

Cover Letter

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to

Editors
Biological Conservation

Dear Editors,

Please find enclosed the article untitled “*Combining global tree cover loss data with historical national forest-cover maps to look at six decades of deforestation and forest fragmentation in Madagascar*” by G. Vieilledent, C. Grinand, F. A. Rakotomalala, R. Ranaivosoa, J.-R. Rakotoarijaona, T. F. Allnutt, and F. Achard for publication in *Biological Conservation*.

Authors declare that:

- the work is all original research.
- they agree with the contents of the manuscript and its submission to the journal.
- the manuscript is not being considered for publication elsewhere while it is being considered for publication in *Biological Conservation*.
- all sources of funding are acknowledged in the manuscript.
- no direct financial benefits could result from publication.

Summary of the scientific results

In our study, using an original methodology, we produced new 30 m resolution wall-to-wall forest-cover maps for Madagascar for the year 1990 and annually for the period 2000-2014. We show that Madagascar has lost 44% of its natural forest-cover over the period 1953-2014 (including 37% on the period 1973-2014). We also show a strong increase in forest fragmentation. About half (46%) of the tropical forest in Madagascar is now located at a distance lower than 100m from forest edge. Analyzing the forest-trend on six decades from 1953 to 2014, we show that annual deforestation rate has increased in Madagascar since 2005 to reach about 100,000 ha/yr (1.08%/yr) on the period 2010-2014, most probably due to population growth and poor law enforcement and implementation of conservation measures.

Importance and originality of the research

Madagascar is recognized for both its unparalleled biodiversity, concentrated mainly in tropical forests, and its high level of threat, which is associated in particular to anthropogenic deforestation (Allnutt *et al.* 2008). The disappearance of the tropical forest in Madagascar would be a terrible scenario for both local people in term of livelihoods (Gardner & Davies 2014) and at the global scale for biodiversity (Goodman & Benstead 2005) and carbon emissions (Vieilledent *et al.* 2016).

In this article, we propose a new approach combining historical (1953-2000) national forest-cover maps (Harper *et al.* 2007) with recent (2001-2014) global annual tree cover loss data (Hansen *et al.* 2013) to look at six decades (1953-2014) of deforestation and forest fragmentation in Madagascar. We produced new forest-cover maps at 30 m resolution over the full territory of Madagascar for the year 1990, and annually from 2000 to 2014. This approach could be easily extended to other regions or countries for which an accurate forest-cover map is available at any date within the period 2000-2014.

Harper *et al.* (2007) have published an article in 2007 analyzing fifty years of deforestation and forest fragmentation in Madagascar since *c.* 1953. In their study, Harper *et al.* (2007) produced forest-cover maps and forest-cover estimates for Madagascar (up to year 2000) which were highly used in many studies about conservation and management of natural areas in Madagascar. The paper has thus been cited more than 400 times considering Google Scholar statistics (200 times considering Web of Science statistics). We hope our article will meet the same success.

Impacts on conservation policy

Accurate forest-cover change maps and forest-cover change estimates can be used to assess the effectiveness of past and current conservation programs and implement new strategies for the future. With our results, we underline the fact that conservation and management efforts must be intensified in Madagascar if we want to save country's unique forest and biodiversity. Our results can be used in the framework of the REDD+ ("Reducing Emissions from Deforestation and Forest Degradation") initiative and for increasing the effectiveness of the current protected area network.

Reproducibility and transparency of the research

All the data and codes used for this study are made publicly available in the **deforestmap** GitHub repository (<https://github.com/ghislainv/deforestmap.git>). The results of the study are fully reproducible running the R/GRASS script **deforestmap.R** located inside the **deforestmap** repository. Forest-cover maps are also made publicly available on the BioSceneMada project website at <https://bioscenemada.cirad.fr/forestmaps>

We think our study fits well into the scope of the *Biological Conservation* journal which offers the publication of high-quality papers that advance the science and practice of conservation. We sincerely hope you will find our study interesting and suitable for publication in your journal.

Preprint

The article is publicly available as a preprint on the *bioRxiv* server:

Vieilledent G., C. Grinand, F. A. Rakotomalala, R. Ranaivosoa, J.-R. Rakotoarijaona, T. F. Allnutt, and F. Achard. Combining global tree cover loss data with historical national forest-cover maps to look at six decades of deforestation and forest fragmentation in Madagascar. *bioRxiv*. 147827. [doi: <https://doi.org/10.1101/147827>].

Referees

As potential referees, we suggest the following names:

- Jean-Philippe Puyravaud [jp.puyravaud@gmail.com]. J.P. Puyravaud from Sigur Nature Trust (<http://www.sigurnaturetrust.org>), has published a highly cited article in 2003 on computation methods for estimating annual rates of deforestation (Puyravaud 2003).
- Holger Kreft [hkref@uni-goettingen.de]. H. Kreft is an Associate Professor and Head of the Department of Biodiversity, Macroecology and Biogeography at the University of Göttingen. He is currently contributing to an applied land use research project in Madagascar (<https://www.uni-goettingen.de/en/project-summary/531390.html>).

- Jean-François Bastin [bastin.jf@gmail.com]. J.-F. Bastin is a consultant at the Food and Agriculture Organization (FAO). He has recently published a high-impact article on the extent of forest in dryland biomes (Bastin *et al.* 2017).
- Julia P. Jones [julia.jones@bangor.ac.uk]. J. P. Jones is Professor of Conservation Science at Bangor University (<https://www.bangor.ac.uk/senrgy/staff/jjones.php.en>). She is currently leading a conservation and development project in Madagascar (<http://www.p4ges.org/>).
- Rémi D’Annunzio [remi.dannunzio@fao.org]. R. D’Annunzio is a consultant at the Food and Agriculture Organization. He is specialized in forest change monitoring through satellite image analysis. His work contributes to the Global Forest Resources Assessment by FAO.
- Kurt Riitters [kriitters@fs.fed.us]. K. Riitters is a research ecologist at the USDA Forest Service (<https://www.srs.fs.usda.gov/staff/776>). He has developed new approaches to measure, evaluate and predict landscape and forest spatial patterns and their implications for resource management. In our study, we used one of the approaches he developed (Riitters *et al.* 2000) to estimate forest fragmentation in Madagascar.
- James E. M. Watson [james.watson@uq.edu.au]. J. E. M. Watson is an Associate Professor Fellow at University of Queensland and Director of Science and Research Initiative at the Wildlife Conservation Society (<https://sees.uq.edu.au/profile/1005/james-watson>). He has published a paper on the effects of habitat fragmentation on the avifauna in South-East Madagascar (Watson, Whittaker & Dawson 2004).

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