

Collections: Baseline data on the Past, Present, and Future





ATBP

African Tropical Biodiversity Program 2004 Reunion, Makerere University





Programme Biodiversite des Ecosystemes Aquatiques et Terrestres dans Le Rift Albertin (P-BEATRA)

Field Training



Biodiversity Inventories

Station Revitalization



Graduate Student Support



Public Outreach Materials



Support from the John D. and Catherine T. MacArthur Foundation

Museum of Zoology, Makerere University Kampala, Uganda

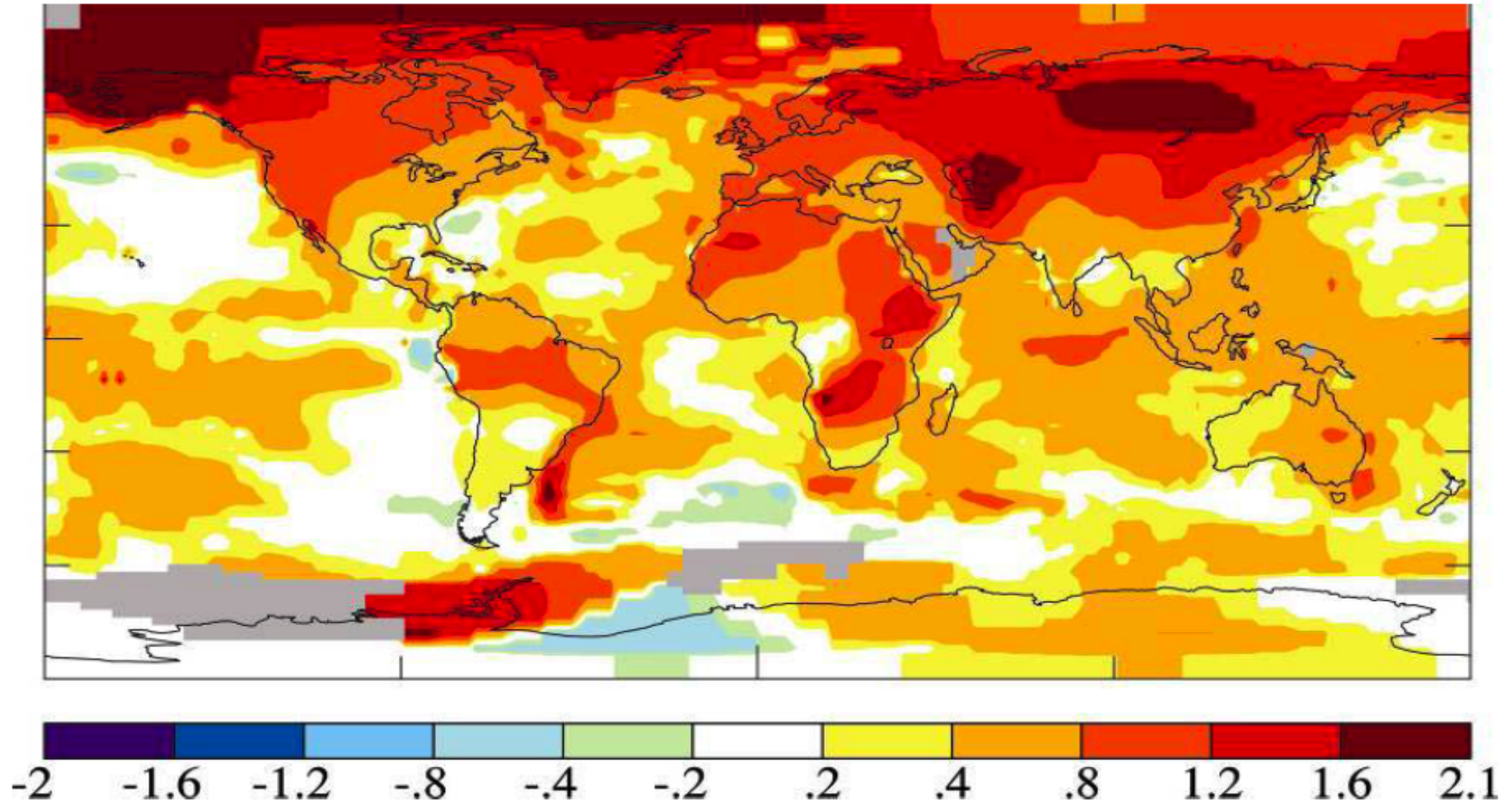


Botany Laboratory - CSRN Lwiro



The heating is not uniform geographically

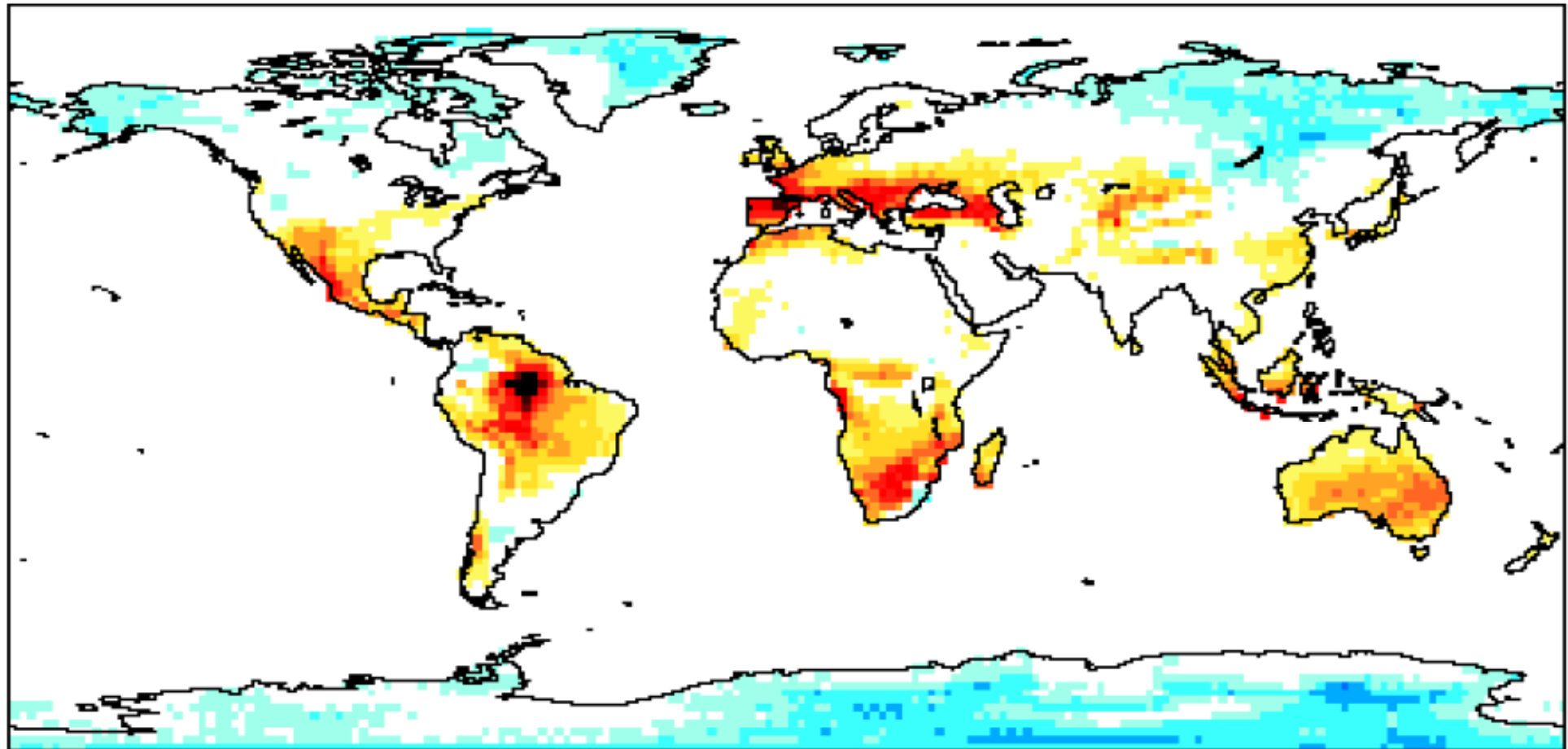
Surface T in 2001-2005 vs 1951-80, averaging 0.53°C increase



J. Hansen et al., *PNAS* 103: 14288-293 (2006)

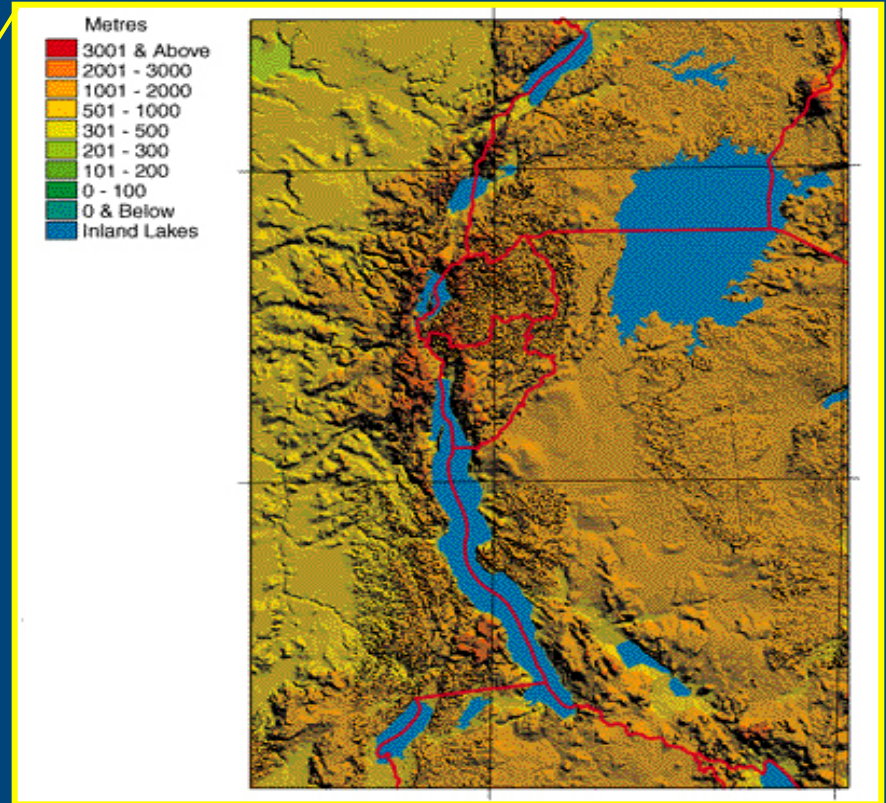
Where we're headed: droughts

Drought projections for IPCC's A1B scenario



Percentage change in average duration of longest dry period, 30-year average for 2071-2100 compared to that for 1961-1990.

The Albertine Rift





Why does evolutionary history matter?

- 1) Time is a continuum.
- 2) Because it does often repeat itself.
- 3) We may see patterns (or not), but the underlying processes are the same.
- 4) Adaptation is evolution.

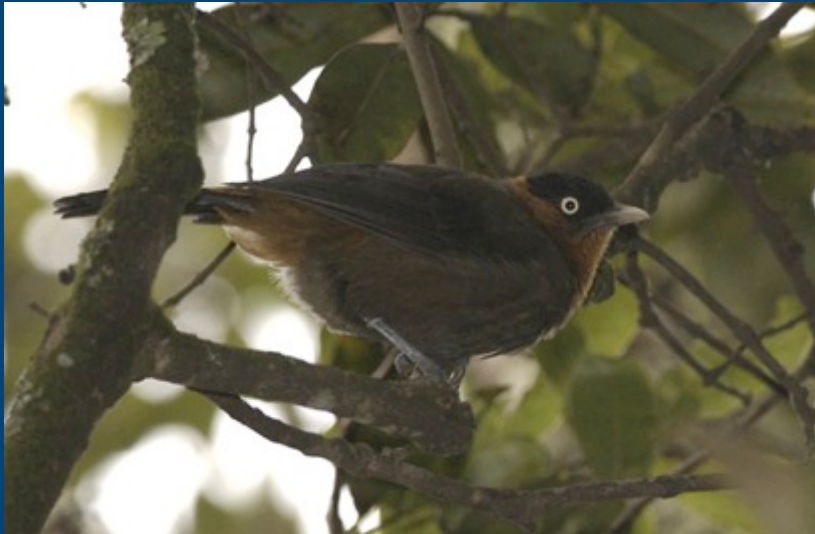
Historical Climate Change and Albertine Rift Animals

- Patterns
- Timing
- Responses at different scales
 - a) Between populations
 - b) Within populations

How have birds and small mammals responded to past climate change?

