



RS & NFI IN

Forest Carbon Accounting in India



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India's Forestry Scenario at a Glance

- India's geographical area is 328 m ha, human pop. over 1 billion. India is the second most populous and seventh largest country in the World
- India's forests constitute 2% of World's forests but sustain the needs of 17% of human and 18% livestock population of the World
- Per capita forest 0.064 ha. (World avg. 0.64 ha.)
- About 5% of geographical area (or 16 m ha) covered under 572 Protected Areas
- Recorded Forest Area: 77.18 m ha (23.48% of GA)
- Forest Cover: 69.79 m ha (21.23 % of GA); Tree Cover: 9.1 m ha (2.78% of GA)
- Forest & Tree Cover: 78.92 m ha (24.01 % of GA)



REDD+ Action

- India contributed in evolving REDD+ concept, maintains that C is one of the products in the basket of multiple benefits from Forests.
- For awareness and capacity building on REDD+ Organised a series of national and international workshops
- 2011- 2 National Workshop, 4 Regional Workshop
- 2012- 2 National Workshop, 2 international Workshop
- 2013- Preparation of REDD+ reference level document
- 2014- Preparation of REDD+ National Policy & strategy document.
- **USAID-FOREST PLUS**
- FP works closely with MoEF&CC, SFDs and communities to support REDD+ activities
- **Expected results** – Developing tools, techniques & approaches . deployment for taking REDD+ action to scale
- Support REDD+ readiness activities & approach to implement REDD+



Reporting of GHG inventory for LULUCF

Six categories namely

- **Forest land,**
- Cropland,
- Grassland,
- Wetlands,
- Settlements and
- Other lands



Definitions

- **Forest** - Forest is defined structurally on the basis of
 - **Crown cover** percentage: Tree crown cover - 10 to 30 % (**India 10%**)
 - **Minimum area** of stand : area between 0.05 and 1 ha (**India 1.0 ha**), and
 - **Minimum height** of trees: Potential to reach a minimum height at maturity in situ of 2 to 5 m (**2m**)
- *(Decision 19/CP9) - Kyoto Protocol definition)*



Approaches for activity data

Three different approaches are given in the IPCC GPG

Approach1:Total area of each land-use category but no information on conversions (only net changes)

Approach2:Tracking of conversions between land-use categories (only between 2 points in time)

Approach3:Spatially explicit tracking of land-use conversions over time

Preparing for REDD+ **Approach 3**



Tiers that are used for the emission factors

Tiers for emission factors: change in Carbon stocks

Tiers 1: IPCC default values

Tiers 2: Country specific data for **key** factors

Tiers 3: Detailed national inventory for **key C stocks**, repeated measurement for key stocks through time or modeling

Preparing for REDD+ tier 3 Phase.



Methodologies for Assessing 'Activity data'

Three different methodologies

- Wall-to-wall mapping using remote sensing data
- Mapping of sampled areas using remote sensing data and
- Using field survey methods



Stratification of Forest area

Forest carbon stock depends upon

- Canopy density
- Forest type
- Aspect
- Altitude



Assessment of Forest Carbon Stock for India

- Forest cover maps,
- Forest types maps,
- National Forest Inventory,
- Estimation of missing components of forest biomass, and
- Integrating the above four components to estimate the forest carbon and change

For estimation and stratification of 'Activity data'

For developing 'Emission factors'



FOREST COVER ASSESSMENT OF THE COUNTRY



Forest Cover and change Assessment

INPUTS

- Satellite data of the entire country from National Remote Sensing Centre (NRSC) IRS-P6 LISS III (23.5m spatial resolution)
- SOI Topographic sheets - 1: 50,000

METHODOLOGY

- Digital / visual Interpretation
- Ground Verification
- Minimum mappable area is 1.0 ha

OUTPUTS

Forest cover maps on 1:50,000 scale in digital or hard copy form showing following forest cover classes:

