Incorporating climate change and connectivity into the Mpumalanga Biodiversity Sector Plan

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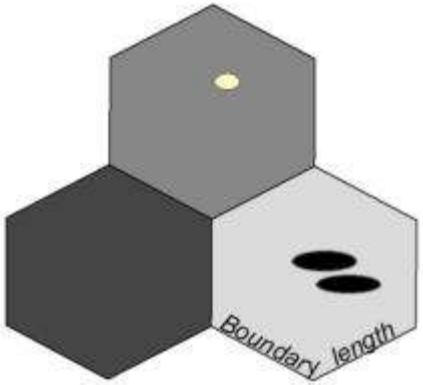
Introduction

1. Actively planned to incorporate climate change within MBSP.
2. Climate change (CC) in not an exact science – many uncertainties - but there are certain underlying principles and approaches that can support biodiversity's ability to adapt to a changing climate.
3. If CC does not happen, its inclusion within the MBSP would still add value to the MBSP (building resilience to change).

Planning approach

- Focus on species or ecosystem's ability to adapt to a changing climate.
- To do so we needed to identify:
  - Areas of *intact/unfragmented habitat* that support species/populations.
  - Priority intact grasslands that form part of a *connected network of grassland habitat (patches that are important as stepping-stones supporting other patches)*.
  - *Climate change refugia* - where species are likely to persist into the future.
  - Prioritise areas with a diversity of *landscape facets* (abiotic variables).
  - Corridors to enable *the movement of species or ecosystems across a landscape*.
  - Corridors that *follow areas of climate change resilience*.
  - Climate change corridors that link up with the *CC corridors from adjacent provinces.*
  - Climate change *corridors that* also *link up CC refugia and PAs* located to across a range of altitude and latitude.

Systematic spatial assessment



MARXAN identify most efficient area to meet all targets.

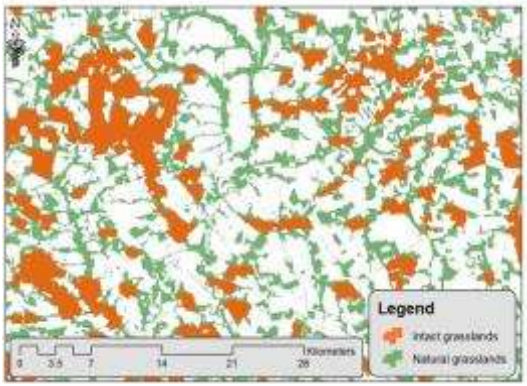
Low cost (cost surface) +

Good target achievement (biodiversity features) +

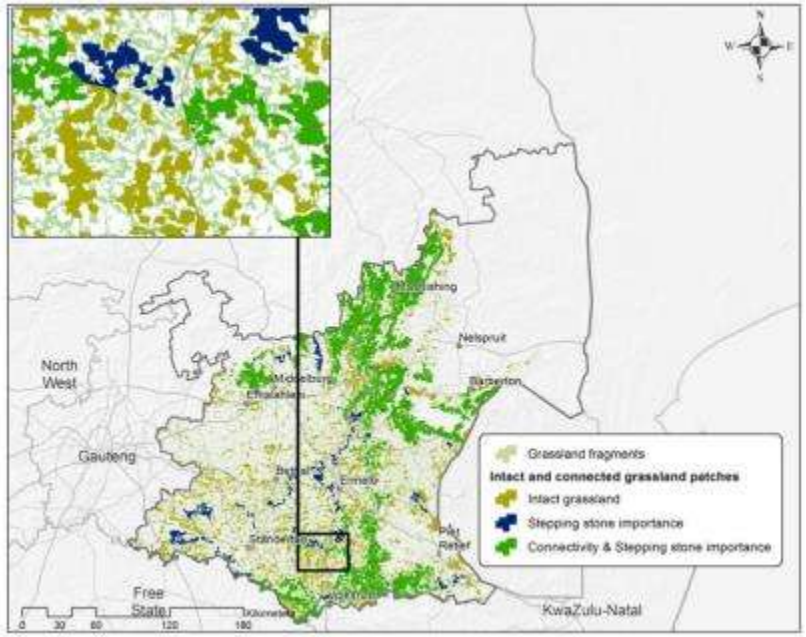
Good connectivity (minimise boundary length)

