# ITTO Program PD 519/08 Rev.1 (F)

Tropical Forest Conservation For Reducing Emissions From Deforestation and Forest Degradation and Enhancing Carbon Stocks in Meru Betiri National Park, Indonesia

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[Bahasa Inggris] [Indonesian]

## LAND COVER MAP
## MERU BETIRI NATIONAL PARK



LEGEND :
- City
- District boundary
- River
- Primary Dryland Forest
- Secondary Swamp Forest
- Secondary Swamp Forest
- Primary Mangrove Forest
- Bush/Shrub
- Estate Crop Plantation
- Shrub Mixed Dryland Farm
- Grassland
- Swamp
- Barren land
- Settlement Area
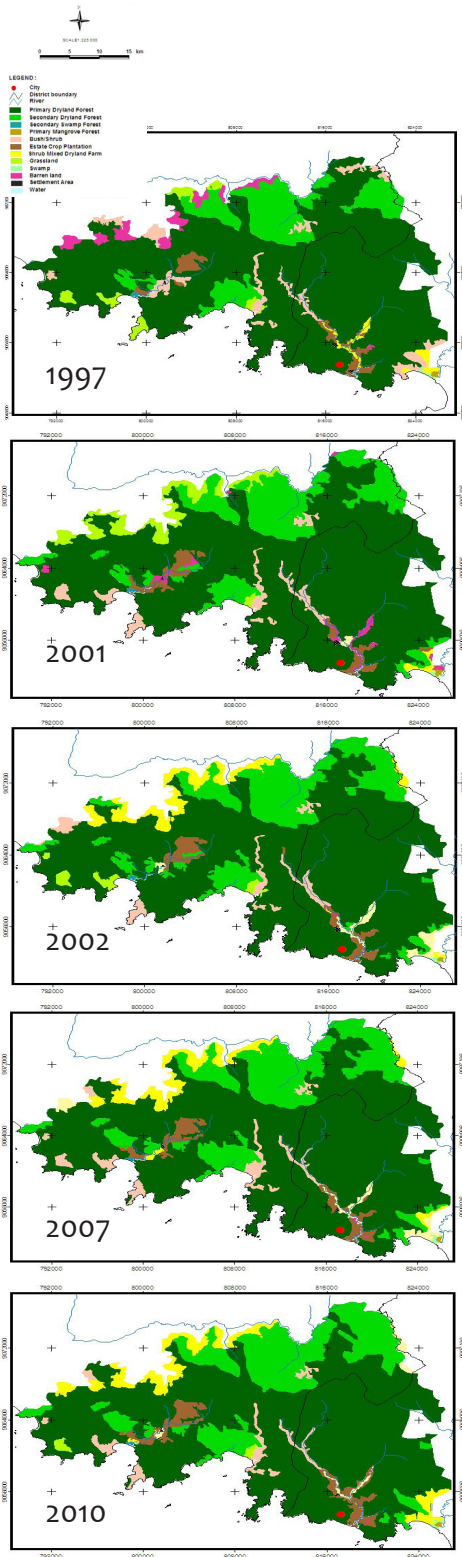- Water

1997

2001

2002

2007

2010

**Figure 1.** MBNP Land Cover Change Map 1997-2010

[**Gambar 1.** Peta Perubahan Tutupan Lahan, 1997-2010]

## Land monitoring by GIS to find Activity Data as an element for estimating emission or enhancement

[Monitoring data perubahan lahan secara spasial untuk estimasi emisi atau removal]

Spatially interpretation of remote sensing data is one approach to determining area of land use change required for estimation with highest tier (3) of IPCC 2006 guidelines.  This international recognized standard, has been used for estimating Green House Gases (GHGs) inventory for national communication elsewhere, including Indonesia.  In general, there are two basic elements needed for the inventory, namely (i) the activities data due to human activity on land use change, and (ii) emission or removal factor, a coefficient that quantify the emissions or removal per unit activity data.

The available image varies from low resolution, medium resolution (Landsat) and high resolution (IKONOS, Quickbird). For the case of Meru Betiri National Park, as a start, a Satellite imagery Landsat 7 ETM+ with spatial resolution 30 meter and categorized as a medium resolution of satelite imagery would be applied to estimate gross loss of forest cover, including type and location.

Landuse Change Matrix (LCM) was made based on the result of satellite imagery (Landsat) analysis as can be shown in Figure 2. It was the first step to analyze carbon and biomass accounting for developing REL (Refference Emission Level) for REDD+ (Figure 3 and 4).  LCM would then be used for inventory GHGs using IPCC method that has 39 table.

