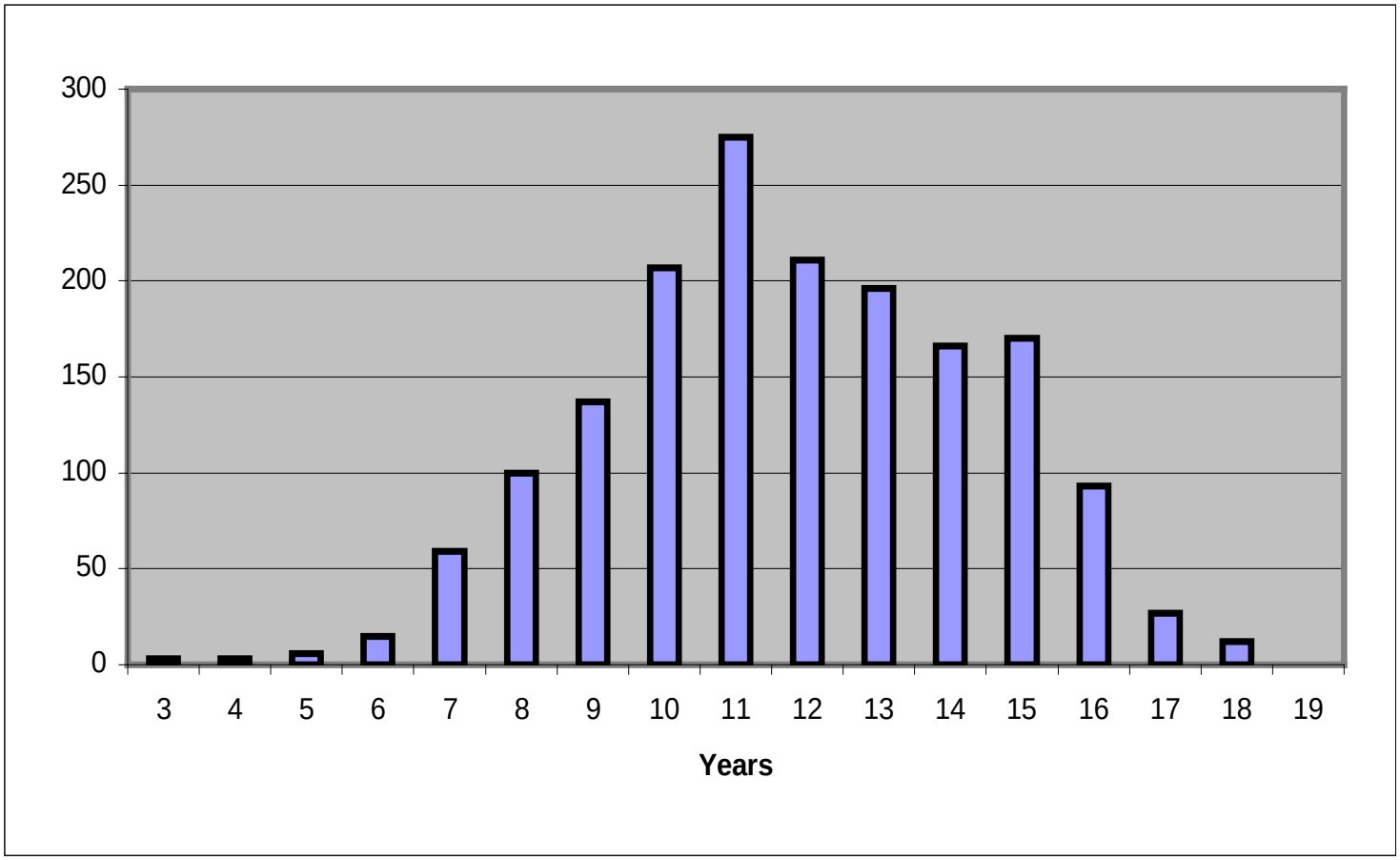

Carbon2Markets
Value chains from carbon and agro-forestry products
in Southeast Asia

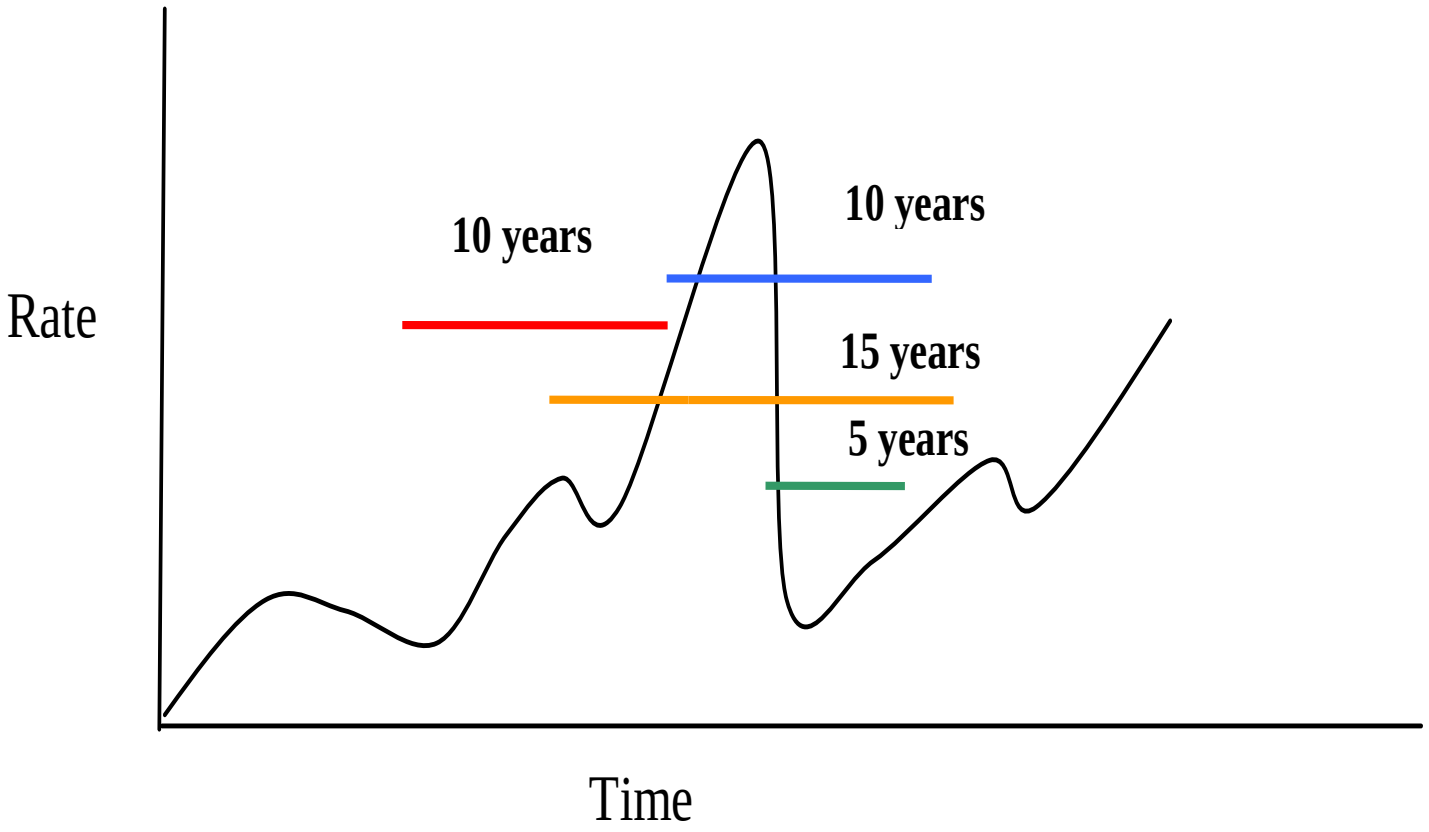
Main Concepts

- Methods have improved and capacity for *global* tropical forest assessment is available.
- R/S approaches can be used to support climate change mitigation for: REDD and A/R
- Methods have yet to be deployed globally to leverage the growing multi-national EO capabilities

