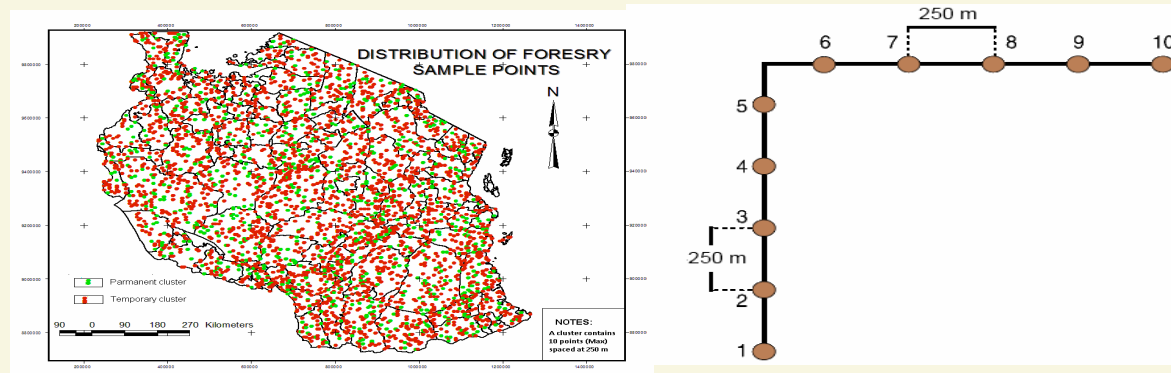


National Forestry Resources Monitoring and Assessment of Tanzania (NAFORMA)

SAMPLING DESIGN

MRV COORDINATION MEETING 3rd-5th Feb 2010
Peacock Hotel



Rogers E. Malimbwi and Soren Dalsgaard

NAFORMA Background

3 parties involved in compiling the NAFORMA Project Document:

- Government of Finland, Donor (US\$ 3 mill. over 3-year period).
 - Government Tanzania (US\$ 0.8 mill. (WB loan) for the same 3-year period + staff and office facilities)
 - FAO logistical framework and technical support
- + additional technical assistance and methodological support through *FAO-Finland SFM in a Changing Climate Program*.

- NAFORMA OBJECTIVES

- **Develop a broad consensus to NAFORMA process and approach incl. methodology**
- **Strengthen capacity of FBD in inventory and monitoring of forests and TOF**
- **Develop a national database on Forests and TOF**
- **Prepare national maps of forests and other land uses**
- **Define long term monitoring program – design and formulate specific management oriented inventories**

Stakeholders' Needs Assmt

Since compiling Project Document many changes have taken place in policy and operational environment

- New information needs for REDD & GHG reporting.
- Sub-national information needs of Tanzania

Initial effort done to define data needs and efficient sampling design for NAFORMA

Results from Stakeholders' Needs Assmt

- Extent of forest resources in Tanzania by categories of:
- vegetation type (species in plantations & natural forests)
- ownership (e.g size of reserved forests and forests in general land)
- stocking levels including carbon estimates
- ecological status
- use status (productive/protective e.g catchment & wetlands areas)
- Biodiversity status
- Tree outside the Forest area (TOF)
- NTFP

NAFORMA SAMPLING DESIGN

- The framework of the sampling design is Double sampling for stratification
- The first phase - dense grid of clusters over Tanzania, 5 km x 5 km
- The second phase is a subsample of phase 1 measured during the actual inventory
-

SAMPLING DESIGN CONT

From the dense grid of clusters, the optimal sampling ratio was calculated for each stratum considering the following variables:

- wood volume estimates based on satellite images calibrated with field data from past inventories
- measurement time;
- slope

SAMPLING DESIGN CONT

- It takes less time to measure trees in an agricultural land with a flat terrain than in forested land with prohibitive slope.

Different combinations of wood volume, measurement time and slope resulted into 18 strata

Description of the 18 NAFORMA strata

Strata No.	Time (minutes)	Mean volume on land (m ³ /ha)	Slope (%)	Sampling ratio
1.	0-480	0-27	0<=10	12
2.	0-480	27<=61	0<=10	10
3.	0-480	61<=118	0<=10	8
4.	0-480	118<-	0<=10	2
5.	480-960	0-27	0<=10	13
6.	480-960	27<=61	0<=10	12
7.	480-960	61<118	0<=10	9
8.	480-960	118<-	0<=10	4
9.	>960	0-27	0<=10	20
10.	>960	27<-61	0<=10	17
11.	>960	61<-118	0<=10	13
12.	>960	118<-	0<=10	5
13.	0-960	0-61	10<=20	7
14.	0-960	61<-	10<=20	4
15.	>960	0-61	10<=20	3
16.	>960	61<-	10<=20	5
17.	0-	0-118	20<=slope	6
18.	0-	118<-	20<=slope	4

