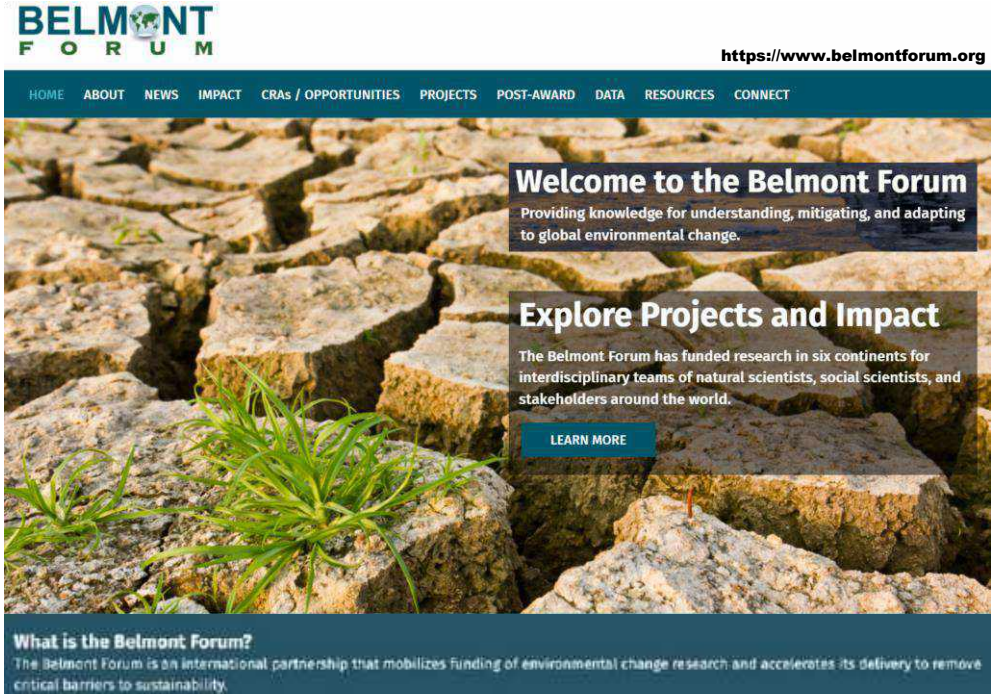
ABRESO
Land use: Social Views

Istituto sull'Inquinamento Atmosferico

CNR IRET
Istituto di Ricerca sugli Ecosistemi Terrestri

IRCrES
ISTITUTO di RICERCA sulla CRESCITA ECONOMICA SOSTENIBILE
RESEARCH INSTITUTE on SUSTAINABLE ECONOMIC GROWTH

UNIVERSITÀ DI PAVIA



ABRESO
Land use: Social Views

Abandonment and rebound: Societal views on landscape- and land-use change and their impacts on water and soils

WHERE?

3 study sites on the Italian Alps

High biodiversity alpine semi-natural grasslands are recognized as “priority status habitat”, by the European Habitat Directive (92/43/EEC)