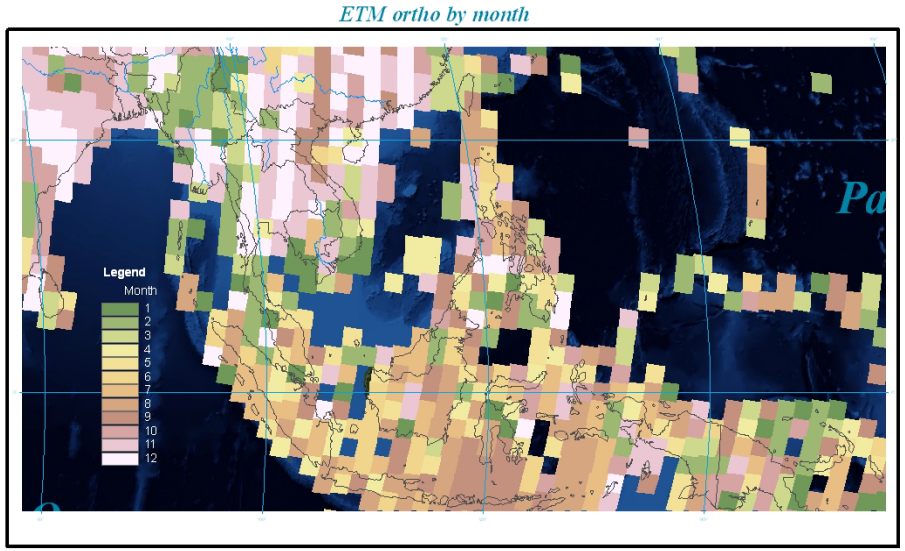
Lack of Central Tendency

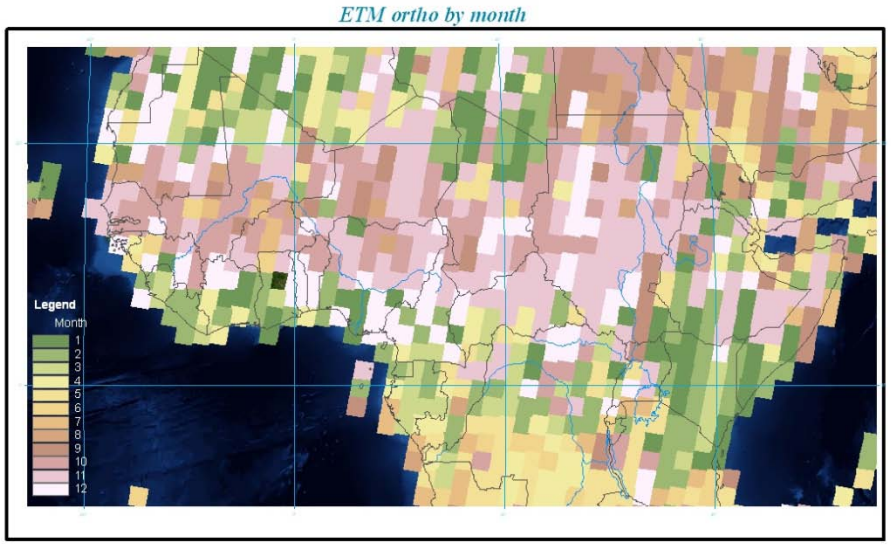


Lack of Central Tendency



Phenological Consistency



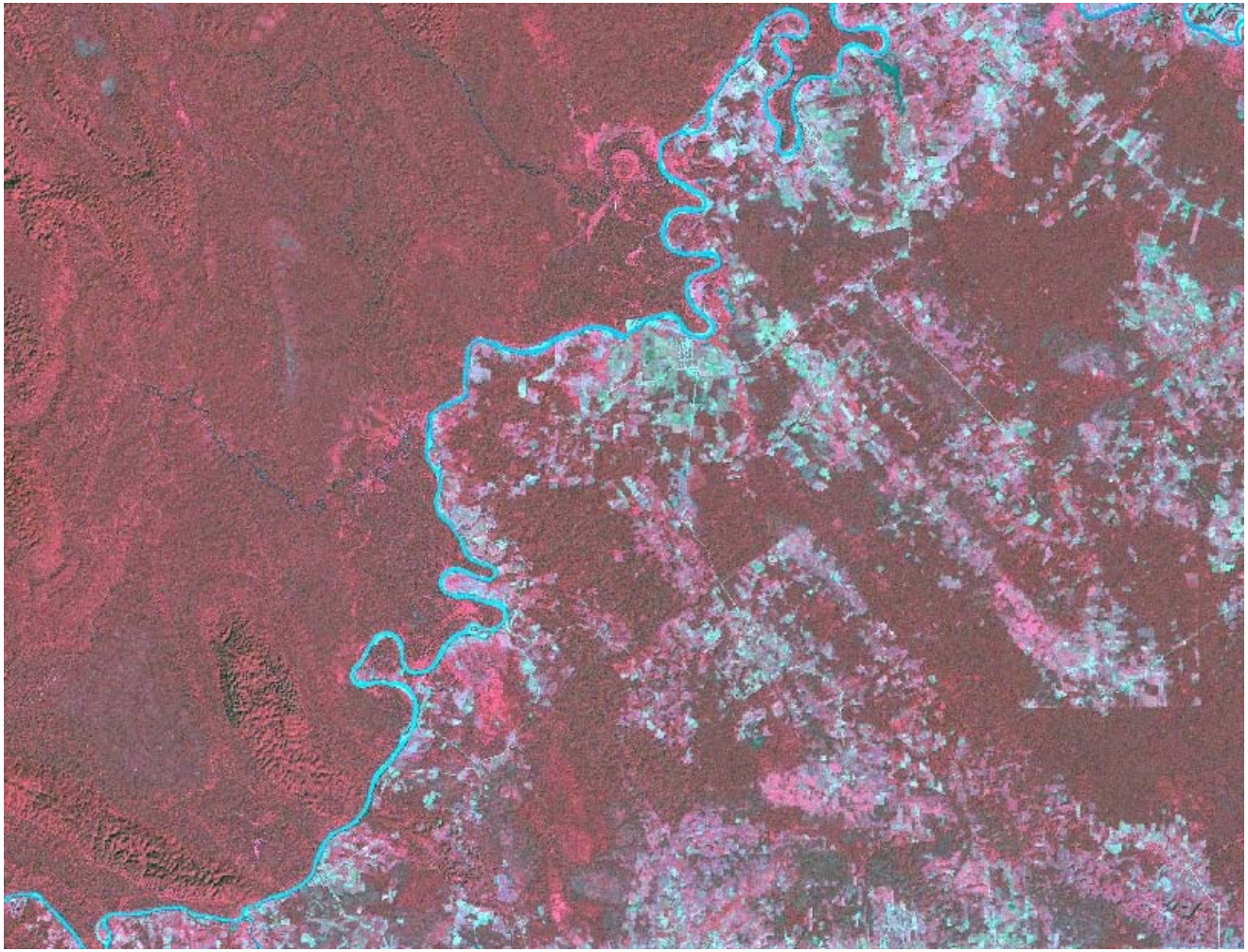


Color shading shows the month of acquisition for ETM data. The problem is worse for TM data. There is wide variation across the regions and frequently the months of acquisition for TM is not the same as ETM. Some serious phenology problems given erroneous estimates of deforestation in, for instance, deciduous forests of Asia that loose their leaves during dry months

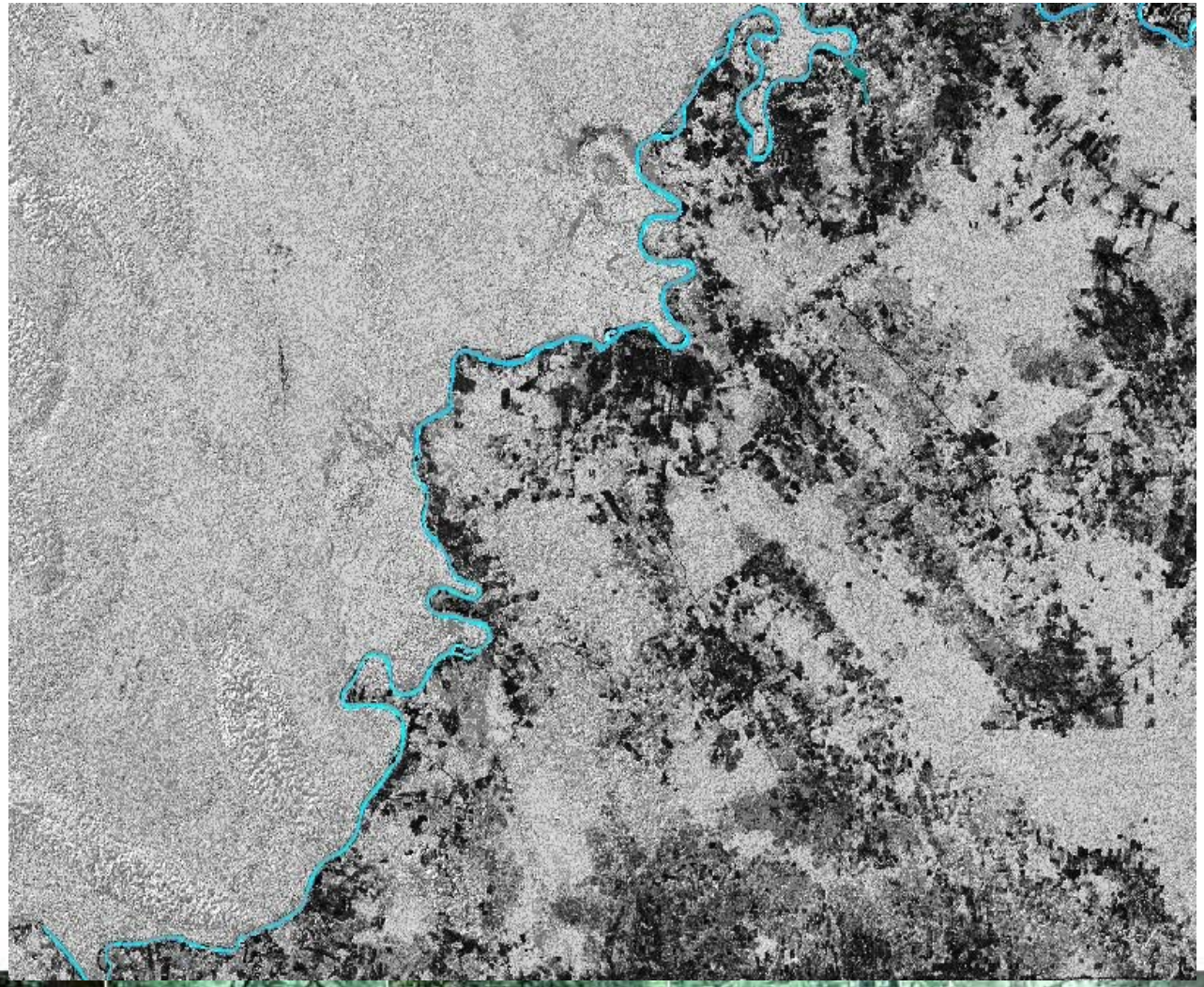
Four ways to reduce greenhouse gases

- ***Industrial Emission reduction***: switch to better technologies with lower emissions
- ***Industrial Emission substitution***: using more renewable fuels in the energy mix
- ***Land Cover Change Emission Reduction:*** reducing emissions from deforestation and degradation
- ***Off-setting by Biotic Sequestration***: biotic uptakes from the atmosphere (e.g. soil management, tree planting)

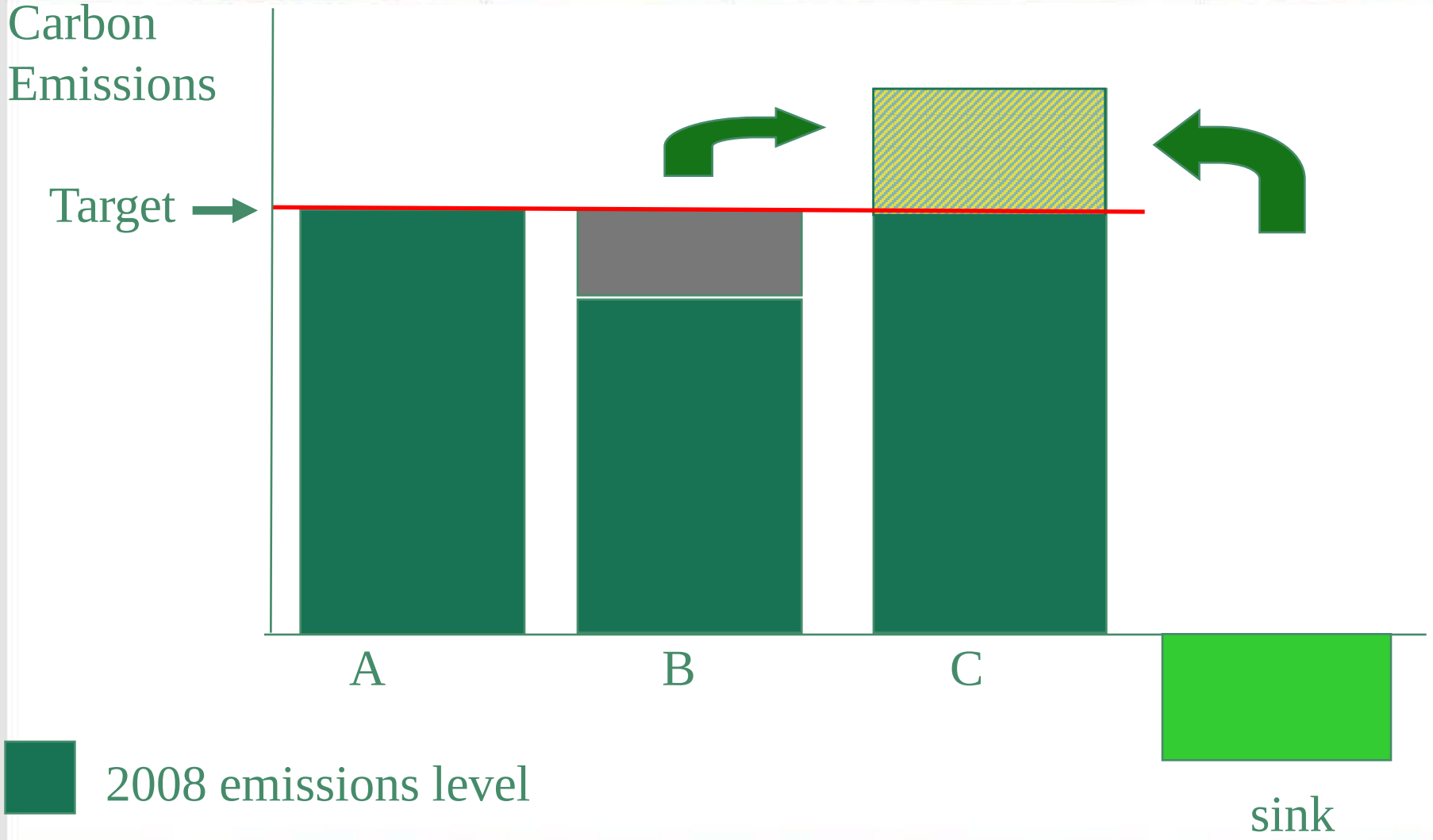
Tropical Deforestation and Degradation Products