- 1) Expansions (dispersal into new areas)
- 2) Contractions (Isolation events)
- 3) Other factors:
 - a) abiotic aspects
 - b) the human factor

Presumably old lineages in the Albertine Rift



Red-chested Alethe: population structure in the an Albertine Rift endemic

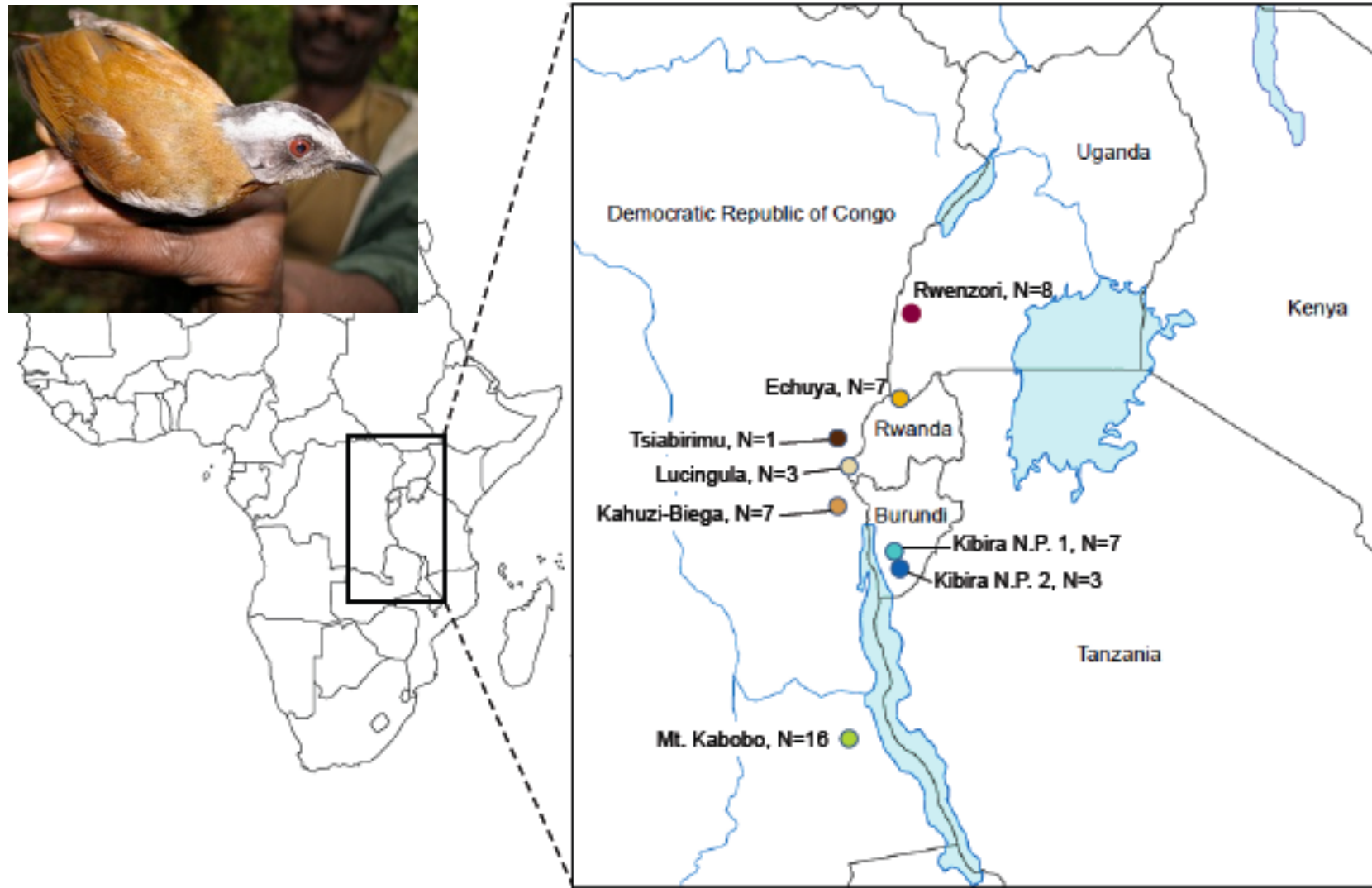
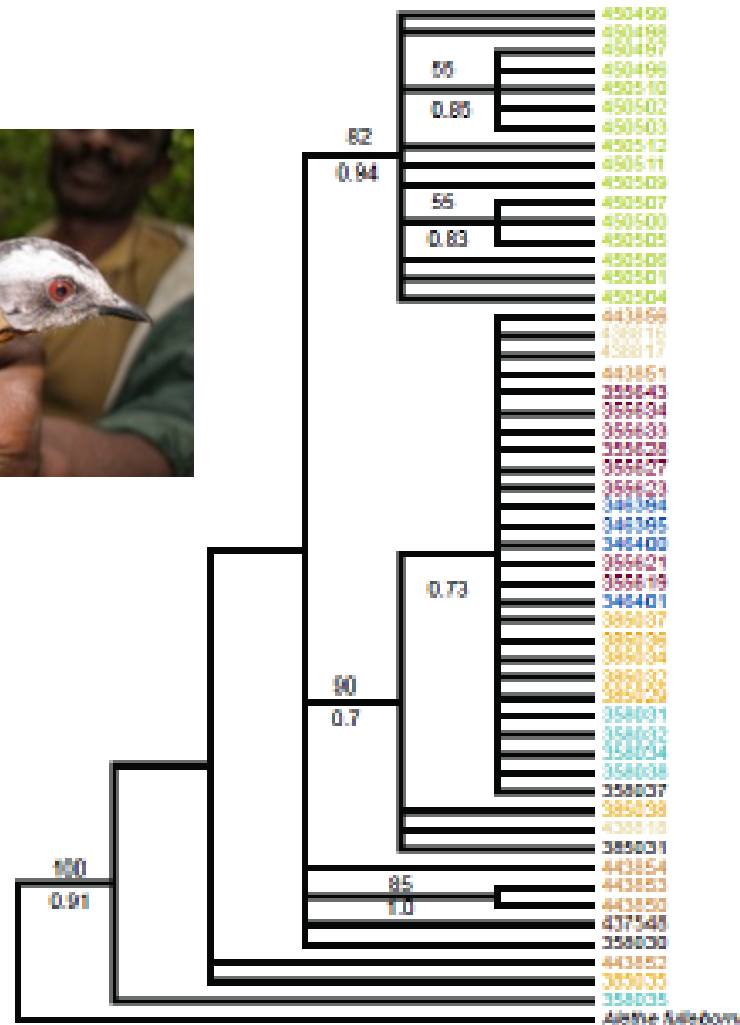


Figure 1. Inset shows close-up image of the Albertine Rift and sampling sites for specimens of *Alethe poliophrys* used in this study..

A.



- Rwenzori
- Echuya
- Tsiabirimu
- Lucingula
- Kahuzi-Biega
- Kibira N.P. 1
- Kibira N.P. 2
- Mt. Kabobo



B.

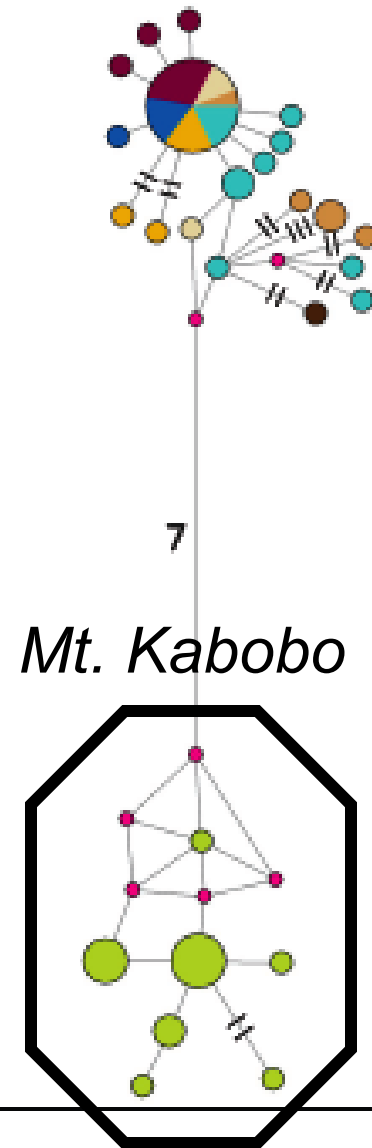


Figure 2.

A. Maximum likelihood phylogeny of mtDNA haplotypes. Numbers above nodes are ML bootstrap proportions, values below nodes are Bayesian posterior probabilities. B. Maximum parsimony haplotype network. Ellipses represent unique haplotypes and their sizes correspond to frequency of occurrence; pink dots indicate presumably missing haplotypes.

Albertine Rift study species



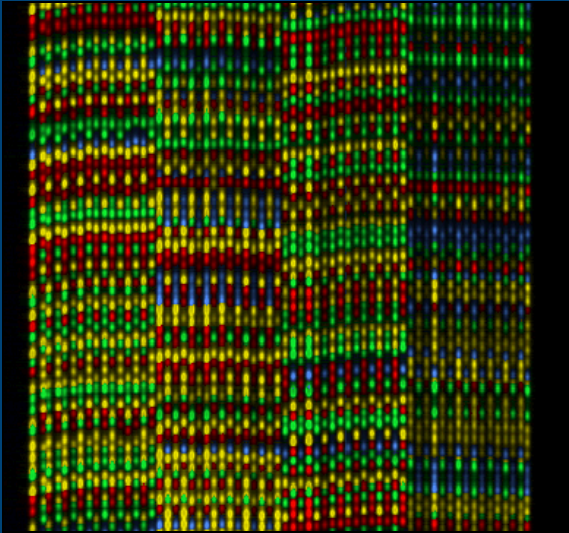
Charles Kahindo

Ph.D., 2006

Makerere University, Uganda

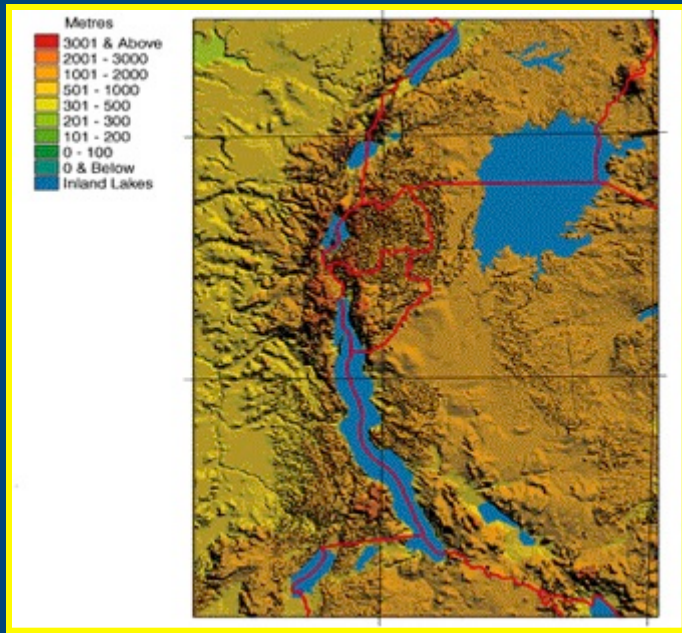
Professor, Bukavu State University

D. R. Congo



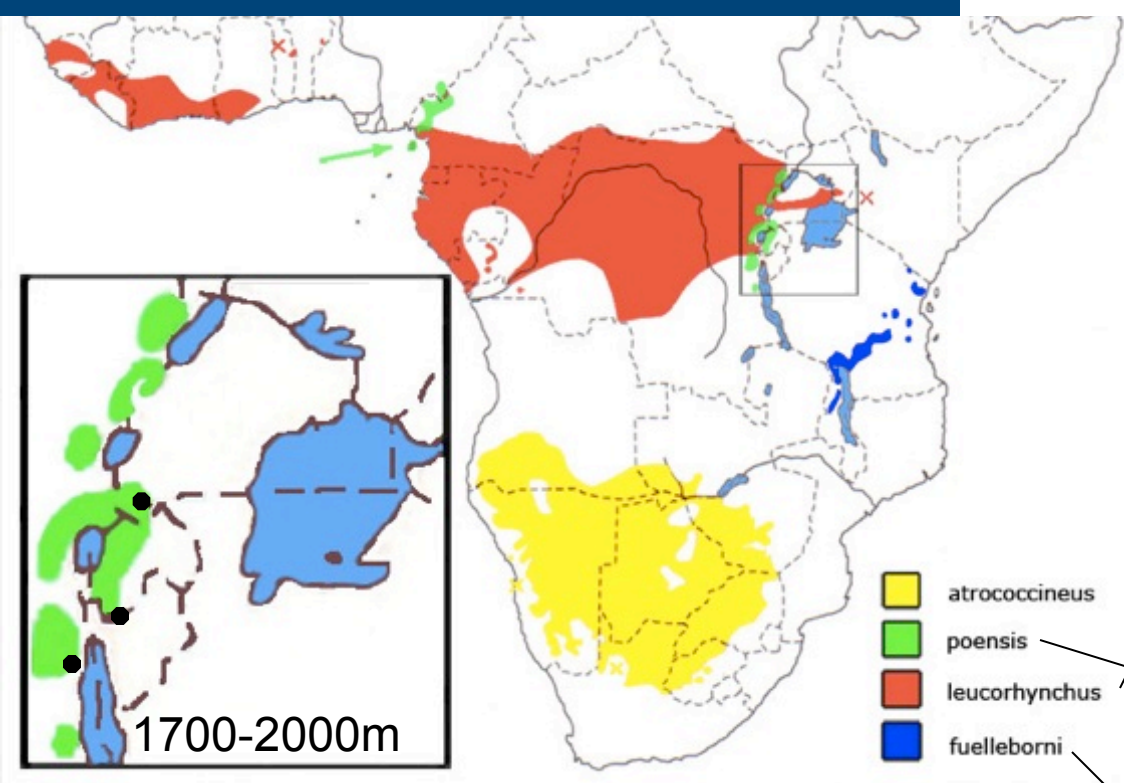
Research: Genetic
diversity in endemic
Albertine Rift warblers





