FOREST INVENTORY & PLANNING INSTITUTE

Designing NFMS for REDD+ in Vietnam

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Contents

1. Overview of existing forest monitoring programmes in Vietnam
2. Process of designing a NFMS for REDD+ in Vietnam
3. Conclusions and future works

Existing forest monitoring programmes in Vietnam

- General Forest Inventory & Statistics Programme (GFI&S)
- Annual Forest & Forestry Land Changes Monitoring Programme
- National Forest Inventory, Monitoring & Assessment Programme (NFIMAP)

General Forest Inventory & Statistics Programme (GFI&S)

- Conducted periodically (1989–1992; 1997–1999; 2011–2016)
- Generates forest cover maps for forest owners (previous cycles: for state forest owners only; current cycle: for all forest owners)
- The current cycle has two main steps
  - Forest inventory step: forest cover maps are generated at the commune level based on SPOT-5 or equivalent imagery
  - Forest statistics step: forest cover maps are overlaid with forest owner maps and printed out, sent to each owner for checking and updating
- Uses a random sampling system for estimating mean volume
- Accurate but very expensive

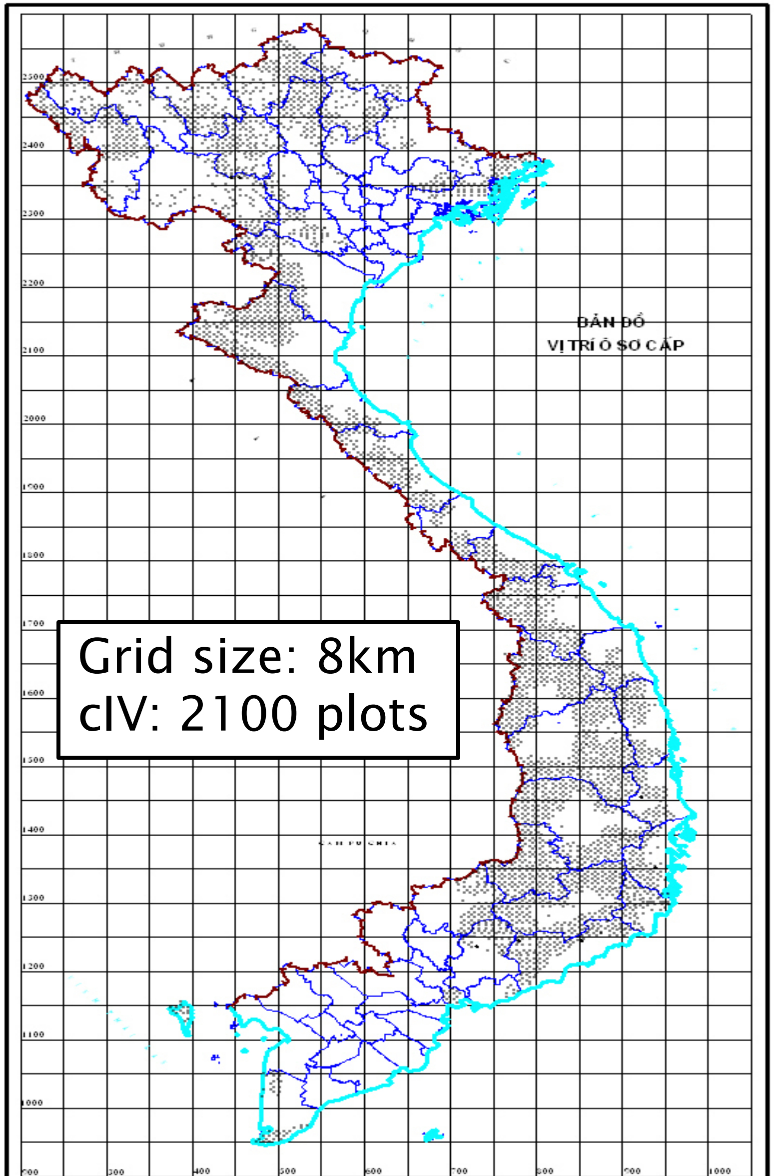
Annual Forest & Forestry Land Changes Monitoring Programme

