Workshop on Mitigation: Agriculture, Forestry and Rural development SBSTA, Bonn, May 23

Methods and Techniques for Monitoring Reductions in GHG Emissions from Avoiding Deforestation

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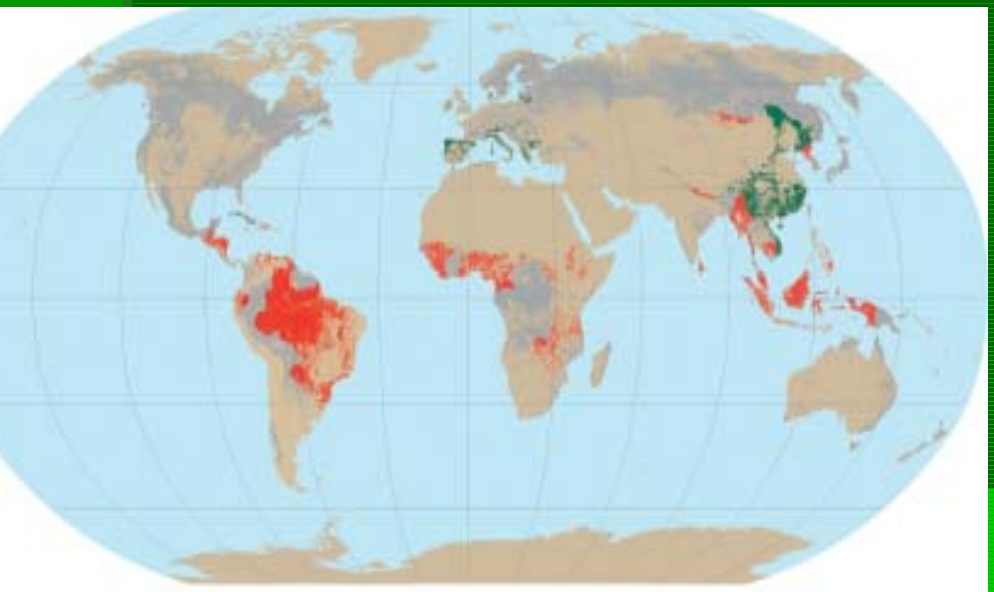
Tropical deforestation and global carbon cycle



