Characterizing species, habitats and ecosystem services likely to be sensitive to the combined effects of climate change and methods for assessing likely changes

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Why study the effects of climate change on species?

- Easy to study
- Use as a proxy for habitats and ecosystems
- Predict latitudinal and elevational distributional shifts
- Predict changes in behavior (e.g. timing of migration or nesting)
- Evaluate the future effectiveness of current conservation interventions
- Design information-based mitigation strategies

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Why study the effects of climate change on habitats

- Predict changes in distribution of habitats
- Evaluate future habitat connectivity
- Predict the effects of climate change on species and ecosystems
- Prioritize sites for conservation

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Why study the effects of climate change on ecosystem services

- The poor are those most effected by climate change:
- Depend on natural resources and ecosystem services most directly for basic needs and livelihoods.
- Depend on climate sensitive sectors

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Factors which make a good climate change indicator: species

- high-latitude species
- restricted range species
- poor dispersers
- low-lying island species
- mountain-top endemic species
- extreme niche specialists
- species with lots of data

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Bad indicator species

- Widespread species
- Habitat generalists
- Broad altitudinal tolerance

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Factors which make a good climate change indicator: habitats

- Limited distribution
- Not anthropogenic
- Of importance for species or communities

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Study design: before you begin

- What do you want to find out?
- How do you want to apply your results?
- Who is going to use your results?
- Read what others have done already
- If possible, copy a method which works!

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Many different methods

- Long-term field study: measure real changes
- Desk study: model potential future changes

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A method that works

- Select indicators
- Determine key data to gather
- Set up monitoring stations
- Gather biological data over a long time period
- Gather concurrent climate data
- Analyze long term correlations and trends

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Long-term monitoring

- Elevational changes of birds in Costa Rica
- Changes in arrival date of migrants in Europe

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Another method that works

- Select indicators
- Calculate climate envelopes
- Model current distribution based on climatic envelopes
- Model potential future distribution
- Compare current and future distributions

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Select indicators

- Literature study
- Consult global and regional experts
- Collaborate with others

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Calculate climate envelopes

- Gather precise distributional data
- Use bio-climatic models to calculate climate envelopes (based on e.g. temperature, humidity, day length etc)

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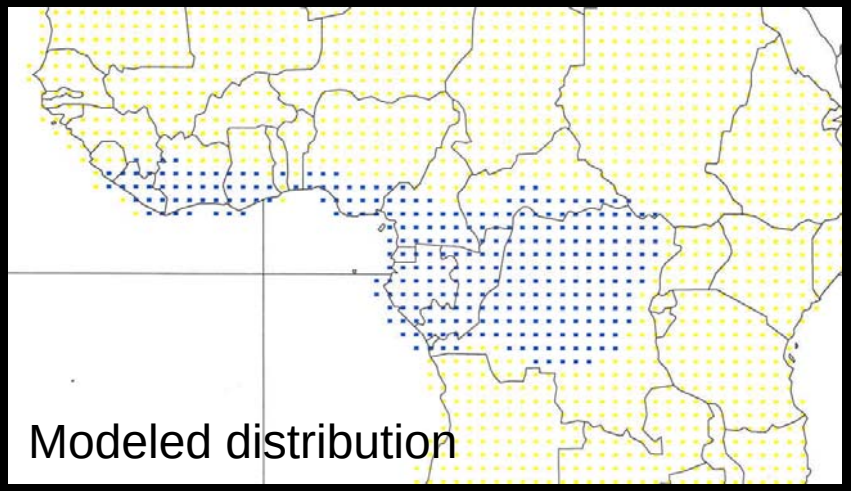
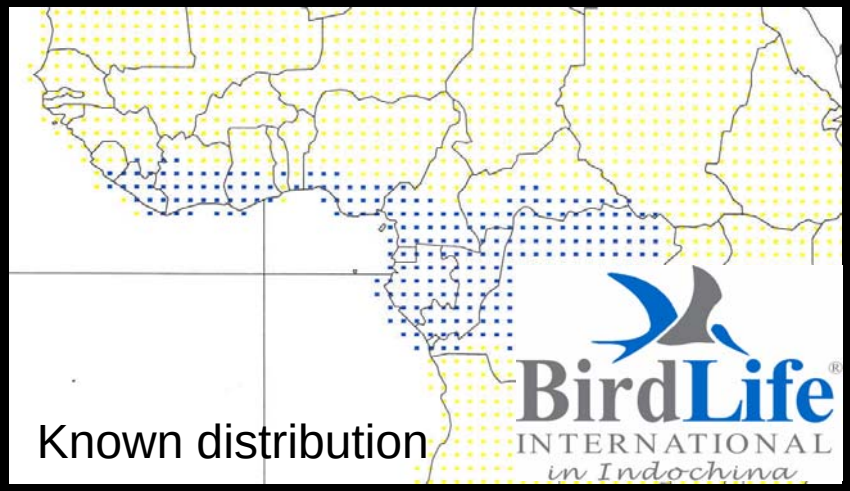
Model current distribution

