Requirements for Data Products

- Deforestation
- Regeneration
  - Maps of regenerating forest extent
  - Maps of regeneration pathway
- Biomass
  - Maps of regenerating forest biomass (early stages)
- Thinning (e.g., Selective logging)

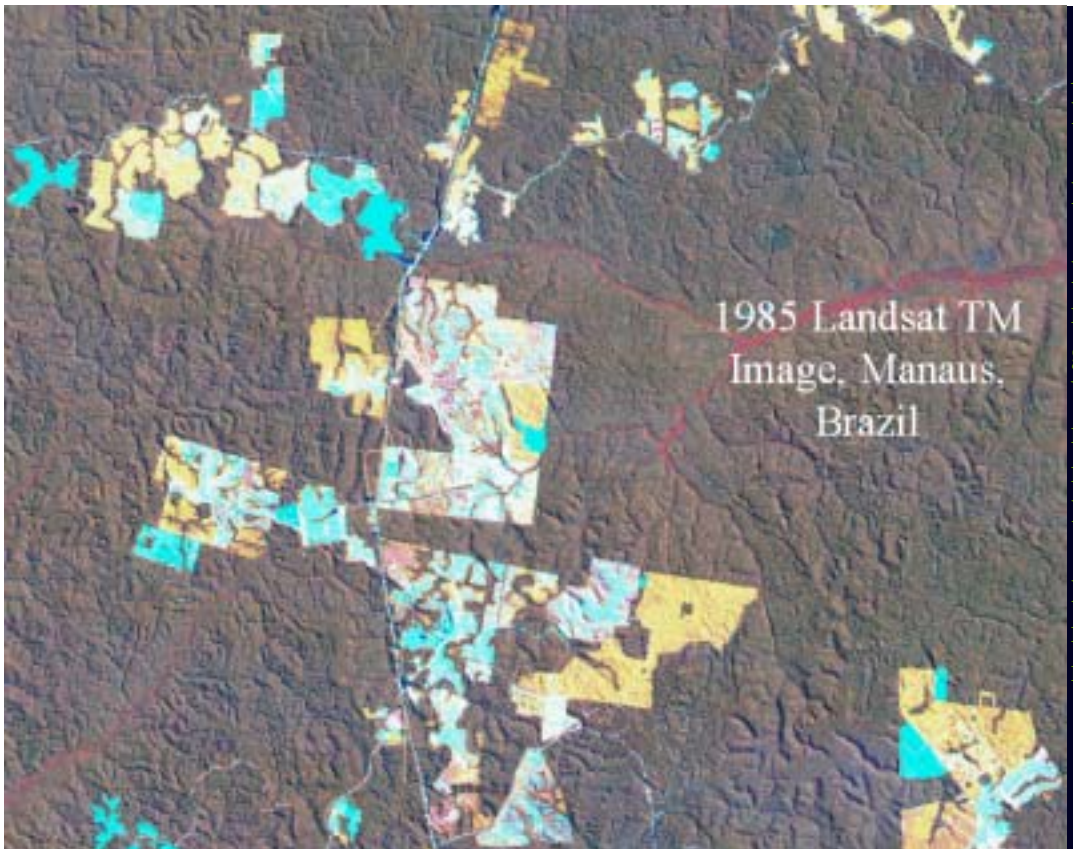
- Amazon Basin
- Africa/Southeast Asia

Data Requirements

- Dual POL ALOS PALSAR (fine resolution)
- ScanSAR
- GLI

Targeted End Users

- International/national LULUCF monitoring agencies
- Research organisations

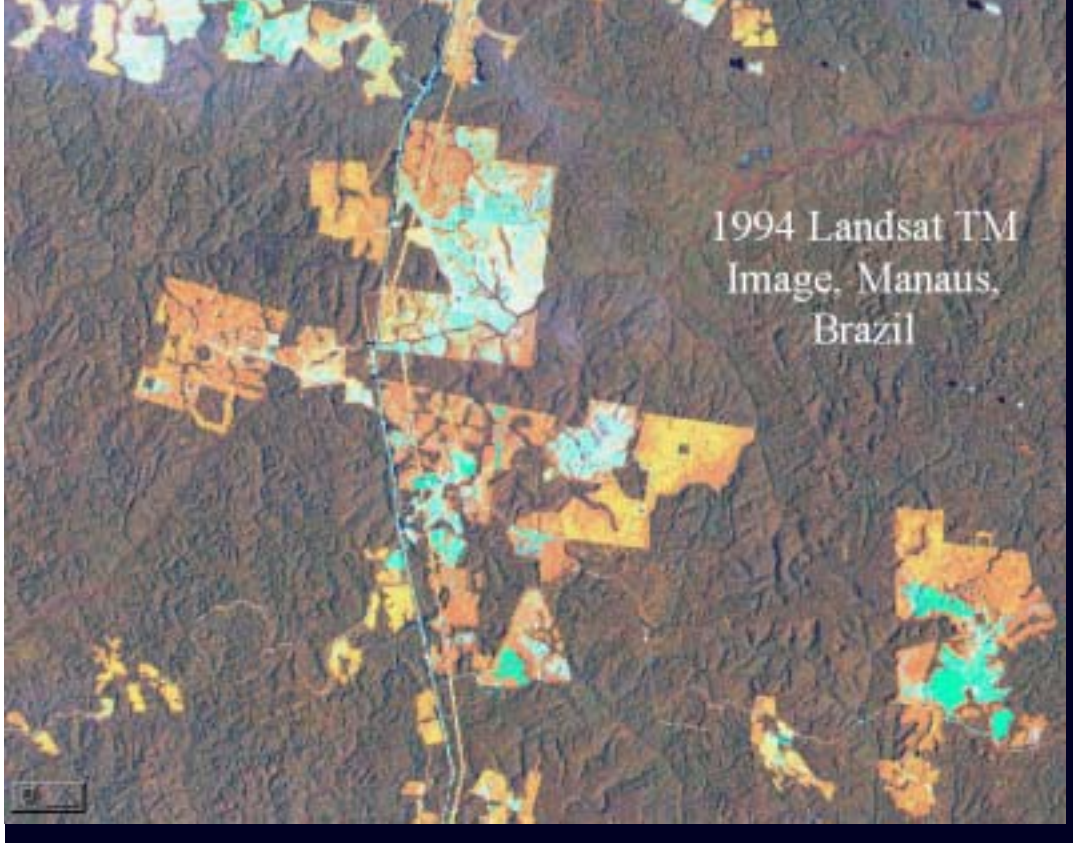


Abandonment of Pastures

Early regeneration

Blue areas represent bare ground/pasture Yellow areas represent regenerating Forests

Dark green areas represent mature rainforest.

