Protecting and using Forest Genetic Resources for a changing environment

Stephen Cavers,
UK Centre for Ecology & Hydrology

'Forest Genetic Resources for future resilient forests'
All-IUFRO Conference 2022, Vienna

Future resilient forests?

- ‘Resilience’ has multiple and dynamic meanings, but…
- Likely to be delivered by:
  - some degree of diversity
  - dynamic systems (natural or managed)
- Need to make best use of the diversity available to us
- At species level this means genetic diversity
- Challenge: identify genetic diversity, bring it into use

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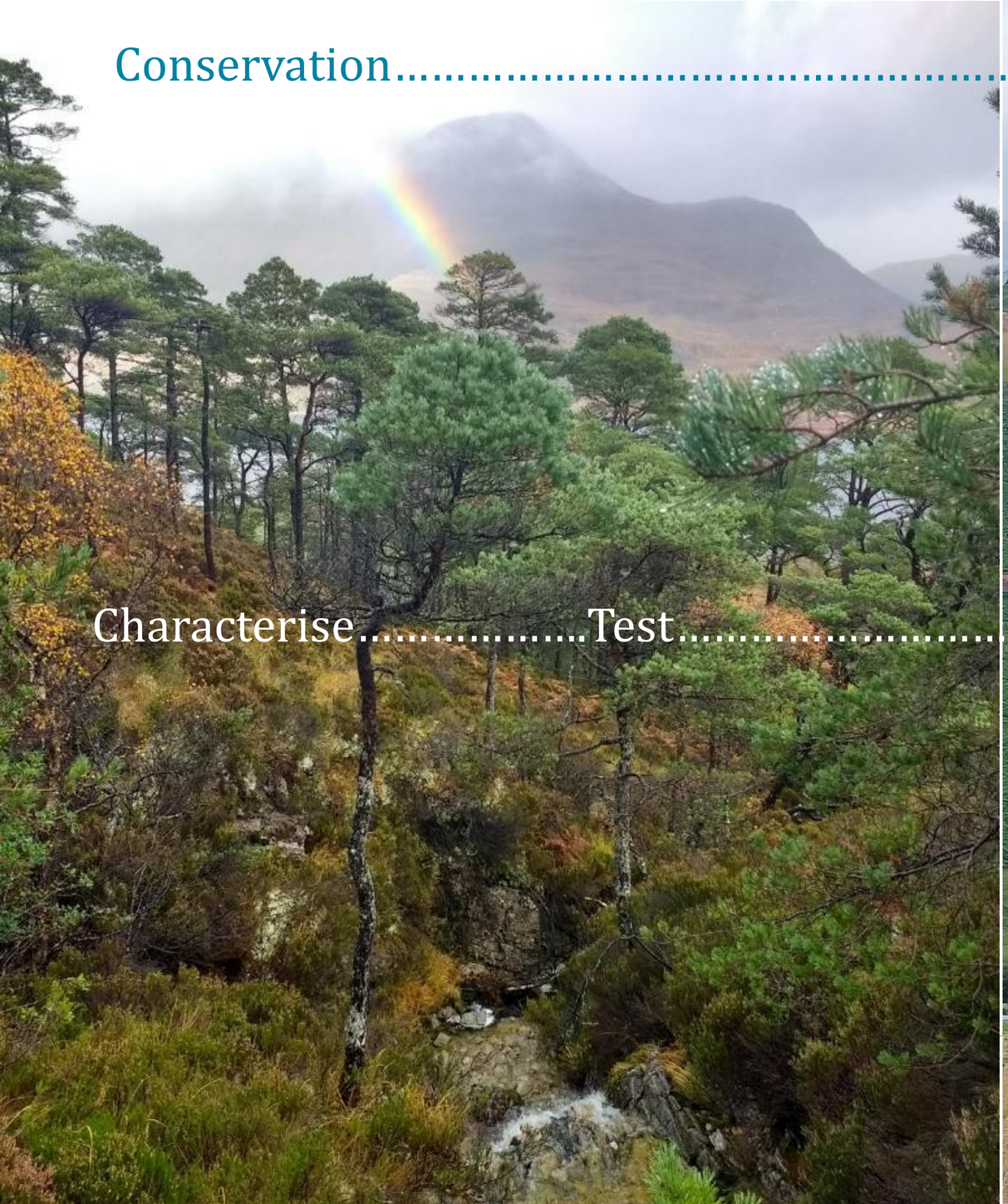
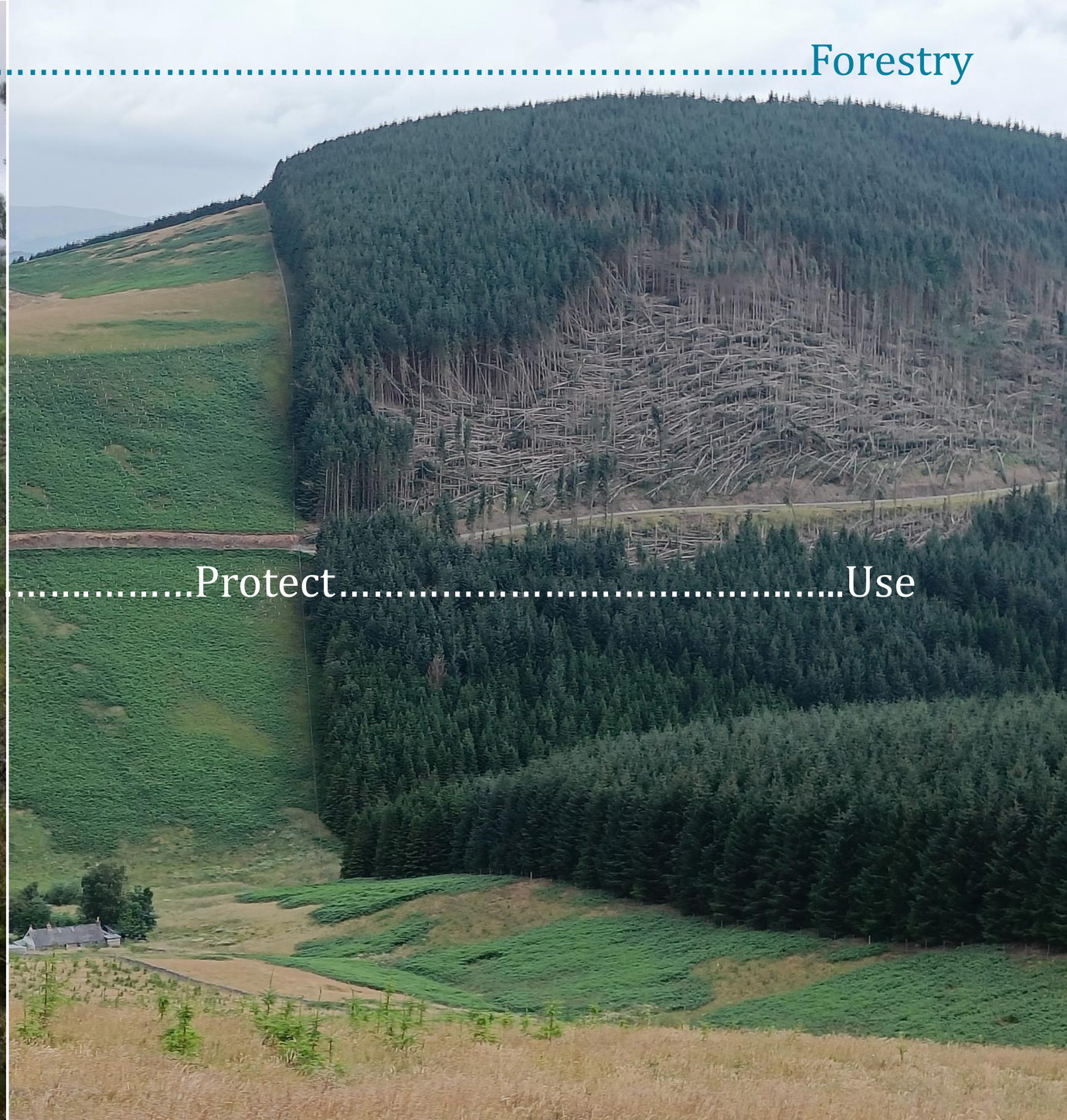
Conservation.....Forestry

