

# Mobility of active coastal dune system in Victoria, Australia: An example from Cape Woolamai

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## Background

Dunes can be completely mobile to fully vegetated (Fig.1). Most often, they are characterised by both mobile and stable dunes co-existing under the same climate conditions. This has been termed bi-stability.

Dune mobility can be described by a wind-vegetation relationship (Fig.2). That is sand will move when wind is high

and vegetation is sparse. Stabilisation will occur when wind power decreases and vegetation increases,. Once the dunes are fixed, a much higher wind is needed to remobilize them than would be needed to shift bare sand.

Human activities and climate are critical in moderating this balance between wind and vegetation cover.

**This study explores historical dune mobility in Victoria**

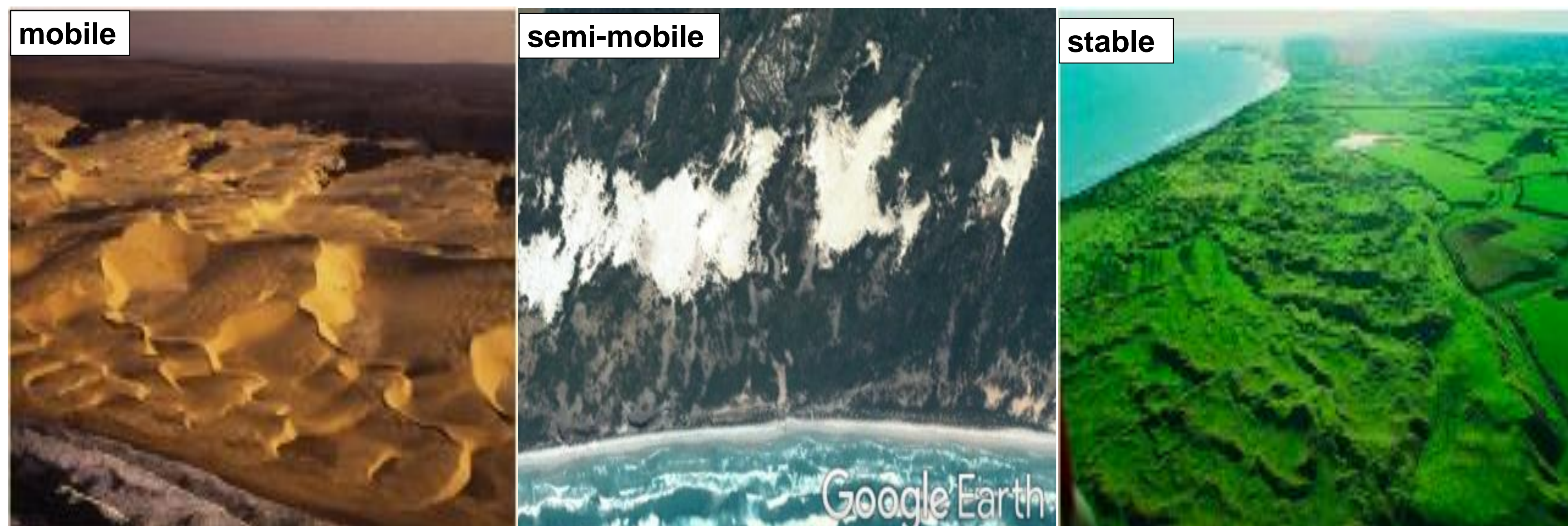


Fig.1 Different states of coastal dune mobility

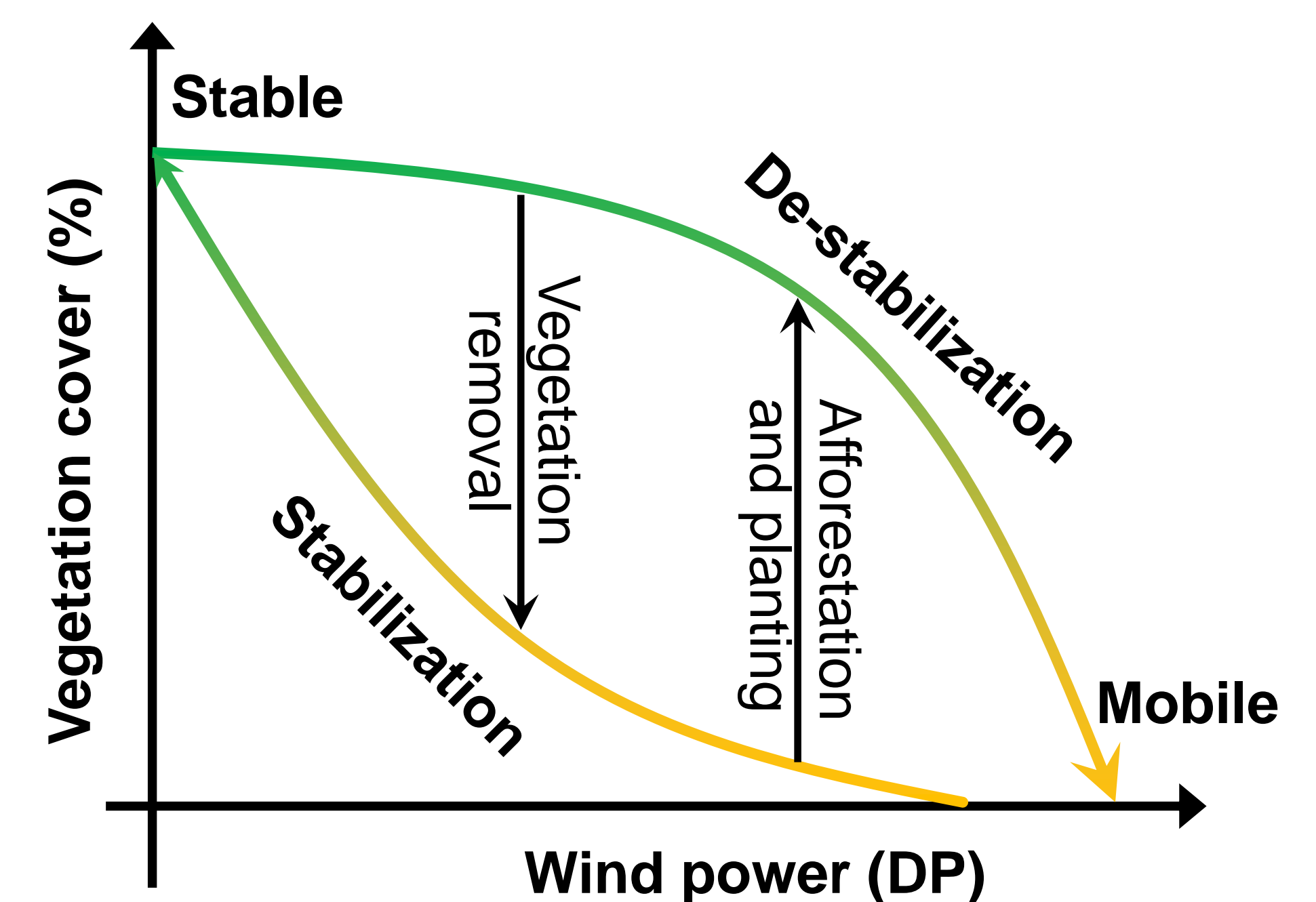


Fig.2 Hysteresis curve of dune mobility changes (Modified from Tsoar, 2005).

## Materials and methods

Aerial photos from 1930s/ 1940s and satellite images were used to identify dune mobility changes. Specifically, supervised classification based on ArcGIS were conducted to classify bare sand and vegetation in

different years. Long term reanalysed meteorological data (e.g., rainfall, temperature and wind) and coastal management histories (e.g., grass planting) on dunes were also analysed to compared with the GIS results.



Fig.3 Historical aerial photos in one case study site in Victoria -- Woolamai (a-1939; b-1977; c-1998; d-2010; e-2017).