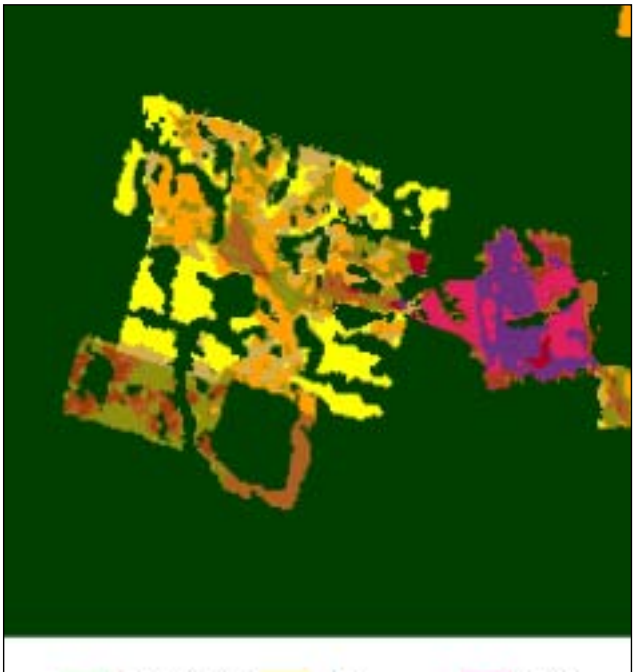


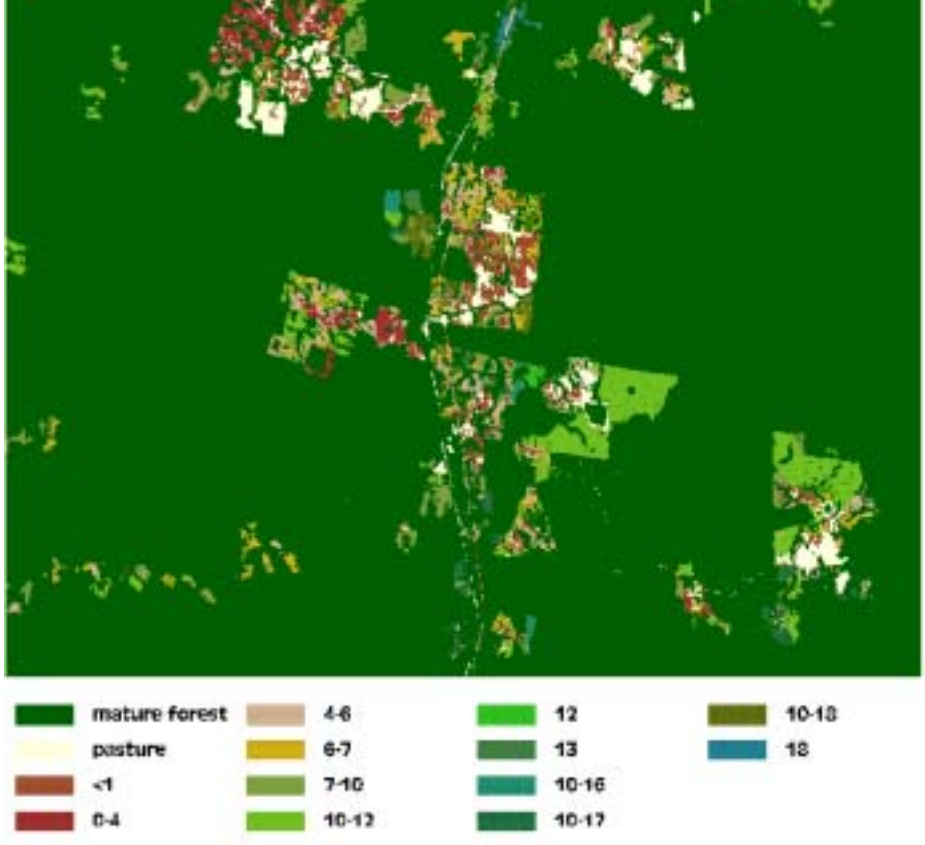
The area of deforestation had increased only in the top right of the image where oil palm plantations were established.

Majority of cleared areas occupied by regenerating forest.

