



# Allocating the REDD+ national baseline to local projects: A case study of Cambodia

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**Abstract** We proposed a set of decision support tools to allocate Cambodia's REDD+ national baseline to local REDD+ projects, based on their forest cover and forest carbon stocks, and the historical deforestation trends in their reference regions. Our samples included 77 hypothetical REDD+ projects and five actual REDD+ projects. To identify reference regions for our samples, a cluster analysis of 127 districts in Cambodia was conducted using the Partitioning Around Medoids algorithm. To calculate the baseline amount to be allocated to projects, four allocation methods were proposed. Two methods used 'snapshot' variables (i.e., [1] existing forest area or [2] forest carbon stock) and two used 'change' variables (i.e., [3] historical forest area change or [4] historical forest carbon stock change from 2006 to 2014). We weighted the baseline by the deforestation risk in 2014. We found that 'snapshot' methods could stimulate more forest loss in non-project jurisdictions. In contrast, 'change' methods are expensive and subject to political adjustment of their performance. Technically, the 'change' method [4] seems to be the desired choice for allocating the national baseline to local projects; this is because it fits best with the idea of counter-factual thinking using a 'reference period' that a national baseline must have under the United Nations Framework Convention on Climate Change (UNFCCC). However, the 'change' methods are more likely to face the challenge of political adjustment to balance the reduced emissions from some jurisdictions/projects with increased emissions from the other jurisdictions/projects, compared with the 'snapshot' methods.