- Use computer modeling programs
- Base on climate envelopes
- Check the validity of the modeled distribution against known current distribution



Modeled distribution



Known distribution

Model potential future distribution

- Use a range of climate change scenarios
- Produce attractive maps
- Compare against current distribution
- Analyze patterns of change

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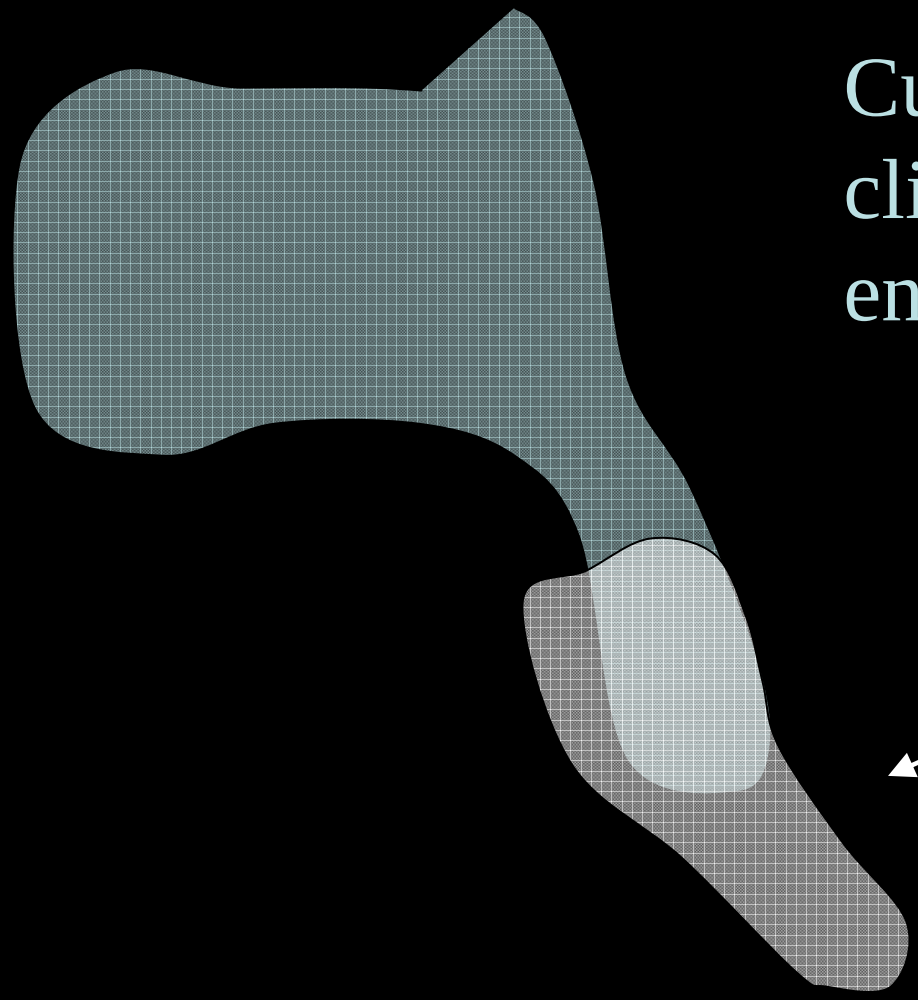
Using climate change models to predict future climate envelopes for birds