The cluster sizes and the rough land estimates

Strata	Plots per cluster	Land area estimates (mill. ha)
1-12	10	83
13-16	8	4.6
17-18	6	0.5
Total		88.1

The cluster

- An L shaped arrangement of plots
- The distance between clusters and number of plots in cluster vary according to the strata
- The distance between plots in a strata is 250 m except for clusters 17-18 where the distance will be 200 m
- Total number of clusters = 3419
- Total number of plots = 32 660

Alternative SD based on cost

Three levels of cost of field work were considered

- 1 mill USD
- 2.5 mill USD
- 4 mill USD

Variation of number of plots, crew days, and CVs of area and volume at different costs for Tanzania

	1 mill USD	2.5 mill USD	4 mill USD
Plots on land	13011	32551	52536
Plots on 1-6	11635	29086	47133
Plots on 1-3	7806	19472	31704
Crew days	2517	6259	10189
Costs (USD)	1006648	2503600	4075421
CV			
Area 1-6	0.77	0.44	0.33
Area 1-3	1.88	1.16	0.81
Mean vol 1-6	0.99	0.60	0.48
Mean vol 1-3	1.54	0.85	0.69
Total vol 1-6	0.81	0.53	0.42
Total vol 1-3	1.81	1.12	0.86

Variation of number of plots, crew days, and CVs of area and volume at different costs for Singida District

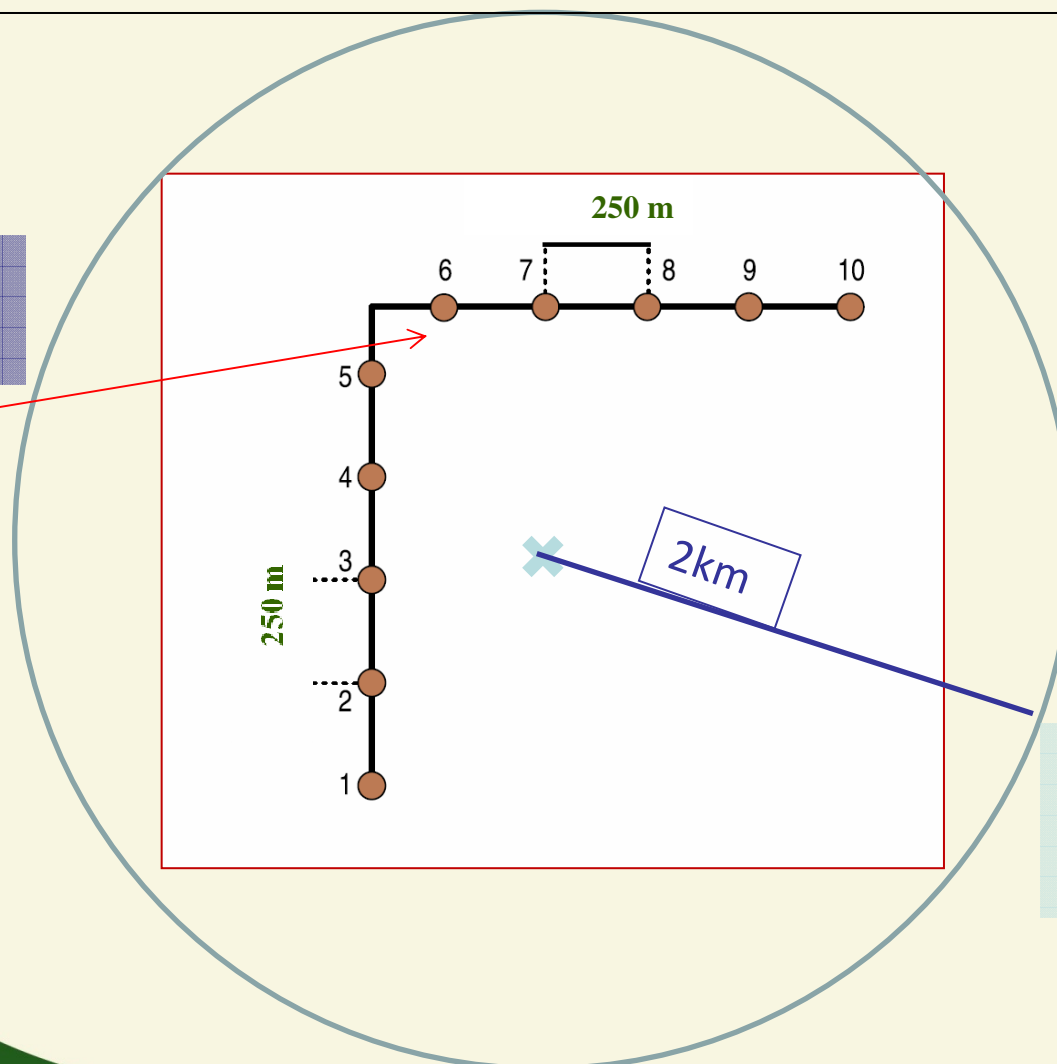
	1 mill USD	2.5 mill USD	4 mill USD
Plots on land	228	544	887
Plots on Land 1-6	204	484	795
Plots on 1-3	139	334	561
Crew days	50	107	169
Costs (USD)	19,928	42,677	67,630
CV			
Area 1-6	8.61	4.33	3.29
Area 1-3	17.86	9.78	7.80
Mean vol1-6	7.88	4.75	3.86
Mean vol 1-3	13.65	6.94	5.47
Total vol 1-6	8.32	4.33	3.87
Total vol1-3	15.08	9.78	5.92