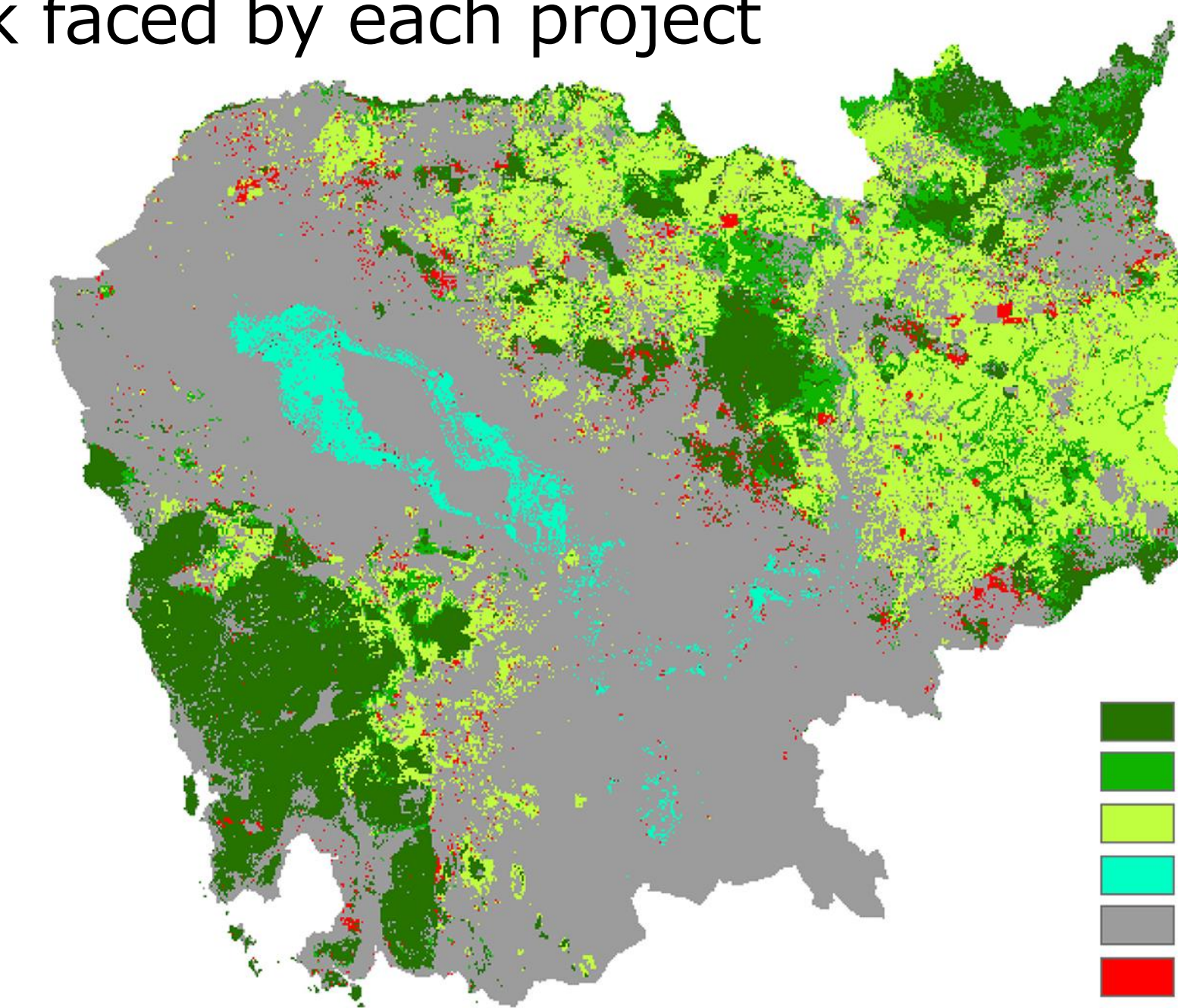
## Introduction

Under UNFCCC, emission reductions by REDD+ are derived against its national baseline. Sub-national/project baselines can be aligned with higher baseline. Few studies have examined the values of project baselines allocated from a national baseline using different methods.

**Aim:** Proposing a set of decision support tools to allocate Cambodia's REDD+ national baseline (78,953,951 tCO<sub>2</sub> yr<sup>-1</sup>) to REDD+ projects by considering the differences in the forest types and carbon stocks, the historical deforestation trends at the relevant scale of projects' reference regions, and the deforestation risk faced by each project

## Materials and methods

- **Forest cover change:** Overlaying official forest cover maps (2006-2014-2016)
- **Samples:** 77 hypothetical REDD+ projects (districts) and 5 actual REDD+ projects (A-E in Fig.2)
- **Reference regions :** Cluster analysis of 127 districts in Cambodia (Fig.2) using the Partitioning Around Medoids algorithm. Variables: forest cover rate in 2006 (%), forest cover change between 2006-2014 (%point), economic land concession in 2016 (ha), semi-evergreen forest cover in 2006 (ha)
- **Allocation methods:**