Tropical Deforestation and Degradation Products



Convention Compliance Market Requirements



Markets Require Carbon Accounting Systems and Protocols

One of the primary issues in carbon markets is the need for assurances. EO technologies provides this assurance.

- Carbon buyers need assurance that they are buying real carbon sequestration
- Carbon sellers need to know how to account and report the carbon they have
- Market growth is constrained by the lack of effective protocols
- Markets are looking for effective, rigorous and challenge-proof accounting systems

Carbon markets can reduce poverty

- Carbon is now a commodity that can be grown on farms
- Internationally carbon markets can be leveraged as a *poverty reduction tool*
  - Poor rural farmers in developing countries can promote conservation practices and benefit from carbon sales
  - Natural resource conservation can be used to raise rural incomes for the poorest of the poor.
- Multiple benefits: climate and poverty

Example Multiple Benefit Projects

Restoration planting

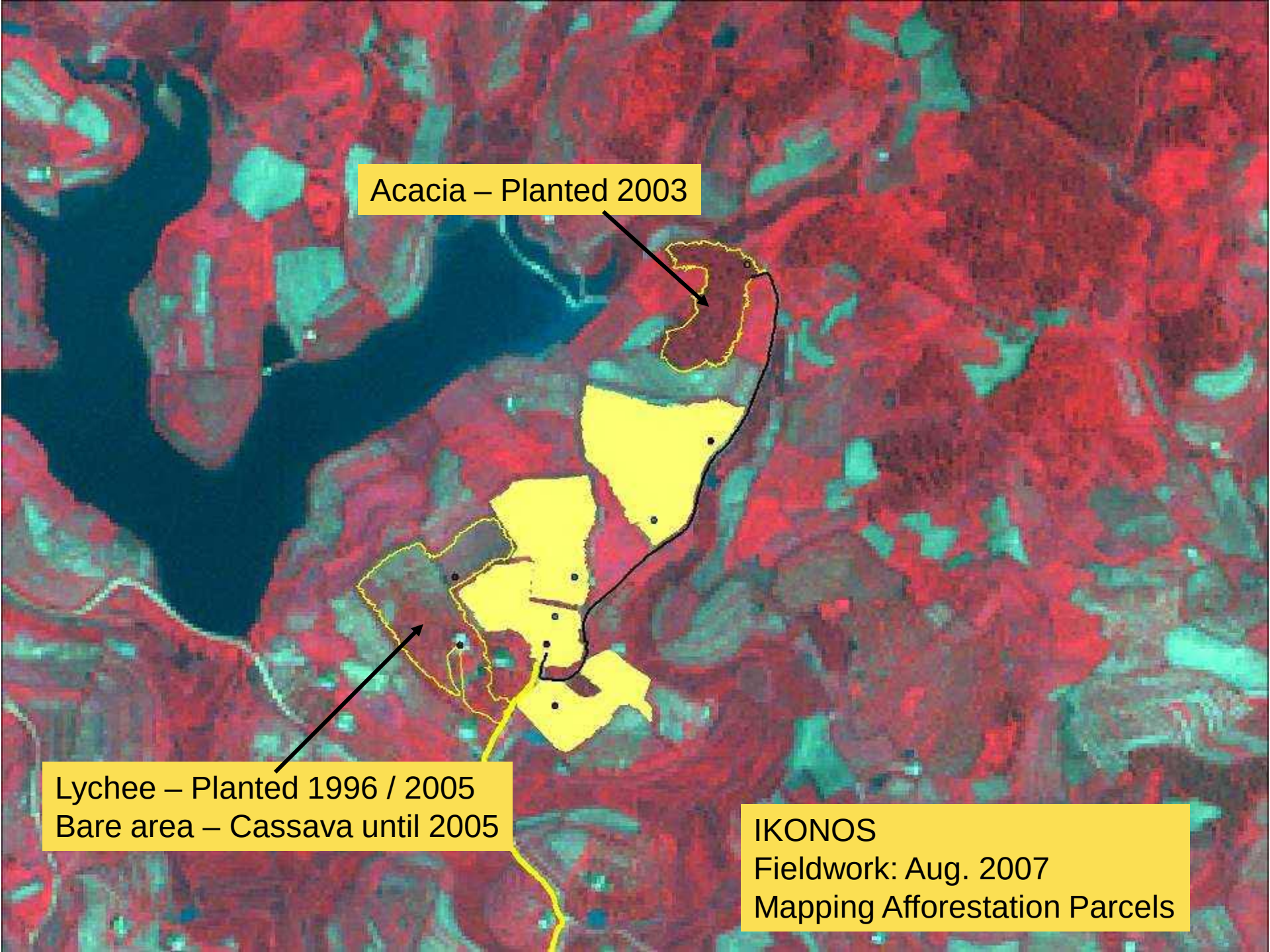
Biofuels

Agroforestry

Community Forestry


Viet Nam

Acacia


Acacia – Planted 2003
Lychee – Planted 1996 / 2005
Bare area – Cassava until 2005
IKONOS
Fieldwork: Aug. 2007
Mapping Afforestation Parcels


Thailand

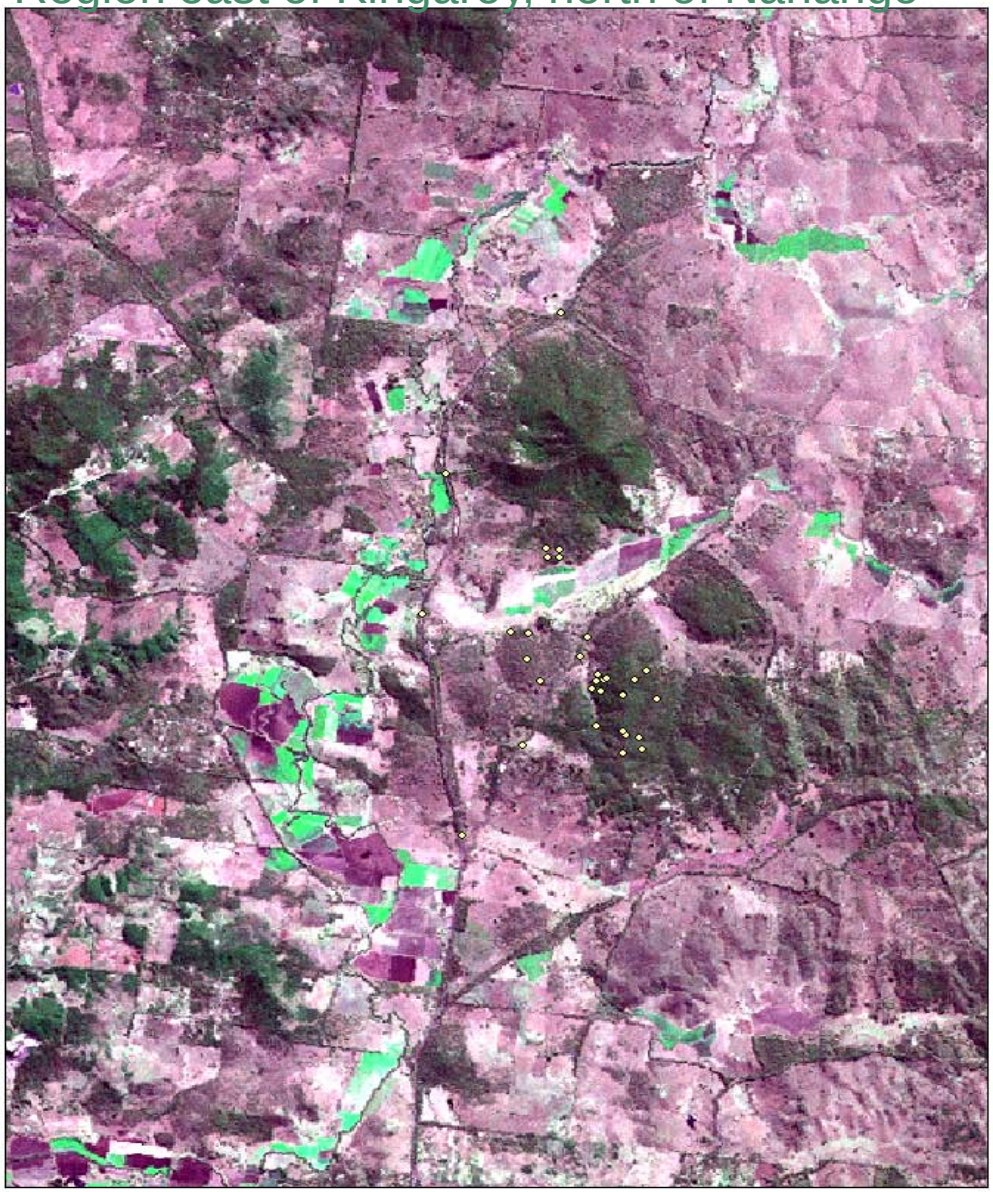
Natural Para Rubber Plantation on Degraded Land