CATEGORY

Very Dense Forest

Moderately Dense Forest

Open Forest

Scrub

CANOPY DENSITY

More than 70% canopy

40-70%

10-40%

Less than 10% in forest lands

It takes almost two years to complete the assessment process

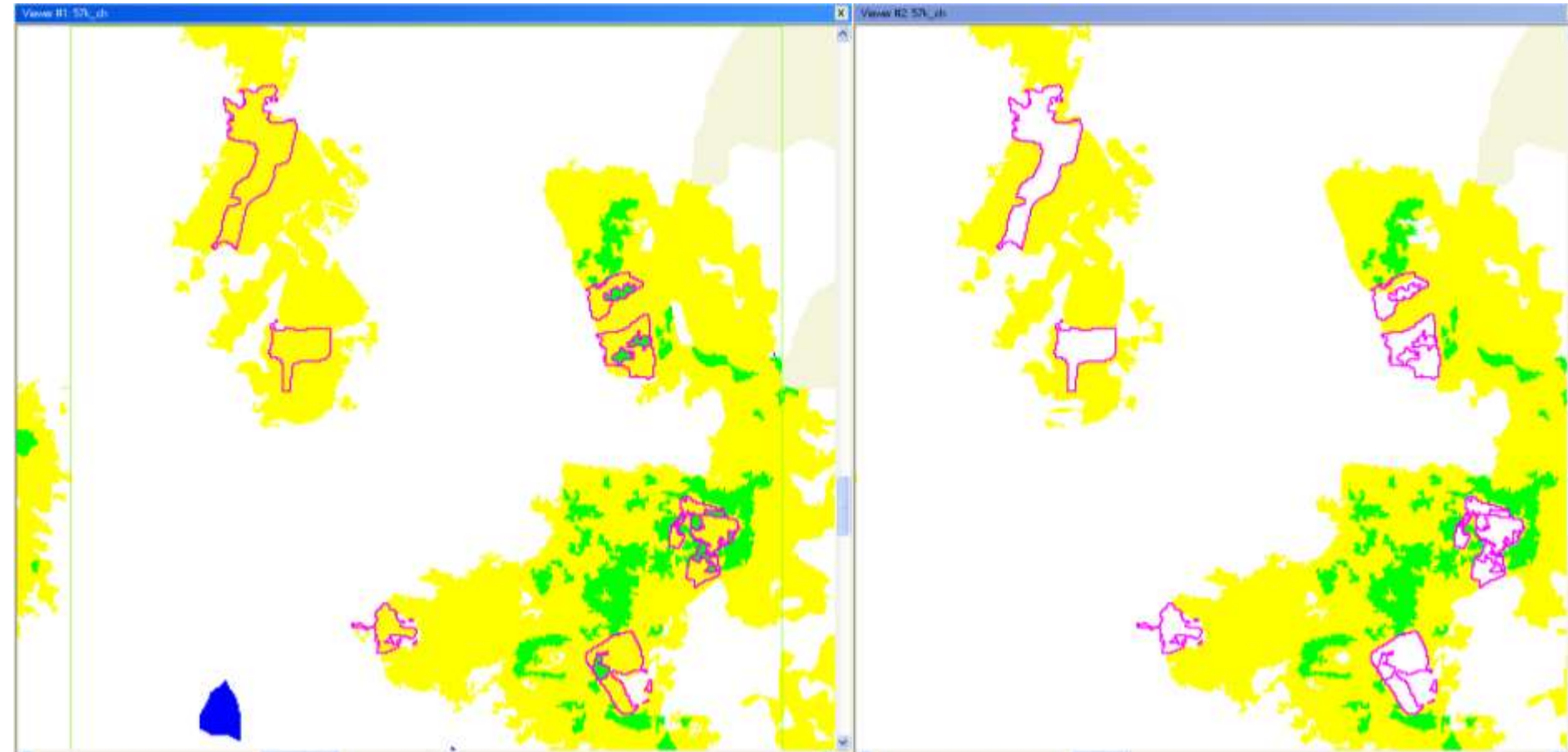


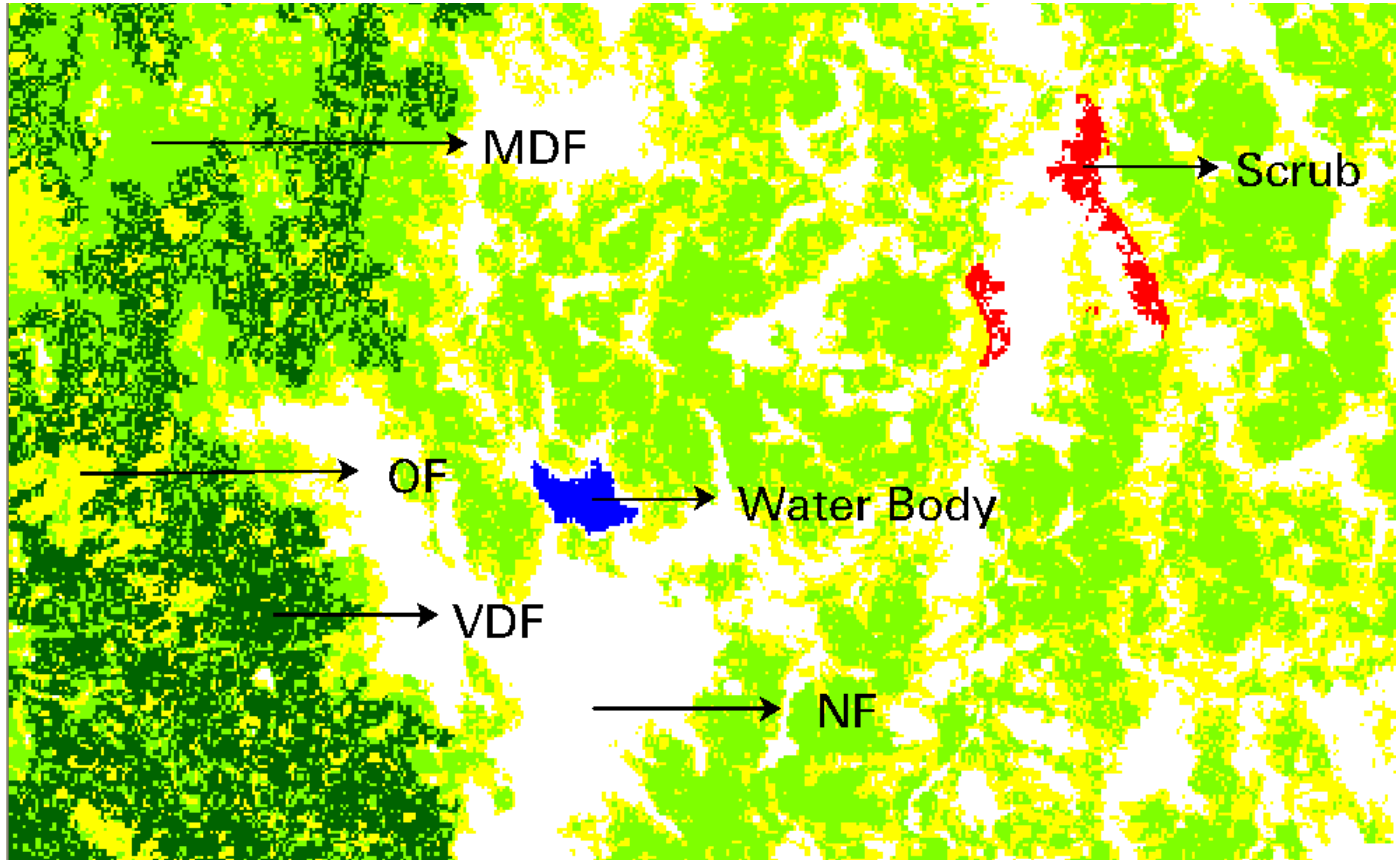
Details of Different Forest Cover Asses

| | | | | |