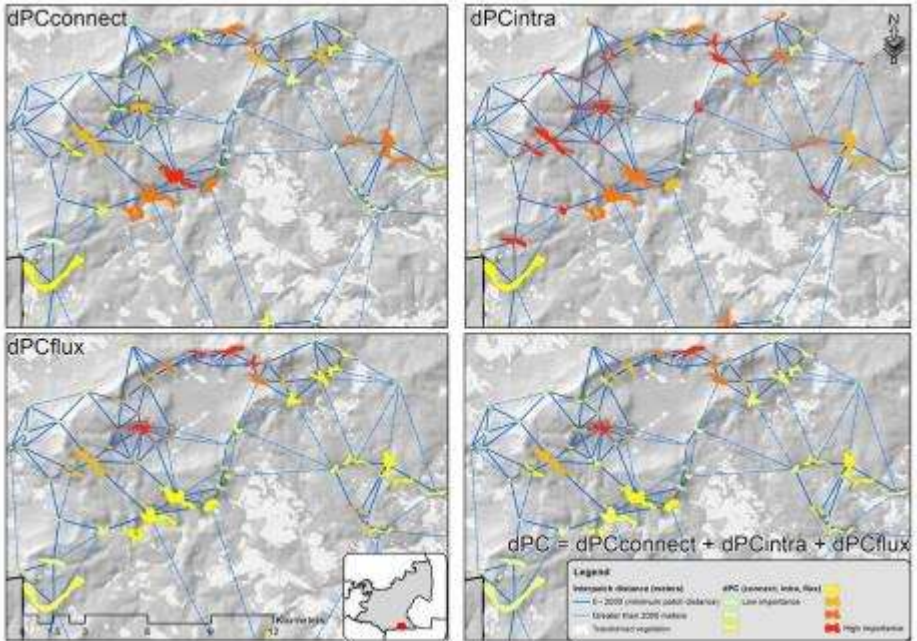
Biodiversity Features

Intact (source) areas – and those supporting dispersal

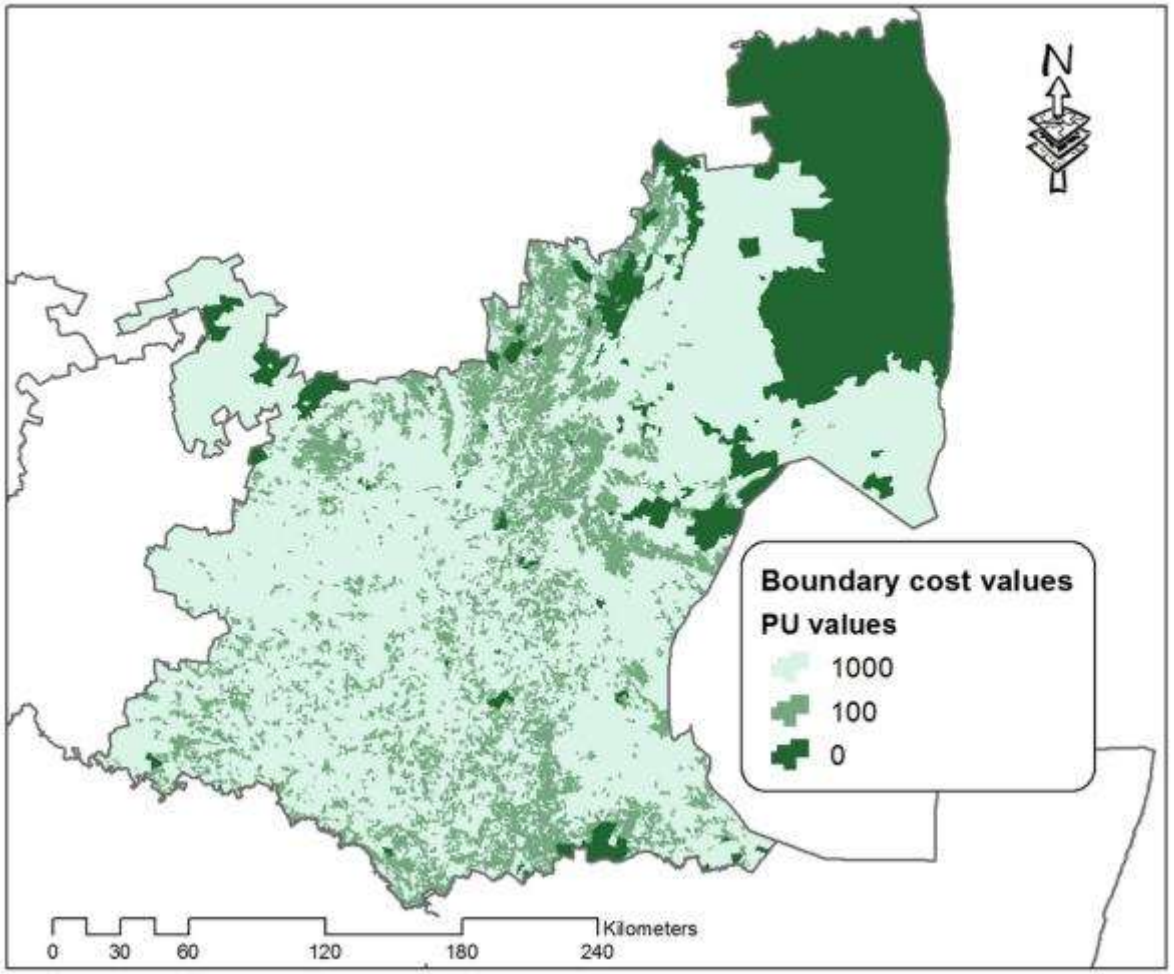


- Intact grassland patches – ID those that may support species moving in response CC
  - Intact /unfragmented grassland patches, >100 ha (*PatchMorph*)
- Quantified the connectivity importance of grassland patches (*Conefor Sensinode* – 10km interpatch distance)
  - Envisaged to support the dispersal of smaller mobile mammal, avifauna and plant species
- Important forest patches supporting dispersal