Conservation……Forestry



Characterise……Test……Protect……Use



Case study: Scots pine in UK

- Native species
- ‘National icon’
- Reduced to ~10% of original area
- Persists in multiple small, fragmented populations

These populations represent:

- Naturally selected trees
- Remaining pool of ‘indigenous’ diversity

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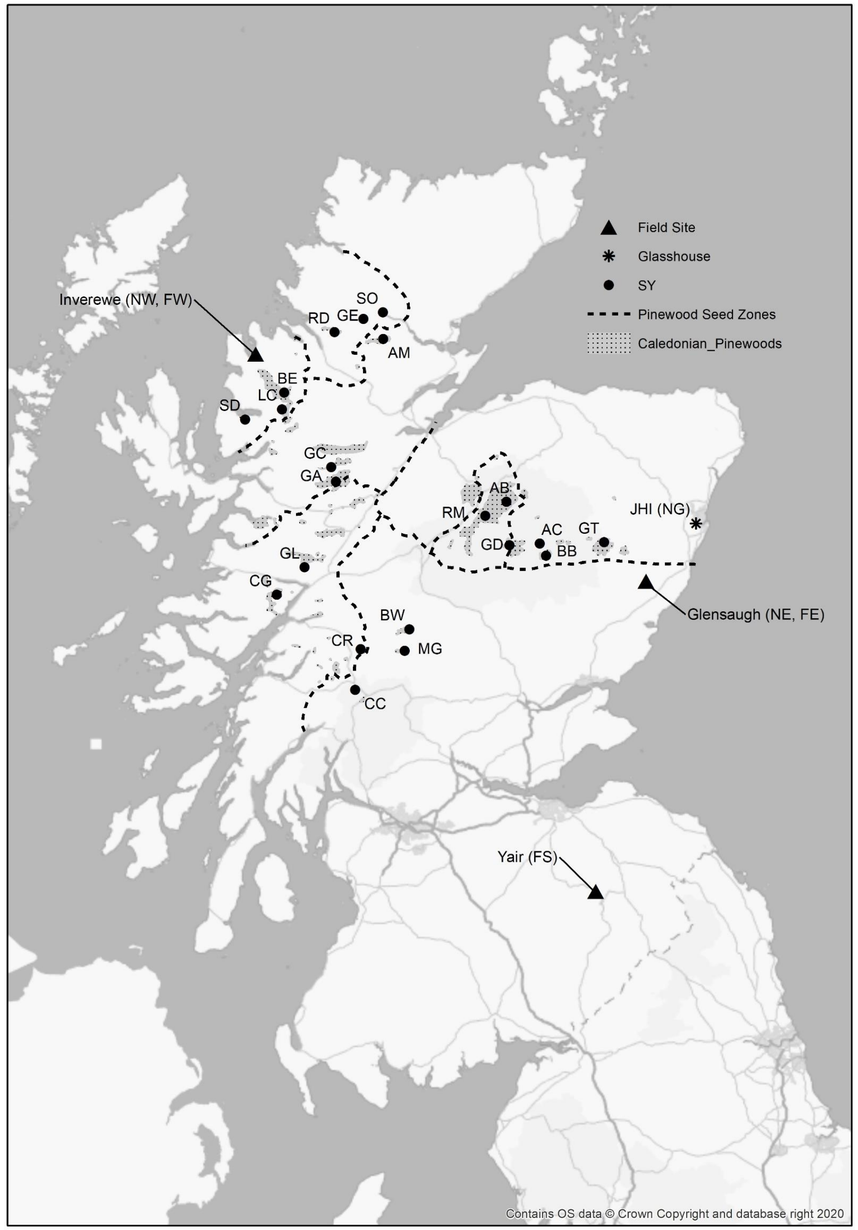
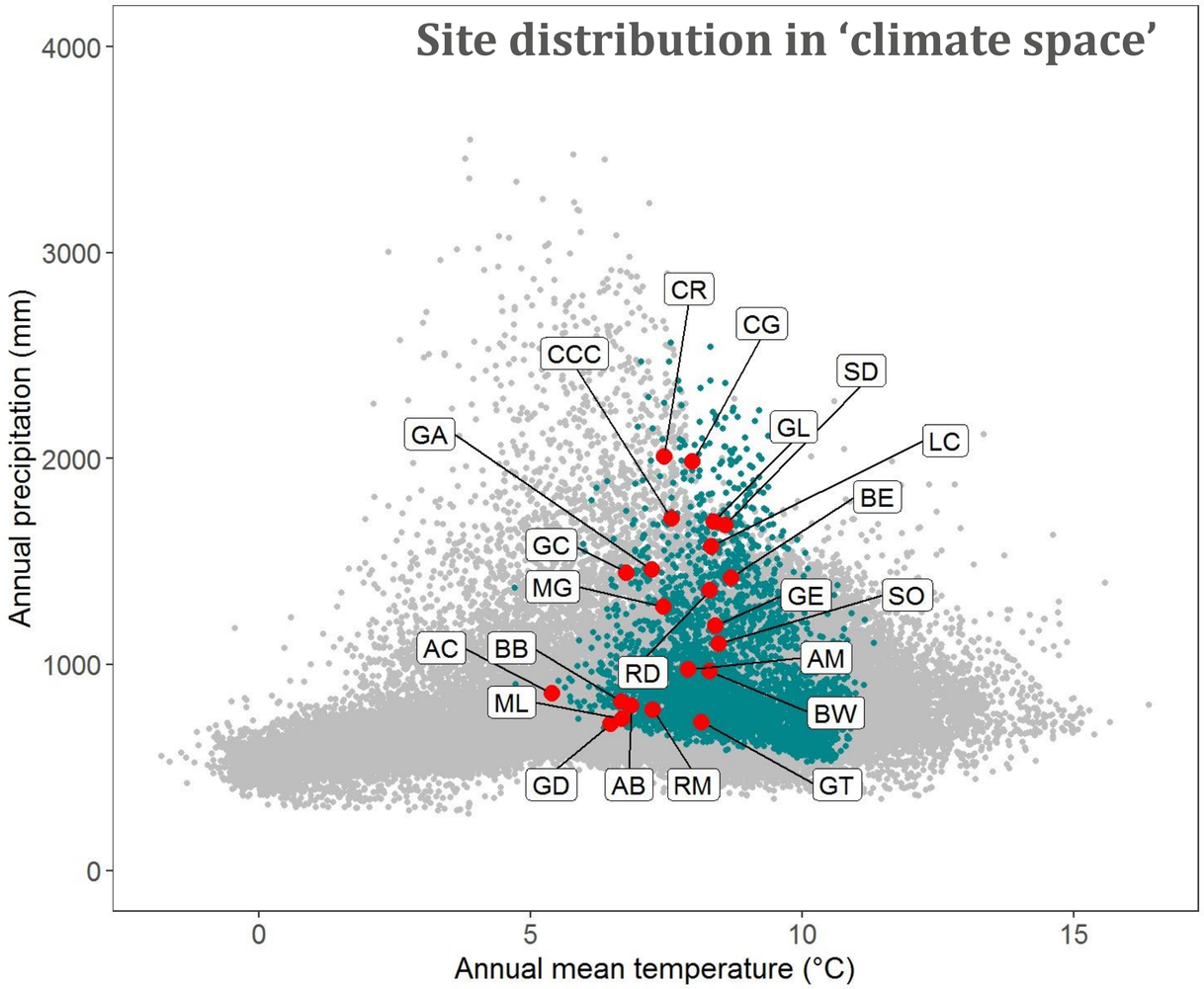
Characterise