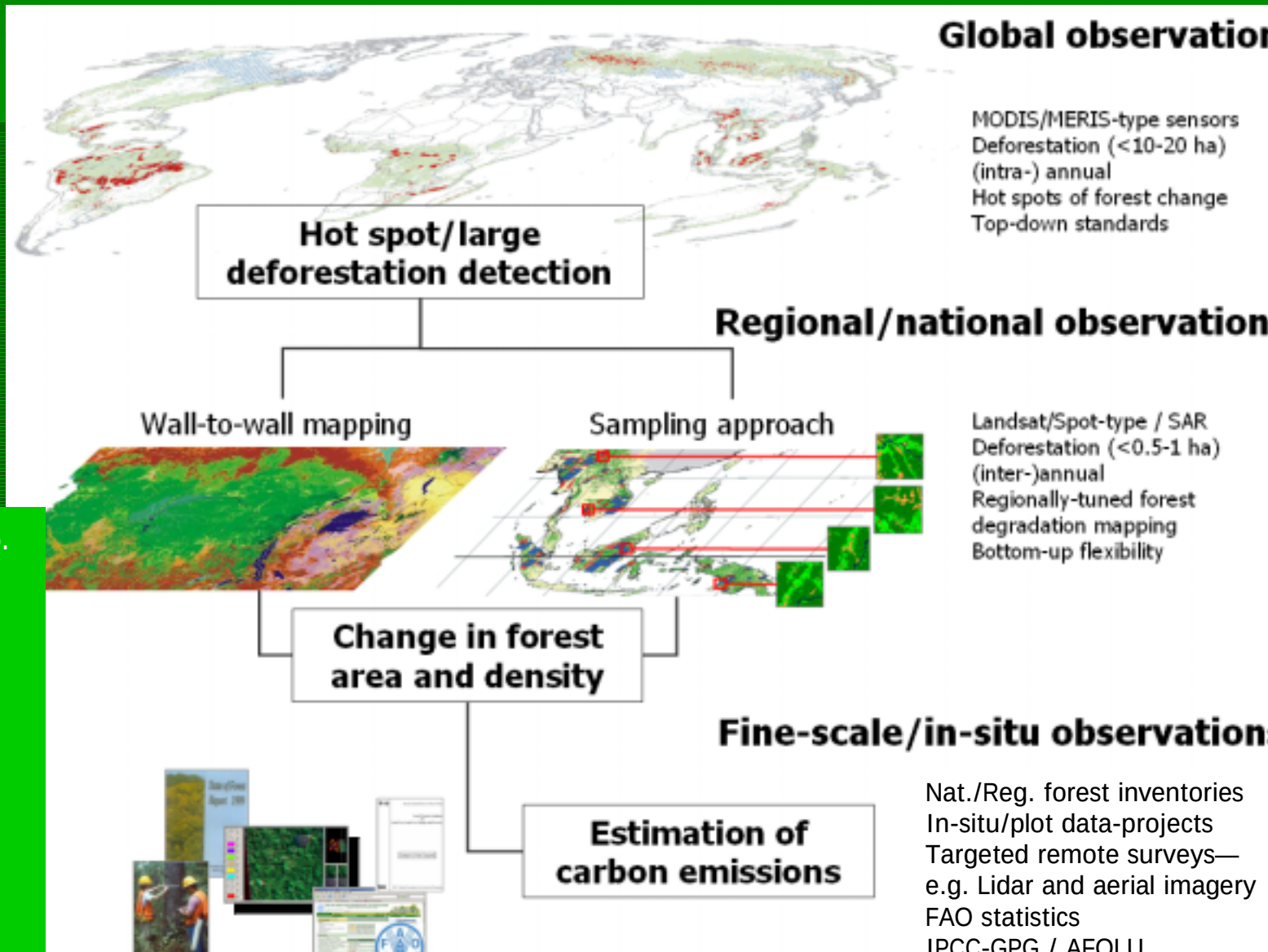
Red = decrease >0.5%/yr
Green= increase>0.5%/yr
Grey= change below 0.5%/yr

- Ongoing deforestation, degradation, and devegetation (DDD) are a significant source of GHG emissions—about 20-25% of global CO_2 emissions
- Conversion to agriculture is main cause, often due to unsustainable use of land
- Activities leading to a reduction in DDD rates present significant opportunity to affect atmosphere and at same time offer other socioeconomic and environmental benefits for sustainable development

Can GHG emissions from DDD be quantified?

- Technology exists—tools and methods available and implementable to accurately and precisely monitor change in area through time
- New technologies developing to accurately and precisely monitor change in carbon stocks but still not widely tested
- Methods for carbon accounting well established and described in several IPCC and national reports

Framework for monitoring GHG emissions from deforestation



eFries et al. 2006. educing GHG missions from eforestation in eveloping ountries: onsiderations for onitoring and easuring, OFC_GOLD

How to address reducing emissions from DDD?

- If can monitor GHG emissions from DDD at national or sub-national scales then can monitor "reductions"
- Monitor all or some changes in land cover and land use?
- Consider all pools or selection of pools and CO_2 and non-CO_2 GHGs?

Raises technical issues……..

Forest definitions

- Need to define deforestation, degradation, and devegetation
  - Described and defined in IPCC reports—IPCC GPG and Special Reports
  - Under KP, rules established for how countries define forests
    - Based on crown cover (10-30%), tree height (2-5 m), area (0.05-1ha)
    - Use similar criteria for defining degradation and devegetation-will vary by country

Carbon accounting

- Methods already exist:
  - IPCC GHG inventory methods (1996, and currently under revision AFOLU report)
  - IPCC GPG 2003 –Ch. 3 (national) and Ch. 4 project scale
  - Contains tables of default values for various processes and pools
- Methods can account for all changes in carbon stocks caused by DDD and all pools and gases

Approach to reducing emissions from changes in DDD for "compensation"

- Model exists in Article 6—Joint Implementation for trading credits
  - Track 1—do national inventory and can trade carbon credits (leakage and baseline projections issues disappear)
  - Track 2—no national inventory required and trading subject to rules as for AR-CDM (need baseline projections, address leakage, tCERS)

How to set “baselines”?