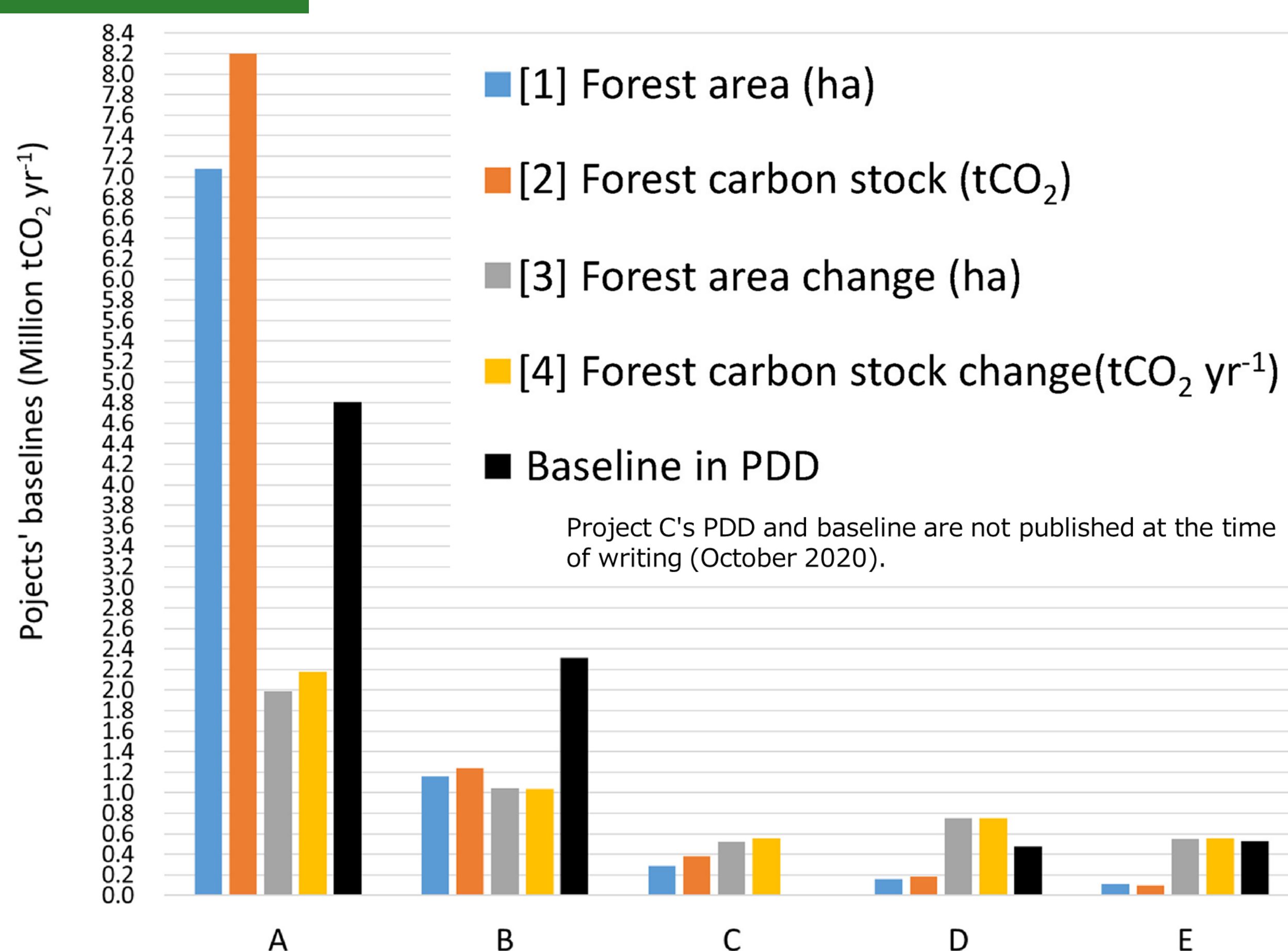


**Fig.1** Forest cover map for Cambodia, 2016

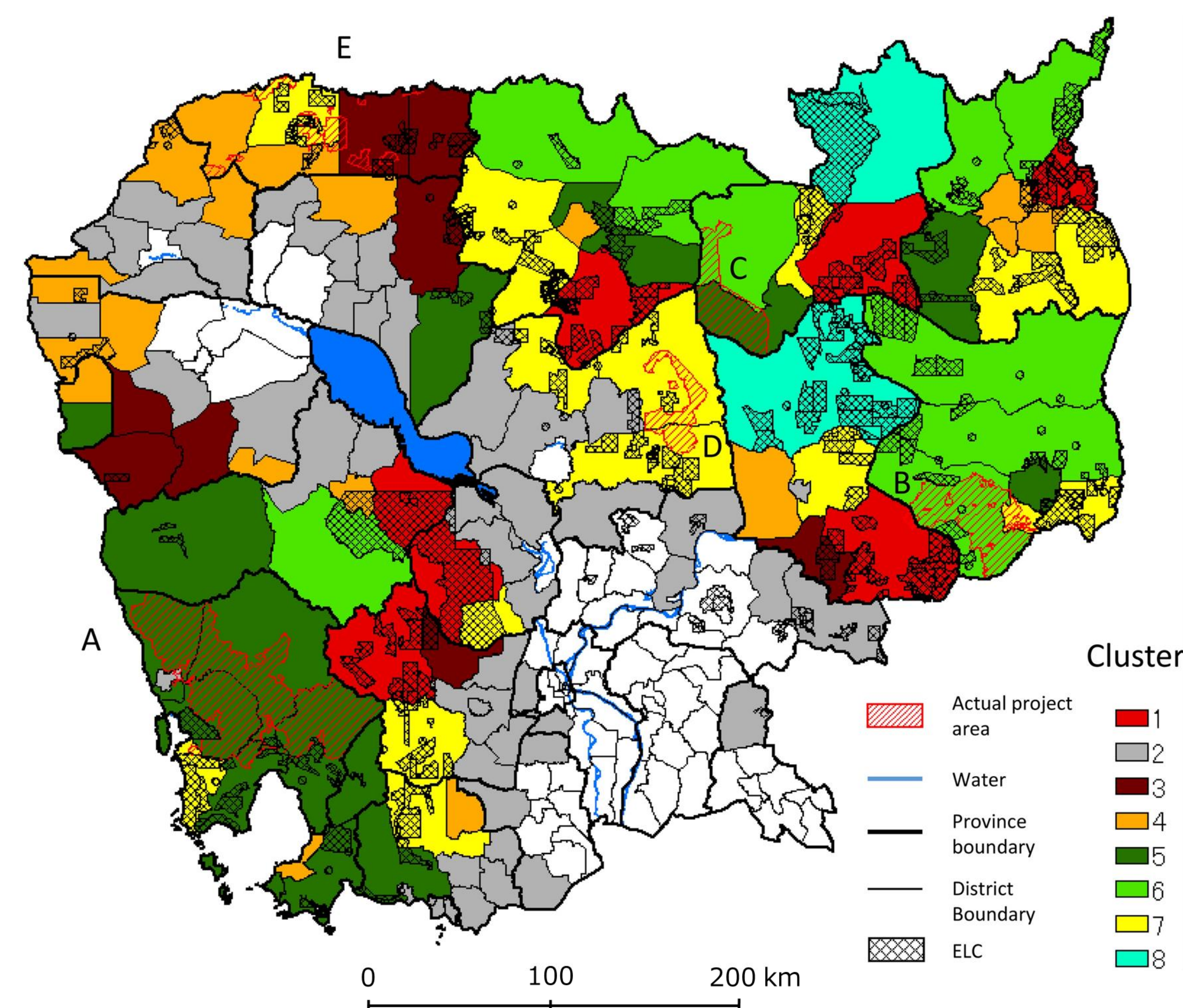
**'Snapshot' methods** Allocate according to the [1] forest area (ha) or [2] forest carbon stock (tCO<sub>2</sub>) of the project in 2006, weighted by the forest area (ha) at risk of deforestation in the project in 2014

**'Change' methods** Allocate according to the [3] forest area change (ha) or [4] forest carbon stock change (tCO<sub>2</sub>) between 2006-2014 in the project's reference regions weighted by the forest area (ha) at risk of deforestation in the regions in 2014

## Results



**Fig.3** Comparison of allocated baselines to actual projects (A-E) with their own baselines shown in their Project Design Documents.



**Fig.2** Reference regions set for the 'change' methods.

The clusters correspond to reference regions, which means there are 8 reference regions in total for 5 actual projects (A-E).

## conclusions

- We analyzed methods to allocate a REDD+ national baseline to REDD+ projects.
- **'Snapshot'** and **'change'** methods used current or historical trend data, respectively.
- The former could stimulate more forest loss in non-project jurisdictions (Table 1).
- The latter are expensive and subject to political adjustment of their performance (Table 1).
- The different methods produced large variations in baselines for REDD+ projects (Fig. 3).

**Table 1** Political pros and cons of using the 'snapshot' or 'change' methods

Methods	Pros	Cons
<b>'Snapshot' methods</b> [1] [2]	<ul style="list-style-type: none"> <li>• Easier in data collection &amp; analyses</li> <li>• Guide future REDD+ projects to larger forest area or those richer in carbon stocks (this could also be a con)</li> </ul>	<ul style="list-style-type: none"> <li>• Do not consider the extent of the 'changes' took place in reference regions → higher risk of over-rewarding forest conservation efforts</li> <li>• Could stimulate further deforestation in a jurisdiction that has large forest cover or high forest carbon stocks at the time of allocation</li> </ul>
<b>'Change' methods</b> [3] [4]	<ul style="list-style-type: none"> <li>• Fit with the idea of counter-factual thinking using a reference period &amp; reference regions</li> <li>• Less risk of over-rewarding forest conservation efforts</li> </ul>	<ul style="list-style-type: none"> <li>• A decision on the appropriate timeframe of the reference period to cover the diversity of the historical trends of deforestation in the reference regions is required</li> <li>• A decision on the appropriate reference region boundaries is required</li> </ul>