

SAR monitoring concept and estimation of woody cover by means of SIR-C/X-SAR Kruger National Park Data Set

by

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A Contribution to the
SARvanna Project
(SANPARKS – NRF – BMBF)



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I - Why Radar ?

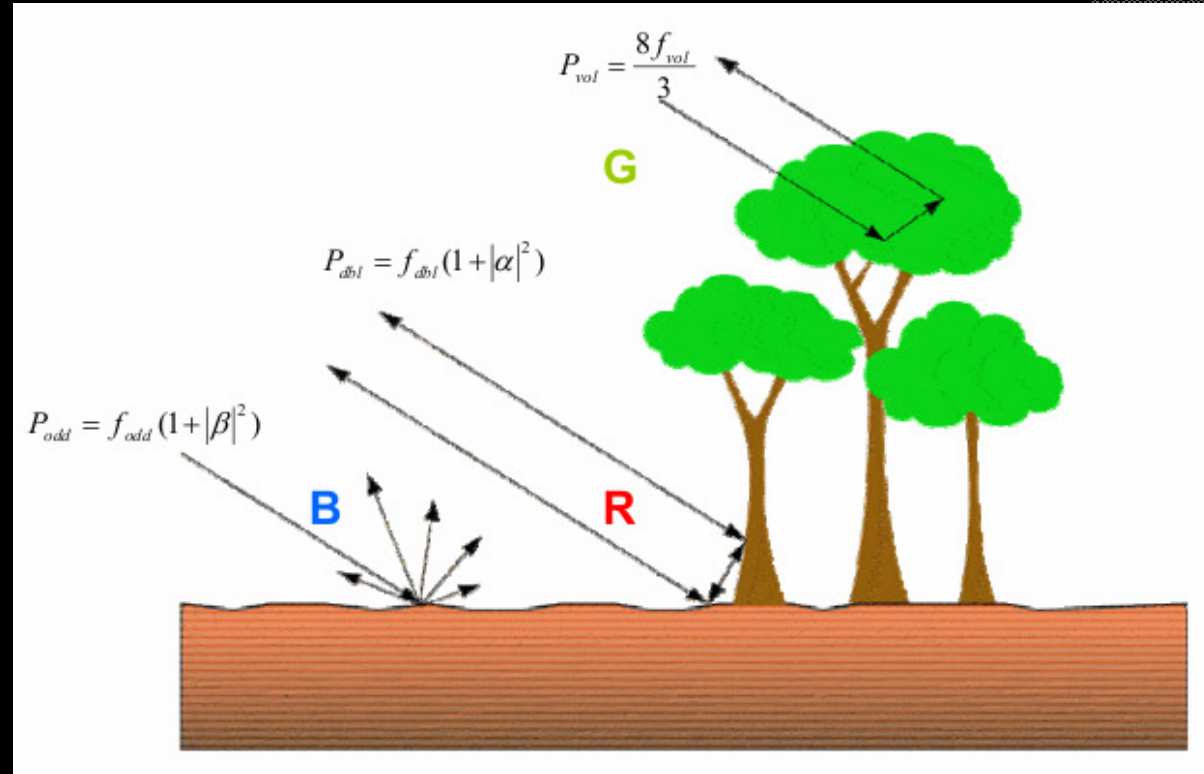
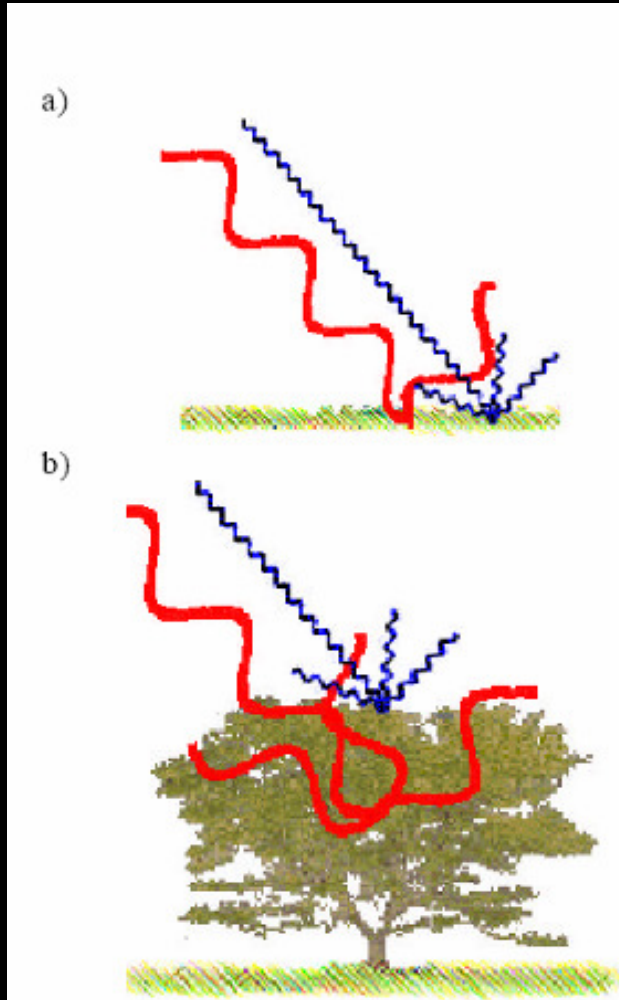