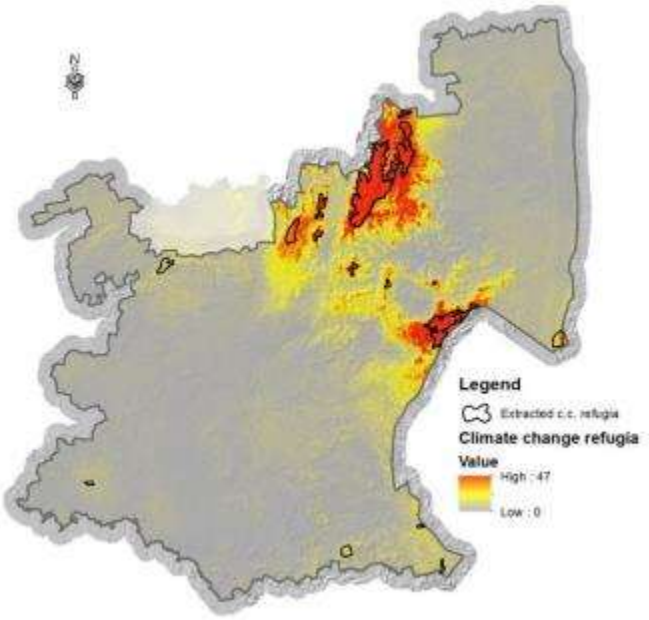


Discounting boundary costs in intact/unfragmented areas



Biodiversity Features

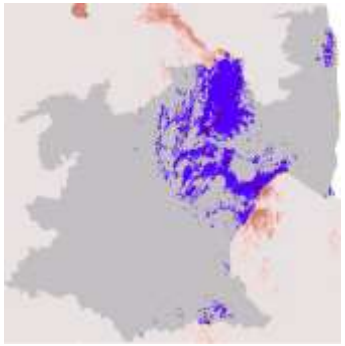
Climate change refugia



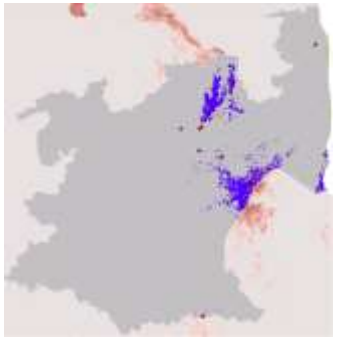
Distribution model output

Prunus africana potential distribution maps

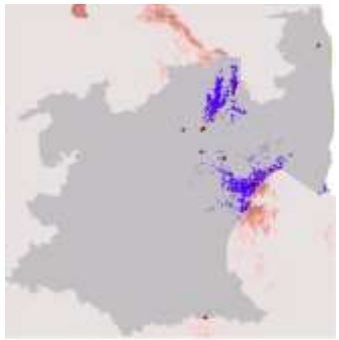
= Present
= Absent
= Known localities



Current

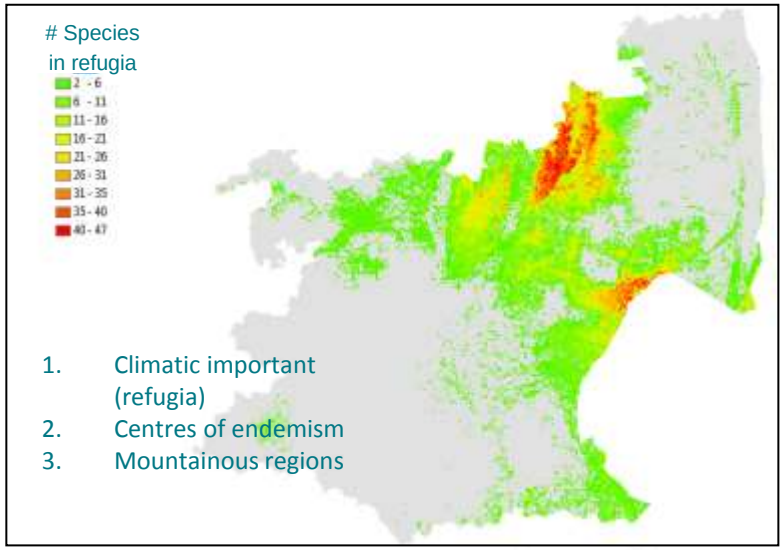


Future



Refugia

HadCm3, 2080, scenario B2



