

# Forest cover extent and loss in Democratic Republic of the Congo

Peter Potapov, Svetlana Turubanova, Matthew C Hansen Geographic Information Science Center of Excellence, South Dakota State University











An exhaustive mining of the Landsat ETM+ archive was performed to map forest cover extent and loss for the Democratic Republic of Congo from 2000 to 2010. A total of 8,881 ETM+ images were processed to make the final map product. The method is an evolution of the approach of Hansen et al. (2008), where data from the MODIS are used to pre-process Landsat time-series images which are in turn used to characterize forest cover extent and loss. Forest was defined as 30% or greater canopy cover for trees of 5 meters or more in height. All such assemblages that were converted to non-forest are quantified and labeled as forest cover loss. Forest cover and loss were divided into three categories, primary forest, secondary forest and woodlands. Primary forest cover is defined as mature forest with greater than 60% canopy cover. Secondary forest is defined as regrown forest with greater than 60% canopy cover. Woodland is defined as forest cover with greater than 30% and less then or equal to 60% canopy cover.

The map was prepared by the Observatoire Satellital des Forêts d'Afrique Centrale (OSFAC) team at South Dakota State University. OSFAC was launched as part of the Global Observations of Forest Cover and Land Dynamics (GOFC-GOLD) network for Central Africa under the Global Terrestrial Observing System (GTOS). Its primary objective is to support the management of natural resources and promote sustainable development by producing reliable land cover products, distributing satellite data, building capacity and providing technical assistance to implementing partners. The work was done in collaboration with the University of

WORLD RESOURCES NASA

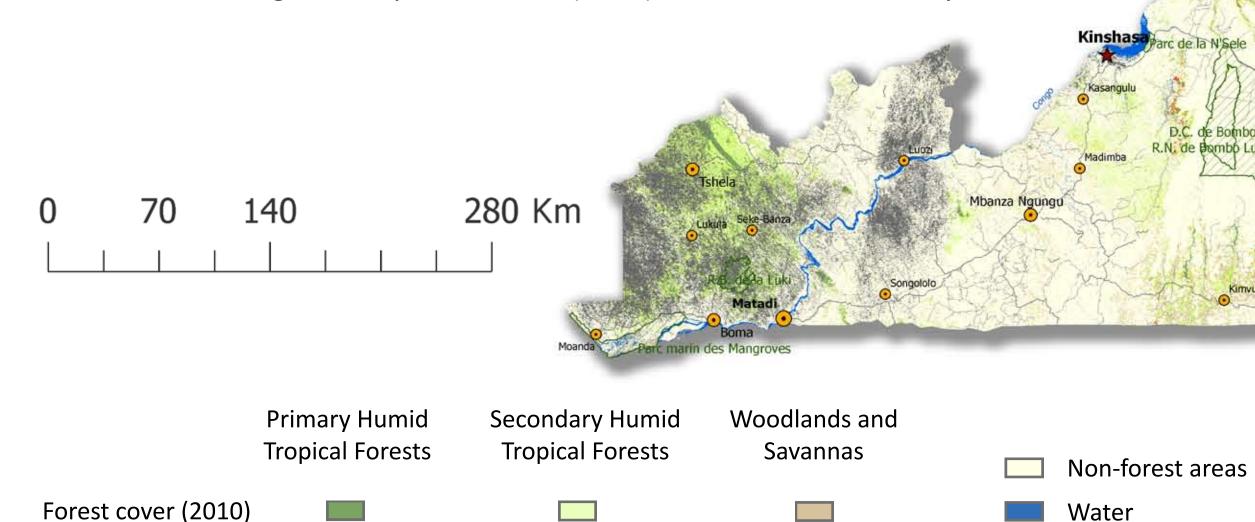
Maryland and the World Resources Institute, with support from the NASA Land Use Land Cover Change Program and the United States Agency for International Development (USAID) through the Central African Regional Program for the Environment (CARPE).

