



# Adaptation strategy development at the landscape scale: AWF's progress and challenges in pilot sites

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# Goal/Problem

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- AWF launched incipient climate adaptation program in 2010 to mitigate CC impacts on conservation targets.
  - no experience in formulating species adaptation strategies/conducting vulnerability assessments.
  - Limited staff capacity



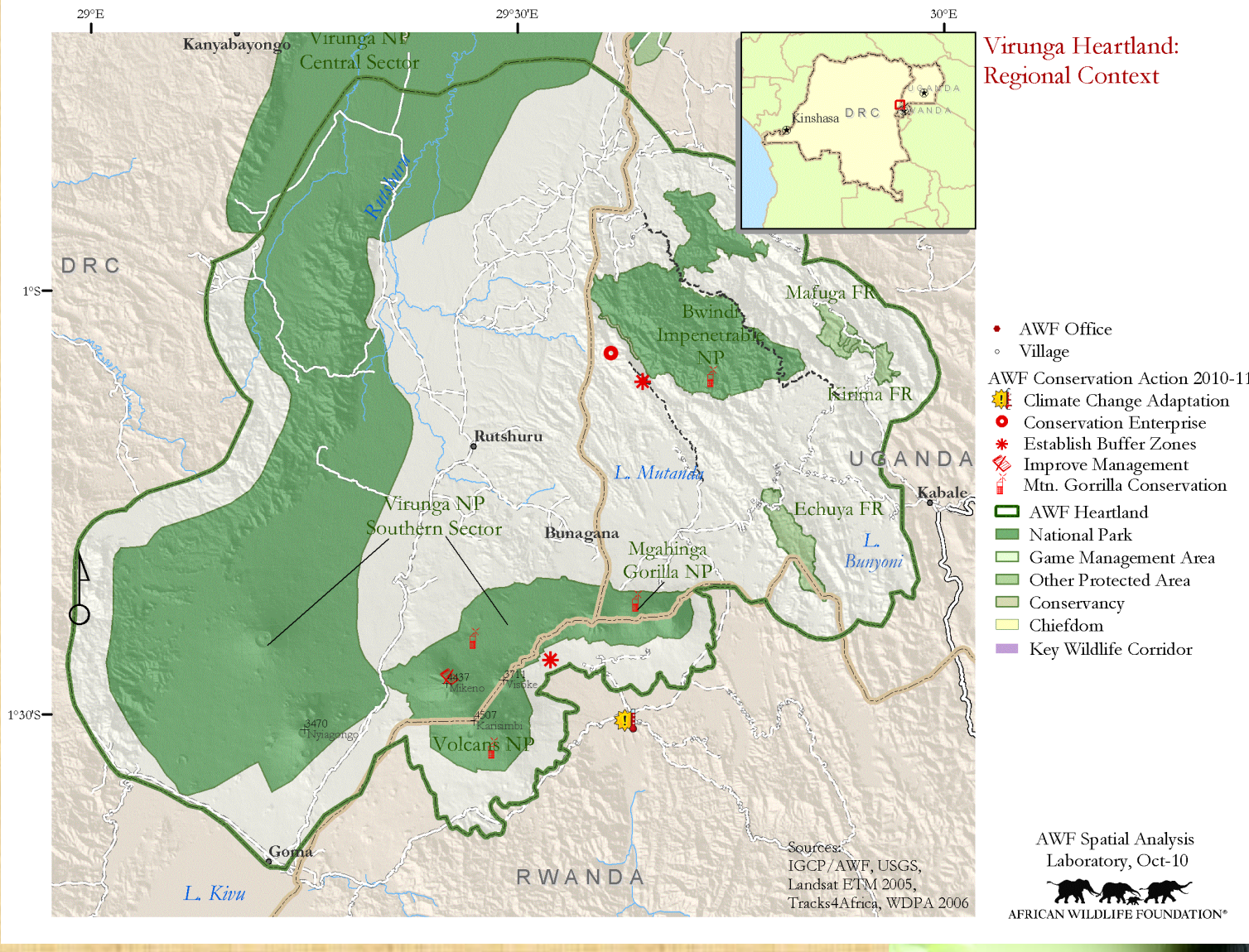
# AWF Heartlands



- 7 savannah-dom. landscapes
- ~ 8 conservation targets (sps, systems) in each
- What is our approach to adaptation?



# Virunga Mountain Gorilla

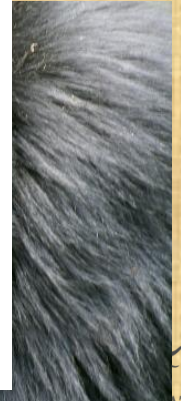


duals in  
egion.

prox.

SS

might



# IGCP

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- Created in 1990 by FFI, WWF, and AWF, the International Gorilla Conservation Project's (IGCP) conserves mountain gorillas and their regional afro-montane forest habitat in Rwanda, Uganda and the Democratic Republic of Congo.
  - Emphasis on technical assistance to PA authorities.
  - Integrated transboundary conservation programme.





# Virunga MG Vulnerability Assessment

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- Goal: reduce the vulnerability of mountain gorillas to the negative effects of climate change
  - 18 months MacArthur funded project jointly implemented by AWF-IGCP-EcoAdapt
  - Obj: Understanding effects on gorillas, their habitat and critical resources.
  - Outputs: modeling, workshops, white paper to improve understanding of CC vulnerability to inform new conservation strategies/management plans.