- Implemented annually since 2002 by FPD
- Collects and updates forest & forestry land areas based on results of latest GFI&S
- The changes in area are divided by causes: logging, forest fires, pest, land use change, afforestation etc.
- The area data are (mostly) not map-based
- Data on forest structure, quality, health are not collected in this programme

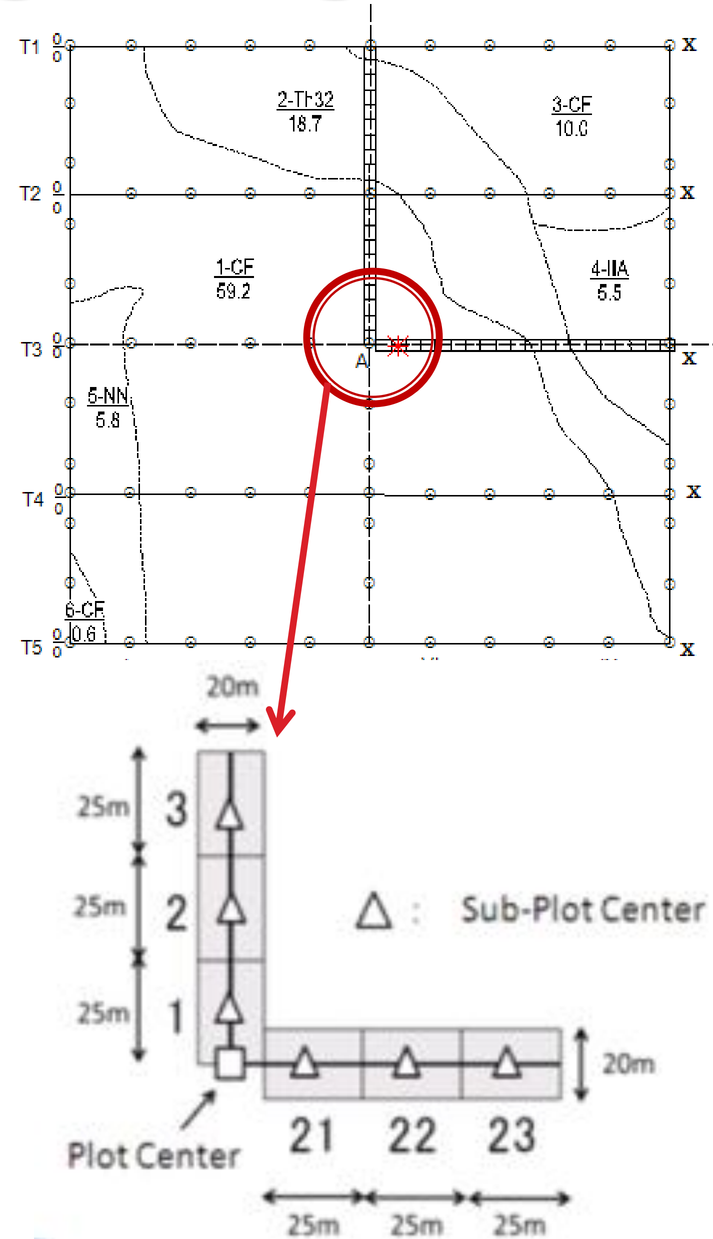
NFIMAP

- Implemented since 1990 in 5-year cycles by FIPI
- So far, 4 cycles have been completed (I: 1991-1995; II: 1996-2000; III: 2001-2005; IV: 2006-2010)
- Had two main components:
  - Forest cover maps generation (using satellite imagery)
  - Forest inventory (using sample plot system)
- Outputs:
  - Forest cover maps at national, regional, provincial levels
  - Mean volume per ha for each forest type
  - Others (forest structure, fauna, biodiversity, insect, pest, soil, socio-economy)