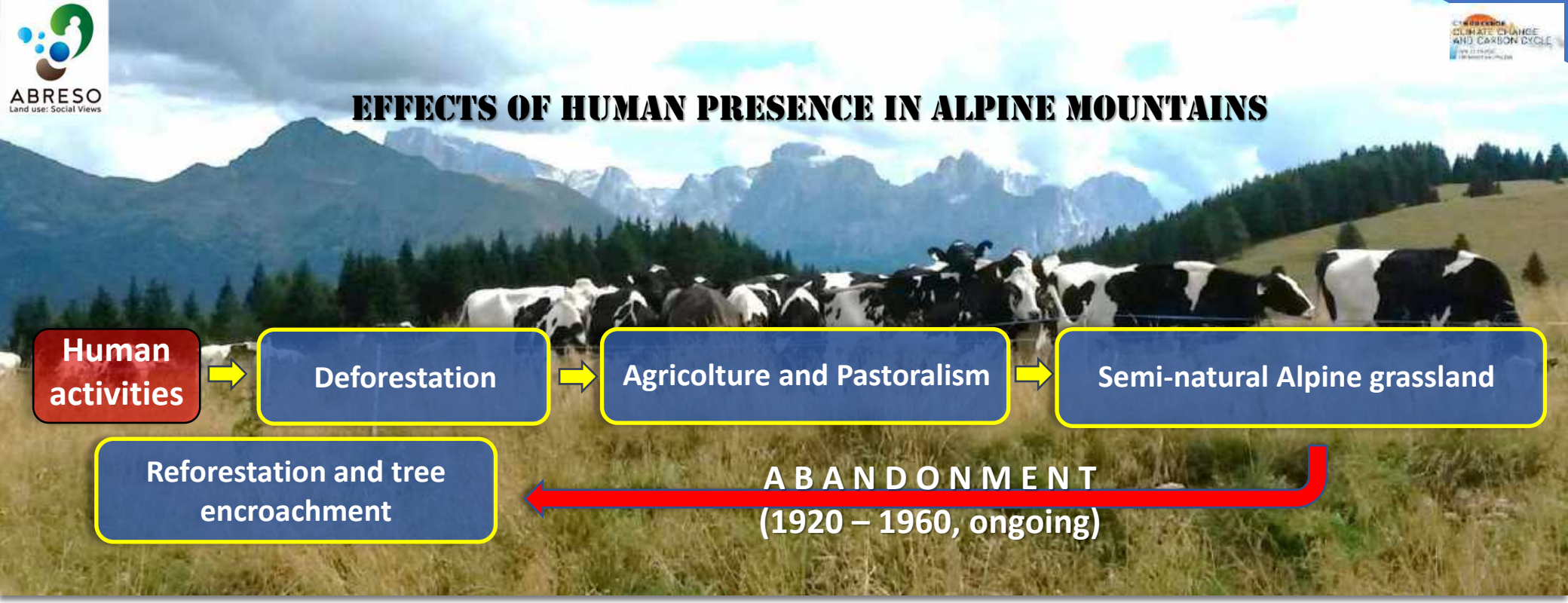
NATURAL & SOCIAL SCIENCE

Soil biochemistry
Environmental geochemistry
Geomorphology

Plant physiology
Remote sensing algoritms
Phenology

Economics of complex systems
Policy evaluation
Economic territory planning

EFFECTS OF HUMAN PRESENCE IN ALPINE MOUNTAINS



Ecosystem services in semi-natural alpine grassland:

CULTURAL

- Recreation
- Cultural heritage
- Educational and aesthetic value

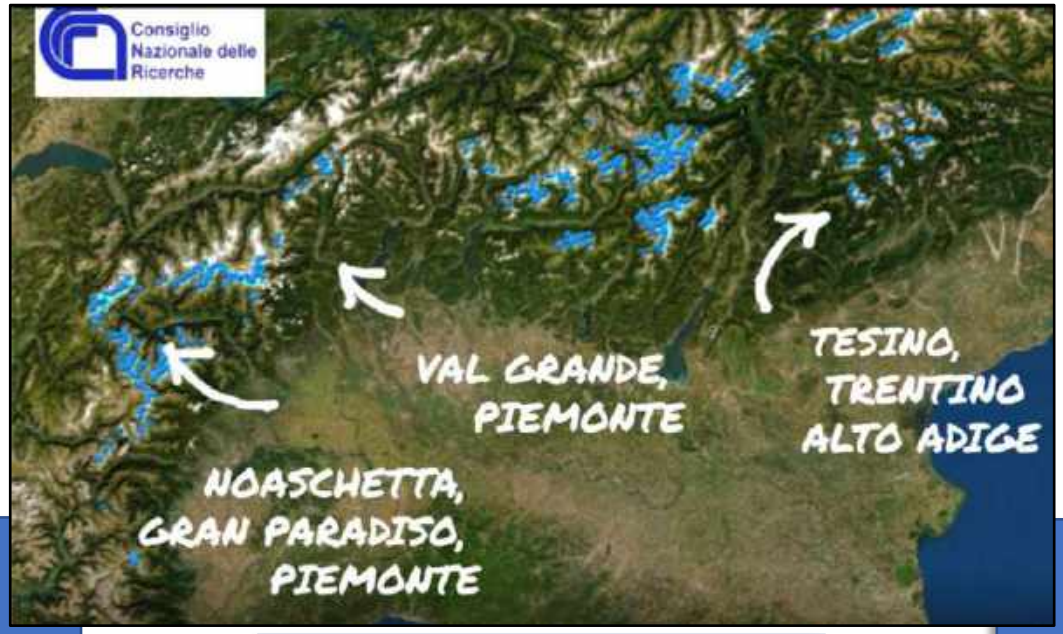
PROVISIONING

- Dairy products
- Honey, Forage
- Medicinal and human food plants
- Biomass for energy