# Virunga MG Vulnerability Assessment

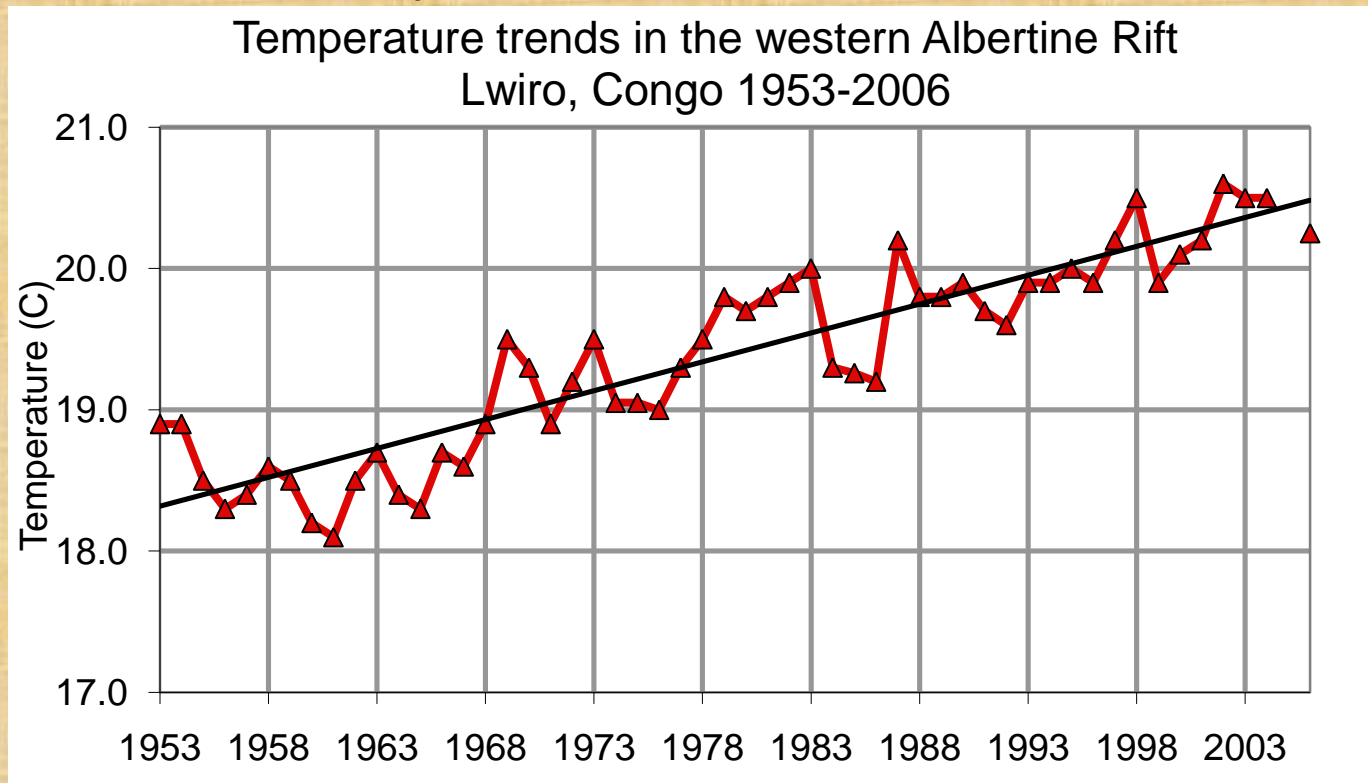
## Process/Players

- EcoAdapt – “Climate Camp” facilitation
- UCDavis – Species distribution modeling
- WCS – climatological modeling
- IGCP/AWF - data, capacity development, implementation
- Stakeholder workshops
  - Review SDM and climatological modeling results
  - Review gorilla viability and non-climate stressors
  - Synthesize discussion into specific management recommendation sectors (PAs, conservation, research, human health, livelihoods)



# Virunga Climatology: Temperature Trends

Temperature is largely a function of elevation and exhibits little seasonal variability. Strong increasing trend evident (+2.1 C over 53 yrs).