NFIMAP sampling design



Grid size: 8km
cIV: 2100 plots



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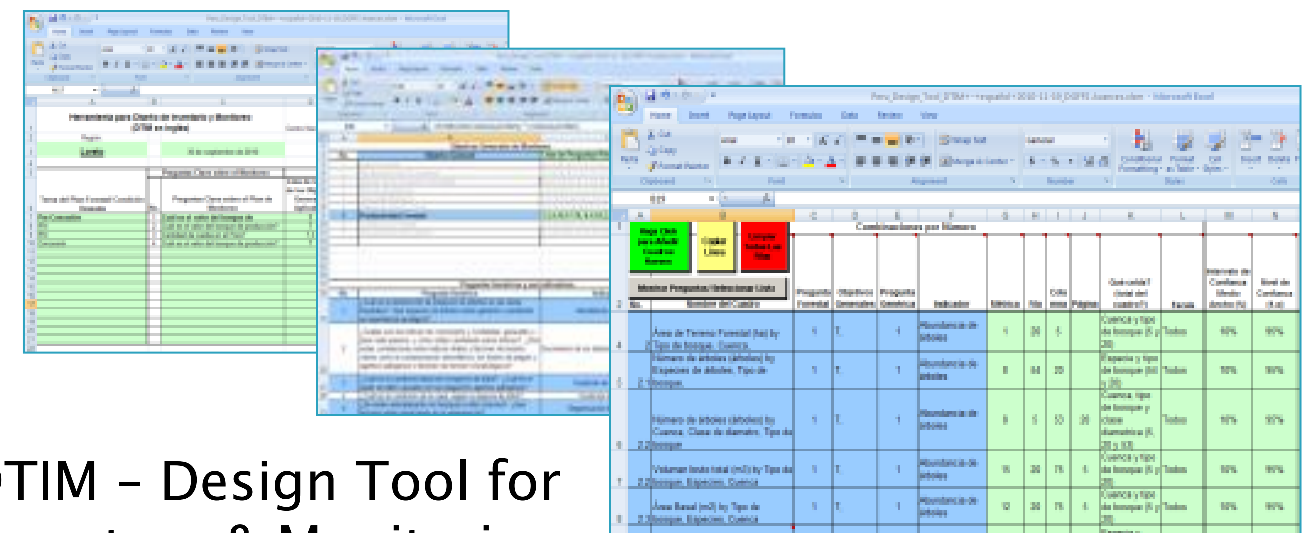
Various tasks in designing a NFMS for REDD+

- Information needs analysis
- Designing a sample plot system
- Designing a land monitoring system for REDD+
- Developing country-specific allometric equations and factors
- Developing an information system
- Developing a QA/QC and verification protocols
- …

Applying DTIM to Information needs analysis (support by SilvaCarbon)

- Identify relevant users of data
- Select main objectives
- Select relevant questions
- Select indicators



DTIM – Design Tool for Inventory & Monitoring

Result 1: Identifying relevant stakeholders & users

- Policy makers (MARD, MONRE)
- Management agencies at different levels
- Forest production organizations
- Forest owners
- Scientists
- International communities (FRA, REDD+)
- NGOs

Result 2: Selecting main objectives

- Of the 11 objectives from which to choose, 6 rose to the top:
  - Value of Forests (ecosystem services)
  - Biological Diversity
  - Carbon Sequestration
  - Forest Governance
  - Forest Productivity
  - Forest Fire Effects
- Others
  - Forest Health
  - Ecosystem Restoration
  - Wildlife Habitat
  - Food Security
  - Effects of Invasive Species

Result 3: Selecting monitoring questions and indicators

- Of the 33 monitoring questions, all but one were selected.
- Of the 64 indicators, 51 were chosen.
- Interest in understanding the forests of Vietnam is strong.
- However, <u>further prioritization will be necessary</u>.

