

# Climate change and threats to species: lessons and experiences from land use change in forest reserves

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# Outline

- Our project
- What we know so far:
  - temperate and tropical systems
- The problems encountered during our project
- Moving forward?

# 1. Our project

*Title:* Predictive tools for targeting conservation effort in Bornean forest reserves

## *Personnel*

University of York

University of Leeds

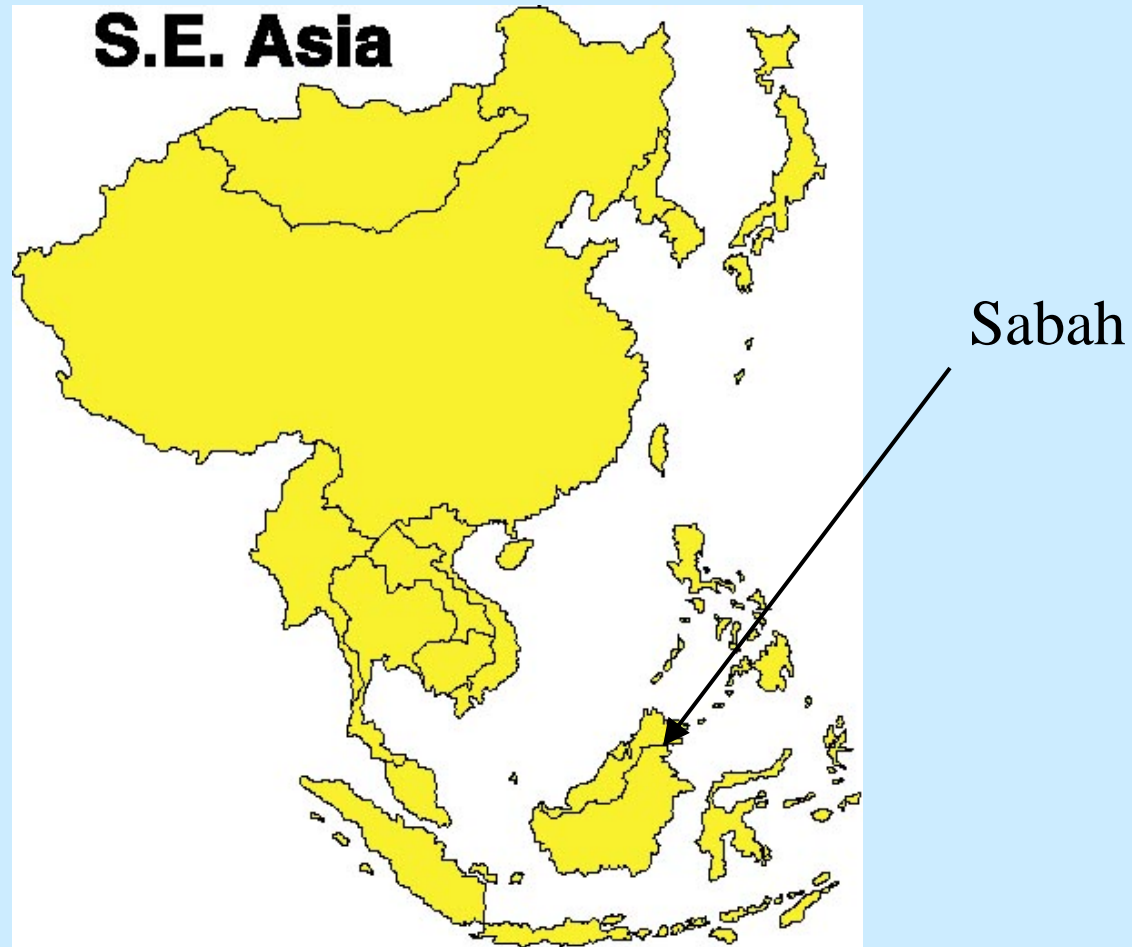
Universiti Malaysia Sabah

Forest Research Centre, Sabah