Seimon and Picton Phillipps, 2010

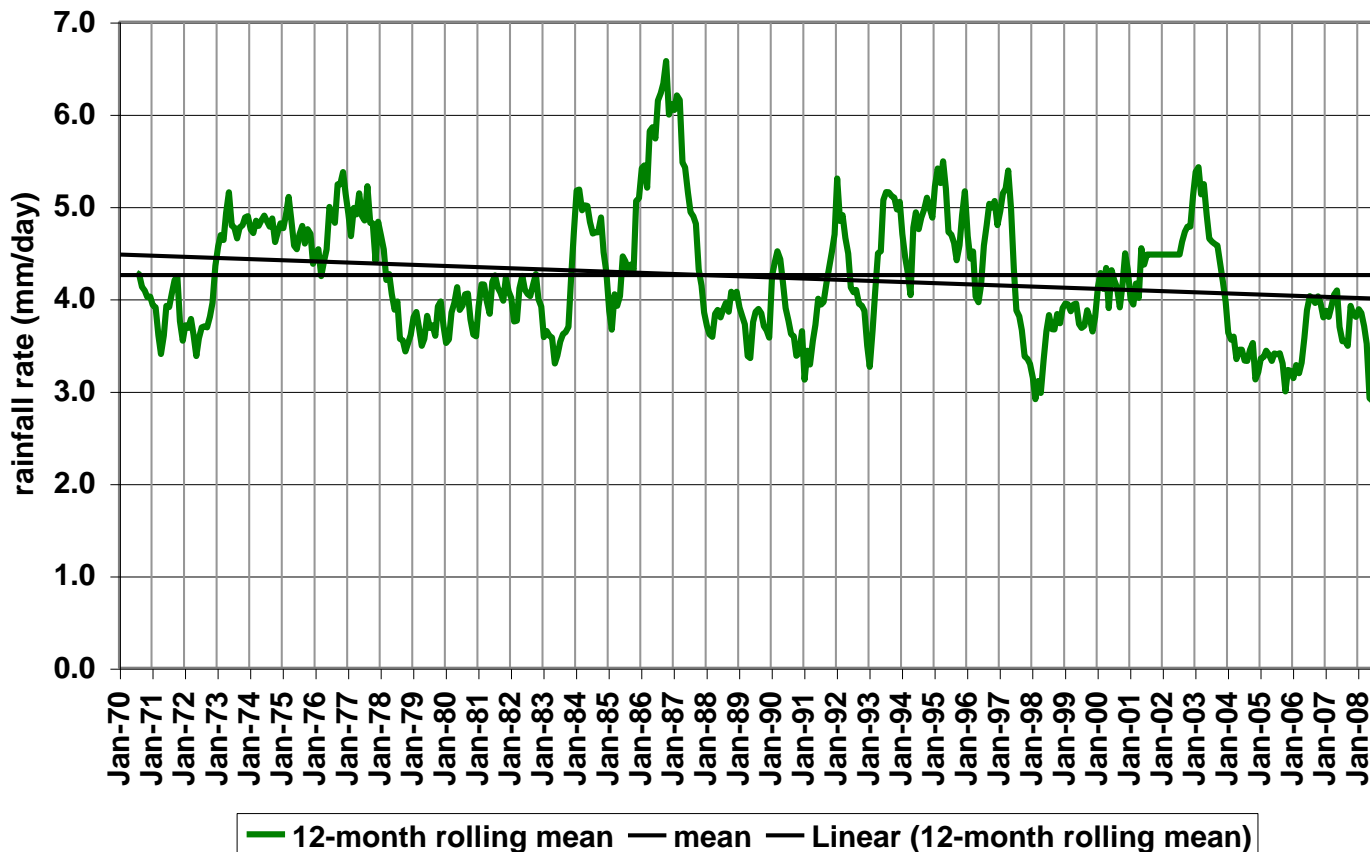


# Virunga Climatology: Precipitation Trends

Local precipitation trends vary across datasets.

-- no clear indications of predicted increases in rainfall as yet

Torokahuna Tea Estate 1970-2008



# Virunga Climatology: Projections

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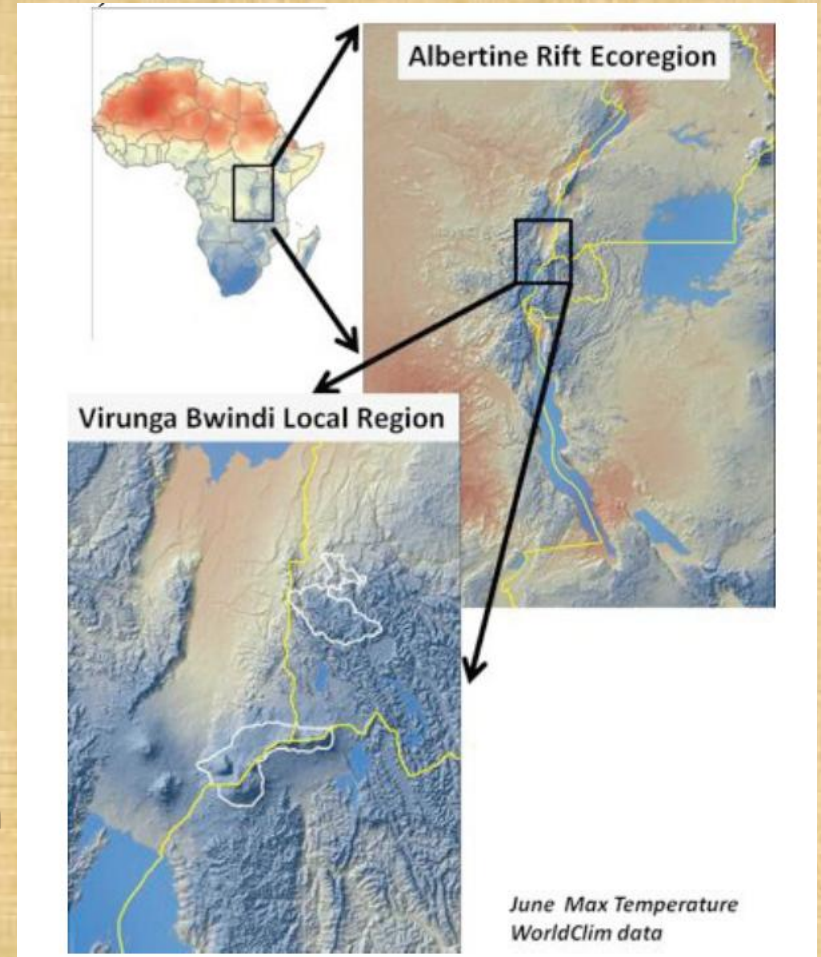
- Downscaled IPCC global ensemble models to 50Km resolution predictions for 2030, 2060, 2090 across A. Rift region.
- Used IPCC A2 (more severe) and B1 (more moderate) greenhouse gas emissions scenarios.
- >> +3.6°C under A2 would translate to a large upward displacement of species ranges and vegetation zones, +600-720 meters relative to 1990 levels.
- >> Unlike temperature projections, monthly precipitation projections display marked seasonal differences as well as steepening rates of rainfall increase.



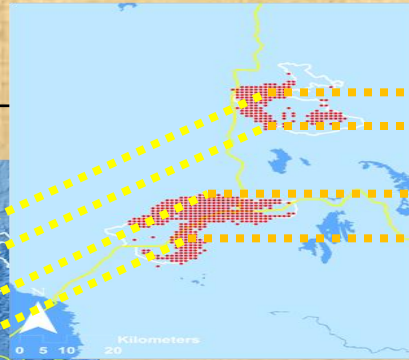


# Virunga MG Vulnerability Assessment

- Two spatial study boundaries: ecoregional and more localized view of mountain gorilla range. Both at 1Km resolution.
- Inputs
  - Gorilla observations
  - Contemporary and future climates: WorldClim (Hijmans et al. 2005) 1Km.
  - Plant samples
  - Net Primary Productivity/month (Hijmans) –where might be high enough to support gorillas under future climates.
  - Elevation/topographic roughness as climate driver



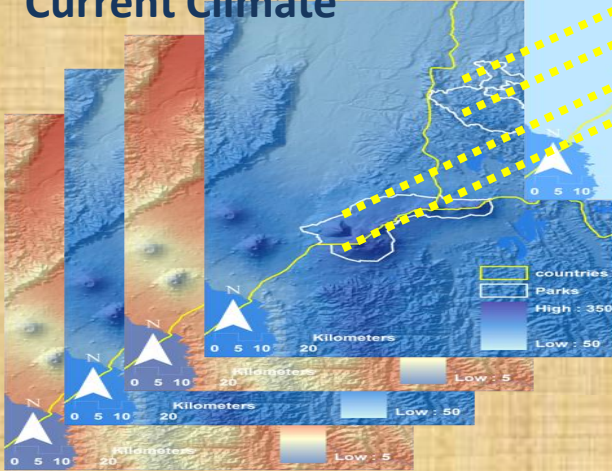
# Gorilla Location



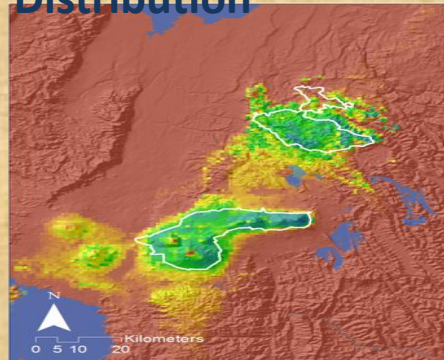
# Model Input Data

ID	X	Y	P1	P2	P3	...
1						
2						
3						
4						
...						

