NPP estimation of cropland and abandoned cropland using biomass sample felid spectra and field meteorological data

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1. Introduction: Net primary productivity (NPP) is a quantitative measure of the carbon absorption by plants per unit time and space. Japan is a mountainous country in which managed farmland occupies only 10% of the land area (ca.3, 868,000 ha) (Odagiri 2008). In Gifu prefecture, the abandoned area was 3,803 ha in 2000 and increased to 5,528 ha in 2005 (Gifu Prefecture, 2009). Such land abandonment activities is crucial for any study linked to landuse. Land use is a critical factor in the carbon cycle, but land-use effects on carbon distribution are poorly understood in mountainous agroecosystem, where land-use intensity decrease substantially due to politico-socio-economic reasons. However effects of farmland abandonment on carbon cycle/ carbon distribution are unclear. Our objective is to estimate and mapped NPP of cropland and abandoned cropland over our study site.

2. Materials and method: Incident PAR (PAR_0), PAR reflectance (PAR_{ref}), PAR transmittance (PAR_{Trans}) and PAR background (PAR_{back}) were measured in the field using LI190SA sensor. fAPAR was calculated by the following equations (1&2)

$fAPAR=APAR / PAR_0$ --------- (1) and $APAR= PAR_0 - PAR_{ref} - PAR_{Trans} + PAR_{back}$ -------- (2)

Spectral reflectance was measured in the fields by handheld spectroradiometer (MS 720, version 1.3, EKO Instruments, and Japan 2004 and Normalized Difference Vegetation Index (NDVI) was calculated. Regression analysis was done between fAPAR and field NDVI.08 July NPP map were produced by QB image after atmospheric correction by Dark Object Subtraction (DOS) method (Chavez 1988). NDVI of QB was incorporated by fAPAR to get the spatial NPP distribution of our study site using the equation (3) $NPP=\sum LUEi \times fAPARi \times PARi$ (3)

Here, LUE= Light Use Efficiency, fAPAR= Fraction of Photosynthetic Active Radiation, PARi=Photosynthetic Active Radiation and i=growing season, LUE was calculated for crop and non crop vegetation by the following equation (4) LUE= NPP/ APAR---- (4)

3. Results and discussion: NDVI had linear relationship with fAPAR in our study site which includes cropland and abandoned cropland. A scatter plot and regression equation for ground measured NDVI and fAPAR is given Figure 1.We originally calculated LUE value for different crop and non crop vegetation in our study site. Using LUE value, ground fAPAR (simulated from ground NDVI), PAR (Asia Flux site TKY) data we estimated NPP of our study site. Spatial distribution NPP map of 8 July 2007 was also produced. This suggested that ground based NPP estimation model can be applied to the July image. Darker areas represent higher NPP. 4. **Conclusions:** Our study showed the possibility of NPP estimation and mapping of cropland and abandoned cropland using field spectra, metrological data and satellite imagery.

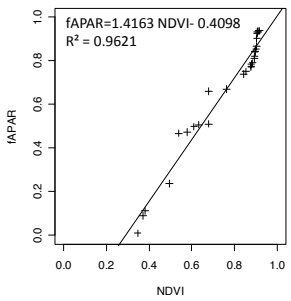

Fig1. Relationship between NDVI and fAPAR (n=36)

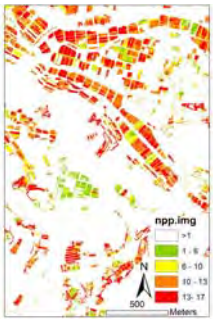

Fig2. NPP map ($g.m^2$) of 08 July 2007