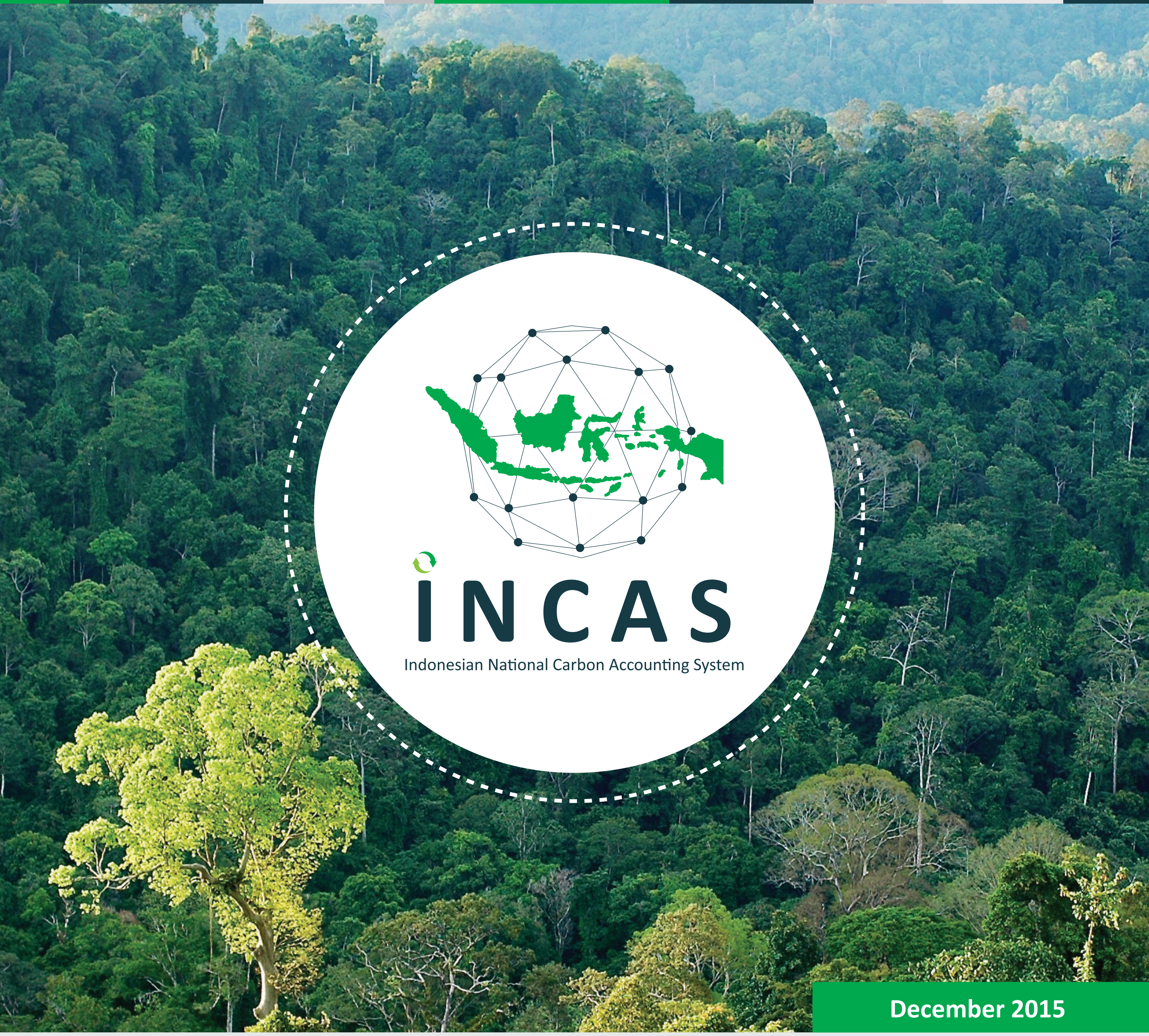
MINISTRY OF ENVIRONMENT AND FORESTRY
REPUBLIC OF INDONESIA



INCAS
Indonesian National Carbon Accounting System

December 2015

"Indonesia's forest and land use sectors have traditionally been considered as a significant contributor to global greenhouse gas (GHG) emissions. However, estimates of their total contribution have always been uncertain. The Indonesian National Carbon Accounting System (INCAS) has been developed to better account for these net emissions. This brochure summarises the methodologies and results for monitoring net GHG emissions under phase one of the INCAS."

