CARPE monitoring of the Congo Basin – results and ideas for REDD monitoring



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CARPE

- Goal of promoting sustainable natural resource management in the Congo Basin
- Maintain biodiversity and other key ecological services
- Secure sustainable livelihoods for local populations
- Monitor changes within the forest environment
 - Satellite-based monitoring



Congo Basin Forest Partnership Landscapes





Deforestation

- FAO and UNFCCC define forests as having >=10%
- Forest clearing from >=10% cover to <10% cover is the most readily discriminated forest change dynamic
- However, systematic monitoring of even deforestation is not well-established in the Congo Basin
- CARPE has developed a processing system for operationally monitoring forest clearing



Degradation

- FAO and UNFCCC define forests as having >=10%
- For carbon accounting, this means that fully stocked intact forests may be treated the same as highly degraded forests still having >=10% tree cover
- Need to account for within forest conversion processes degradation



Conversion of tree cover – estimating change in carbon stocks





Mollicone et al. 2007

Methods for estimating forest area clearing using remotely sensed data sets

- Regional expert stratification for sampling high-resolution image blocks (FRA RSS and Achard et al.)
- Systematic sampling of high resolution image blocks (FRA 2010 and TREES 3)
- Stratification using coarse resolution hot spot mapping to target the sampling of high resolution image blocks (NASA LCLUC)
- Coarse spatial resolution exhaustive mapping using highresolution estimates for calibration (Hansen and DeFries)
- High spatial resolution exhaustive mapping (INPE, CARPE)



MODIS time-series data sets



MODIS forest cover



2000 Geocover



DOS-adjusted



Anisotropy-adjusted



3-5 image inputs per path/row



Landsat forest cover and change



Full-resolution





Forest clearing in the Congo Basin

- Forest clearing (1990-2000)
 - Congo Basin 277 th ha / yr (0.17% / yr)
 - Inside CBFP landscapes 46 th ha / yr
 - Outside CBFP landscapes -231 th ha /yr
 - Protected areas 10 th ha / yr
- Virunga landscape features highest rate of clearing of any landscape – 0.77% / yr
- Landscapes feature extensive logging have some of the lowest clearing rates, Sangha Tri-National – 0.02% / yr
- Democratic Republic of Congo features highest rate of clearing of Congo Basin countries – 0.20% / yr





is a United States Agency for International Development (USAID) Imaging Spectromekometer (MOOIS), Landast Enhanced Thematic initiative aimed at promoting sustainable natural resource Mapper (ETM+) and Thematic Mapper (TM) imagery. Forest loss management in the Congo Basin. In recognition of the important role, derived from that procedure was enhanced by buffering to 225 meters of the Congo Basin forest and arricht the increasing pressures facing to highlight key areas of change. The enhanced forest loss is depicted the Congo Basin forest, CARPE works to reduce the rate of forest, here over a composite of Landest imagery from the same time period. degradation and loss of biodiversity by supporting increased local, netional, and regional natural resource management capacity.

CARPE currently works within 12 key blodiversity landscapes in seven study, approximately 1.5% was deforested between the 1990s and countries. The 12 landscapes have been identified as priority areas for circa 2000. Work is underway to produce a 2000 to 2005 forest cover conservation based on their relative teconomic importance, their change map. overall integrity, and the resilience of ecological processes For more information about the mapping procedure developed by represented.

Decadal Forest Change Mapping

Republic of Congo. Forest cover and forest loss between circs 1990 to website at http://carpe.umd.edu.

The examples to the right are at the original 57 meter resolution. Of the more than 1 million so km of DRC's forest area mapped in this

South Dakota State University and the University of Maryland, in permership with NASA, please see "The Decadal Forest Change Mapping Project" at http://carpe.umd.edu/resources/dfcm. Date, maps This image map shows a decade of forest change in the Democratic and other information relevant to CARPE are evaluable on the CARPE



Matter Toronto.

Registered and



Clevel / His Date

Examples of forest change in the Democratic Republic of Congo (from left to right): Image A shows agricultural expansion into upland forest areas, while swamp forest is avoided; image B shows the expansion of rural complexes and logging roads north of Bumbe; and image C shows forest change occurring outside of NW Virunge National Park.

Al investories are appreciately

Congo Basin forest cover loss



0.19%/yr Duveiller et al. 2007 UCL 0.17%/yr CARPE

1990 - 2000





Landsat epochal data over Congo





123452005 epoch with SLC-off data



Mid-decadal results – 2000 to 2005



Recent change in Mambasa, DRC





ASTER acquisitions over the Congo Basin



Methods for estimating degradation using remotely sensed data sets

• Direct observation of degraded forest classes (Steininger, Souza)

• Using spatial context/buffering of identified change to infer degradation (LaPorte, Asner, Matricardi, GFWR)







Direct observation of degradation



Intact Forest Landscapes (GFWR 2006)

• a seamless, intact forest zone with no visible signs of significant human activity and not fragmented by developed areas or infrastructure:

– Minimum Area of at least 500 sq. km

– **Minimum Width** of at least **10 km** (the diameter of a largest circle that can be fit inside the contour of an area)

– **Corridors or appendages** of areas meeting minimal area and width criteria must have a minimum width of **2 km**



Intact Forest Landscapes, change 2000 to 2005 (www.intactforests.org)



615 th ha decrease in IFL area from 2000 to 2005, representing a 5% decrease in IFL area

Degradation via IFL analysis:

Example of the expansion of logging roads, responsible for the largest reduction in IFL area for many regions, even if area cleared is low.



Degradation via IFL analysis:

Example of the expansion of shifting cultivation zones and local population pressure on forest resources. Most prevalent change dynamic in the Basin.



Degradation via IFL analysis: Example of the expansion of shifting cultivation zones along transportation corridors.



A system for REDD monitoring via remote sensing is feasible and can be implemented, given:

- Coordinated earth observation data acquisition
- Free/low cost data
- Standardized, consensus protocols for data analysis
- Regional/biome scale monitoring to ensure consistency between national monitoring systems
- Distinguishing intact, non-intact and cleared forests

