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## **Land Cover And Land Use Change And Its Effects On Carbon Dynamics In Monsoon Asian Region**

The overall goal of this project is to improve understanding of the potential for and biogeochemical consequences of LCLUC in the Monsoon Asia region (South, Southeast, and East Asia, SSEA).. This research will focus on the spatial and temporal dynamics of LCLUC in SSEA and its impact on the net CO<sub>2</sub> exchange between terrestrial ecosystems and atmosphere, and biogenic emissions of non-CO<sub>2</sub> greenhouse gases (GHGs) and other tracers, including black and organic carbon aerosols. To accomplish this goal, we have three overarching objectives:

- (1) Improve our understanding of the historical effects of land cover change dynamics on the quantities and pathways of terrestrial carbon and nitrogen fluxes, to be achieved through the integration of satellite-based estimates of historical rates of land cover changes with a biophysical model (ISAM).

- (2) Project future LCLUC in the study region in next 50 years and explore the potential contribution of land use-related activities to future emissions, to be achieved by linking the biophysical model to the Population-Environment-Technology (PET) socio-economic model while explicitly accounting for competition for land across sectors, climate and biophysical feedbacks, and changes in land use drivers.

- (3) Quantify the impacts of current and future LCLUC on carbon and nitrogen dynamics in the study region, in particular the fluxes of CO<sub>2</sub> and other trace gases, to be achieved by applying an improved version of the biospherical model.

Objective 1 will include analysis of large-scale Landsat and other remote sensing data for various management purposes to develop land cover maps and biophysical products (LAI/FPAR) for the current past decade for the study region. These products will then be used to evaluate the ISAM biophysical model by integrating ISAM into the Terrestrial Observation and Prediction System (TOPS), which acquires data from satellite, aircraft, and ground sensors along with other data sets and statistically downscales at 0.1 x 0.1 degree resolution. Objective 2 will be addressed by integrating the ISAM and a newly modified version of the PET model to analyze future LCLUC under alternative scenarios. At least two scenarios will be assessed in order to explore a range of possible magnitude of feedbacks: one with higher global emissions (and therefore higher atmospheric CO<sub>2</sub> and temperature), and one with lower global emissions. Objective 3 will quantify the impacts of current and future LCLUC on carbon and nitrogen dynamics in the study region using the ISAM-PET modeling framework. The results from this project will advance our understanding of the dynamics of LCLUC and its impact on the carbon dynamics in the Monsoon region. In addition, we will develop a tool to study linkages and feedbacks between biophysical and socioeconomic processes, which, in turn, will allow us to study the relative influence of these factors on future LCLUC and its impact on carbon, other gases, and climate.