The Biological Reclamation and Monitoring of Disturbed Lands
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Deforestation Level Alters the Land Use Role in Climate Change and Ecosystem Functions**

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Abstract

The main land use forms, in a watershed, such as agriculture, forest and pasture are assessed for ecosystem services. When these forms are proportionally optimum, products and services will be maximum for ecosystem needs. Unplanned and irregular changes as deforestation and degredation in land uses affect ecosystem functions, adversely. Initially, changes in the land use regime in forest ecosytems particularly affect the above-ground biomass as well as the total carbon stock and soil erosion degree, which is vital importance for climate change and desertification events, two of the most important environmental problems of the 21st century. In this study, the ecological impact levels on carbon stock and soil erosion resulted from converted into in the last 40 years pasture, hazelnut and annual agricultural (cabbage) areas of Oriental Spruce and Oriental Beech forests in the Kiremitli location of Maçka district in Trabzon, Turkey were investigated.

As a result, the aboveground biomass including trees, living and litter layer in the spruce forest was calculated as 95.2 t/ha and the soil organic carbon stock was calculated as 410.70 t/ha and total carbon stock was determined as **505.9 t/ha**. In the Beech stand, aboveground biomass value was 158.4 t/ha and soil organic carbon stock was 179.3 t/ha and the total organic carbon stock was determined as **337.7 t/ha**. Soil erosion rate were approximately 1.4 t/ha/yr in Spruce while this value was approximately 3.5 t/ha/yr in Beech forest. In the last 40 years, with the conversion of spruce and beech forests to pasture, hazelnut and annual (cabbage) agricultural areas, the amount of erosion has increased significantly ($p<0.05$), while the total carbon stock has decreased ($p<0.05$). For instance, the conversion of spruce forests to annual agricultural area decreased the total organic carbon stock by 7 times, while the amount of erosion increased 17 times. Consequently, these results clearly has been disclosed the impact of land degradation on climate change and desertification events.

Key words: Land degredation, Disturbed lands, Erosion, Ecosystem carbon stock

**Some part of results were published in FEB (31/02, 2239-2249, 2022)

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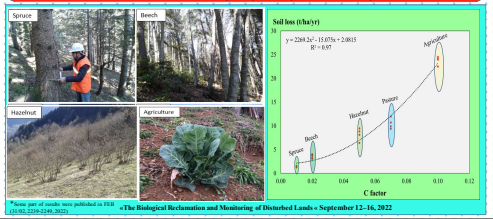

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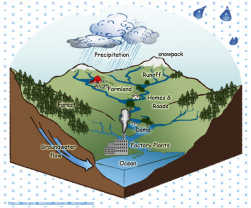
Introduction



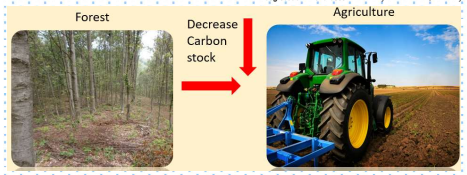
Land Use Effects

The main land use forms, in a watershed, such as agriculture, forest and pasture are assessed for ecosystem services. When these forms are proportionally optimum, products and services will be maximum for ecosystem needs.

Introduction

Land Use Effects

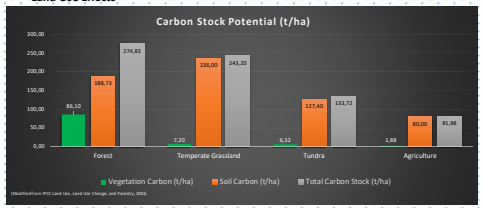
Unplanned and irregular changes as **deforestation** and **degredation** in **land uses** affect ecosystem functions, adversely.



- There is a strong relationship between land use pattern and carbon stock potential (Twesigye, 2011).
- Total Carbon stock will be decrease if forest area converted into the agricultural area (Inoue, et al. 2010; Pascual, 2005).

Introduction

Land Use Effects

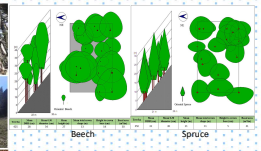


(Modified from IPCC Land Use, Land Use Change, and Forestry, 2003)

Carbon stock potential has an important effect on environmental problems like soil erosion and climate Change (Pauze and Colaire, 2014).

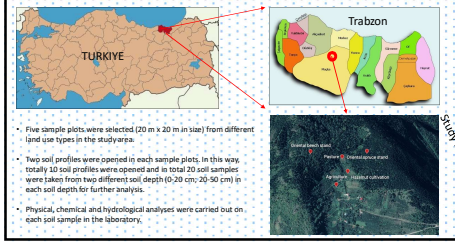
Introduction





In this study, the ecological impact levels on carbon stock and soil erosion resulted from converted into in the last 40 years **pasture**, **hazelnut** and annual agricultural (**cabbage**) areas of **Oriental Spruce** and **Oriental Beech** forests.