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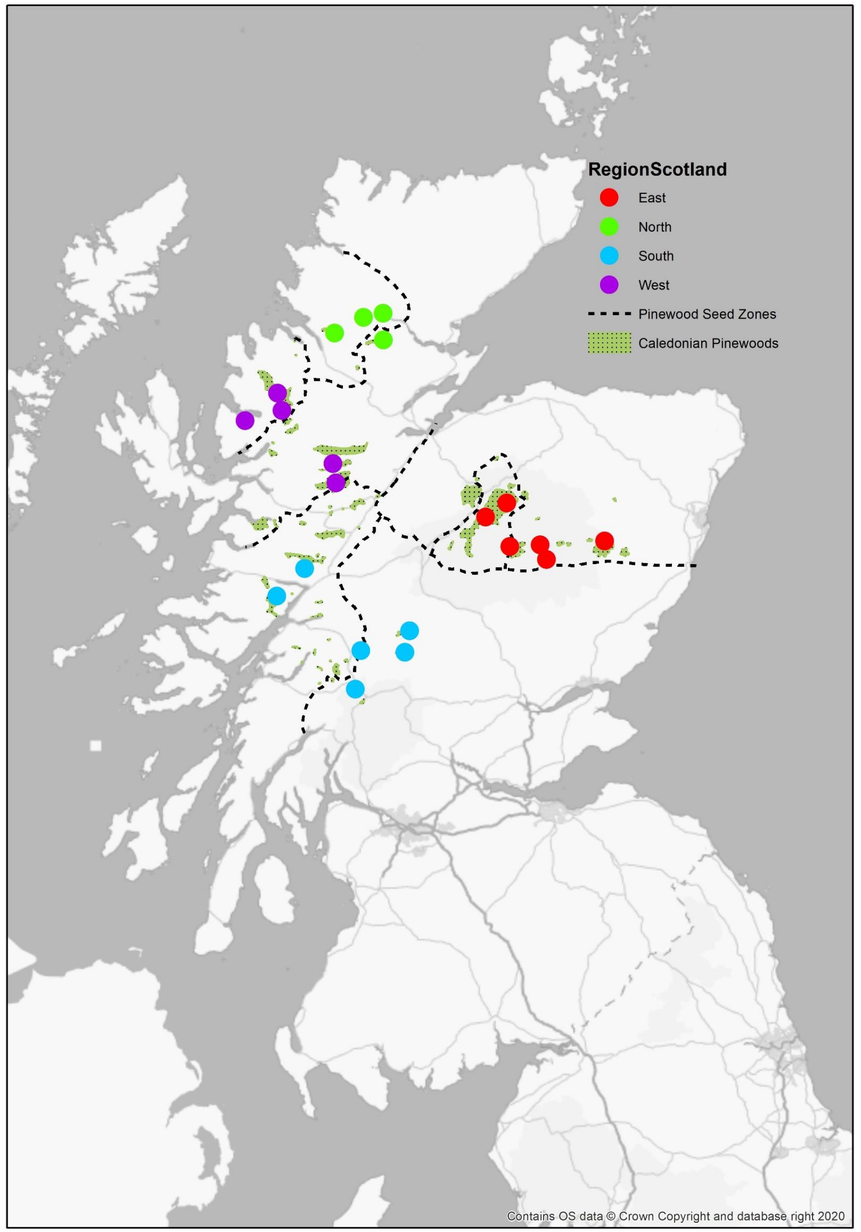
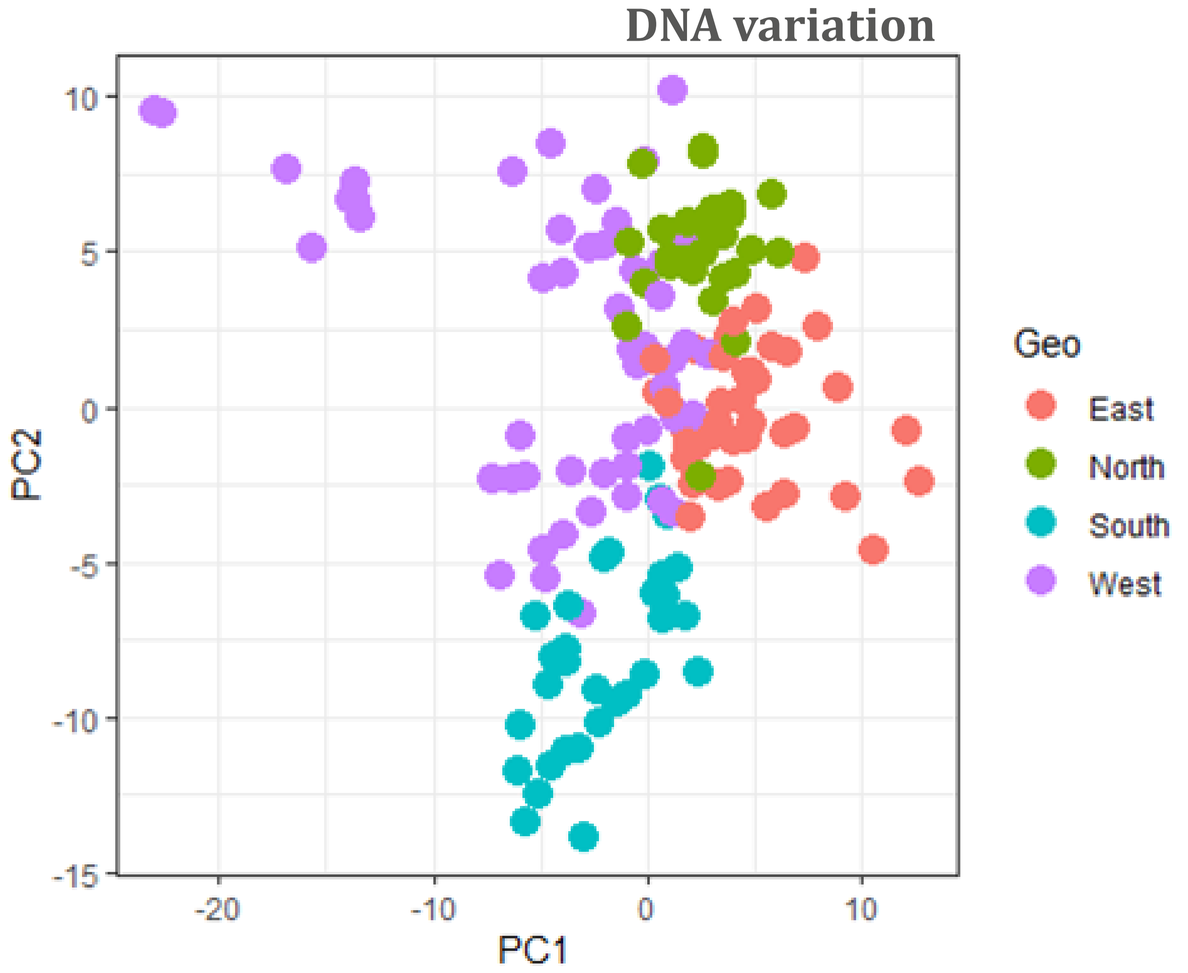
Characterise