Some reclearance of regeneration evident

Period of Active Land Use





Forest Age

Frequency of vegetation clearance

Fire frequency

Method of initial clearance

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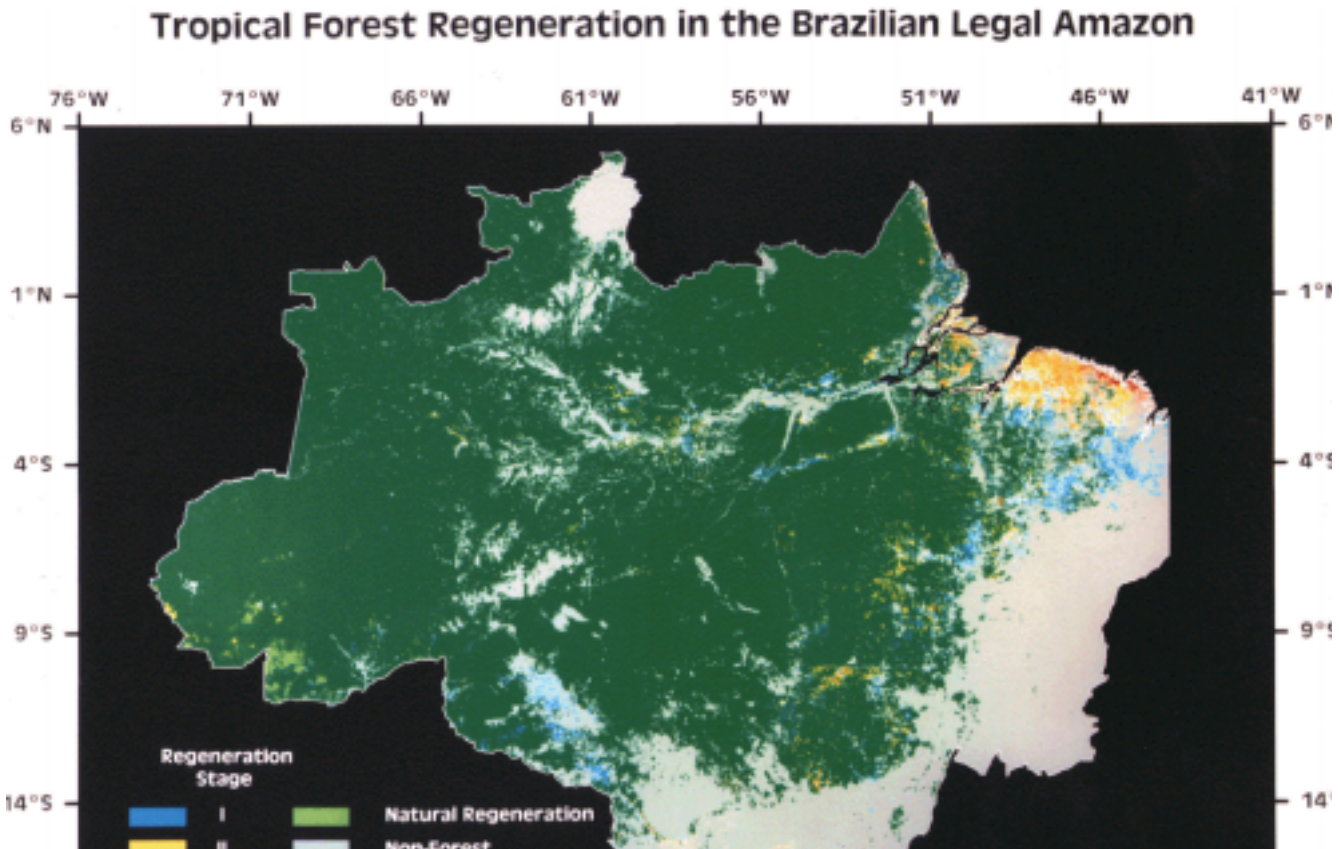
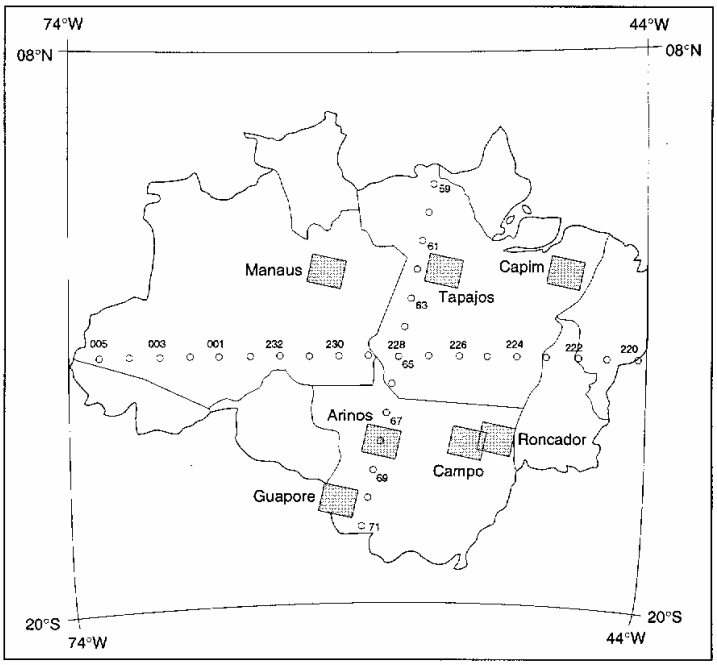
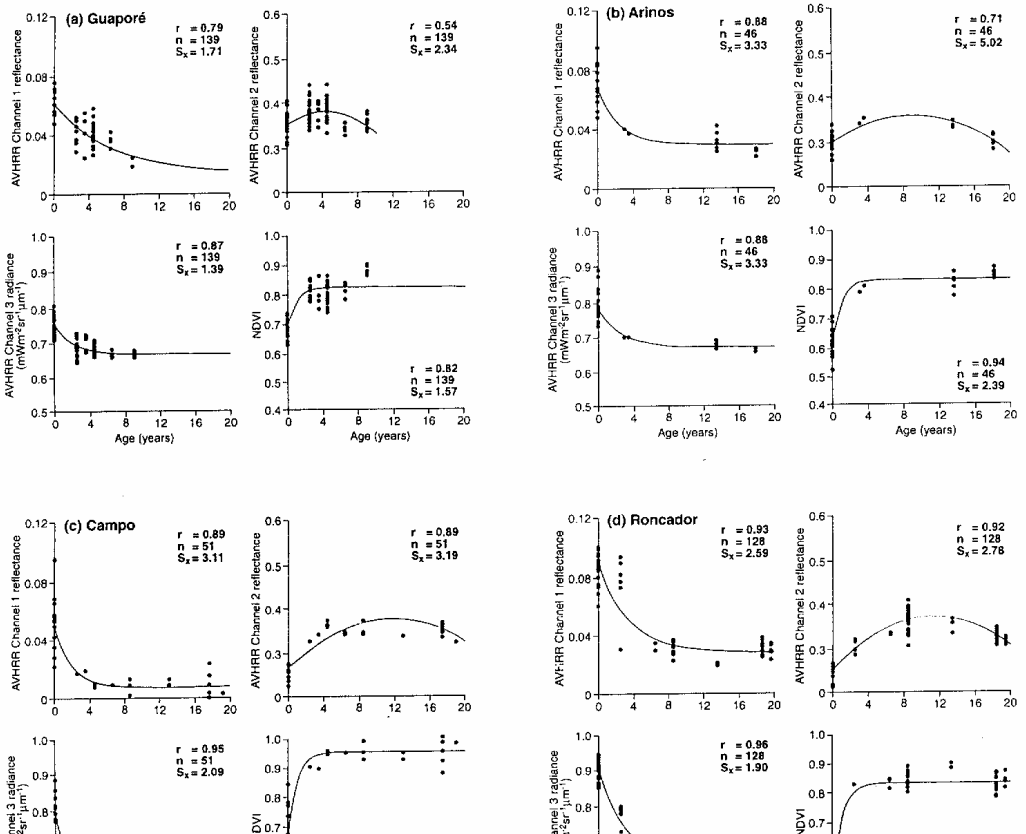
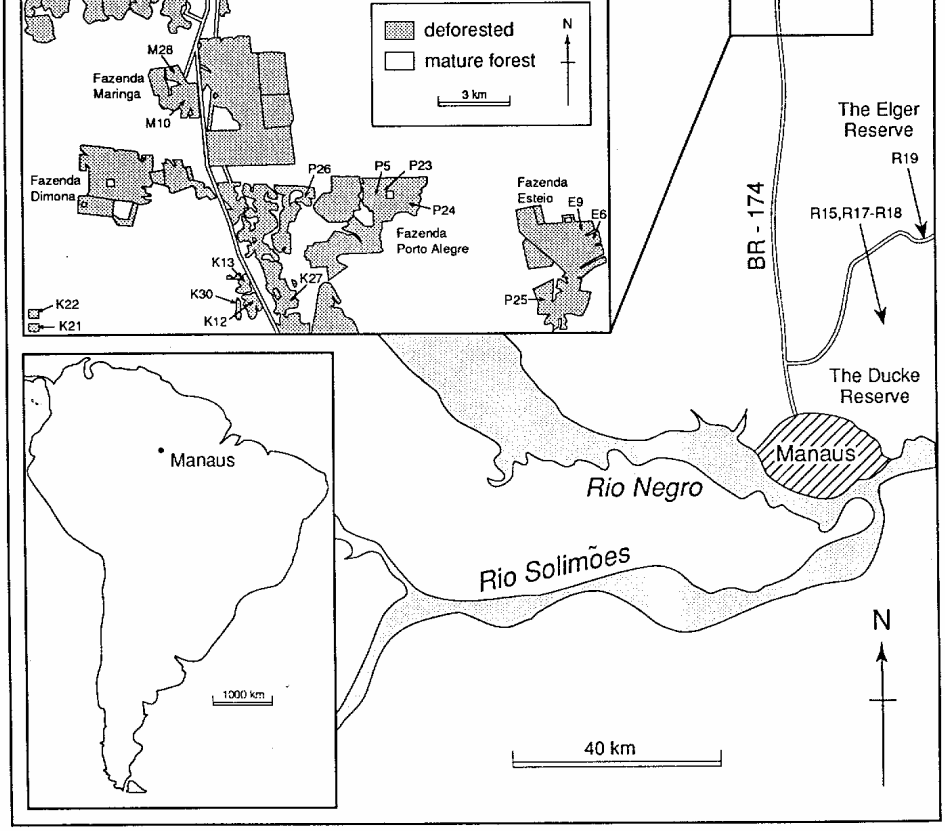


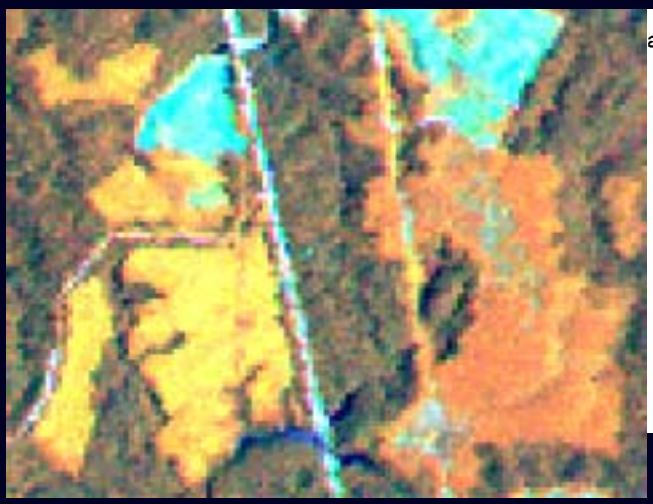
- 475 regenerating forests were aged at seven sites across the Legal Amazon using time-series of Landsat sensor data.