|------------|------|---------|----------|-------|
| First | 1987 | 1981-83 | 640,819 | 19.49 |
| Second | 1989 | 1985-87 | 638,804 | 19.43 |
| Third | 1991 | 1987-89 | 639,364 | 19.45 |
| Fourth | 1993 | 1989-91 | 639,386 | 19.45 |
| Fifth | 1995 | 1991-93 | 638,879 | 19.43 |
| Sixth | 1997 | 1993-95 | 633,397 | 19.27 |
| Seventh | 1999 | 1996-98 | 637,293 | 19.39 |
| Eighth | 2001 | 2000-01 | 6,53,898 | 19.89 |
| Ninth | 2003 | 2002-03 | 6,77,816 | 20.62 |
| Tenth | 2005 | 2004-05 | 6,77,088 | 20.60 |
| Eleventh | 2009 | 2006-07 | 6,92,394 | 21.06 |
| Twelfth | 2011 | 2008-09 | 6,92,027 | 21.05 |
| Thirteenth | 2013 | 2010-12 | 697,898 | 21.23 |



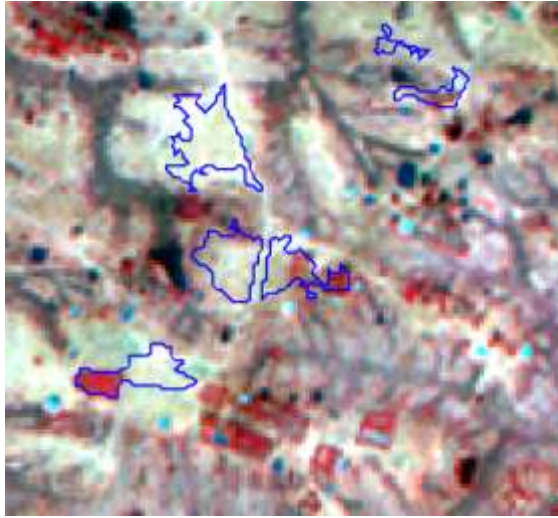
Change Detection (Classified)