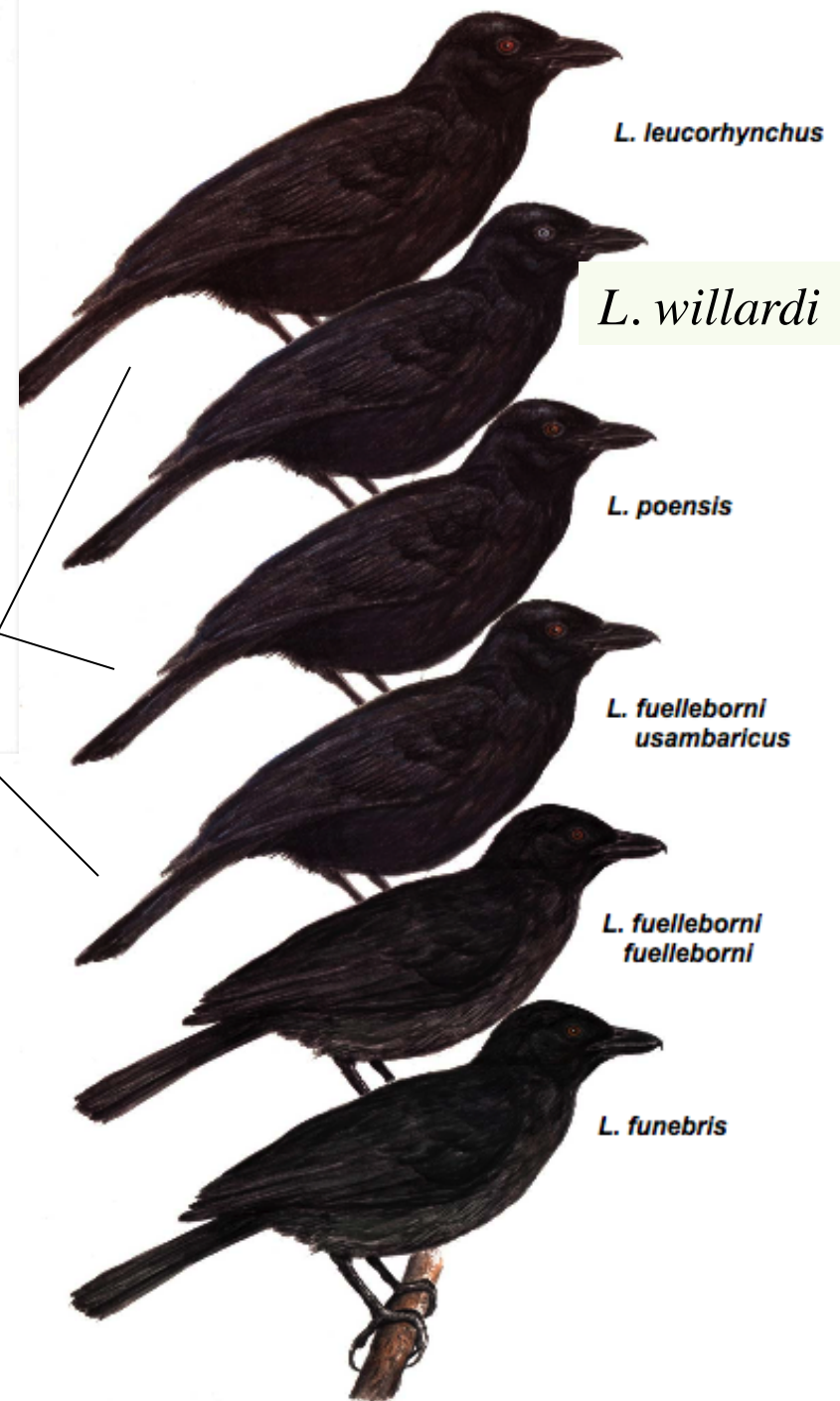
Grauer's Rush Warbler (*Bradypterus graueri*) an Albertine Rift Endemic

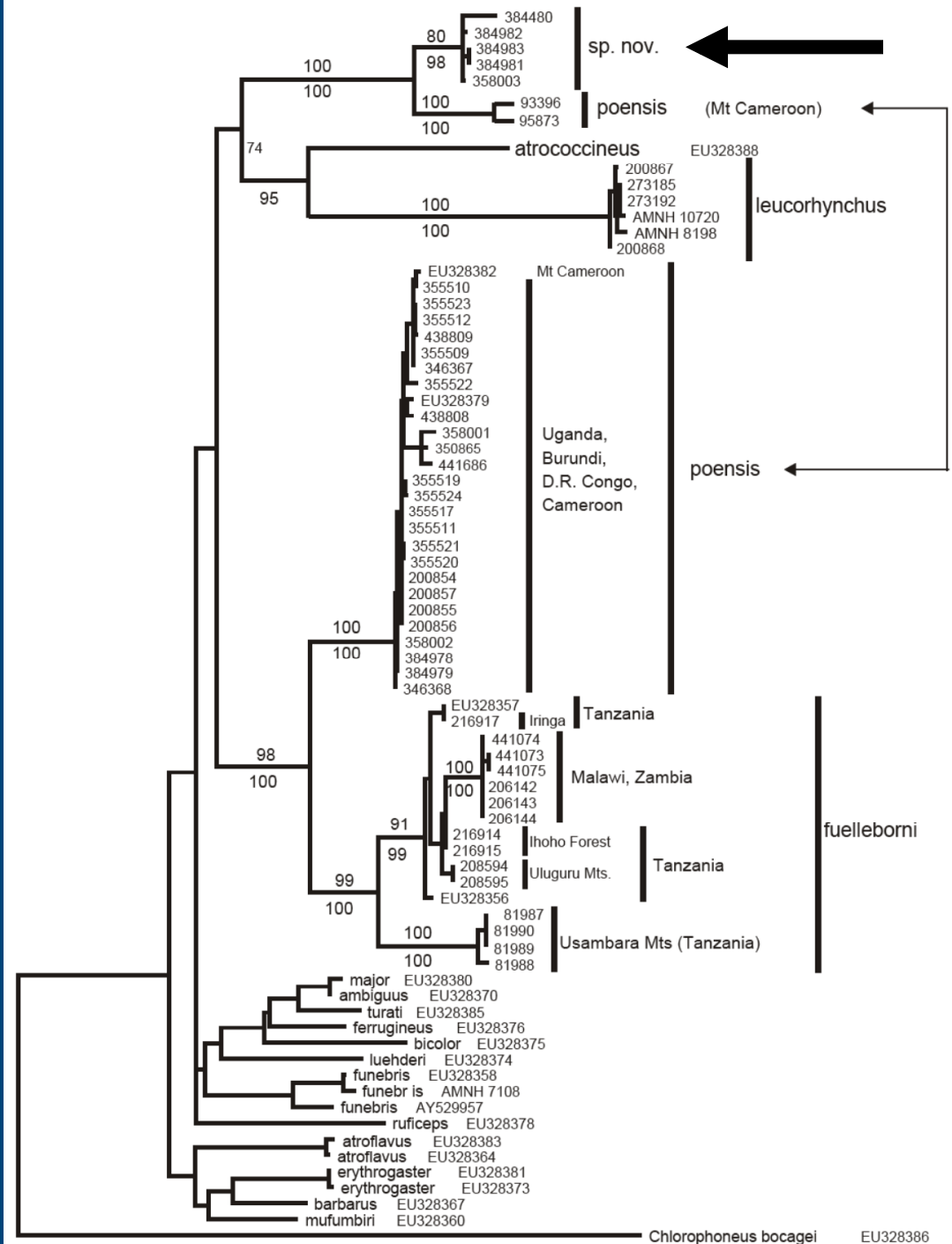
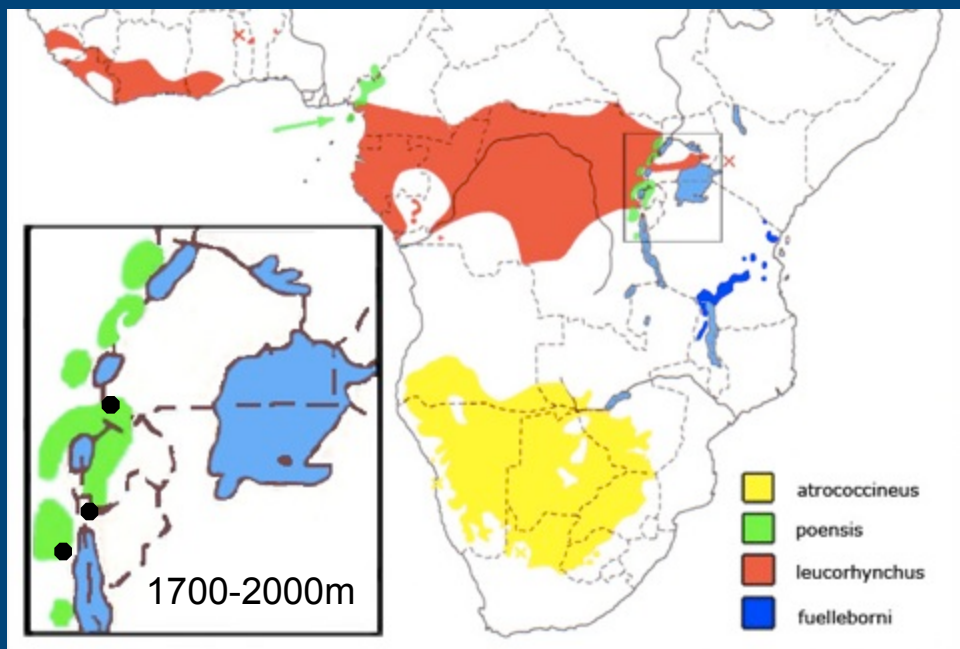




Willard's Sooty Boubou
(Laniarius willardi) a
 new species of shrike
 from the Albertine Rift

Voelker et al. 2010





Genetic	Ecol.	Geogr.	Niche
+	-/+	+	+
+	-	-/+	-

Voelker et al. 2010

MtDNA Sequence divergence benchmarks



Pan troglodytes

11% divergence



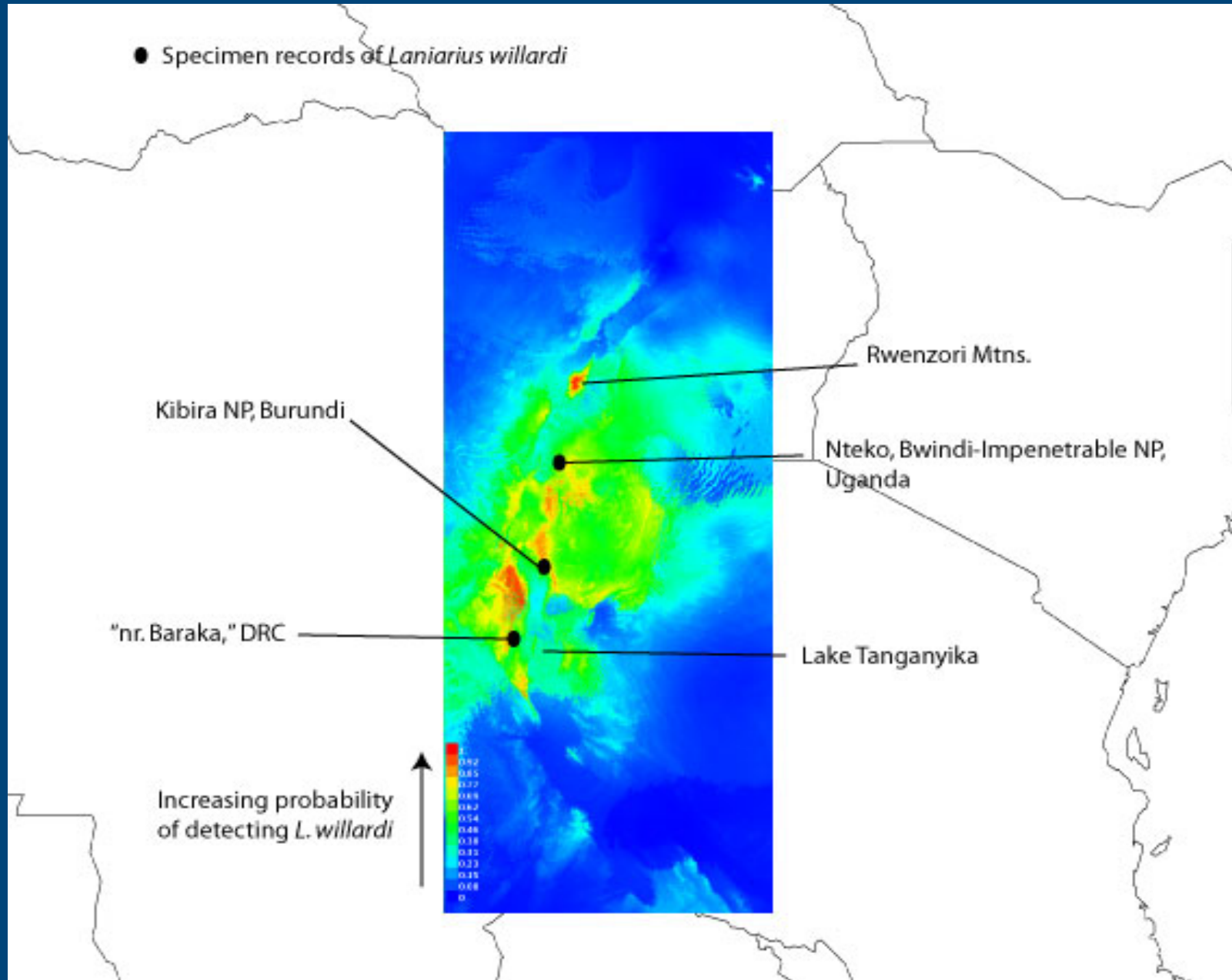
Homo sapiens

5% diverg.