FORESTS COMPONENT

Methods

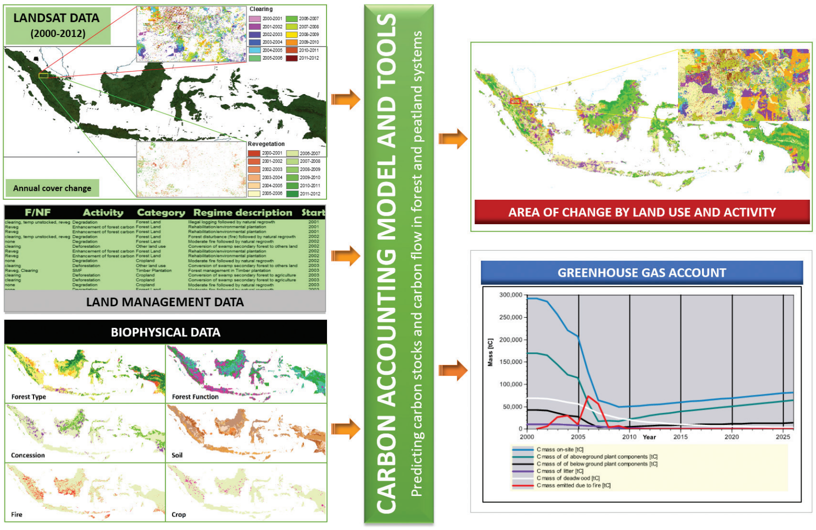


Figure 1. Overview of INCAS forest GHG emissions estimation approach

The INCAS estimates both GHG emissions and removals from forests in all provinces in Indonesia using a Tier 3 level methodology with both spatial and non-spatial data inputs (**Figure 1**).

The best available input data are collated from a wide range of sources through a series of INCAS standard methods (**Table 1**).

The INCAS uses an event-driven process to quantify natural growth, turnover and decomposition processes and the progressive impact of forest disturbances on forest condition. This approach tracks the flow of carbon between the different carbon pools in the forest and ultimately estimates the net GHG emissions released into the atmosphere (**Figure 2**).

Table 1. INCAS data inputs

Standard method	Modelling input data
Initial conditions	Carbon stocks (above- and belowground biomass and debris) at start of simulation.
Forest growth and turnover	Rate of growth, turnover of above- and belowground biomass, and decomposition rate of debris.
Forest management events and regimes	Impact of each forest management event on carbon stocks, combined into management regimes by forest type and location.
Land Cover Change Analysis	Forest loss and gain derived from annual forest/ non-forest data.
Spatial allocation of regimes	Area by year by forest management regime to be modelled.