## Results and discussion

Dunes in Woolamai were experiencing stabilization during last from 1939 to 2017, with the most significant change were observed during 1977-1998 (Fig. 4).

An increasing trend were observed in rainfall and temperature during last century, while two decreasing phases were observed in wind speed (Fig.5).

Besides, a dune stabilization program was conducted in Woolamai dunefield during 1976-1988, which considered to cause the dune to a basically stabilized condition (Fig.5).

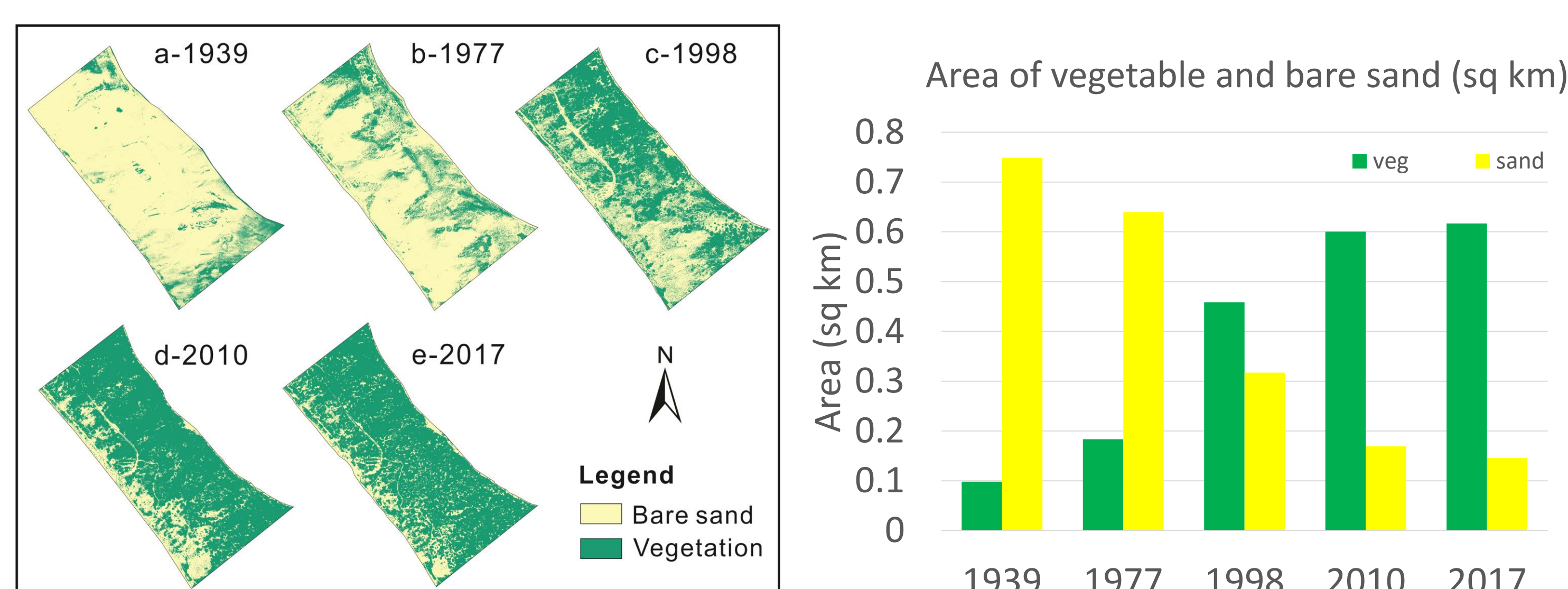