Fig. 1 (left): Backscattering mechanisms (Dennison et al. 1999)

Fig.2 (right): B: Surface scattering

R: Double Bounce

G: Volume Scattering

II – Study area

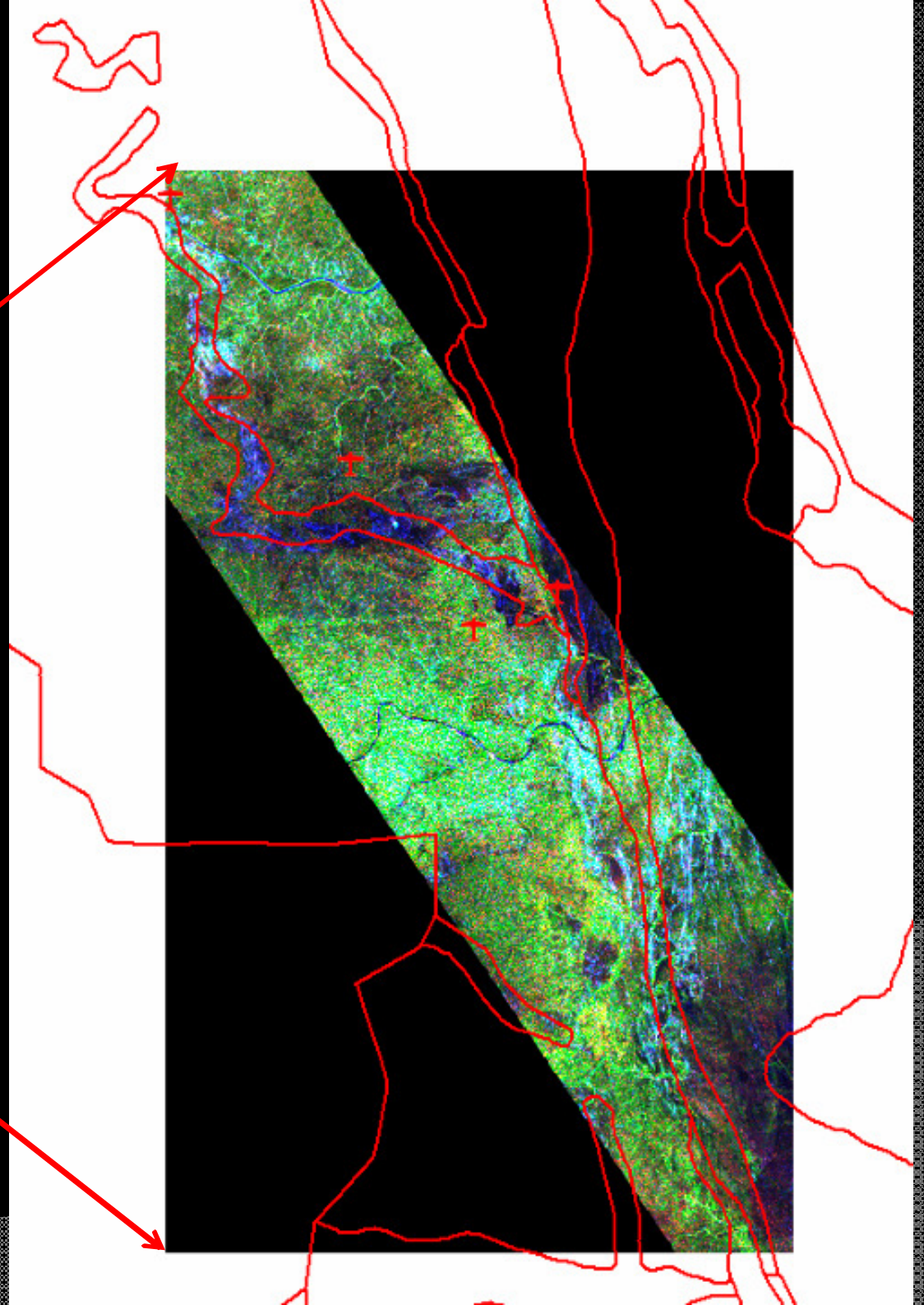
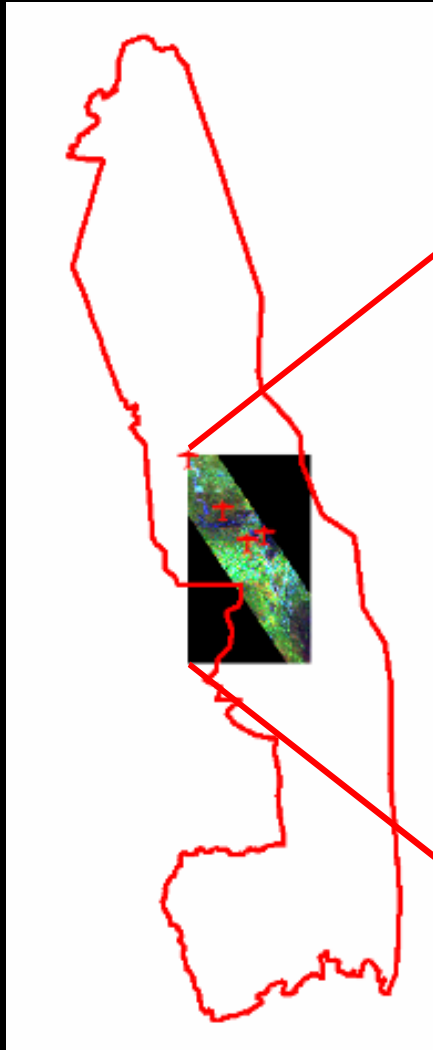


Fig. 4:
Right: Geology and air photo locations
R: Dbl B, G: Volume, B: Surface Scattering

