Potentialities of using ASTER & SRTM DEM for road planning in a Central African sustainable forest logging context - A case study in Gabon

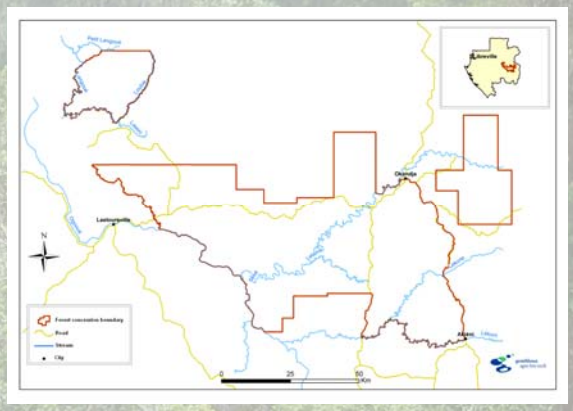
Julien Philippart, Daphné Handerek, Philippe Lejeune, Jean-Louis Doucet

Objectives

Evaluate potentialities and limitations of SRTM and ASTER DEMs for slope evaluation in sustainable forest road planning in Central Africa

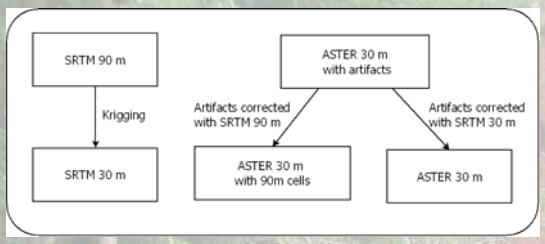
Study area and logging context

- Forest concession under sustainable management in the south-east Gabon (0°45'00'' S, 13°15'00' E)
- Covered by dense moist evergreen tropical forest, dominated by Okoume (*Aucoumea klaineana*)
- Canopy height is about 50m
- Selective logging (0.5 to 2 trees / ha)
- Reduced impact logging rules applied
- Maximum slope limitation : - 12% for primary roads
  - 30% for secondary roads



Methodology

- Five Elevation maps : 2 derived from SRTM and 3 derived from ASTER

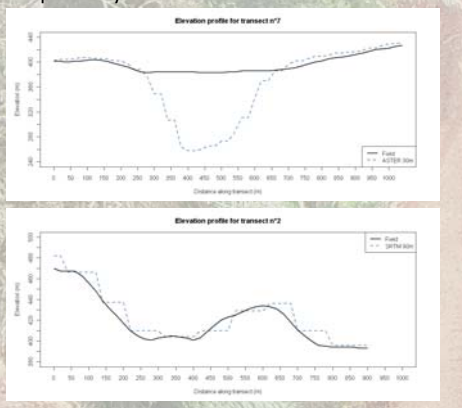


- Two test zones : Milolé (hilly) and Okondja (flat)
- Field Data : 992 and 668 slope measures along transects in Milolé and Okondja respectively
- Database compilation and slope comparison

Results

Qualitative approach

Examples of artifact and pixelisation effect for original ASTER 30m and SRTM 90m respectively



Quantitative approach

Comparison of RMSE, User's Accuracy (UA) and Global Accuracy (GA) for maximum slope limitation of primary roads (12%) and secondary roads (30%) for the two test zones Milolé (hilly) and Okondja (flat)

	MILOLE						
DEM	RMSE (°)	UA < 12%	UA > 12%	GA 12%	UA < 30%	UA > 30%	GA 30%
SRTM 90 m	7.8	70.8	59.5	67.4	81.6	65.2	79.3
SRTM 30 m	8.1	68.1	63.6	67.2	77.6	56.5	76.1
Aster 30 m	11.7	74.6	57.3	67.6	82.3	45.6	72.9
Aster Corr 90 m	10.1	75.2	58.8	68.7	91.8	21.7	84.3
Aster Corr 30m	9.3	74.0	63.2	70.5	91.7	31.3	88.0

	OKONDJA						
DEM	RMSE (°)	UA < 12%	UA > 12%	GA 12%	UA < 30%	UA > 30%	GA 30%
SRTM 90 m	10.7	59.5	80.0	63.9	66.7	73.2	67.3
SRTM 30 m	10.1	58.6	82.8	63.0	63.9	100.0	64.6
Aster 30 m	11.2	55.5	61.9	57.2	65.3	57.1	64.3
Aster Corr 90 m	11.2	55.5	61.9	57.2	84.3	43.3	82.5
Aster Corr 30m	11.0	55.6	63.3	57.4	84.1	44.0	82.7

Conclusions

- All DEMs show a greater GA in hilly area (Milolé) than in flat area (Okondja)
- SRTM derived DEMs show a higher UA for secondary roads constraint
- The use of corrected aster DEMs increases initial ASTER UA from 0.1 to 18.8% depending on category and slope limitation
- Resampling initial SRTM 90 m DEM to SRTM 30 m does not improve slope evaluation
- Despite a relatively high RMSE for slope grade, all of the DEMs tested (under the condition of correcting artifacts) were found to be consistent for consideration of maximum slope constraint aiming at sustainable road planning for forest logging in Central Africa

Contact: j.philippart@student.ulg.ac.be

University of Liege. Gembloux Agro bio-tech. Unit of Forest and Nature Management