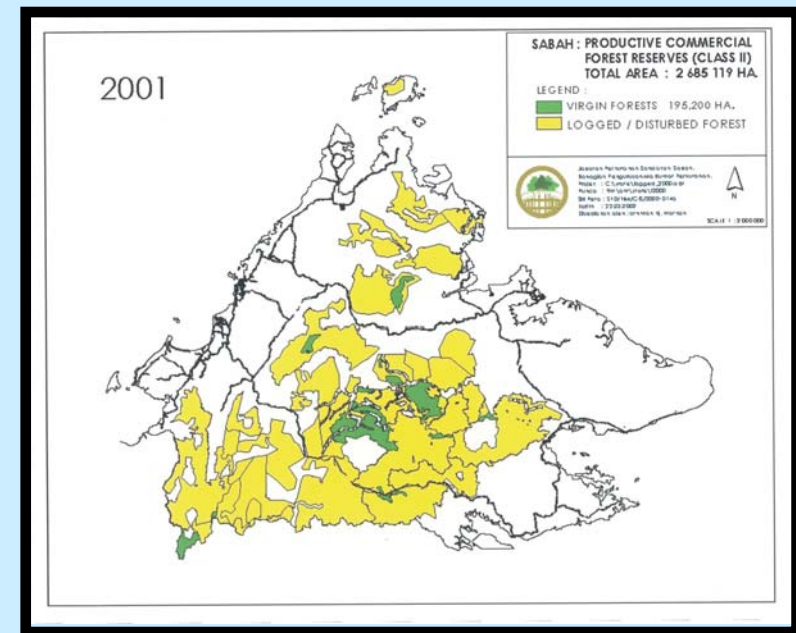
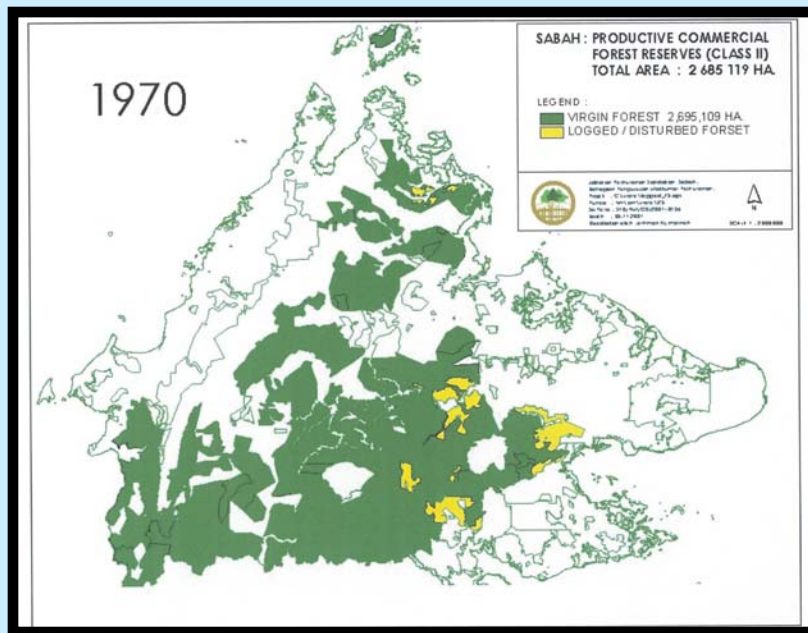
*Darwin Fellows;* Dr Suzan Benedick, Mazidi Abd. Ghani



# Study area: State of Sabah (Malaysian Borneo)



In Sabah, large areas of undisturbed forest have been cleared or selectively logged. Some forest areas are preserved, but their biodiversity value is poorly understood.



# Project aims

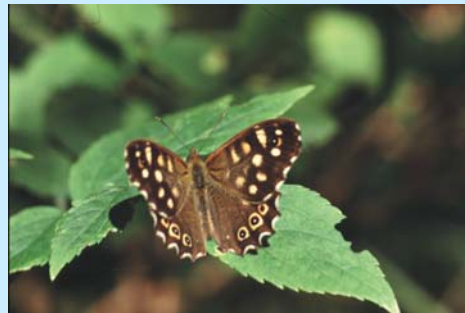
- To prioritise the conservation value of existing reserves and to assess the likely impacts on conservation value of future land-use and environmental changes.

