

Landscape dynamics over time and space from ecological perspective

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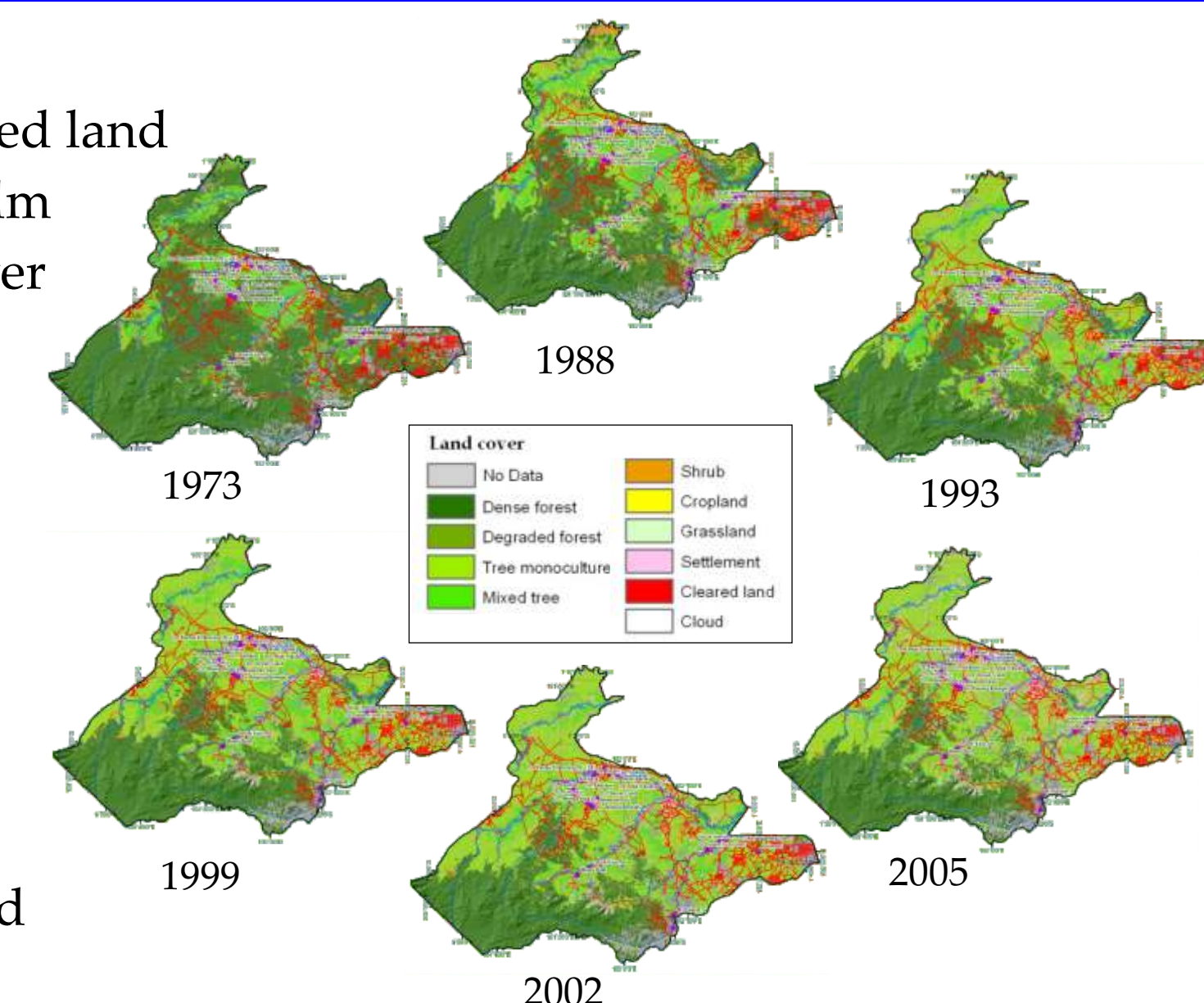
Background

Methodological approaches to biodiversity studies in a multifunctional landscape need to consider the dynamics of land cover and land uses over space in order to capture ecological process, such as habitat fragmentation and matrix effects. Remote sensing and GIS tools instrumental in capturing the complex dynamics of tropical landscapes and in communicating the results to decision-makers. Further, spatial analysis can derive indices to quantify patterns of composition and configuration of patches in a landscape. This study will address landscape dynamics over time and space with explicit links to the interface between livelihood and biodiversity in 5 study areas of the project: Indonesia (Bungo), Laos (Viengkham), Madagascar (Manompana), Cameroon (Takamanda Mone) and Tanzania (East Usambara).