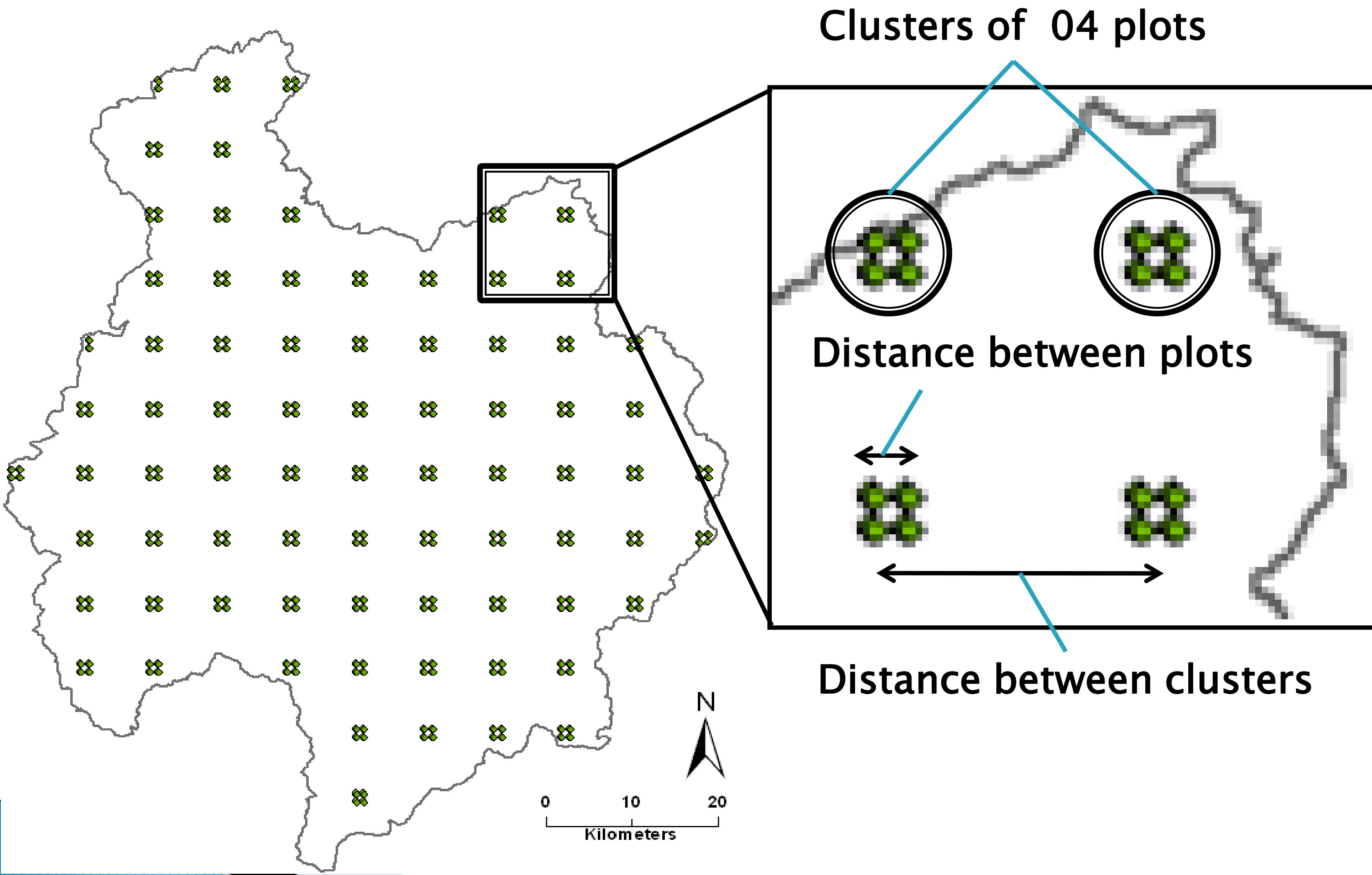
Designing new sample plot system for future NFIMAP (by FAO-Finland)

- Justification:
  - The existing system is almost 25-year old and does not take advantages of recent technologies & methodologies
  - Therefore, the system needs to be reviewed and redesigned if necessary
- Objectives:
  - To find the most suitable sampling design for future NFIMAP implementation
- Scope:
  - Use systematic cluster design (a grid of clusters, each cluster contains a certain number of plots)
- Specific contents:
  - What is the most suitable shape of clusters
  - What is the most suitable number of plots in a cluster
  - What is the best distance between plots in a clusters
  - What is the best distance between clusters

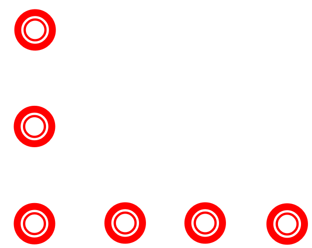
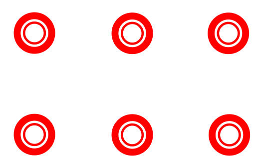
Method: using simulation