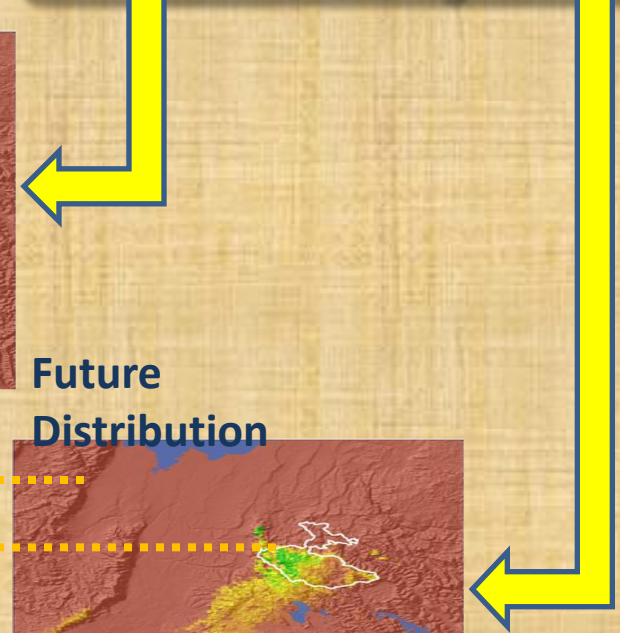
Predictor Variables  
Current Climate



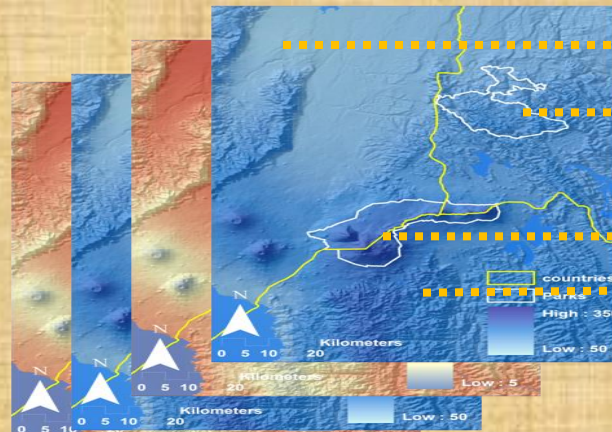
Current Distribution



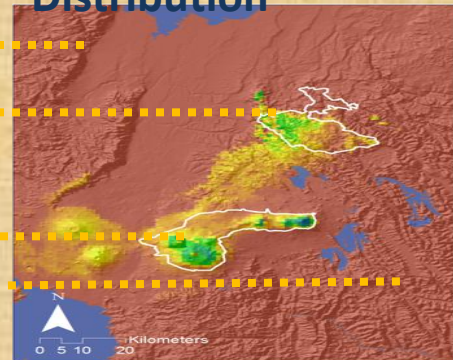
Species Distribution Modeling



Predictor Variables  
Future Climate



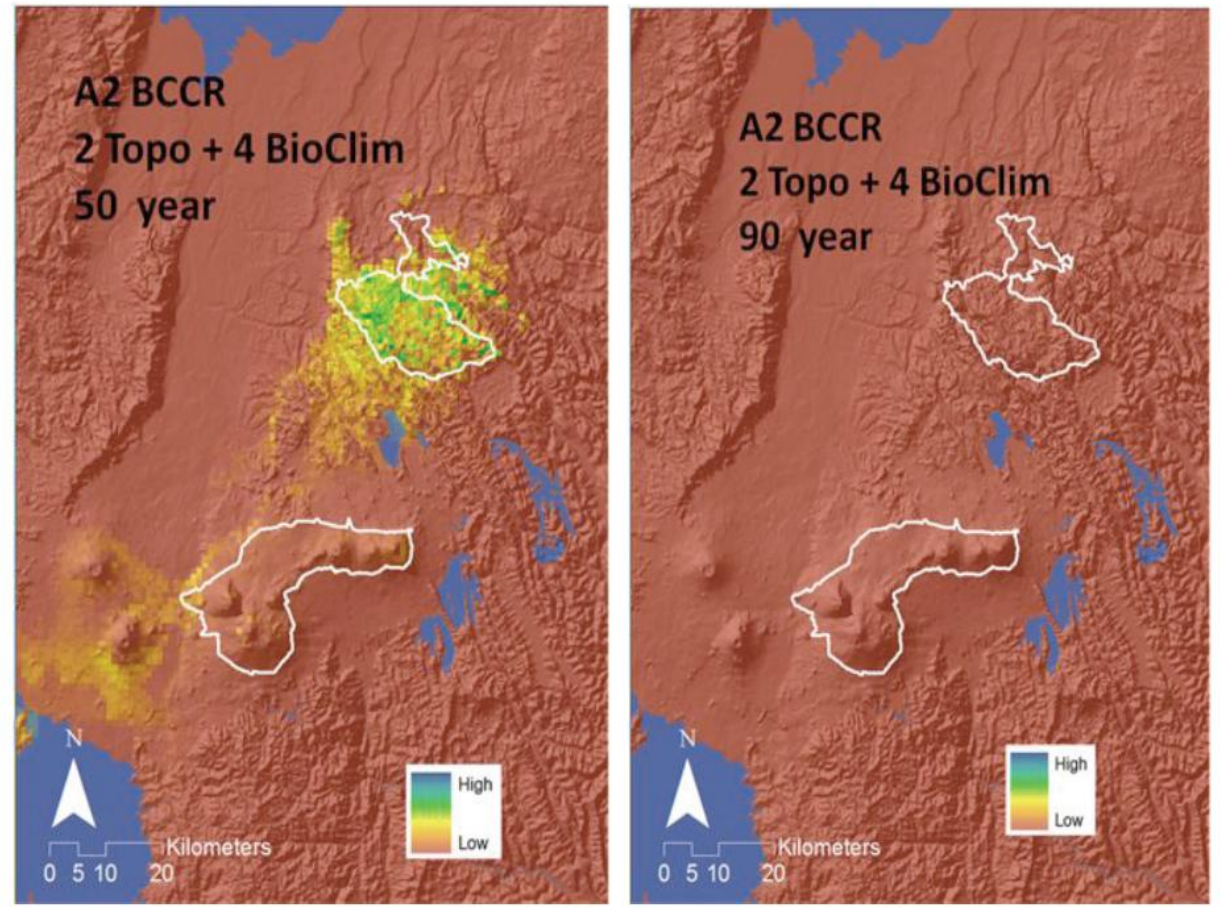
Future Distribution





# SDMs: Topography + Bioclim

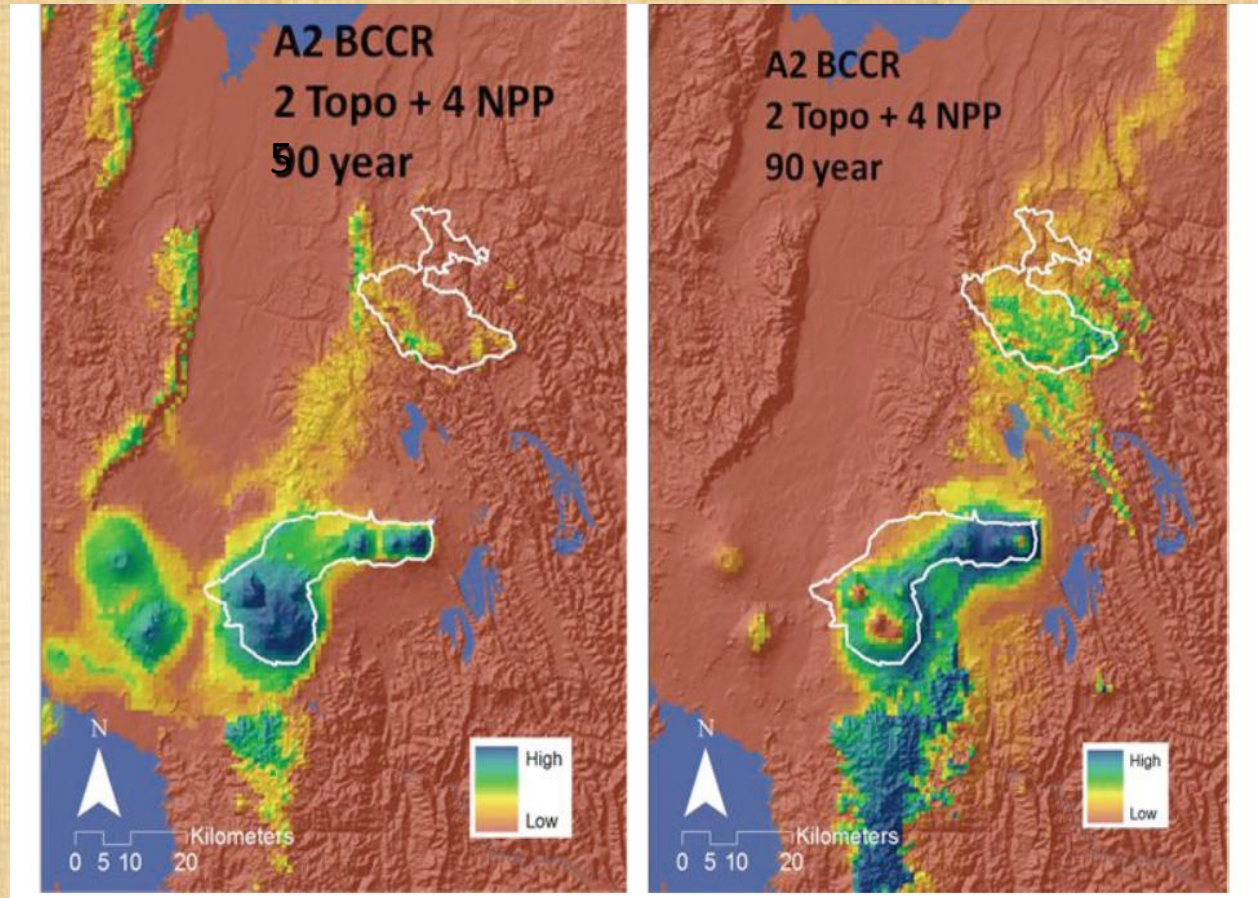
- Only Bwindi suitable in 2050 years; 0 in 2090



Top 4 bioclim (1. annual precip, 2. precip driest qtr, 3. temp seasonality, 4. mean temp in wettest qtr)

# SDMs: Topography + NPP

- Both PAs still viable in 2100.





# SDM Modeling Interpretation/Challenges

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- Divergent projections? Call in the experts...
- Skepticism that climate, especially temperature, controlling factor for MG distribution as Eastern lowland gorilla (sub-sps) exists at lower elevations and former MG range much lower.
- NPP SDMs featuring suitable areas adjacent and between parks considered more realistic>>restoration via C sequestration \$?
- MG are generalist species...tricky to model.

# Virunga MG: Example recommendations

Activities	Pressures/Threats	Adaptation Suggestions
<p><b>Crop Raiding</b></p> <p><b>•Gorilla</b></p>	<ul style="list-style-type: none"> <li>•Trend is increasing but current threat is low</li> <li>•<b>Likely to increase with climate change</b></li> <li>•Community attitudes will become negative with increased pressure</li> </ul>	<ul style="list-style-type: none"> <li>•Unpalatable buffer crops</li> <li>•Encourage compatible landuse practices</li> <li>•Feasibility study on options for addressing crop raiding</li> <li>•Relocation of people?</li> <li>•Feasibility study on electric fencing</li> <li>•Communal buffer zones of unpalatable crop (eg tea)</li> </ul>



# Successes

- Vulnerability assessment for MG...a foundation that will inform future climate change planning within adaptive management framework.
- Capacity building/stakeholder buy-in. Put CC firmly on the agenda for many organizations/stakeholders.
- Coalition-building among authorities, NGOs, researchers, and other stakeholders.
  - First time all 44K MG observations pooled.
- Jointly-developed IGCP climate change response plan.