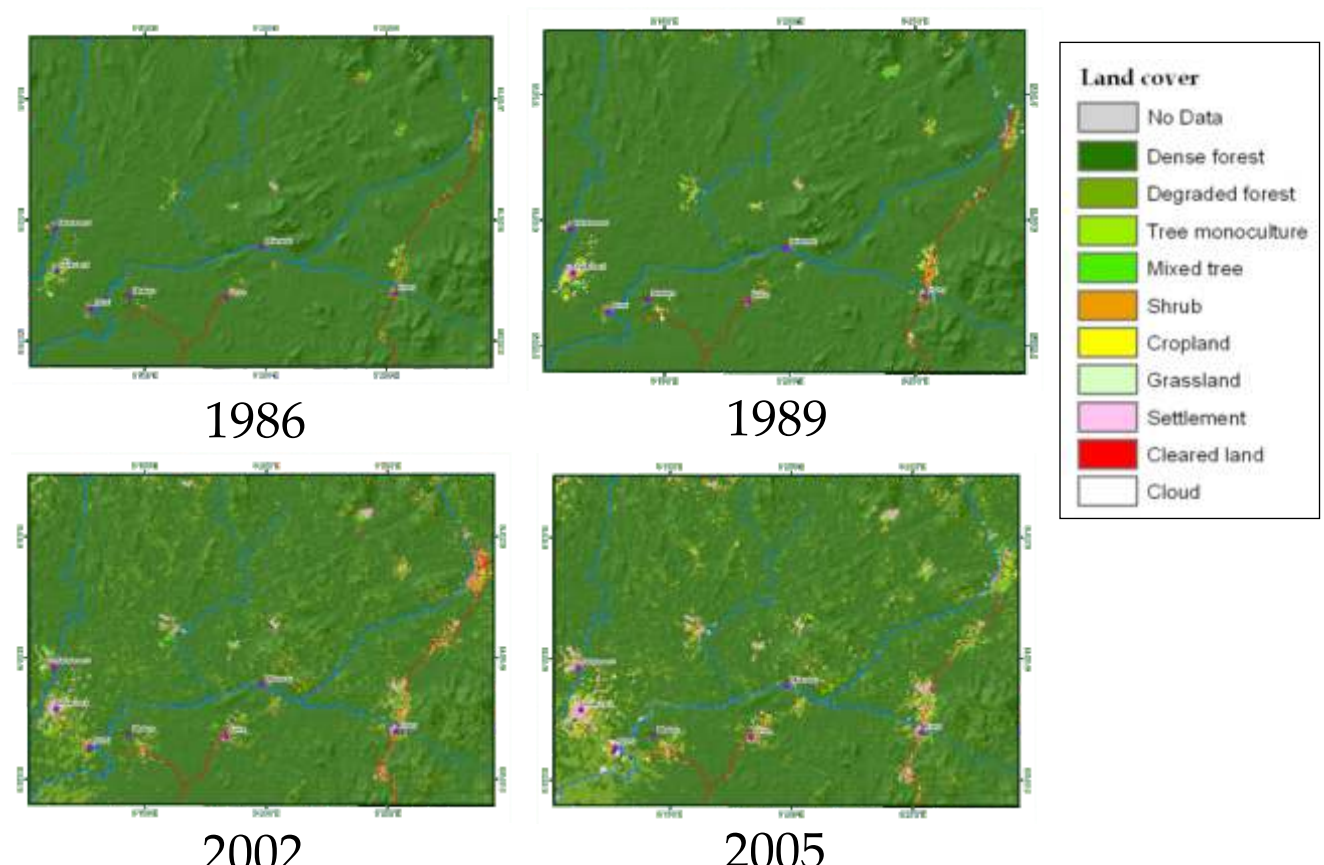
Site	Landscape
Bungo, Indonesia	National Park in the upper watershed, toward intensified management in the lower part: tree crops, forest plantation, cropland
East Usambara, Tanzania	Protected areas surrounded by smallholder farming and plantation
Viengkham, Laos	Fallow systems and monoculture forest plantation surrounding the national park
Manompana, Madagascar	Fallow systems surrounding protected areas and within the protected region
Takamanda, Cameroon	Fallow system and tree crop plantation in highly forested area; road infrastructure is poor

