


Comprehensive understanding of the tropical forest conservation effects of protected areas and OECM candidate sites based on large-scale complete data

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## Purpose and Background of the Research

### ●Outline of the Research

In order to achieve the international goal of Nature Positive 30by30 (conserving more than 30% of land and marine ecosystems by 2030), it is becoming increasingly urgent internationally to expand protected areas (PAs) such as national parks and other effective area-based conservation measures (OECMs) such as community forests. At the same time, there is a demand to establish management systems that are highly effective in conservation. However, most of the studies on the conservation effectiveness of PA/OECM have been individual case studies or meta-analyses that internationally integrate a small number of cases, and there are few studies that contribute to conservation measures in a single country. Therefore, in this study, we will build unprecedented large-scale complete data for five tropical Southeast Asian countries that are high conservation priorities but suffer from severe deforestation and forest degradation, and comprehensively elucidate the factors that influence the success or failure of tropical forest conservation effects of PAs and OECM candidate sites at a multi-scale in one country and across multiple countries.

### ●Background of the Research

Meta-analyses that integrate a small number of cases from each country are mainstream in top journals, but they face academic challenges such as incomplete data (many missing values and biases, small number of samples per country). On the other hand, our research team has found new insights that cannot be obtained through international meta-analysis by using large-scale data on an entire country scale, and has pointed out the possibility that the results of an international meta-analysis do not necessarily hold at the scale of an individual country, the so-called "Simpson Paradox" (Figure 1: differences in trends between the whole and the parts) may be occurring.

### ●Objectives of the research

The objective of this study is to compile unprecedented, large-scale, highly accurate, complete data for each of five tropical Southeast Asian countries (Cambodia, Thailand, Vietnam, Myanmar, and Laos), which are considered high conservation priorities worldwide but suffer from severe deforestation and forest degradation, and to comprehensively elucidate the factors that determine the success or failure of conservation effectiveness in PA/OECM at a multi-scale within and across countries, in order to develop new tropical forest conservation measures.

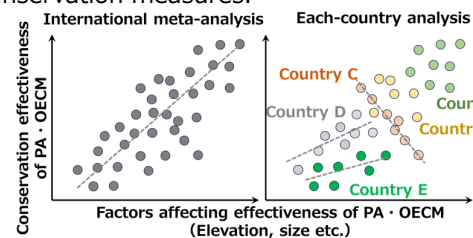


Figure 1. Possibility of "Simpson Paradox" (difference in results between international meta-analysis and each-country analysis)

## Expected Research Achievements

### ●Building large-scale complete data

<High-precision mapping of deforestation and forest degradation>

We will combine the strengths of both the long-term observational capabilities of Landsat images and the spatial and temporal resolution of Sentinel-2 to attempt more accurate mapping of deforestation and forest degradation across five Southeast Asian countries.

<Preparation of boundary data for PA/OECM, and data on geographical and socio-economic factors >

We will compile boundary polygon data for PAs and OECMs candidates; geographic information data such as elevation, slope, distance from roads, settlements, rivers, and borders; and socio-economic data such as population density.

<Assembling data on management system factors: Interview survey>

Data on management system factors (degree of legal binding force, specificity of management objectives, rules, and plans, degree of boundary management, number of management staff, degree of participation of local managers and local residents, etc.) will be collected through on-site interview surveys. Because these interview surveys require experience-based and subjective scoring, a quality assurance program for the interview surveys (prior training and data accuracy evaluation) will be implemented to build accurate and complete data.

### ●Multiscale factorial analysis

We use deforestation and forest degradation as objective variables to comprehensively elucidate the geographical, socio-economic and management factors that affect them. We examine how the results differ for deforestation and forest degradation, and for PA and OECM (Figure 2), at different scales: five-country scale, two or three multi-country scale, and single-country scale (Figure 3).

### ●Proposal for conservation measures, verification of Simpson's paradox

Based on the multiscale analysis, we try to answer the questions; "Where, at what scale, and under what management system should PAs/OECMs be placed within an entire country or multiple countries to be effective in tropical forest conservation?" and "Whether and how the Simpson paradox has occurred?"

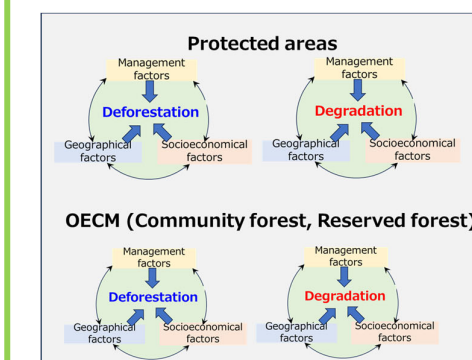


Figure 2. Understanding how drivers of deforestation and forest degradation differ and how these outcomes differ between protected areas (PAs) and other conserved areas (OECMs)

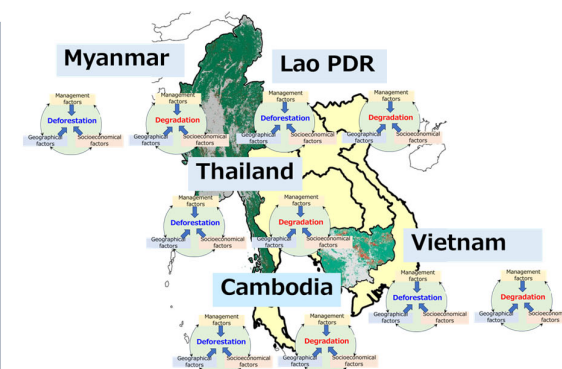


Figure 3. Examining how the factors that influence the success or failure of PA and OECM candidate sites differ at different scales: a five-country scale, a two or three-country scale, and a single country scale.