Predicting the risk of plant invasion on islands: *Miconia calvescens* in the Marquesas, French Polynesia (South Pacific)

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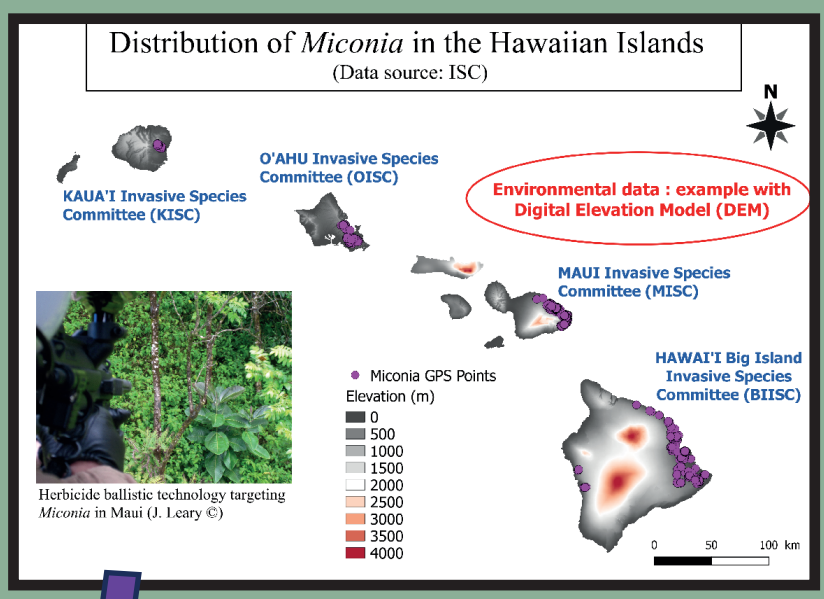
Introduction: Predicting the potential distribution of alien plant species in newly introduced areas where they are found in small numbers is crucial for management (Lockwood *et al*. 2007). Indeed, predictive models can be useful tools to assess the risk of invasion and refine the areas for further surveys and control.

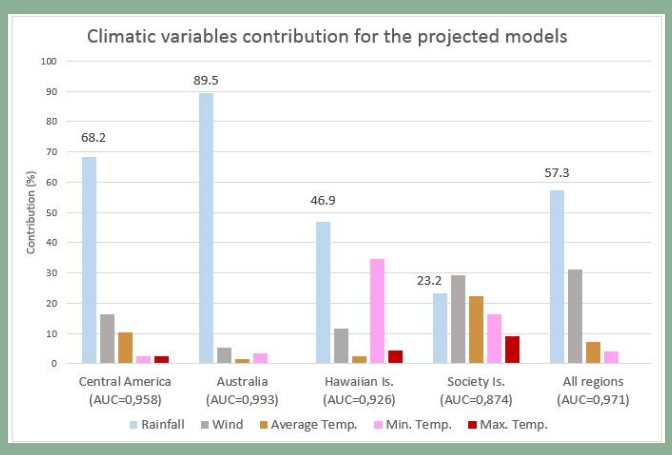
Miconia calvescens (Melastomataceae) is classified among the 100 world's worst invasive alien species (Lowe *et al*. 2000). This small tree (4-12 m) native from Central and South American tropical rainforests has become a dominant plant invader in the Society Islands (French Polynesia), the Hawaiian Islands (USA) and the Queensland region of Australia where it was introduced between the 1930's and the 1960's as an ornamental plant because of its large leaves with purple undersides (Meyer *et al.* 2011).