Bungo, Indonesia

In Bungo, natural forest cover sharply declined during 1973 to 1988, tree-based land cover such as rubber agroforest, oil palm and recently acacia mangium took over and became the dominant land cover since then. The pattern of changes in Bungo follows closely the forest transition theory. The earlier stage was dominated by loss of forest and biomass, in which most forests were converted to tree-based systems. The third period was when there was conversion from established tree-based systems to non-tree based systems.



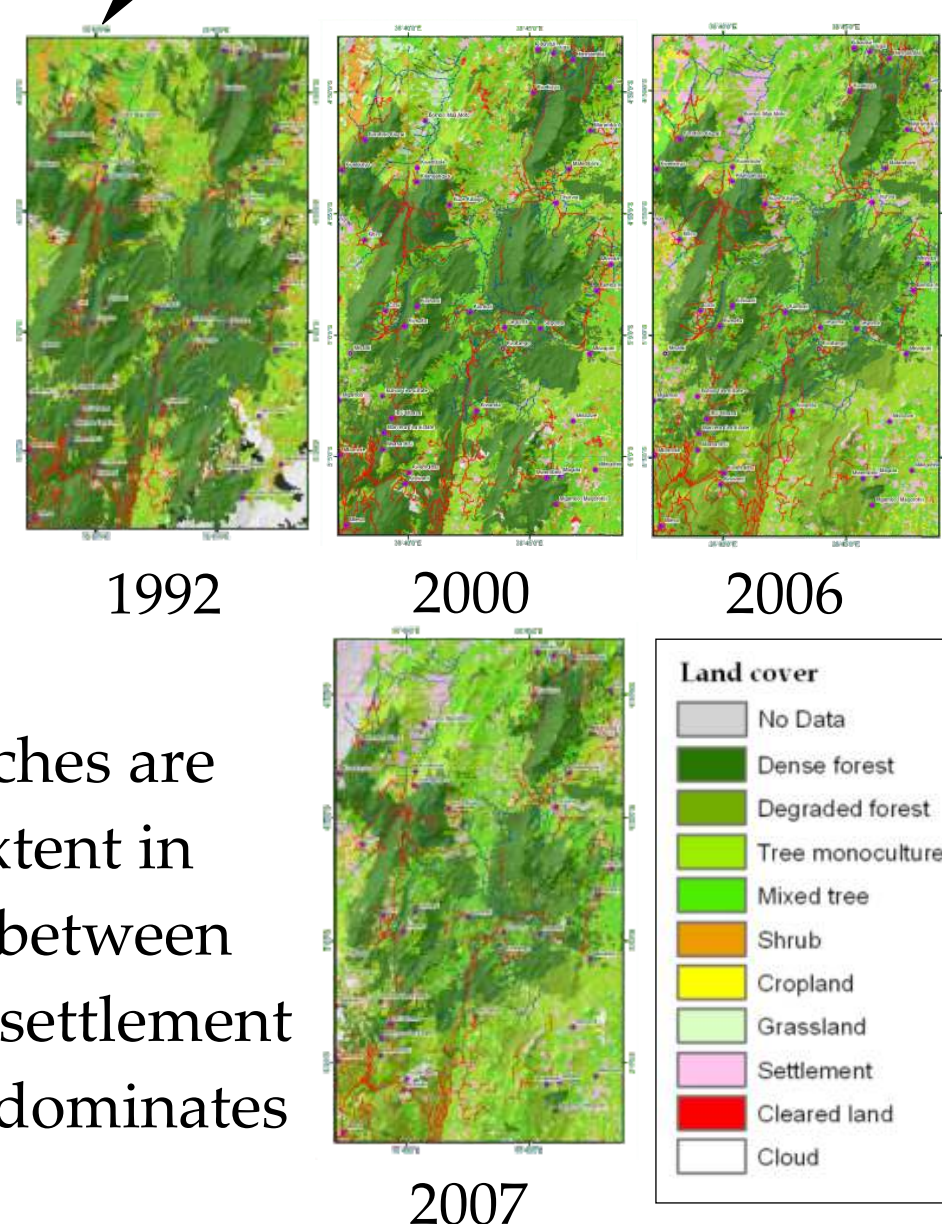
Takamanda Mone, Cameroon



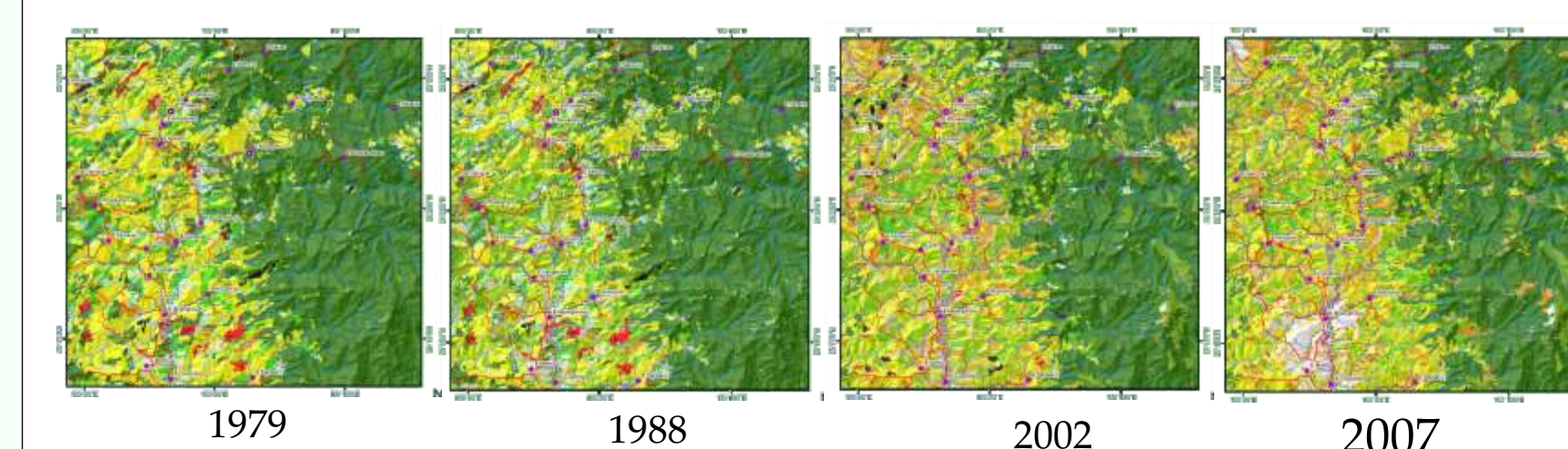
Within the time series, forest loss has been quite low in extent, compared to other sites. The increase of non-tree based cover is quite marked in the most recent years. Another pattern to note that has happened lately is the increase of area of settlement. Interchanges from tree-based to non-tree based cover and vice versa is also high, most likely due to the fallow systems. We see that road access has an influence and that recently the settlements tended also to be located in the upper river.

The landscape of East Usambara is the second largest and roughest in terms of topography among the five sites. In 2007, three quarters of the landscape was covered by forest and tree-based systems of comparable proportion. Compared to the other sites, forest cover in East Usambara landscapes is the most scattered and fragmented. The shape of forest patches are distributed mostly in montane and sub-montane, plus to a lower extent in the lowland area. Forest continues to decline over time. Proportion between tree-based and non-tree based cover interchanges over time, whilst settlement areas show steady increases in size. Most recently tree-based cover dominates the landscape.