- Fossil fuel emissions uses a base year, but for DDD need a base period and a “since when”
  - base period—preferable for up to 10 years
  - “since when” makes sense to coincide with when remote sensing data are available for establishing rates of DDD—1990s earliest
- More than rates of land use change—also needs carbon stock changes
  - Which pools-conservatively select from approved 5 pools (deletion of pools produces conservative estimates)
  - Net or gross changes in stocks
    - Wood removed for long-term products not emitted to atmosphere-need to account
    - Regrowth after timber extraction
    - Is biomass burned on site during the conversion—emits non-CO_2 GHGs

Baselines—cont:

- Options for “reducing” base period emissions
  - Rate of growth –could slow if growing or maintain constant
  - Actual reduction
    - Implies need data to develop trend
- For national level reductions, no need for projections of future emissions
- For Track-2 project scale would be subject to rules similar to those in place for AR CDM—need baseline projection

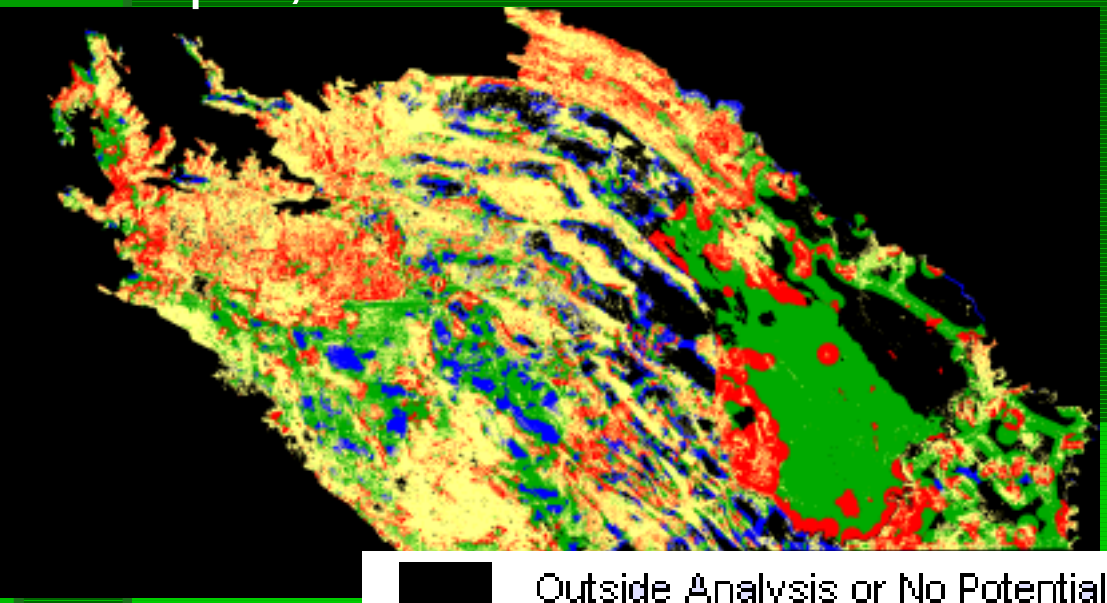
Baselines at project scale-need projections at regional scales

- Baseline composed of change in land cover and carbon stocks and can be treated separately
- Experience in the development of land cover change projections exists:
  - Methods exist to map threat for deforestation based on spatial analyses using remote sensing data, key drivers of deforestation, and GEOMOD at the regional scale
  - Tested and applied to seven regions in the tropics (Brown et al. 2006, in press; supported by US EPA and US AID)
    - Suite of key drivers varies by region and country
- Such an approach could also be used by countries in planning where to focus efforts to reduce DDD