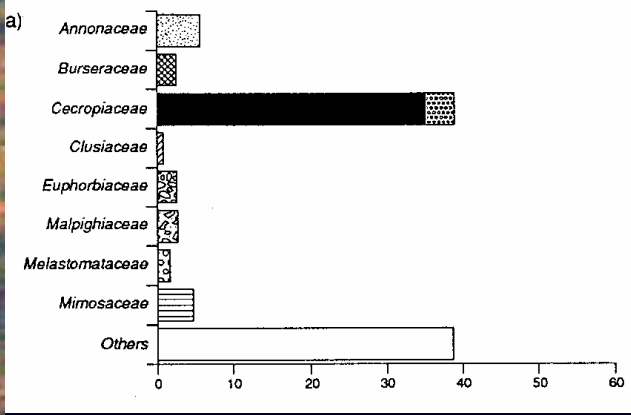
- Forest age related to NOAA Advanced Very High Resolution Radiometer (AVHRR) channel 1 (visible), 2 (near infrared) and 3 (mid/thermal infrared) data.

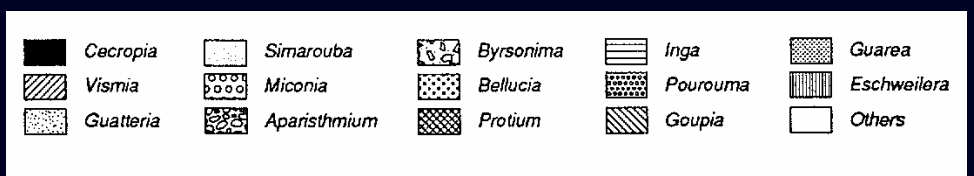




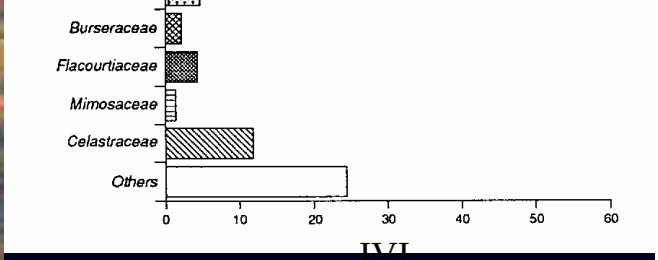


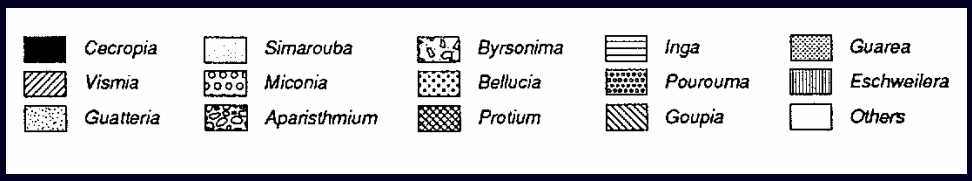






Forest on left (bright yellow) dominated by the pioneer genus *Cecropia* (family *Cecropiaceae*).





Forest on right (orange) dominated by the pioneer genus *Vismia* (family *Clusiaceae*)

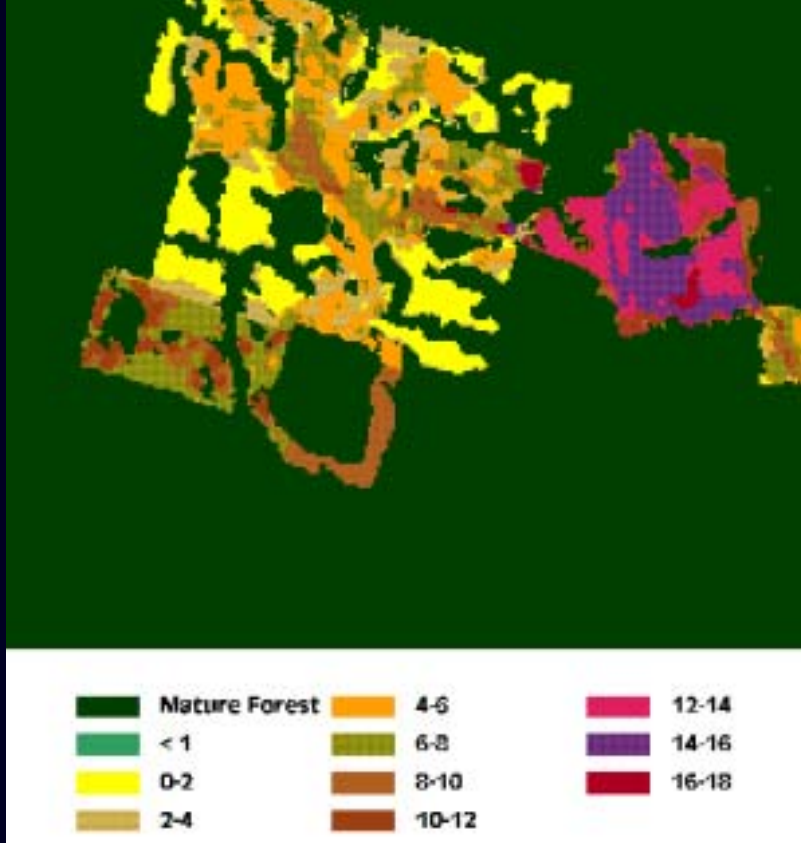
Differences in Appearance

- *Cecropia* species typically have large, horizontally orientated leaves.
- In the younger stages, form a smooth upper closed canopy with maximum leaf area and minimal shadowing.
- Low density of trees with umbrella shaped crowns

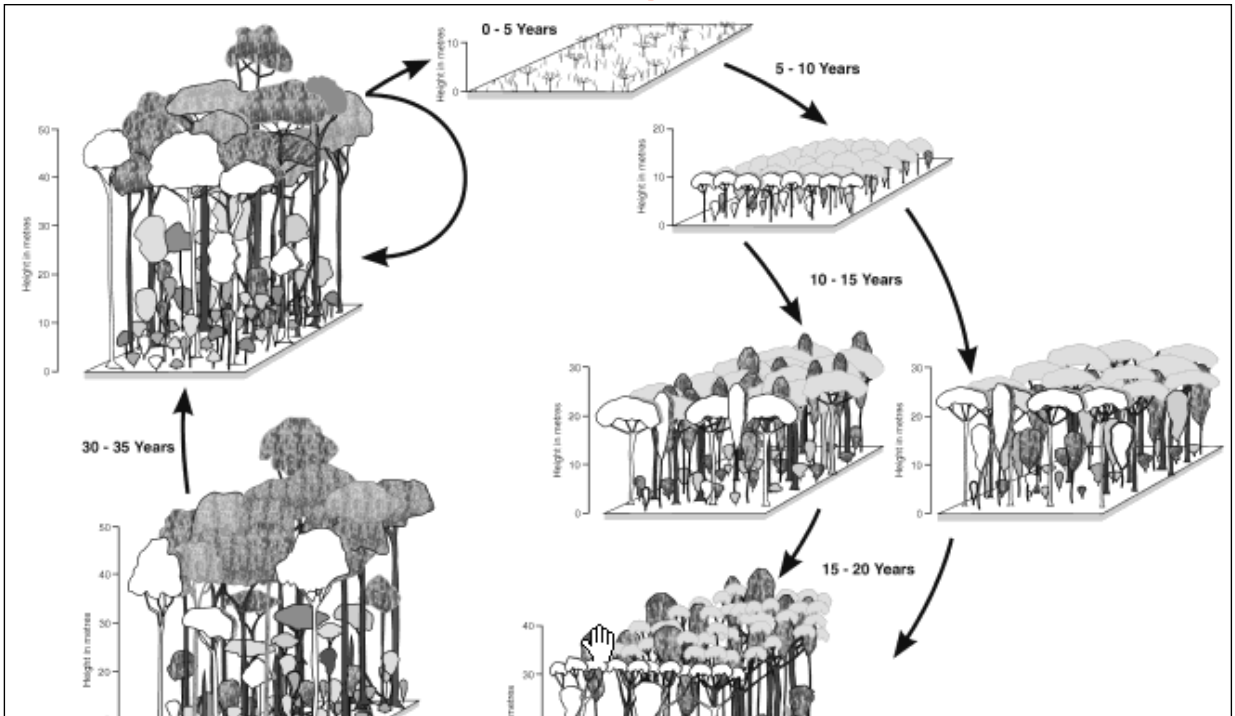
- *Vismia* species typically have small, vertically orientated leaves.
- *Vismia* does not dominate the upper canopy but is generally mixed with species with similar leaf structures.

