World Agroforestry Centre
TRANSFORMING LIVES AND LANDSCAPES

Land Use, Land Use Change & Forestry

- Some Landscape Ecological Effects -







Outline

- Detection of Land Use and Land Use Change in the tropics
  - Wall-to-wall approach vs. systematic sampling scheme
  - Multi-sensor approach
  - Topographic correction
- Effects of Land Use on ecological parameters
  - Assessment
  - Up-scaling
- Implications

Land Use Change Detection

Peru

- Wall-to-wall approach
  - Complete area assessed
  - Cloud incidence
  - Topographic heterogeneity
- Example
  - Alto Mayo, Peru
  - Andes, Eastern Slopes
  - 800 - 3000 m asl.
  - 8000 km^2

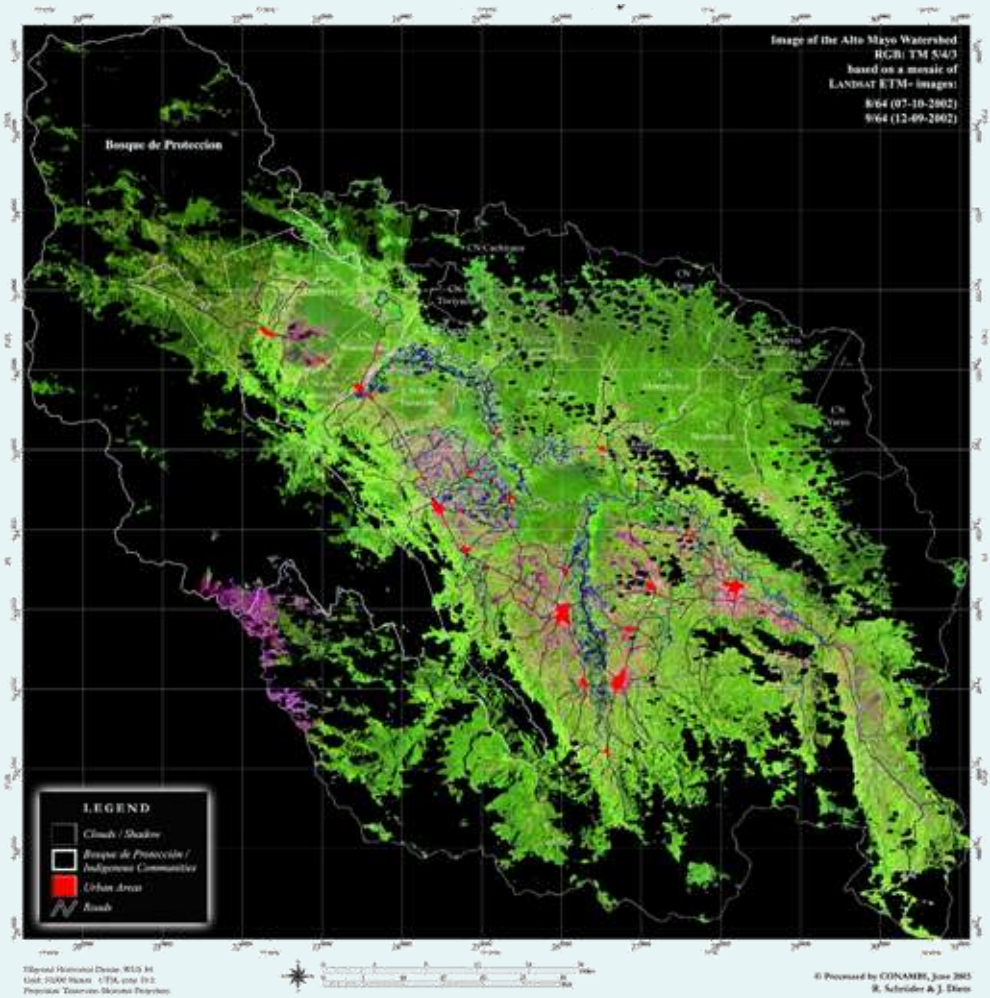


Dietz (2002)

Land Use Change Detection

Wall-to-wall

- Multi-temporal assessment
  - 1989 - 2002
  - Landsat imagery
- Challenges
  - Cloud-free scenes
  - Distinction between agroforest (coffee) and secondary vegetation
  - Clear identification of rice fields

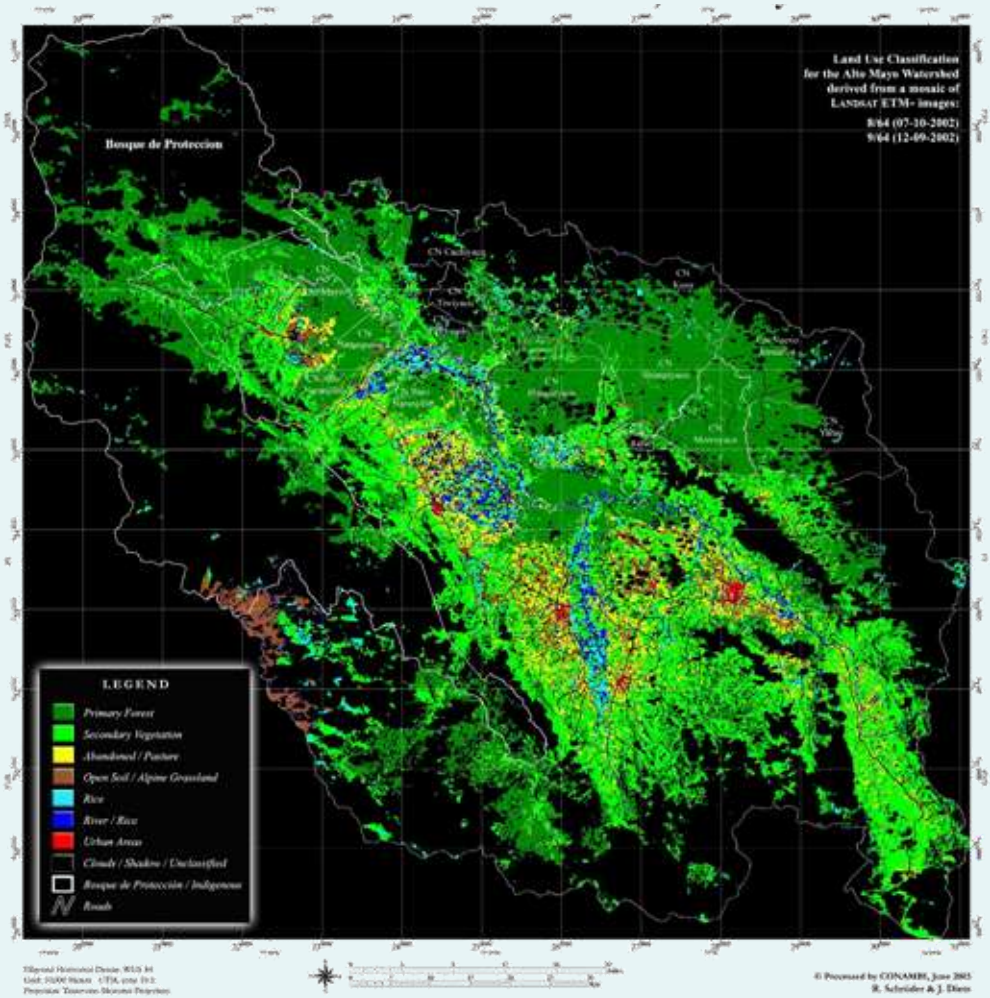


Zimmermann et al. (2003)

Land Use Change Detection

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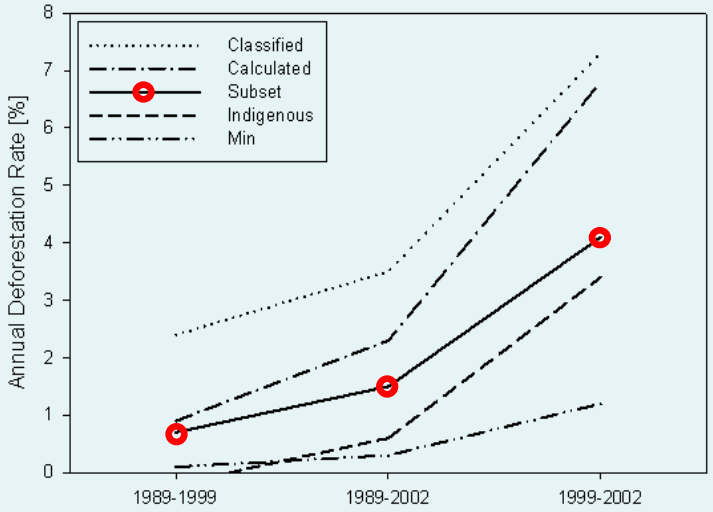