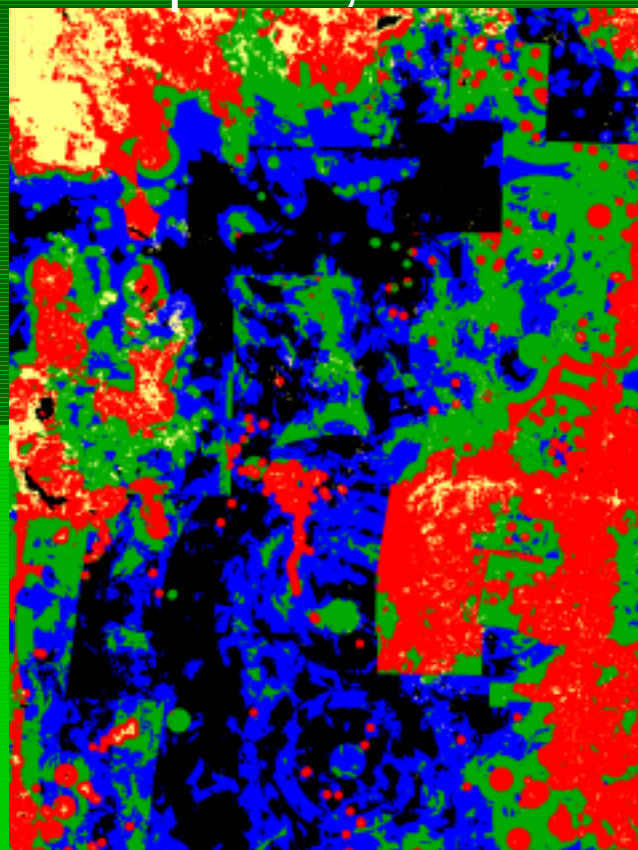
Spatial representation of threats for deforestation—

Target avoided DDD activities in areas under highest threat for maximum effect

Chiapas, Mexico



Campeche, Mexico



Outside Analysis or No Potentiality
Low Deforestation Potentiality
Med Deforestation Potentiality
High Deforestation Potentiality
Already Developed

From Brown et
l. in press.

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Baselines for projects....

- Maps of threat for deforestation combined with projected deforestation rates (based on past), and measured estimates of carbon stocks can generate projected baselines
- Because changes in land cover driven by a variety of socioeconomic factors, baseline projections may need to be revisited regularly (5-10 yr?)
- This type of approach was applied to Noel Kempff project for projected baseline for avoided deforestation component and has been verified and “approved” by third-party (SGS)

Challenge: data availability on land cover change

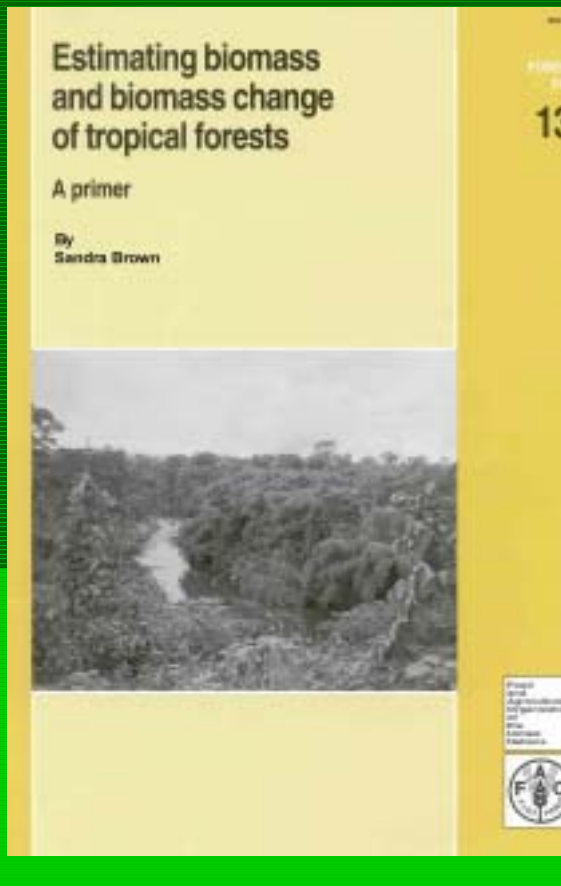
- Historical remote sensing data available for many land cover changes and many developing countries since 1990s
  - Remote sensing technology available but not all areas covered; cloud cover issues for many key tropical countries
  - Identification of secondary forests—not “easy”
  - Identification of selectively logged forest developing
  - Wall-to-wall interpretation versus stratified sampling (related to leakage)
- New technology and new analytical methods developing in RS field for moving forward and likely to be available for future monitoring