ENVIROMENTAL REGULATION

- **Carbon storage and climate regulation**
- Protection from natural hazards (soil stability, landslides)
- Biodiversity and soil fertility
- Habitats for wild animals

SELECTED ITALIAN SITES



Noaschetta, Gran Paradiso National Park , Piemonte

Elevation: 1600 m
Watershed area: 25 km^2
Population: 106

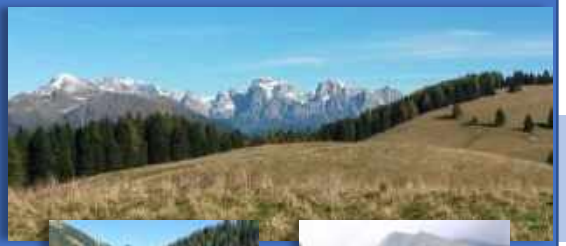
Val Grande National Park, UNESCO, Piemonte

Elevation: 800-1300 m
Watershed area: 150 km^2
Population: ca. 17



Tesino (Malga Telvagola, Brocon) Trentino Alto Adige

Elevation: 1700 m
Watershed area: 90 km^2
Population: 4307

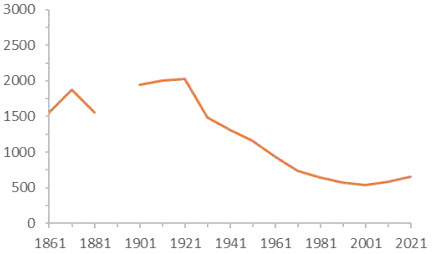


ABANDONMENT EFFECTS ON THE SELECTED STUDY CASES

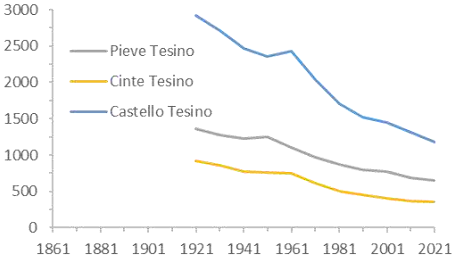
Noasca: pasture abandonment and tree recolonization

NOASCA, residents 1861 - 2021

COSSOGNO, residents 1861 - 2021

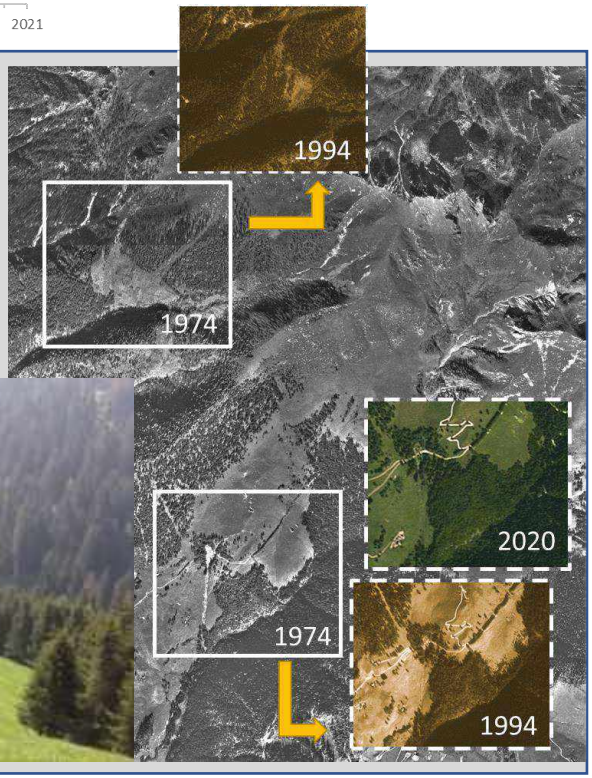


TESINO, residents 1921 - 2021



Val Grande: terraces abandonment depopulation and ageing

Tesino:
Tree encroachment over grasslands alpine pasture



CARBON CYCLE MONITORING AND ECOSYSTEM PRODUCTIVITY

Eddy Covariance tower

Flux chamber

Assessing the effects of land-use changes on **plant biodiversity**, **carbon sequestration** and **nutrient cycling**