The cluster cont

- Every 4th cluster will be **permanent**
- There are 856 permanent sample clusters
- Soil samples for soil carbon measurement taken in PCs

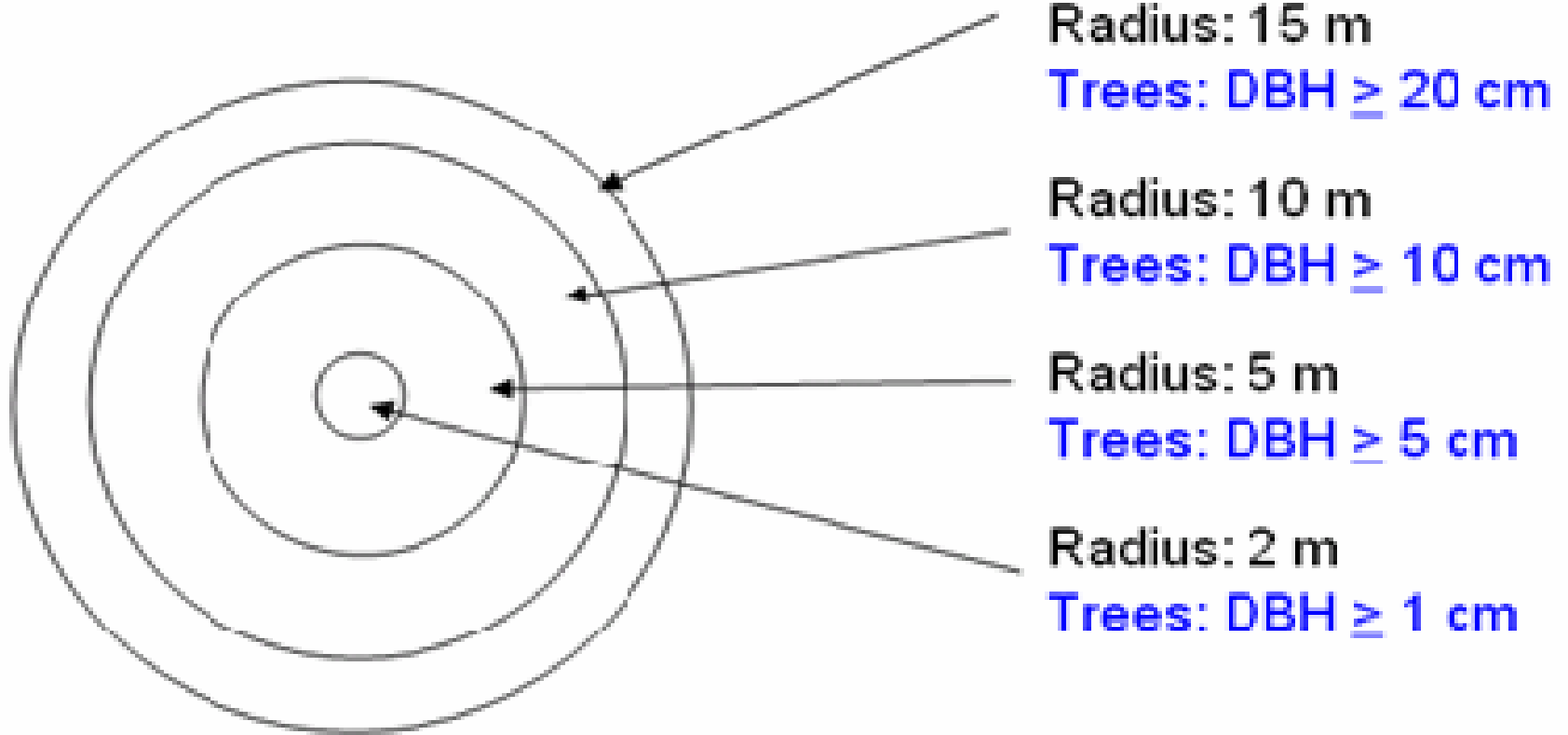
The NAFORMA cluster