## The Implications of Global Climate Change for Mountain Gorilla Conservation in the Albertine Rift



A White Paper prepared by the African Wildlife Foundation, the International Gorilla Conservation Programme and EcoAdapt, and funded by the John D. and Catherine T. MacArthur Foundation

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# IGCP Plan Implementation

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- Established a network of weather stations in mountain gorilla habitat.

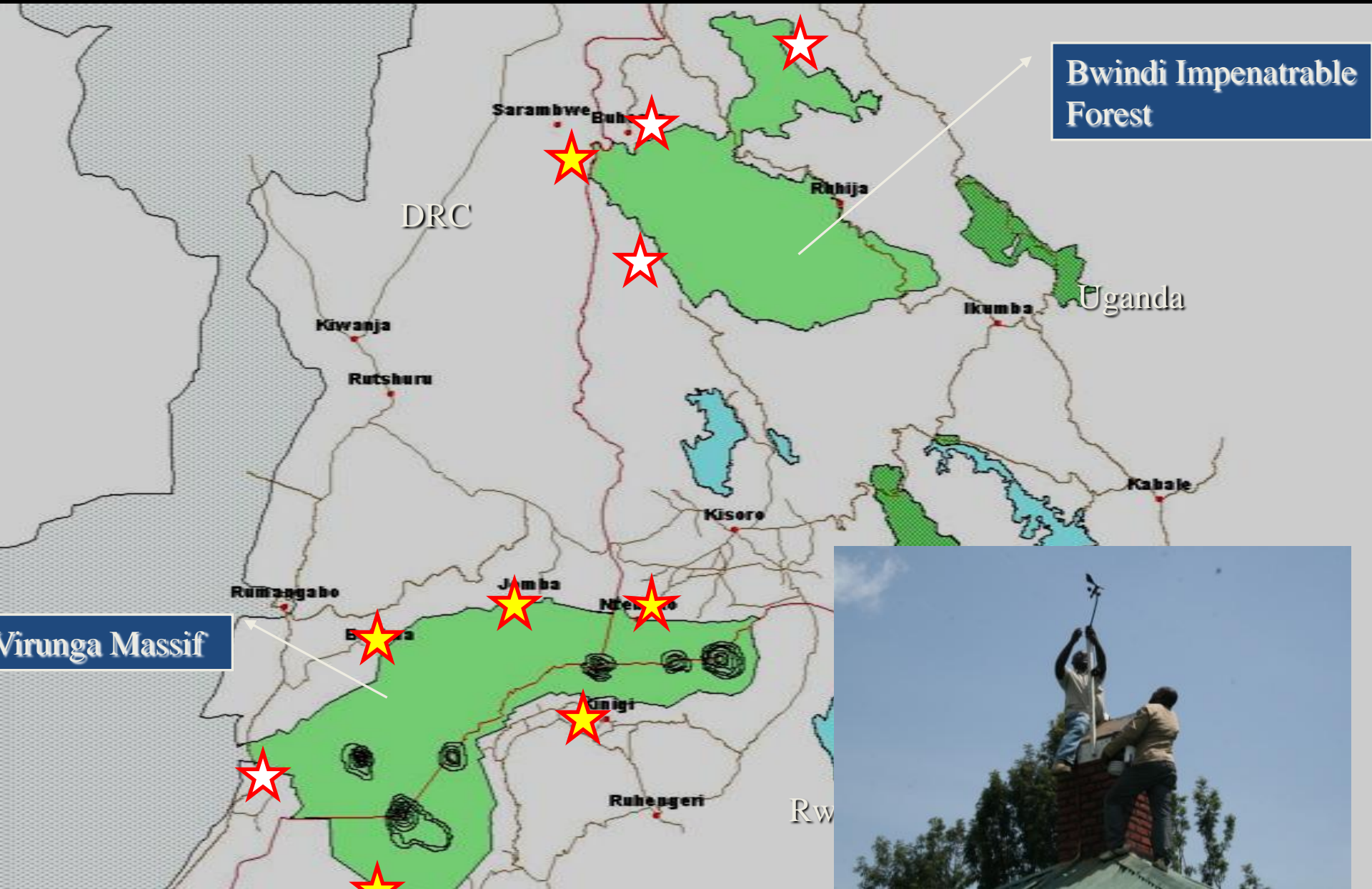
>>improve understanding of climate change impact at micro-habitat level of the mountain gorillas.

- Set up monitoring of plant phenology.

>>Plant phenology is likely to be greatly affected by climate change, and may have a large effect on gorilla transition ability, or sustainability.