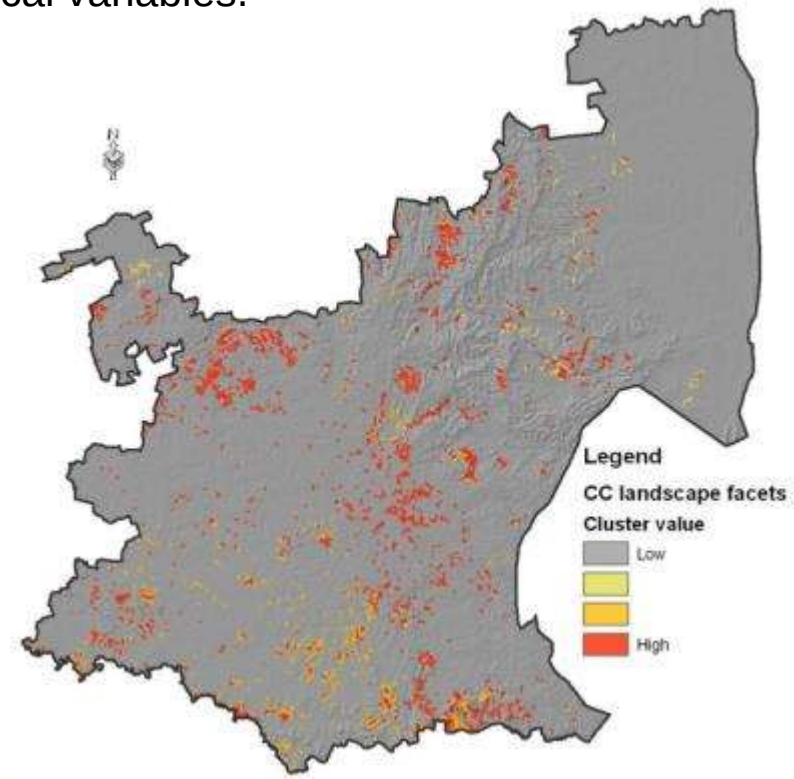
1. Climatic important (refugia)
2. Centres of endemism
3. Mountainous regions

Charles Hopkins – UP

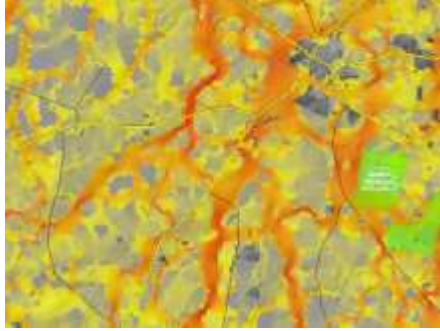
130 plant species

Landscape facets

- Landscape facets (combination of abiotic variables to identify microclimates that may allow species to persist).
- Landtypes, landscape, altitude, aspect, slope.
- Study entailed a separate Marxan analysis to identify clusters of landscape facets with a diversity of biophysical variables.