## **Methods**

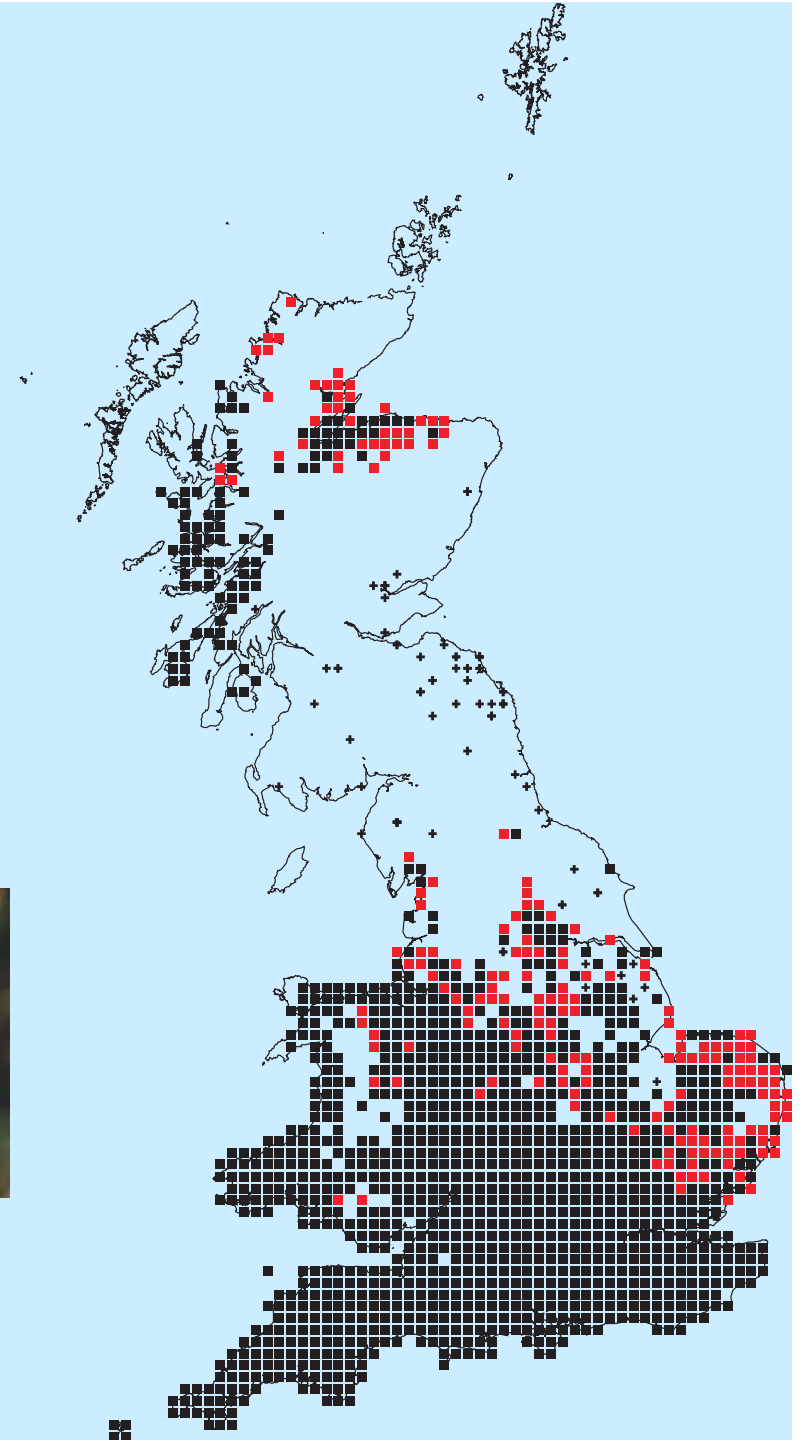
- Collate existing data on distributions of forest butterflies
- Predict species' distributions across Borneo in relation to climate
- Quantify the biodiversity value of existing reserves
- Examine how changes in the size of existing forest affects the conservation value of remaining reserves

# What we know:

- In **temperate** regions we know that species have responded to climate warming by shifting their **distributions** and altering the timing of events (**phenology**)