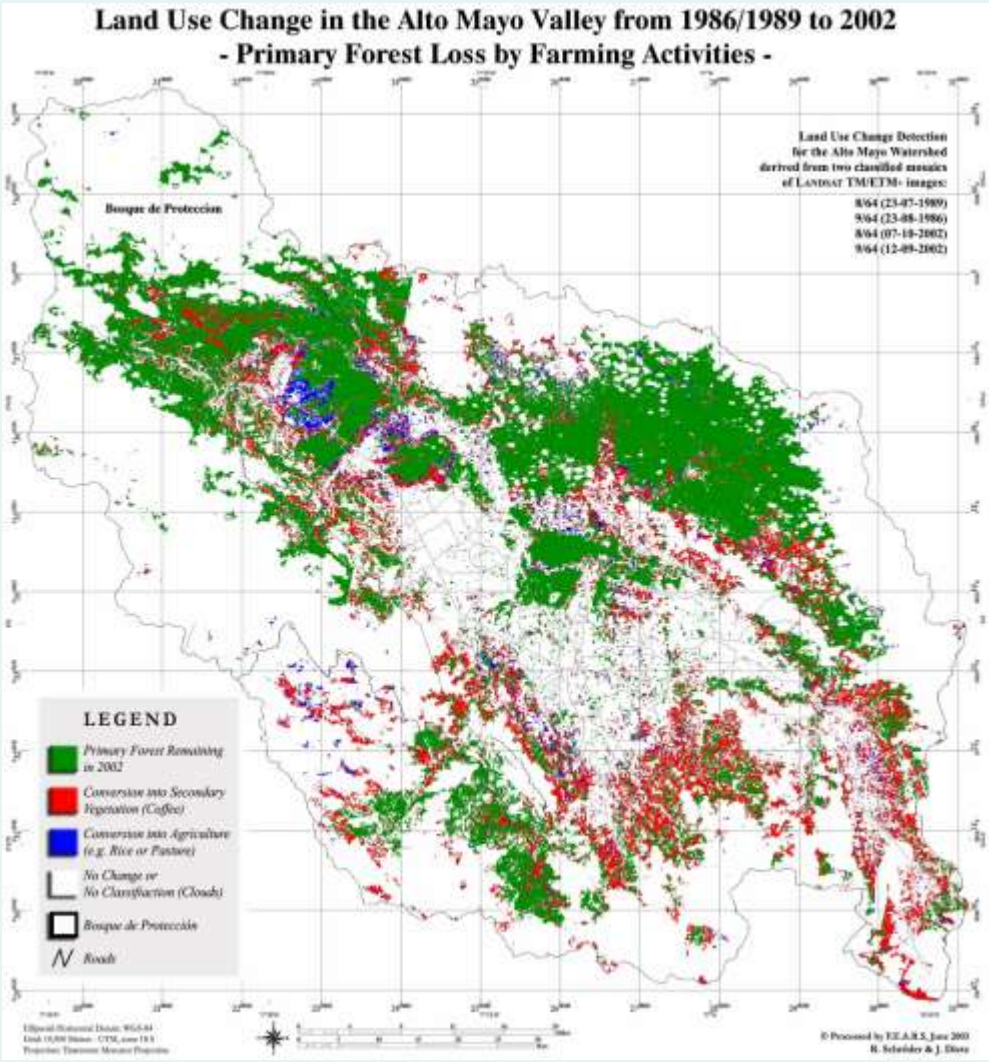
Zimmermann et al. (2003)

Land Use Change Detection

Wall-to-wall

- Land use change
  - < 50% assessed
  - No clear identification of agroforests
  - Bias to high deforestation

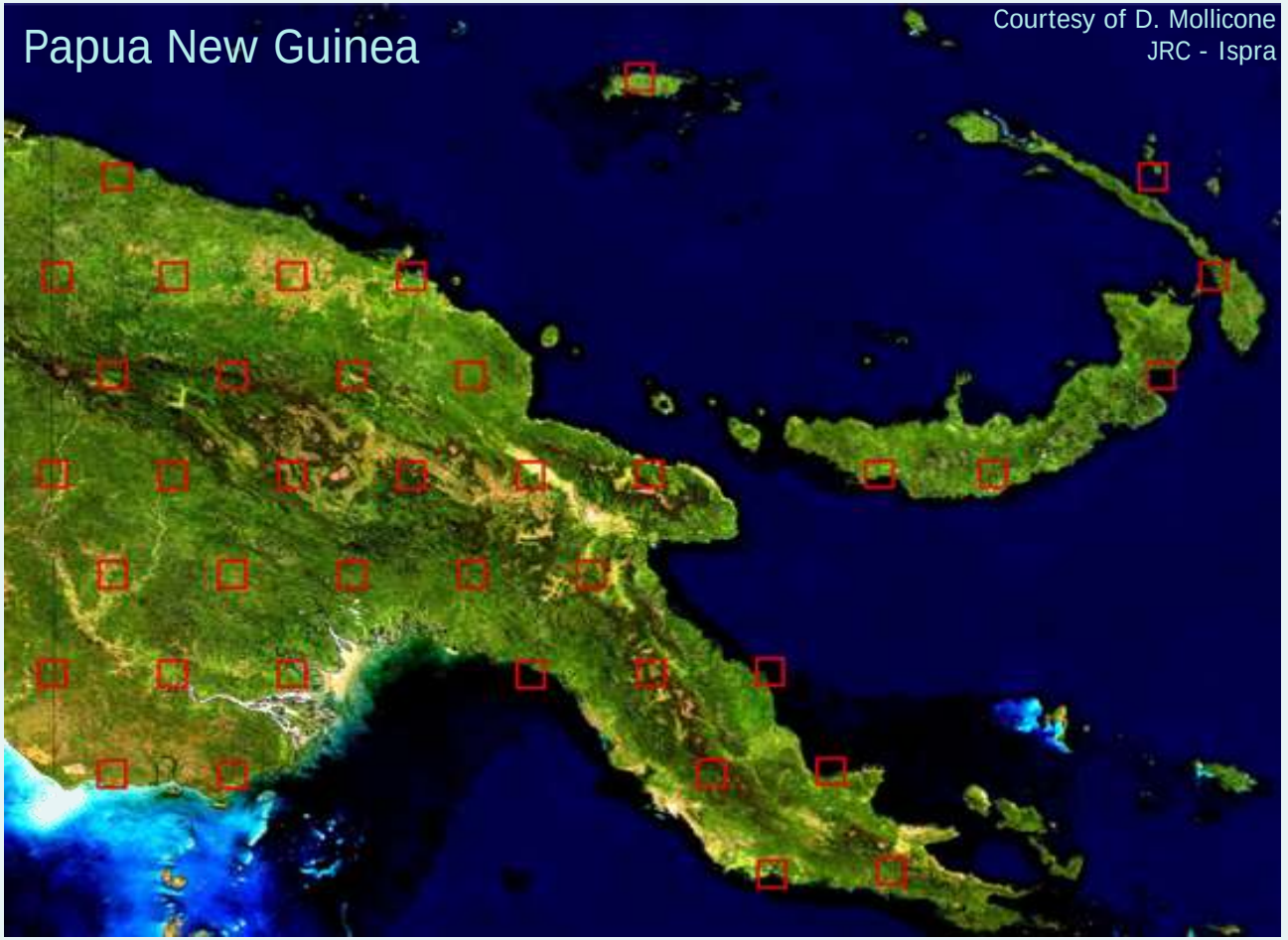




Land Use Change Detection

Systematic

- Systematic sampling scheme
  - FAO-FRA
  - Deforestation assessment
  - Trial in PNG
  - 9% of country's land surface