(Interprestasi data spasial merupakan pendekatan yang dilakukan untuk inventarisasi gas rumah kaca (GRK) dengan tingkat kerincian tinggi (tier 3) sebagaimana disyaratkan dalam pedoman IPCC 2006. Sebagai suatu pendekatan yang sudah diakui keakuratannya secara internasional, pedoman ini telah digunakan untuk komunikasi nasional di berbagai Negara termasuk Indonesia. Secara umum terdapat dua elemen yang diperlukan untuk inventarisasi gas rumah kaca yaitu aktivitas data akibat perubahan aktivitas manusia terhadap lahan dan faktor emisi/ removal, yaitu  kuantifikasi emisi/removal untuk setiap unit aktivitas).

Citra satelit terdiri dari resolusi rendah, sedang (Landsat), dan tinggi (IKONOS, Quickbird). Dalam analisis awal, akan digunakan citra satelit Landsat 7 ETM+ dengan resolusi spasial 30 m dan termasuk kategori resolusi sedang untuk memperkirakan perubahan tutupan lahan termasuk tipe dan lokasi).

(LCM dibuat berdasarkan hasil analisis citra Landsat sebagaimana dapat dilihat pada Gambar 2. Pembuatan LCM merupakan langkah awal dalam analisis perhitungan karbon dan biomassa untuk membangun REL (Tingkat Referensi Emisi) pada REDD+ (Gambar 3 dan 4). LCM akan digunakan untuk inventarisasi GRK sesuai dengan metode IPCC yang menpunyai 39 tabel.
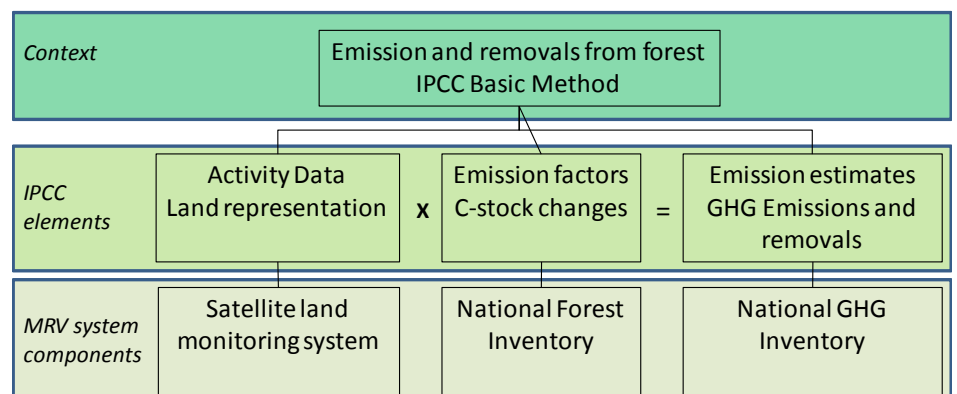
| Context | Emission and removals from forest IPCC Basic Method | | |
|---|---|---|---|
| IPCC elements | Activity Data Land representation | X  Emission factors C-stock changes | =  Emission estimates GHG Emissions and removals |
| MRV system components | Satellite land monitoring system | National Forest Inventory | National GHG Inventory |

**Figure 2.** Relationship between IPCC element and MRV components (Girardin, 2010)

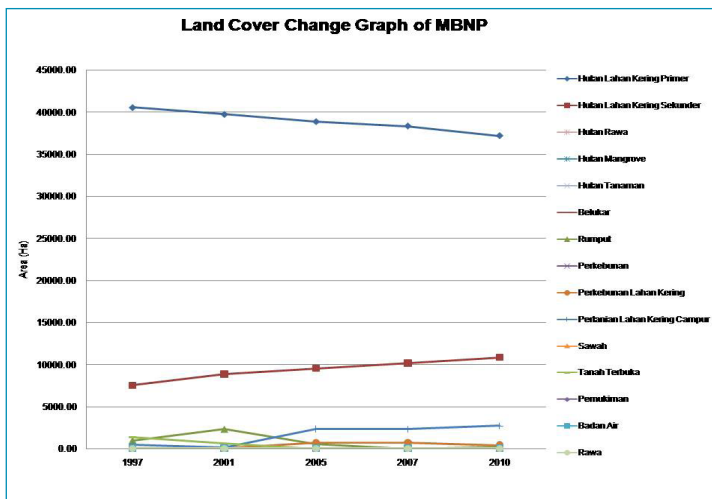[**Gambar 2.** Hubungan antara elemen IPCC dan komponen MRV (Girardin, 2010)]