Pan paniscus (Bonobo)

Niche Model under current conditions for *L. willardi*



Climate Change, Conservation, Biodiversity, Humans



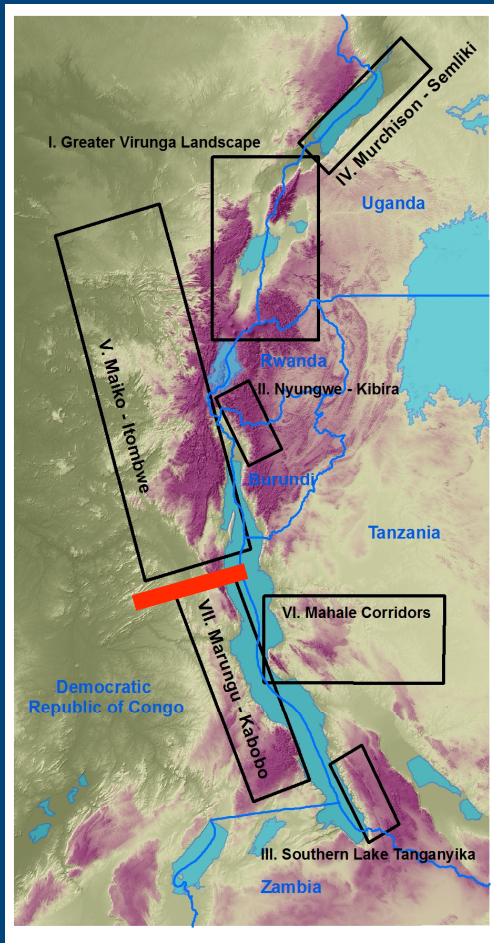
Above 2000m

Below 2000m

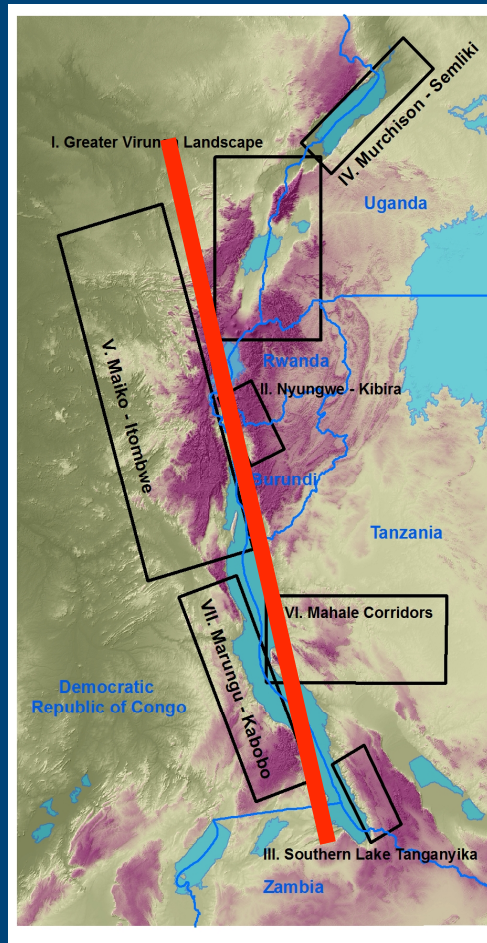


Patterns of genetic structure in some montane birds

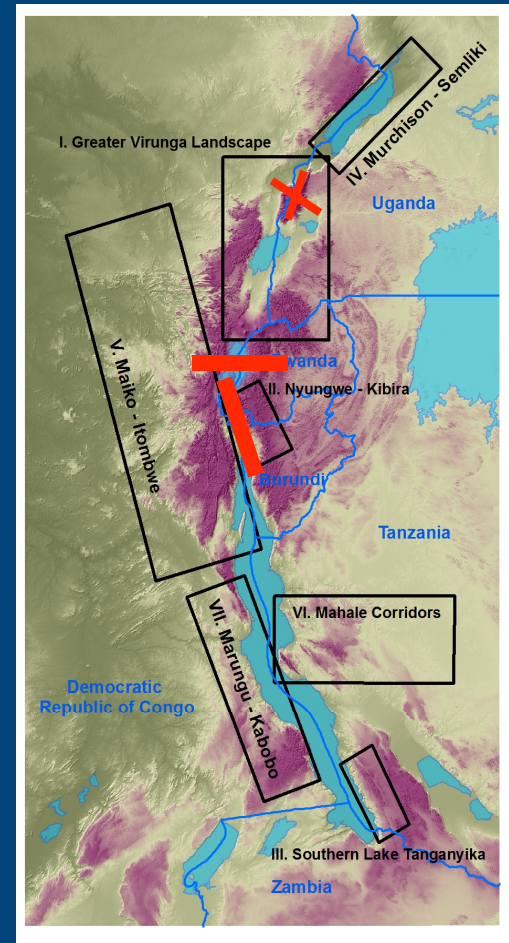
Alethe poliophrys



Psuedalcippe abyssinica

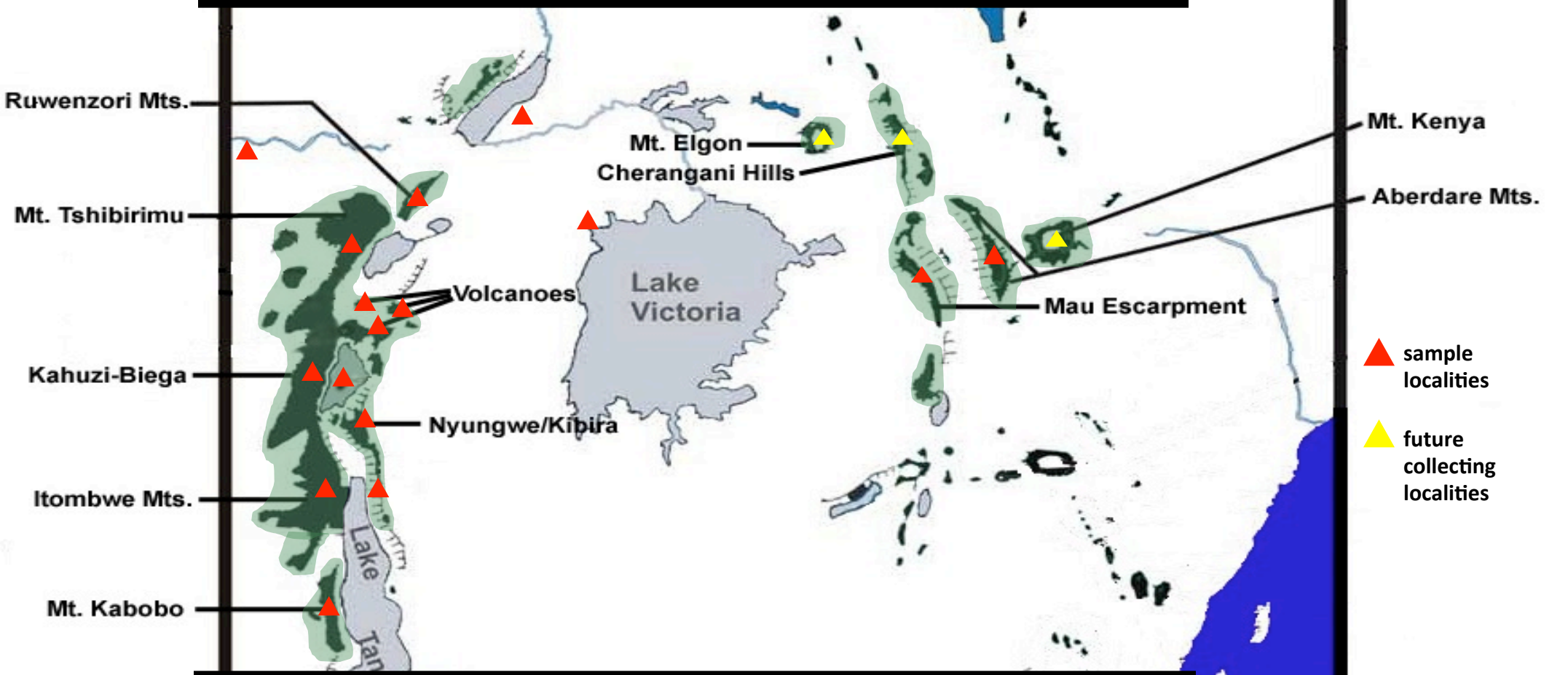


Bradypterus graueri



What about small mammals?





Sylvisorex granti
shrew

Hylomyscus denniae
“tree mouse”