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Test

Extensive trait assessment

- Growth
- Reproduction
- Phenology
- Disease tolerance
- Pest attack
- Leaf microbial associates

-> multiple potential traits of value

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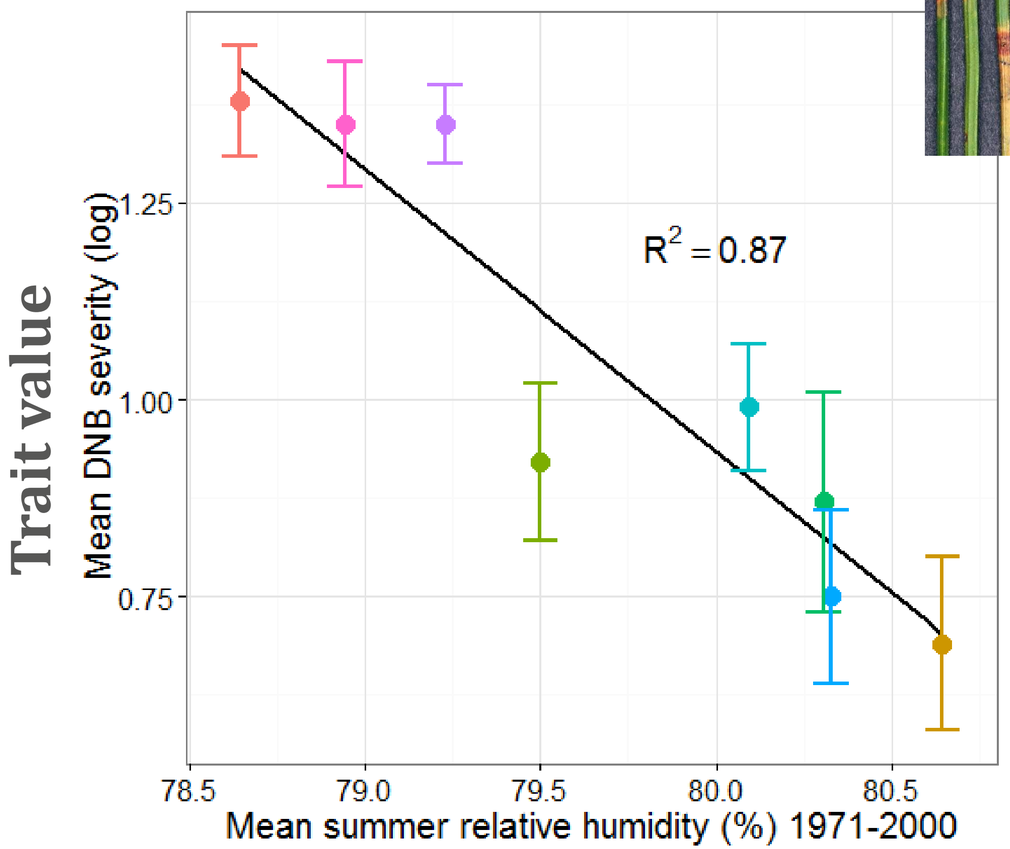
Test

e.g. Dothistroma tolerance



Conditions at site of origin

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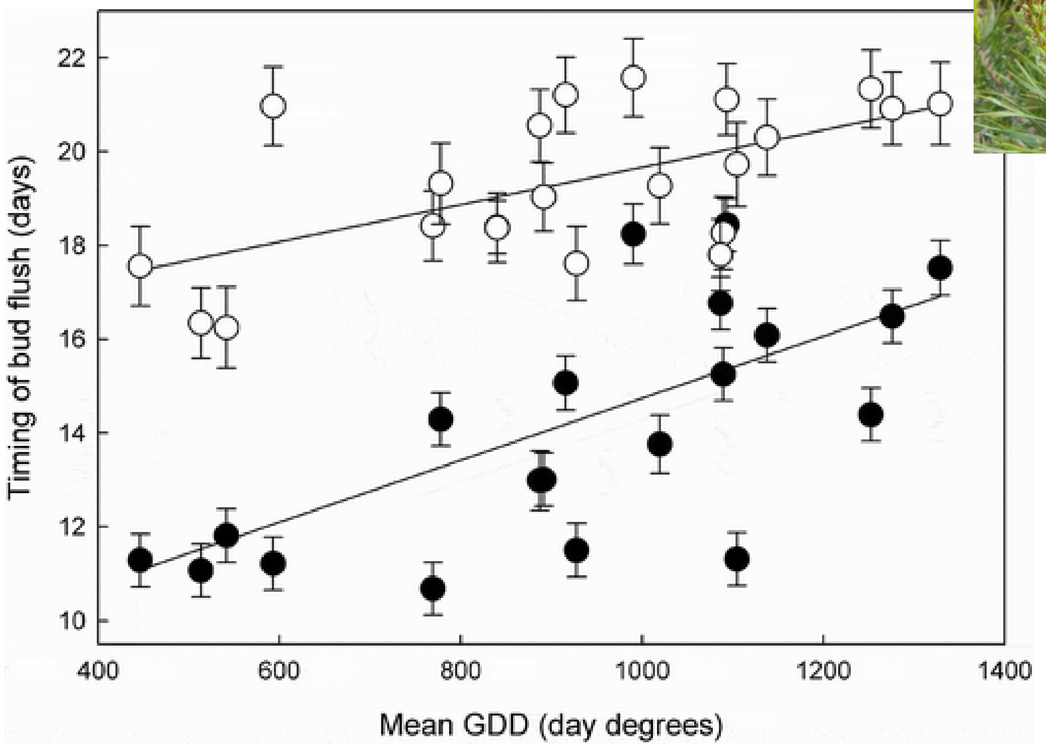
Test