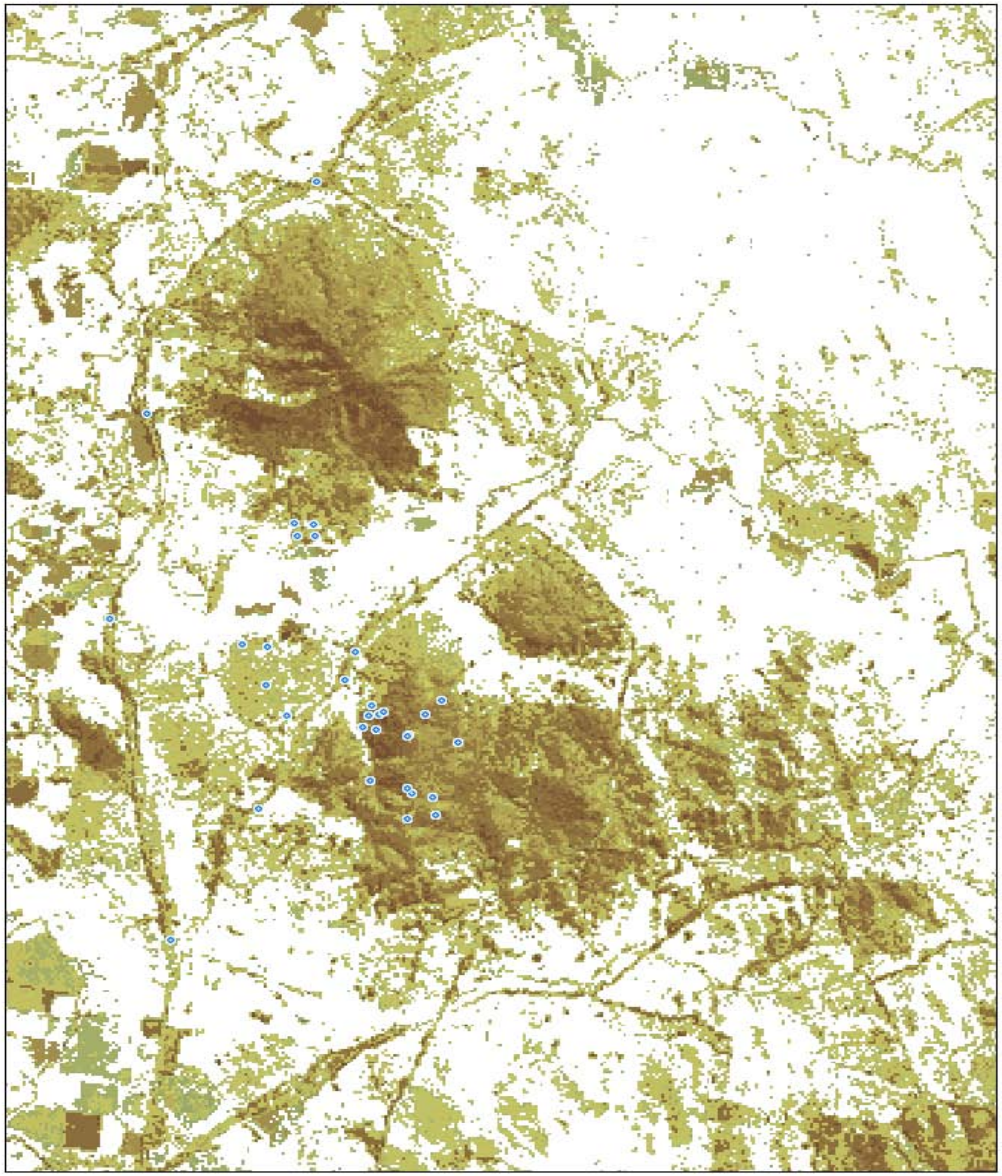
Para Rubber Inter-cropped with Sala fruit

Mixing natural and product species in community forests


Natural forest assisted re-generation

Region east of Kingaroy, north of Nanango

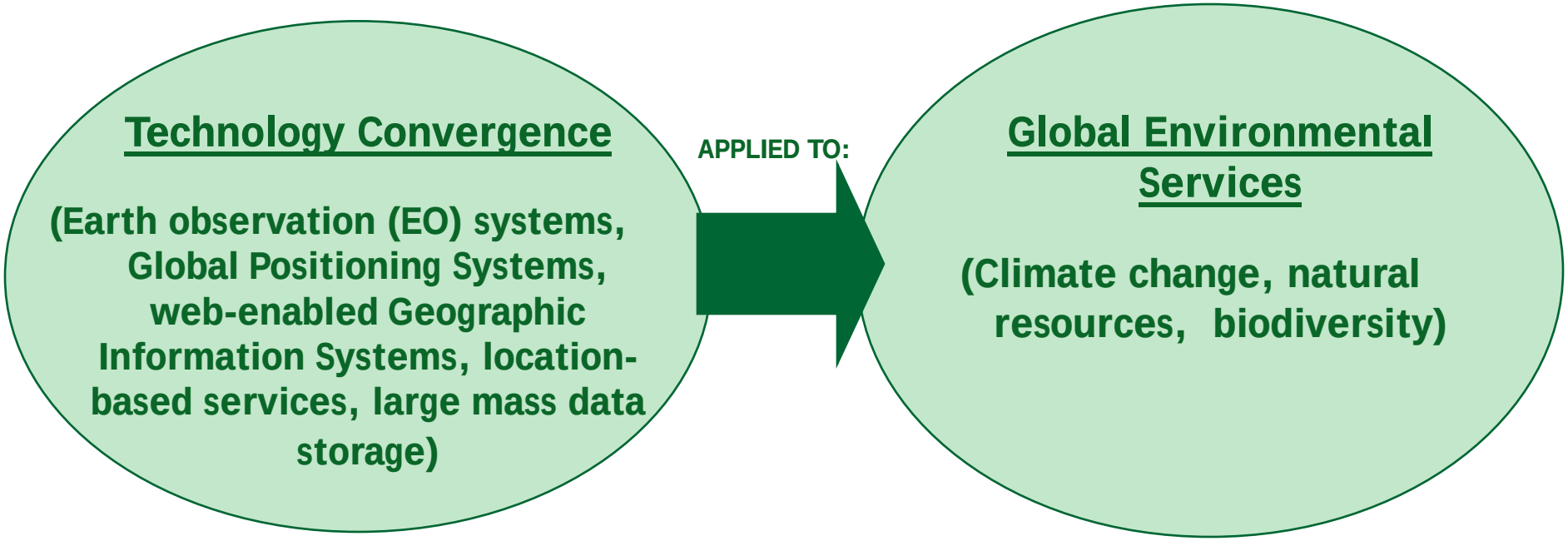


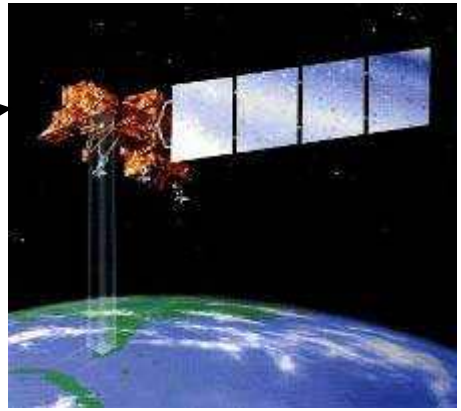


Region east of Kingaroy, north of Nanango. Small blue dots are waypopints. White is non forest/trees. Carbon sequestration range: 4-8 tCO2e per ha per yr (light to dark)

Vision

to apply emerging technologies to measure and monitor land use changes to provide accurate environmental and carbon risk information.