# Automatic Micro stations in mountain gorilla habitat in the Virunga-Bwindi Landscape



# Monitoring Plant Phenology

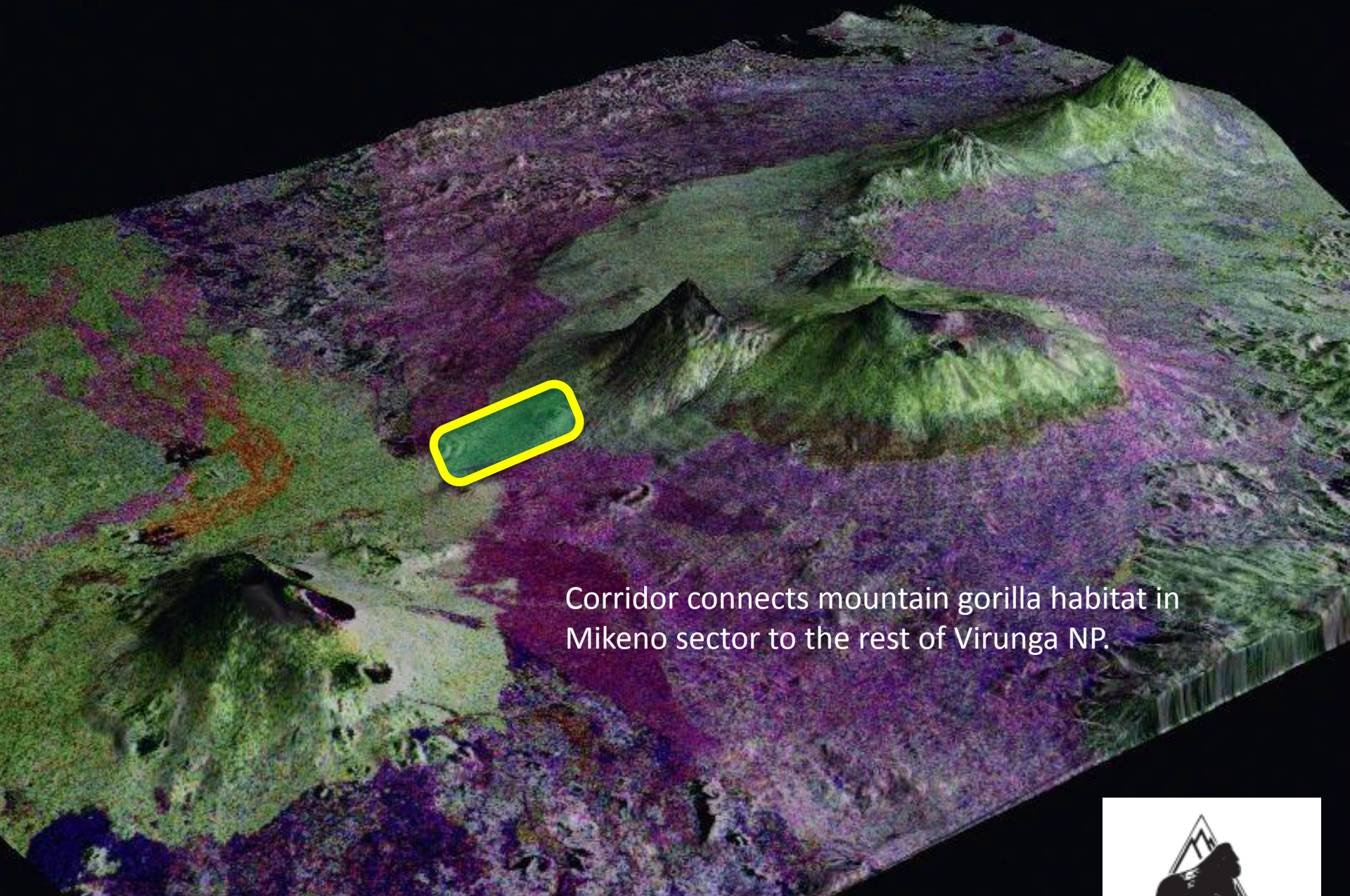
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- Objective: investigate the impact of variability of climatic factors on spatio-temporal distribution of mountain gorilla foods along an altitudinal gradient and consider implications for MG ecology and assess wildlife corridor viability.





# Mwaro corridor



Corridor connects mountain gorilla habitat in Mikeno sector to the rest of Virunga NP.