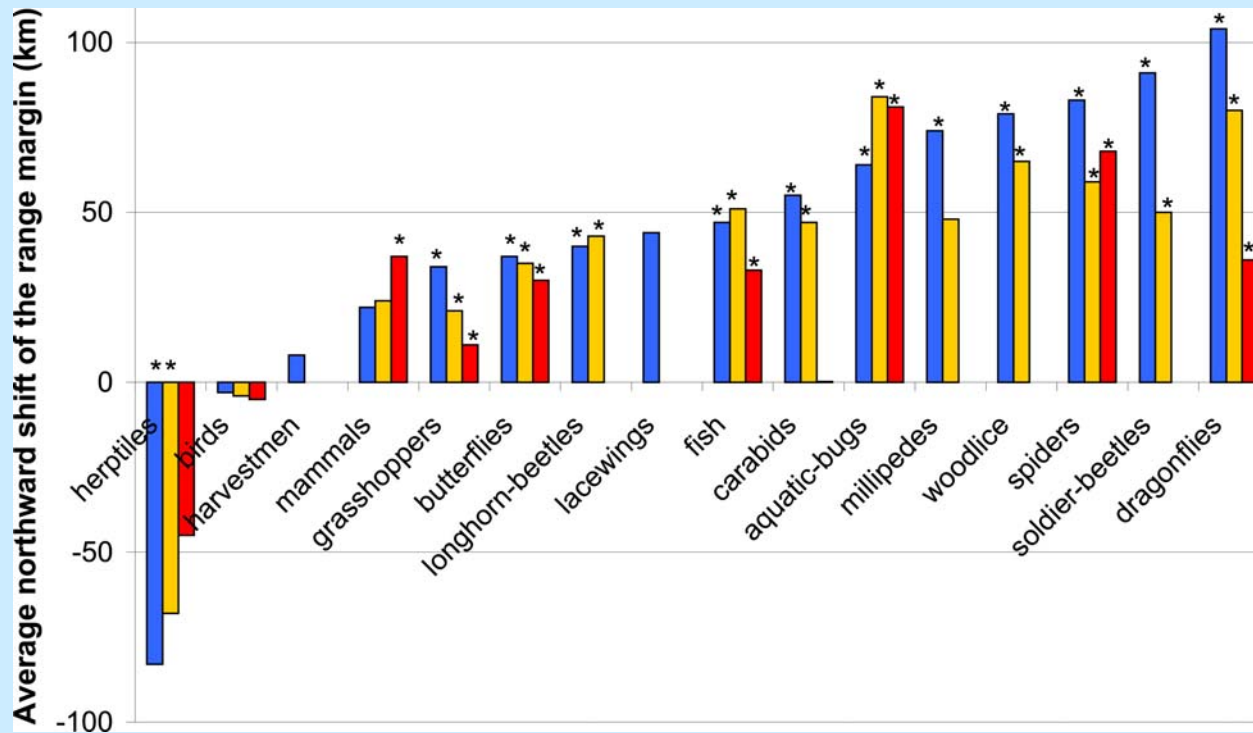


Climate-driven range expansion in the speckled wood butterfly, *Pararge aegeria*  
Hill *et al.* 2002 *Proc Roy Soc*





# What we know:



- In **temperate** regions, range expansions are evident in many taxa, not just cold-blooded organisms

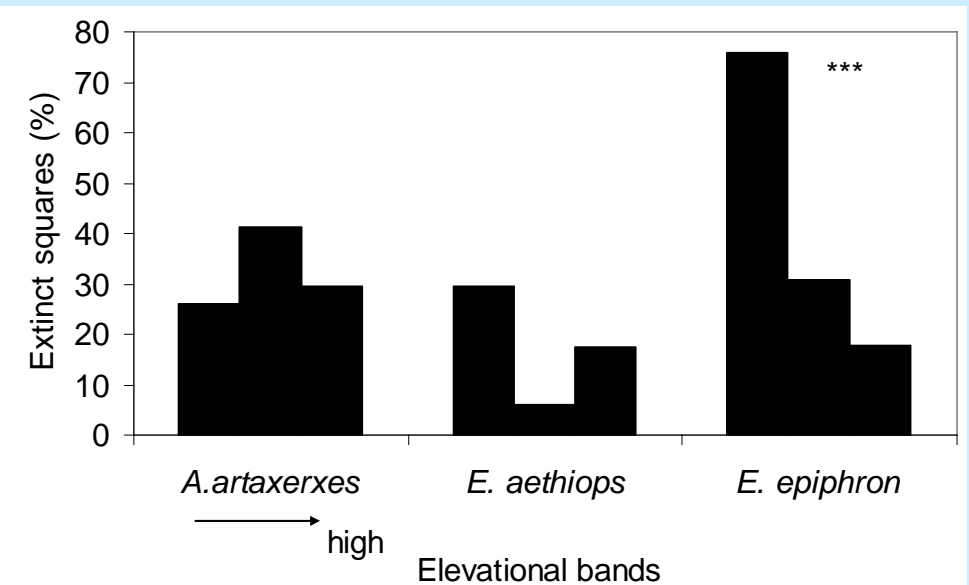
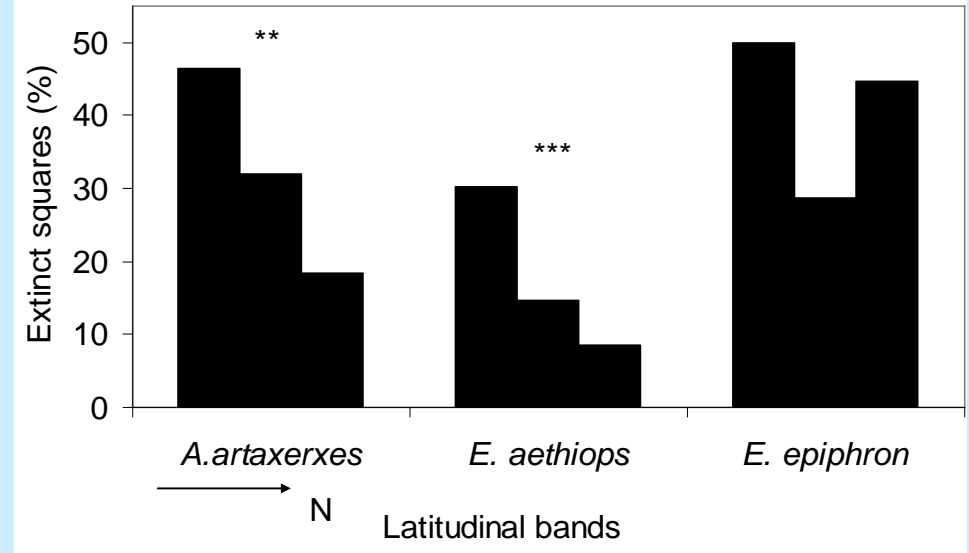
Hickling *et al.* 2006 *Global Change Biol*