Lophuromys aquilus
brush-furred rat

Graphiurus murinus
dormouse

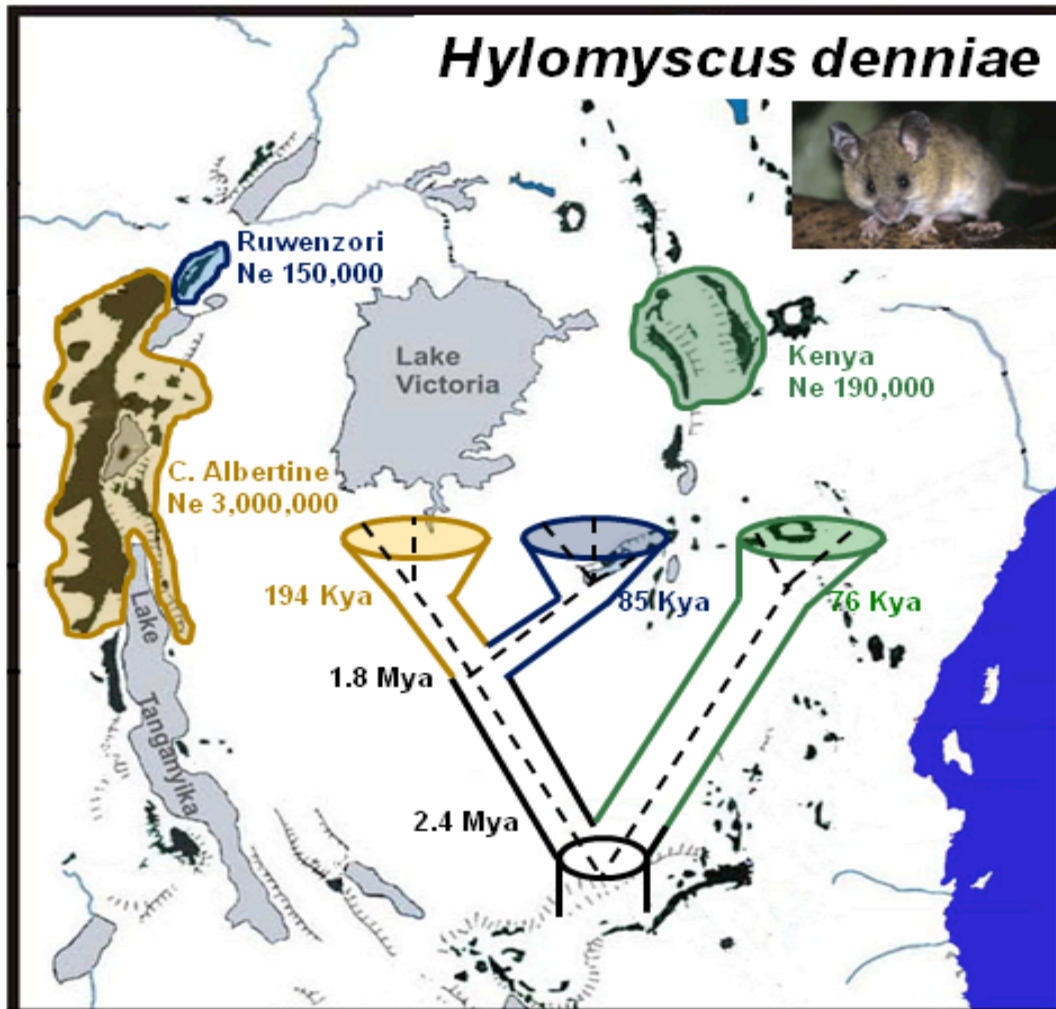
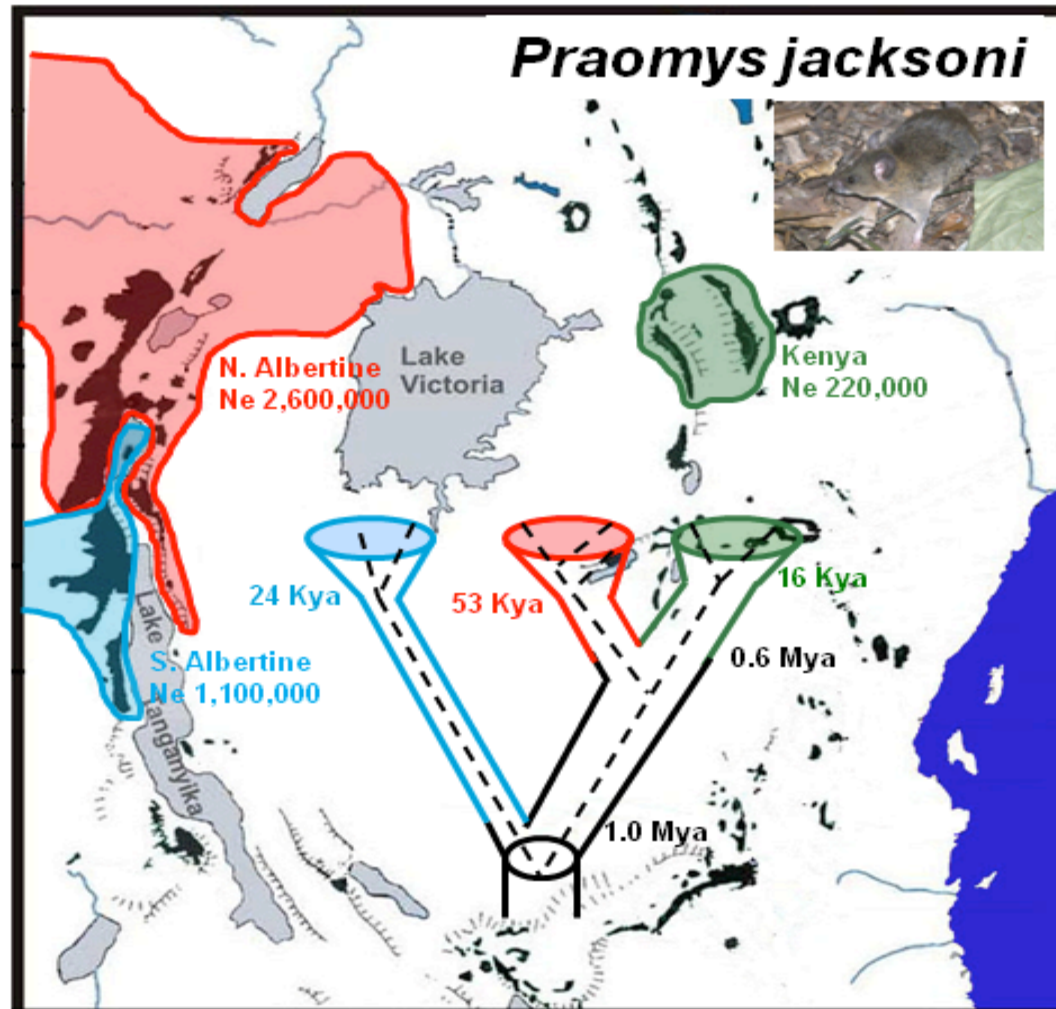
Praomys jacksoni
“ground mouse”



montane forest endemics

montane + lowland forest

Pleistocene history of co-distributed Afromontane rodents

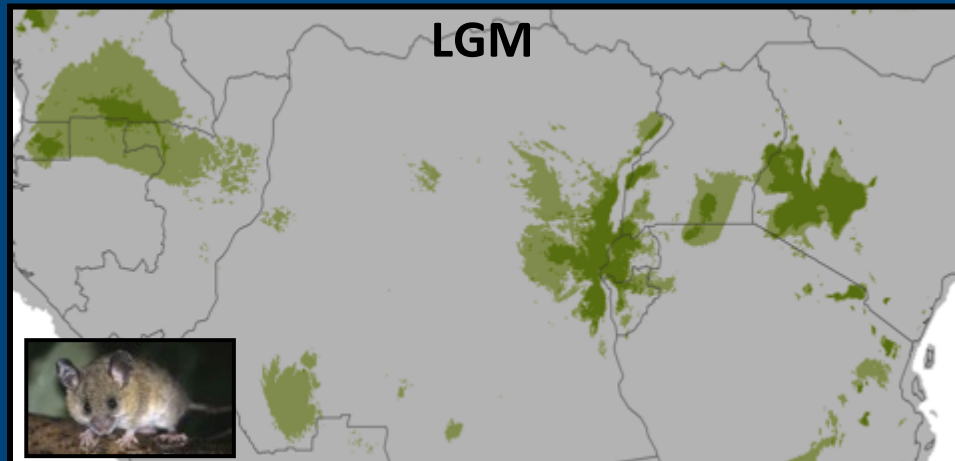
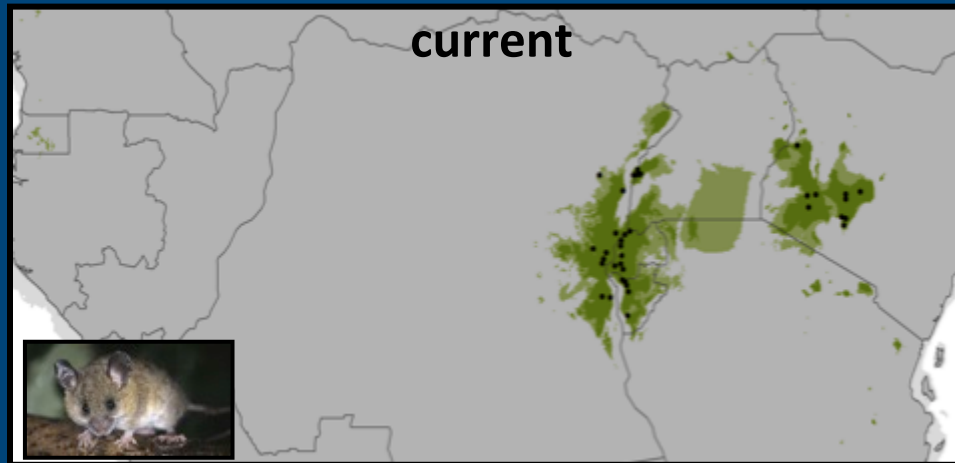


Demographic parameters inferred using Approximate Bayesian Computation (DIY ABC)

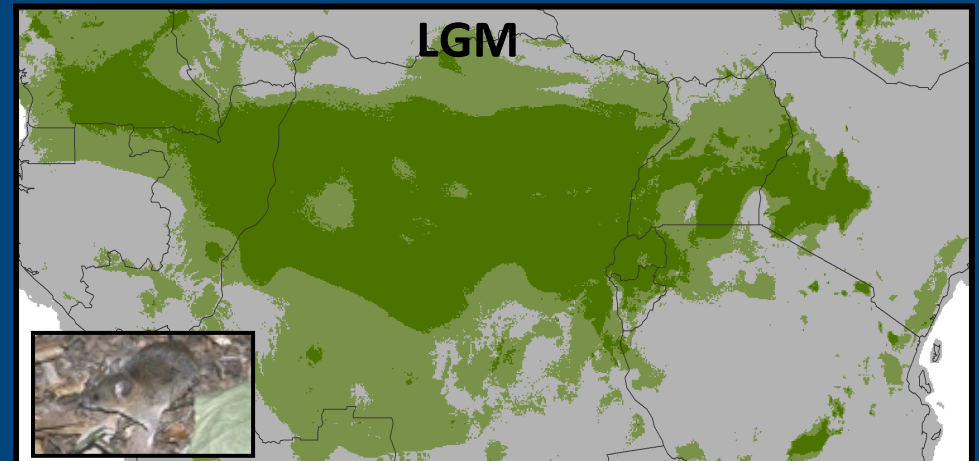
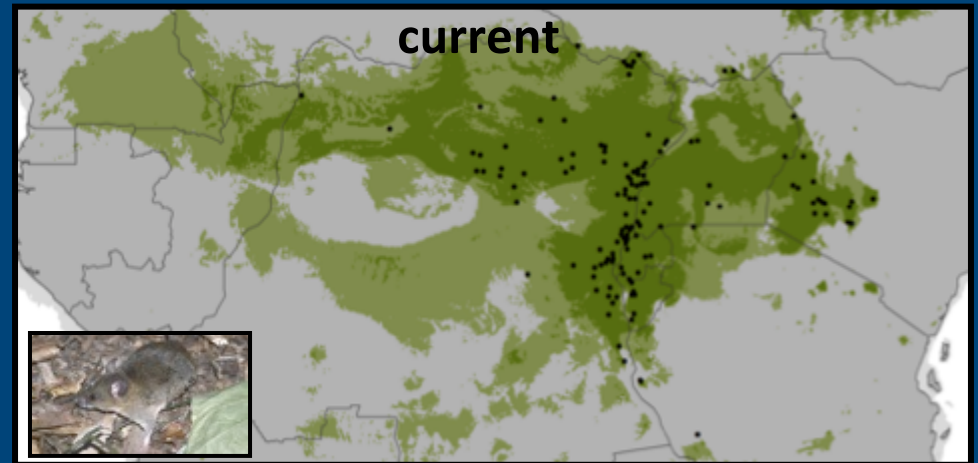
Demos, unpubl. data