Biophysical sample plot

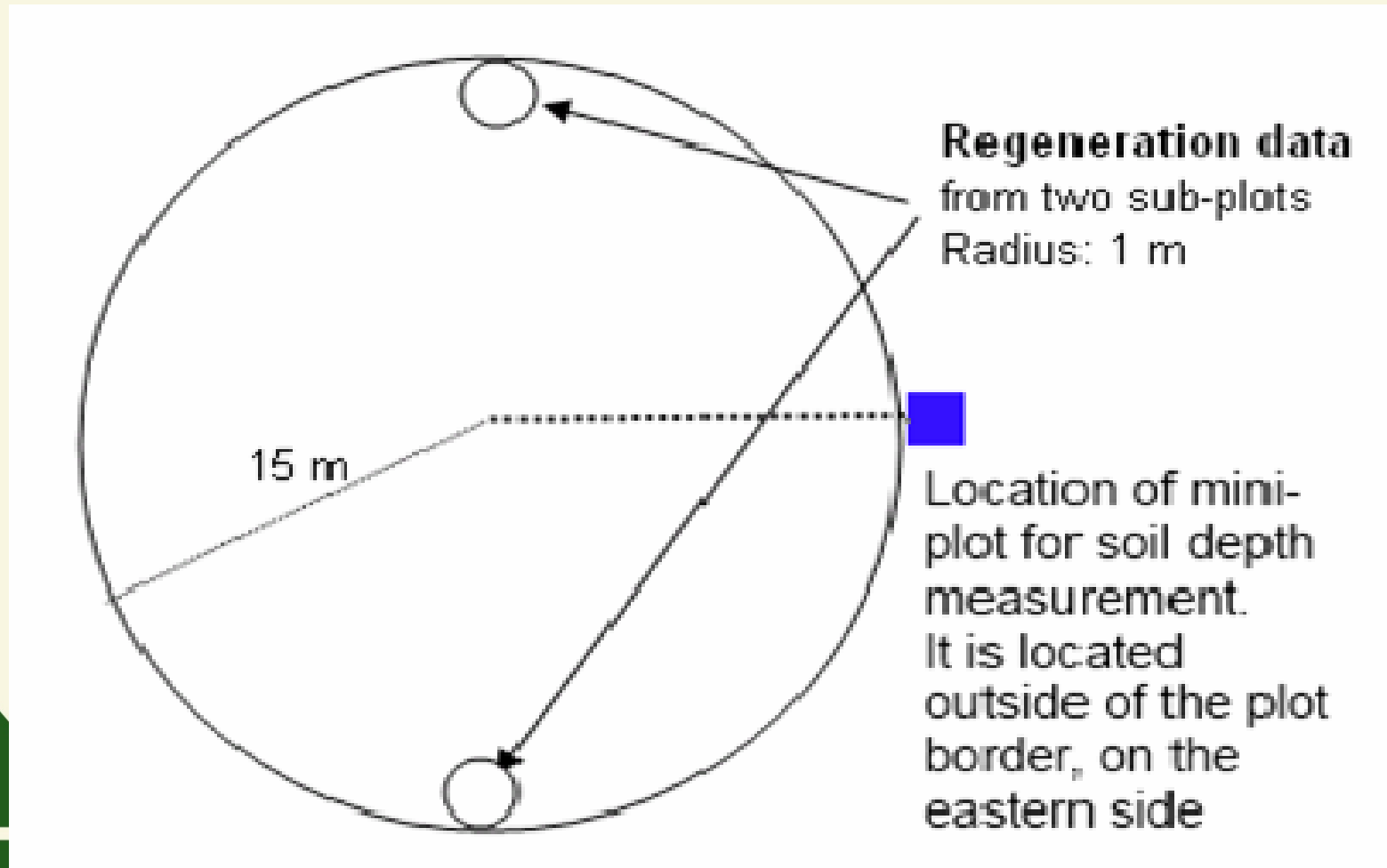


Center of sampling unit for interviews

The plot



Location of regeneration sub-plots and soil sampling in the plot



NAFORMA BIO-PHYSICAL VARIABLES (FORMS)