East Usambara, Tanzania



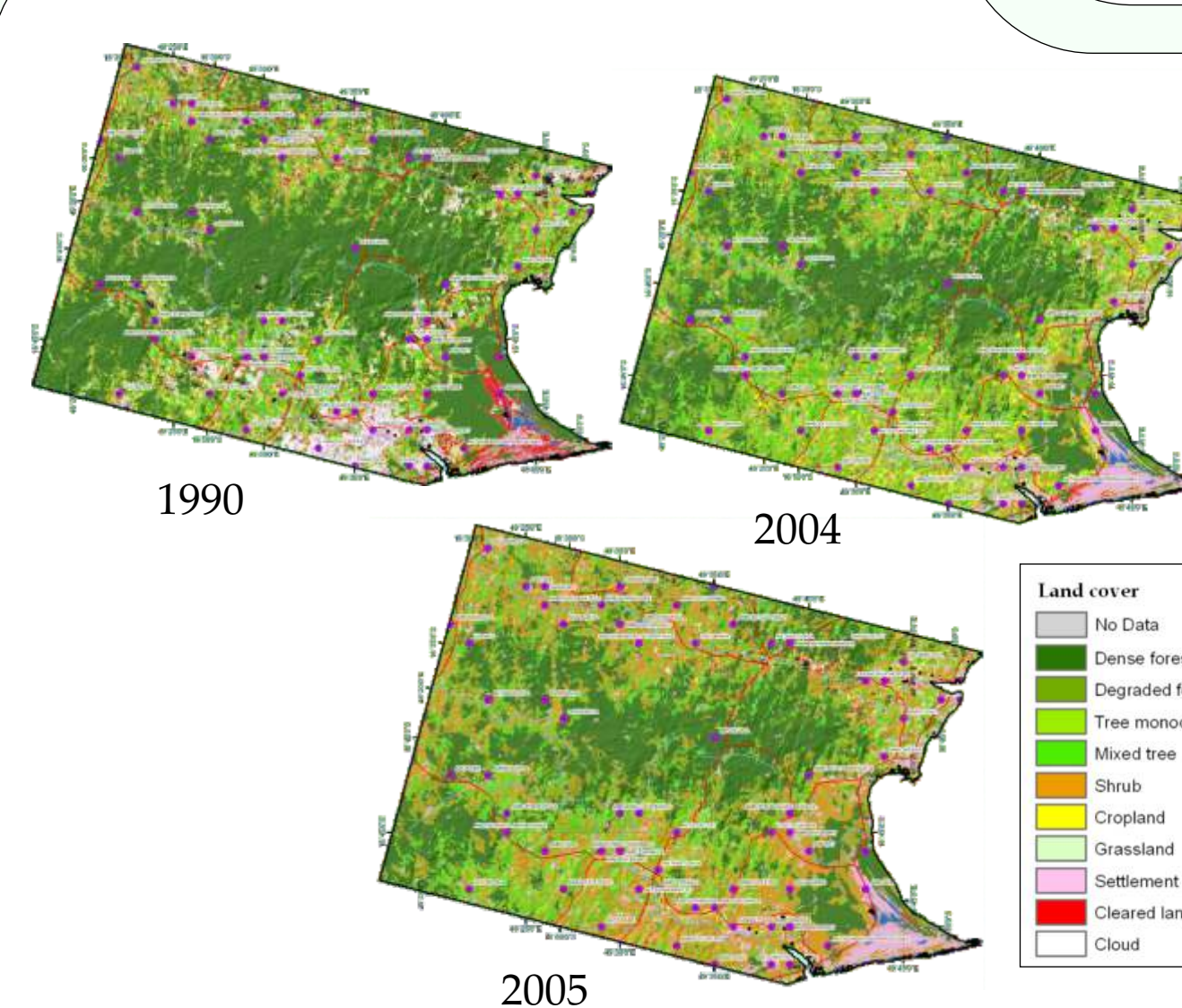
Viengkham, Laos



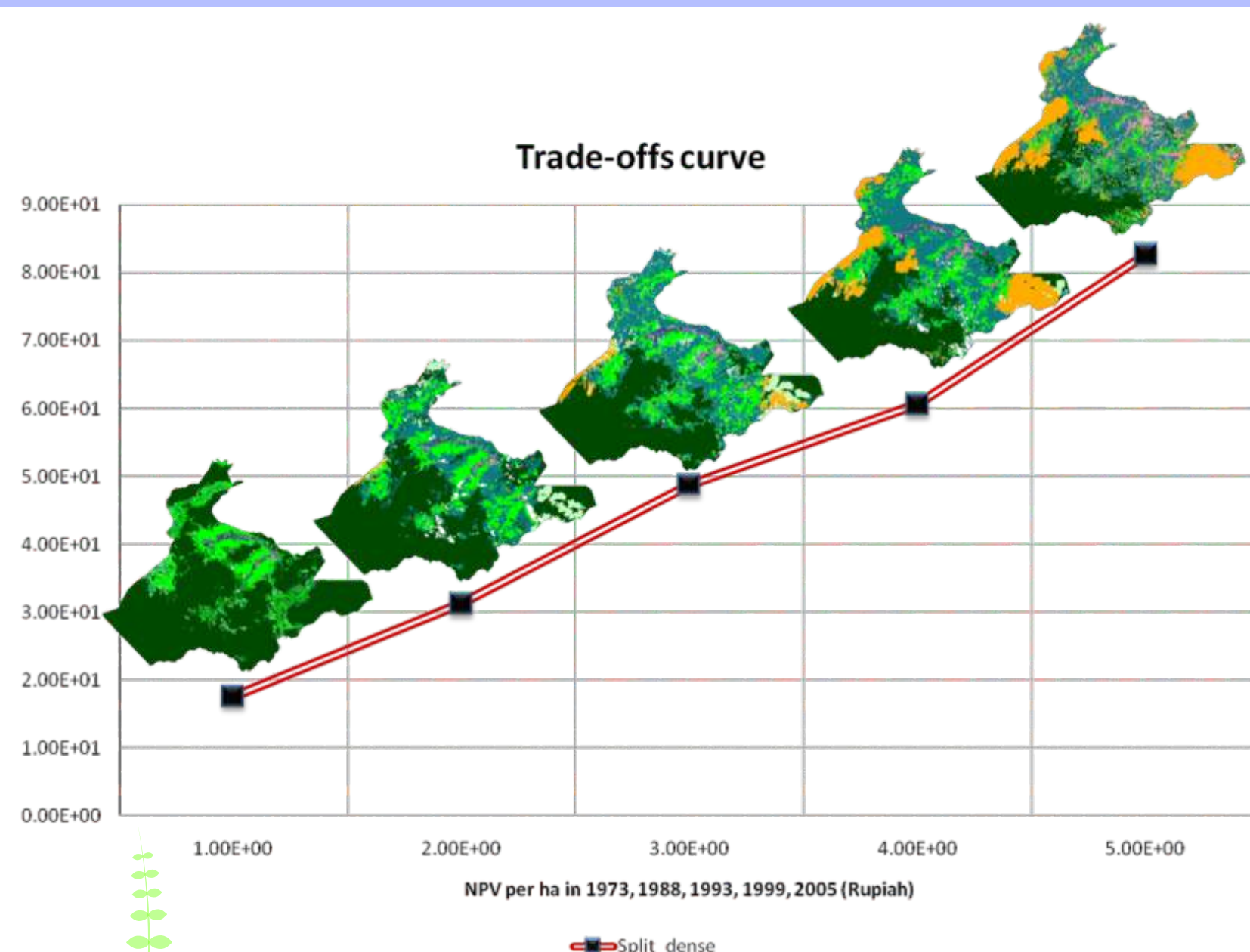
The landscape of Viengkham is dominated by montane ecosystem with rough topography, especially in the eastern half of the area and some area in the northwestern part. Among the five sites of the project, Laos is highest in elevation and roughest in terms of topography. Close to half of the landscape area is covered by natural forest and 37% of tree-based systems, which is most likely natural re-growth (fallow) that are part of shifting cultivation systems. The road networks are limited and the pattern of forested-non-forested areas follow river networks very closely.