# What we know:

- In **temperate** regions, range retractions and local extinctions are driven by climate warming.

Franco *et al.* 2006 *Global Change Biol*

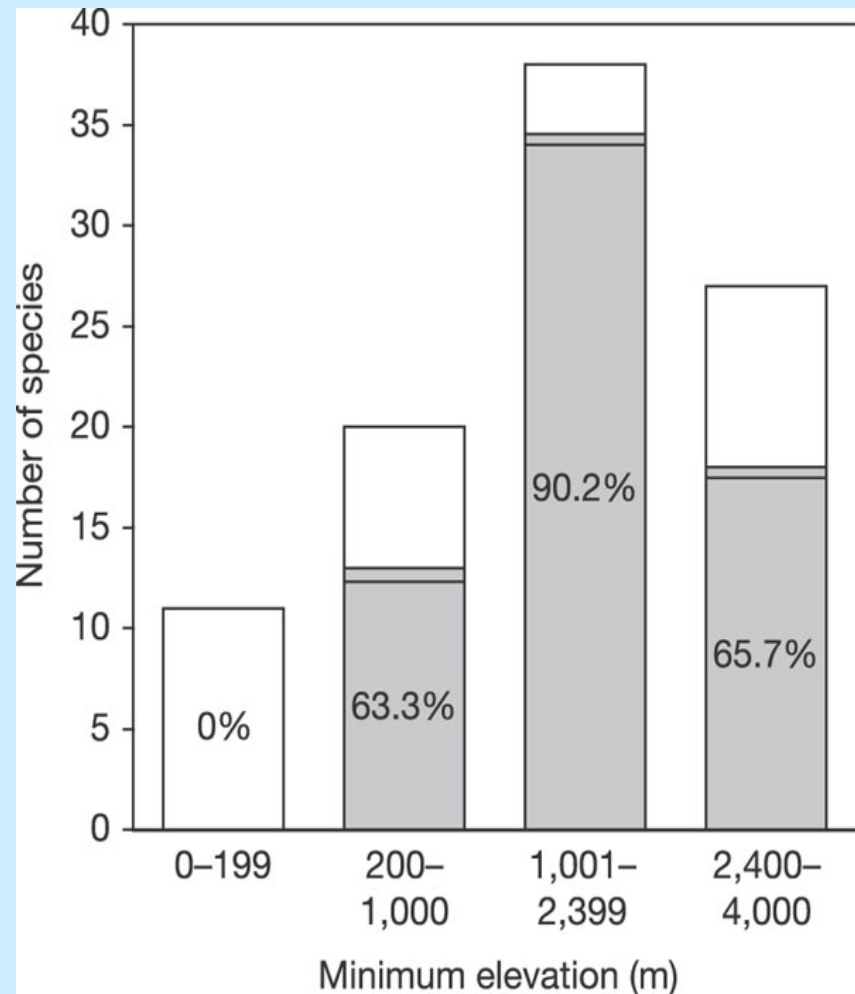


# What we know:

- In **tropical** regions, species are **shifting** up-hill and going extinct due to climate-driven increase of **disease**