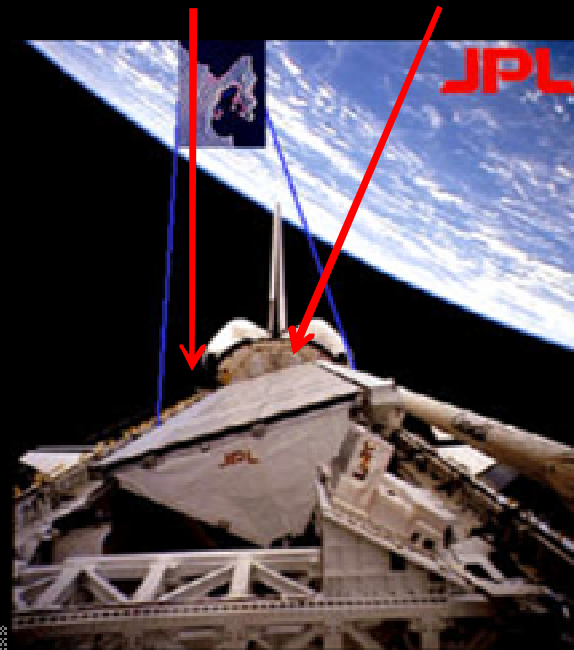
III - Data base

| <i>Mission/Sensor Parameter</i> | <i>Aquisition date</i> | | | |
|-------------------------------------|------------------------|-----------------|-----------------------|-----------------------|
| | 13.04.94 | 14.04.94 | 15.04.94 | 16.04.94 |
| Wavelength | L- & C-Band | L- & C-Band | L- & C-Band | L- & C-Band |
| Polarization Mode | HH/HV (dual) | HH/HV (dual) | HH/HV/VH/VV (full) | HH/HV/VH/VV (full) |
| Incidence Angle | 57.9° | 50.8° | 44.3° | 37.0° |
| Number of scenes | 2 | 2 | 2 | 1 |
| Resolution | 12.5m | 12.5 | 12.5 | 12.5m |

Tab. 1:
Datatakes
during the SRL 1
mission

C-Band antenna

L-Band antenna



IV - Method

- ◎ Object-based classification of the reference data (30cm resolution)
 - Level 1: small segments
 - Level 2: large segments
- ◎ Zonal statistics of the resultant shapes
 - Comparison of the 4 airphoto classes and the corresponding radar-retrieved information layers

