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研究課題名（和文）Determinants and Implications of Global Protected Area Effectiveness

研究課題名（英文）Determinants and Implications of Global Protected Area Effectiveness

研究代表者

SHAH PAYAL (Shah, Payal)

沖縄科学技術大学院大学・サイエンステクノロジーグループ・研究員

研究者番号：30773220

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研究成果の概要（和文）：保護地域は森林、種、生態系の保護に役立つ重要な地球規模の保全政策ツールですが、森林破壊を防止する場合に限られる。そこで本研究では準実験的手法を用いて、森林破壊を回避する上で世界全体の保護区の有効性を評価した。2000年から2012年の間に設置された保護区により86062平方キロメートルの森林破壊が世界的に回避されたことがわかった。少ない農業影響、高い経済成長率、良いガバナンスは、国レベルの保護区の有効性に関連していることがわかった。すべての国の保護区が同じ地域内で最も効果的な保護区を持つ国と同じくらい効果的だった場合、119186平方キロメートルの森林破壊が回避されたであろうこともわかった。

研究成果の学術的意義や社会的意義

This is the first study to explore the key drivers of protected area effectiveness using global data. We find that protected area effectiveness vary significantly by region and income group. Our study provides guidance for future conservation policy that targets global increase in protected areas.

研究成果の概要（英文）：Protected areas are an important global conservation policy tool that can help preserve forests, species and ecosystems but only if they are effective in avoiding deforestation. We evaluate the effectiveness of global protected areas established between 2000 and 2012 in avoiding deforestation using quasi-experimental methods. We find that 86,062 sq. km. of deforestation was avoided globally on account of protected areas established between 2000 and 2012. Protected areas in tropical countries, upper-middle income countries and in South America were generally more effective at avoiding deforestation. We find that lower agricultural pressures, higher economic growth rates and better governance are associated with greater country-level protected area effectiveness. We further find that if all countries' protected areas were as effective as the country with the most effective protected areas within the same region, 119,186 sq. km. of deforestation would have been avoided.

研究分野：Environmental Economics

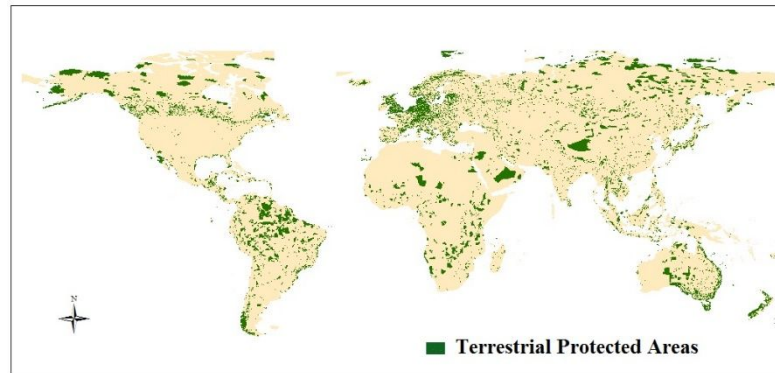
キーワード：protected areas deforestation conservation policy impact evaluation

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## 1. 研究開始当初の背景

(1) There has been a steady increase in the terrestrial area designated as protected in the last 70 years. Currently, the global protected area network covers more than 18 million square kilometers, representing almost 15% of the earth's terrestrial area (see Figure 1). Establishing protected areas is a cornerstone of global

conservation policy targeted at preservation of species and ecosystems and in adapting to and mitigating the impacts of deforestation and climate change. Protected areas are important for conservation, but only if they are effective in protecting land from degradation and



**Figure 1: Global terrestrial protected areas**

conversion. Protection is

also not without cost. Restricting use by nearby communities can have significant economic and cultural consequences for these former forest uses. Further, parks are heterogeneous over their effect. If all parks were relatively more effective at protection, less land would be needed to be under protection to produce the same environmental benefits. In this study, we 1) determine the effectiveness (as measured in forest cover change) of terrestrial protected areas in each country; 2) determine the relationship between key demographic, economic and institutional factors and protected area effectiveness using machine learning methods and 3) estimate how much more effective protected areas can be if all protected areas were as effective as the best performing protected area in their region/income category.

## 2. 研究の目的

(1) There are rising pressures globally to increase the coverage of terrestrial protected areas [1]. However, any further increase in allocation of scarce land for protected area requires a clear understanding of the factors that are important drivers of protected area effectiveness [2]. In this study, we use quasi-experimental methods that can provide accurate and statistically robust estimates of protected area effectiveness. We combine estimates of protected areas effectiveness with a range of demographic, economic and institutional indicators to explain what factors are associated with protected area effectiveness. Furthermore, setting aside land for protection occurs at the expense of other productive uses of that land in the economy (e.g. agriculture). Indeed one of the mainstays of systematic conservation planning is how to achieve maximum conservation benefits at the minimum possible cost [3]. We use the protected areas effectiveness estimates to calculate how much more deforestation could have been avoided if new protected areas could be as effective as the most effective protected area in the same income/region category.

