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Malaria risk assessment through Remote Sensing and MultiCriteria Evaluation in Madagascar

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Objective

Madagascar is one of the low-income countries with limited resources. In order to minimize the cost of the fight against malaria, the main objective of this study is to identify the priority zone for Indoor Residual Spraying (IRS).

Introduction

Malaria remains a major public health problem in Madagascar. Indoor Residual Spraying (IRS) is the adopted strategy for malaria control in the CHs and Fringe regions of Madagascar. Remotely sensed data analysis combined with Multi-Criteria Evaluation become crucial to target priority areas for intervention.

Methods

Satellite images were used to update land cover information using object based image analysis method, NOAA and MODIS for temperature and rainfall data. Multi-Criteria Evaluation was performed by weighted linear combination to obtain the gradient of malaria transmission risk. Factor weights were determined by pair-wise comparison based on literature review and expert knowledge. Fuzzy set theory was used to perform the factors weighting. To estimate a best fit risk magnitude probability per commune, we used per pixel values for inhabited locations, and chose an adjusted mean. The Jenks Natural Breaks algorithm was used to classify the obtained malaria risk gradient. All the process was compiled in a semi-automatic plugin working in an open source software. Comparison of risk magnitude between two consecutive years was performed to assess the environmental change.
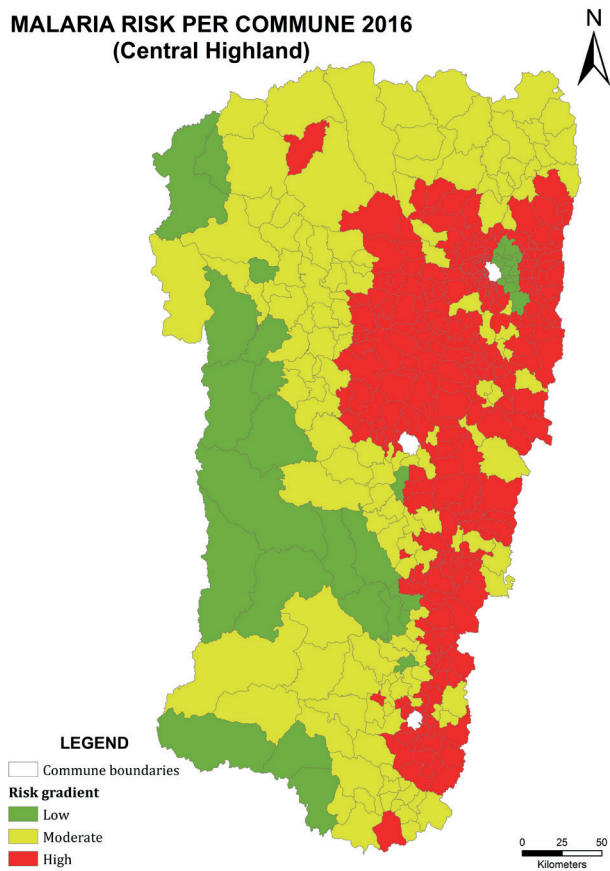
Results

Three models of malaria risk are available for 2014, 2015 and 2016. The updated land cover map showed suitable breeding sites for mosquito responsible of malaria transmission in CHs with an accuracy of 84%. A change of 64.4% and 35.6% unchanged were obtained concerning change detection of malaria risk between 2014 and 2015. Between the years 2015 and 2016, 11.2% of the area of interest remains unchanged while 88.8% changed. Respectively 26.9% decreased and 61.9% increased.

Conclusions

It is crucial to focus the indoor residual spraying efforts according to the risk gradient. This allows to increase the effectiveness of the intervention targeting areas with the most need, as well as to optimize financial and logistical resource management.

ANTANANARIVO

Adminstrative limits of the Central Highlands
Administrative limit of Regions
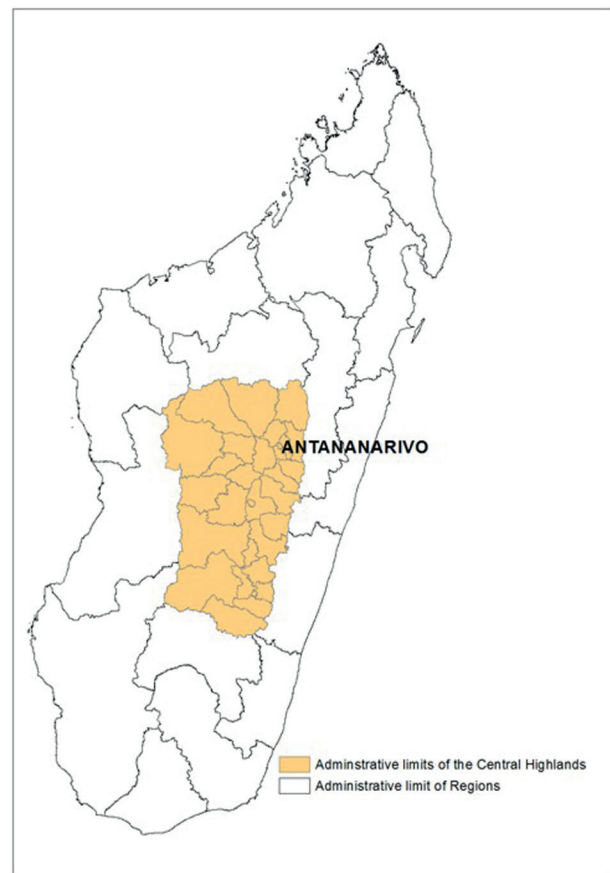
MALARIA RISK PER COMMUNE 2016
(Central Highland)

LEGEND
Commune boundaries
Risk gradient
Low
Moderate
High

Keywords

Malaria; Remote Sensing; MultiCriteria Evaluation

Acknowledgments

References

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