FIELD MEASUREMENTS

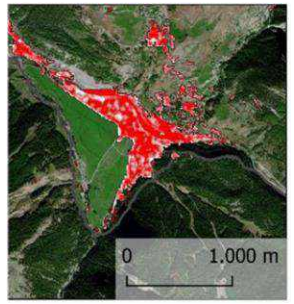
- ECOSYSTEM CARBON FLUX
- CARBON FIXED IN PLANTS
- CARBON STORED IN SOIL

SPAD meter
(Clorophyll content)

Satellite imagery

REMOTE SENSING (SATELLITE)

- LAND COVER AND SNOW COVER
- PRIMARY PRODUCTIVITY AND SOIL ORGANIC CARBON FOR DIFFERENT LAND-USE



SAMPLING AND LAB FACILITIES

80 soil samples

- Old forest
- Young forest
- Pasture
- Grassland

Depths 0-10 cm
10-20 cm

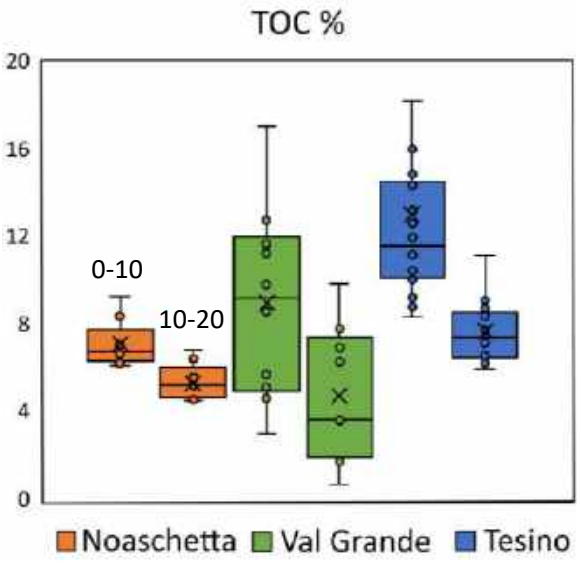
Sample preparation:

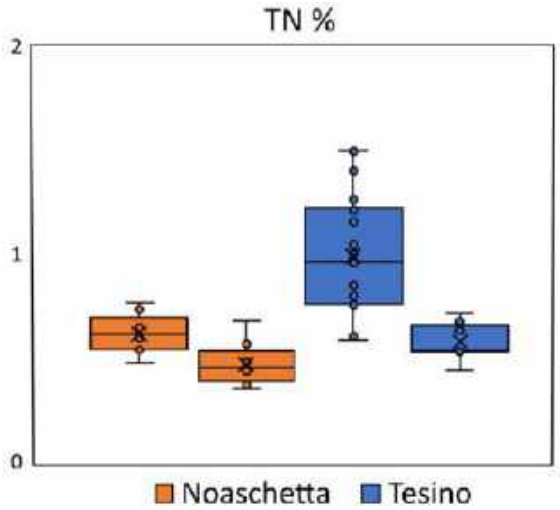
- Sieving
- Milling
- TOC separation

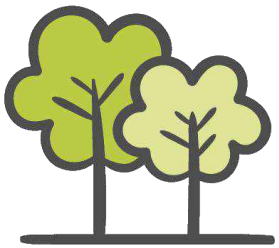
Elemental analyzer associated to IRMS

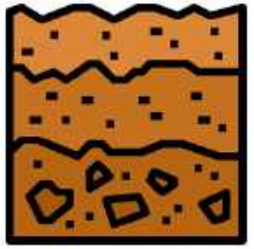
Sequential measurement of **C, N concentration** and **isotopic signature ($\delta^{13}C$, $\delta^{15}N$)**

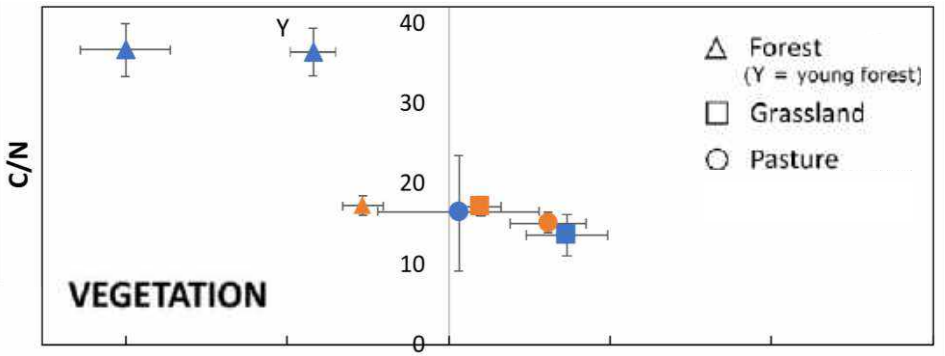
Soil-vegetation relationship (C, N)