Figure 3. Land Cover Change Graph of MBNP, 1997-2010

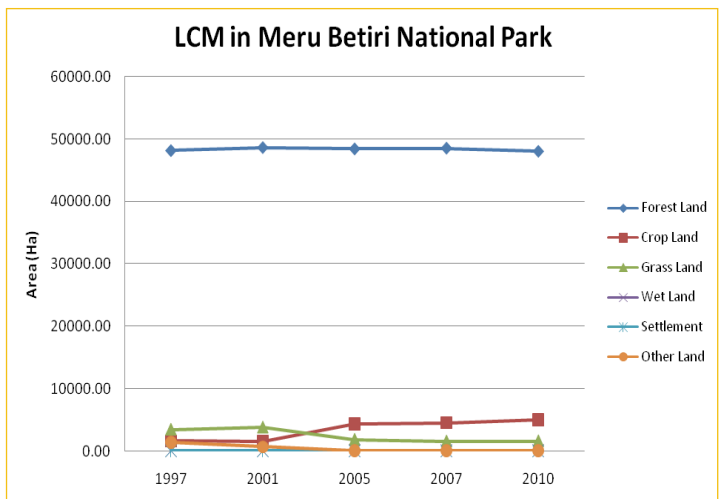[Gambar 3. Grafik Perubahan Tutupan Lahan di MBNP, 1997-2010]



Figure 4. Land Change Matrix based on IPCC GL 2006

[Gambar 4. Matriks Perubahan Lahan berdasarkan IPCC 2006]

Table 1. Land Change Matrix based on IPCC GL 2006

[Tabel 1. Matriks Perubahan Lahan berdasarkan IPCC 2006]

| Category | SUMBER (Landsat TM 1:50.000) | | | | | | | | | |
| | 1997 | | 2001 | | 2005 | | 2007 | | 2010 | |
| | Ha | % | Ha | % | Ha | % | Ha | % | Ha | % |
| Total | 54834.93 | 100.00 | 54834.93 | 100.00 | 54834.93 | 100.00 | 54834.93 | 100.00 | 54834.93 | 100.00 |
| Land Category | | | | | | | | | | |
| A. Forest Land (FL) | 48159.60 | 87.83 | 48647.45 | 88.72 | 48431.16 | 88.32 | 48546.93 | 88.53 | 48043.84 | 87.62 |
| 1. FL remain FL | 48159.60 | | 47061.49 | | 47554.73 | | 47811.97 | | 47956.29 | |
| 2. Land converted to FL | 0.00 | | 1585.964 | | 876.433 | | 734.962 | | 87.551 | |
| B. Crop Land (CL) | 1634.66 | 2.98 | 1564.78 | 2.85 | 4384.36 | 8.00 | 4550.212 | 8.30 | 5038.94 | w9.19 |
| 1. CL remain CL | 1634.66 | | 998.60 | | 1177.02 | | 3820.81 | | 4468.78 | |
| 2. Land converted to CL | 0.00 | | 566.17 | | 3207.34 | | 729.40 | | 570.16 | |
| C. Grass Land (GL) | 3528.29 | 6.43 | 3881.53 | 7.08 | 1890.16 | 3.45 | 1597.73 | 2.91 | 1640.19 | 2.99 |
| 1. GL remain GL | 3528.29 | | 1792.68 | | 1607.95 | | 1374.70 | | 1579.45 | |
| 2. Land converted to GL | 0.00 | | 2088.85 | | 282.21 | | 223.02 | | 60.74 | |
| D. Wet Land (WL) | 43.26 | 0.08 | 30.25 | 0.06 | 38.45 | 0.07 | 46.98 | 0.09 | 46.66 | 0.09 |
| 1. WL remain WL | 43.26 | | 23.90 | | 27.56 | | 22.13 | | 36.36 | |
| 2. Land converted to WL | 0.00 | | 6.35 | | 10.89 | | 24.85 | | 10.30 | |
| E. Settlemant (S) | 37.60 | 0.07 | 36.39 | 0.07 | 24.26 | 0.04 | 26.42 | 0.05 | 19.63 | 0.04 |
| 1. S remain S | 37.60 | | 20.21 | | 20.77 | | 12.90 | | 16.82 | |
| 2. Land converted to S | 0.00 | | 16.17 | | 3.49 | | 13.52 | | 2.81 | |
| F. Other Land (OL) | 1431.52 | 2.61 | 674.55 | 1.23 | 66.54 | 0.12 | 66.66 | 0.12 | 45.68 | 0.08 |
| 1. OL remain OL | 1431.52 | | 48.79 | | 57.00 | | 29.87 | | 25.41 | |
| 2. Land converted to OL | 0.00 | | 625.75 | | 9.53 | | 36.80 | | 20.27 | |
| G. Not Data (ND) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1. ND remain ND | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 | |
| 2. Land converted to ND | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 | |