Current climate envelope

Climate change models

Future climate envelope

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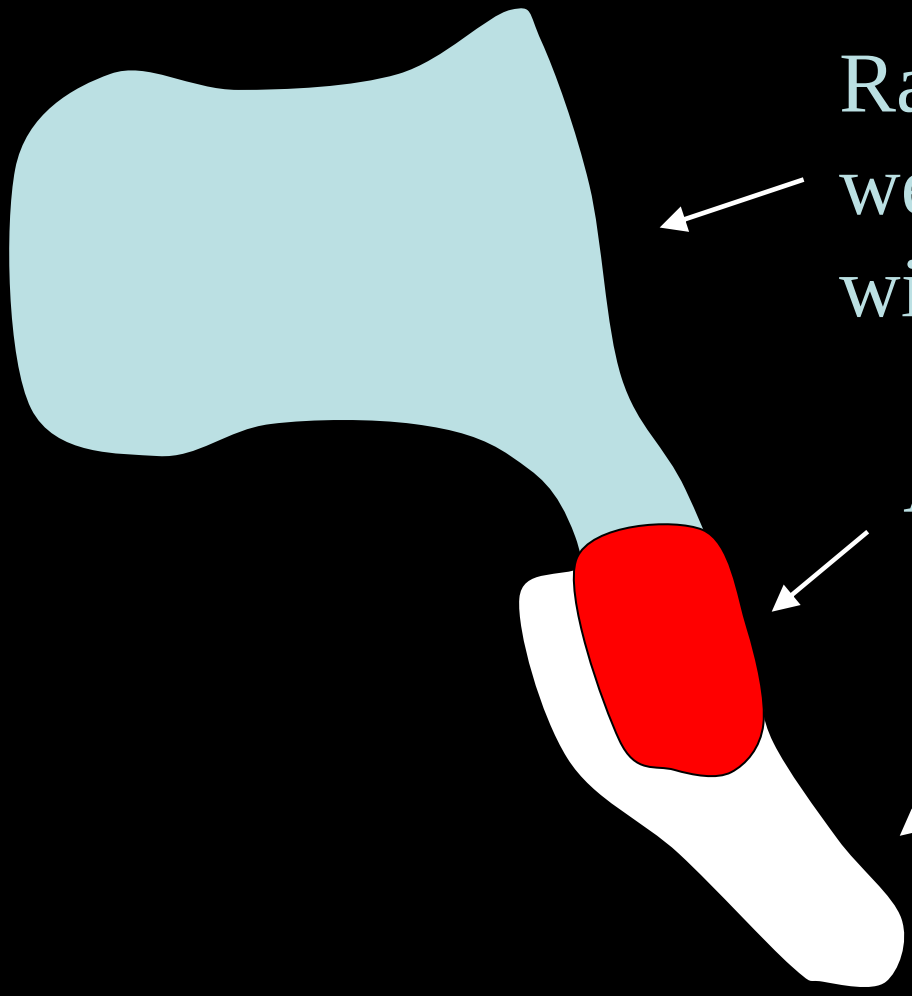
Modelling of predicted species range shifts