Challenge: data availability on carbon stocks

- Need to estimate change in carbon stocks resulting from deforestation, degradation, devegetation
- And, need to match carbon stocks with changes in land cover to improve accuracy and precision of emission estimates
- Current operational optical satellites cannot remotely sense biomass
- They also have difficulty in distinguishing secondary from mature forests, yet carbon stocks can differ greatly because of effects of age and ecological zone

How is forest biomass in the tropics presently assessed?

- Robust tools exist for converting traditional, statistically designed forest inventory data to carbon stocks in trees; use defaults for other pools (IPCC GPG Ch. 3; FAO)
- But, most tropical countries have no recent national forest inventories
- Research plots generally insufficient as not from population of interest and designed for other purposes



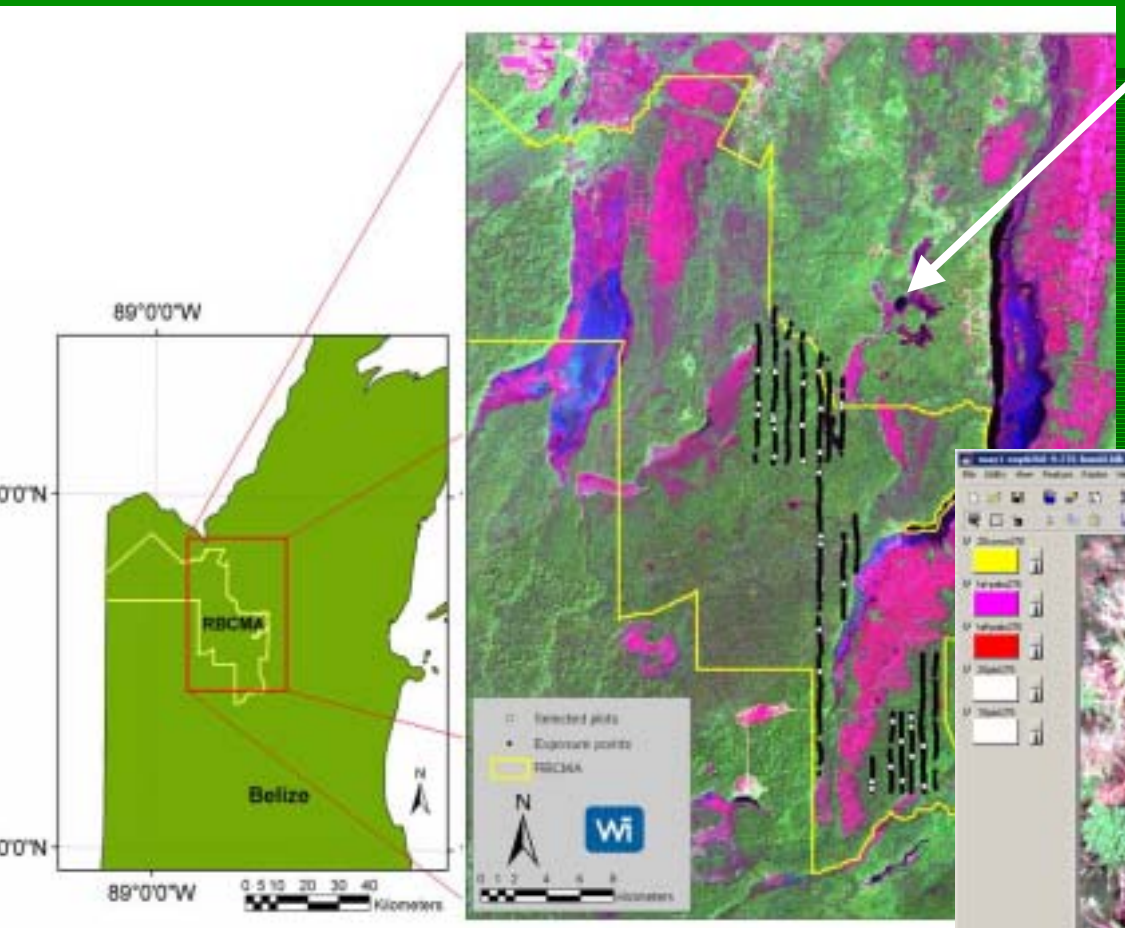
How to measure carbon stocks ?

