Forestry Planning Agency
Ministry of Forestry Indonesia

Balai Besar Penelitian dan Pengembangan
Sumberdaya Lahan Pertanian

World Agroforestry Centre
TRANSFORMING LIVES AND LANDSCAPES

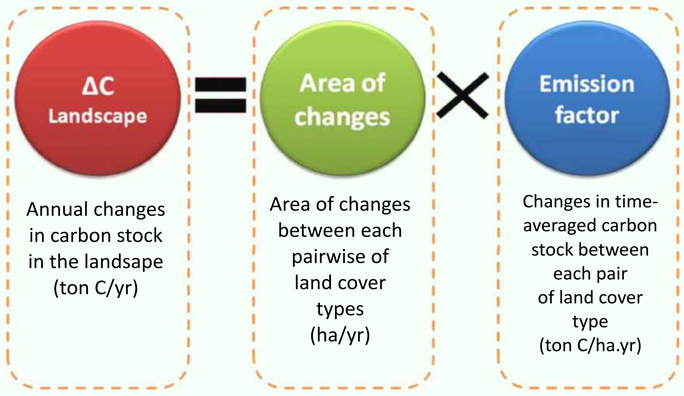
Nation-wide analysis of Indonesia land cover change and above ground carbon stock dynamics

Andree Ekadinata, Sonya Dewi, and Saipul Rahman*

Background

Indonesia has been the center of attention in the current debate of reducing greenhouse gas emissions from deforestation and degradation .Over the past decade it is regarded as the country with the third country of highest emissions although there is considerable debate and uncertainty over the figures. Recently, Indonesia has been taking an active role in the discussion on fair and efficient mechanisms and economic incentives to reduce emissions. Unfortunately, credible carbon accounting system that should serve as the basis carbon incentives negotiation is still not available. More over, data to calculate historic emission as a basis for reference emission level setting are known to have high uncertainty. Through **ALLREDDI** (Accountability and Local Level Initiative to Reduce Emission from Deforestation and Degradation in Indonesia) project funded by European Union (EU), we assist Indonesian government in accounting for land-use based greenhouse gas emissions.

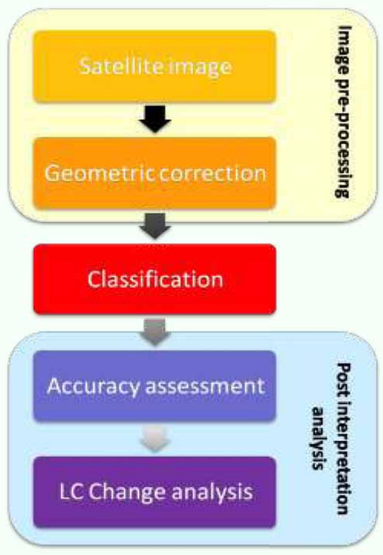
Component of carbon accounting



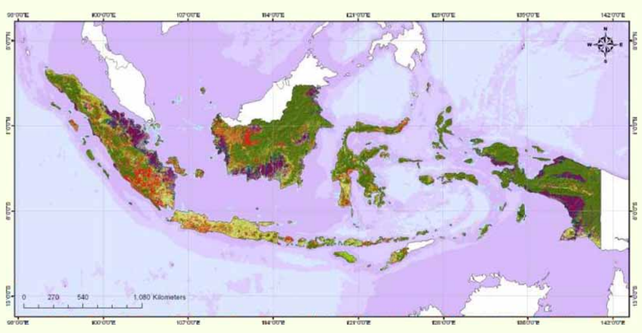
Two types of data are required in landscape level carbon accounting: (1) area of changes and trajectories of land use system and (2) time-averaged carbon stock for each land use system. Data on land use changes and trajectories is acquired through interpretation of satellite image in ALUCT. Estimation of time averaged carbon stock is acquired through plot measurement combined with allometric modelling.