Land Cover Classification

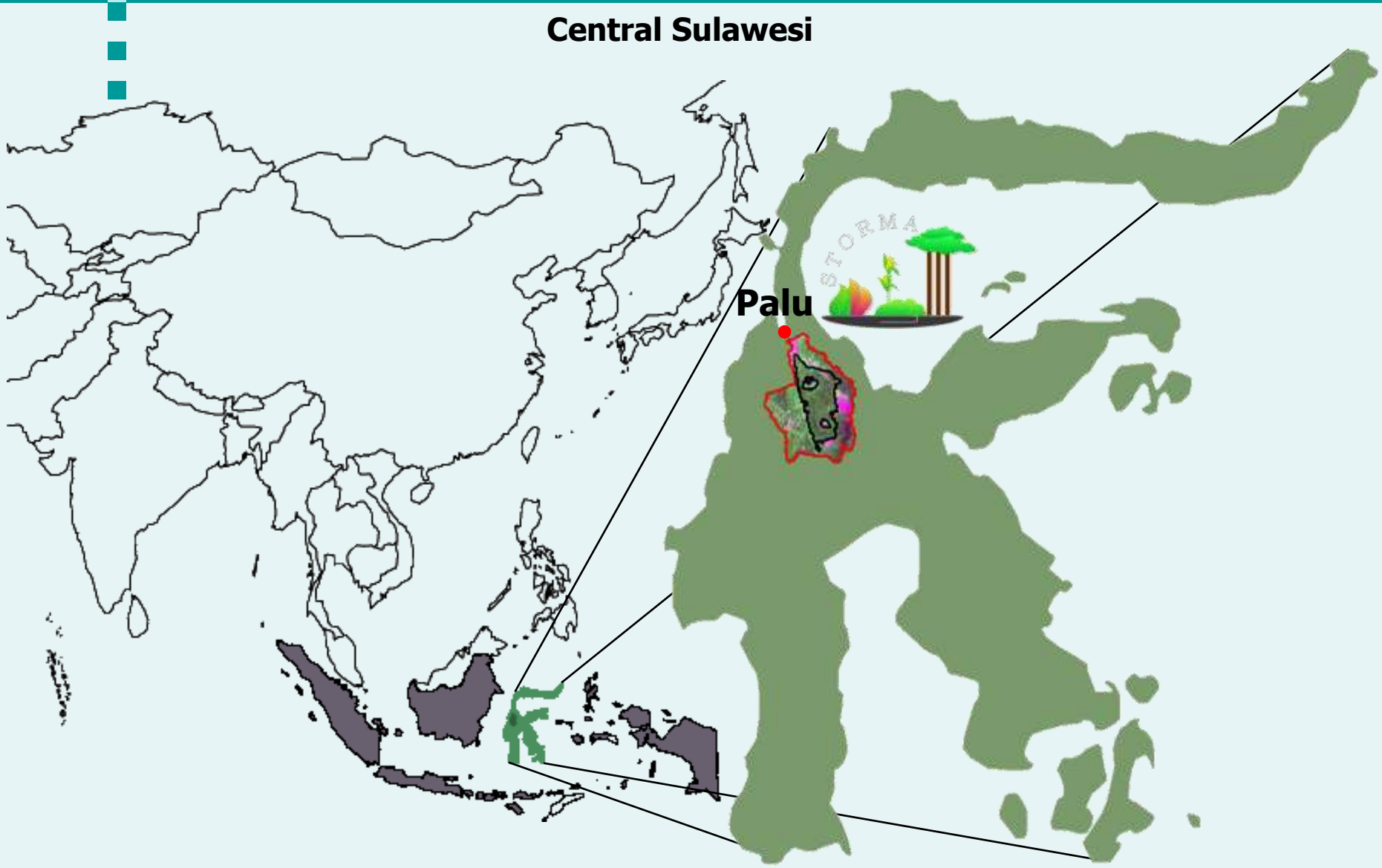
Indonesia

Central Sulawesi



Land Cover Classification

Indonesia



Land Cover Classification

Indonesia



Paddy rice



Scrubland



Old-growth forest



Imperata **grassland**



Fresh clear-cut

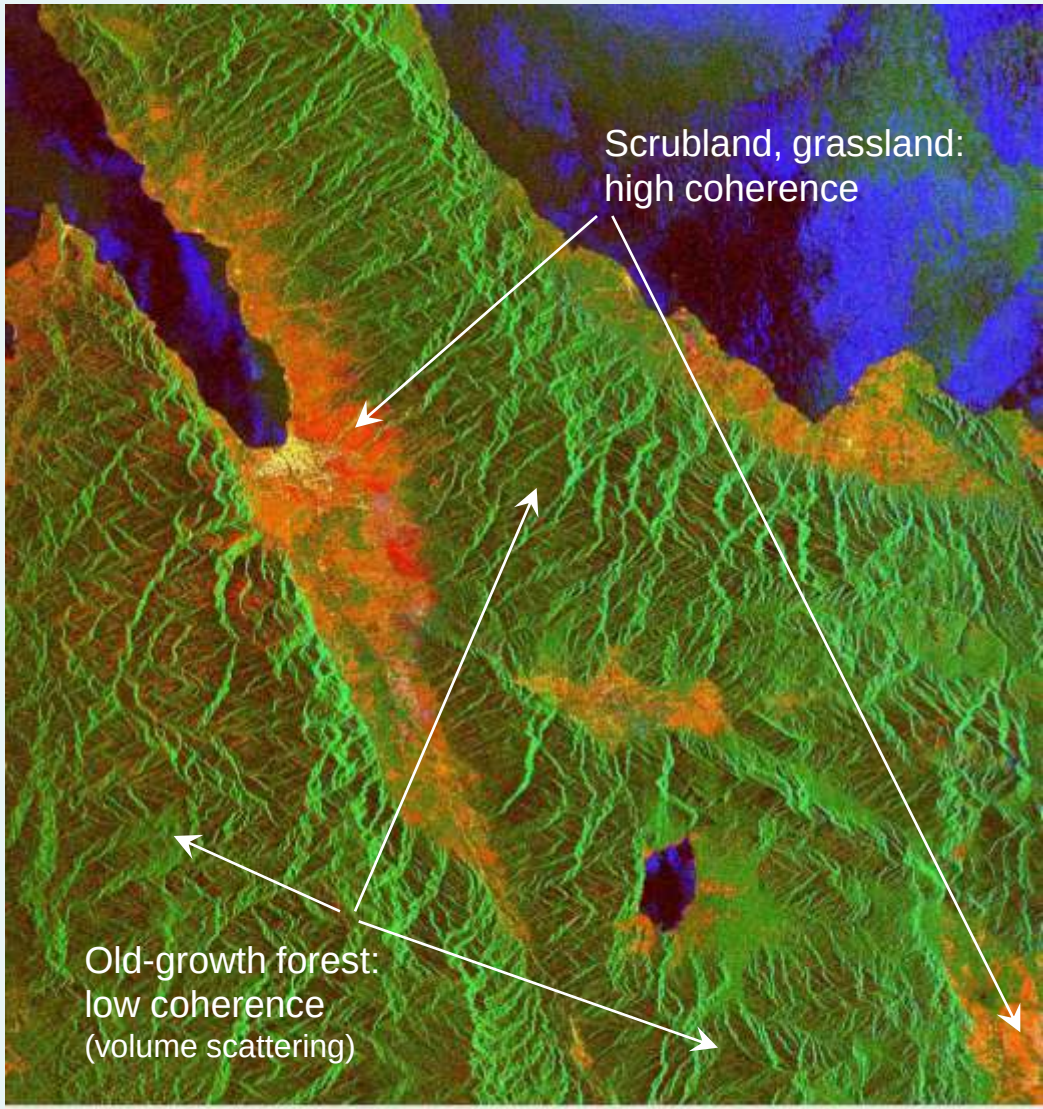


Cocoa agroforestry

Land Cover Classification

Multi-sensor

- Radar application
  - ERS-1/2 Tandem
  - Identification of shrublands vs. rainforest
  - Identification of rice at various stages
- Potential
  - In combination with visible sensors
  - Precise distinction between land cover types

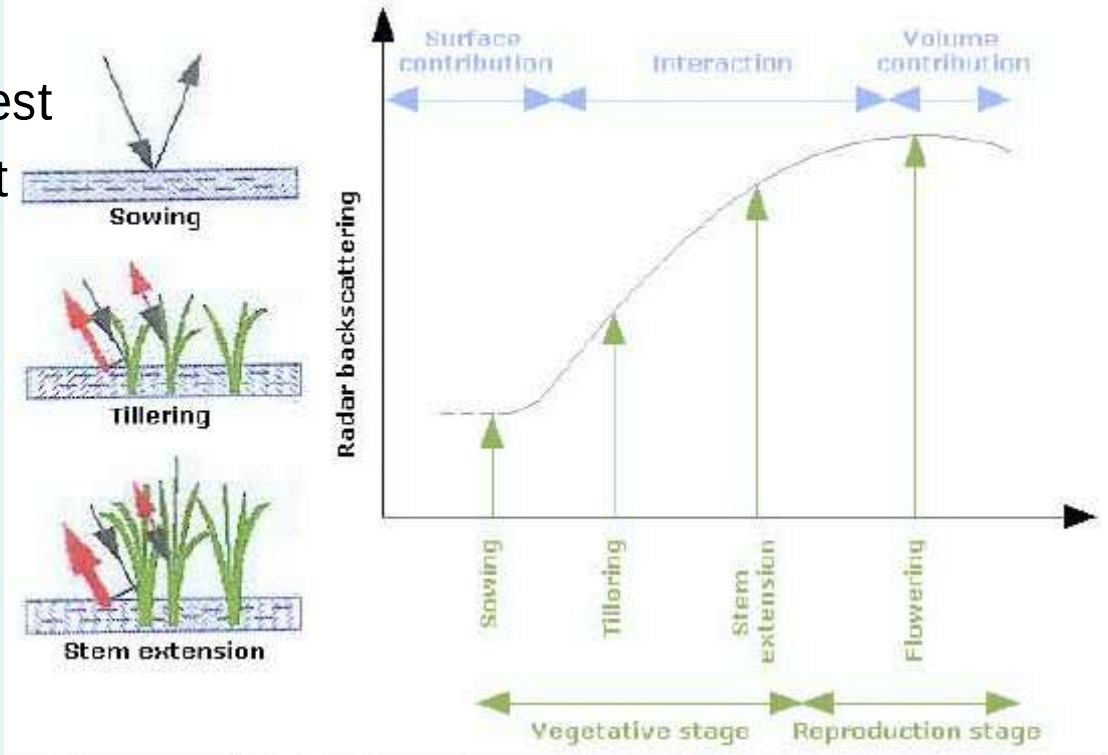


ERS-1/2 Tandem RGB - R: coherence G: mean backscatter B: difference in backscatter

Land Cover Classification

Multi-sensor

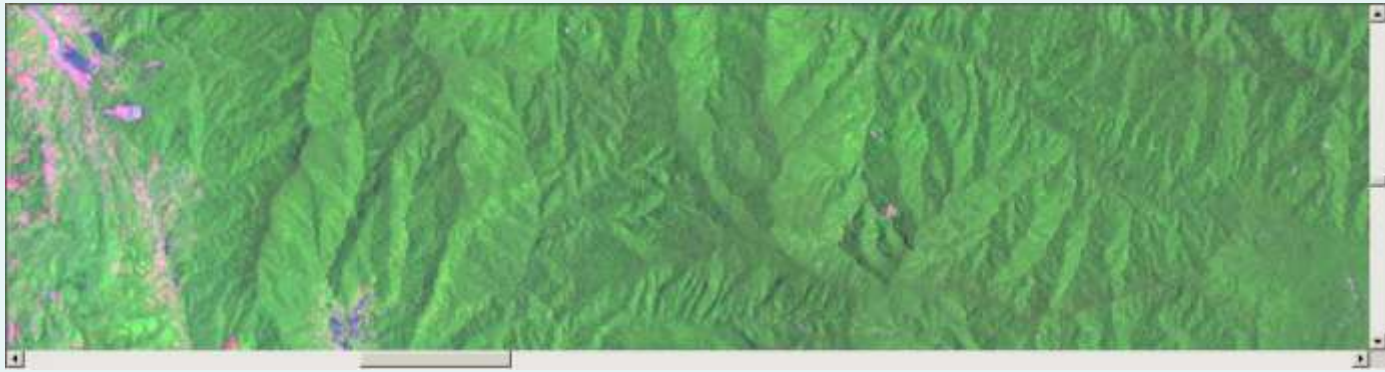
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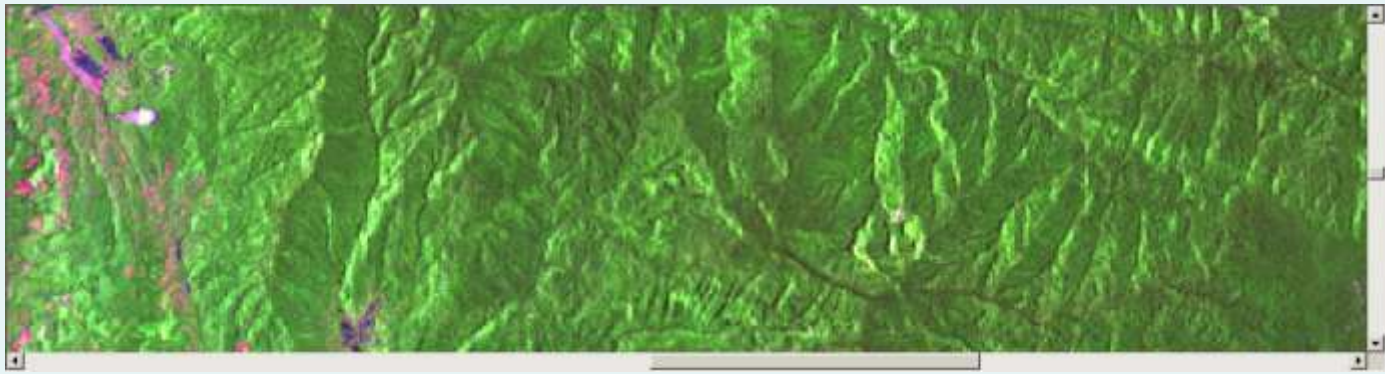
Land Cover Classification