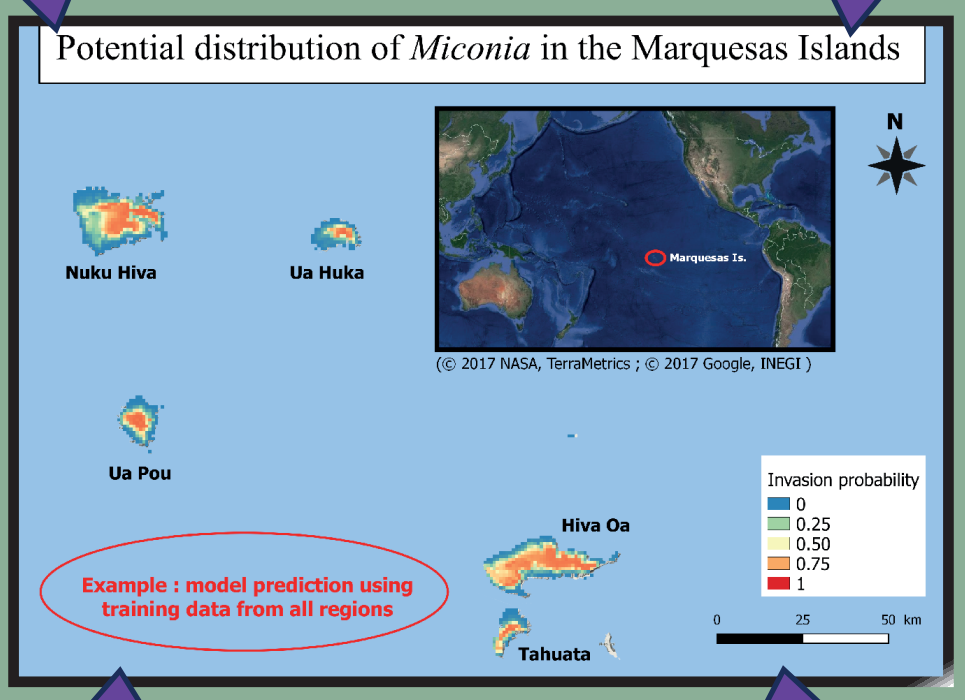
Objectives: Our goal was to project the environmental envelope occupied by *Miconia* in its native and introduced range (Tahiti and Moorea in the Society Is., the Hawaiian Is., Australia) onto the Marquesas which is considered as a « biodiversity hotspot » in French Polynesia (Galzin *et al.* 2016) and where *Miconia* has been recently introduced (in the 1990's).

Material and methods: We used maximum entropy modelling (MAXENT) to project *Miconia*'s potential distribution onto the Marquesas by combining occurrences collected in the field (in its introduced range) or extracted from herbarium specimens (in its native range) with five WorldClim climatic variables: rainfall, wind, minimum, maximum, and average temperature.

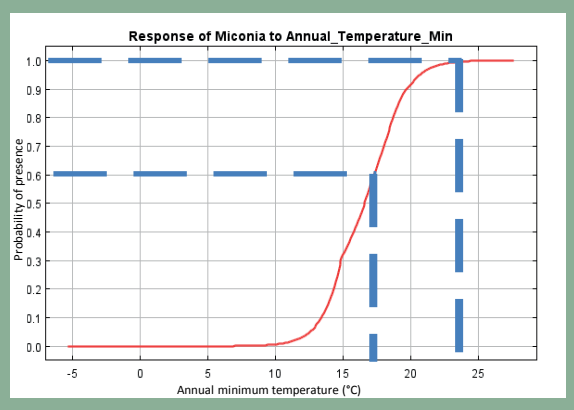


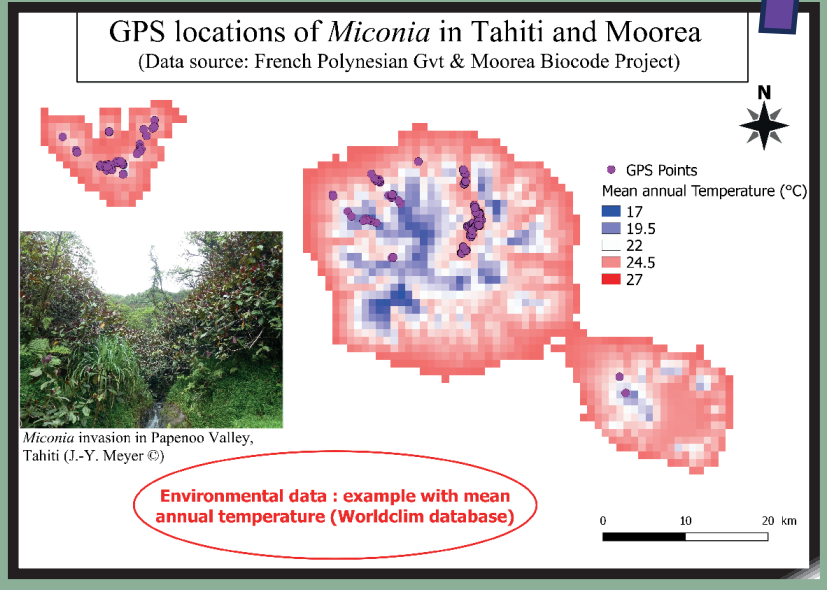
Results 1: *Miconia* potential distribution maps in the Marquesas were produced by projecting climatic variables from Central America, Australia, the Hawaiian and the Society Is., first separately then all together. Rainfall is making the greatest contribution to models for all regions except the Society Is. (see graph below).