- **Traditional inventory approach:**
  - Can be done in smaller countries and at project scale
  - Requires large resources at national level
  - Cost-prohibitive for large countries and not practical
- **Need remote means that are:**
  - Cost-effective
  - Low uncertainty (high precision)
  - Transparent and repeatable
  - Acceptable to policy makers

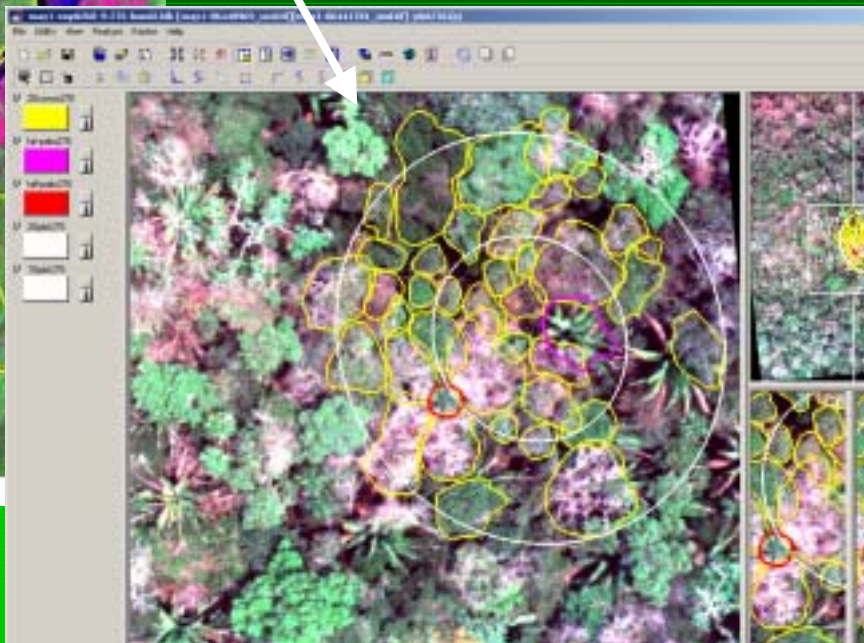
Future trends in measuring and monitoring carbon stocks for DDD

- Build on existing techniques—regular "inventories" done by sampling
- Need remote means
  - Not necessary for wall-to-wall mapping but statistical sampling approach
  - New remote technology developing—
    - Lidar already shown to measure changes in forest structure –height is a good indicator of forest biomass change
    - High resolution digital imagery combined with new field data on key metrics of forest carbon-crown area and tree height