Topographic correction

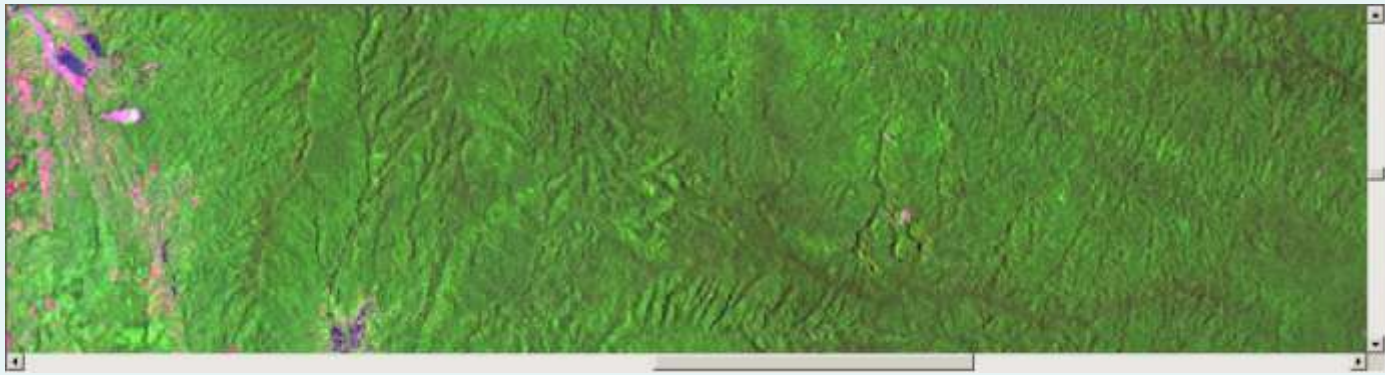
non-corrected
Landsat/ETM 741
28/09/02



Cosine Correction
(lambertian)

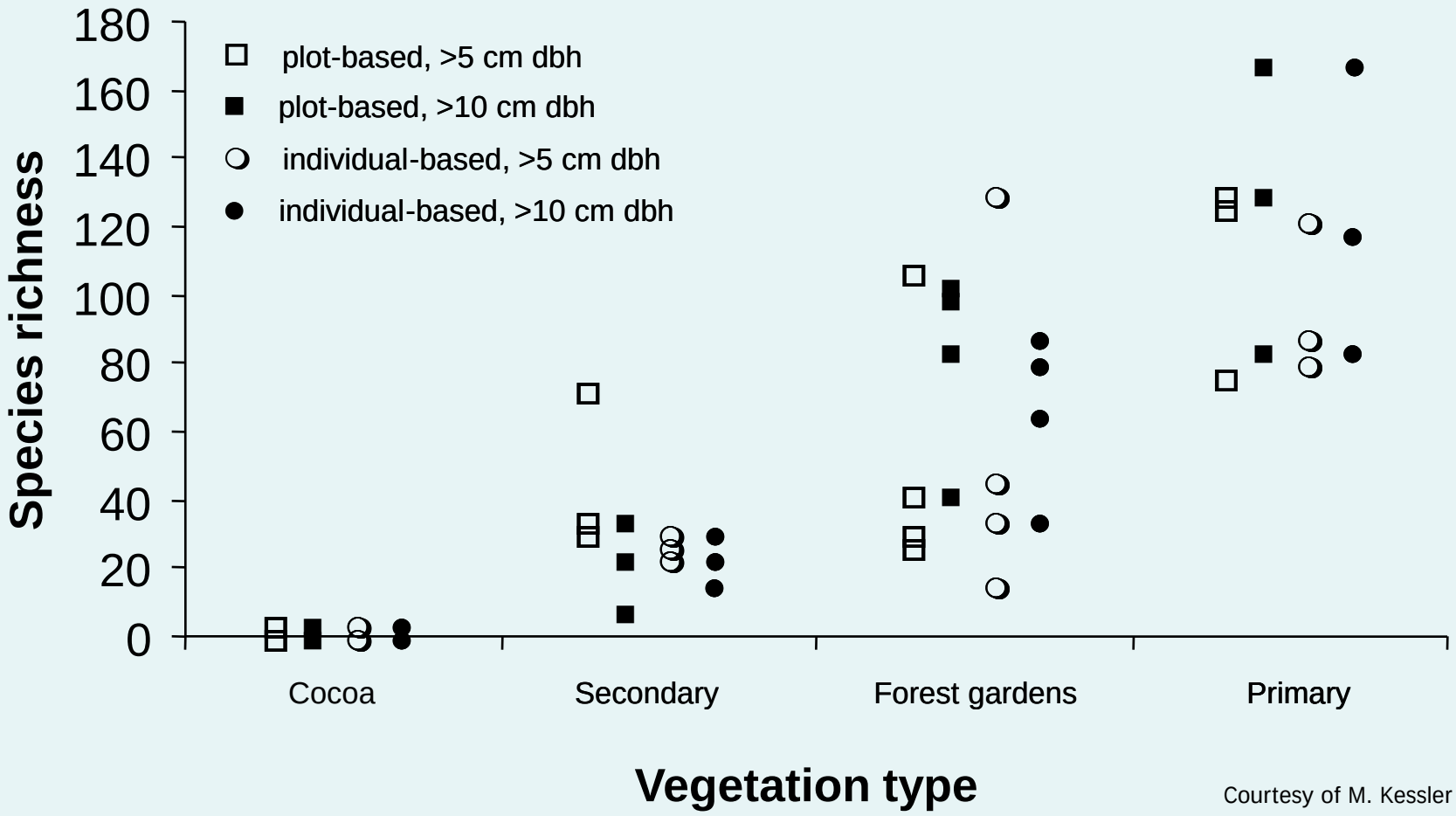


C-Correction
(non-lambertian)