The landscape is dominated by a sub-montane ecosystem, with low to moderate topographic roughness, and the lowland area along the coastal zone (Figure 15). Within the landscape a little fragment of forest is found in the coastal area but most extents of forest cover are located in the "hinterland". In 2005, the extent of forest cover was comparable to that of tree-based land cover and together they constitute two thirds of the landscape area (Figure 16). A large extent of deforestation took place in 1990-2004 and there has been little forest loss more recently. Shifting cultivation is a dominant activity with small scale logging

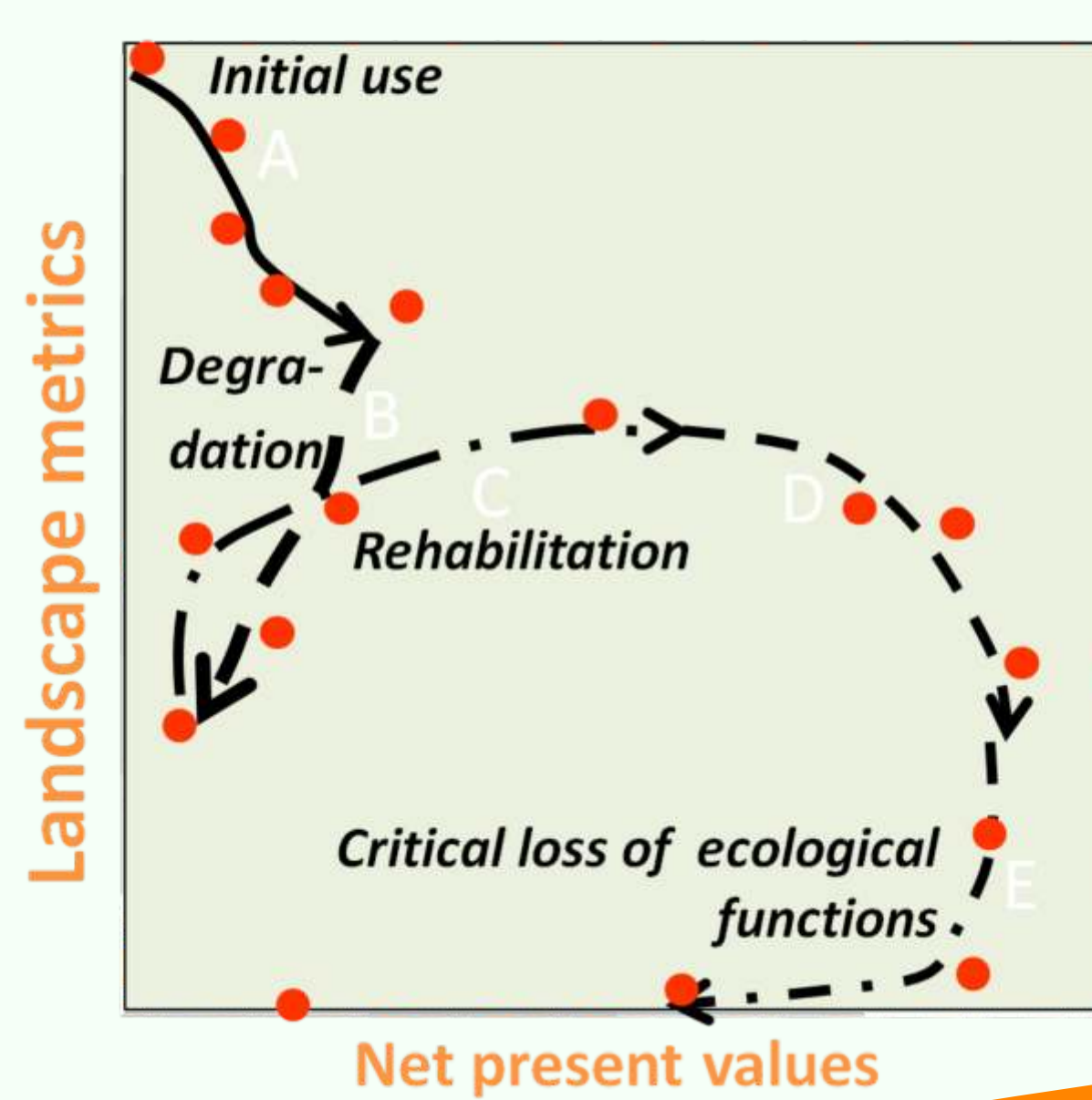
Manompana, Madagascar



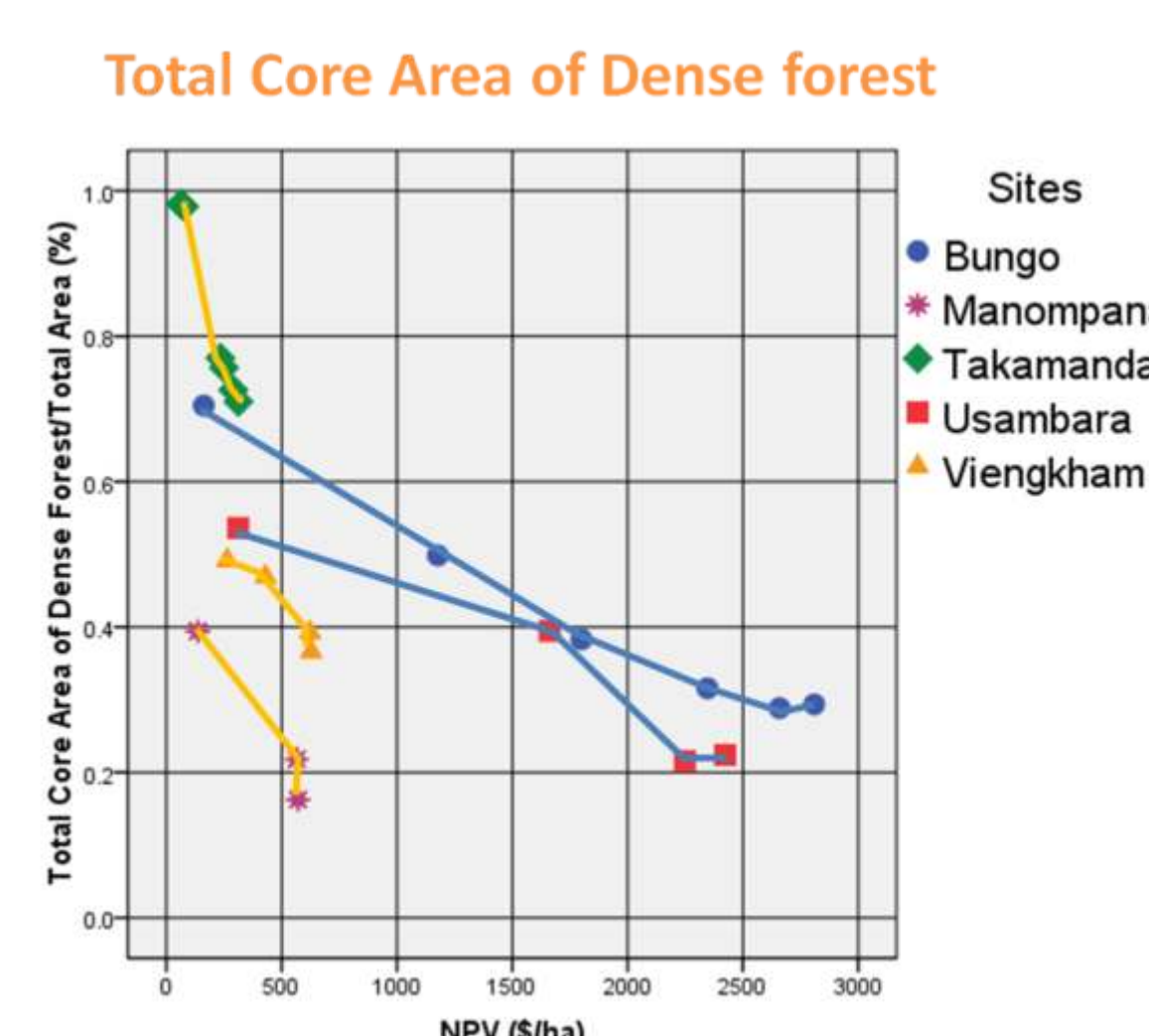
Spatial trade-offs Bungo



Trade-off: convex, concave, win-win after loose-loose



Spatial trade-offs all site



- Mixed tree-based systems that can function as habitat for some species, buffer and corridor offer some options to achieve better trade-offs
- Drivers of LUCC are important in shaping landscape composition, configuration and profitability of land use systems
- Plausible intervention includes: informed, integrative, inclusive spatial planning and rewards for Environmental Services