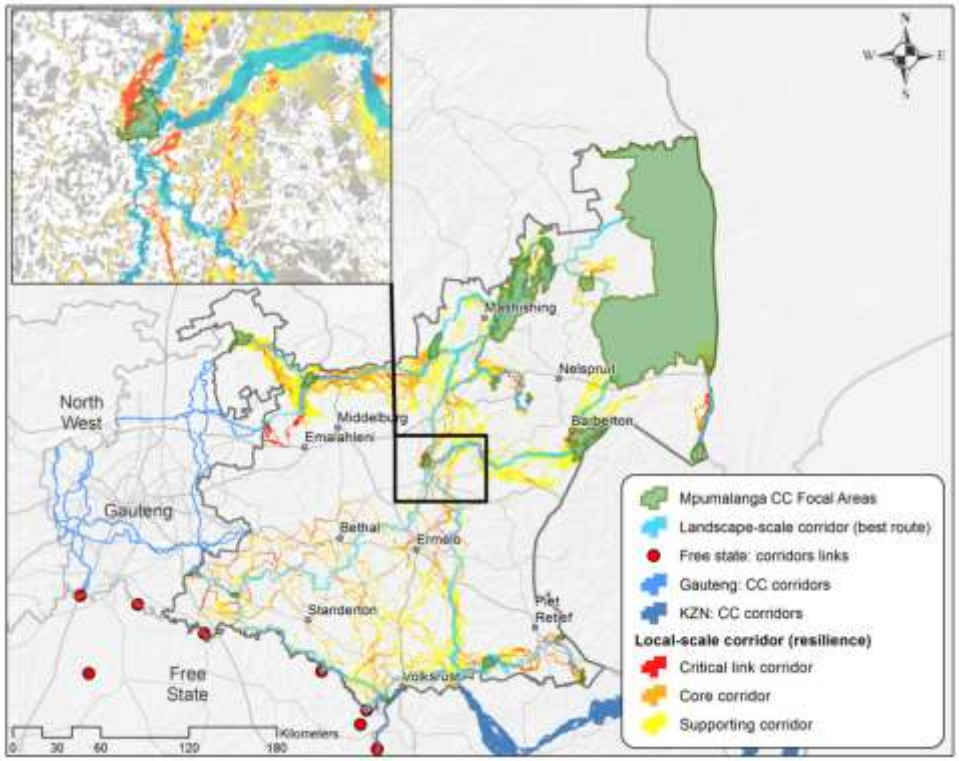


Beier, P. & Brost, B. 2010: Use of land facets to plan for climate change: conserving the arenas, not the actors. *Conservation Biology* 24, 701–710.