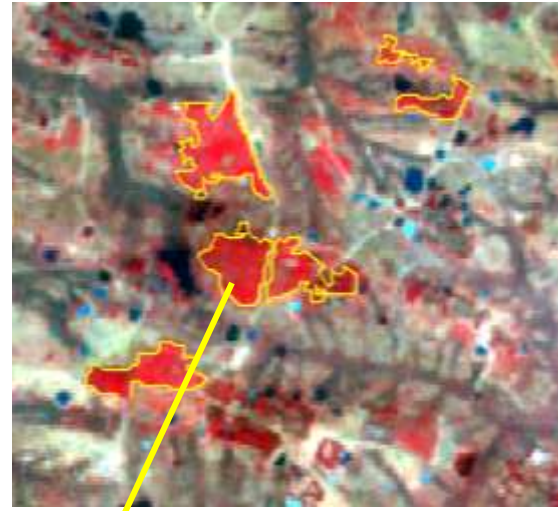


Classified Forest Cover Map

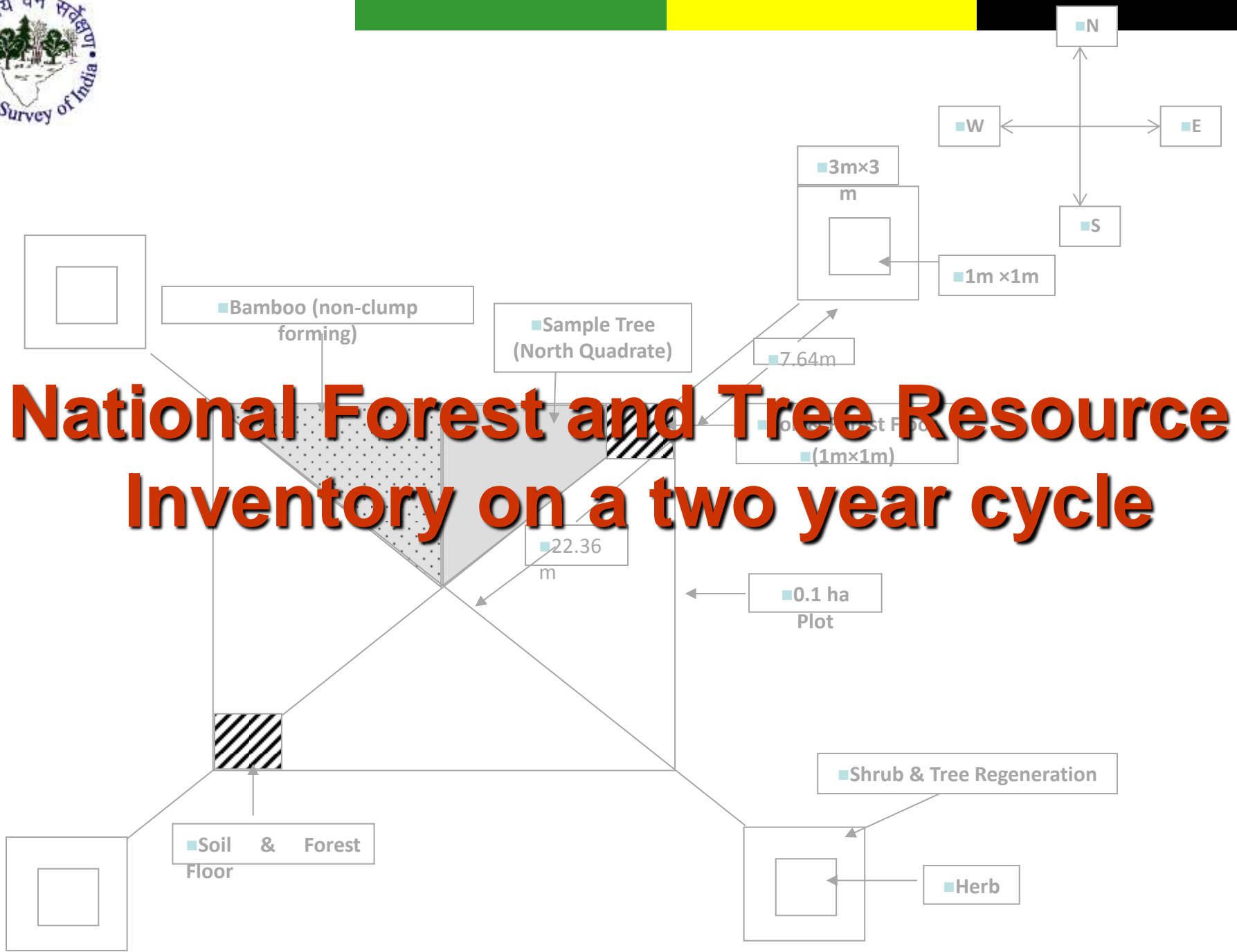
ISFR 2011



ISFR 2013



November 2012, Plantation, Purulia, West Bengal



National Forest and Tree Resource Inventory on a two year cycle



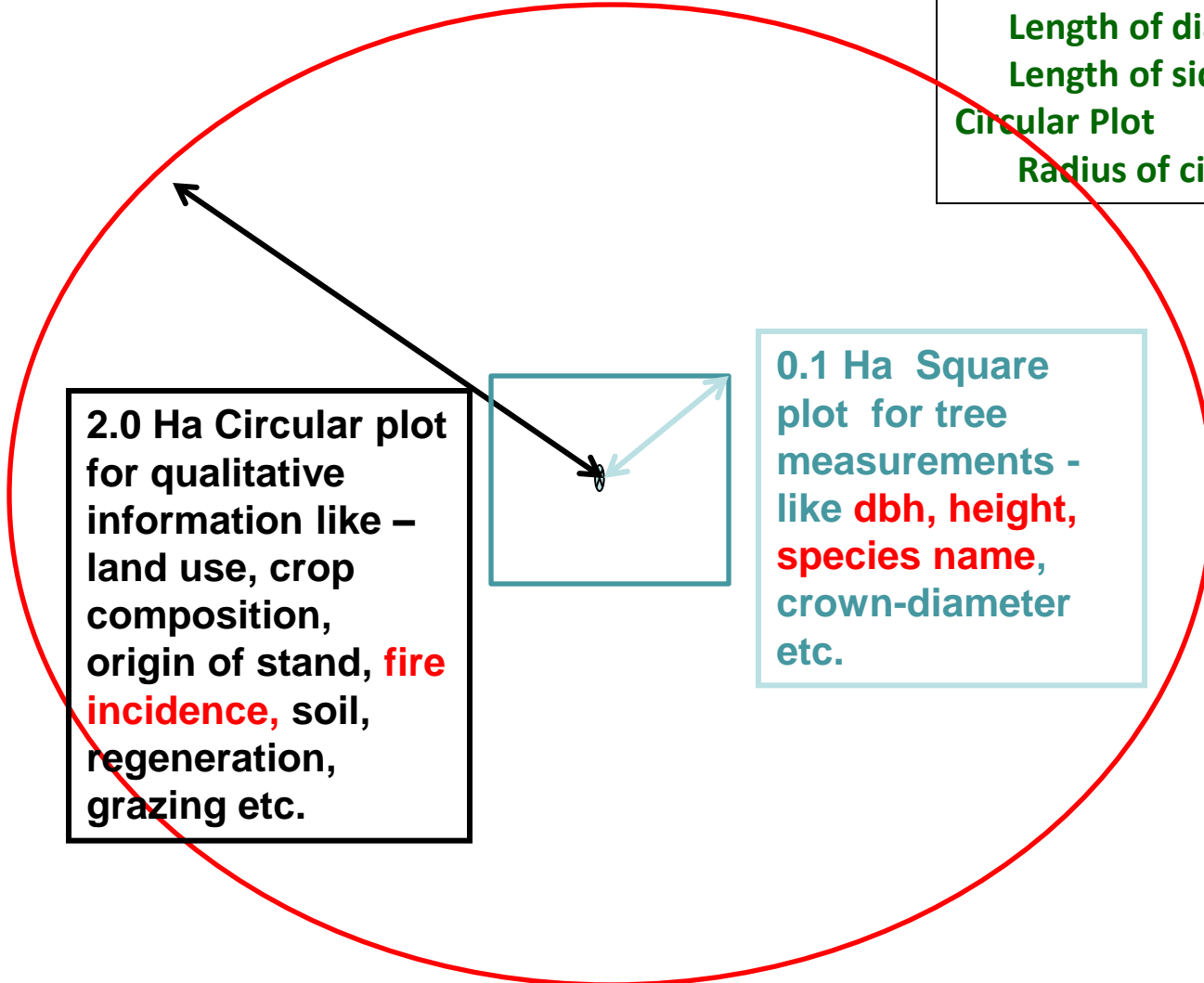
Data Collection

Square Plot

Length of diagonal = 44.8 M
Length of side = 31.6 M

Circular Plot

Radius of circle = 80 M



2.0 Ha Circular plot for qualitative information like – land use, crop composition, origin of stand, fire incidence, soil, regeneration, grazing etc.