Ecological Parameters

Diversity

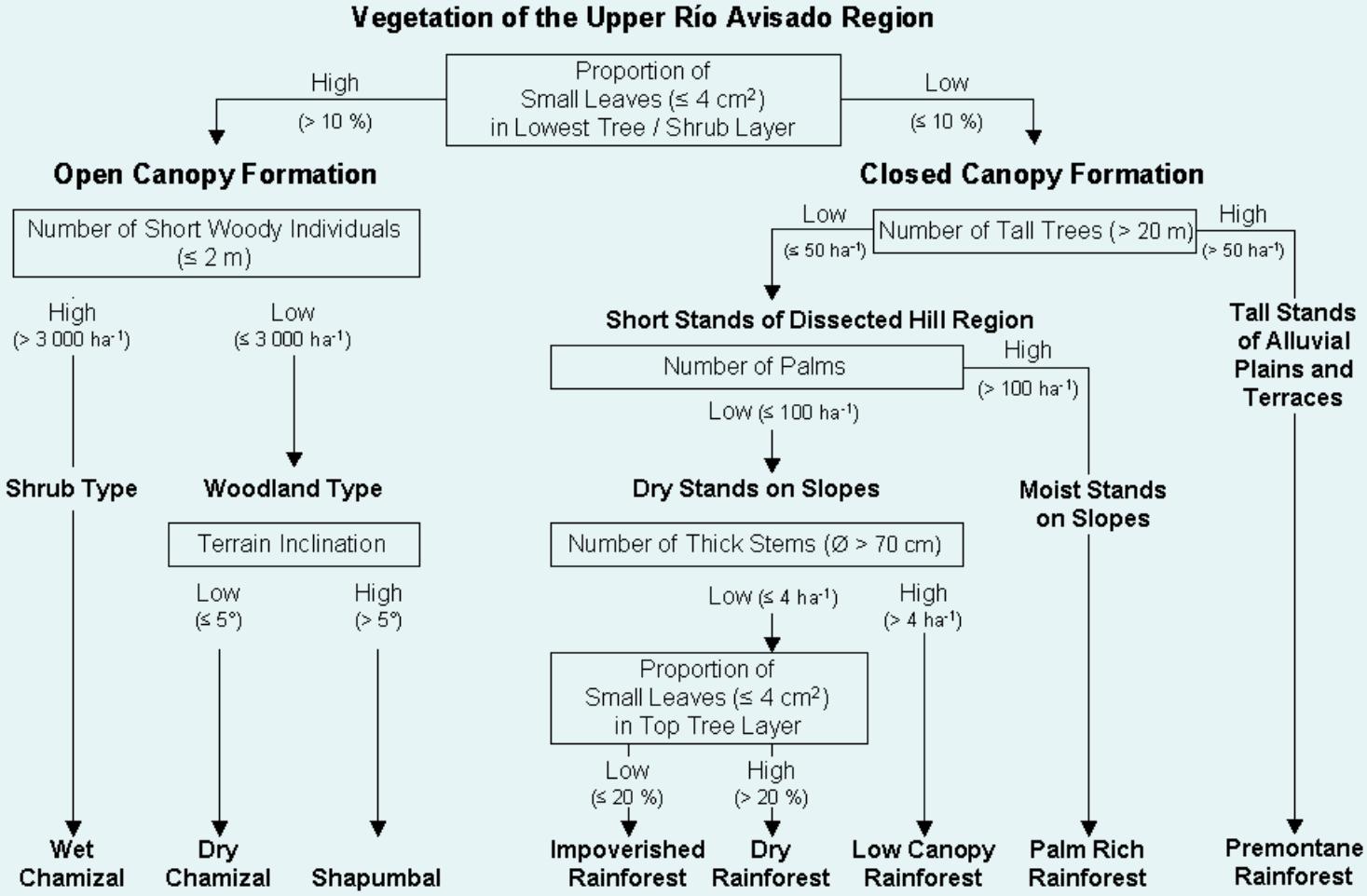


Courtesy of M. Kessler

Ecological Parameters

Assessment

Stand structure and biomass

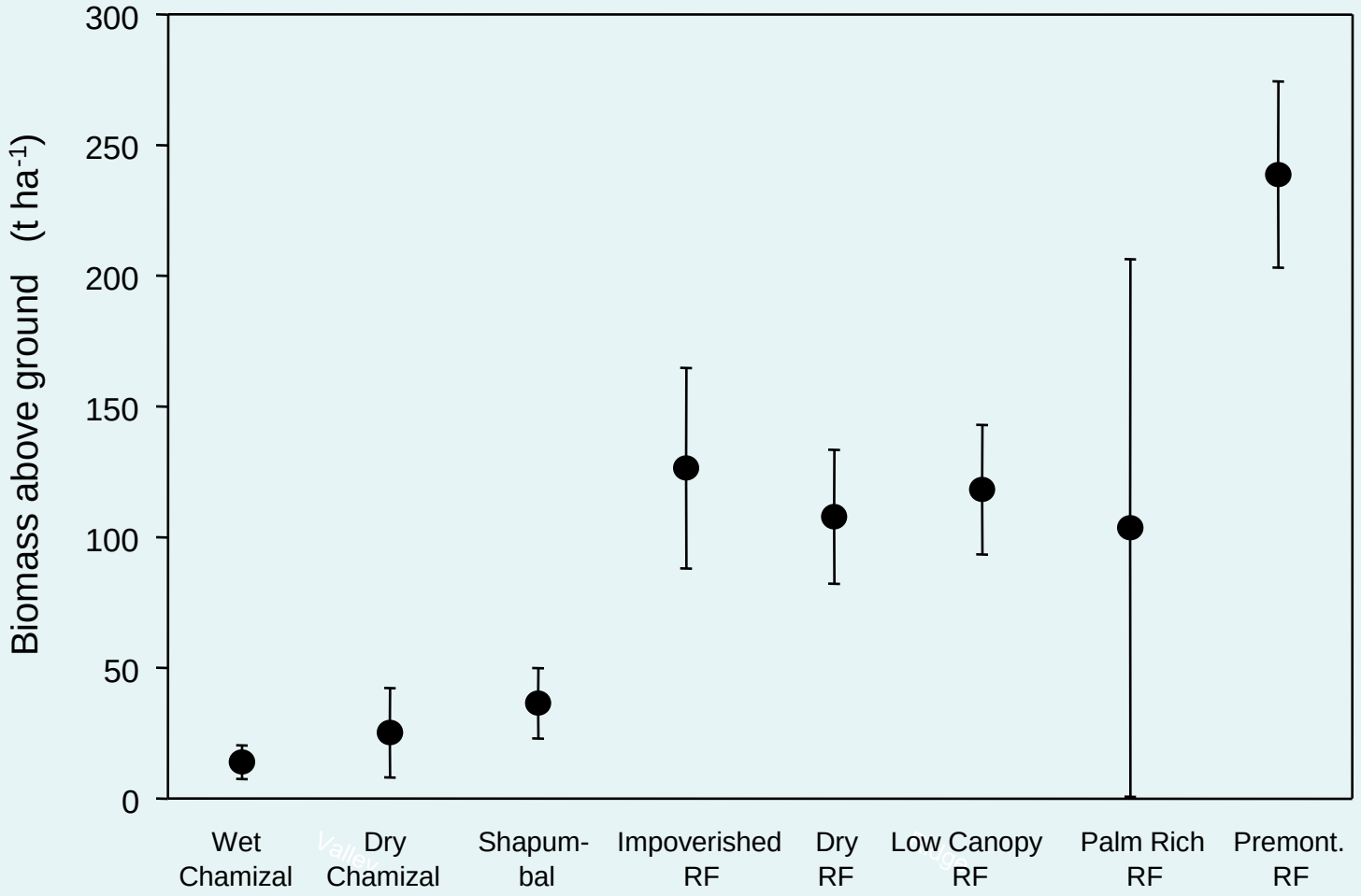


Dietz (2002)

Ecological Parameters

Assessment

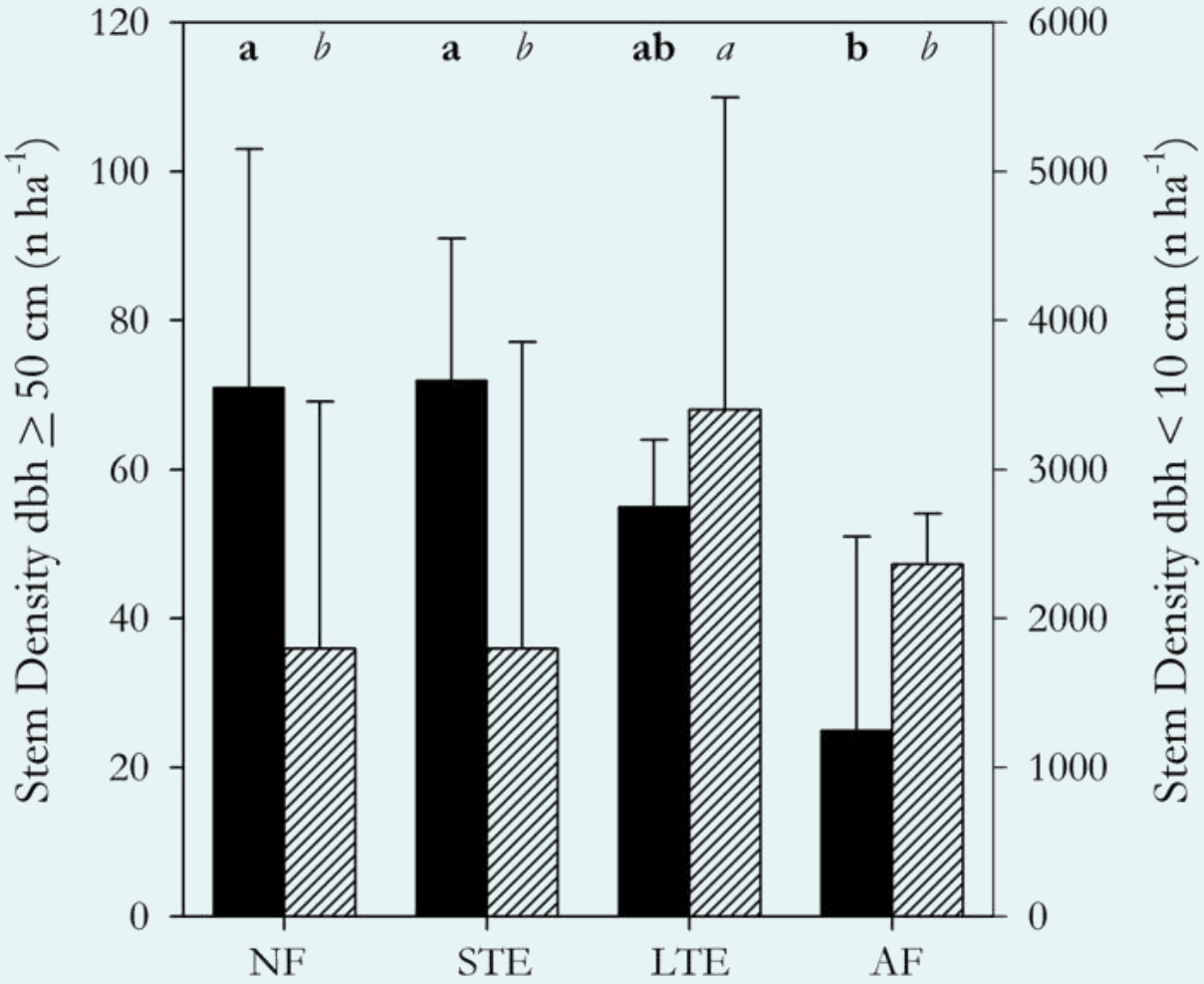
Stand structure and biomass



Dietz (2002)