Earth Observation System

Carbon Sellers

Satellite Database
Data Analysis

Carbon Models
Carbon Accounts

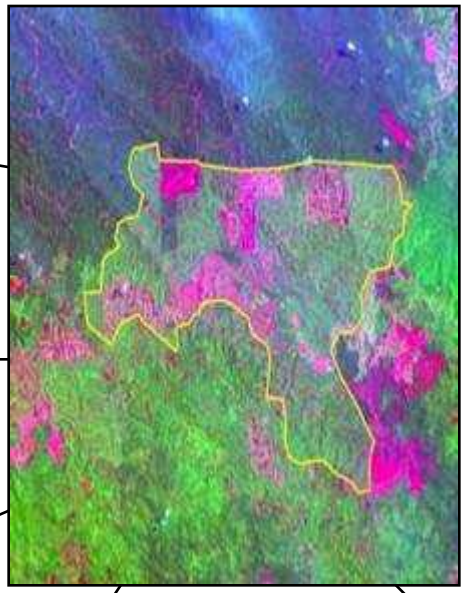
Markets
Buyers

Carbon Project Planner and Registration

This tool is aimed at project developers

Geospatially related databases

Geospatial Mapping



Biomass & Soil Carbon

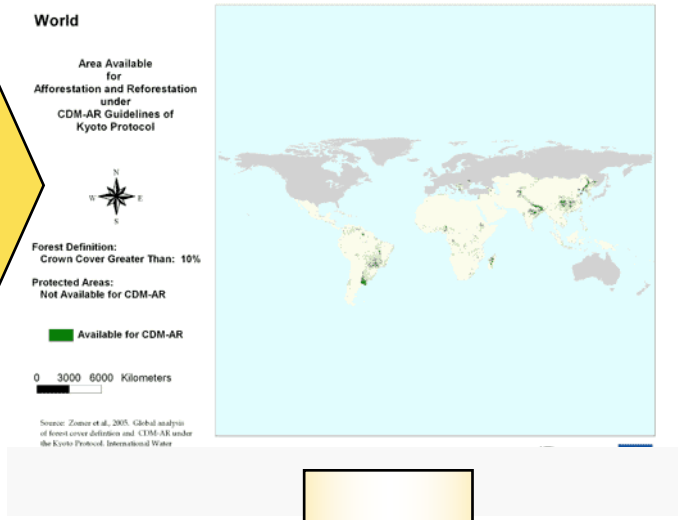
Rainfall & Drought Risk

Fire / Disease Risk

Criteria for Project eligibility

Cadastral / Ownership Data

Carbon Risk & Opportunity Analysis

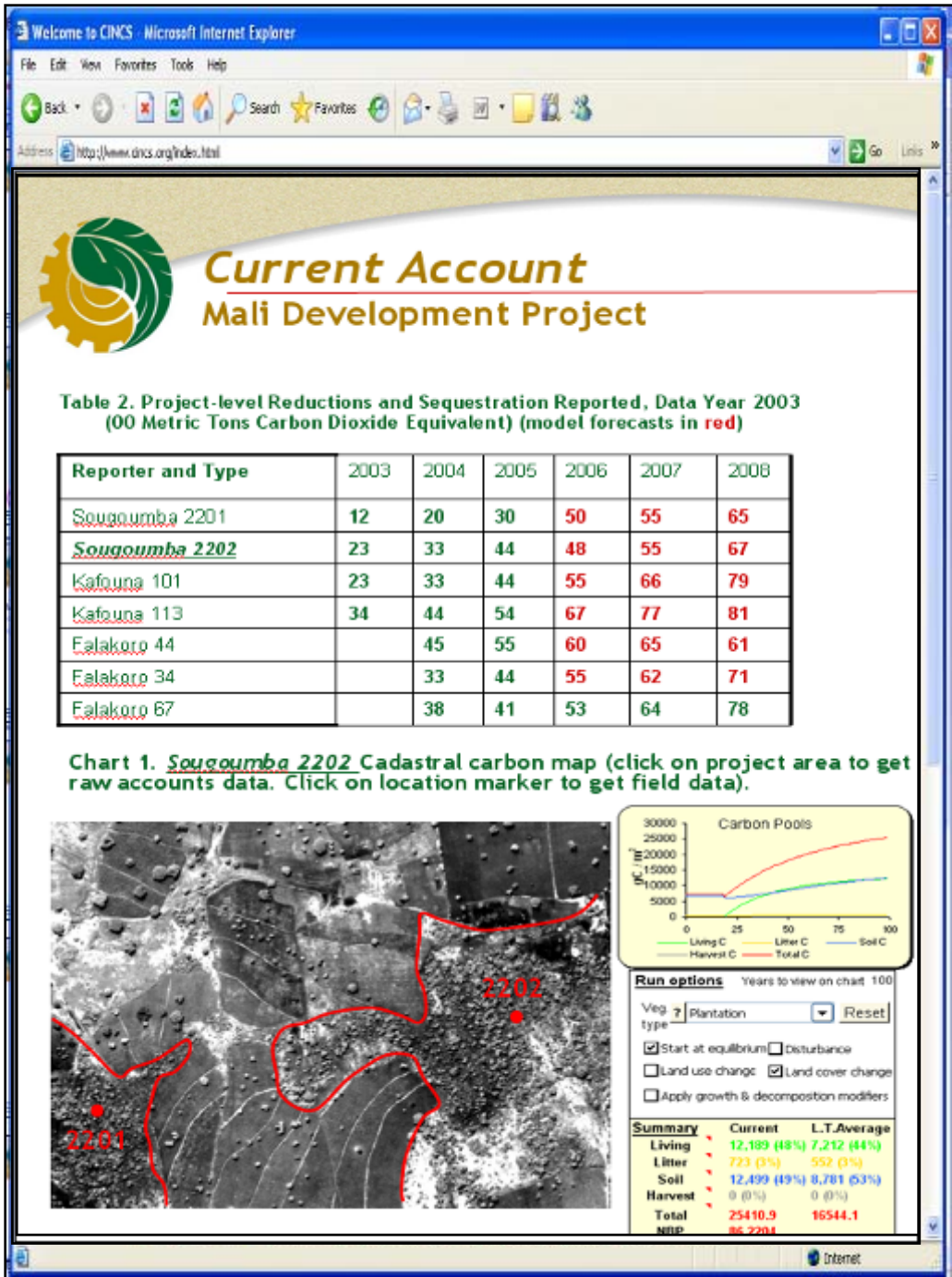


Carbon Measurement and Monitoring

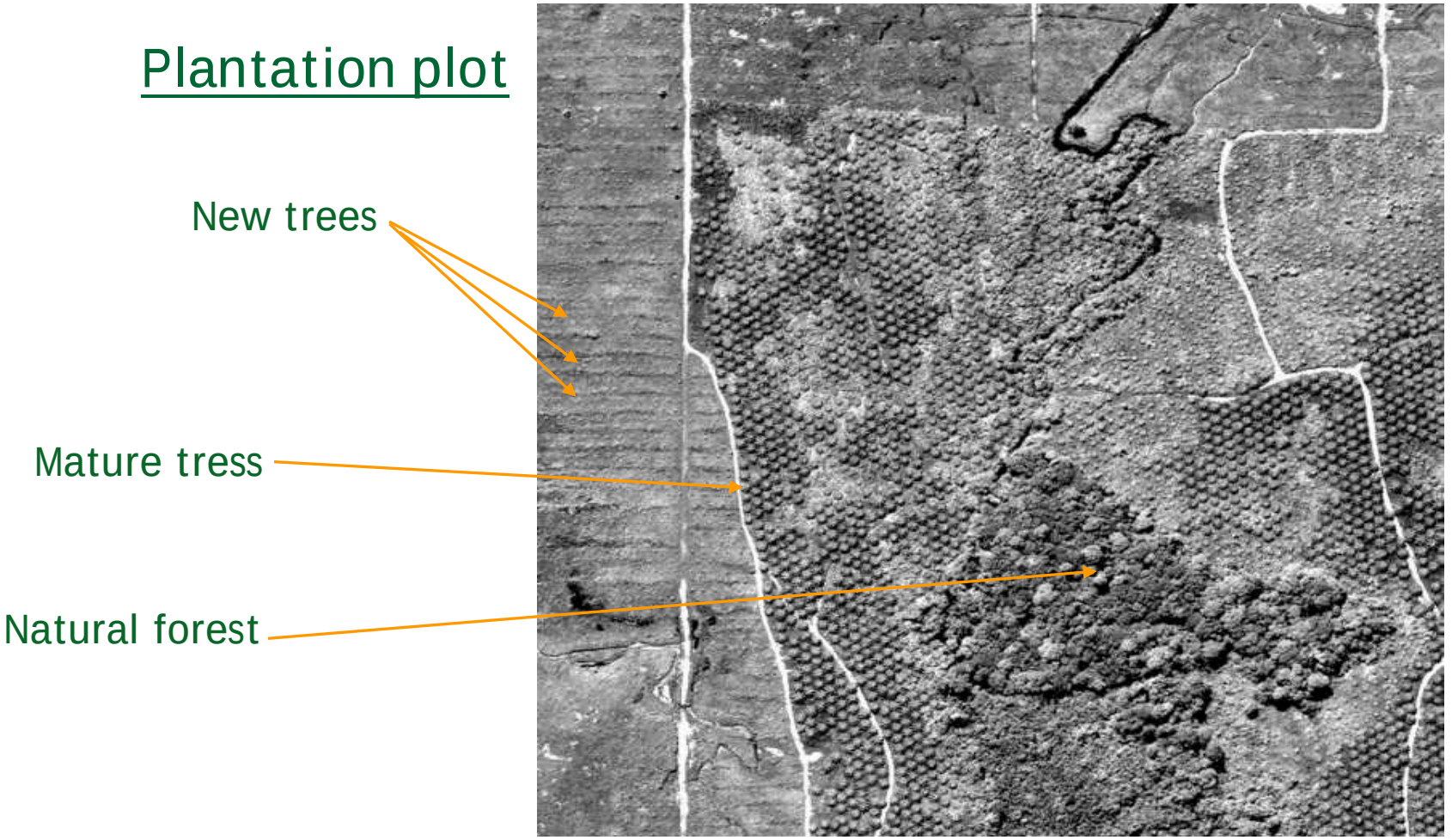
Registration on Market

Carbon Portal

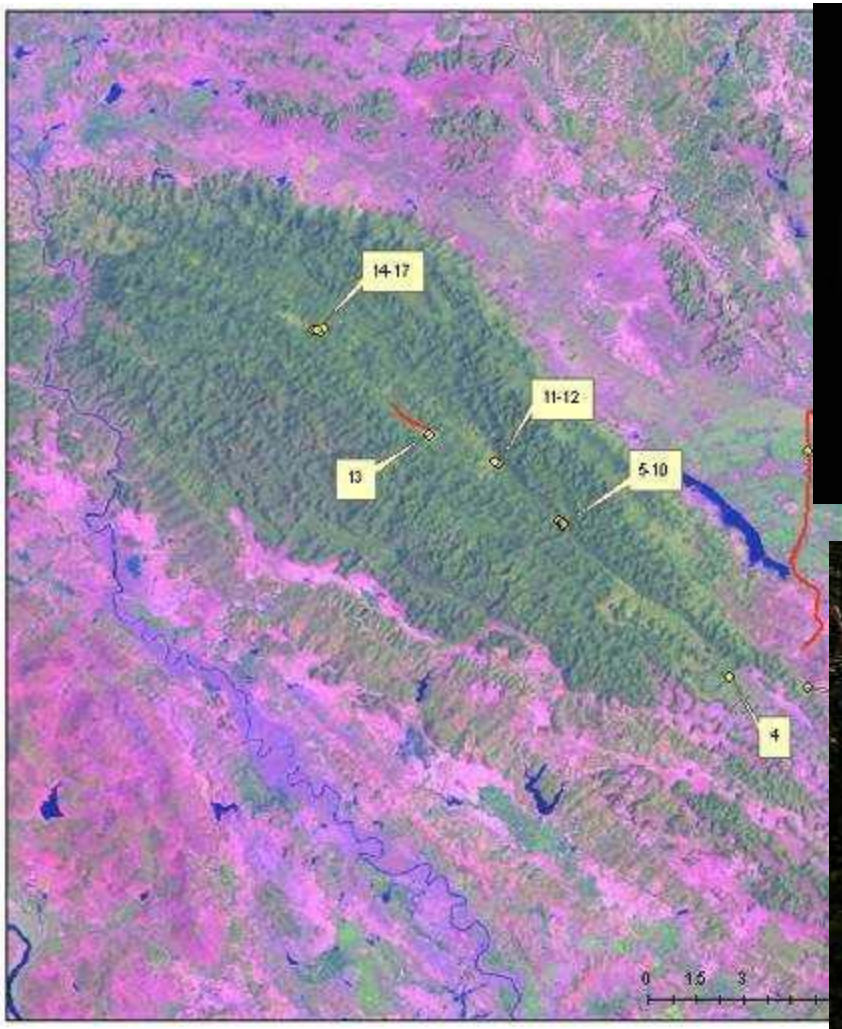
Portal centralizes project information and allows users to access and manage their carbon accounts from anywhere.