Abandonment

- Forests dominated by *Cecropia* establish on the least intensively used land
- Forests dominateed by *Vismia* establish on more intensively used land.



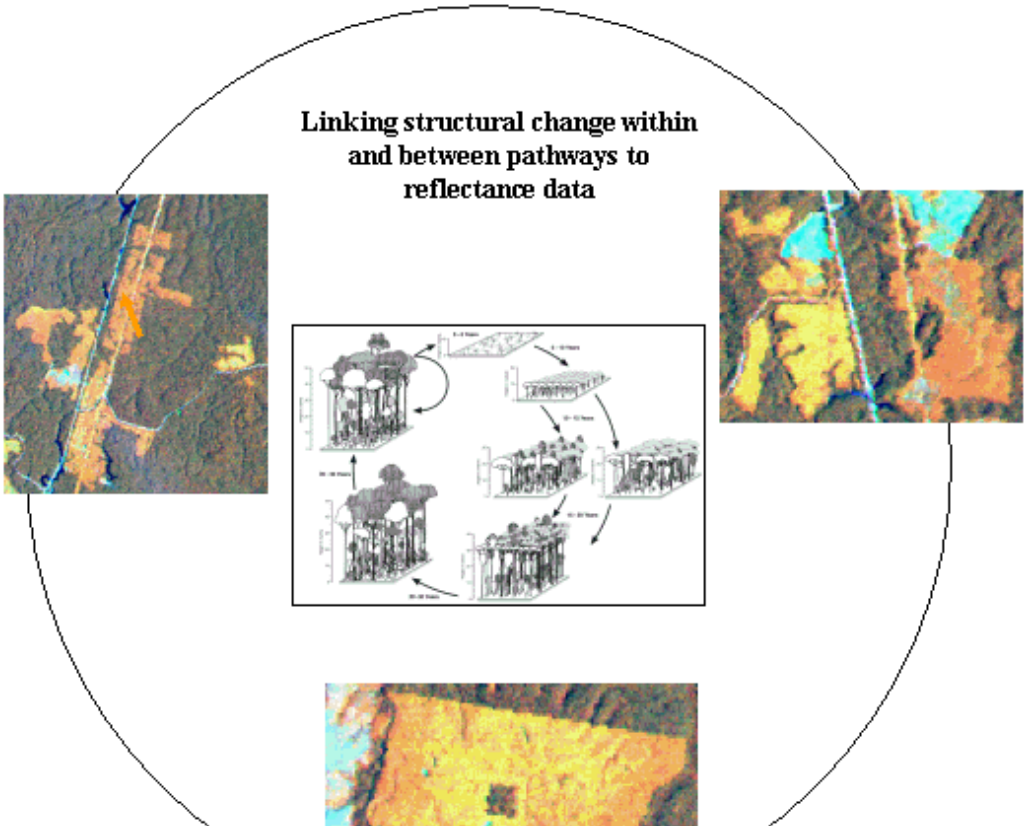
Typical Regeneration Sequence: Cecropia-dominated regeneration