Range that we predict will be lost

Area of stable range

Possible new range

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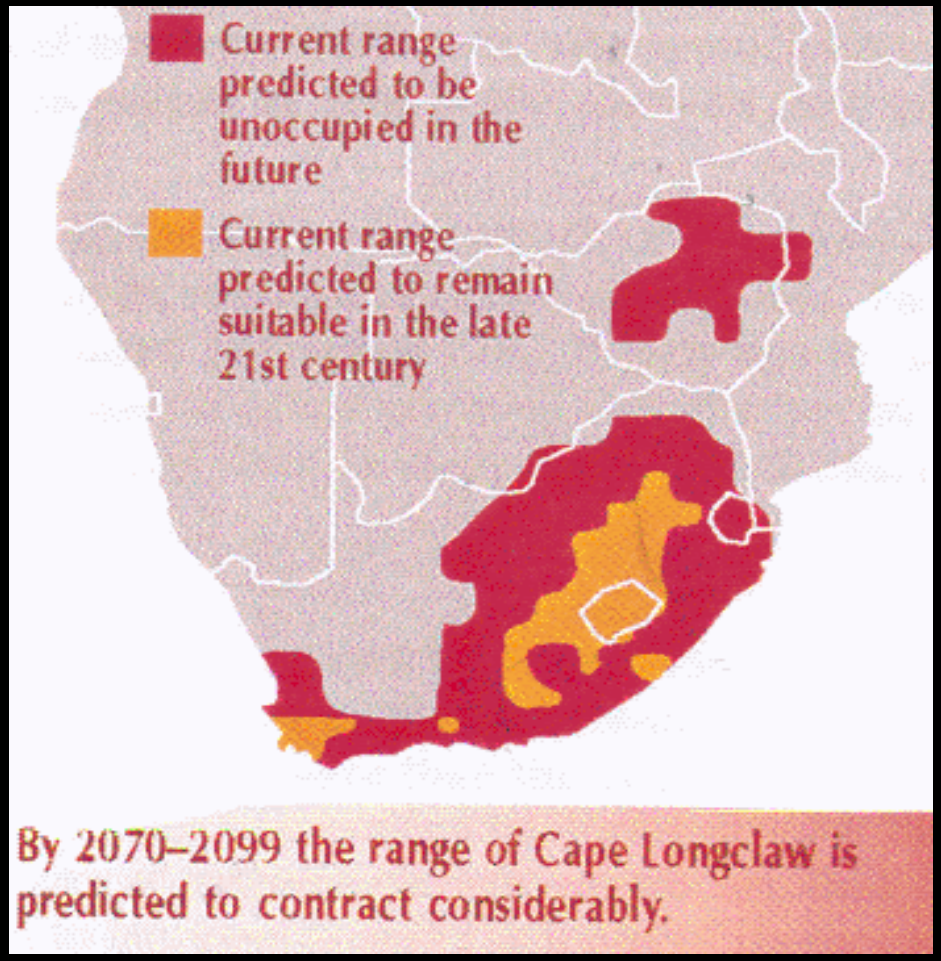
Projected range shifts