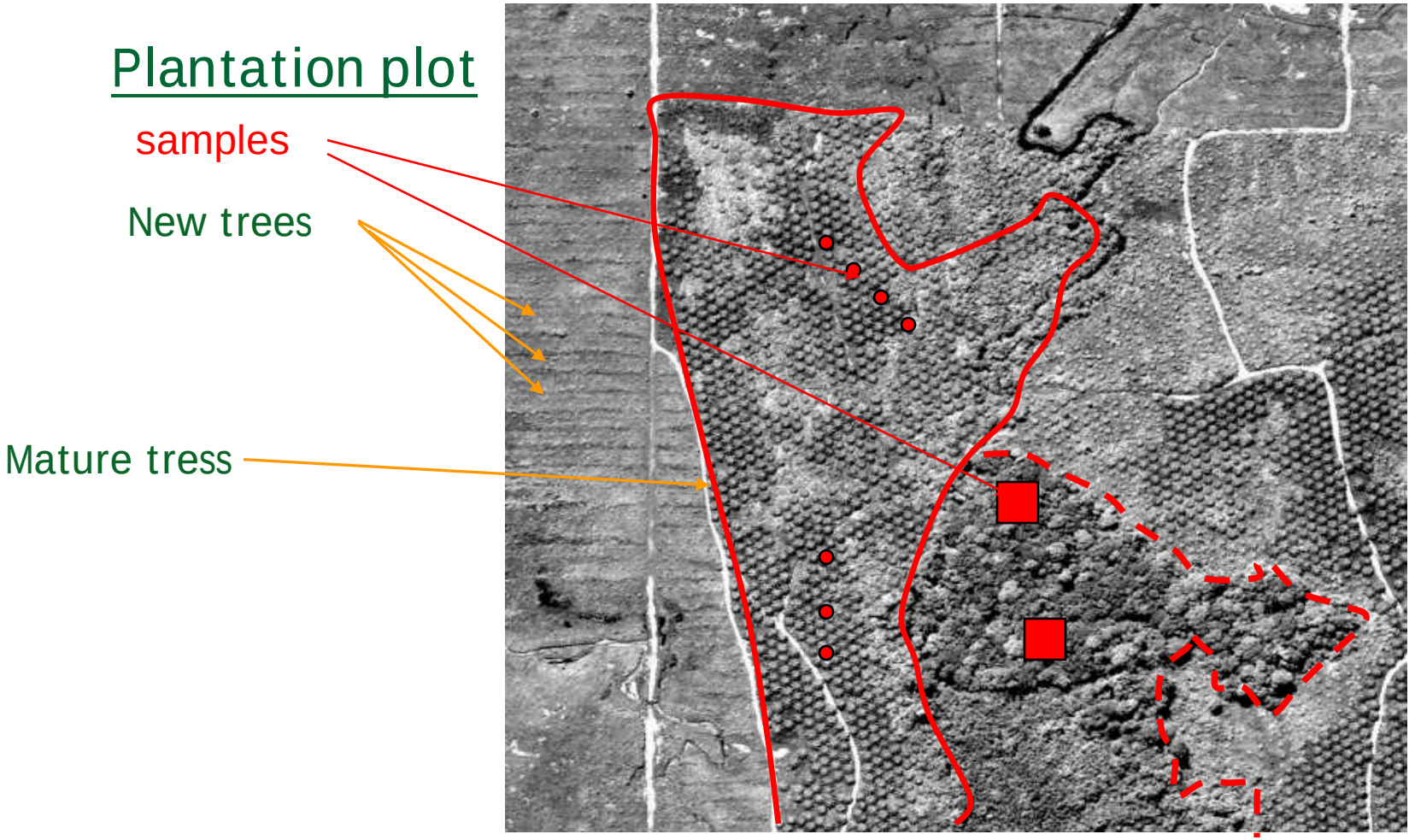
Remote sensing monitors for permanence and tracking carbon in biomass