1. Cluster

- Number
- Position

2. Plot

- Position
- Photo
- Land use
- Vegetation
- Ownership
- Human impact

3. Tree variables

- Species code, Dbh, ht (sample),form etc

Land uses

- Production forest
- Protection forest
- Wildlife reserve
- Shifting cultivation
- Agriculture
- Grazing land
- Built-up areas)
- Water body or swamp
- Other land

The vegetation types

Hunting Technical Services Map (1995)

- Forest
- Woodland
- Bushland
- Grassland land
- Cultivated
- Open
- Water
- Other

N

F

M

A

OWNERSHIP CATEGORIES

- Central government
- Local government
- Community owned
- Private: companies
- Private: individuals and families
- Private: others
- General land
- Not known

N

F

M

A


Socio-economic data

- Collected in 5 house holds within a radius of 2 km from the cluster center
- The area must be in inhabited
- Concentration of bio-physical clusters is in forests => **less populated**
- Need high resolution imagery to identify clusters with dwellings **or**
- **Search for dwellings while in the cluster**

DISTRIBUTION OF FORESTRY SAMPLE POINTS


N



 Permanent cluster

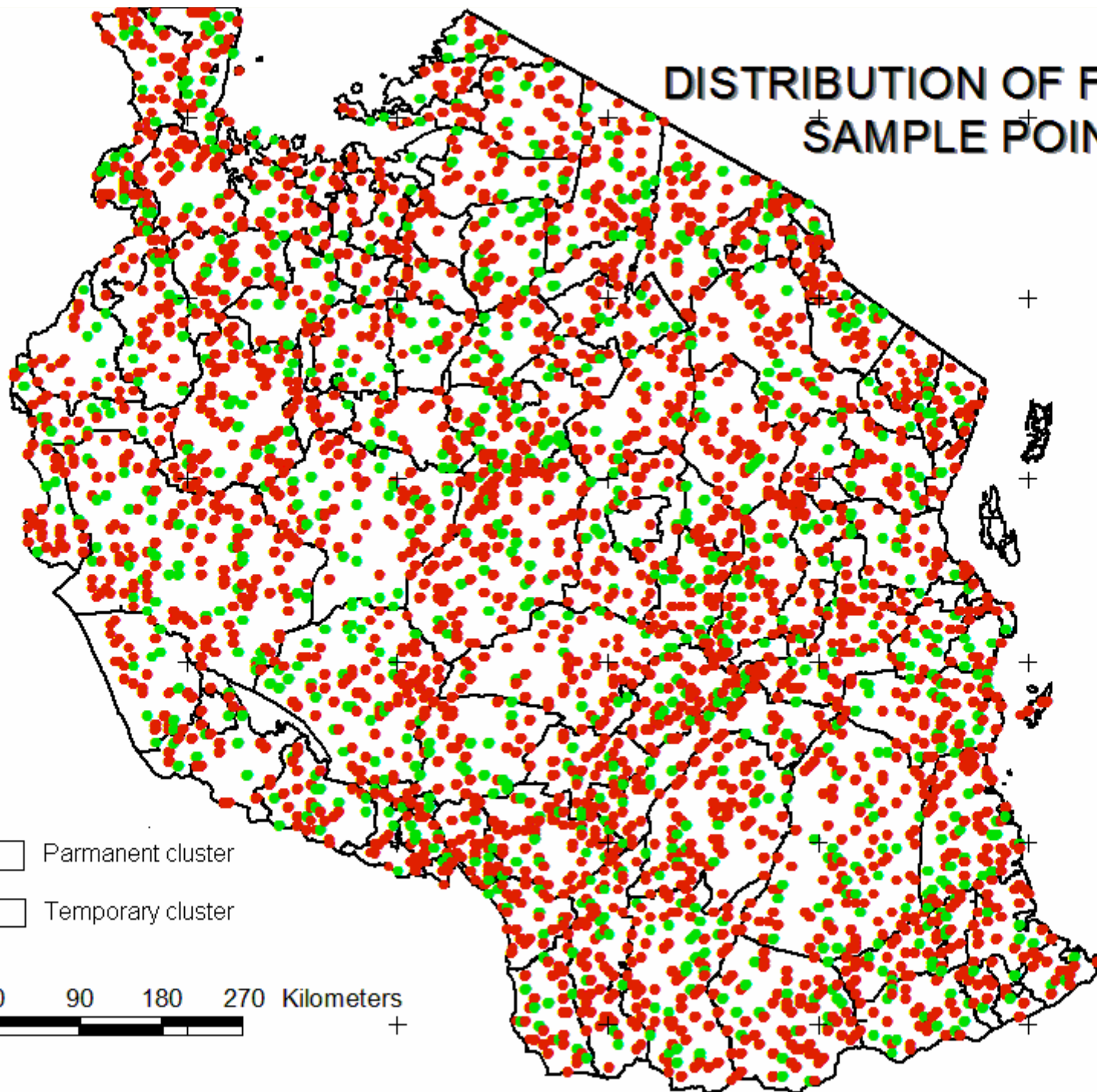
 Temporary cluster

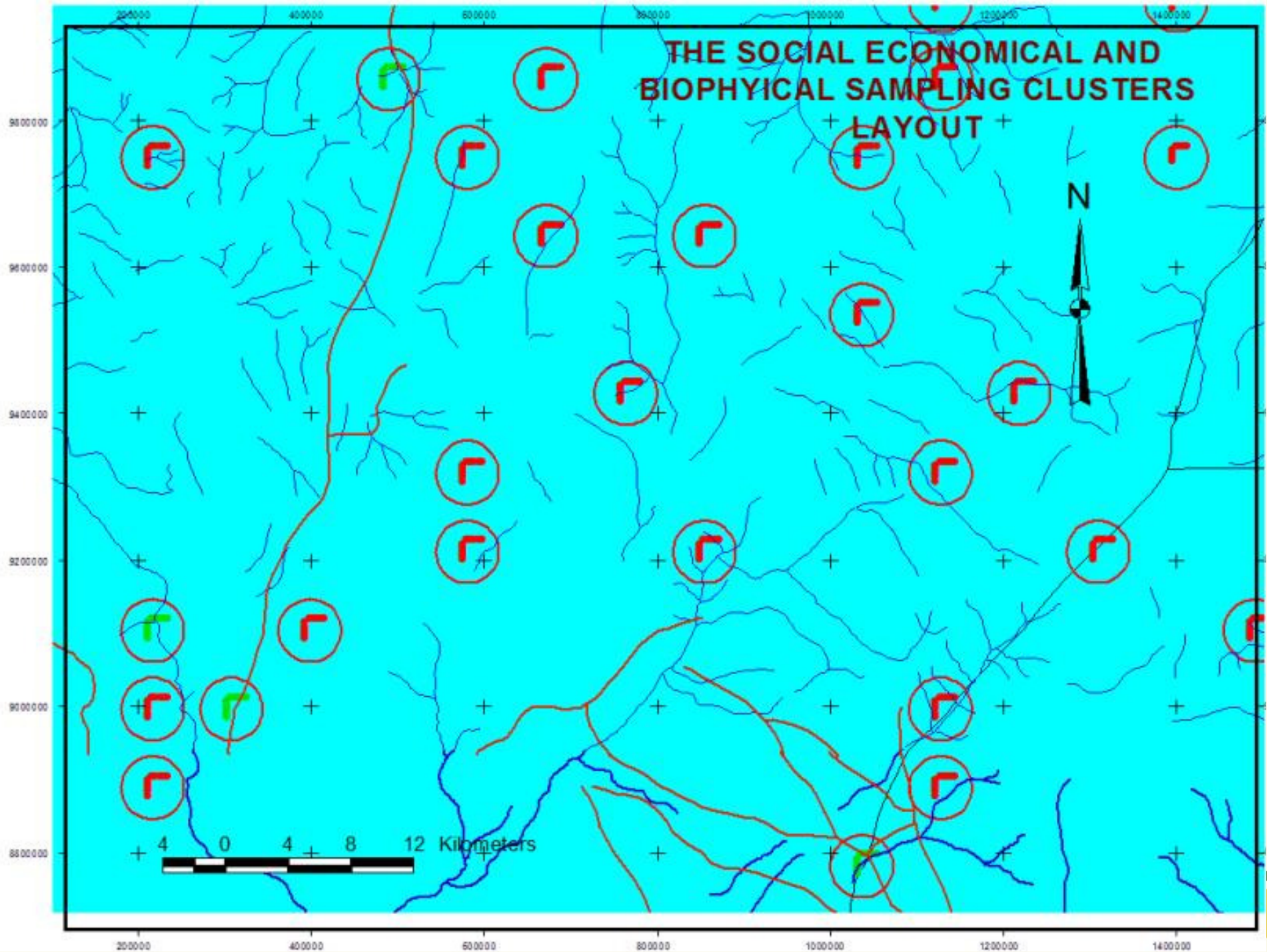
90 0 90 180 270 Kilometers

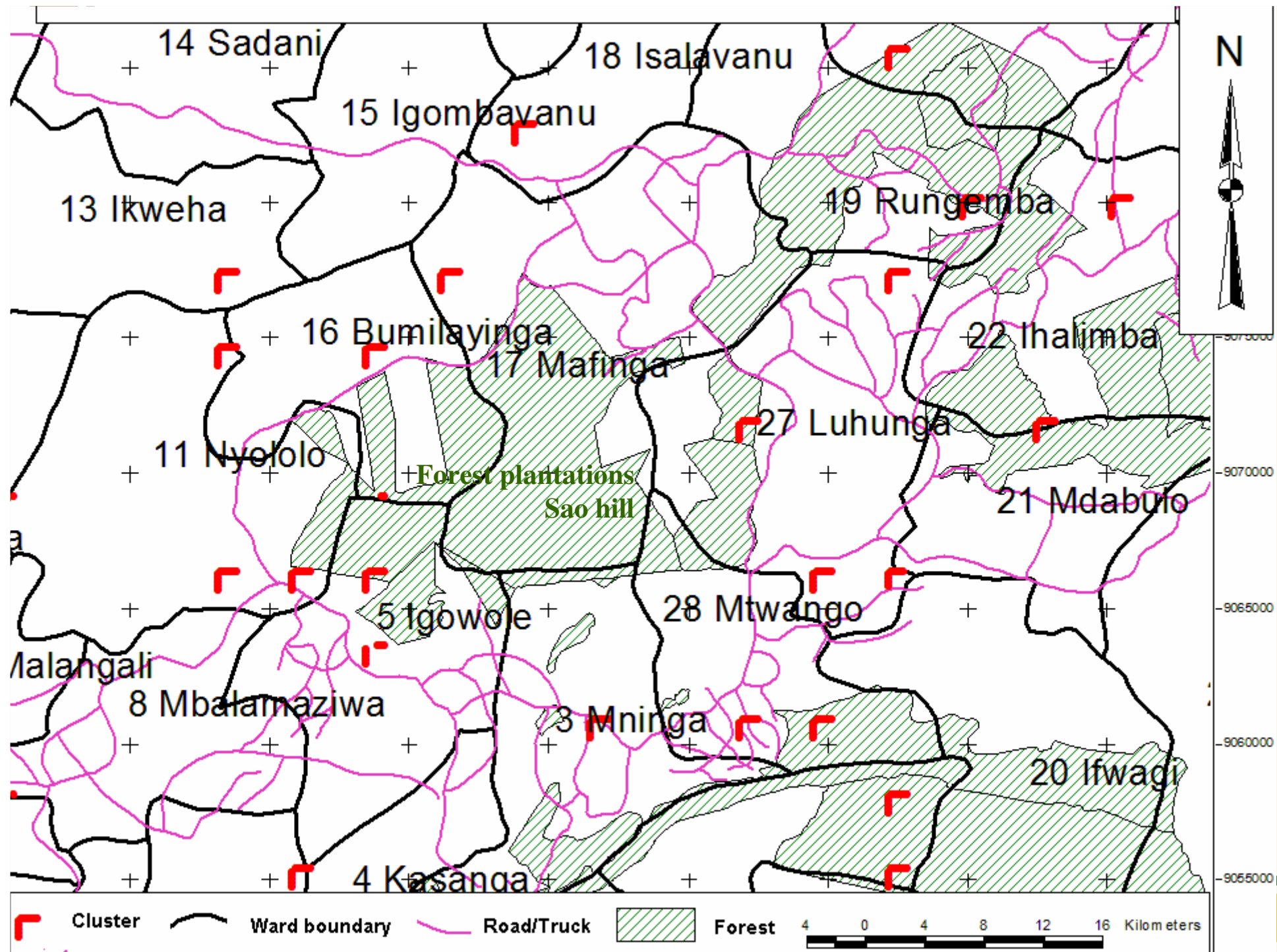


NOTES:

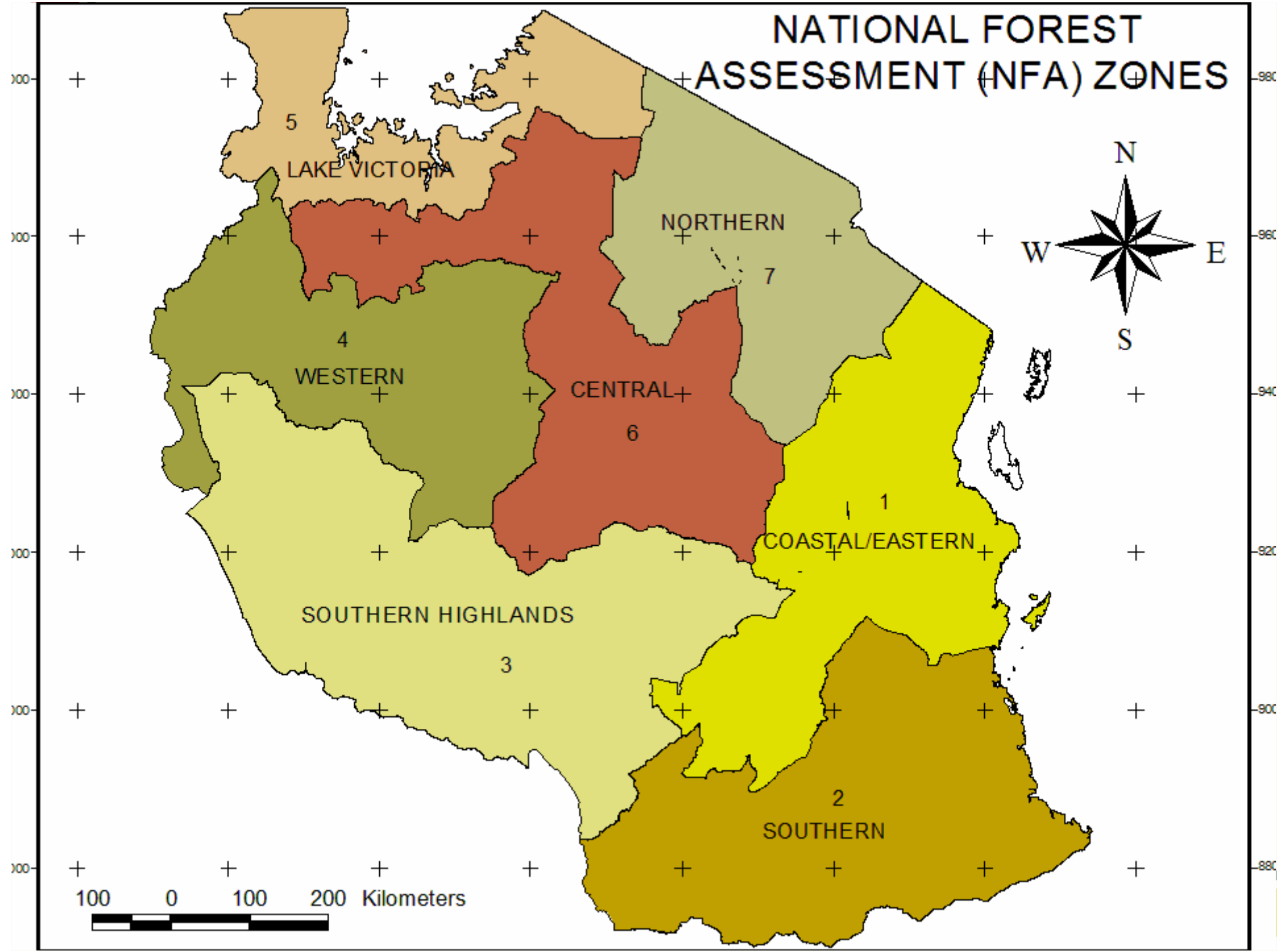
A cluster contains
10 points (Max)
spaced at 250 m







NATIONAL FOREST ASSESSMENT (NFA) ZONES



Mobilization of field teams

- 8 persons pr. team
 - 2 socioec., 4 biophys (TL), ranger, driver
- 14 – 20 Teams (incl quality control teams)
- 7 zones – most forested zones done first
- App. 3419 Clusters – length of fieldwork depends on performance.
- Breaks between work in zones

TRAINING OF FIELD CREWS

- BIOPHYSICAL VARIABLES Dec 2009
- SOCIO-ECONOMIC VARIABLES JAN 2010
- COMBINED
+
• Start of Fieldwork March 2010

End,

Ahsanteni