Cape Longclaw



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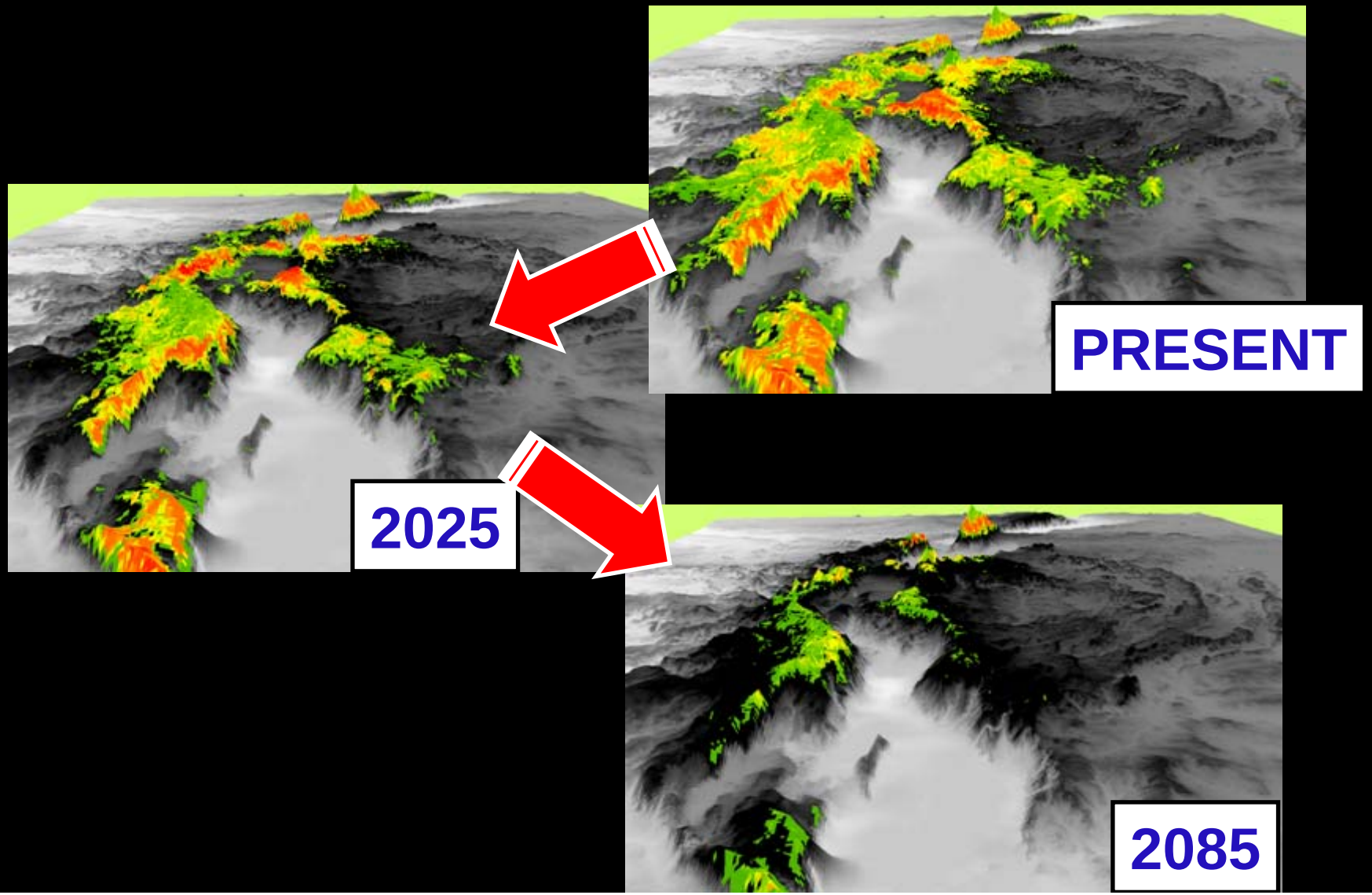
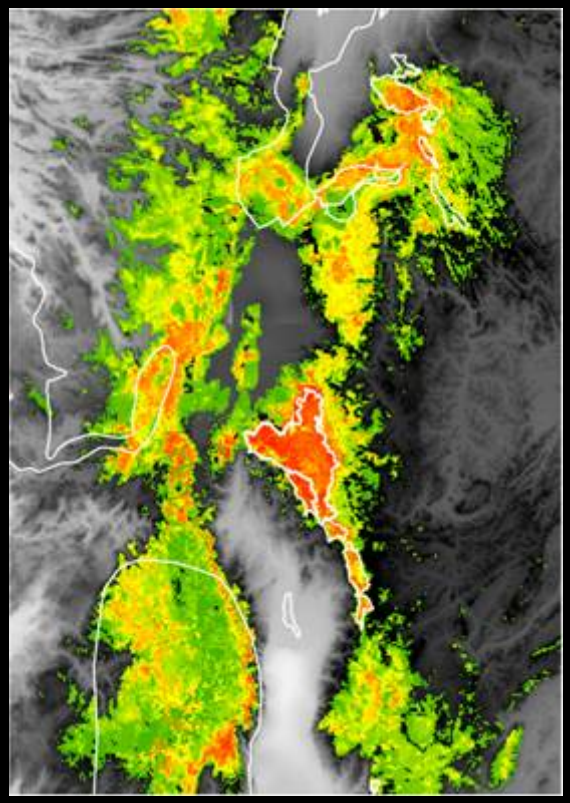
Projected species richness of 14 Albertine Rift endemics across time periods



