Distribution Patterns of Amphibians and Reptiles in Northern Highlands of Madagascar: Response under Global Climate Change

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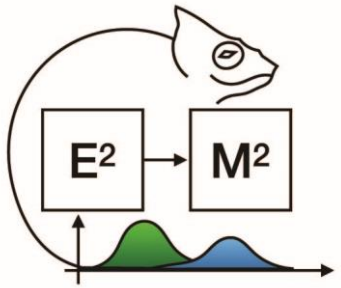
- **Background**: Global Climate Change (GCC) consists of a multitude of drivers causing an unprecedent change of species distribution in Madagascar (Raxworthy et al. 2008)

- **Statistical question**: what are the changes in altitudinal range of amphibians and reptiles in Northern highlands of Madagascar over the last 30 years?

- **Dynamical question**: Can changes in altitudinal range affect the acoustic complexity index of frogs across years?



Acknowledgments:
Fandresena
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- **Statistical question**:

  What are the changes in altitudinal range of amphibians and reptiles in Northern highlands of Madagascar over the last 30 years?

- **Hypothesis**:

  There is no significant difference between the changes in the altitudinal range of each species of amphibians and reptiles.

- **Response variable:**

  Presence and absence of the species in each altitudinal range.

- **Predictor variable**:

  Annual rainfall, temperature, hygrometry, altitude, year.

- **Family**: binomial

- **Link**: logit

R Code:

```
glmer (presence/absence~temperature + rainfall +
hygrometry + altitude + taxa +(1|years),
family="binomial", data=Mydata_taxa)
```

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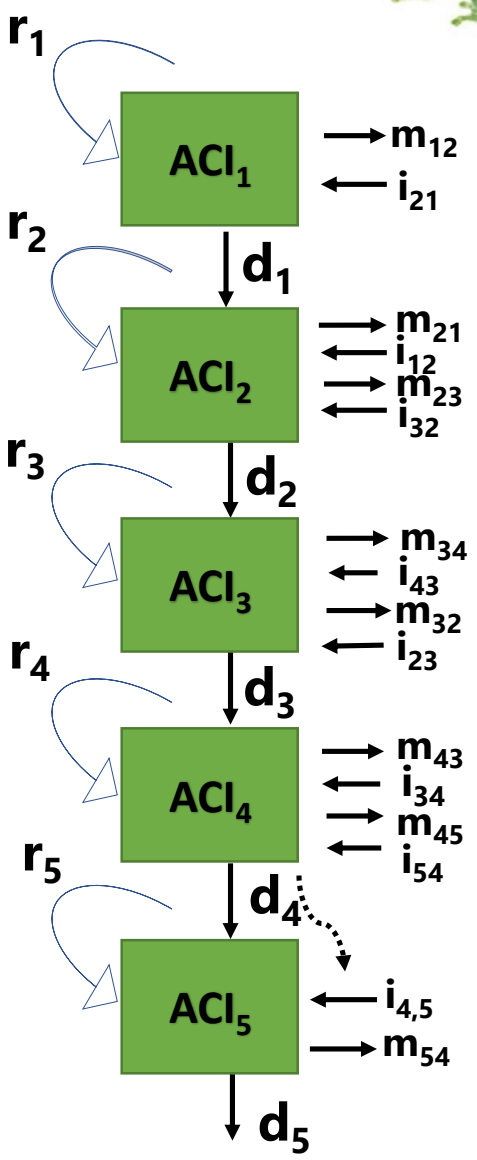
- **Mechanistic question**:
  Can changes in altitudinal range affect the Acoustic Complexity Index (ACI) of frogs across years??

States:	Process:
ACI: Acoustic Complexity Index	r: Birth rate of the Frog d: death rate i: immigration m: migration



- **Equation:**

$$\frac{dACI_1}{dt} = r_1 ACI_1 - d_1 ACI_1 - m_1 AIC_1 + i_{21} ACI_2$$

$$\frac{dACI_2}{d_t} = r_2 ACI_2 - d_2 AIC_2 - m_{21} ACI_2 + i_{12} ACI_1 + i_{32} ACI_3 - m_{23} AIC_2$$

...

...

for $\sum_{i=1}^{5}$

$$\frac{dACI}{dt} = r_i ACI_i - d_i ACI_i + m_{(i-1)} ACI_i - i_{i(i-1)} ACI_i - i_{(i(i-1))} ACI_i + m_{(i-1)} ACI_{i+1}$$

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Next step:

- Collect more data in the other massifs in the northern massif of Madagascar and set up data logger for long-term study.
- Museum analysis for taxonomic purposes in Malagasy and Germany Institution
- Analyzing, drafting and submitting paper (by September 2020)

Misaotra

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