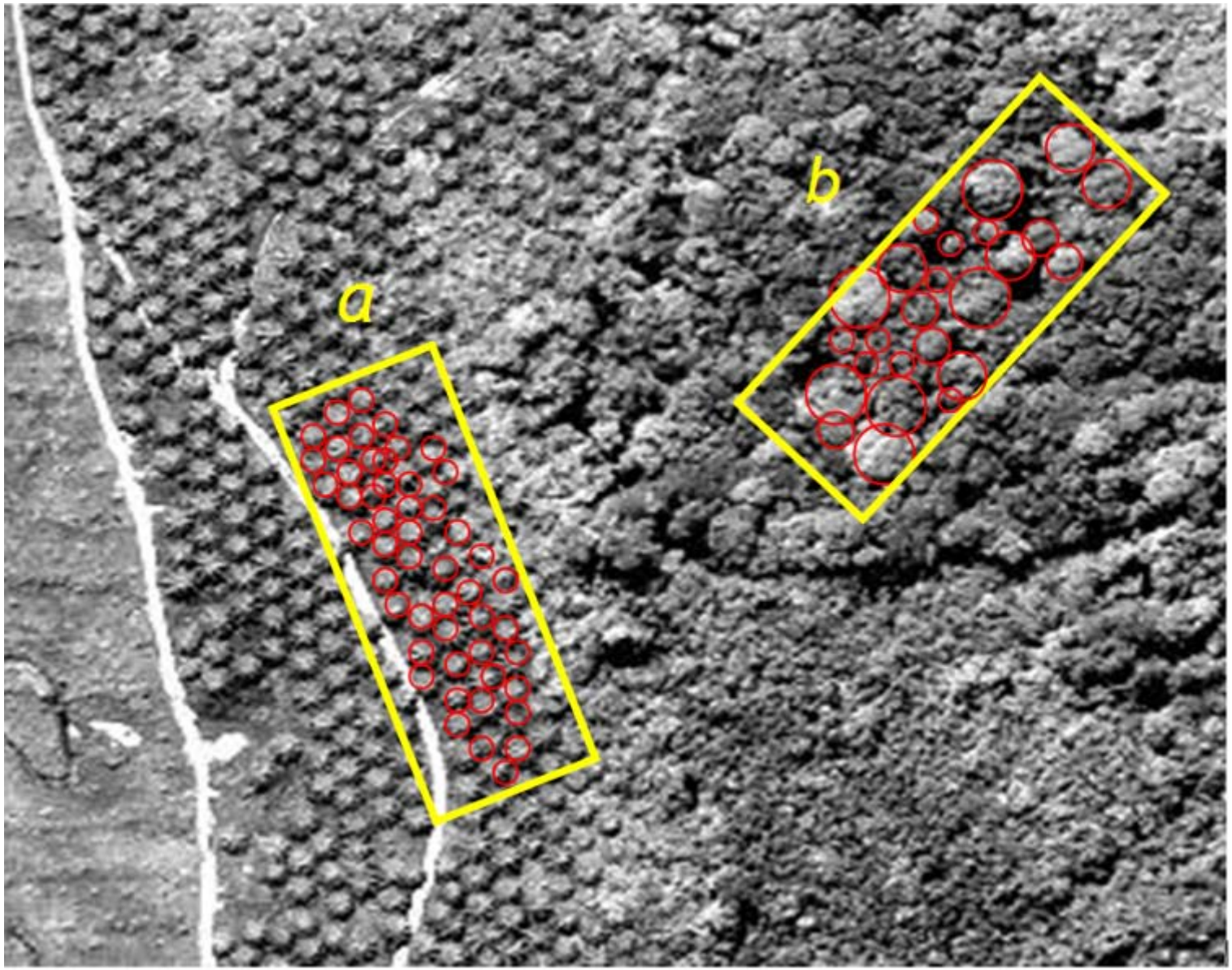
Ground Calibration

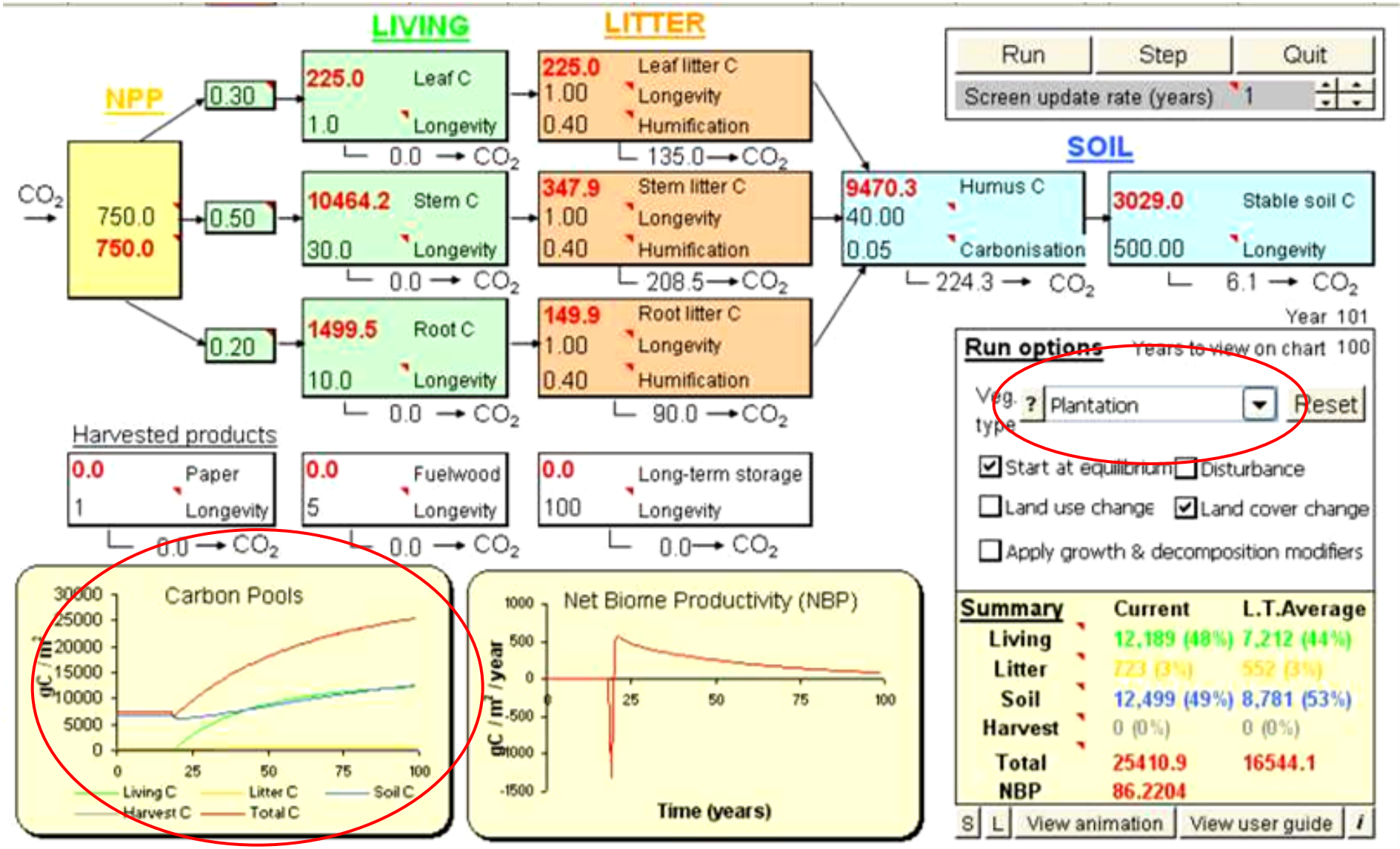


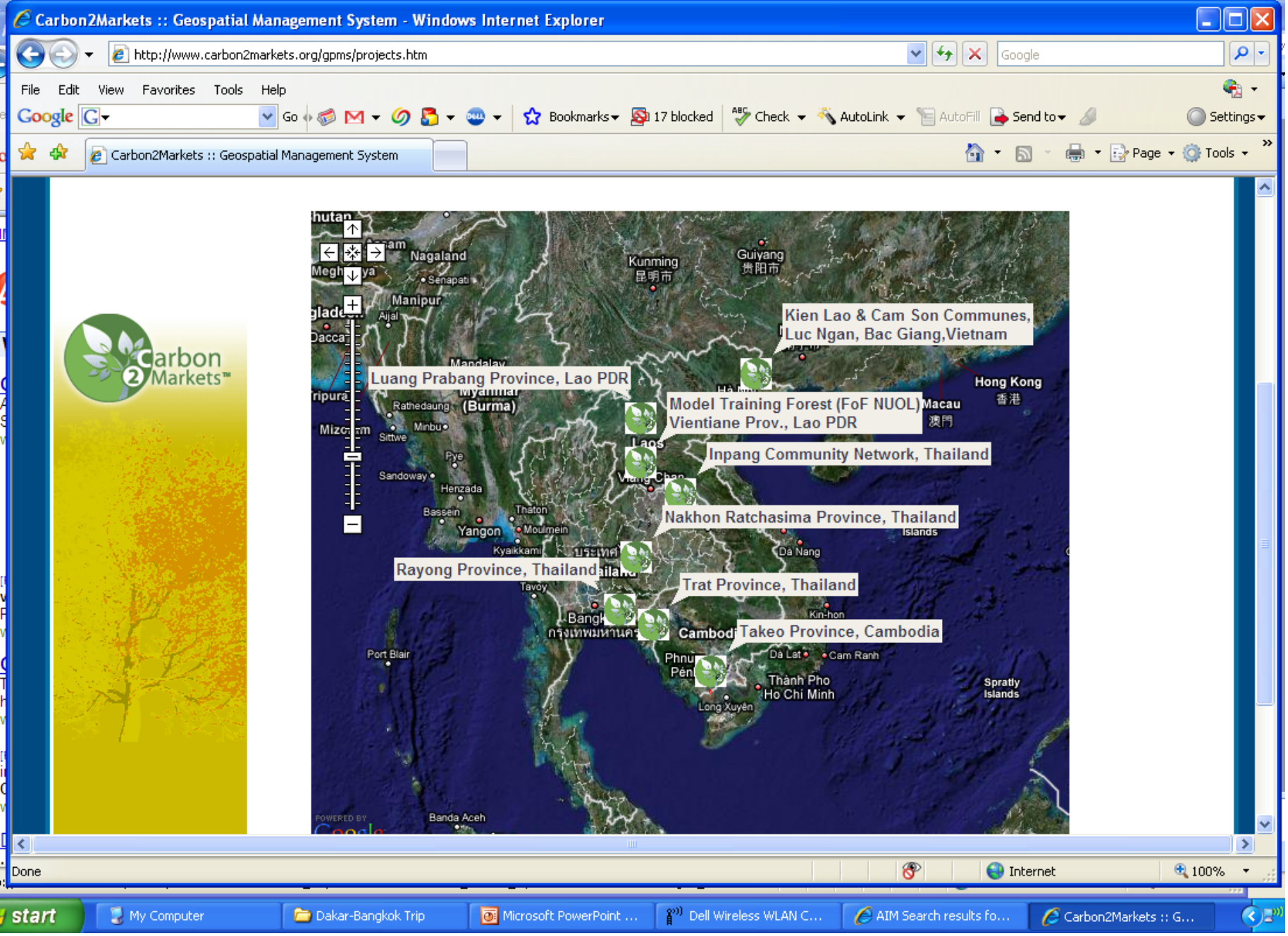
Integration of in situ carbon and nitrogen with imagery



Automated Tree Geometry




LIVING
LITTER
SOIL
NPP
CO_2
750.0
750.0
0.30
0.50
0.20
225.0 Leaf C
1.0 Longevity
0.0 → CO_2
225.0 Leaf litter C
1.00 Longevity
0.40 Humification
135.0 → CO_2
10464.2 Stem C
30.0 Longevity
0.0 → CO_2
347.9 Stem litter C
1.00 Longevity
0.40 Humification
208.5 → CO_2
1499.5 Root C
10.0 Longevity
0.0 → CO_2
149.9 Root litter C
1.00 Longevity
0.40 Humification
90.0 → CO_2
9470.3 Humus C
40.00
0.05 Carbonisation
224.3 → CO_2
3029.0 Stable soil C
500.00 Longevity
6.1 → CO_2
Harvested products
0.0 Paper
1 Longevity
0.0 → CO_2
0.0 Fuelwood
5 Longevity
0.0 → CO_2
0.0 Long-term storage
100 Longevity
0.0 → CO_2
Carbon Pools
gC / m²
Living C
Litter C
Soil C
Harvest C
Total C
Net Biome Productivity (NBP)
gC / m² / year
Time (years)
Run
Step
Quit
Screen update rate (years) 1
Year 101
Run options
Years to view on chart 100
Veg. type ? Plantation
Reset
Start at equilibrium
Disturbance
Land use change
Land cover change
Apply growth & decomposition modifiers
Summary
Current
L.T.Average
Living 12,189 (48%) 7,212 (44%)
Litter 773 (3%) 552 (3%)
Soil 12,499 (49%) 8,781 (53%)
Harvest 0 (0%) 0 (0%)
Total 25410.9 16544.1
NBP 86.2204
S
L
View animation
View user guide
i


Carbon2Markets :: Geospatial Management System - Windows Internet Explorer
http://www.carbon2markets.org/gpms/projects.htm
Carbon2Markets :: Geospatial Management System
Kien Lao & Cam Son Communes, Luc Ngan, Bac Giang,Vietnam
Luang Prabang Province, Lao PDR
Model Training Forest (FoF NUOL) Vientiane Prov., Lao PDR
Inpang Community Network, Thailand
Nakhon Ratchasima Province, Thailand
Rayong Province, Thailand
Trat Province, Thailand
Takeo Province, Cambodia
Kunming
Guiyang
Nagaland
Manipur
Mandalay
Hong Kong
Macau
Laos
Yangon
Thaton
Moulmein
Da Nang
Tavoy
Port Blair
Banda Aceh
Thành Phố Ho Chi Minh
Spratly Islands
Done
Internet
100%
start
My Computer
Dakar-Bangkok Trip
Microsoft PowerPoint ...
Dell Wireless WLAN C...
AIM Search results fo...
Carbon2Markets :: G...

Carbon2Markets :: Geospatial Management System - Windows Internet Explorer

http://www.carbon2markets.org/gpms/projectmanager.htm

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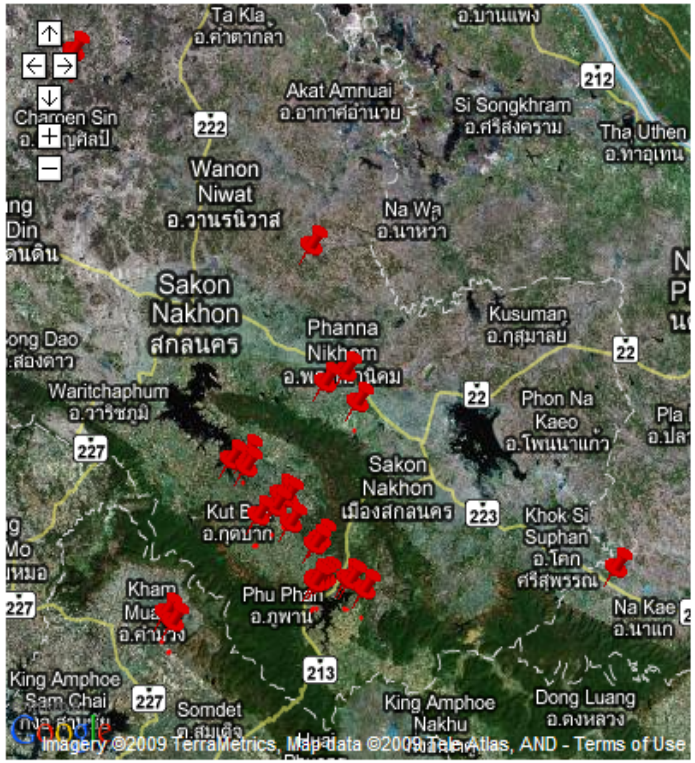
Carbon2Markets :: Geospatial Management System

Inpang Community, Thailand - Small-holder Teak(Project ID: IN_1_T)



Farmers who belong to the Inpang Community Network embrace the tenants of His Majesty King Bhumibol Adulyadej's Sufficiency Economy. Most of the Inpang-member, small-holder teak plantations have been established on farms previously planted with cassava. Inpang teak plantations are part of a whole farm systems that includes annual crops, fish ponds, and multi-species agro-forestry that support a number of traditional non-timber forest goods as well as marketable commodities. Sequestering carbon is an ecosystem service Inpang teak plantations provide, and this carbon is now a commodity. The sale of carbon offsets will help sustain the diverse, socially-conscious agro-forestry systems practiced by Inpang members and mitigate climate change.

To see an example of a detailed project management and measurement system for one of these sites click here.

Land_Owner	Date_Planted	Teak_Area (ha)
Thanakorn Promburom	1993	12.00
Uean Lamkham	1993	0.32
San Lamkham	1994	0.32
Pramun Kamkot	1994	0.32
Yuanchai Chaitamat	1993	0.80
Adisai Chaitamat	1993	0.80
Sot Lasuk	1994	0.80
Bunkaen Chantawan	1994	0.48
Somchit Kanburom	1994	0.96
Kampan Sunyarat	1993	0.16
Nintha Chuni	1995	4.00
Bunruam Thokaewkheaw	1994	0.80
Reanthong Thokaewkheaw	1994	1.60
Kum Thothumphon	1994	2.40
Samli Khamthong	1996	1.60
Sawat Hanket	1994	2.56

Done

Internet 100%

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Inpang Community Project - Teak(IN_1_T)

Click here to download data

Site 026

Project_ID	INI1
Land_ID	127
SiteID	026
Number of Sampling Plots	2
Initial	Mr
Land Owner Name	Sak Sawaengphet
Carbon Offset	Managed Forest
Tree Species	Tectona grandis
Other Vegetation	None
Year Planted(Bhuddist)	2538
Year Planted (Mod)	1995
Age of Trees	13
Teak Area(rai)	7
Teak Area(ha)	1.12
Area Estimate or Measured	Measured
Land Use Before 1990	Cassava
Plant to Harvest	No
Year of Harvest	NA
Use for Harvested Wood	NA
Wood fuel	No
Survay Date	12-Oct-2008
Ave Total tCO2 per plot	11.65801803
Total tCO2 per ha	233.1603607
Total tCO2	261.139604