Ecological Parameters

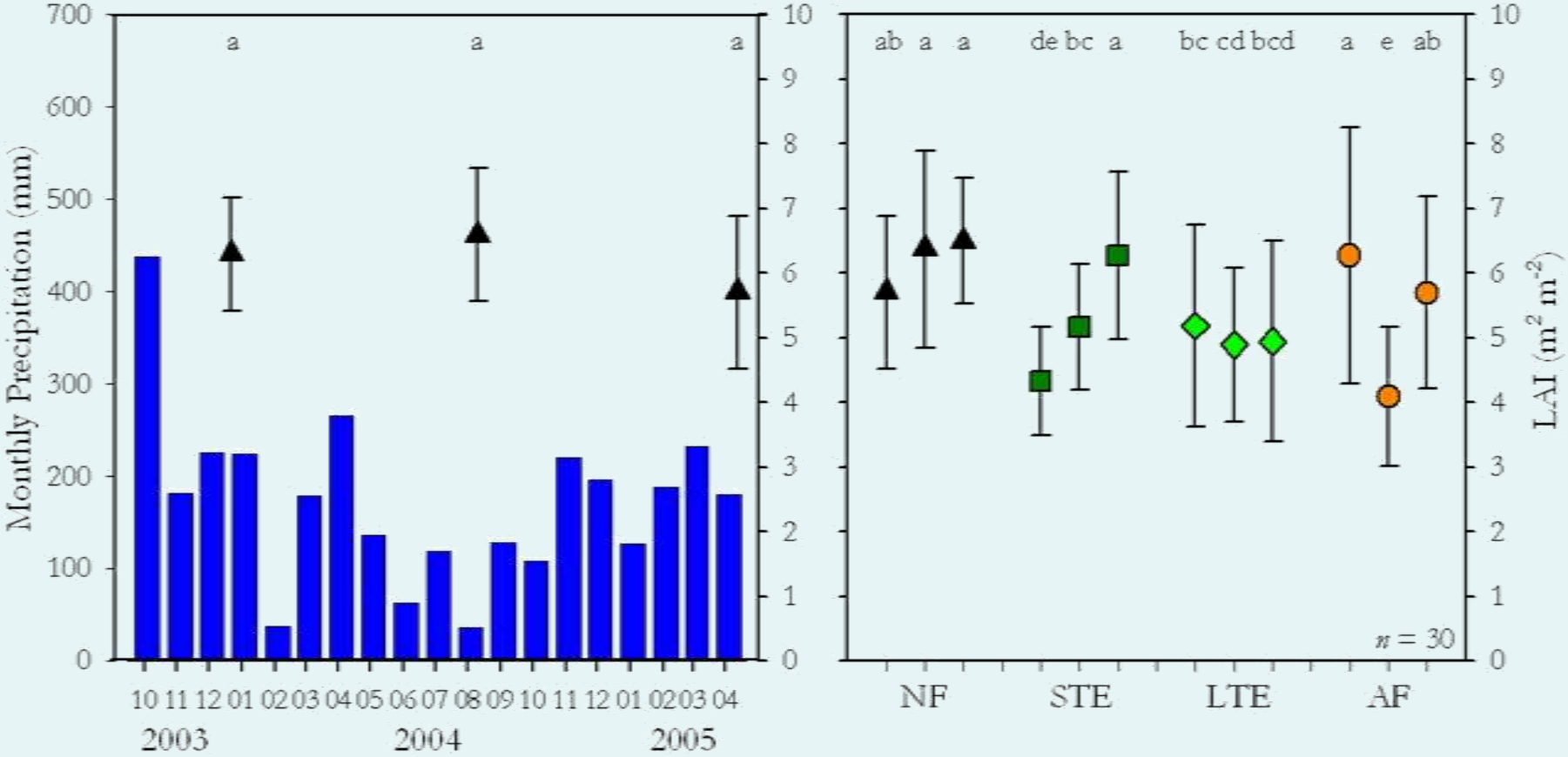
Stand structure and biomass



Dietz et al. (2007)

Ecological Parameters

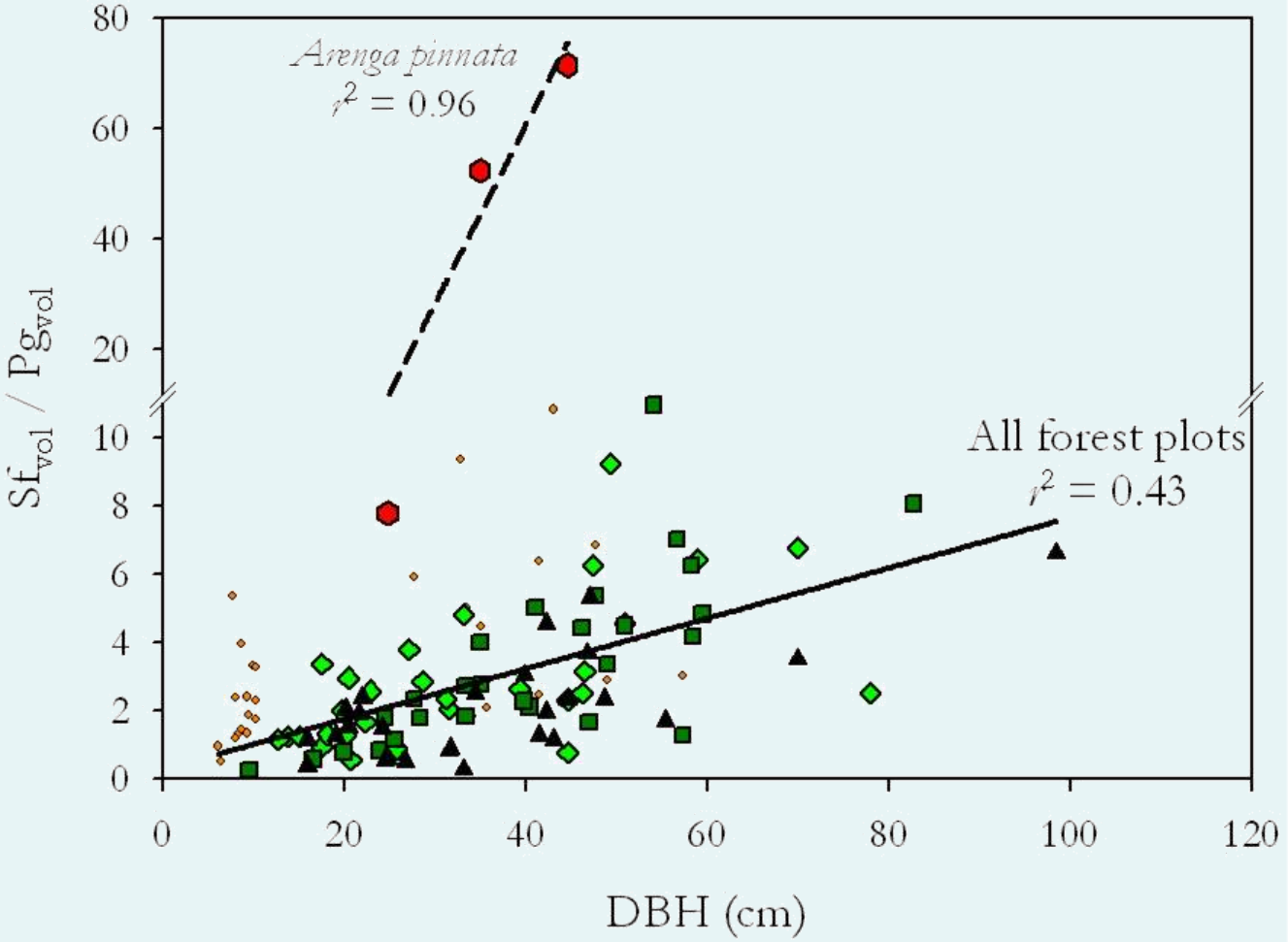
Leaf Area



Dietz et al. (2007)