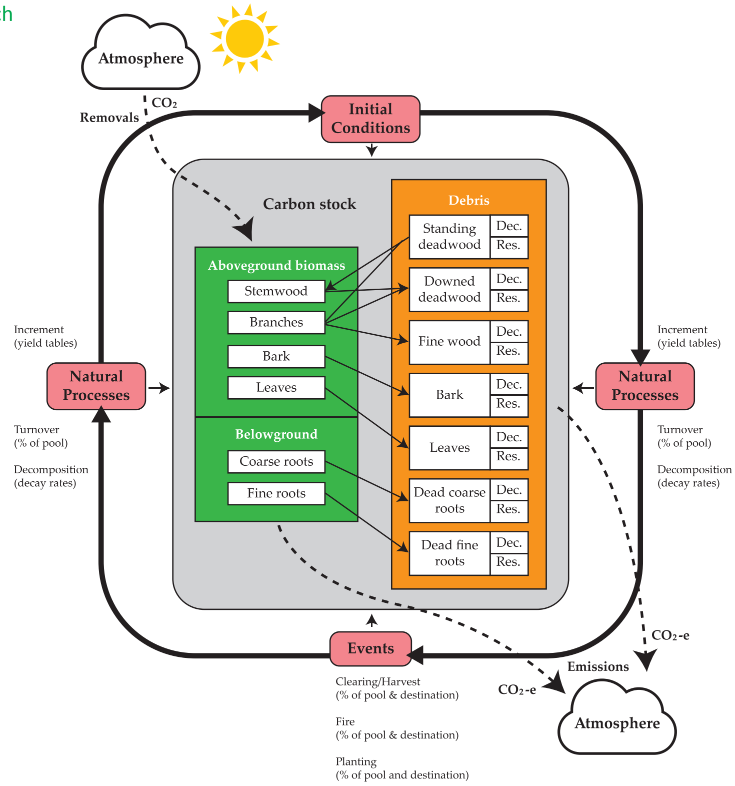


Figure 2. Modelled flows of carbon between pools

Results

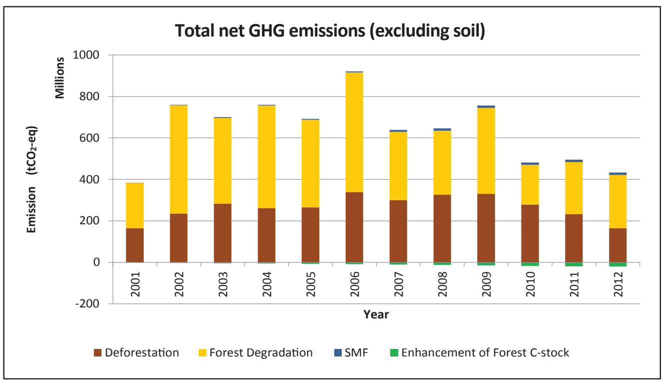


Figure 3. Total annual net GHG emissions estimates in Indonesia for the period 2001 to 2012 from REDD+ activities

The INCAS detects significant annual variations in GHG emissions and removals on forest and peatlands across Indonesia. This reflects the impact of historical land management, current practices and fluctuations in weather conditions, particularly dry years with higher incidences of fire.

Figure 3 shows annual GHG emissions and removals estimates for each REDD+ activity in Indonesia for the period 2001 to 2012, covering all primary GHGs and all carbon pools from forest components (excluding soil). The results reflect the definitions of REDD+ activities adopted for the GHG inventory, the observed forest cover changes and forest management activities between 2000 and 2012, as well as historical land-use changes that result in ongoing GHG emissions.

PEATLANDS COMPONENT

Methods

The INCAS estimates GHG emissions from biological oxidation and peat fires across Indonesia's peatlands (**Figure 4**). Currently, it uses a Tier 2 level methodology incorporating both spatial and non-spatial data inputs.

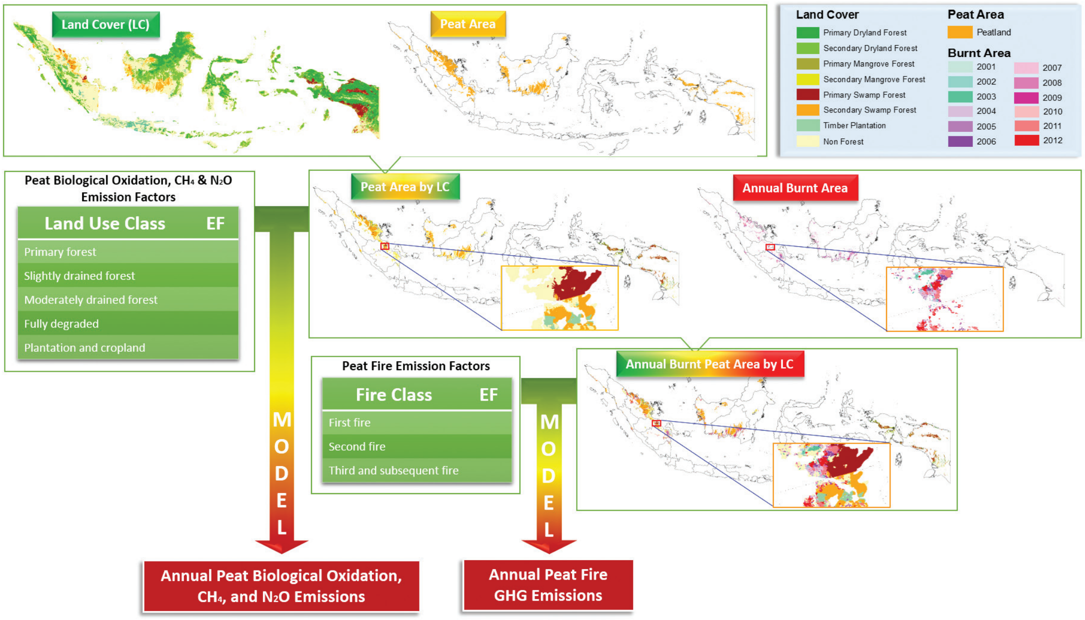


Figure 4. Overview of INCAS peat fire GHG emissions estimation approach

Annual changes in the area of drained peatland are estimated using the INCAS Land Cover Change Analysis outputs and land management information. Annual areas of peatland burnt are currently estimated using MODIS hotspot data which is corrected by Landsat and LiDAR burn scar data. Annual fire frequency and the area of each fire frequency (1 to 10) is derived for the entire country (**Figure 5**).