Material & Methods



- Five sample plots were selected (20 m x 20 m in size) from different land use types in the study area.
- Two soil profiles were opened in each sample plots. In this way, totally 10 soil profiles were opened and in total 20 soil samples were taken from two different soil depth (0-20 cm; 20-50 cm) in each soil depth for further analysis.
- Physical, chemical and hydrological analyses were carried out on each soil sample in the laboratory.

Material & Methods

Soil Loss Equation

$$A = R.K.LS.C.P$$

ABAG (Allgemeine Boden Abtrags Gleichung) (Schwertmann et al. 1990) simulation model modified from *USLE* (Universal Soil Loss Equation) (Wischmeier & Smith 1978) was used in soil loss accounting.

A=is the average annual soil loss (t/ha per year)
R= the rainfall erosivity factor
K= the soil erodibility factor
L= the slope length (m)
S= the slope (%)
LS= Topographic factor
C= the cover management factor
P= the supporting practice factor (terracing)

Factors Affecting Soil Loss

R	K	LS	C	P
Climatic	Edaphic	Topographic	Vegetative	Protective prevention

Material & Methods

Soil Carbon Stock

$$SOCS = BD \times C\,\% \times D$$ (Guo and Gifford, 2002).

SOCS: Soil organic carbon stock (t ha^{-1})
BD: Bulk density (g cm^{-3});
C: Organic carbon (%) (Walkley black)
D: Soil sampling depth (cm)

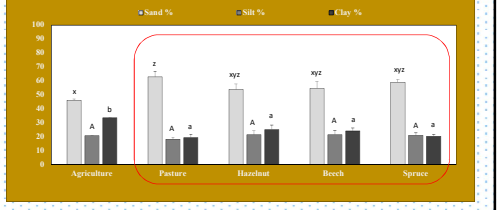


Material & Methods



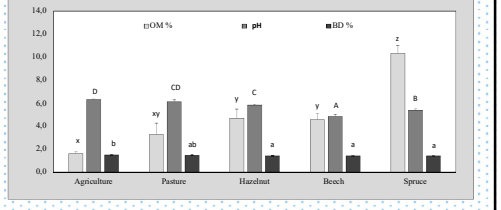
- Particle size analysis
- Organic matter
- Hydraulic concductivity
- pH
- Bulk density
- Electrical concductivity (EC)
- Total Dissolved Solid (TDS)
- Wilting point
- Saturation
- Field capacity

Results & Discussions



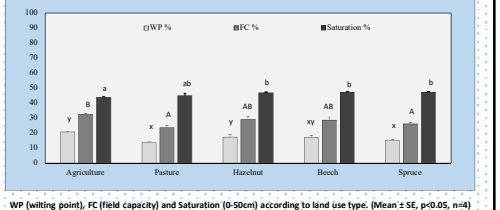
Soil texture (0-50cm) according to land use type. (Mean ± SE, p<0.05, n=4)

Results & Discussions



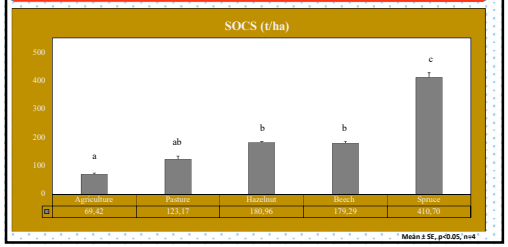
OM (organic matter), pH and BD (bulk density) (0-50cm) according to land use type. (Mean ± SE, p<0.05, n=4)

Results & Discussions

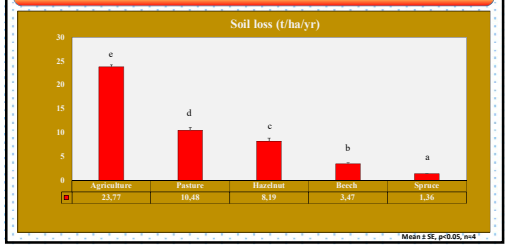


WP (wilting point), FC (field capacity) and Saturation (0-50cm) according to land use type. (Mean ± SE, p<0.05, n=4)

Results & Discussions



Results & Discussions



Conclusions

After Deforestation

- Significant changes have occurred in most soil properties as well as SOCS and soil loss by land conversion.
- With the conversion of the land that was previously a spruce forest into agricultural area, the amount of erosion has increased approximately 18 times.
- After hazelnut plantation, the amount of erosion has increased approximately 6 times.
- If these agricultural areas were converted from beech forest, the amount of erosion would have increased approximately 7 times in agricultural area and approximately 2 times in the hazelnut area.
- These values have been an indicator of how much deforestation will contribute to the more devastating effects of climate change in the future.

Thank you!