Gray bars show losses of amphibians (*Atelopus* spp) at different elevations due to disease

Pounds *et al.* 2006 *Nature*



# What we know:

- In **tropical** regions, climate warming may have strongest effects on **precipitation** and extreme events (e.g. **ENSO** events)

Butterflies on Borneo were severely affected by the 1997-98 ENSO event, but then quickly recovered. Approx. 17 months after the drought, butterfly numbers were back to pre-drought levels.

Hill *et al.* 2003 *J Tropical Ecology*

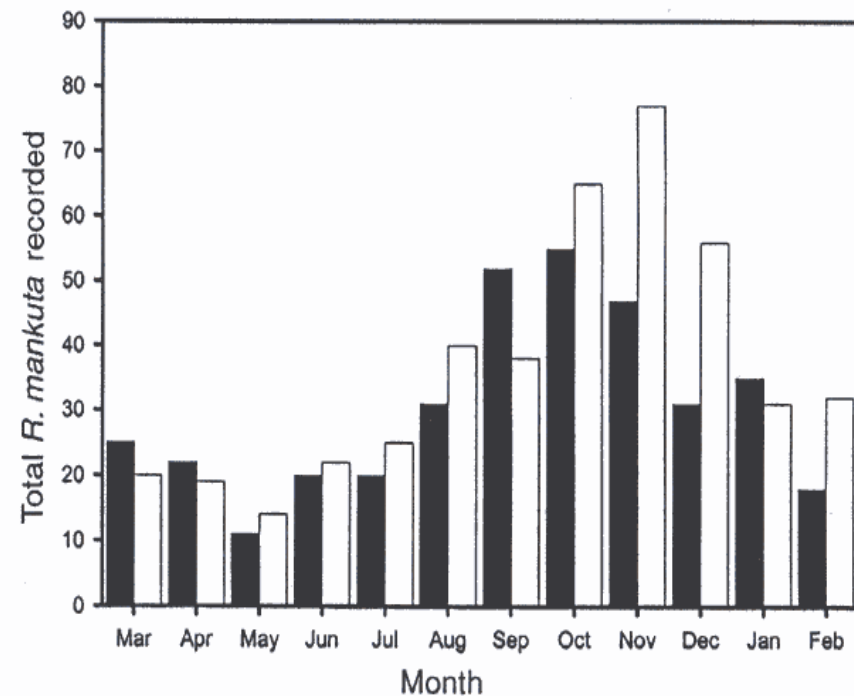


Figure 1. Total numbers of *Ragadia mankuta* recorded at 80 observation stations on four transects in unlogged (solid bars) and selectively logged (hollow bars) forest from March 1999 until February 2000.

# What we know:

- **ENSO** events on Borneo usually lead to forest fires.

Butterflies on Borneo were severely affected by forest fires following the 1997-98 ENSO event, but quickly recovered. Species with restricted geographical ranges, with more specialist larvae, and with low initial abundances were less likely to return after the fires.

Charrette *et al.* 2006 *Ecology*



*Mycalesis kina* – endemic to Borneo.

# The problems

- How important is climate warming *versus* habitat destruction for tropical species? Are there interactions between climate and habitat loss?
- Which species/regions will be most affected?
- What about the relative importance of direct *versus* indirect effects of climate?
- How do we incorporate climate impacts into practical conservation management?

# The problems encountered in our project

- Difficulties in working at large biogeographical scales - failure to communicate among different countries
- Long-term data and ecological information about species are lacking – insufficient resources and no data repositories
- Impacts may be unpredictable e.g. fires following drought
- Currently protected areas may not conserve species of concern in the future – ‘corridors for life’

# Moving forward...

1. Now widespread consensus about climate change impacts
2. There's still time for mitigation – lags in system
3. Habitat loss is probably still the most immediate threat to species
4. Appreciation of scale of climate-change impacts comes from fine-scale distribution data – these are lacking in the tropics and are urgently need.

