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## Thermoregulation of Radiated Tortoises in an Altered Landscape in Madagascar

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### Abstract

The radiated tortoise (*Astrochelys radiata*) is an endemic species of southern Madagascar. It is classified as Critically Endangered according to the IUCN Red List of threatened species. Forest degradation, deforestation and subsequent livestock grazing or agriculture result in an increase of ambient temperature ( $T_a$ ) in the species' native habitats. Ambaro, a degraded zone located at the North-eastern border of Tsimanampetsotsa National Park, was selected as a study site to understand the responses of tortoises to thermal stress imposed by changes in habitat characteristics due to changes in land use management. We studied the contributions of alteration in daily activity, behaviour and microhabitat utilisation for the regulation of body temperatures ( $T_b$ ) in *A. radiata* in relation to changes of  $T_a$ . Our results showed a bimodal daily activity pattern of tortoises. The morning activity was characterised by frequent changes of burrows, while the afternoon activity was related to searching food. Throughout the day the tortoises maintained relatively stable  $T_b$ . Thus, animals limited their activity time and remained inactive in their refuges most time of the day. The tortoises preferred partially shaded microhabitats with a substrate covered by leaf litter and thus thermoregulated so that  $T_b$  stayed consistently below  $T_a$ , especially during the hot midday conditions. Since the rigid thermoregulatory behaviour suggests a vital role of  $T_b$  for proper maintenance, we suggest that conservation of the intact spiny forest ecosystem is important for the reproduction and survival of the species in the long run.

**Keywords:** *Astrochelys radiata*, body temperature, Madagascar, radiated tortoise, spiny forest, thermoregulation, Tsimanampetsotsa National Park