Total annual GHG emissions are estimated by multiplying the area affected by drainage and fires by activity specific emission factors (EFs) derived from the IPCC 2013 Wetlands Update, supplemented by peat fire data from studies in Indonesia. EFs are derived from the depth of burn for first and subsequent fires, peat bulk density and carbon content values that are representative of normal fire conditions in Indonesia.

Results

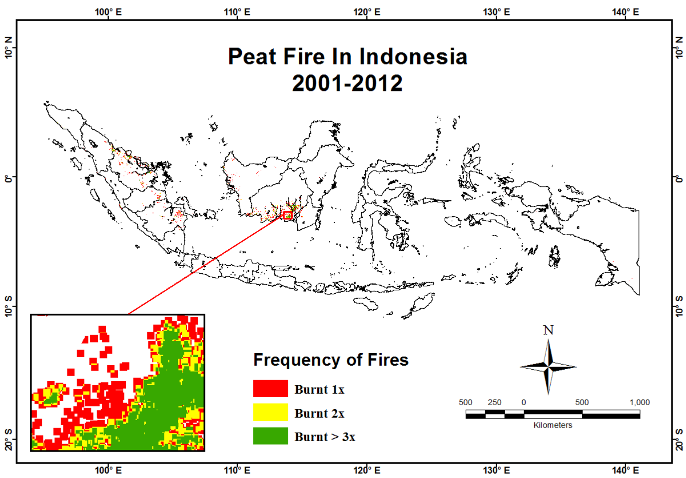


Figure 5. Annual Peat Fires In Indonesia 2001-2012

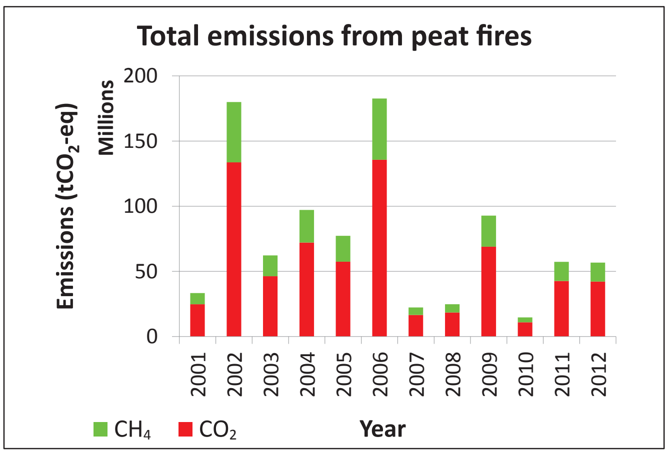
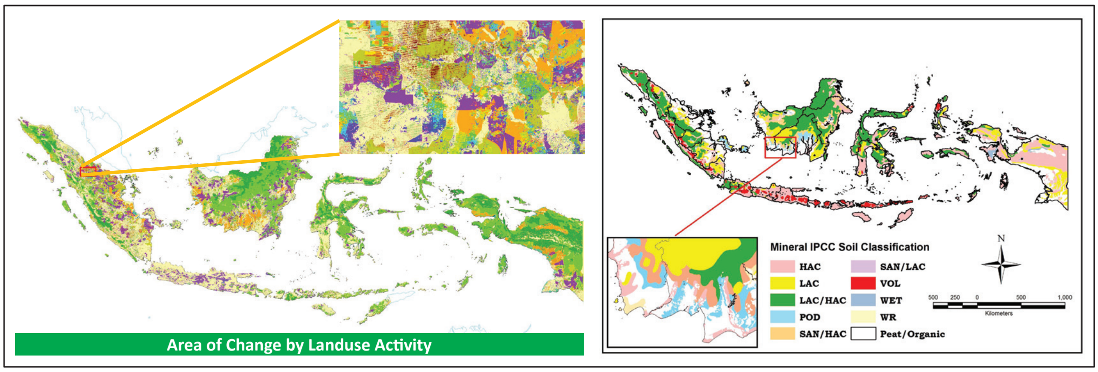


Figure 6. Annual estimates of GHG emissions from peat fires in Indonesia for the period 2001 to 2012

Figure 6 presents annual estimates of CO_2 emissions and non-CO_2 emissions (CH_4) from peat fires in Indonesia during 2001 to 2012. Significant annual variations in GHG emissions from peat fires are detected across Indonesia during 2001 to 2012. The high emissions from peat fires in 2002 and 2006 contributed significantly to the elevated total emissions from peatlands in those years. Riau, Central Kalimantan and South Sumatra are the three provinces with highest incidence of peat fires throughout the period contributed more than 70% of the total GHG emissions from peat fires in Indonesia.