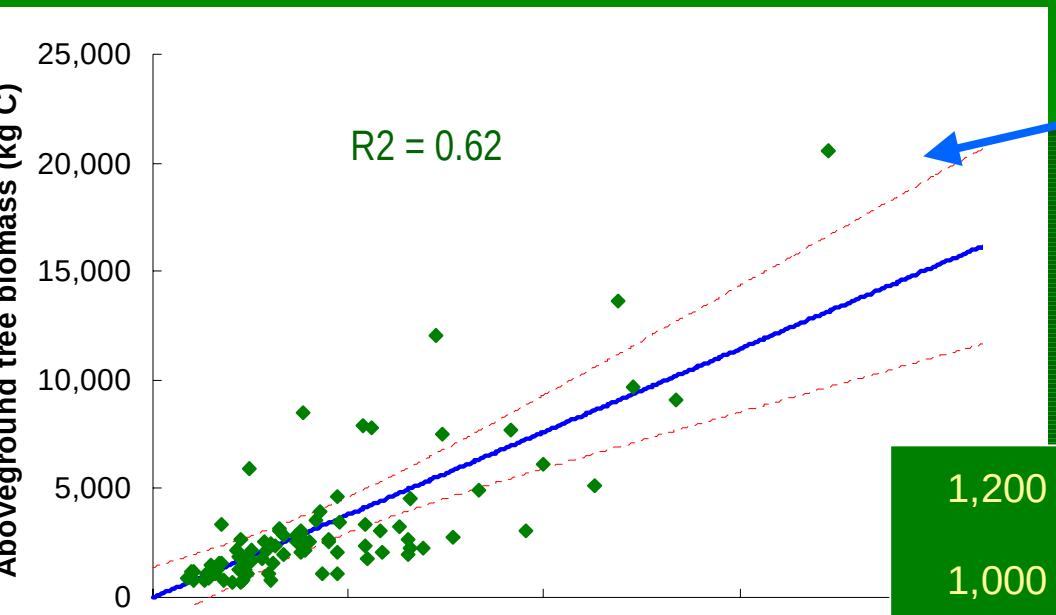
Example of application of high resolution imagery to tropical forests in Belize



- Fly parallel transects and establish image "plots"
- Measure tree crowns and heights

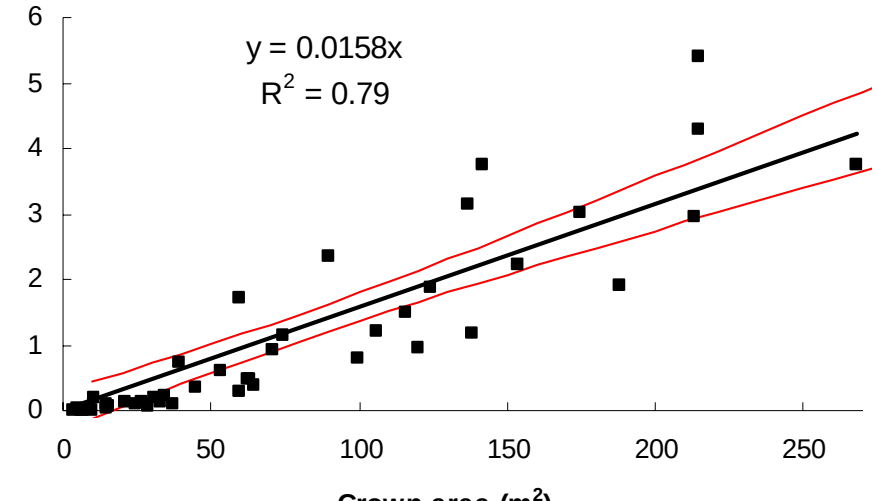


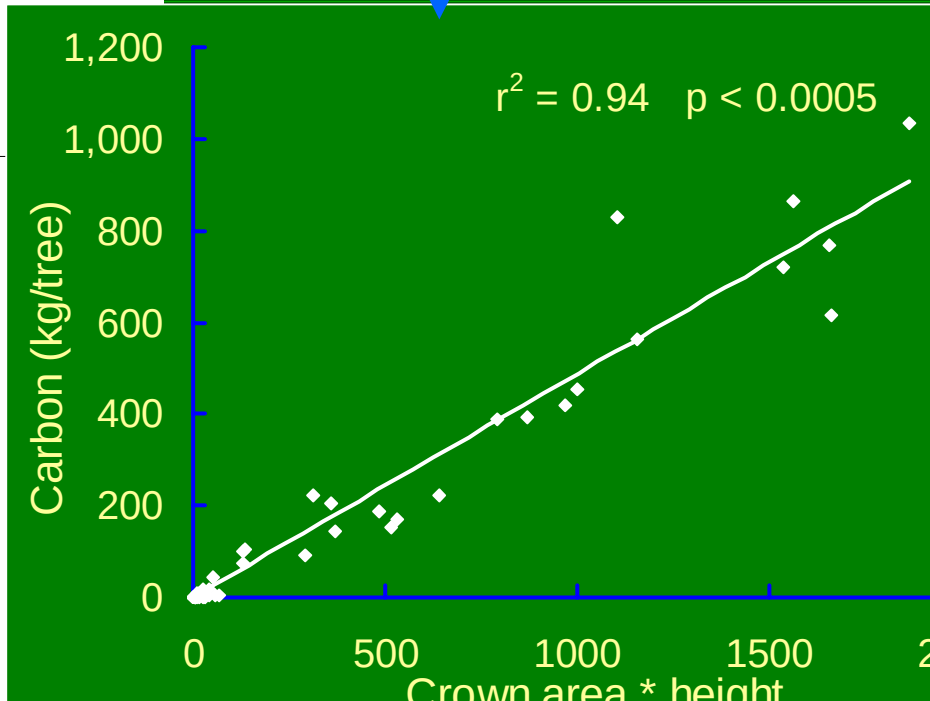
Develop new allometric equations based on tree crown area & height