1. Create the volume map & land cover map
2. Choose a sampling design
3. Generate the location of the systematic grid of sample plots randomly, calculate the forest coverage, forest area, mean volume and total volume
4. Repeat the above step 1.000 times, estimate the empirical and theoretical errors of total volume
5. Repeat from Step 2 for other sampling designs
6. Analyze the results to select the best one

Sampling design example

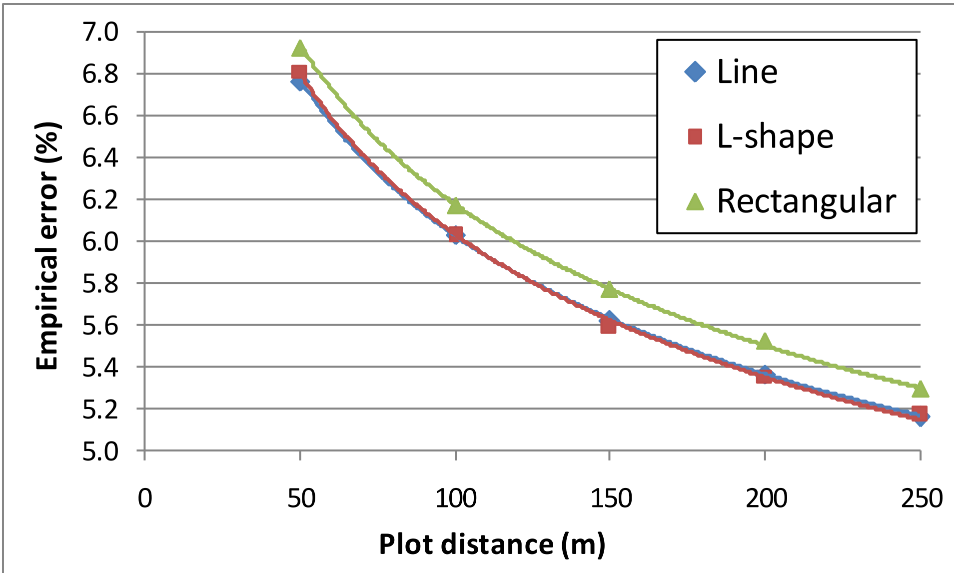


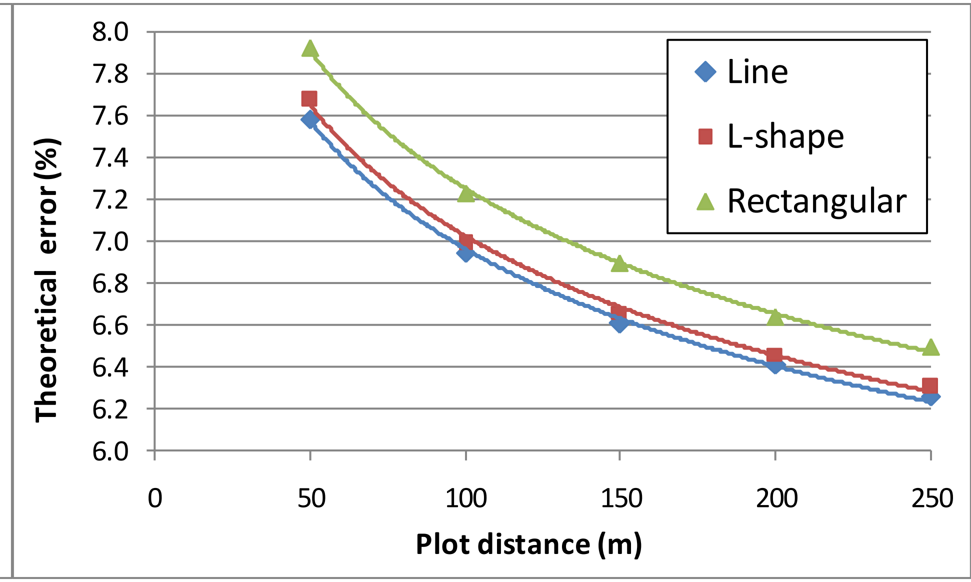
Cluster forms to be compared

Line	
L-shape	
Rectangular	

- Line form has the least auto-correlation between plots but is the most difficult to implement
- Rectangular form is easiest to implement, but has the most auto-correlation between plots.
- The L-shape form lies between these two forms.