e.g. Bud burst phenology



Trait value

Conditions at site of origin

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Protect

- National FGR Strategy

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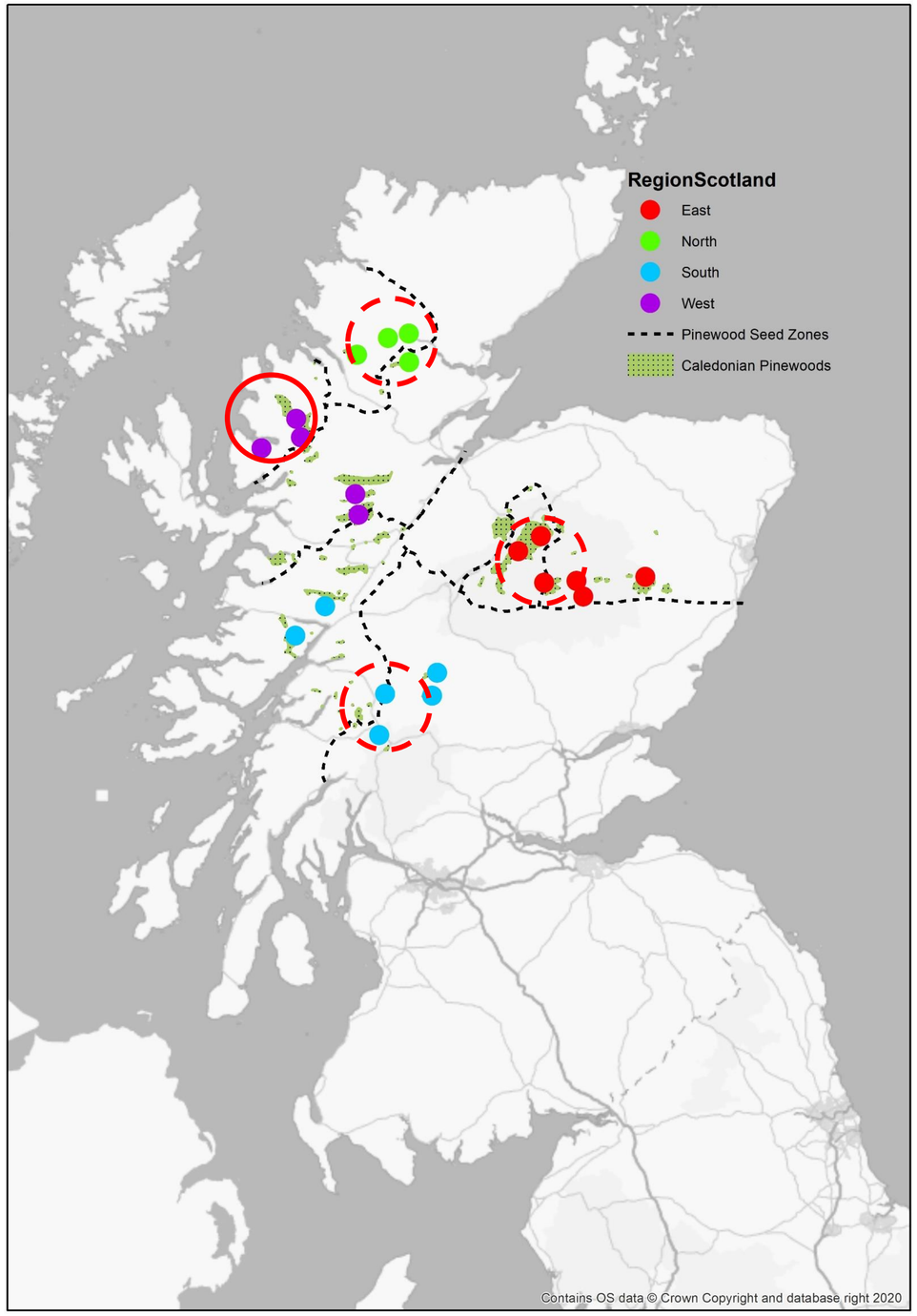

Protect

- National FGR Strategy
- *In situ* protection: Establishment of conservation populations – 'Genetic Conservation Units'

EUFORGEN | EUROPEAN FOREST GENETIC RESOURCES PROGRAMME

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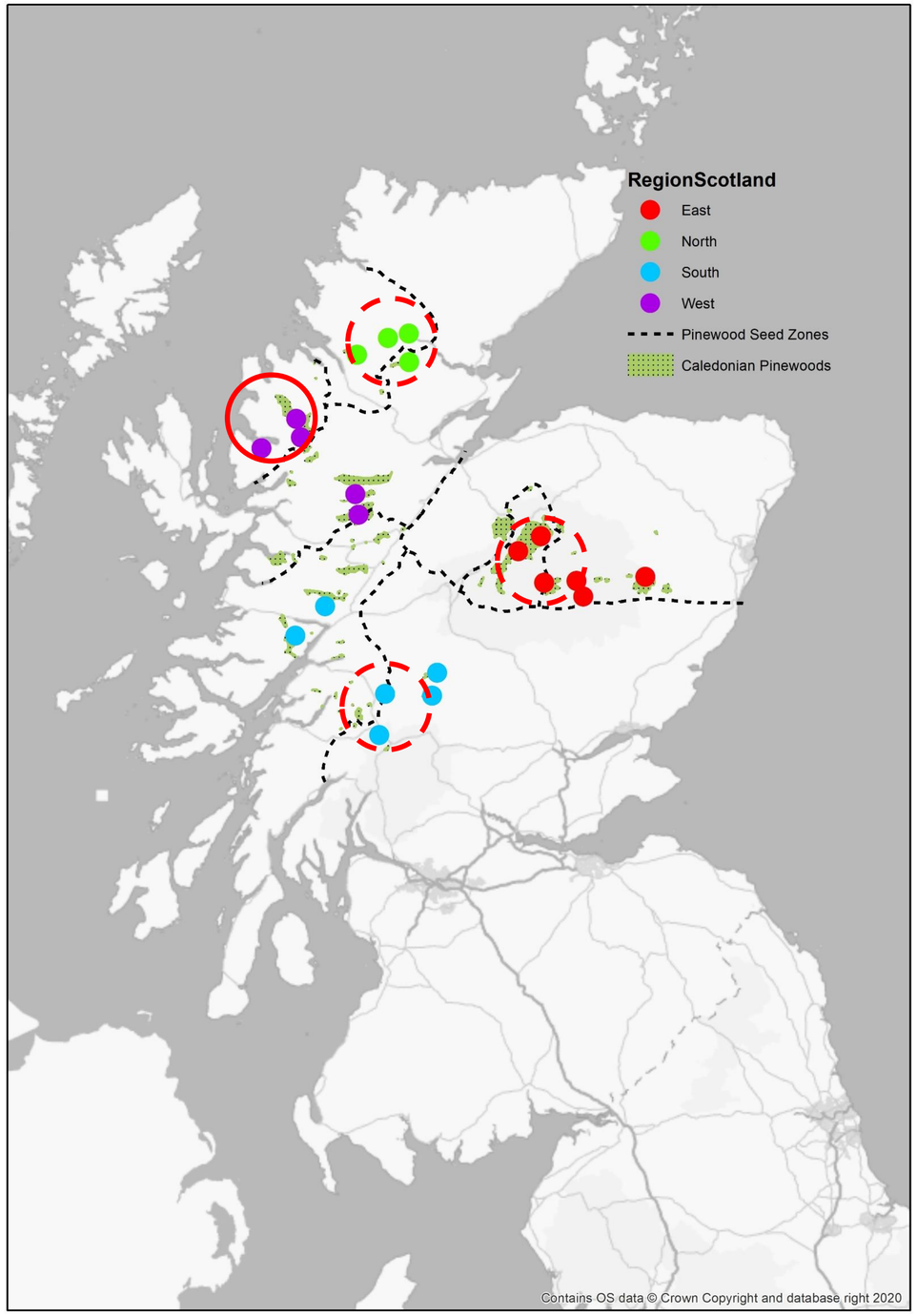

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Genetic reserve in Wester Ross to protect Scotland's national tree