No Data

# Forest cover extent and loss, 2000-2010

Our forest cover and change analysis was performed for the entire area of the DRC, with 99.6% of the country area covered with cloud-free Landsat observations. The total forest cover for the DRC was estimated to be 159,529.2 thousand hectares (kha). Primary humid tropical forests occupy 66% of total forest extent, secondary humid tropical forests 11%, and woodlands 23%. Our forest cover estimates are close to that provided by the Congo Basin Forest Partnership (2009) for the year 2008 (155,500 kha) as well as that of the FAO FRA for the year 2000 (157,249 kha; FAO, 2010).

The area of gross forest cover loss form 2000 to 2010 was estimated to be 3,711.8 kha, or 2.3% of total forest cover area for year 2000. Of total forest loss, 57% occurred within secondary humid forests, 29% within primary humid forests, and 14% within woodlands. The percent of forest loss per forest type was different, with the highest rate of forest loss in secondary humid tropical forests (11.6%) and the lowest in primary humid tropical forests (1.0%). Total gross forest cover loss area increased by 13.8% from 2000-2005 to 2005-2010 interval. The greatest increase was detected within primary humid tropical forests, where forest area loss increased by almost a factor of two (by 91.1%). The average annual gross forest loss for the 2000-2010 interval was 371.2 kha/year (0.23% of forest cover for year 2000). Our total forest cover loss estimates are 16% higher compared to FAO (2010) estimates of 311 kha/year.



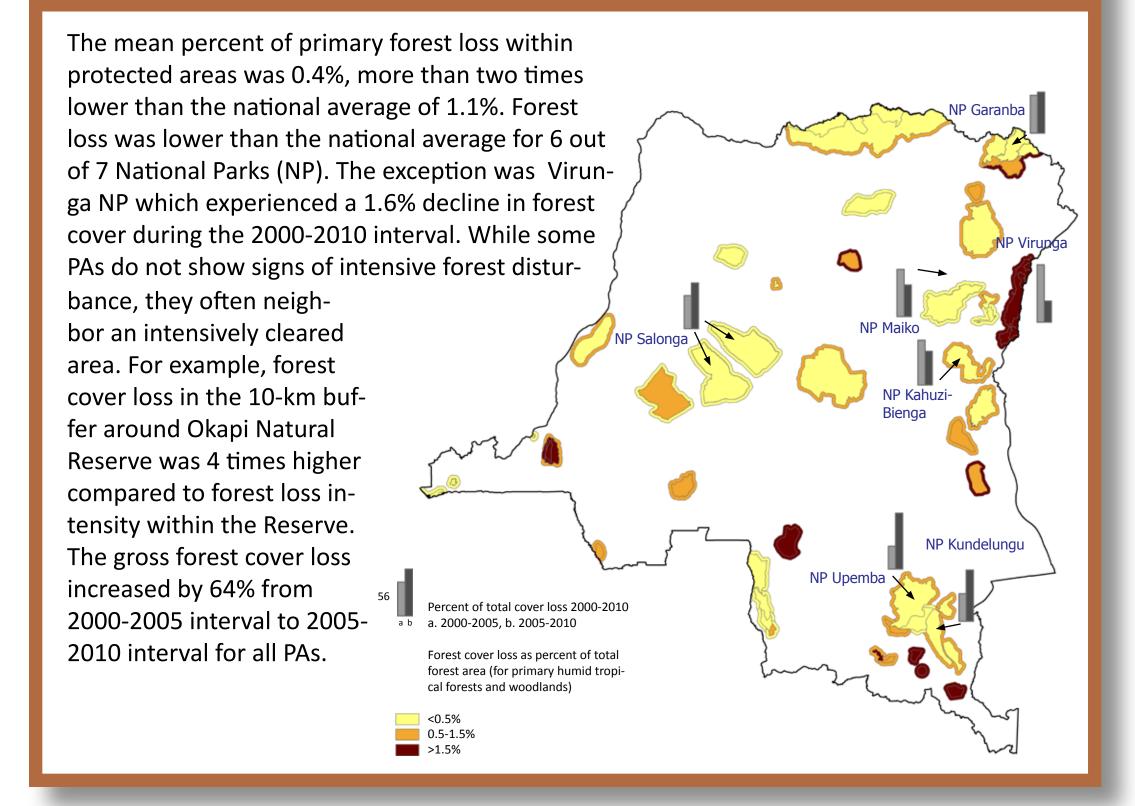
### Forest cover loss area 2000-2010 within all categories of forests per province