Comparing cluster forms





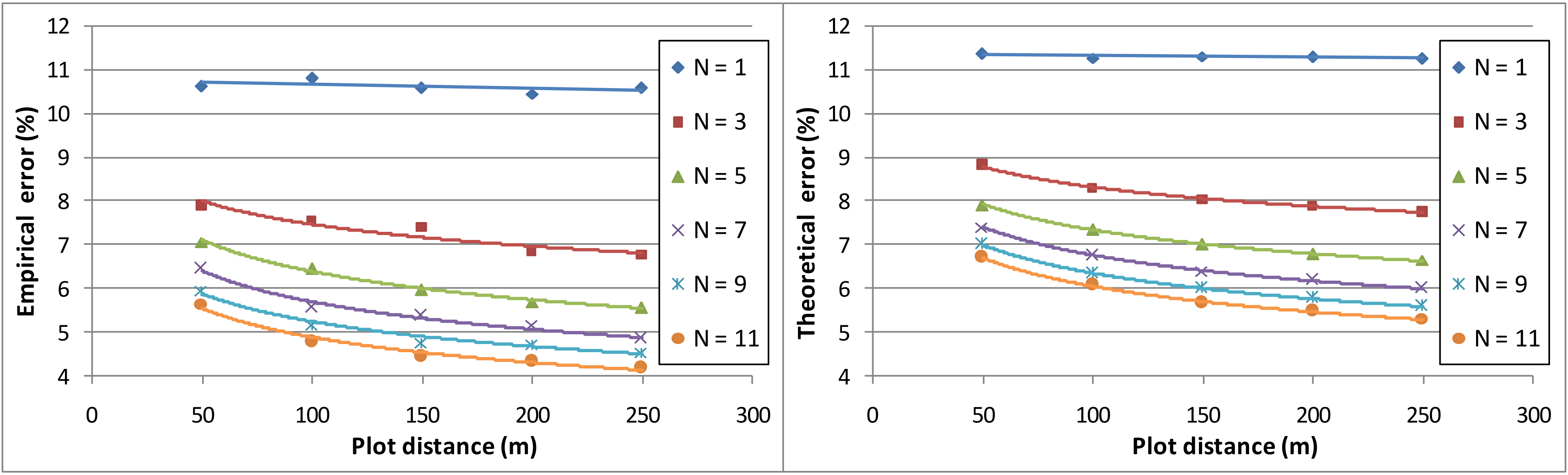
- The distance between clusters is fixed to 8 km
- Errors (both empirical and theoretical) are for total volume
- Rectangular has the worst empirical and theoretical errors
- L-shape ranks second but the differences with Line are very small and are not statistically significant with 1.000 simulations
- The results suggest to use L-shape (more easier to implement than Line but with almost the same level of accuracy)

L-shape sampling designs simulated

- Number of plots per cluster: 1, 3, 5, 7, 9, 11
- Distance between plots: 50, 100, 150, 200, 250 m
- Distance between clusters: 4, 8, 12, 16, 20, 24 km
- Totally 180 (= 6x5x6) designs

Note: The area of a plot is fixed to 1.000 m^2 (equal to the area of sample plots using to generate the volume map)