By Ken Macdonald
BBC Scotland Science Correspondent

20 March 2019

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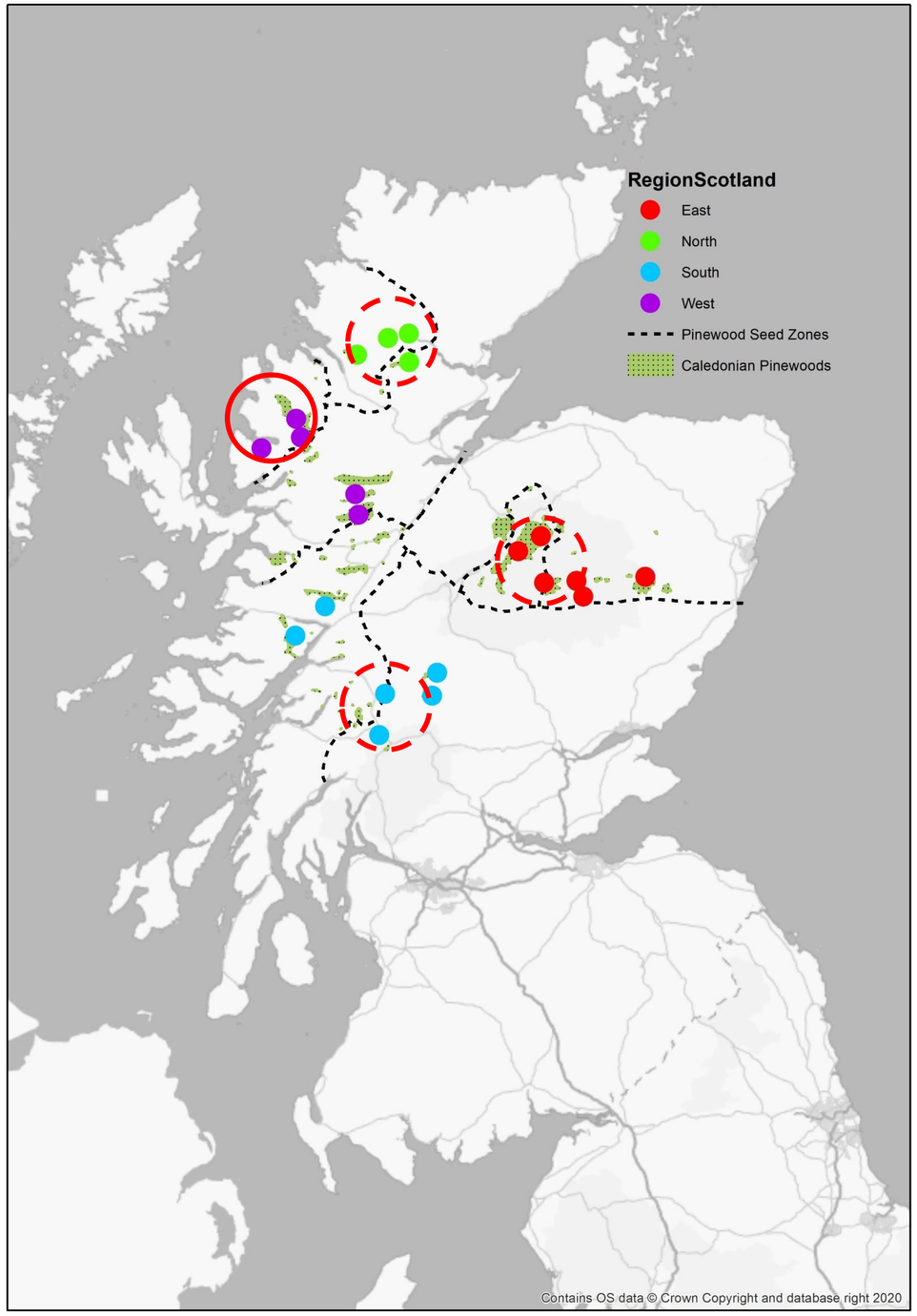

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Scottish Biodiversity Strategy Post-2020:

A Statement of Intent

Scottish Government
Riaghaltas na h-Alba
gov.scot

"declared the first genetic reserve in the UK to help ensure we maintain the distinctiveness of our Scots pine and other species."

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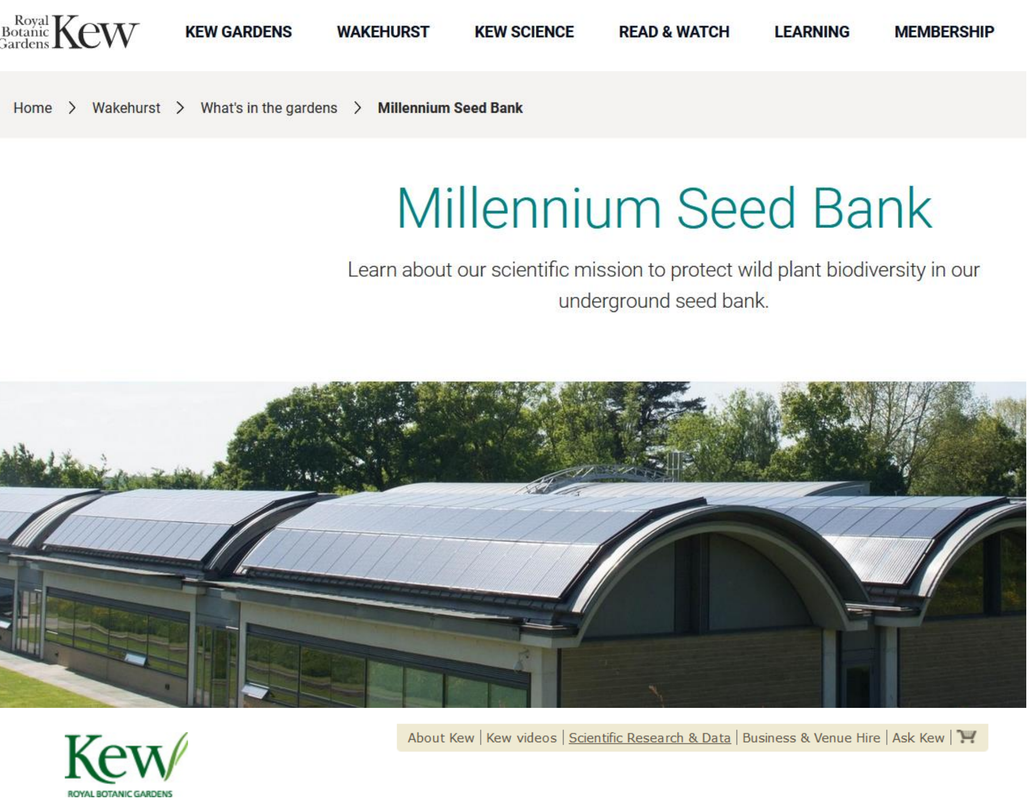

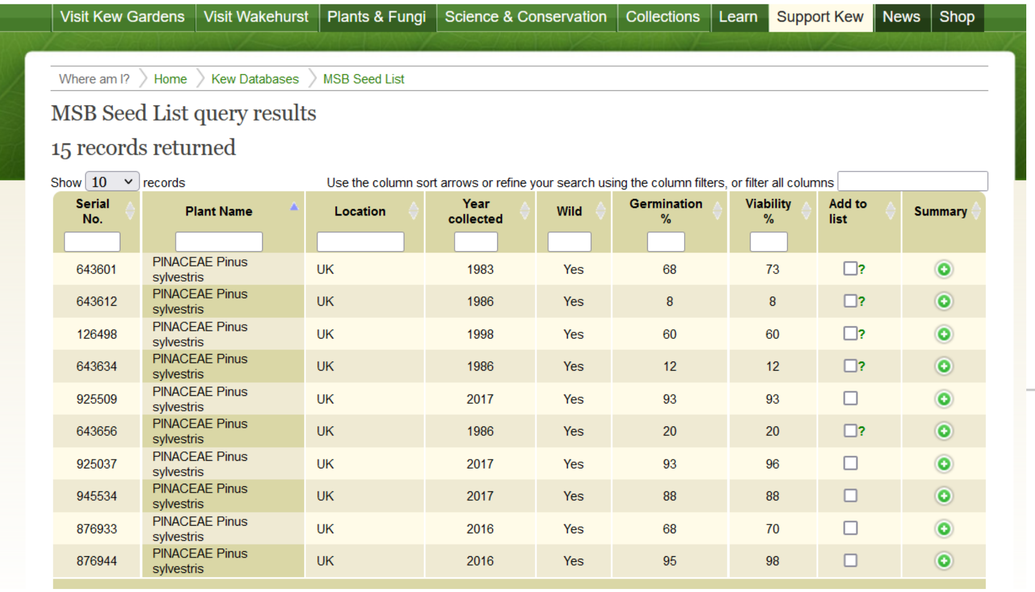

Protect

- National FGR Strategy
- *In situ* protection: Establishment of conservation populations – 'Genetic Conservation Units'
- *Ex situ* protection: seed collections -> RBG Kew Millenium Seed Bank