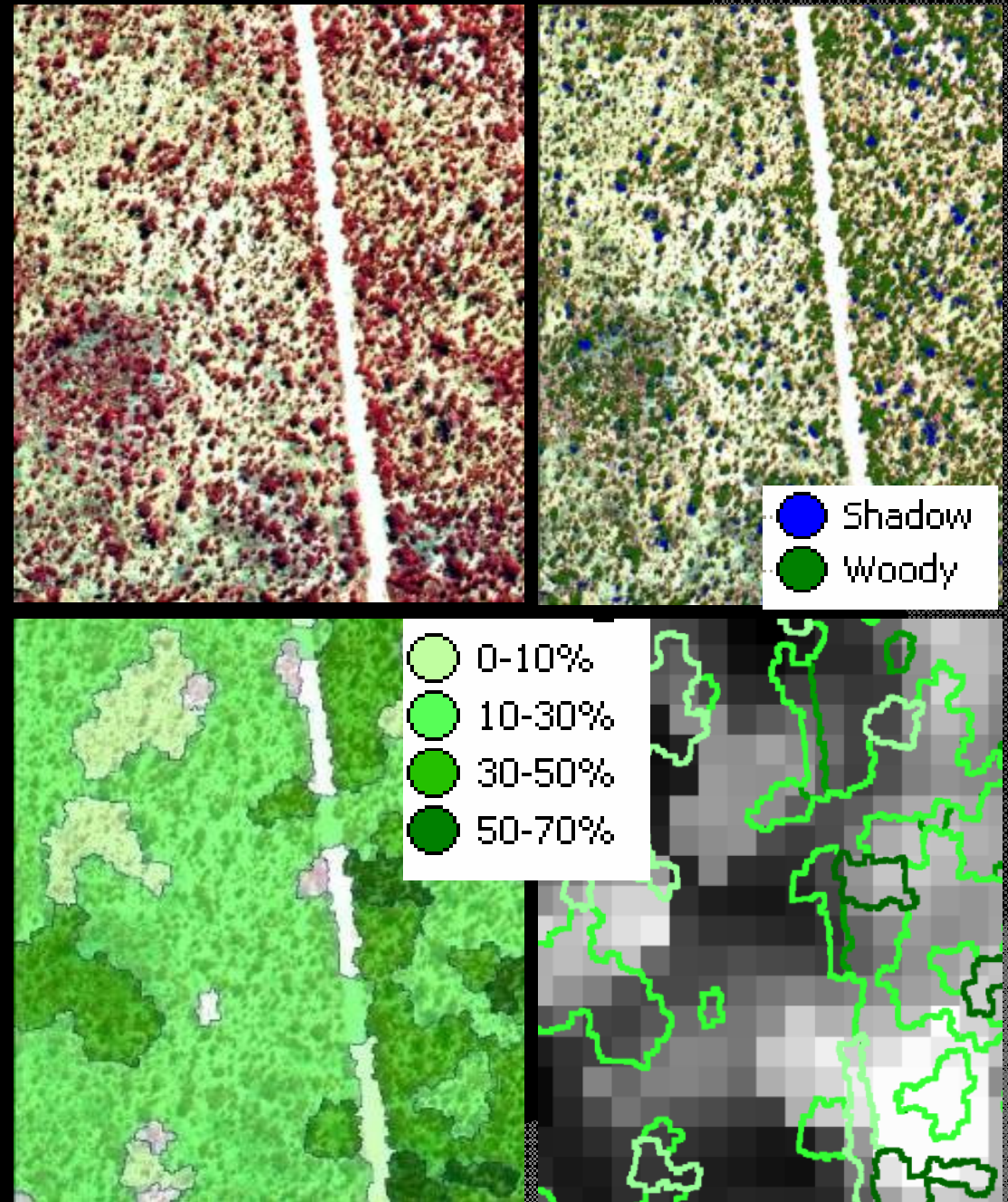


Fig. 6: UL-airphoto, UR-Level 1 classification, LL-Level 2 classification, LR-Level 2 segments and radar image

V - Results from zonal statistics

I Polarimetric Parameters

- Volume scattering components important
- Intensities (especially HV) for dual-polarised data useful
- H/A/alpha decomposition parameters less suited for woody cover estimation

II Wavelength

- L-Band more qualified due to to higher dynamic range
- C-Band in combination with inverse modelling approaches (?)