Analysis of Land Use Change and Trajectories

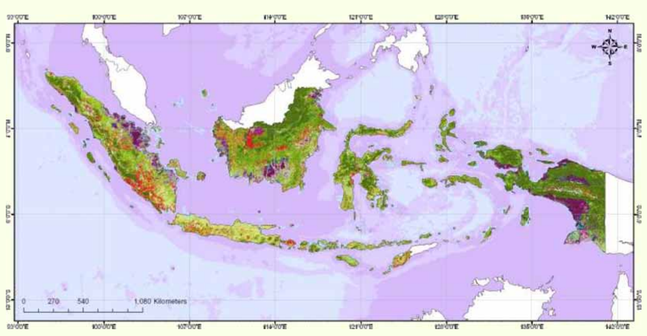
Analysis of land use/cover changes and trajectories (ALUCT) is a standardized framework used to understand the land use dynamics over a landscape within a time period based on remotely sensed data interpretation. The classes are designed in a hierarchical system and defined such that they are recognizable from the satellite imageries. They should embrace the variations of carbon stock that exist in the study area. A list of relevant land-use classes was developed through field work in the study area. ALUCT workflow can be classified into three stages: (1) image pre-processing, (2) image classification; and (3) post-interpretation analysis.



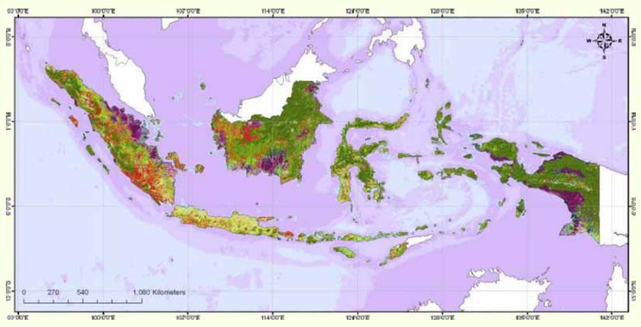
Time series land cover map 1990-2005



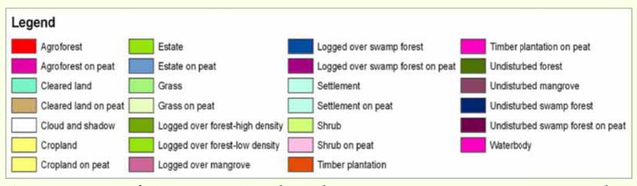
1990



2000

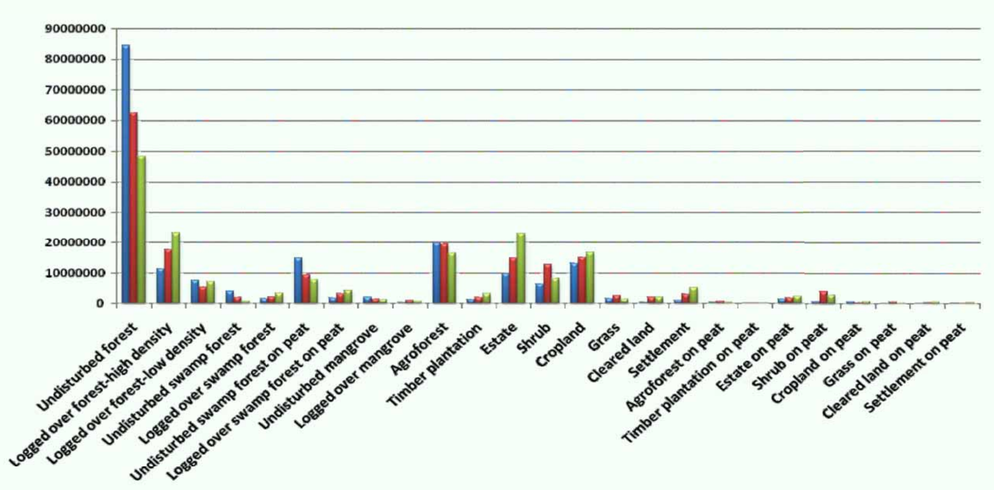


2005



Accuracy of time series land cover map was assessed using 7155 GPS point collected through fieldwork activities and seondary data compilation. Due to sample limitation, only 23 classes were analyze. The estimated overall accuracy is 83.8%