MINERAL SOIL COMPONENT

Methods



X

Emission Factor

=

Emission Estimate

Figure 7: Simple approach of GHG emissions estimation from the soil organic carbon pool on mineral soil

Annual carbon and N_2O emissions from mineral soils subject to change from forest to non-forest classification are calculated using the Tier 1 method as outlined in IPCC (2003) (**Figure 7**). Areas of disturbed mineral soils by IPCC soils classification were estimated using the same spatial data used for the forest land analysis, assuming all areas subject to deforestation are converted to cropland. Emissions were estimated by multiplying the area of disturbed forest on mineral soils and the associated emission factor. This approach will be improved once detailed soil information and soil models are available for Indonesia.

Results

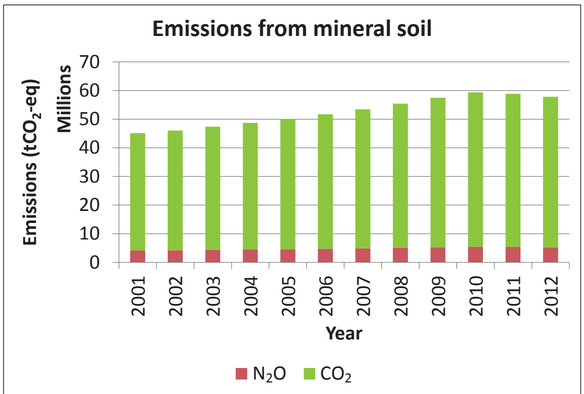


Figure 8. Annual GHG emissions estimates in Indonesia from mineral soils for the period 2001 to 2012

Figure 8 shows the total annual GHG emissions from the soil organic carbon pool on mineral soil subject to change from forest to non-forest. This includes CO_2 emissions and non-CO_2 emissions (N_2O) from mineral soil.

Emissions from mineral soils increased gradually. The increase in emissions is a function of increasing cumulative area of mineral soils is exposed through deforestation during the simulation period, as well as areas deforested prior to 2000.

Figure 9 shows annual net GHG emissions from human-induced land use and land-use change on forests and peatlands for 2001–2012 for all primary GHGs and all carbon pools. Ongoing emissions from deadwood and soils on forest land and areas converted from forest land prior to 2000 are also included.

GHG emissions from the biological oxidation of peatlands were the largest source of emissions. This represents almost one third of the total net GHG emissions during this period (**Figure 9**).

The high peatland GHG emissions result from the large areas of peatlands that were cleared and subsequently drained in the years prior to the analysis period.

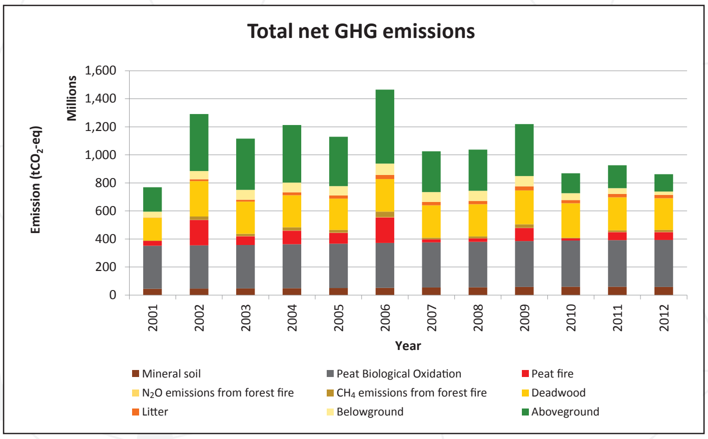


Figure 9. Total annual net GHG emissions estimates from forest and peatlands in Indonesia for the period 2001 to 2012 from all pools

Supported by:

Full details of the INCAS methods and results are available at **www.incas-indonesia.org**

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