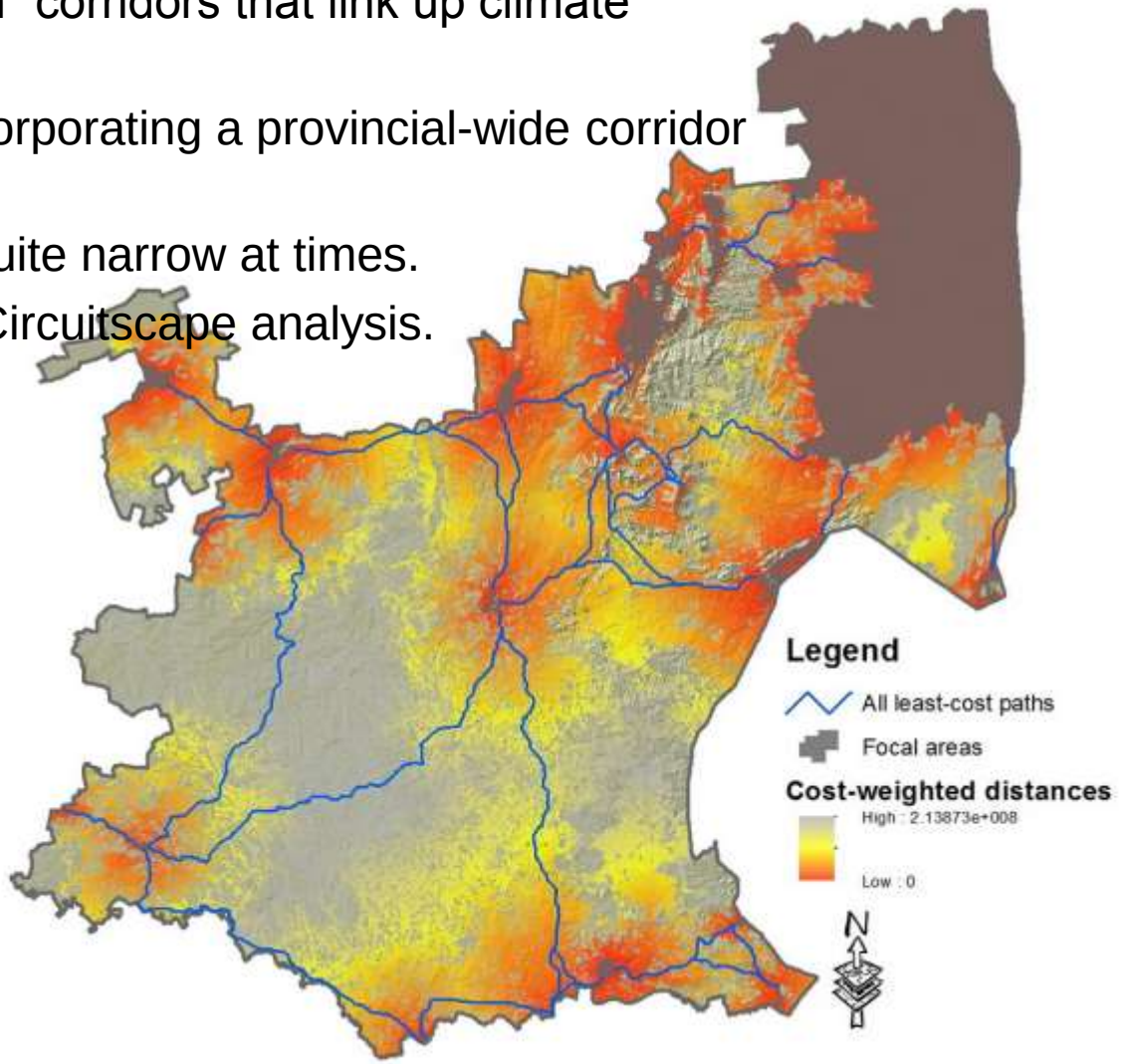
Detailed corridor analysis

- Climate change corridors that link up CC refugia, PAs, and corridors from adjacent provinces – CC focal areas.
- *Purpose of corridors*: to allow species and ecosystems to move in a response to climate change.
- Variety of new approaches (Linkage Mapper, Circuitscape)

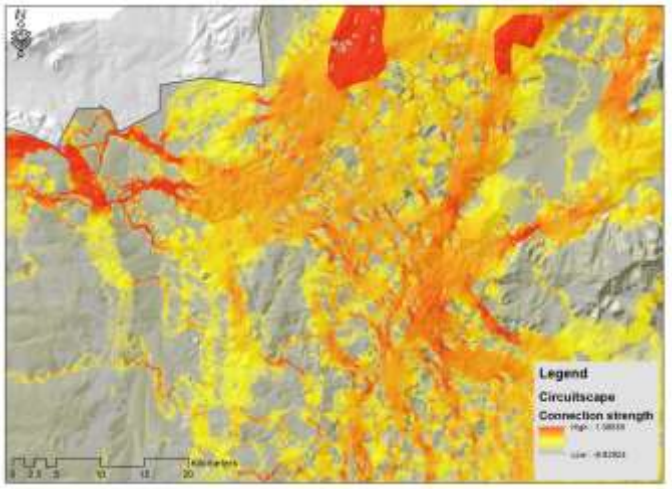


Landscape-scale corridor network

- Limited set of “best option” corridors that link up climate change priority areas.
- Highlight the need for incorporating a provincial-wide corridor network.
- Corridor width could be quite narrow at times.
- Adjusted path based on Circuitscape analysis.