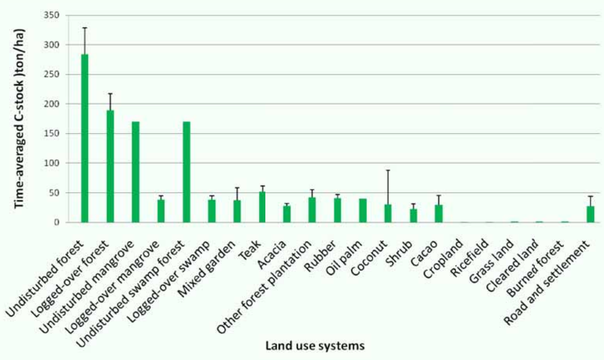
Land cover change and trajectories



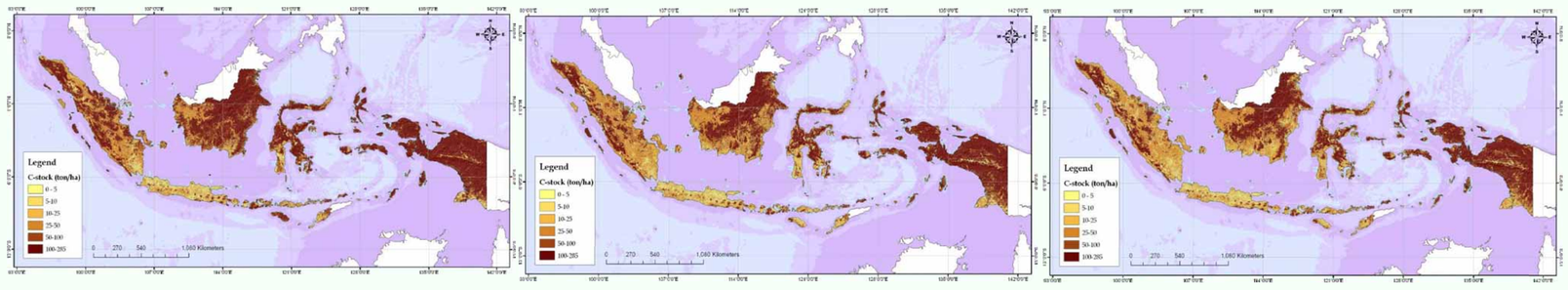
Forest cover has been rapidly declining in Indonesia. In 1990, total area covered by forest was 68% of the country area (128 Mha) and decreased into 53% (99.7 Mha) in 2005. The logged over forest area increased from 12% (22.4 Mha) in 1990 to 21% (38.5 Mha) in 2005. Agroforest area decreased from 11% (19.7 Mha) in 1990 to 8.6% (16.3 Mha) in 2005. The agroforest area was quite stable in the period of 1990-2000 and lately decreased quite rapidly, i.e. 2.13 Mha/yr

Above ground c-stock dynamics 1990-2005

Typical or time averaged carbon stock of variousof non forest land use was collected through several project conducted by ICRAF in Indonesia. Typical carbon stock of forest is collected from secondary data. The current assessment includes only above ground carbon stock. Below ground carbon stock such as soil and peat are not included yet. At this stage, we apply " Stock difference" approach only - hybrid approach incorporating "Gain-loss" of C-stock is possible using national level forest inventory data but not yet conducted. Emission and removal from land cover change are calculated. Removal factor from vegetation growth without land use change is not yet incorporated. This study revealed that total net annual emission of Indonesia is 0.6 Gt/ha.yr. The value is considerably stable across the period of analysis



Above ground c-stock of various land use system

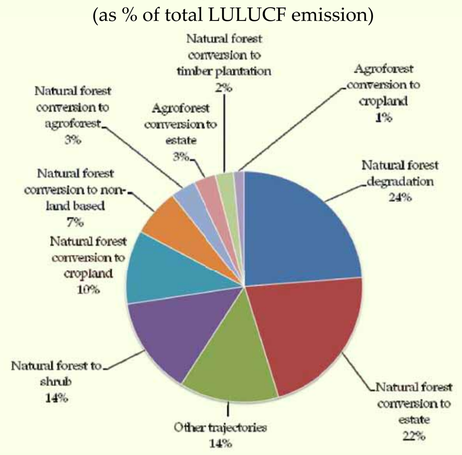


1990 2000 2005

Time series above ground carbon stock maps of Indonesia 1990-2005

Conclusion

INDONESIA LAND USE TRAJECTORIES AND EMISSION SHARE
(as % of total LULUCF emission)



The nation wide analysis of LULUCF c-stock changes by combining c-stock dynamics and land use trajectories data showed that almost 86% of total emission of Indonesia in 1990-2005 are related to forest conversion. The single largest share of emission comes from natural forest degradation (25% of total emission) due to logging activities and conversion to estate plantation such as oil palm and rubber (22%).

*Forest Planning Agency, Ministry of Forestry, Indonesia

More info: **Sonya Dewi** (s.dewi@cgiar.org)
World Agroforestry Centre
Southeast Asia Regional Office