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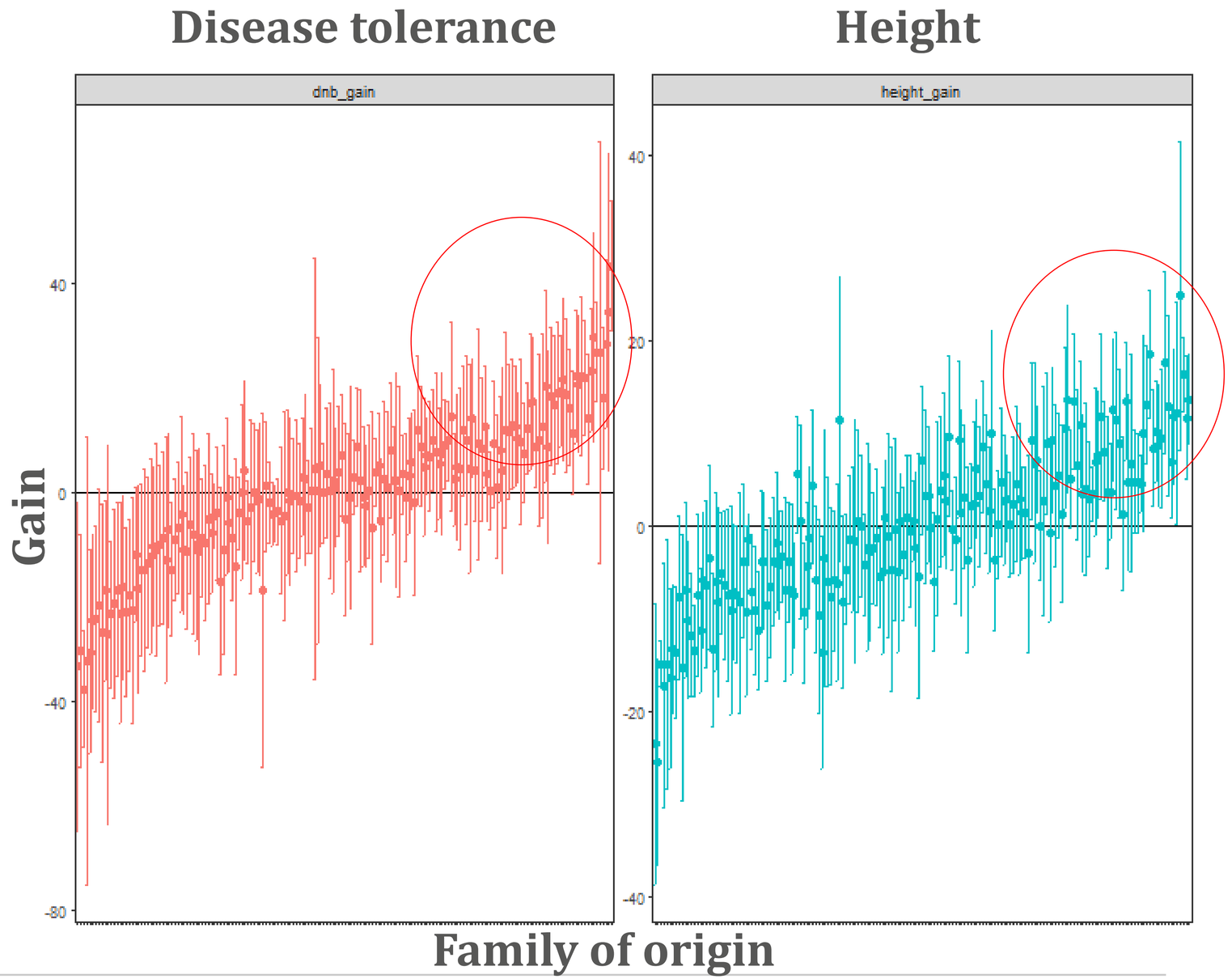
Use

- Selecting ‘best’ trees from test trials
- Estimated potential gains:

- 10% height
- 14% DNB tolerance

- Feed into breeding programme
- Plus: genomic tools to accelerate selection



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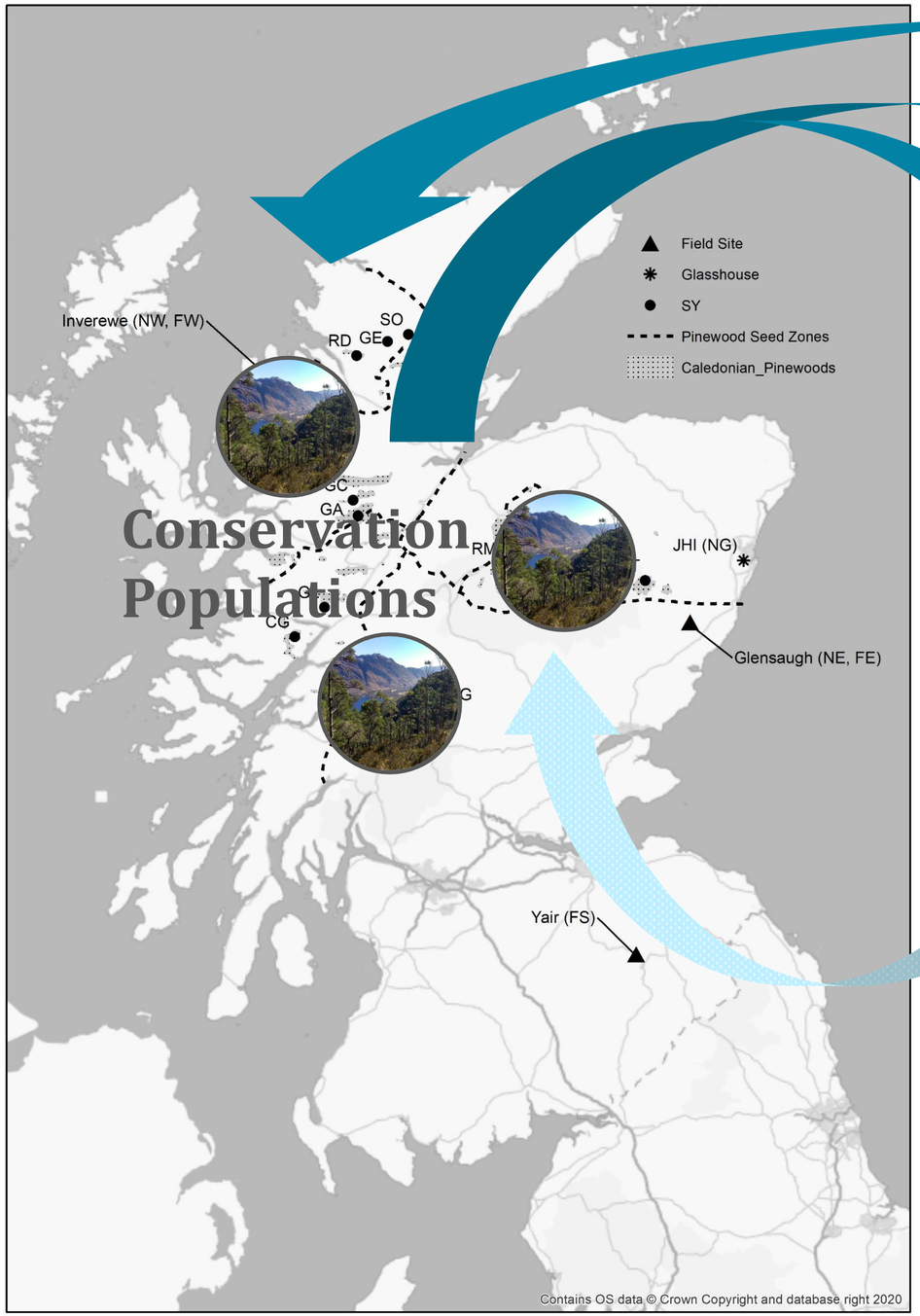
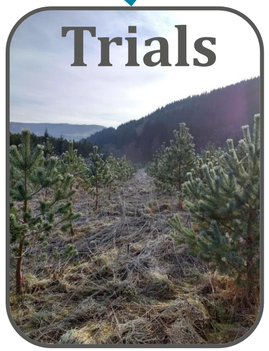