Species distribution models – current and LGM

Hylomyscus denniae



Praomys jacksoni

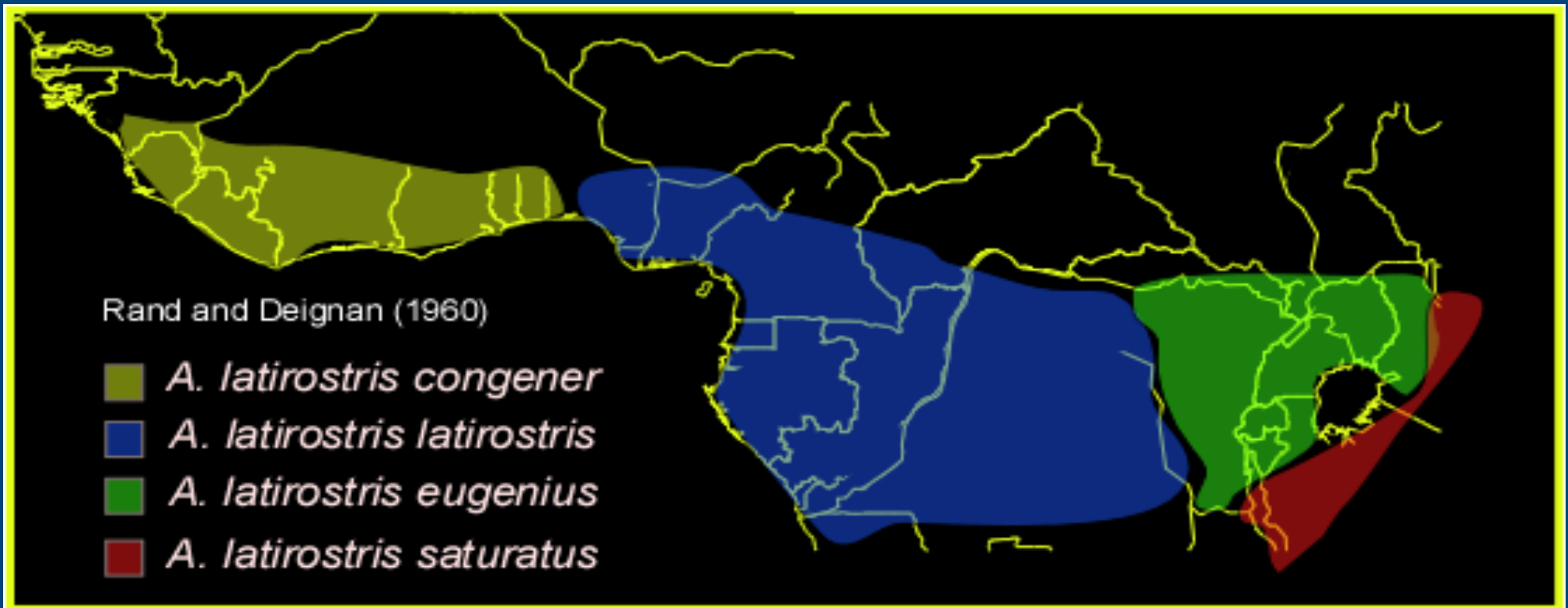


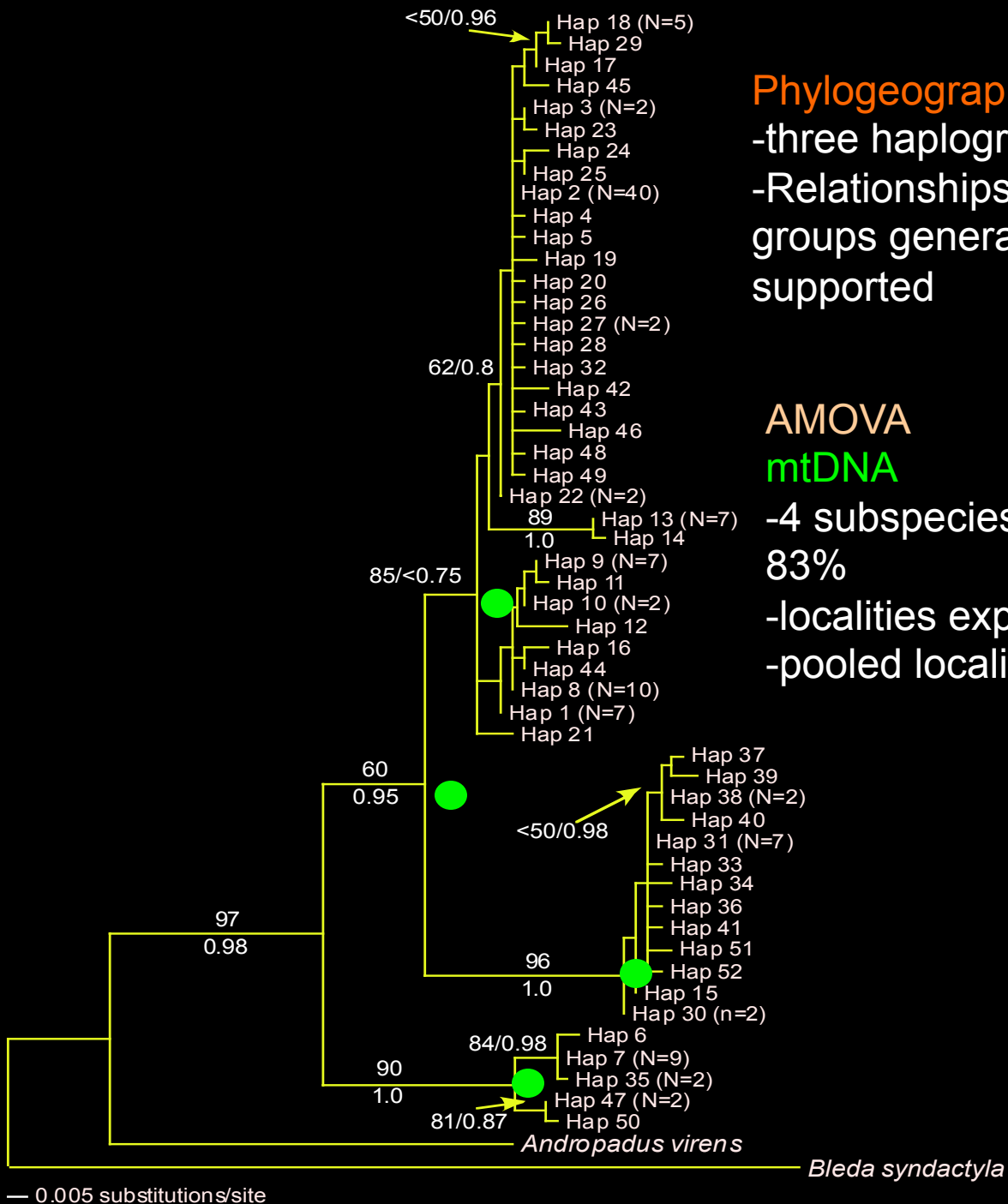
Species distribution modeling predictions generated in MaxEnt

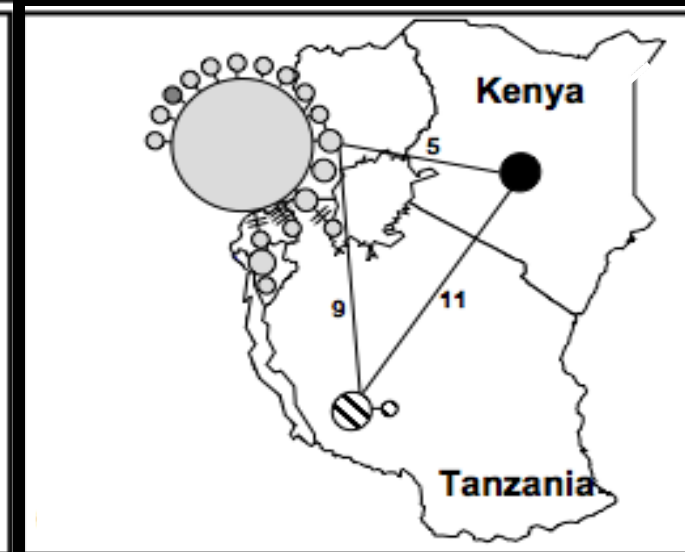
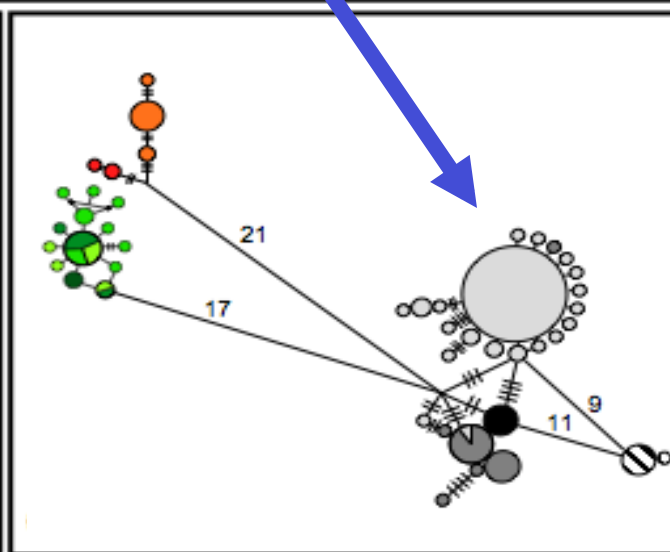
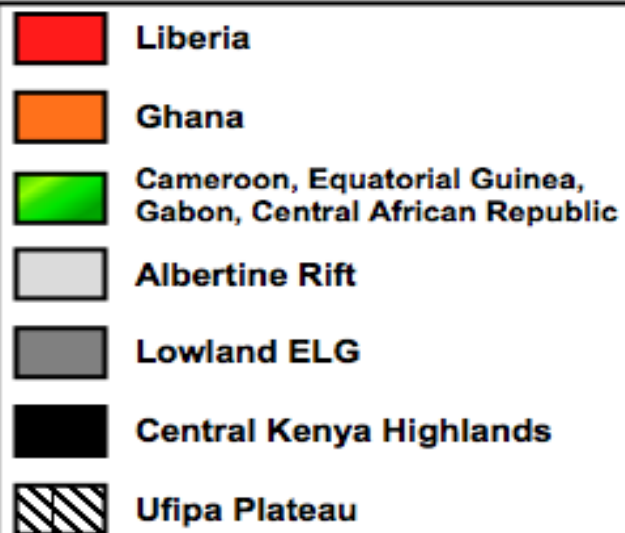
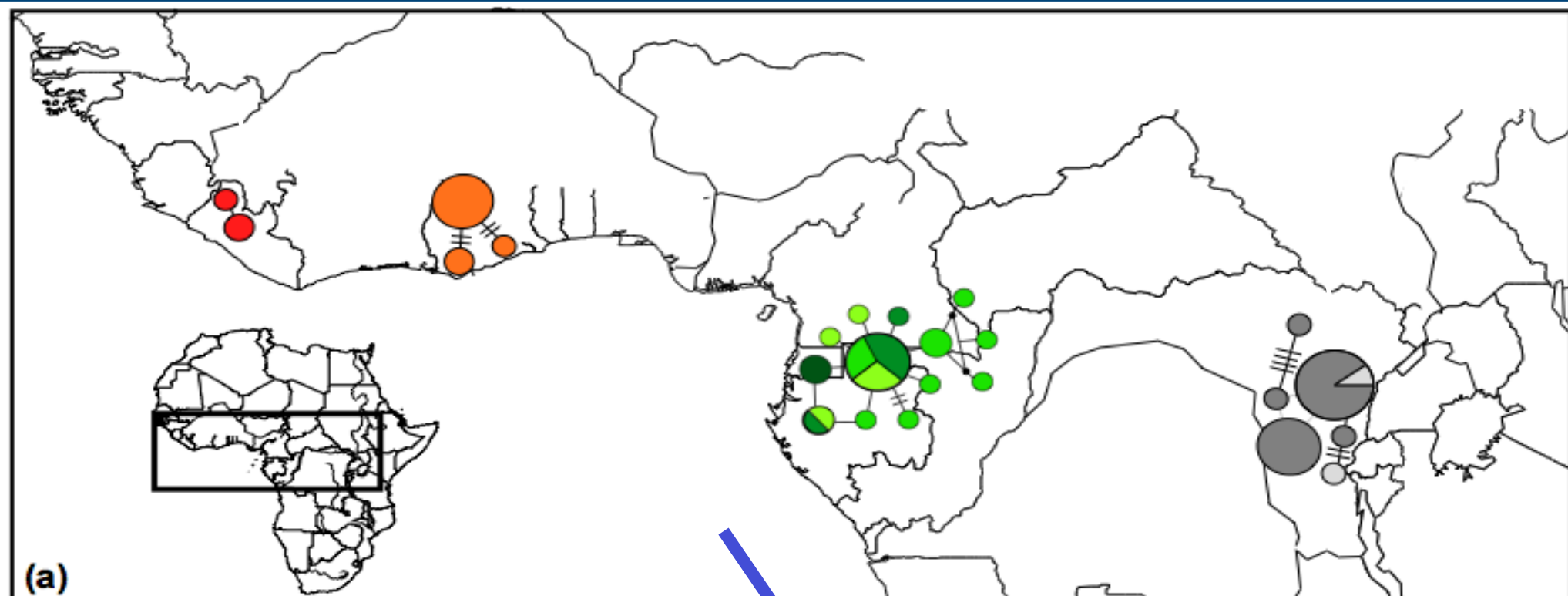


Subspecific variation in *Andropadus latirostris*

- among most widespread and abundant forest greenbuls
- omnivore: fruits, seeds, insects, vertebrates
- extreme elevation tolerance 0->2700m



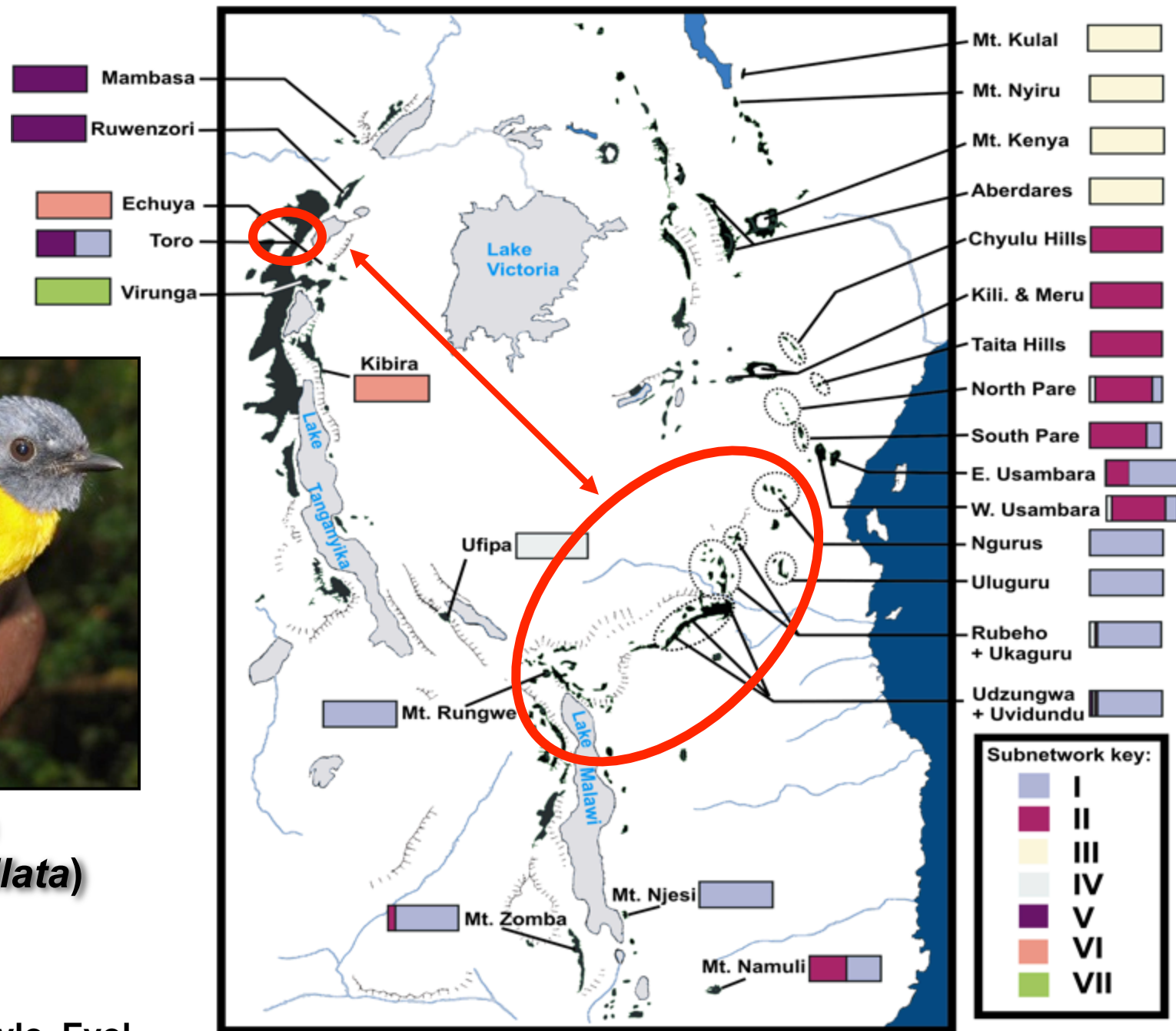




Secondary
contact ?