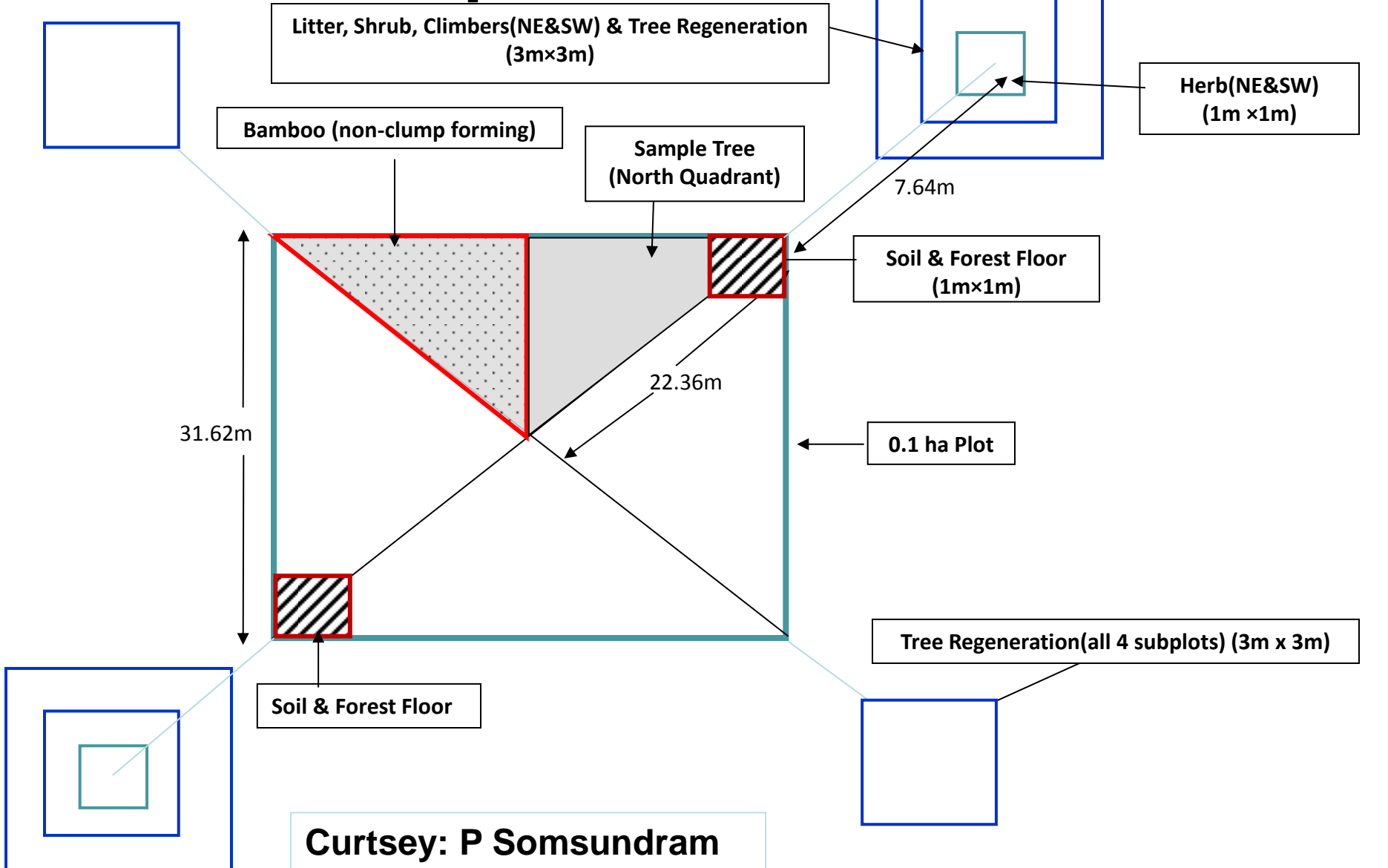
0.1 Ha Square plot for tree measurements - like dbh, height, species name, crown-diameter etc.

- Soil depth
- Rockiness
- Humus
- Origin of stand
- Crop Composition
- Bamboo density
- Bamboo quality
- Plantation potential
- Size class
- Biotic influence

- Area under different **land use** classes
- Intensity of **regeneration**
- Incidence of fire
- Injuries to crop
- Grazing
- Presence of weeds
- Presence of grass
- Soil erosion