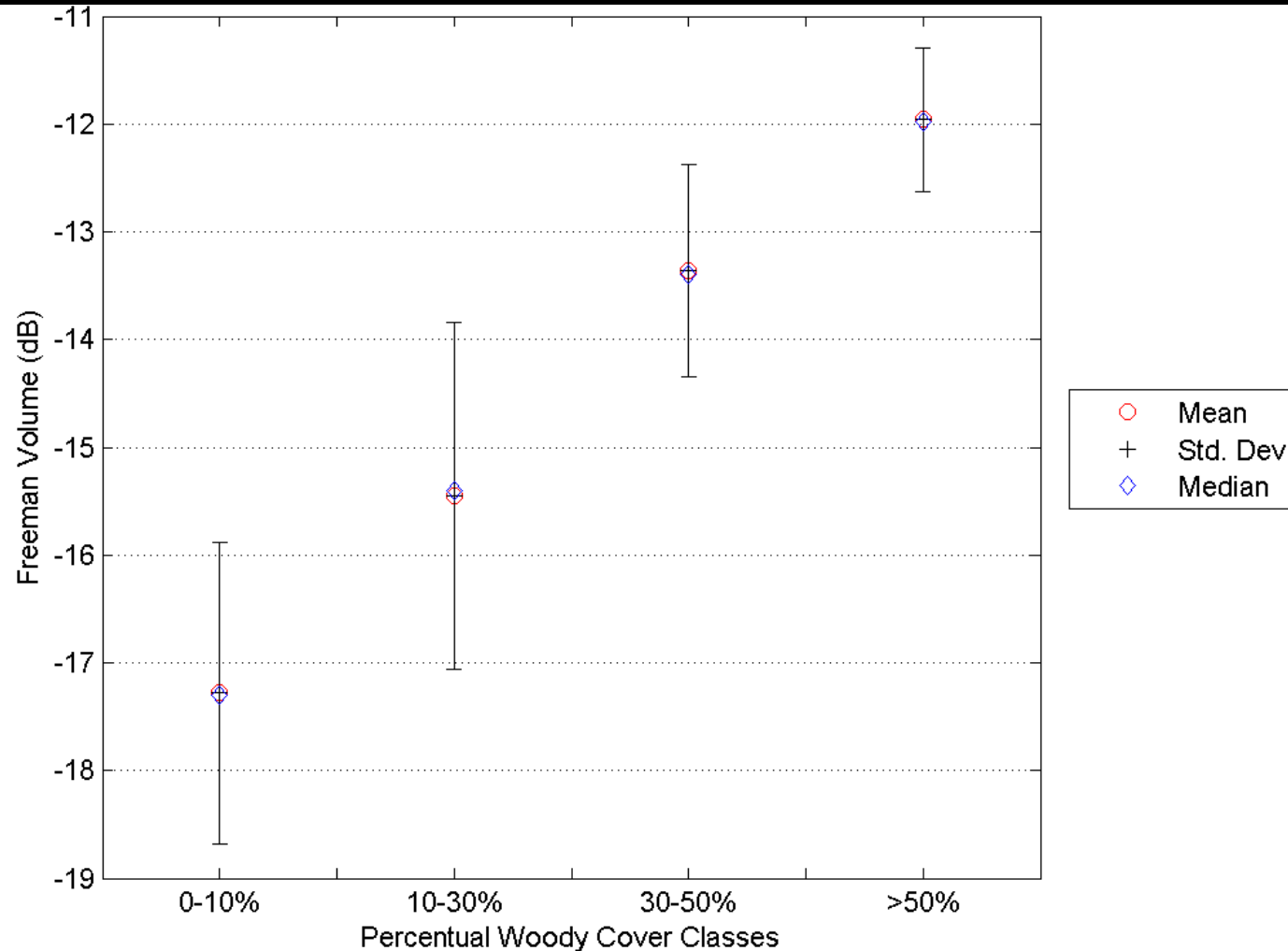
III Incidence Angle

- less influence than the other parameters
- for woody cover estimation: smaller look angle more qualified