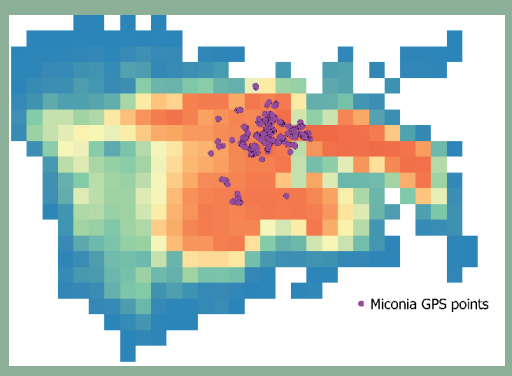


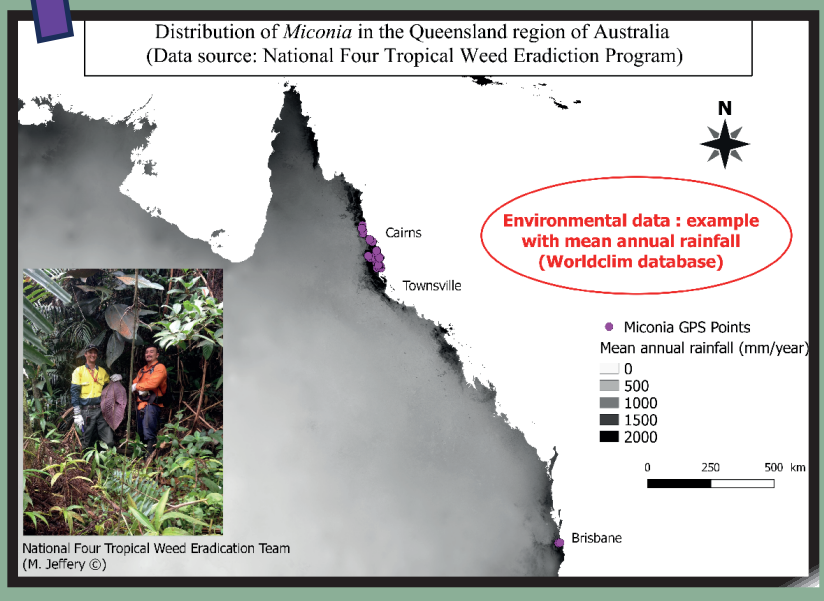
Results 2: The *Miconia* environmental envelope (« ecological niche » *sensu* Warren 2012) has been identified using all available databases. It indicates a lower temperature limit of 17°C and a lower mean annual rainfall limit of 1500 mm/year. The model performed with all regions gives a probability of *Miconia* presence of 60% at 17°C, reaching 100% at 24°C (see graph below).





Conclusion 1: The best predictive model for the Marquesas is the one built from all regions together that gives an AUC of 0.97 and where 97% of current *Miconia* occurrences in Nuku Hiva have a habitat suitability > 0.75 (see figure below).





Conclusion 2: The predicted maps consistently confirm that *Miconia* has the potential to spread over a large area of native lowland rainforest and montane cloud forest in Nuku Hiva unless appropriate control strategies are rapidly adopted. Because most islands where *Miconia* is still absent in the Marquesas (Ua Huka, Ua Pou, Hiva Oa, and Tahuata) appear potentially suitable for the species, biosecurity measures should also be strengthened.

Future prospects: Our next step is to perform MAXENT modelling with topographic variables extracted from fine scale (< 100 m²) digital elevation models which might be more reliable than climatic variables at relatively coarse resolution (1 km²) with uncertainties on remote oceanic islands (Hijmans *et al.* 2005). The final model could be applied to better predict the potential distribution of *Miconia* in other tropical islands and countries where it has been introduced (e.g. New Caledonia, Sri Lanka, Papua New Guinea) or where it is still absent, and a similar approach could be developed for other invasive alien species.

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