Fig.4 Changes of bare sand and vegetation in Woolamai

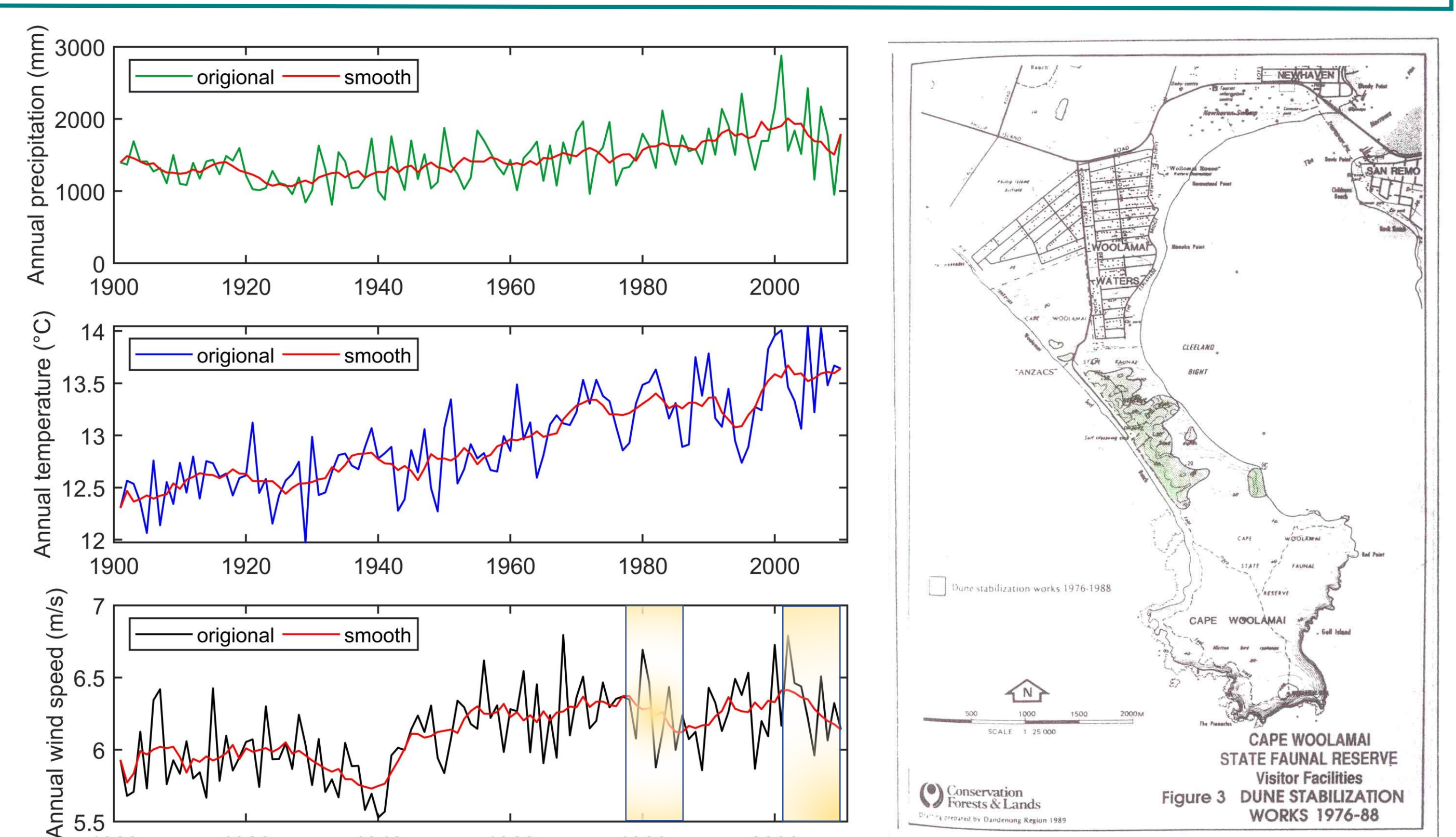


Fig.5 Climatic changes (left) and human planting (right) in Woolamai

## Conclusions

- 1.The Woolamai dune are stabilizing between 1939-2017;
2. Grass Planting from 1976-1988 is the main reason for stabilization;
- 3.Climate factors (increase in rain and temperature, and decrease in wind speed) may also contribute to the success of the dune stabilization program.

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