Allometric Equation
LOG Y = -0.85 + 2.382*LOG(DBH)
Y = biomass in kg

Plot Level Data
- Plot 1
- Plot 2

Ex Ante Carbon Sequestration

800
600

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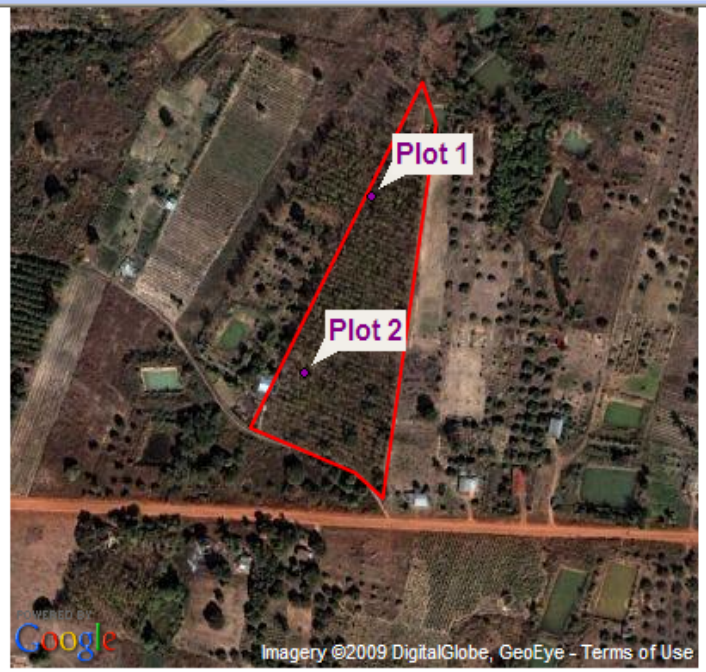
http://www.carbon2markets.org/gpms/manager.htm

Carbon2Markets :: Geospatial Management System



Initial	Mr
Land Owner Name	Sak Sawaengphet
Carbon Offset	Managed Forest
Tree Species	Tectona grandis
Other Vegetation	None
Year Planted(Bhuddist)	2538
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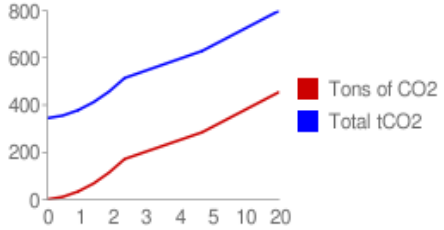
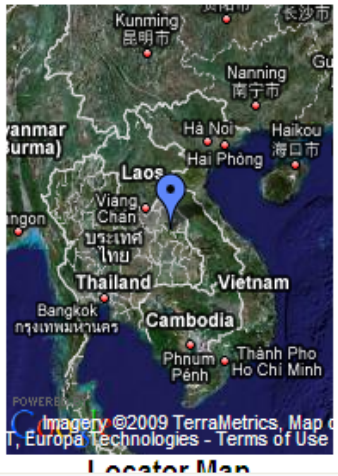
- Plot 1
- Plot 2

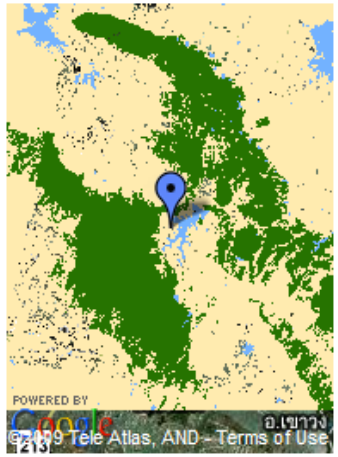
Ex Ante Carbon Sequestration



YEAR	TOTAL C02	Tons of CO2 Sequestered
0	261.139604	8.382916667
1	269.5225206	16.76583333
2	286.288354	33.53166667
3	311.437104	58.68041667
4	344.96877706	92.21208333
5	386.883354	134.1266667
10	470.7125206	217.9558333
15	596.4562076	343.6995833
20	764.114604	511.3579167



Locator Map



1990 Forest/Non-Forest

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Inpang Community Project - Teak(IN_1_T)

Site 026

Click here to download data

General Information Site 26

Plot Data Generalized

Plot 1 Field Data Set

Plot 2 Field Data Set

Ex Ante Carbon Calculation

Land Owner Name	Sak Sawangphet
Carbon Offset	Managed Forest
Tree Species	Tectona grandis
Other Vegetation	None
Year Planted(Bhuddist)	2538
Year Planted (Mod)	1995
Age of Trees	13
Teak Area(rai)	7
Teak Area(ha)	1.12
Area Estimate or Measured	Measured
Land Use Before 1990	Cassava
Plant to Harvest	No
Year of Harvest	NA
Use for Harvested Wood	NA
Wood fuel	No
Survay Date	12-Oct-2008
Ave Total tCO2 per plot	11.65801803
Total tCO2 per ha	233.1603607
Total tCO2	261.139604

Allometric Equation

LOG Y = -0.85 + 2.382*LOG(DBH)

Y = biomass in kg

Plot Level Data

- Plot 1
- Plot 2

Ex Ante Carbon Sequestration

http://www.carbon2markets.org/kml/site_026/xls/IN_1_T_26_plot1.xls - Windows Internet Explorer

http://www.carbon2markets.org/kml/site_026/xls/IN_1_T_26_plot1.xls

http://www.carbon2markets.org/kml/site_026/xls/IN_...

I1

Above-ground biomass (tons) = LOG Y / 1000 = -0.815 + 2.382 * LOG (DBH)
Y = Above-ground biomass in kg
Below-ground biomass (tons) = exp (-1.0587 + 0.8836 * LN Above-ground bio
Survey Date 12-Oct-2008

Project_ID	Site_ID	Plot_ID	Tree_ID	Species	Height (m)	Circum (cm)	DBH (cm)	Above-Ground Biomass (tons)	Above-Ground C (tons)	Above-Ground CO2 (tons)	Below-Ground Bion
IN_1_T	26	1	IN1-26-1-1	Tectona grandis	13.0	49.0	15.59718442	0.106374141	0.05318707	0.195019258	0
IN_1_T	26	1	IN1-26-1-2	Tectona grandis	10.0	25.5	8.116902098	0.022447486	0.011223743	0.041153725	0
IN_1_T	26	1	IN1-26-1-3	Tectona grandis	15.0	65.0	20.6901426	0.208520433	0.104260217	0.382287461	0
IN_1_T	26	1	IN1-26-1-4	Tectona grandis	12.0	34.0	10.82253613	0.044542212	0.022271106	0.081660723	0
IN_1_T	26	1	IN1-26-1-5	Tectona grandis	11.0	37.6	11.96845172	0.056609126	0.028304563	0.103783398	0
IN_1_T	26	1	IN1-26-1-6	Tectona grandis	11.0	38.5	12.25493062	0.059890296	0.029945148	0.109798876	0
IN_1_T	26	1	IN1-26-1-7	Tectona grandis	6.0	29.0	9.230986699	0.030494466	0.015247233	0.055906521	0
IN_1_T	26	1	IN1-26-1-8	Tectona grandis	12.0	41.0	13.05070533	0.069572907	0.034786453	0.127550329	0
IN_1_T	26	1	IN1-26-1-9	Tectona grandis	11.0	40.0	12.73239545	0.065598801	0.032799401	0.120264469	0
IN_1_T	26	1	IN1-26-1-10	Tectona grandis	10.0	26.0	8.276057041	0.023510156	0.011755078	0.043101953	0
IN_1_T	26	1	IN1-26-1-11	Tectona grandis	8.0	22.0	7.002817496	0.015792098	0.007896049	0.02895218	0
IN_1_T	26	1	IN1-26-1-12	Tectona grandis	11.0	46.0	14.64225476	0.091512023	0.045756012	0.167772043	0
IN_1_T	26	1	IN1-26-1-13	Tectona grandis	6.0	24.6	7.8304232	0.02060613	0.010303065	0.037777904	0
IN_1_T	26	1	IN1-26-1-14	Tectona grandis	10.0	37.0	11.77746579	0.054481055	0.027240528	0.099881934	0
IN_1_T	26	1	IN1-26-1-15	Tectona grandis	7.0	19.0	6.047887837	0.011137304	0.005568652	0.020418391	0
IN_1_T	26	1	IN1-26-1-16	Tectona grandis	14.0	49.0	15.59718442	0.106374141	0.05318707	0.195019258	0
IN_1_T	26	1	IN1-26-1-17	Tectona grandis	10.0	38.0	12.09577567	0.058054185	0.029027092	0.106432672	0
IN_1_T	26	1	IN1-26-1-18	Tectona grandis	14.0	45.0	14.32394488	0.086844278	0.043422139	0.15921451	0
IN_1_T	26	1	IN1-26-1-19	Tectona grandis	8.0	15.0	4.774648293	0.006342177	0.003171089	0.011627325	0
IN_1_T	26	1	IN1-26-1-20	Tectona grandis	11.0	45.2	14.38760686	0.087766495	0.043883248	0.160905241	0
IN_1_T	26	1	IN1-26-1-21	Tectona grandis	6.0	20.6	6.557183655	0.013502703	0.006751352	0.024754956	
IN_1_T	26	1	IN1-26-1-22	Tectona grandis	10.0	45.0	14.32394488	0.086844278	0.043422139	0.15921451	0
IN_1_T	26	1	IN1-26-1-23	Tectona grandis	12.0	41.0	13.05070533	0.069572907	0.034786453	0.127550329	0
IN_1_T	26	1	IN1-26-1-24	Tectona grandis	12.0	39.0	12.41408556	0.06175966	0.03087983	0.113226044	0
IN_1_T	26	1	IN1-26-1-25	Tectona grandis	11.0	36.5	11.61831085	0.052743702	0.026371851	0.096696786	0
IN_1_T	26	1	IN1-26-1-26	Tectona grandis	11.0	47.4	15.08788861	0.098286306	0.049143153	0.180191561	0
IN_1_T	26	1	IN1-26-1-27	Tectona grandis	11.0	34.5	10.98169107	0.046118385	0.023059192	0.084550372	0
IN_1_T	26	1	IN1-26-1-28	Tectona grandis	10.0	30.5	9.708451529	0.034386757	0.017193379	0.063042388	0
IN_1_T	26	1	IN1-26-1-29	Tectona grandis	10.0	41.0	13.05070533	0.069572907	0.034786453	0.127550329	0
IN_1_T	26	1	IN1-26-1-30	Tectona grandis	8.0	22.0	7.002817496	0.015792098	0.007896049	0.02895218	0
IN_1_T	26	1	IN1-26-1-31	Tectona grandis	8.0	25.5	8.116902098	0.022447486	0.011223743	0.041153725	0
IN_1_T	26	1	IN1-26-1-32	Tectona grandis	11.0	38.5	12.25493062	0.059890296	0.029945148	0.109798876	0

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