Forest cover loss

2000-2010

While distribution of total forest loss area within DRC provinces reflected their forest cover area, the forest loss intensity was distributed unevenly and reflected areas with high population density and grows rate. Two Northern provinces, Equateur and Orientale, are responsible for 44% of the total forest loss within the country and for 50% of the forest loss within primary humid tropical forests. The forest loss intensity is the highest in Kinshasa province (11.4% of Equateur forest cover for year 2000), followed by Kasai-Occidental, Sud-Kivu and Kasai-Oriental provinces. Primary forest loss intensity was high-Kinshasa est in Kinshasa (9.6%) and Bas-Congo (4.5%) followed by Kasai-Occidental, Sud-Kivu, Katanga and Kasai-Oriental provinces, while it was below the national Percent of total cover loss 2000mean in the Northern Katanga a. 2000-2005, b. 2005-2010 provinces (Equateur and Forest cover loss as percent of Orientale). total forest area

## Primary forest clearings within officially designated nature protection areas and within 10-km buffer zones around them



#### Primary forest clearing in the vicinity of selected major urban areas

We provided analysis of forest cover loss intensity within 50-km buffer areas of 55 selected major urban areas. Cover loss within primary humid tropical forests and woodlands within all buffer zones was estimated to be 33% of the total forest cover loss within these categories of forests for the 2000-2010 interval. Our result shows that the most intensive clearings occur near towns located on the eastern and southern borders of humid tropical forests, along the Congo river, and in southern woodland areas. Intensive forest loss areas are **Kinshasa** co-located with areas rich of metal deposits and diamonds, especially near large industrial mining areas. Nearly all ur-Forest cover loss area (thousand ha) ban areas experienced a b a. 2000-2005, b. 2005-2010 increased forest clearing Primary humid tropical forests and woodlands Kolwezi from 2000-2005 to 2005-Areas affected by active mining (both industrial

# Primary forest clearings within CARPE priority landscapes

The mean forest loss area for the CARPE priority forest landscapes (0.6%) is half the national average. The highest forest cover loss of 2.6% was found in the Virungas landscape. However, Virungas forest cover loss intensity was stable during the last decade Maringa-Lopori-Wamba while forest clearing intensity grew rapidly for land-Lac Télé-Lac scapes within Nord-Kivu Tumba Swamp and Sud-Kivu provinces. Maiko-Lutunguru Tayna-Kahuzi-Biega Forest Forest cover loss as percent of total forest area (for primary humid tropical forests and 0.5-1.5% >1.5%

#### District capital Territory capital Roads National

# Provincial Local

#### Protected areas P.N. - National Park R.B. - Biosphere Reserve R.N. - Nature Reserve

**★Kinshasa** National capital

Province capital

Forest clearing, 2000-2010,

Virunga NP remained one of

the most threatened natural

protection areas in the coun-

try, with the largest patch

near Beni and along new

ern part of the Park.

of contiguous deforestation

road extensions in the north-

within the Northern part

of Virunga National Park.

- D.C. Hunting Reserve R.I.C - Integral Reserve R.S. - Scientific Reserve
- R.F. Fauna Reserve

Congo. World Resources Institute, 2010 Landsat vs. MODIS SWIR 1628-1652 nm band spectral reflectance. Landsat reflectance represents median MODIS-based calibrated reflectance value from all cloud-free observations for 2000 to 2005. MODIS

(2000-2009 peak greenness composite) Landsat median spectral reflectance from 2000-2005 composite

0.05 0.10 0.15 0.20 0.25 0.30

R – Landsat band 5 (SWIR)

G – Landsat band 4 (NIR)

B – Landsat band 3 (Red)

spectral reflectance from 2000-2009 peak greenness composite

**MODIS** mean

reflectance represents mean TOC reflectance value

16-day interval values were collected from the least

cloud contaminated observations from 2000 to 2009.

for 6 16-day intervals with the highest NDVI. The