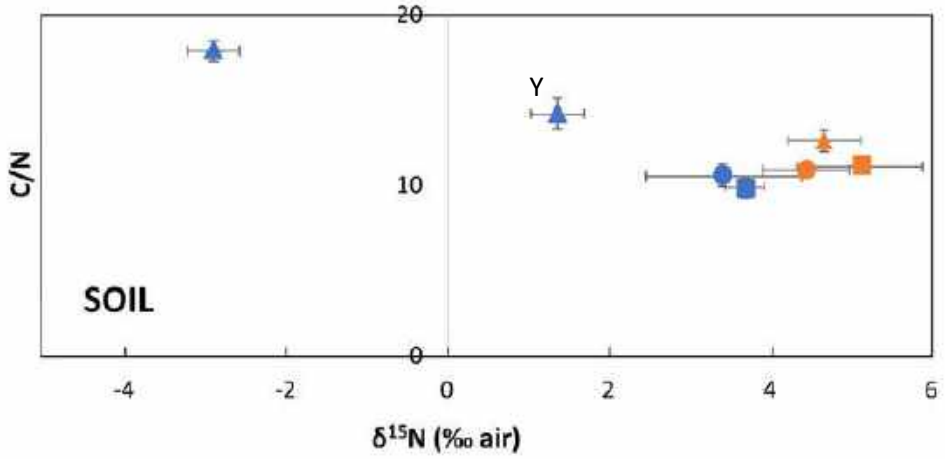






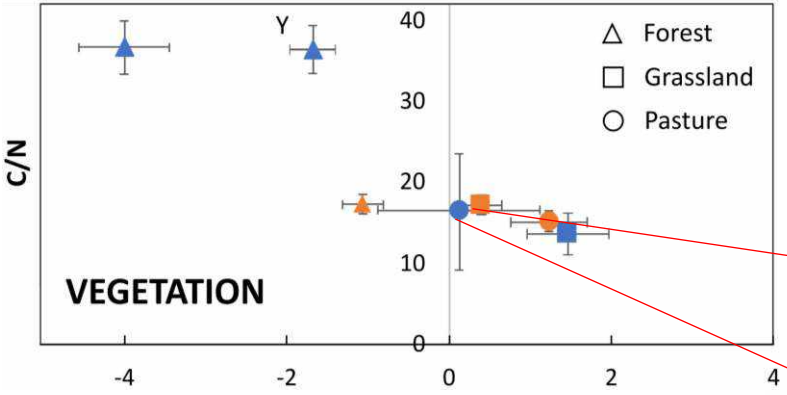


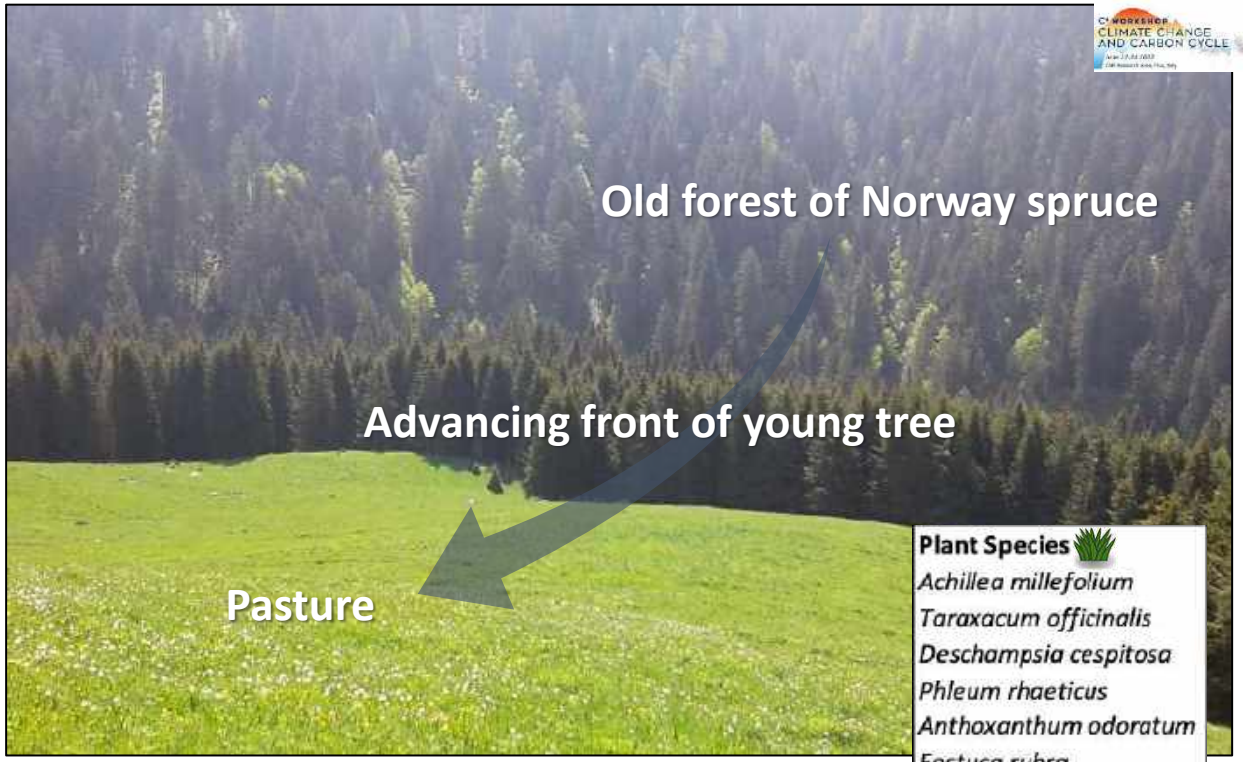




Transition from pasture to forest induces a strong **reduction of biodiversity**

Change in C/N ratio and isotopic signatures of SOM and plants tracing this process





Plant Species

Achillea millefolium
Taraxacum officinalis
Deschampsia cespitosa
Phleum rhaeticus
Anthoxanthum odoratum
Festuca rubra
Avenula pubescens
Poa pratensis
Avenula versicolor
Dactylys glomerata
Crocus albiflorus