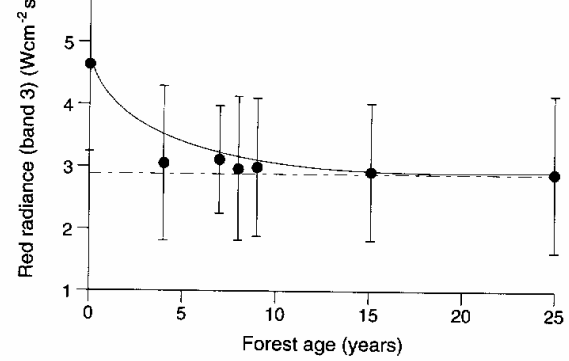


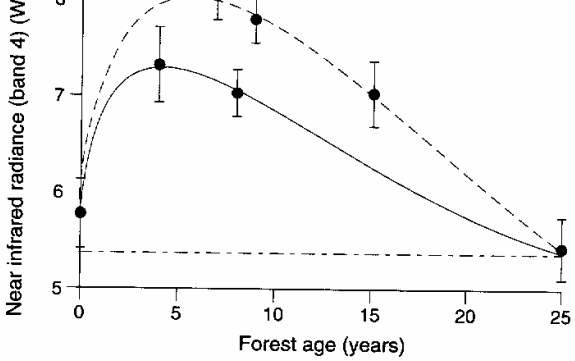
Mature Forest

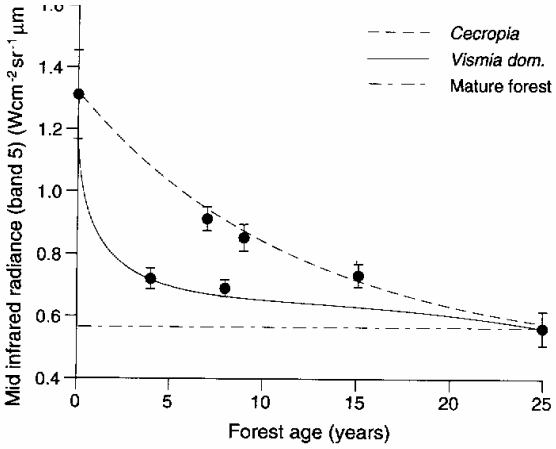
Cecropia with a smooth upper canopy

Vismia with a rougher upper canopy





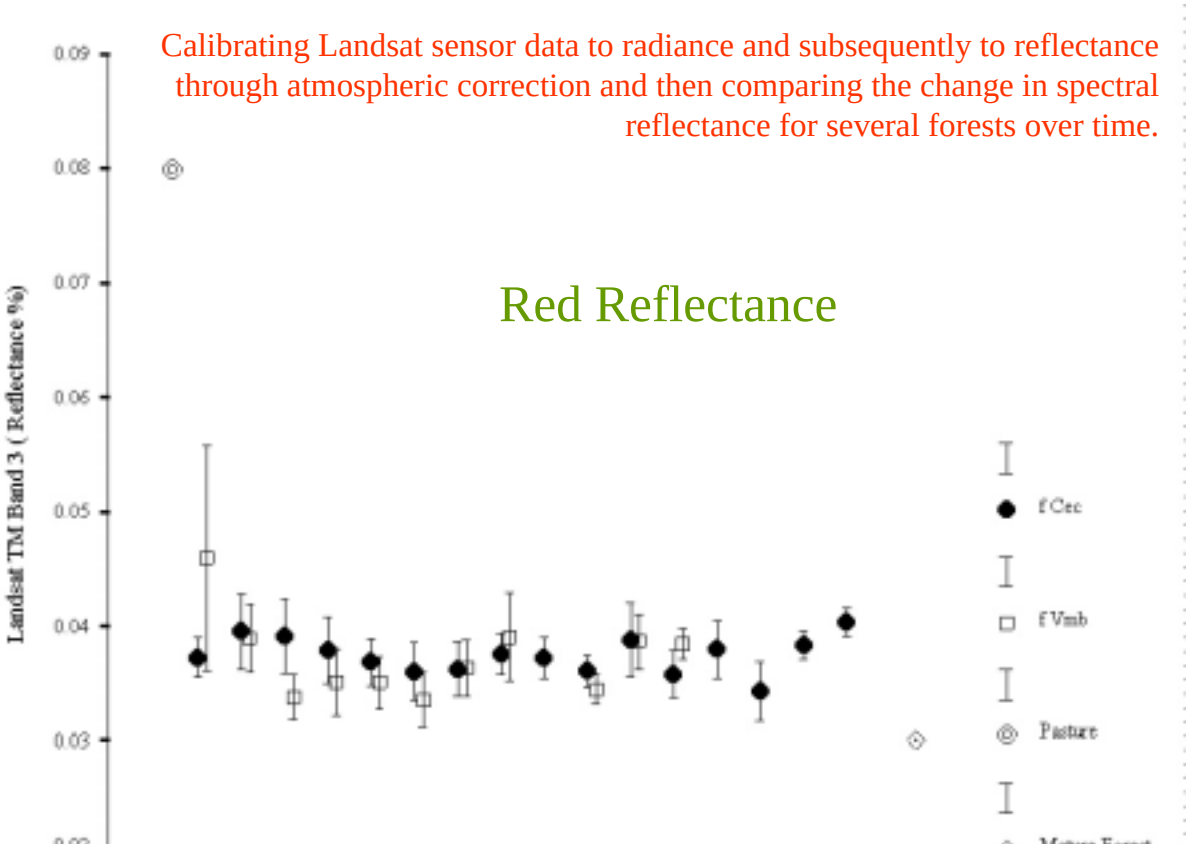


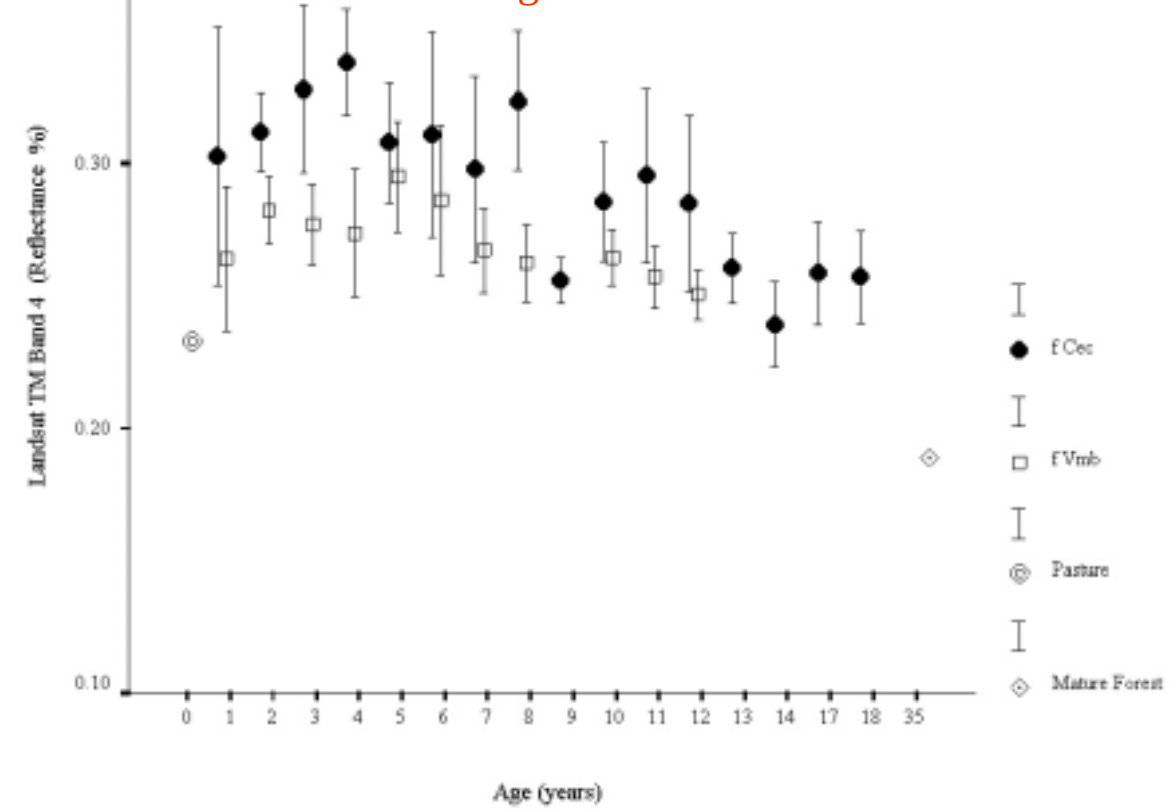


Relationship between forest age and red, near infrared and mid infrared reflectance data, as extracted from a single-date Landsat TM image.

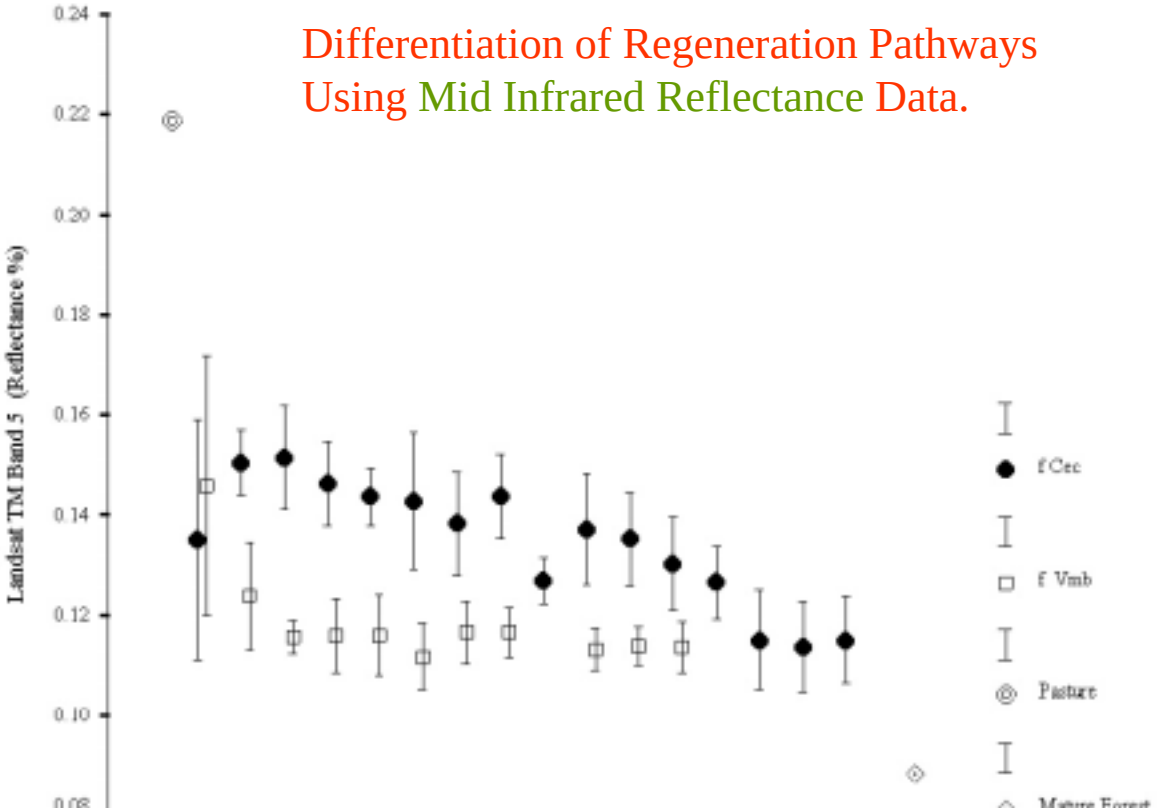
Calibrating Landsat sensor data to radiance and subsequently to reflectance through atmospheric correction and then comparing the change in spectral reflectance for several forests over time.