(2) Studies to date have focused on the relationship between demographic and economic variables and forest cover loss, especially in the tropics [4 and 5]. However, no study till date has looked into the key drivers of success or failure of protected areas in preserving forest cover. More importantly, previous studies have looked at evaluating the effectiveness of protected areas on a case by case basis but no study till date has looked at evaluating the effectiveness of the entire global protected area network.

## 3. 研究の方法

(1) We obtain data on protected areas established between 2000 and 2012 from the World

Database on Protected Areas and forest cover loss data between 2000-2012 from [6]. We include 84 countries in my analyses. Across these 84 countries, terrestrial area under protection increased from 9 million sq. km. in 2000 to 12.2 million sq. km. by 2012.

(2) We use a combination of spatial matching methods and cross-sectional univariate regressions to estimate the effectiveness of the new protected areas. Since protected areas are not randomly allocated, we use spatial matching methods to control for this site selection bias [7 and 8]. Post matching, we run univariate regressions to arrive at the final estimate of protected area effectiveness by country.

(3) We assess 13 demographic, agricultural, economic and governance indicators to determine which variables were most strongly associated with protected area effectiveness using machine learning methods. We select variables for inclusion based on the previous studies that identify key drivers of forest loss.

#### 4. 研究成果

(1) We find that protected areas established between 2000 and 2012 reduced forest loss by 72% over the 12 year period compared to what would have occurred without protection. Protected area effectiveness estimates varied substantially across and within region and income groups (see Figure 2). We find that protected areas in upper-middle income countries in South America had the highest impact on reducing deforestation by 85% compared to unprotected areas. Protected areas in high income countries in Oceania reduced deforestation by 65% while protected areas in lower-middle income countries in Asia and in upper-middle income countries in Africa reduced deforestation by 50%. If every country's protected area was as effective as the country with the highest protected area effectiveness within the same region, the new protected areas in the 84 countries could have avoided an additional 40% deforestation.

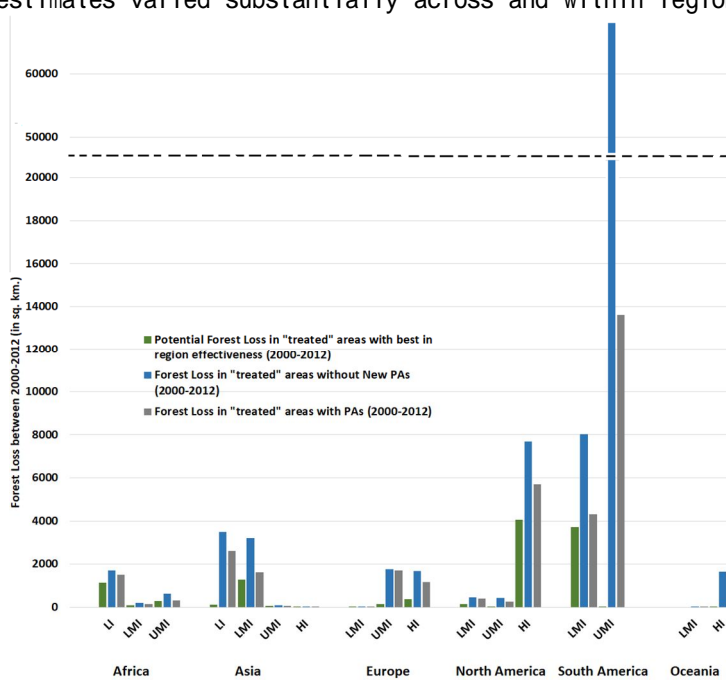


Figure 2: Protected area impact by region and

(2) Using machine learning methods, we find that lower agricultural pressures, higher economic growth rates and better institutional indicators are associated with greater protected area effectiveness.

(3) The results from this study indicate the importance of including protected area effectiveness targets as essential goals in future conservation policy that seeks to address issues of deforestation and preservation of ecosystem services. Moreover, countries with larger agricultural pressures, lower economic growth rates and poor governance require additional support and guidance for ensuring the effectiveness of their protected area network.

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5. 主な発表論文等

〔雑誌論文〕 計0件

〔学会発表〕 計2件（うち招待講演 0件 / うち国際学会 2件）

1. 発表者名 Payal Shah
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〔図書〕 計0件

〔産業財産権〕

〔その他〕

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6. 研究組織

	氏名 (ローマ字氏名) (研究者番号)	所属研究機関・部局・職 (機関番号)	備考
研究協力者	ベイリス キャシー  (Baylis Kathy)		
研究協力者	ブッシュ ジョナ  (Busch Jonah)		