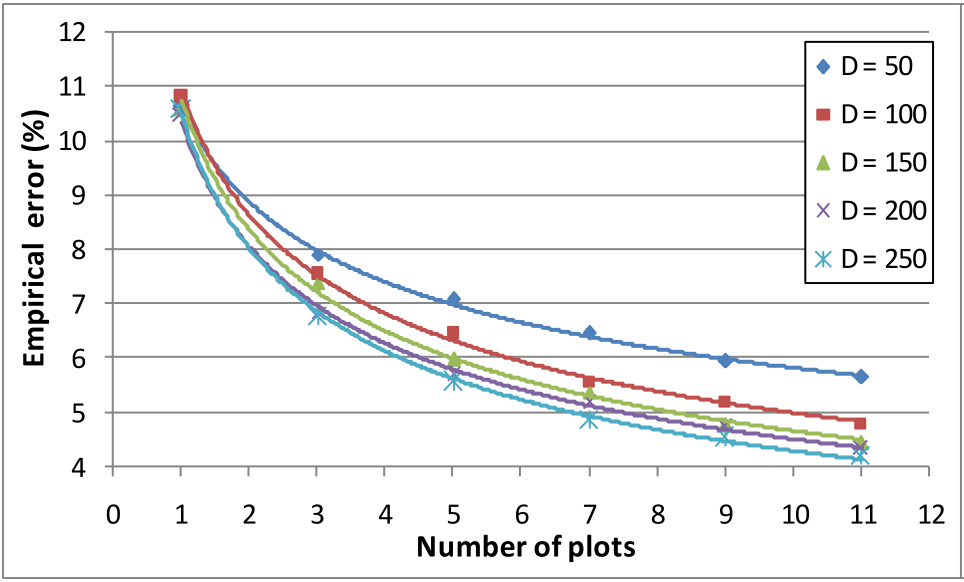
Choosing the best number of plots

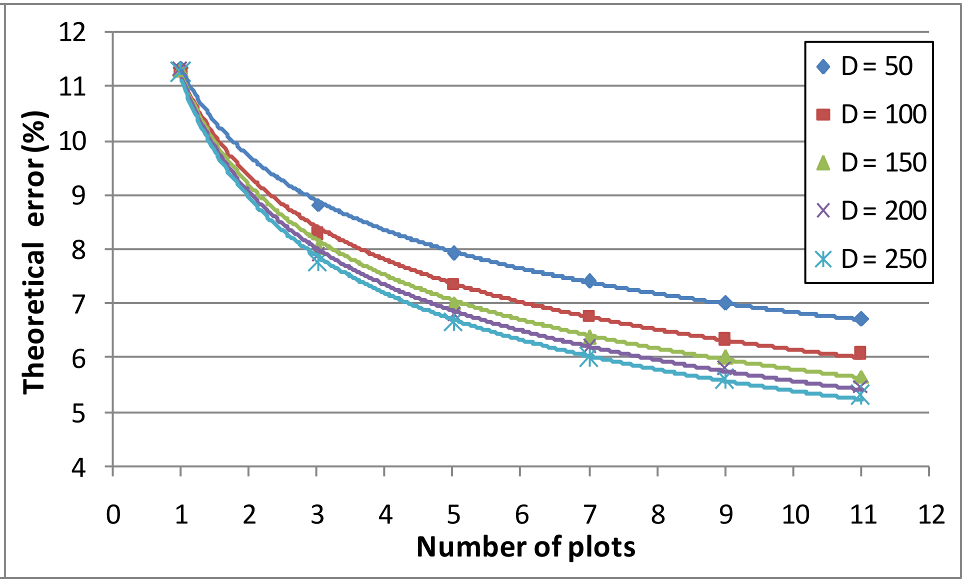


Comments:

- For each design, the empirical errors are slightly smaller than the theoretical errors
- Increasing the number of plots will reduce the errors
- Increasing the number of plots from 7 to 9 and further only reduces the errors slightly → The best numbers of plots are 5 or 7 (depends on the desired accuracy level)