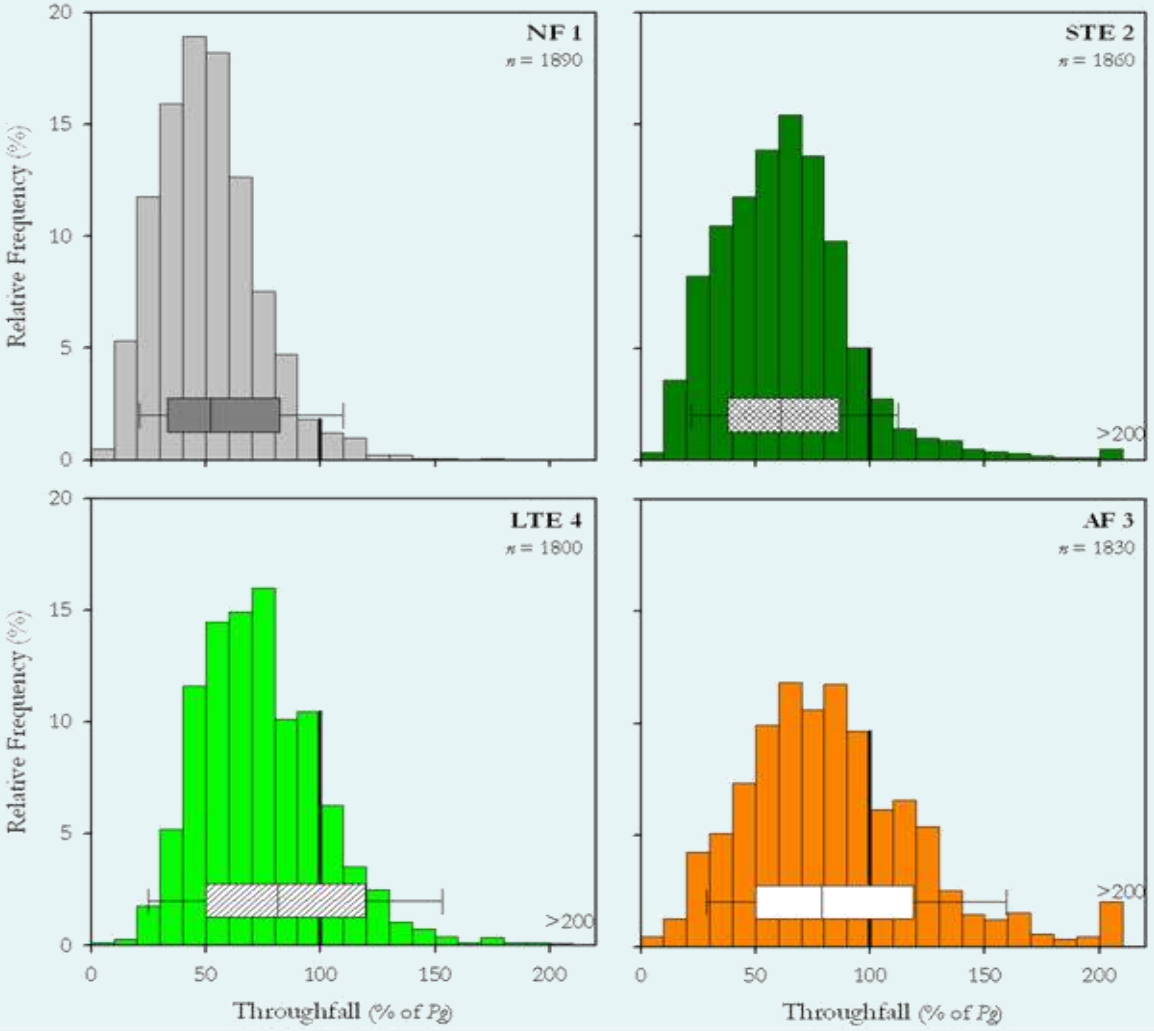
Ecological Parameters

Stemflow



Ecological Parameters

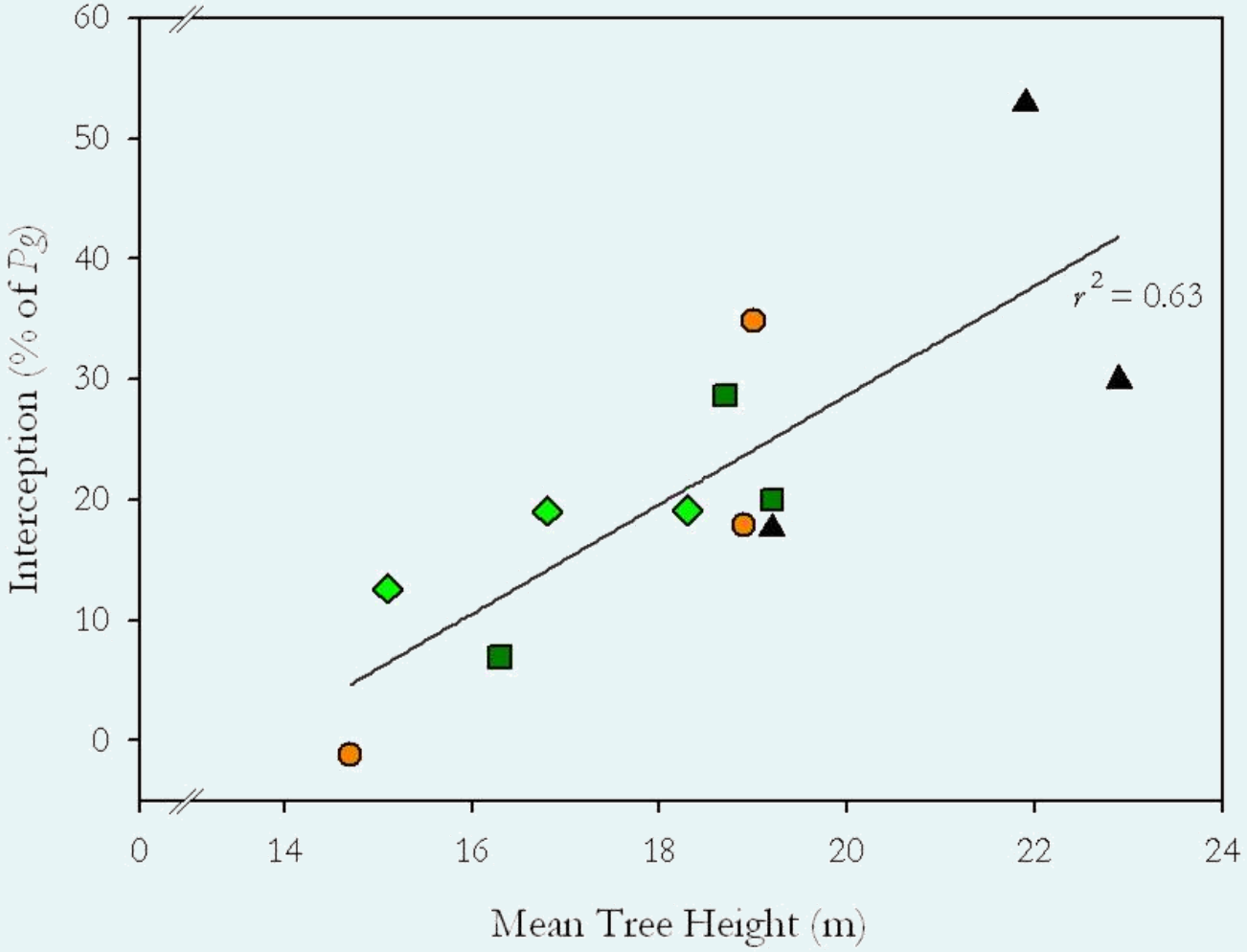
Throughfall



Dietz (2007)

Ecological Parameters

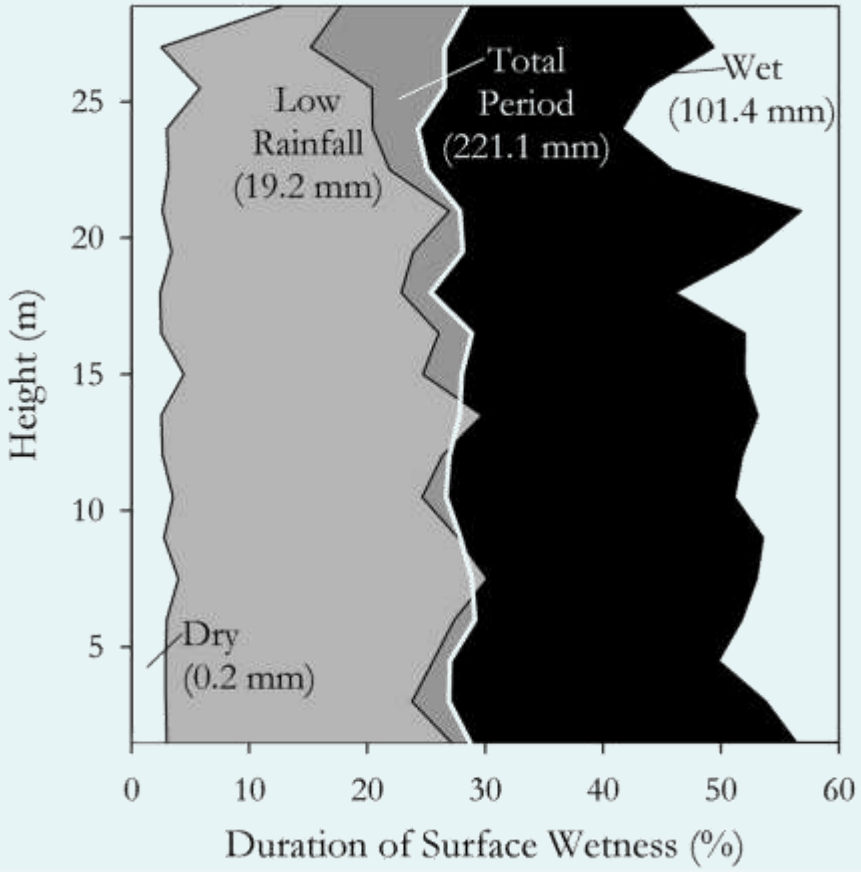
Interception

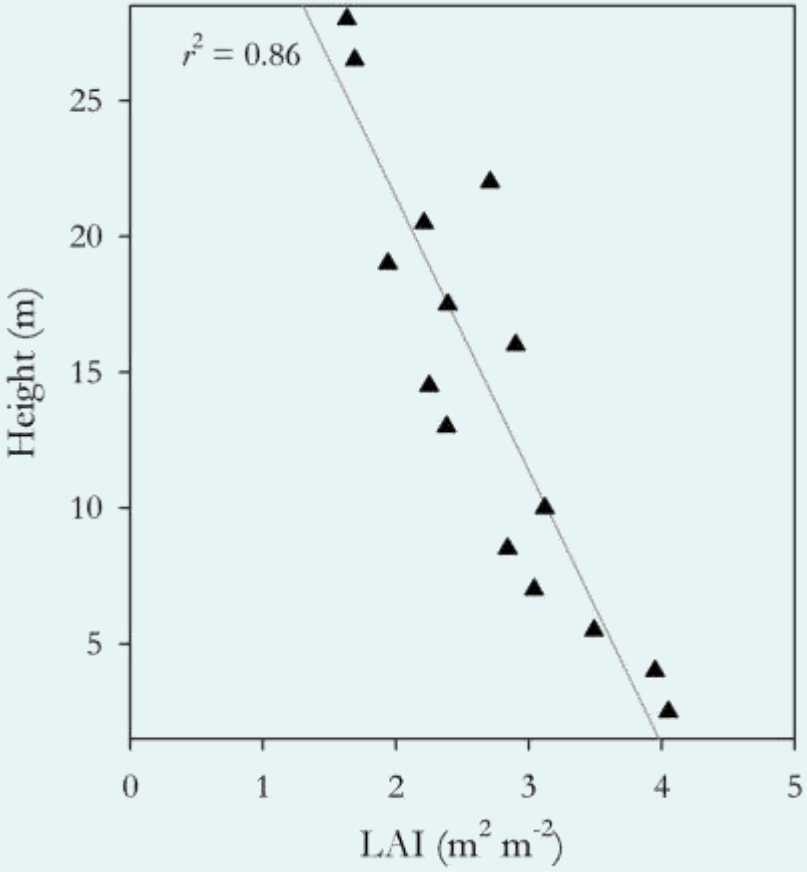


Dietz et al. (2006)

Ecological Parameters

Leaf wetness vs. leaf area?