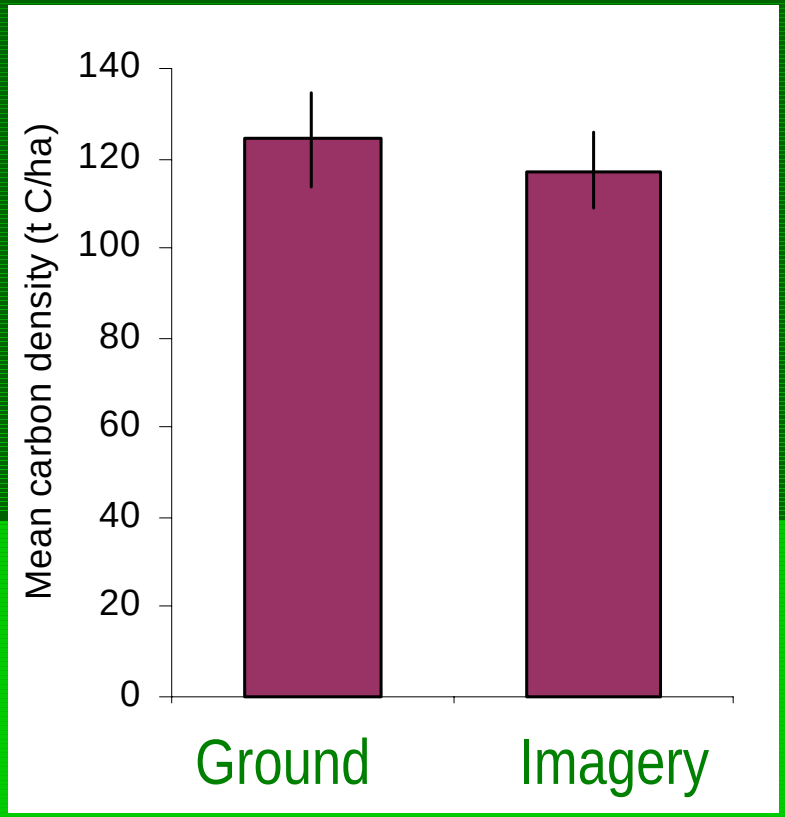
Broadleaf

Tropical pine





Estimate biomass-mean carbon density for all plots



Number of plots required to estimate biomass-carbon to within 8 % of mean with 95 % confidence

116 25

In summary

- Build on existing modalities and procedures as much as possible—definitions, IPCC accounting methods, etc
- Maintain flexibility –JI two-track approach for participation at either national or project level
- Remote sensing data for1990s useful for national and sub-national base period
- New RS technology and analytical methods developing and will be available for future monitoring
- Data on forest carbon stocks for base period at national level based mostly on old forest inventories or default data from FAO but guidance in IPCC GPG report provides tools to reduce uncertainties
- New technologies developing to improve carbon stock estimates by remote means, cost effectively and with reduced uncertainty
- Need greater commitment to developing countries to increase their capacity to acquire and use the needed data and tools.

For further information..

- Contact Sandra Brown –sbrown@winrock.org

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