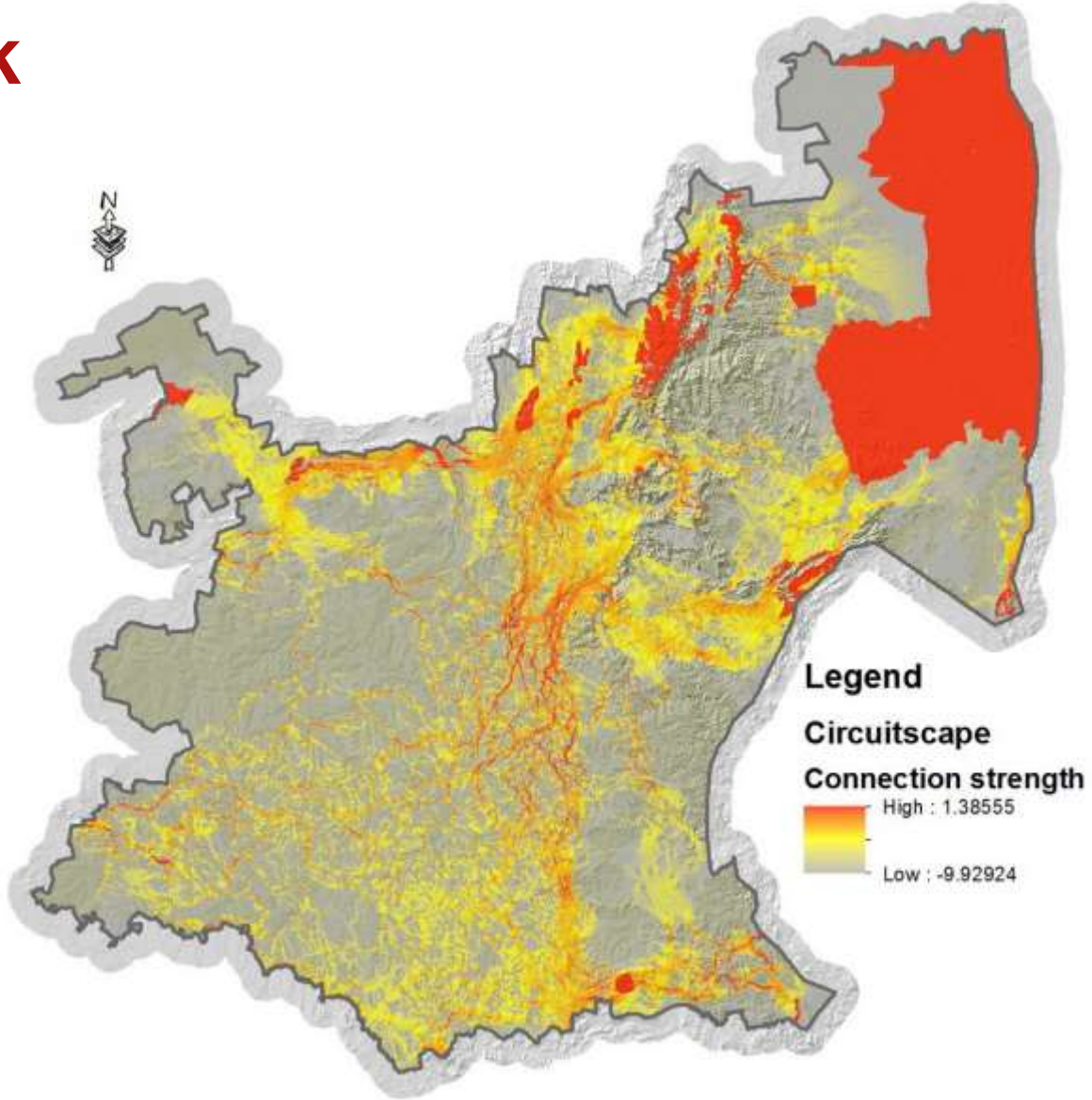


Local-scale corridor network



- *Circuitscape*: based on electrical circuit theory and identifies all possible paths that may contribute to connectivity.
- Reflects movement routes taken by random walkers.
- Circuit theory has the advantage of identifying "*pinch points*" or "*critical linkages*" (constrictions in corridors that, if lost, could disrupt connectivity).
- *Circuitscape* can also identify alternative pathways for movement, which can lessen the effect of critical linkages and loss of a single "*best-route"* corridors, and provides for networks that are more robust to disturbance.

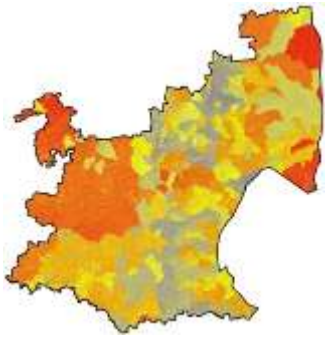
Application of a local-scaled corridor network



COST

Cost surface

Freshwater biodiversity priorities
(National Freshwater Ecosystem Priority Areas)



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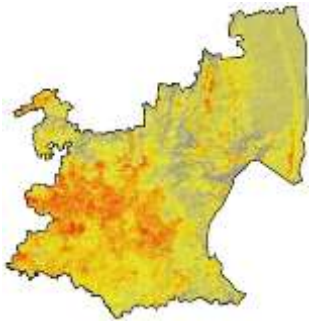
Assessment of competing land-uses
to minimize conflict



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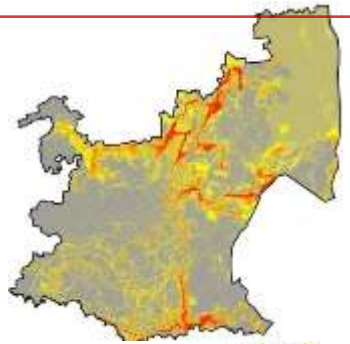
Areas important for climate change
resilience and connectivity