V - Results

◎ Woody cover estimation

- L- Band, 37° incidence angle, Freeman volume component



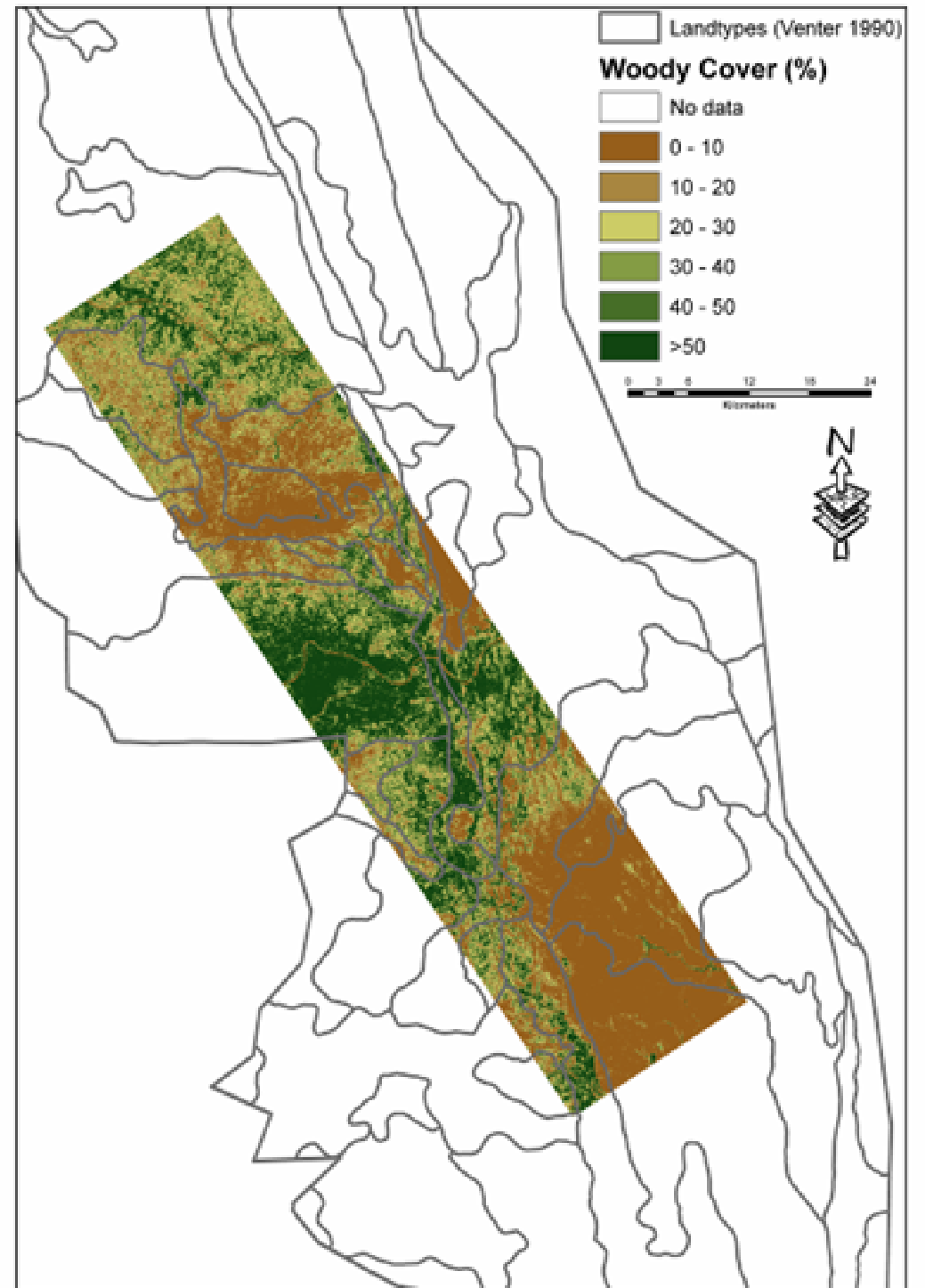
- high variance within the classes
 - georeferencing issues
 - vertical tree component not being considered
- Speckle phenomena
- soil roughness ?

Fig. 7: Volume scattering component vs. Airphoto woody cover.

V - Results

- Visual Interpretation
 - existent landscape patterns can be detected
 - results are in agreement with other estimates (e.g. Bucini et al. 2009, Kemp et al. 1997)
- Further steps:
 - Validation at smaller scale
 - Inverse physical modelling
 - field campaign
 - relation to height and volume (biomass)

Fig . 8: Woody cover map derived from Freeman volume component (L-Band, 37° incidence angle) overlaid with landtypes after Venter 1990



VI - Operational Space-based Monitoring Concept

◎ **Suitable space-borne Sensors**

- ALOS-1/-2 PALSAR: L-Band, dual- & full polarised modi
- Radarsat 2 : C-Band, dual- & full polarised modi
- ENVISAT ASAR: C-Band, dual-polarised modi (large scale mapping)
- SENTINEL-1: C-Band, full polarised, cost free

Acknowledgements

- ◎ Staff from Dept. Of Earth Observation, Jena
- ◎ SANParks
- ◎ Project partners of SARvanna

Thank you for your attention!