Species richness of 14 AR endemics (white polygon outlines are IBAs)



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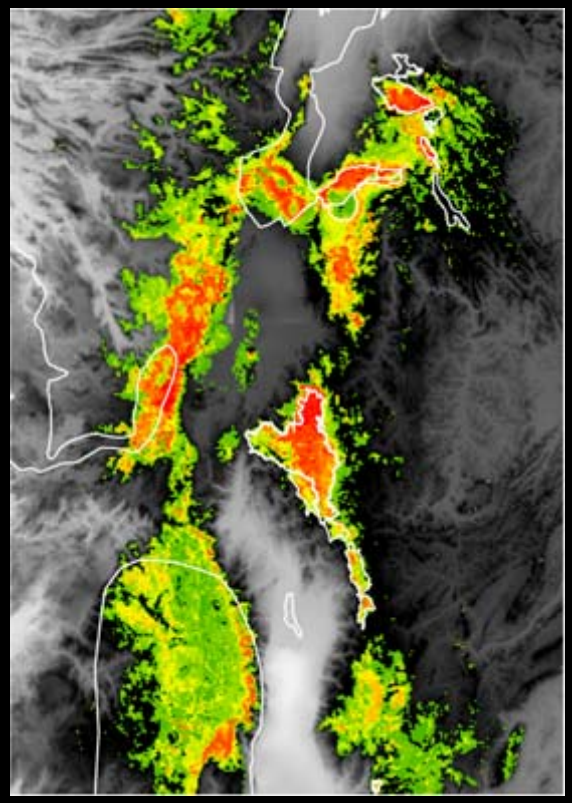

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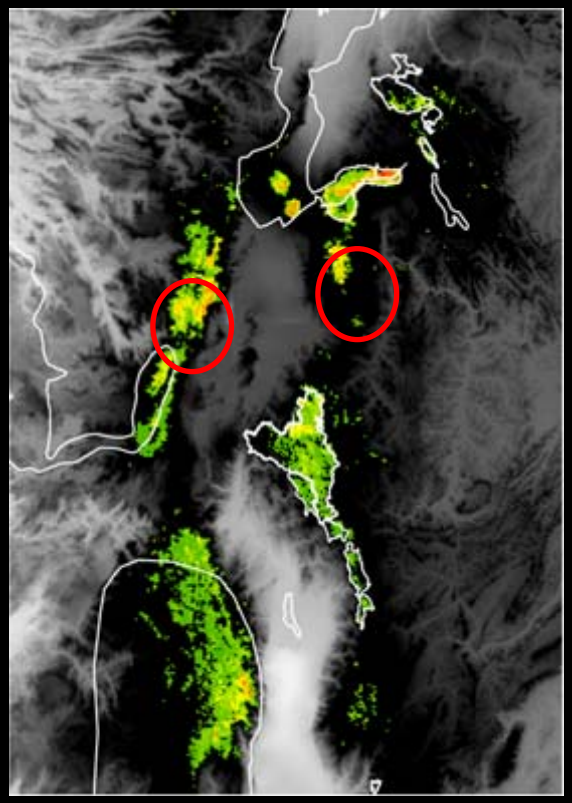

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Publish and apply results

- Use results in conservation planning
- Design site level interventions
- Conduct long-term monitoring to test your models

Thank you for listening!

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