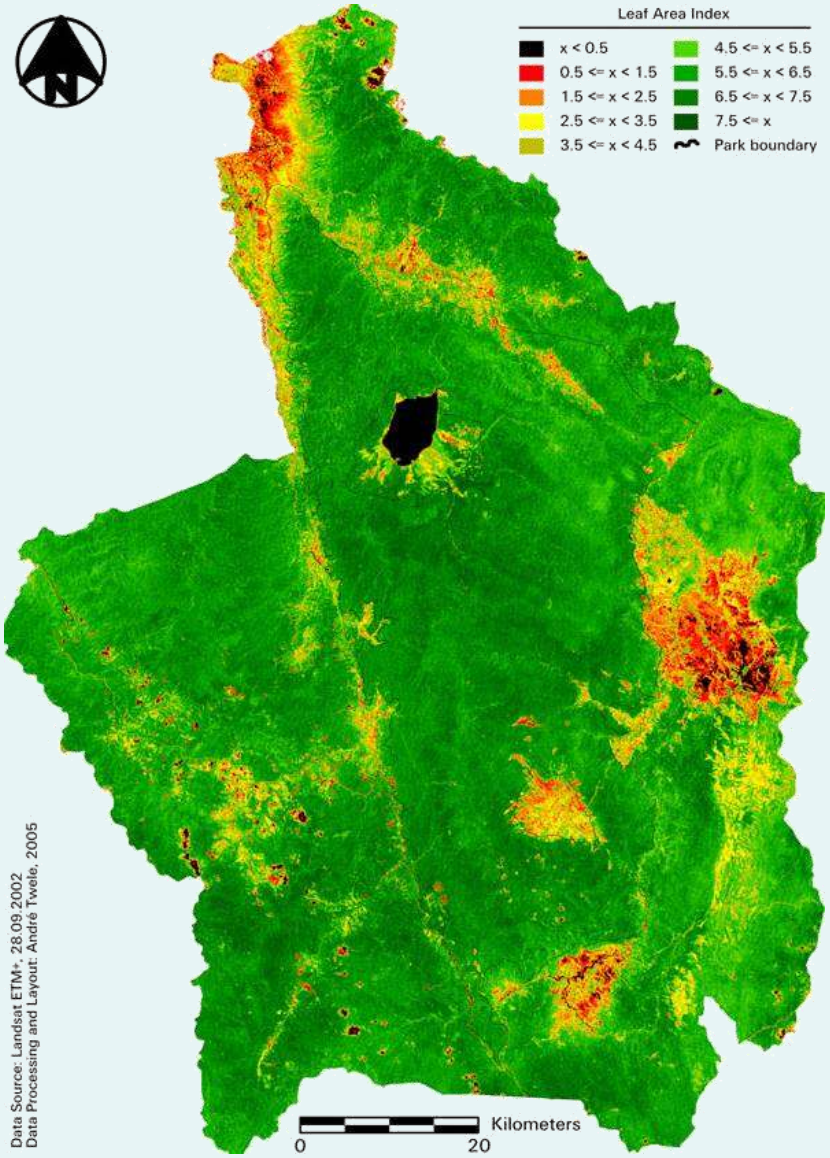


Dietz et al. (in press)

Ecological Parameters

Leaf area index

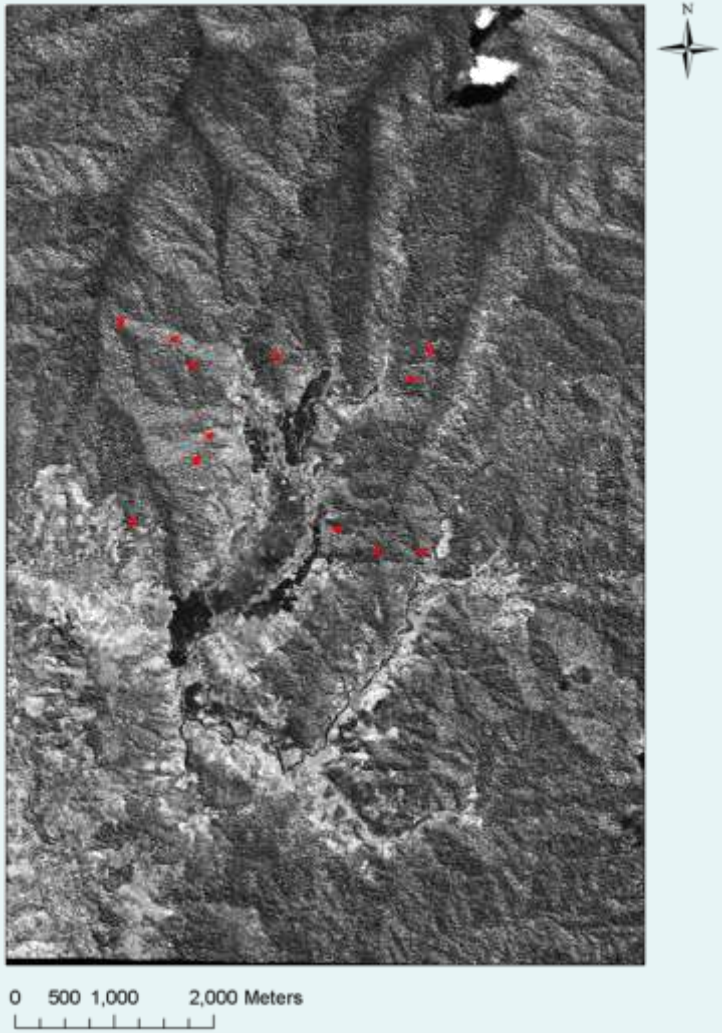
- Ground truthing
  - > 500 measurements
  - Old-growth forest to grassland
- Input
  - Landsat data
  - Atmospherically and topographically corrected
  - Neural network analysis



Land Use Change Detection

Interception

- Quickbird imagery
  - 7.8 km^2
  - 12 training sites
  - 0.7 m panchromatic resolution
- Input
  - Forested areas only
  - Local maxima
  - Vegetation indices
  - Interception data



Nieschulze et al. (under review)

Land Use Change Detection

Interception

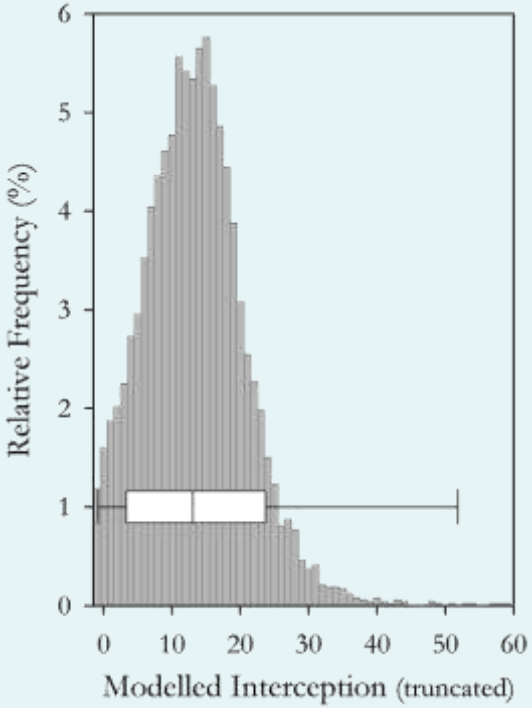
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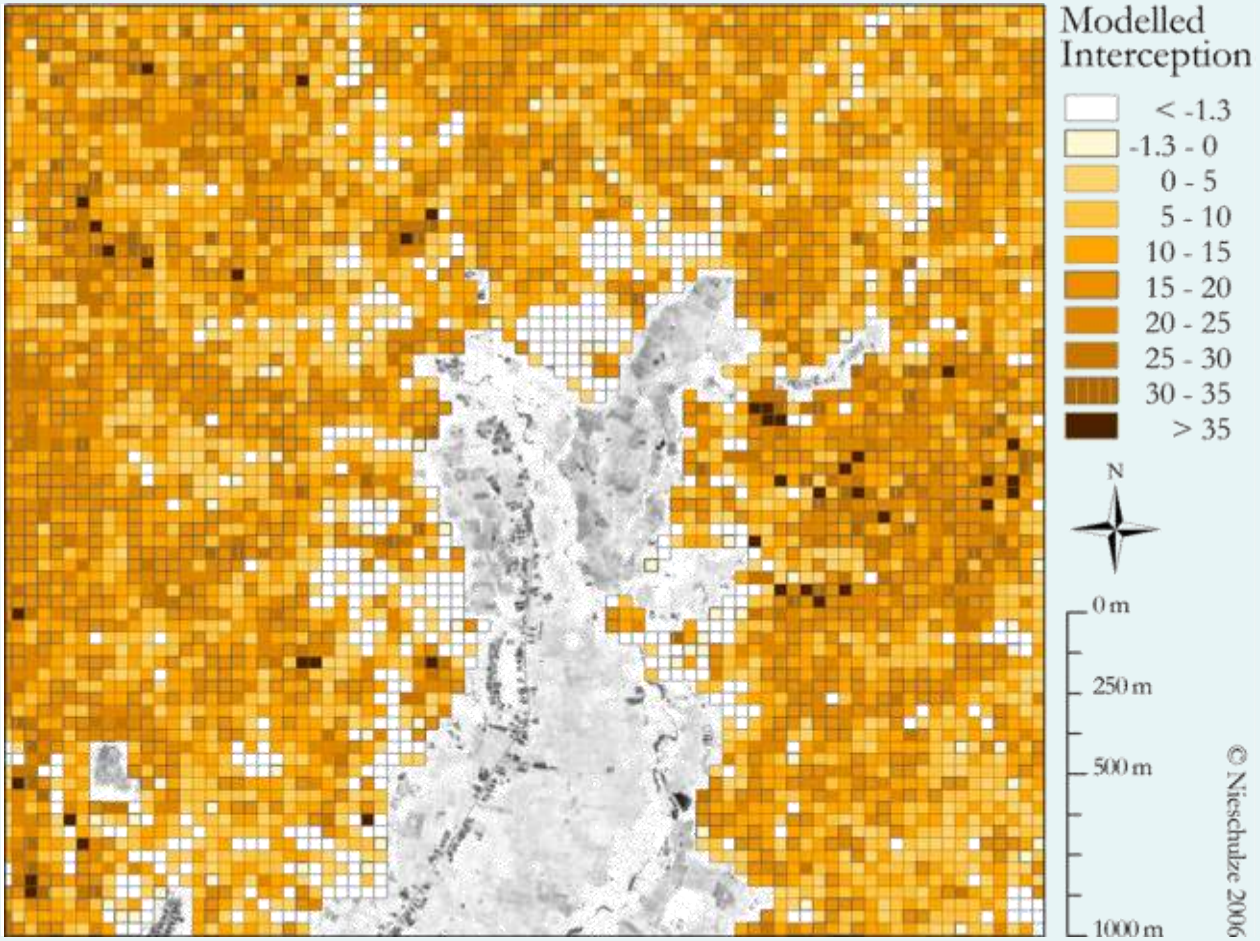


Nieschulze et al. (under review)

Land Use Change Detection

Interception





Nieschulze et al. (under review)

Implications

Environmental Services

- Radar Application
  - Improving land cover classification
  - Improving topographic correction
  - Soil moisture detection
- Biomass
  - Foliage production (humid tropics vs. ASAL)
  - C-sequestration
- Above-ground hydrology
  - Identification of trees with appropriate crown and foliage characteristics
    → Interception loss vs. mitigation of soil erosion
    → Role of stemflow

Thank You for Your Attention!