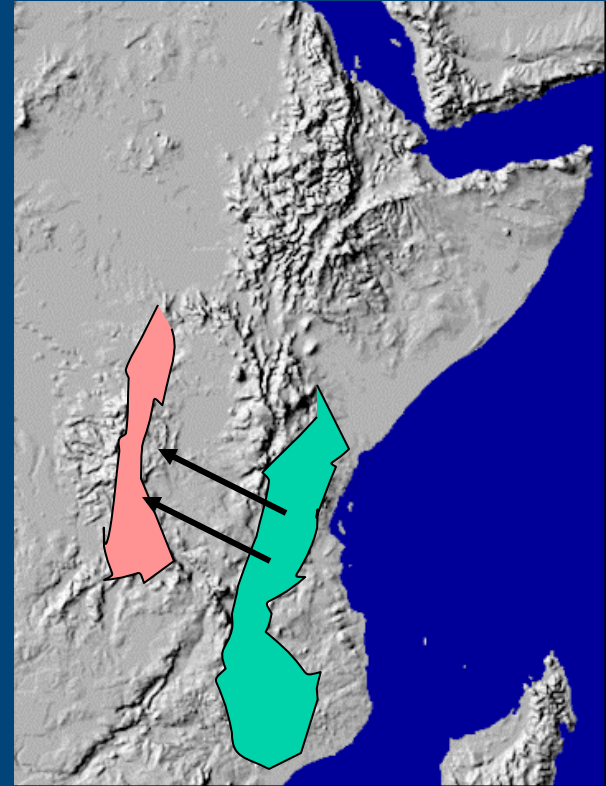
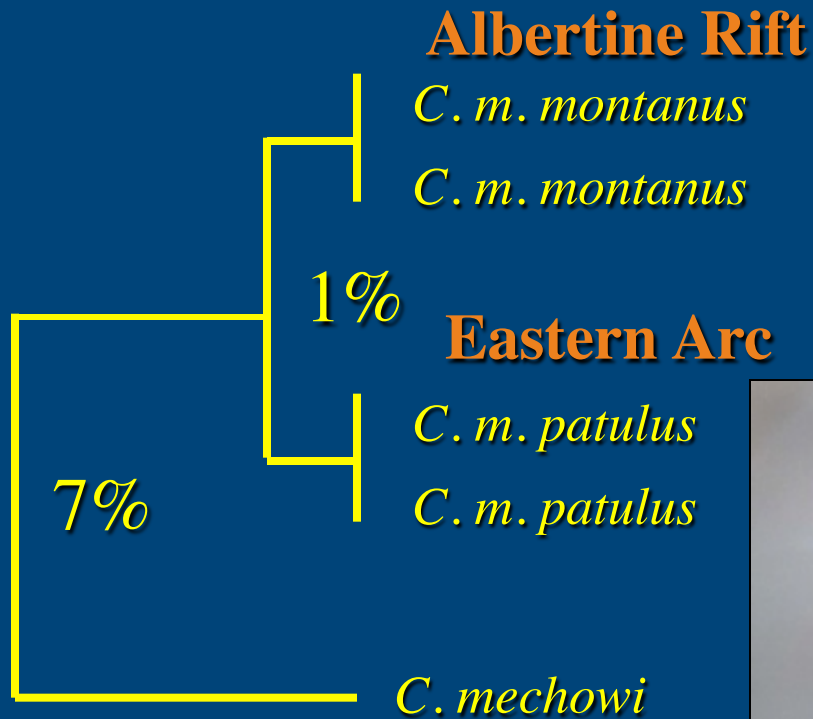
Starred Robin
(*Pogonocichla stellata*)



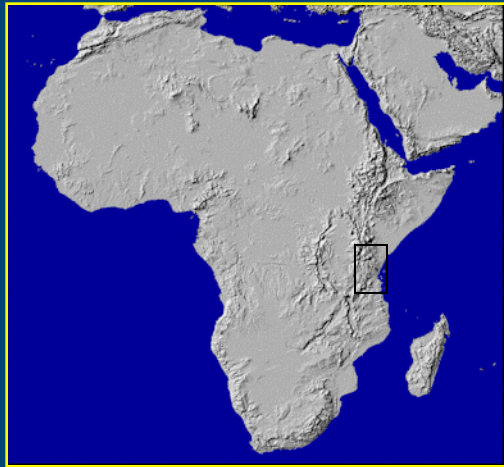
An Albertine Rift Endemic/Inter-African Migrant

Long-tailed Mountain Cuckoo

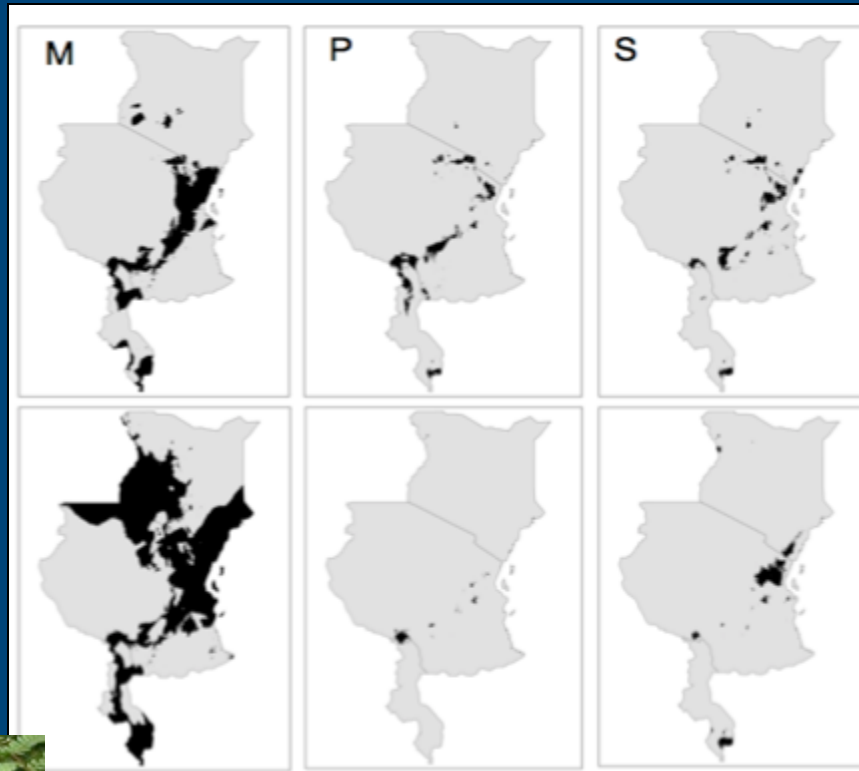
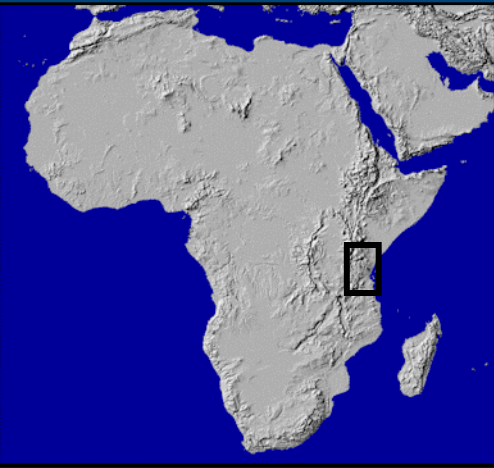
(*Cercococcyx montanus*)



The Eastern Arc Mountains of Africa

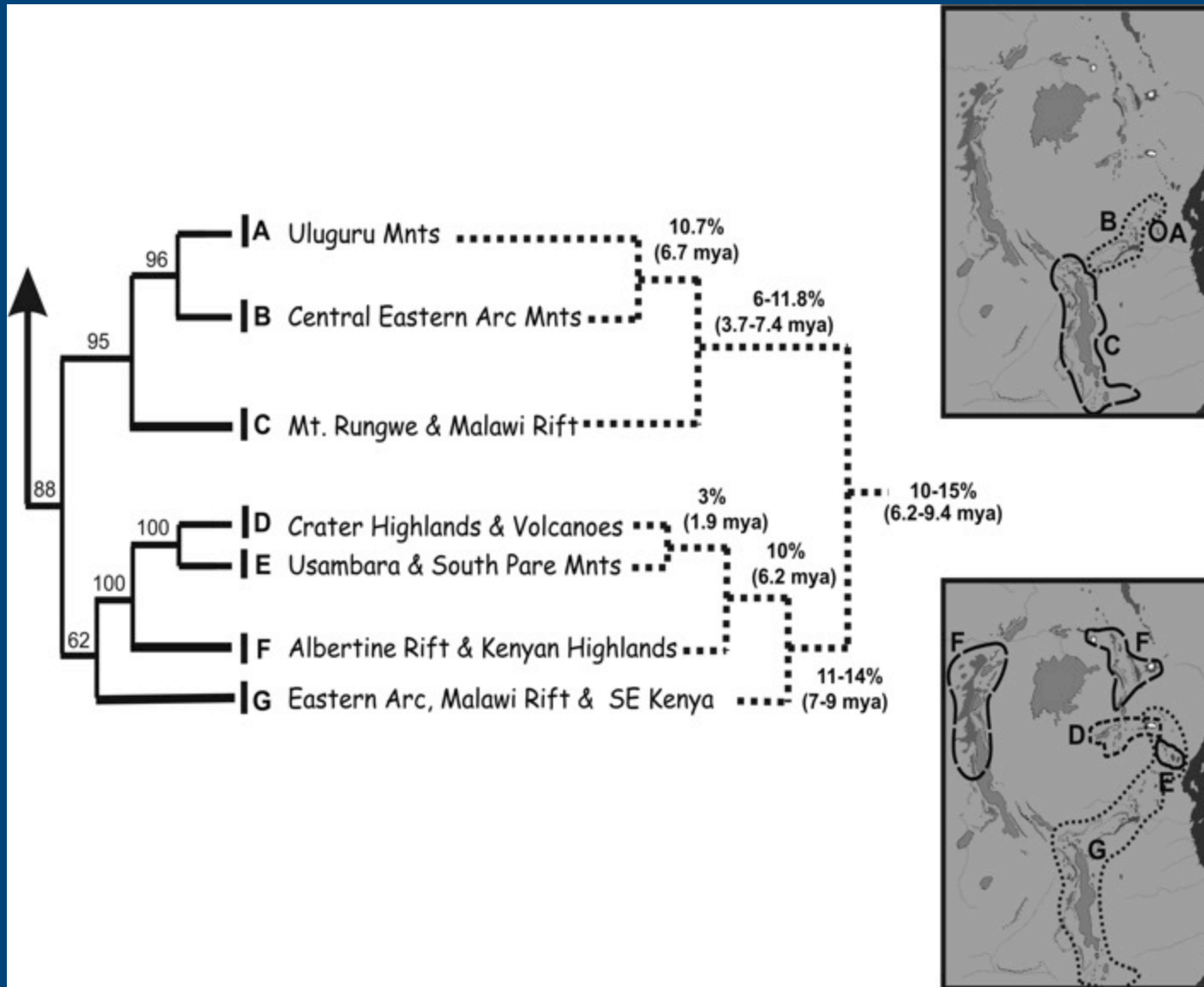


Investigating the role of climate fluctuations on patterns of population divergence in *Hyperolius* frogs



Lucinda Lawson, Ph.D. 2010
Committee on Evolutionary Biology
University of Chicago
The Field Museum

