Land cover mapping and phenology in French guiana using remote sensing

Valéry GOND

CIRAD
Forest ecosystems goods and services
Montpellier
Context

- Tropical humid forests have a crucial role in the climatic and biologic equilibrium of the Earth

- These forests are not homogeneous in terms of structure and functioning

Question

- What is the spatial organization of these tropical humid forests?

Hypothesis

- The use of remotely sensed data helps to monitor spatial and temporal patterns
From global to local

Behind the green layer of the global maps, there are various tropical forest types
Forest phenology

Terminalia superba (Gabon)
Monthly temporal monitoring

Monthly synthesis from daily data (2000)
Spatial patterns on annual synthesis SPOT/VGT data

- Countries borders
- Brazilian states borders
- Protected areas
ISODATA classification
(Iterative Self-Organizing Data Analysis Technique)

- Iterative method grouping pixels within the radiometric spaces to the closest gravity center

- The user chooses the number of iterations and of classes [min – max]

- In this study, 10 iterations and from 40 to 50 classes gave optimal results

- The final result was chosen by comparison with local maps (TerSteege et al., 2001), experts knowledge (Botanist, forester, etc.) and regional maps (IBGE, Eva et al., 2004).
Statistics with environmental parameters

A l'échelle de la Guyane

Géologie

Topographie

Régions géomorphologiques

Espèces dominantes ?
Epèces remarquables ?

Système-sol dominant d'une région

Géomorphologie caractéristique (formes des reliefs)
Sampling sites

Botanical and canopy structure description

SRTM data
Sampling site description

Carte de végétation

Photo-interprétation

Placettes écologiques
Sampling site, photo-interpretation, validation
Field work on several validation points
Transects for validation
Cluster distribution

Forest clusters

- **22** - Open forest / *Euterpe* Palm
- **21** - Mixed high and open forest
- **19** - High forest with regular canopy
- **18** - Low dense forest / included savanna on poor drainage soils

Cluster distribution based on NIR and MIR values.
Land cover: Low dense forest / included savanna on poor drainage soils (LC 18)
Land cover: High forest with regular canopy mostly on *terra firme* (LC 19)
Land cover: Mixed high and open forest (LC21)
Land cover: open forest / *Euterpe* palm forest (LC22)
Land use mapping using SPOT/VGT time series data

Gond, et al., 2011
Phenology analysis using MODIS data time series

- MOD13A1 processing to calculate mean value on 9 years

1st 16-day images of the data base

- 2001
- 2002
- 2003
- 2004
- 2005
- 2006
- 2007
- 2008
- 2009

Pennec et al., 2011
Temporal analysis on the spatial database from SPOT/VGT

- MODIS temporal dynamique on SPOT/VGT classes

SPOT/VGT classes locations
Meteorology

Rainfall

Sun

Normales insolation de 1971 à 2000
(en heures)

Normales des températures de 1971 à 2000
(en degrés Celsius)
Phenological interpretation

- Leaves Ageing
- Steady Stage
- Establishment of Young Leaves
- Leaves Ageing

- Decline in chlorophyll activity
- Drop in water content
- Coexistence of 2-year-old and 1-year-old foliage
- Low activity, low water content
- Increased activity
- Increased water content
- Anthocyanic foliage

Day of Year:
- Rainy season
- Dry season

Penec et al., 2011
Conclusion

- Remote sensing allows to characterize spatial organization and phenology of the tropical humid forests of the Guiana Shield

- These information are important to better estimate forest biomass and carbon storage

- The mapping of these ecosystems give a more precise idea of their vulnerability in face of the global changes
Thank you