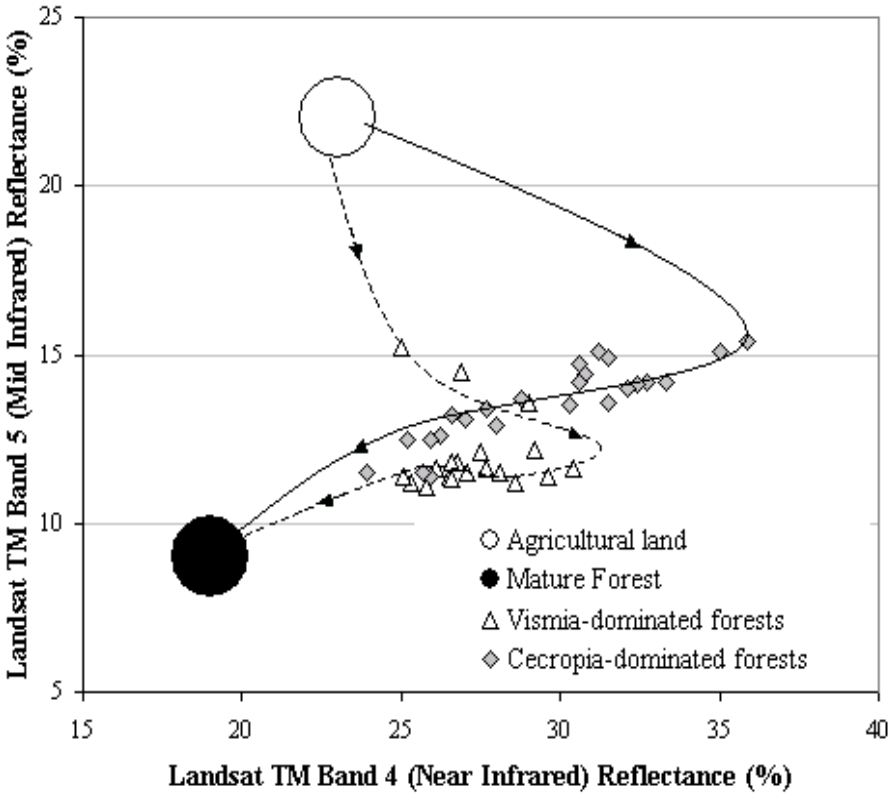
Red Reflectance





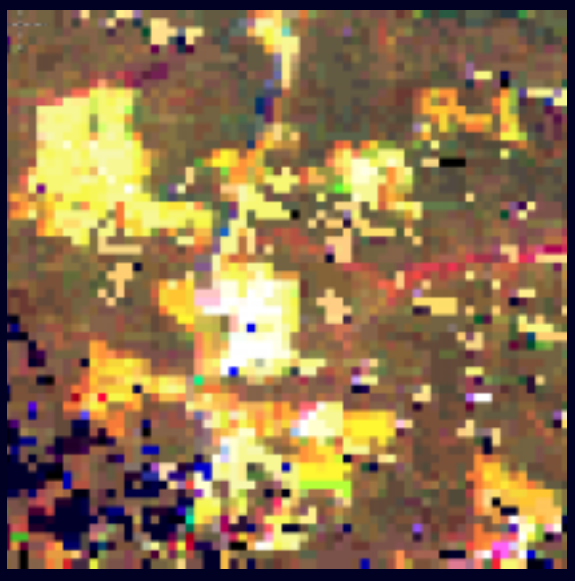
Differentiation of Regeneration Pathways Using Mid Infrared Reflectance Data.



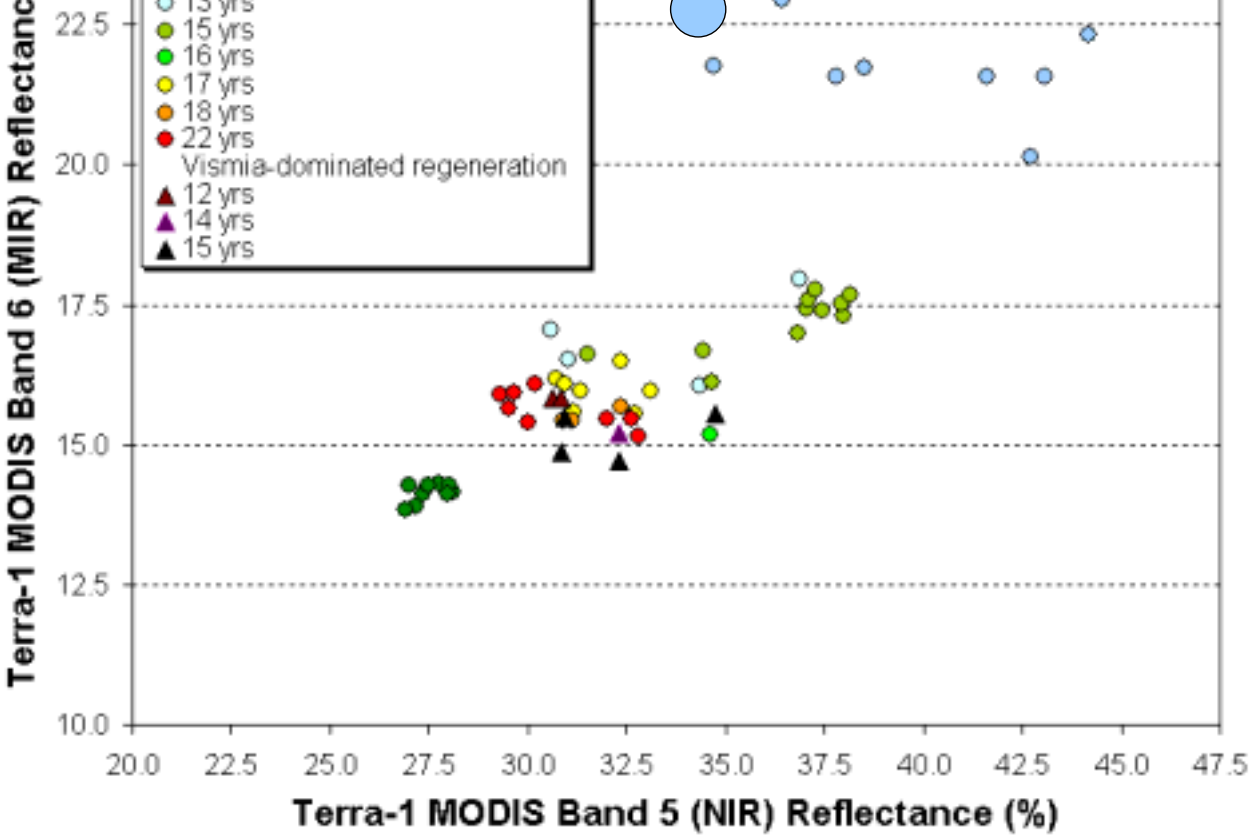


TERRA-1 MODIS

Landsat TM-derived age class



Terra-1 MODIS MIR, NIR and



AVHRR data for mapping regeneration stage/pathway.