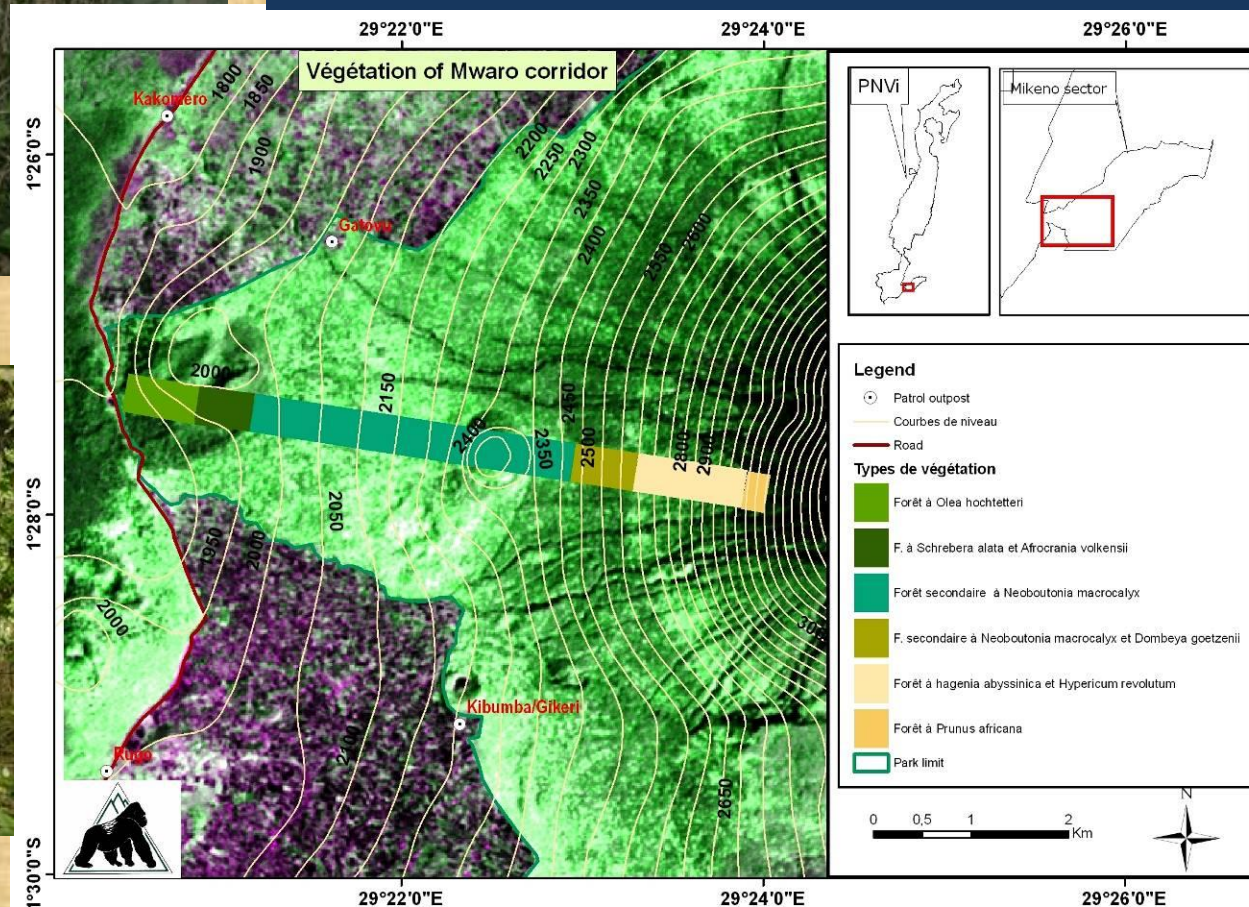




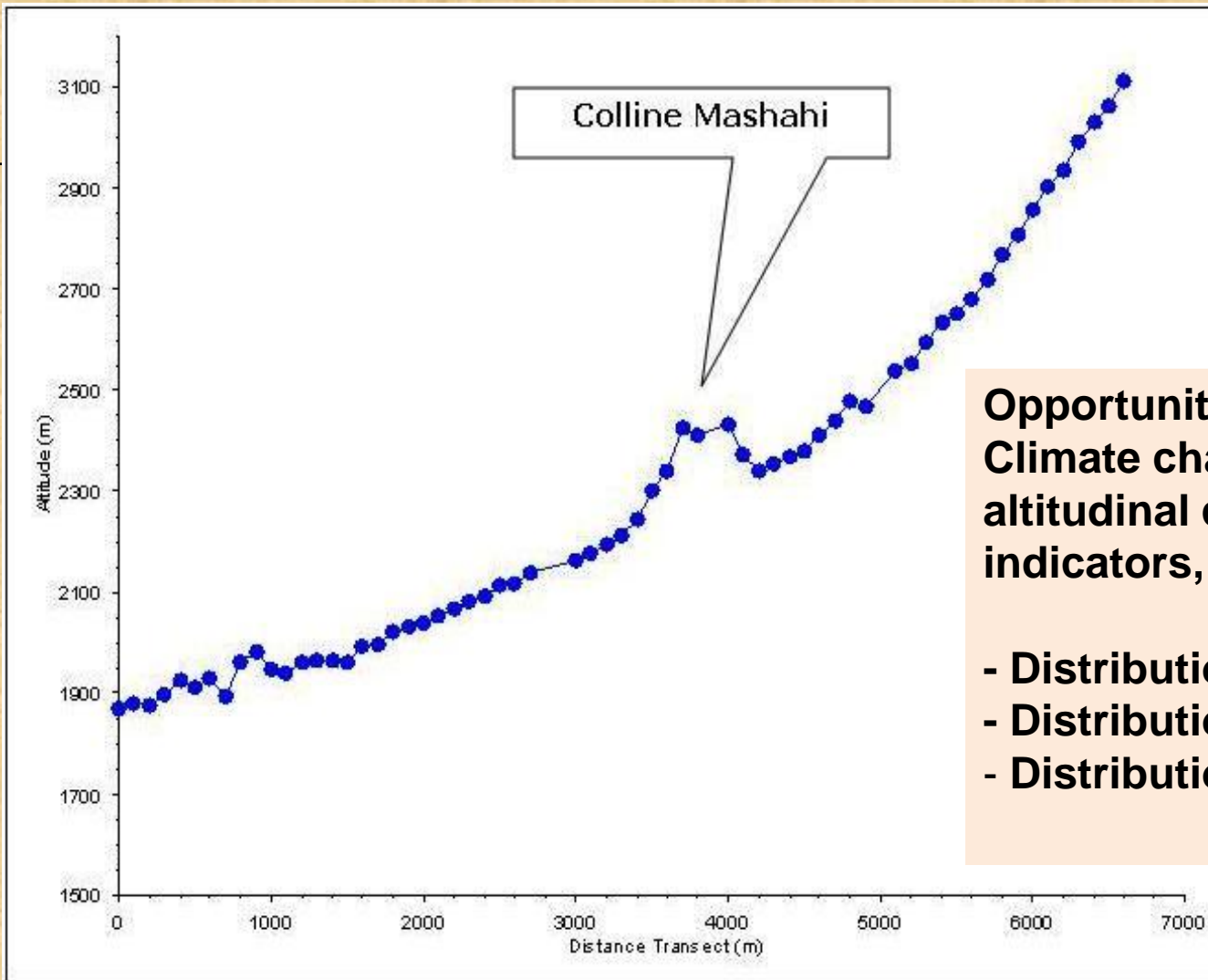
# 1-ha permanent plot and 7 Km line transect



To obtain sufficient and sustainable data on the seasonal change of flora and fauna in Mwaro ecological corridor







Opportunity to assess Impact of Climate change on the altitudinal changes of biological indicators, e.g.:

- Distribution of **lichens**
- Distribution of **small mammals**
- Distribution of **amphibians**

*Topographic shape of Mwaro ecological corridor*



• These **Taxa** and others are **Highly valued ecological indicators** known for their sensitivity to a wide variety of environmental stressors like air quality and climate change.

# Vision for Complete Success

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- Another round of modeling.
  - include historic gorilla range information.
  - Improved locality data for important food species and habitat plants
- Monitoring and research initiatives to inform ongoing adaptation efforts.
  - Compare long term monitoring and rapid assessment programs findings with those of studies conducted in the same region 3+ decades before.
- Iterative process. Use modeling and monitoring results to revisit CC questions.
- Expand collaborations with other stakeholders (e.g., to combat CC disease threat from existing/new pathogens).



# AWF Heartlands



- 7 savannah-dom. landscapes
- ~ 8 conservation targets (sps, systems) in each
- What next?

# Beyond Virunga

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Samburu Savannah fine-scale modeling pilot:

- Good biophysical and soc-economic representation of 3 E. African HLs.
- Elephants and grevy's zebra
  - ele – in all 7 LS; representativeness/umbrella/flagship values
  - grevy's – rarity
- Explore expert-driven trait-based risk assessment of key species at HL level through workshop with experts panel.
  - Rank species in order of vulnerability
  - More vulnerable might receive fine-scale modelling treatment/more aggressive monitoring.



# Lessons Learned

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- Herd the cats. Results could not have been achieved without collaboration, capacity brought by the various players.
- Workshops are pivotal for building awareness for adaptation and monitoring need/opportunities.
- Build strong foundations. E.g., same dataframes could be used to perform SDMs for other targets by simply changing dependent variable.