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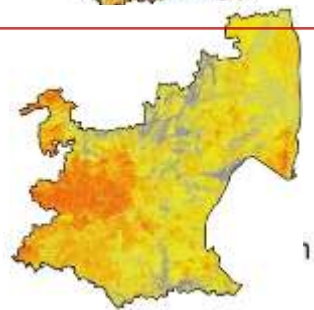
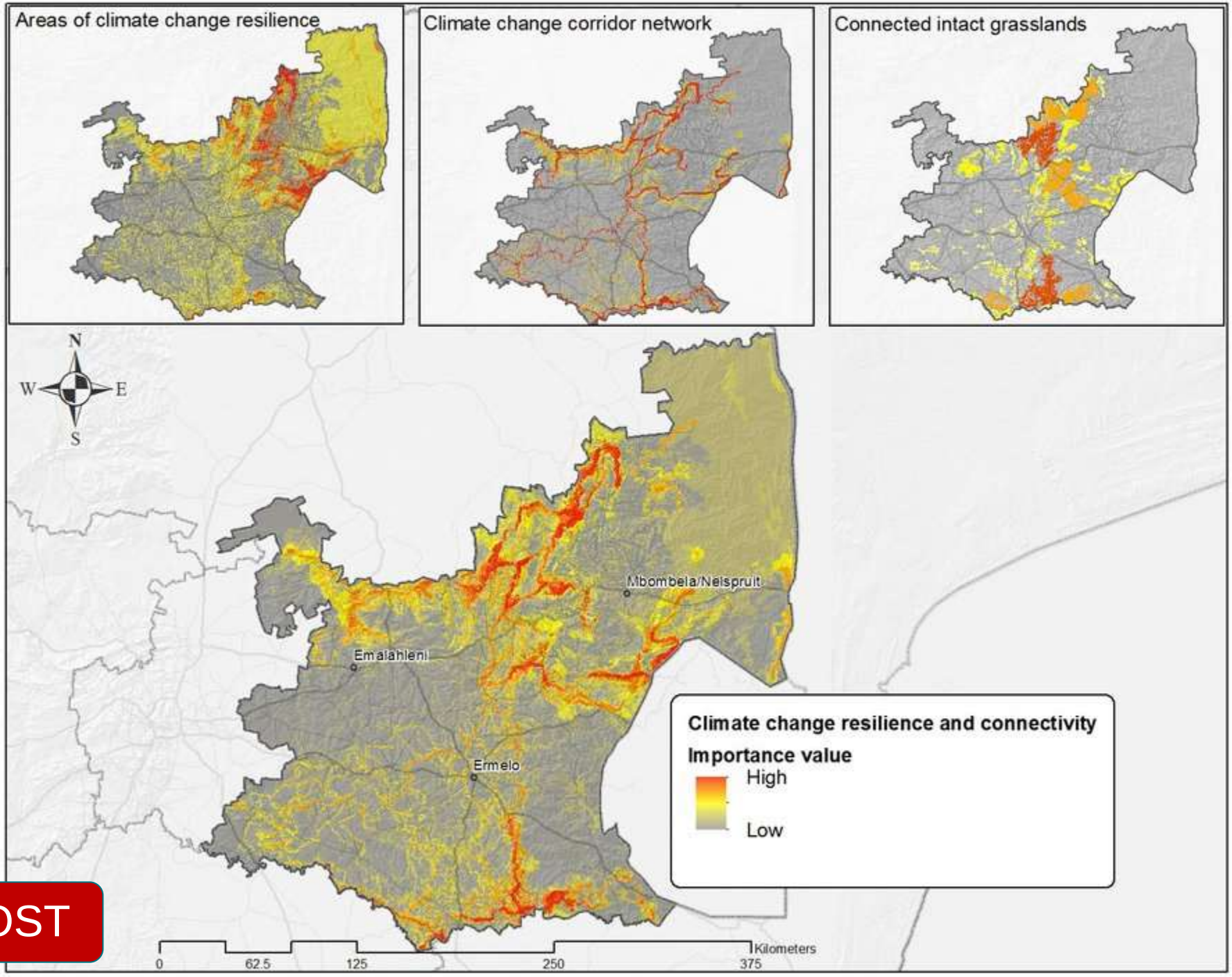
Incorporate into final cost surface




Areas of climate change resilience
Climate change corridor network
Connected intact grasslands
N
W
E
S
Mbombela/Nelspruit
Emalahleni
Ermelo
Climate change resilience and connectivity
Importance value
High
Low
0
62.5
125
250
375
Kilometers

COST

Concluding remarks

- Climate change (CC) in not an exact science, but our approach does build resilience into a spatial assessment.
- We propose the use multiple approaches to try and incorporate the effects of climate change on biodiversity. **No single best approach**.
- Improving connectivity was ranked as the most recommended response for climate change adaptation strategies (Heller & Zavaleta 2009)
- Our approach is not always based on empirical evidence. More research required.
- We believe our approach builds resilience and persistence into our SBP.

Heller, N.E. & Zavaleta, E.S. (2009). Biodiversity management in the face of climate change: A review of 22 years of recommendations. *Biol. Conserv.*, 142, 14–32

Acknowledge input from Dr. Mathieu Rouget and Dr. Stephen Holness

THANK YOU