- Up to four stages of forest regeneration (up to 20 years) can potentially be discriminated.
- Stages less able to be discriminated in complex deforestation/regeneration due to coarse (> 1 km) spatial resolution.
- Discrimination procedure is optimal where large, discrete areas of regenerating forest occur
- Dynamic range of data is relatively low

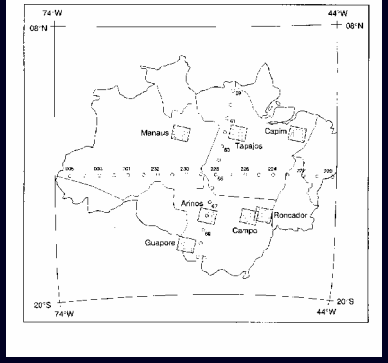
- Well suited to discrimination of regeneration stages and also common pathways over local areas due to:
  - Fine (< 30 m) spatial resolution.
  - Availability of both NIR and MIR reflectance channels
  - Time-series data

- For regional mapping, use of data limited due to vast quantities of data required to cover the Legal Amazon.

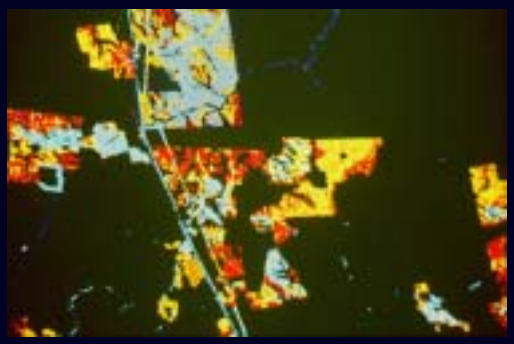
MODIS/GLI

- Promise for regional mapping of both regeneration stage and pathway.
  - Availability of NIR and SWIR reflectance data.
  - Regional coverage - GLI at 250 resolution (advantage over MODIS)
  - High temporal frequency
    - Some problems associated with persistent cloud, haze and smoke
    - Temporal dynamics of regeneration able to be observed.
  - Relatively consistent geometric, radiometric and atmospheric correction, thereby allowing better comparison of data within and between years.

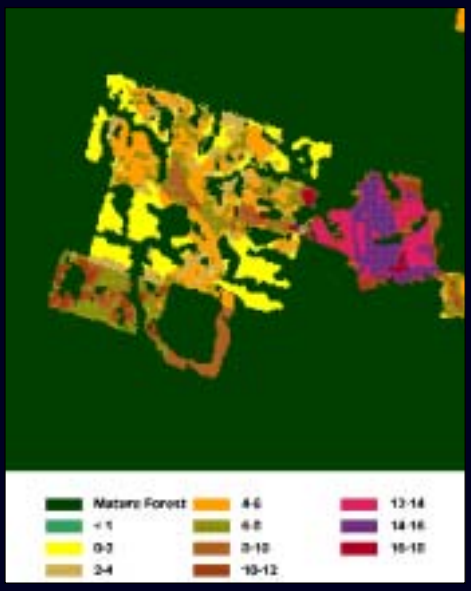
- Comparison of time-series data considered more beneficial



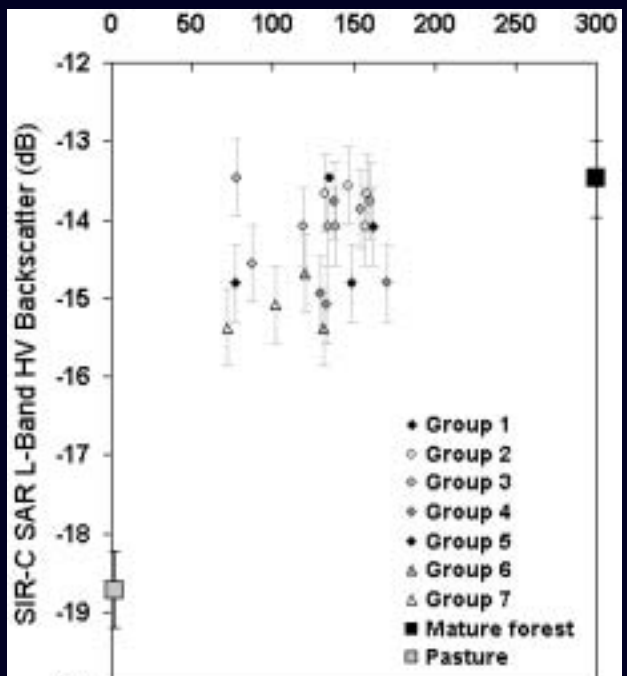
- Regeneration pathway

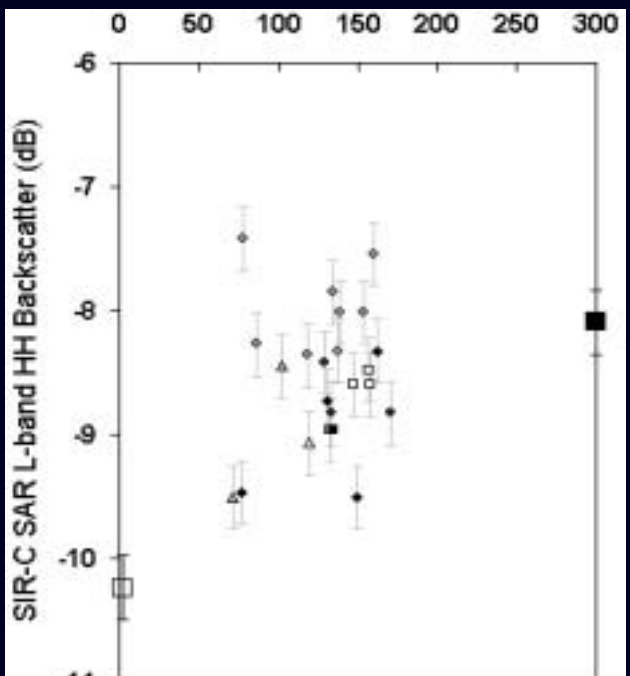


- Age and land use



Relationships with Biomass





- GLI data is well-suited and probably optimal for mapping the regional extent of different stages of regeneration and also common pathways.
- PALSAR could be used to retrieve biomass, biomass classes or relative changes in biomass.
- Such datasets, when generated, should provide considerable capacity to refine regional carbon budgets and better understand the dynamics of deforestation, land use and regeneration

Requirements for Data Products

- Deforestation
- Regeneration
  - Maps of regenerating forest extent
  - Maps of regeneration pathway
- Biomass
  - Maps of regenerating forest biomass (early stages)
- Thinning (e.g., Selective logging)