Assessing the impacts of long-term maize cultivation using the Dynamic of total Carbon and Nitrogen Distribution (DyCNDis) model in Northwest Vietnam

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Introduction

Population growth → Agricultural intensification

Soil degradation in Northwest Vietnam

Expansion of mono maize cultivation to steep sloping areas

Evaluate the spatial development of soil fertility under mono-maize cultivation

Objective

Specific objectives

(1) Determine dynamics of total Nitrogen (Ntot) and total Carbon (Ctot)

(2) Develop the spatially explicit Dynamic of Ctot and Ntot distribution model (DyCNDis) to assess potential impact of land use change on Ctot and Ntot dynamic

Material and Methods

(1) Study site

Chieng Khoi commune, Yen Chau province, Northwest Vietnam
- Size: 3,100 ha
- Population: 2999 (in 2011)

Climate
- Temperature 24°C
- Rainfall: 1250 mm

(2) Material and Methods

(a) Transect sampling:
- Auger soil sampling every 5 m topsoil of 3 transects, 25-30 m length in slope gradient. Lab analyses Ctot and Ntot by combustion method
- Crop history obtained by interviews in the field

(b) Secondary data collection: Derived from previous studies in the same study region

Results

(1) Reduction of Ctot and Ntot along the slope gradient related with time of cultivation

(2) DyCNDis model identified 134 ha (19% of the total 708 ha) that show a high potential of soil degradation after 20 years of continuous maize mono-cultivation in Chieng Khoi commune

(3) Model validation showed satisfying EF in the range of 0.71 and a RMSE of 0.42

Discussion and Conclusions

DyCNDis model was developed successfully to assess the dynamics of changes of Ctot and Ntot concentrations at watershed level.

Providing assessment tools such as DyCNDis supports land use planners and farmers to identify locations which are susceptible to soil degradation that need urgent soil conservation measures to retain soil fertility in the long run.

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