Lathyrus pratensis
Trifolium pratensis
Trifoluum repens
Vicia sepium
Colchicum autunnale
Veronica arvensis
Rumex acetosa
Ranunculus acris
Trollius europeaus
Alchemilla vulgaris
Cruciata laevips

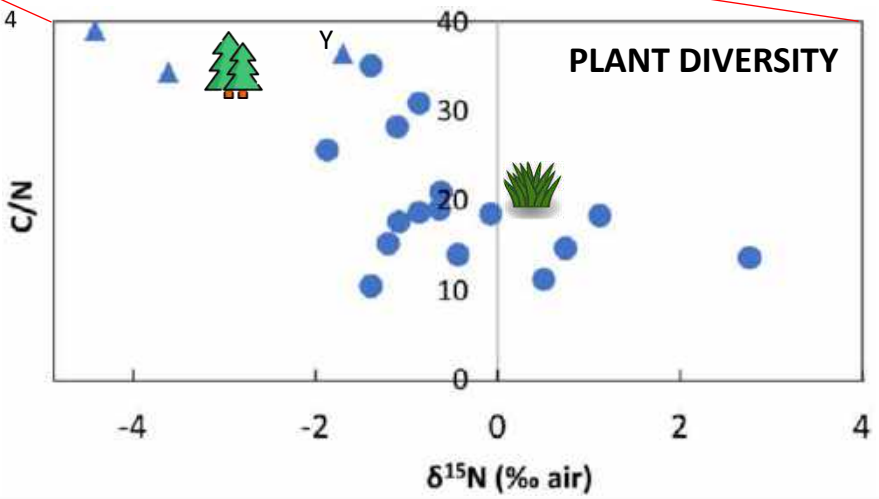
Higher biodiversity

⇩

Functional diversity

⇩

Greater adaptability to climate change

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AND CARBON CYCLE
ABRESO
Land use: Social Views
Stakeholders perception
of land use change?


CLIMATE CHANGE
AND CARBON CYCLE
THANK YOU!