Choosing the best plot distance

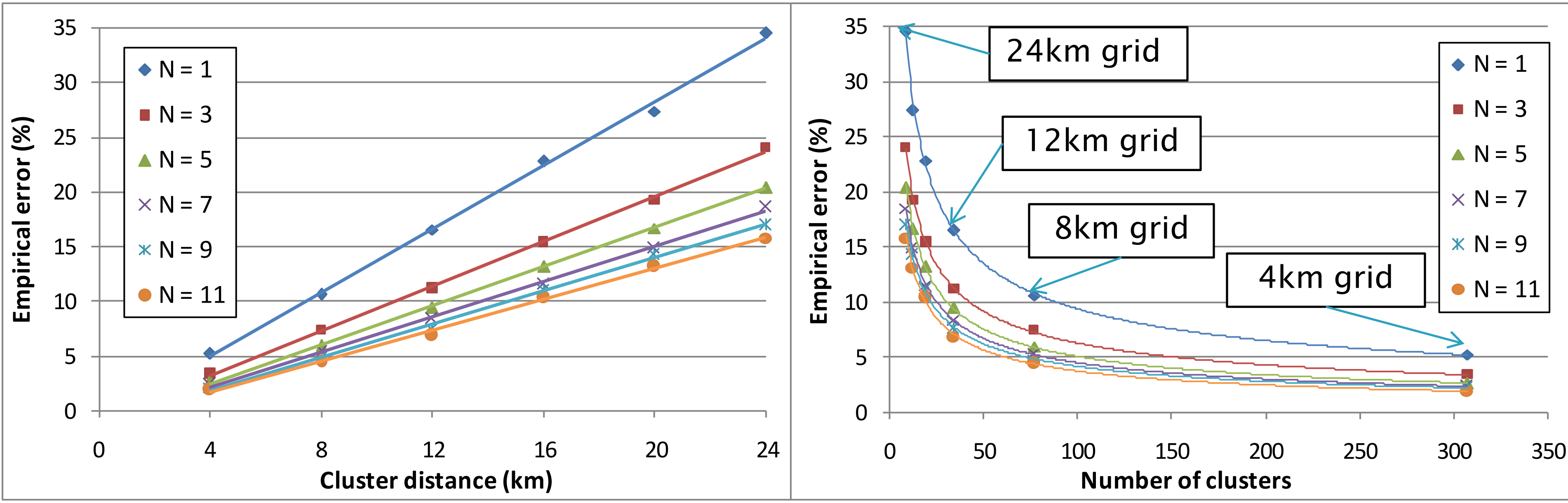




Comments:

- Increasing the distance between plots will reduce the errors
- Increasing the distance between plots from 150m to 200m and further only reduces the errors slightly → The best distance between plots is 150m

Choosing the best cluster distance



Comments: (The distance between plots is fixed to 150 m)

- The graphs for theoretical errors are similar to those for empirical errors
- Increasing the distance between clusters will increase the errors linearly
- When reducing the distance between clusters, the number of clusters increase quadratically
- When increasing number of clusters from 77 (8km grid) to 308 (4km grid) errors only reduce slightly → The best distance between clusters is 8km

Comparing to old design

No	Design type	Plots per cluster	Dist plot (m)	Dist cluster (km)	Empirical error (%)	Theoret. error (%)	Num. clusters	Num. plots	Cost 1 (team-day)	Cost 2 (team-day)	Total cost
1	NFIMAP	20	50	8	4.90	5.93	77	1540	10	1	847
2	L-shape	5	150	8	5.97	7.03	77	385	3	1	308
3	L-shape	7	150	8	5.37	6.40	77	539	4	1	385
4	L-shape	9	150	8	4.89	6.01	77	693	5	1	462

- Cost 1: doing survey in one cluster, Cost 2: moving between clusters. They are estimated based on expert judgment
- Total cost = Num. clusters $\times$ (Cost 1 + Cost 2)
- Designs no. 2 and 3 have errors only slightly larger than those of NFIMAP design, but much less costly. Their total costs are, respectively, just 35% and 45% of the total cost of NFIMAP design
- If we want to keep the error level as NFIMAP design, then design no. 4 can be chosen with about half of total cost of NFIMAP design

Contents

Conclusions

- Vietnam is designing its NFMS for REDD+ taking into account the existing system
- We receive technical assistants from various donors (SilvaCarbon, FAO-Finland, UN-REDD, etc.)
- We have almost completed the information needs analysis and the sampling design tasks
- Other taks (land monitoring system, allometric equation, information system, QA/QC etc.) are on-going or just started

Future works

- Further prioritize monitoring questions and metrics
- Validate the newly proposed sampling design using other tool (e.g. the FRIED tool developed by USFS)
- Complete other tasks (land monitoring system, allometric equation, information system, QA/QC)

Thank you for your attention!