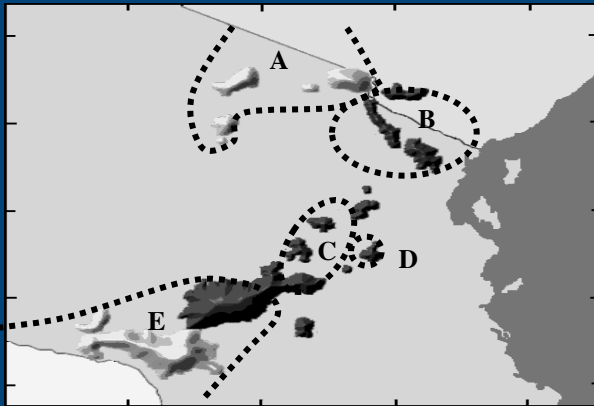
Mountain Greenbul (*Andropadus tephroleamus*) complex



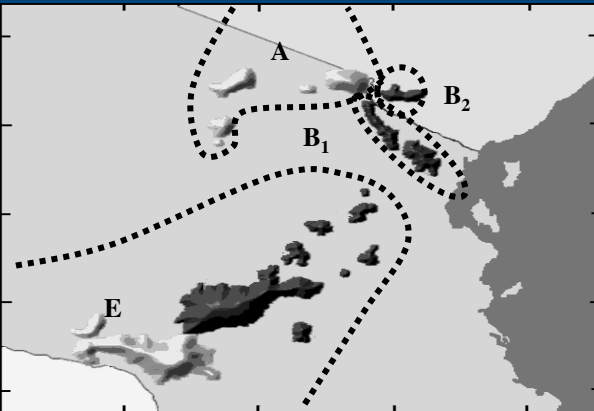
Roy et al. 1998.
 Steenstrupia 24:51-66



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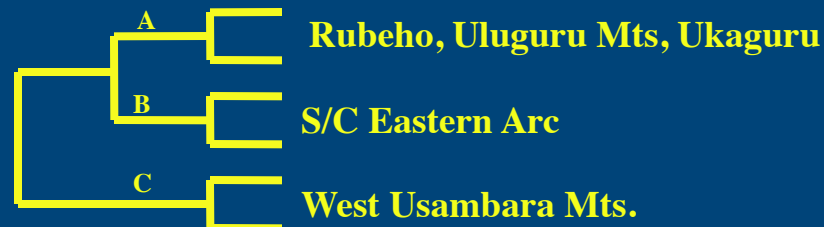
Double-collared Sunbird complex



Olive Thrush complex



Eastern Arc Akalat Complex



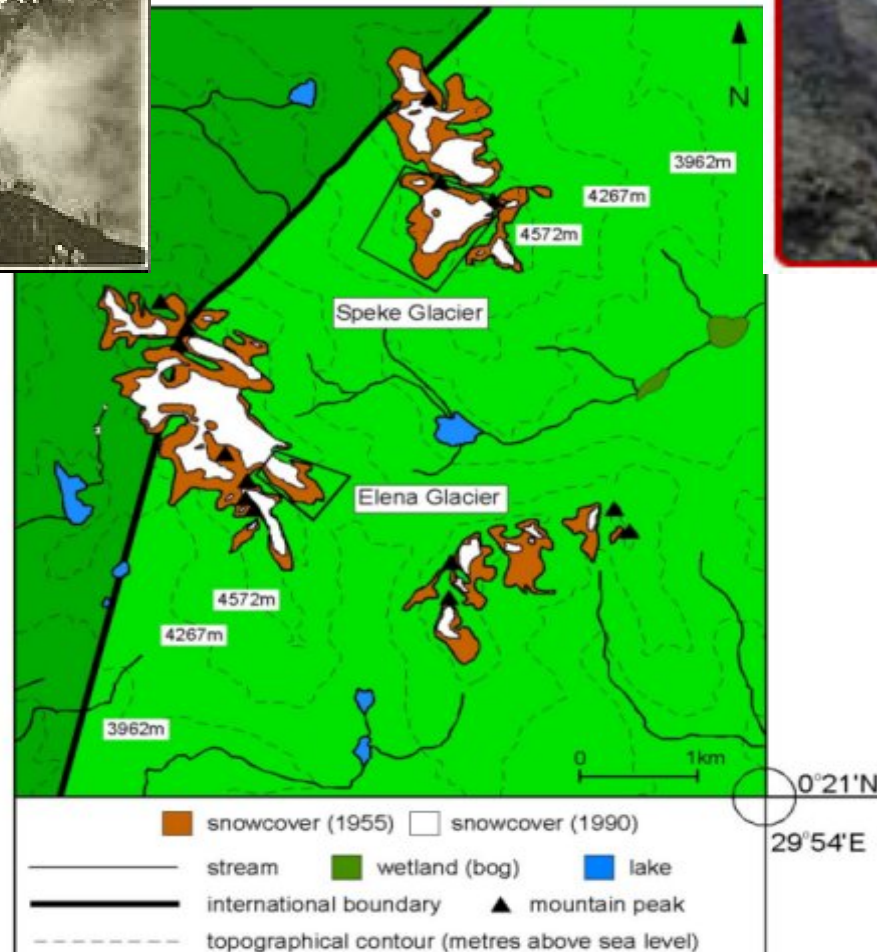
Kahindo et al. 2007. Biological
Conservation 134:262-270

The Rwenzori Glaciers

1925



2006



Source:
Richard Taylor et. al,
University of London



#yose25

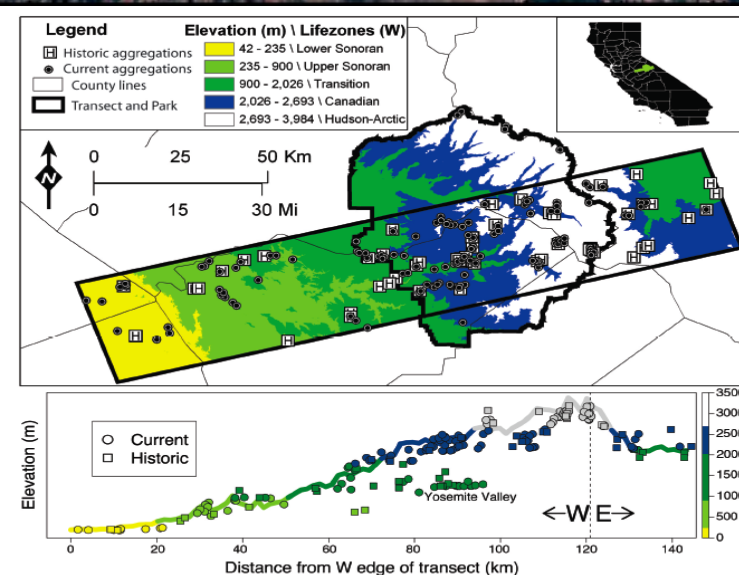
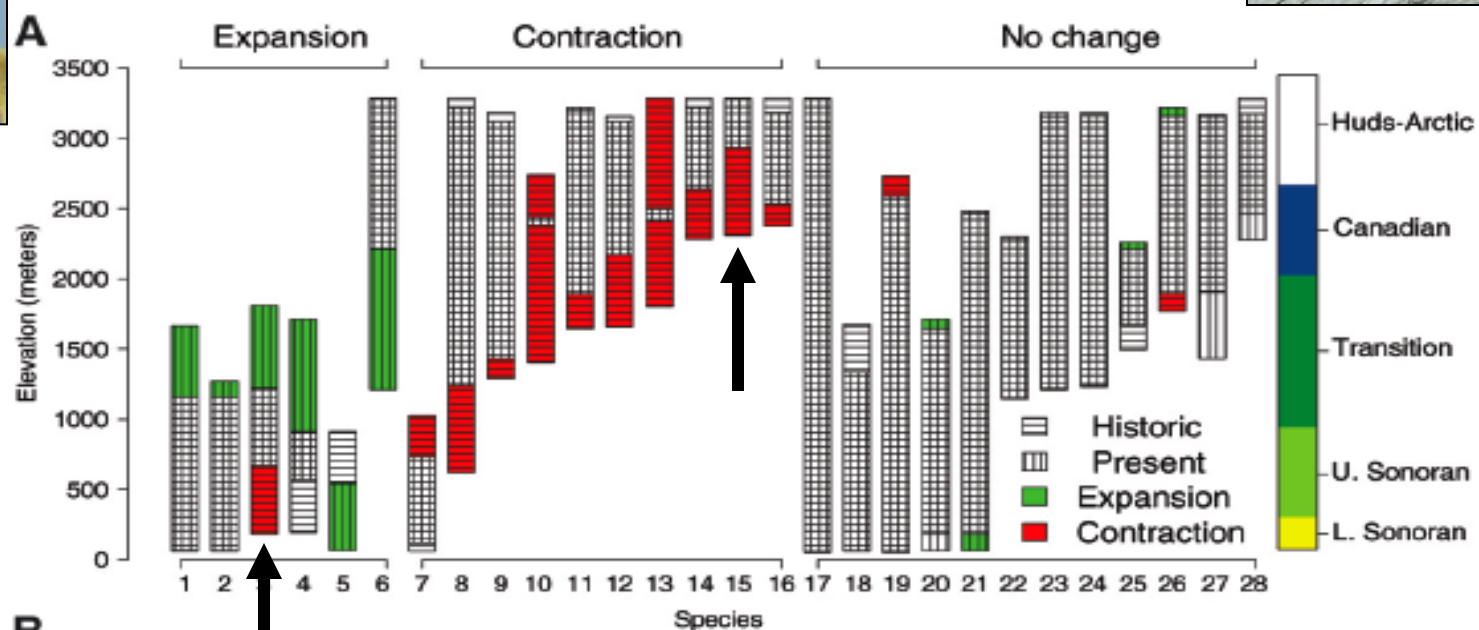


Fig. 1. Map of surveyed sites in Grinnell (Historic) and Current surveys relative to the Yosemite National Park boundary and life zones (upper panel), and to an averaged elevational profile (lower panel).

Impact of a Century of Climate Change on Small-Mammal Communities in Yosemite National Park, USA

Craig Moritz,^{1,2*} James L. Patton,^{1,2} Chris J. Conroy,¹ Juan L. Parra,^{1,2}
Gary C. White,³ Steven R. Beissinger^{1,4}

Science (2008) 322:261-264



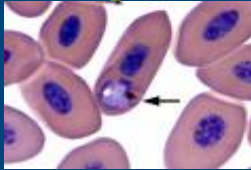
Davee/Falk Emerging Pathogens Project



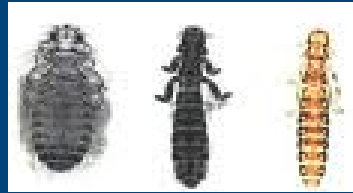
Rickettsia



Heamoproteus



Feather Lice



Batflies



Fleas



Ticks

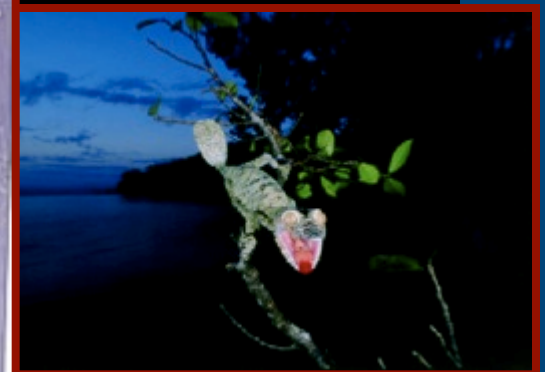
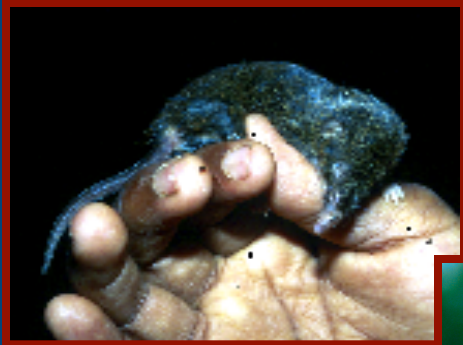


Marburg virus



Steve Goodman

Field Biologist



Why does the past matter?

- For the Albertine Rift genetic data show that the last several million years have resulted in complex genetic structure across species.
- Good news: Populations seem to be substantial for many montane populations.
- Modern approaches offer insights that can be useful for assessing the status of biodiversity on multiple scales.



What do we need to do?

- Integrate these results with other data to better understand this history at various landscape scales.
- Study these data with modern/projected land use data to improve models.
- We need more data on more baseline plants and animals.
- Continued training in the region.

Collaborators:

Charles Kahindo, Univ. Officielle de Bukavu

Josh Engel, Field Museum

Julian Kerbis, Roosevelt Univ.

Ben Marks, Texas A&M Univ.

Gary Voelker, Texas A&M Univ.

Johanna Huntley, Texas A&M Univ.

Terry Demos, City College, N. Y.

Mel Jonas, Illinois State Univ.

Prince Kaleme, C.R.S.N., Lwiro/Univ. Capetown

Robert Kityo, Makerere University

Rauri Bowie, Univ. of California, Berkeley