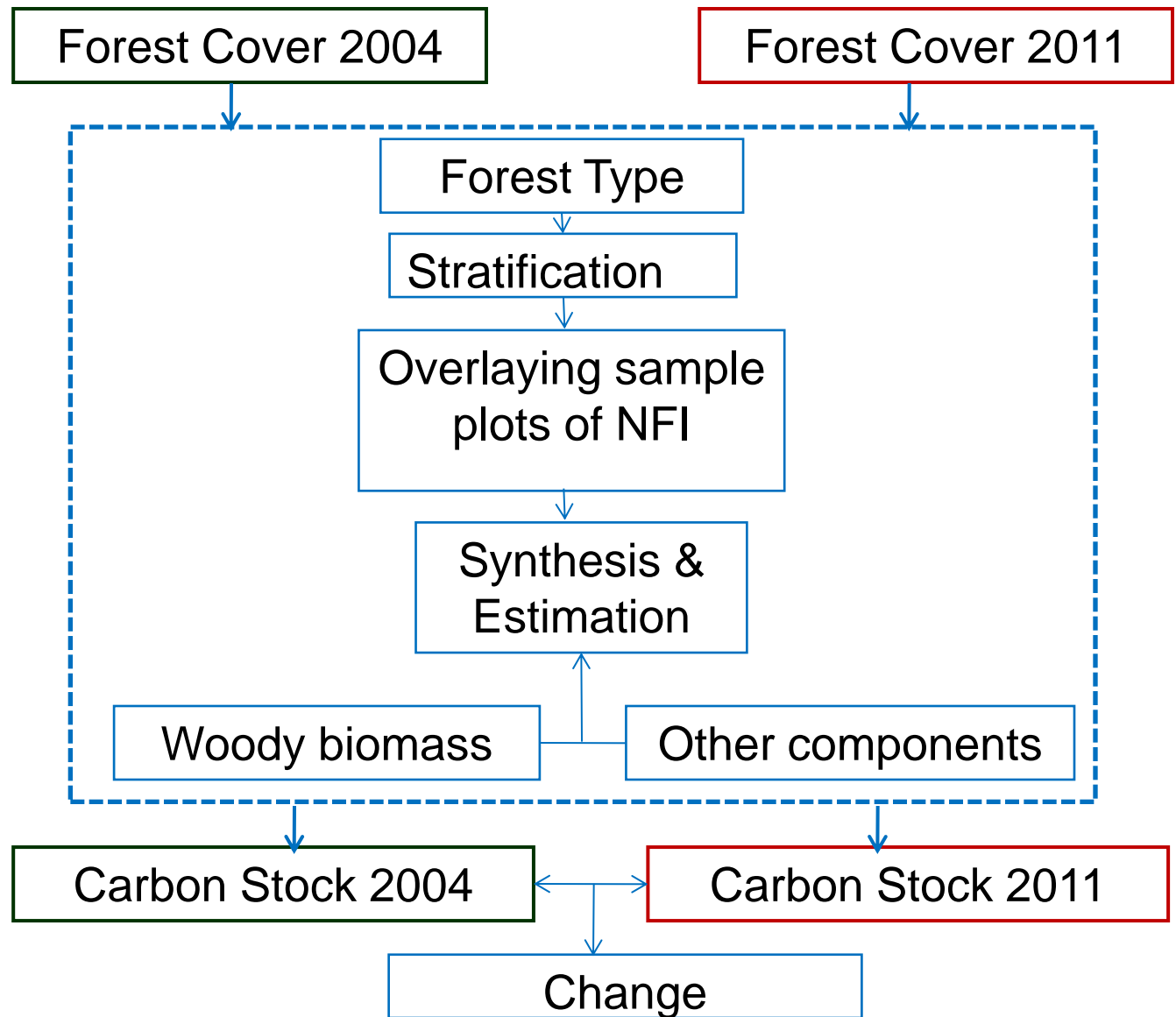


Sample Point and Attached plots





Approach for change





Change in forest carbon stock During 2004 - 2011

| Carbon Pools | C Stock in 2004 (million tons) | C Stock in 2011 (million tons) | Percent carbon in pool | Net Change in C Stock (million tons) |
|----------------------|--------------------------------|--------------------------------|------------------------|--------------------------------------|
| Above Ground biomass | 2101 | 2,192 | 31.6 | 91 |
| Below ground biomass | 663 | 694 | 10 | 31 |
| Dead wood | 25 | 27 | 0.4 | 2 |
| Litter | 121 | 130 | 1.9 | 9 |
| Soil | 3753 | 3,898 | 56.1 | 145 |
| Total | 6,663 | 6,941 | 100.0 | 278 |



Thanks

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