Conservation Populations

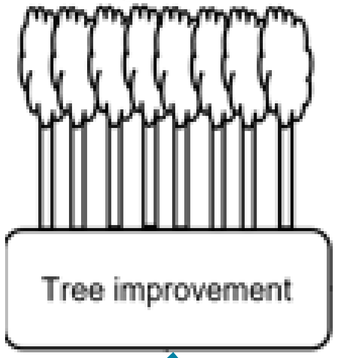
Seed Bank

Kew
ROYAL BOTANIC GARDENS

Trials



Breeding Programe



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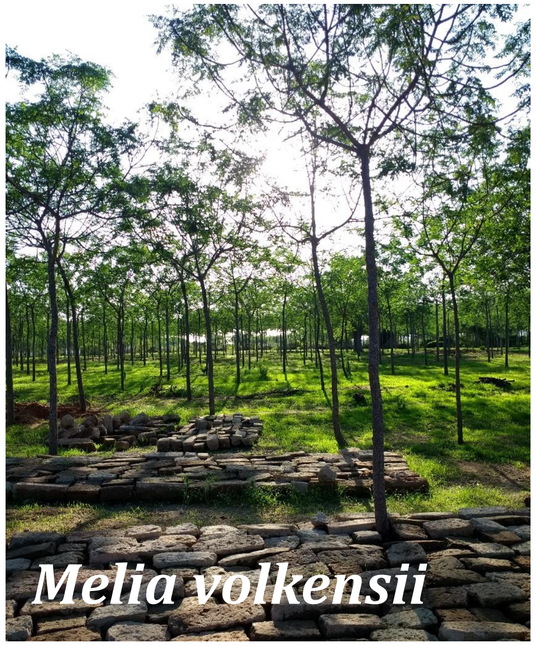
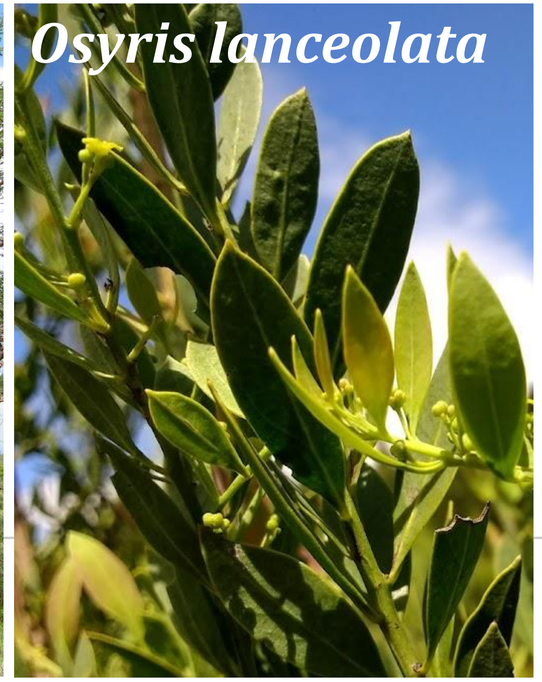
FGR protection in the tropics





Challenges:

- High species diversity
- Climate change impact more acute?
- High number of useful tree species

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Case study: *Moringa* spp in Kenya

- Native & introduced species included
- Highly valued, multipurpose species
- Fast growing

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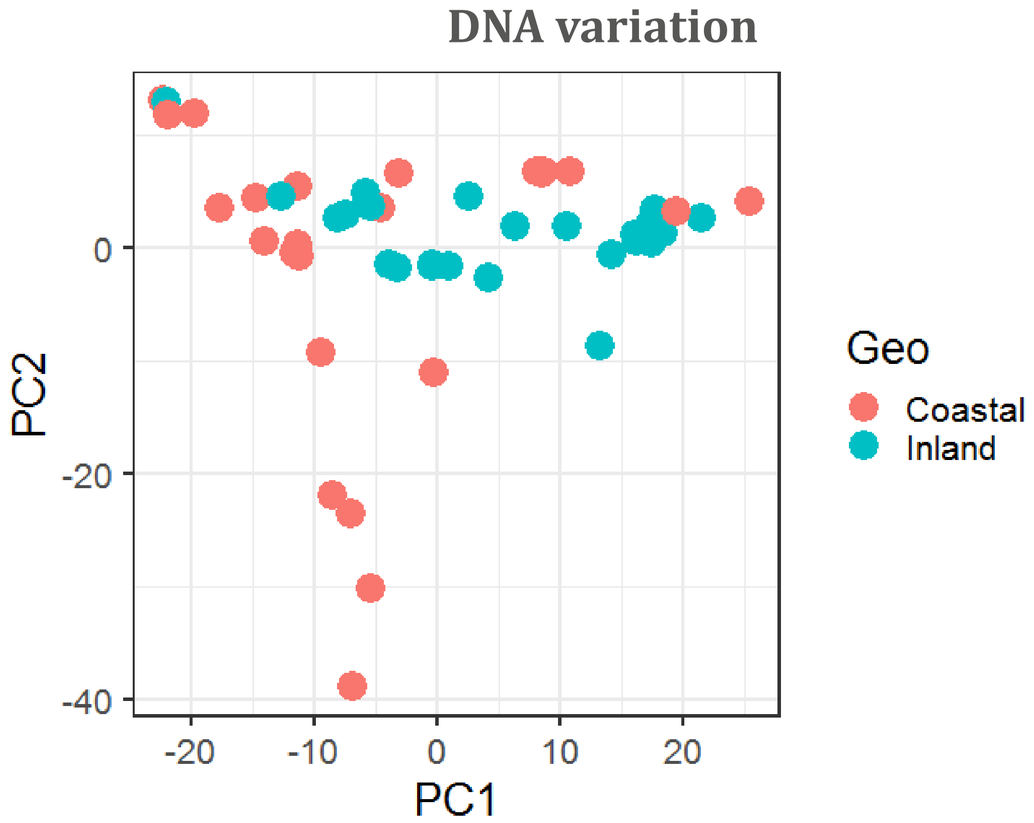
Characterise



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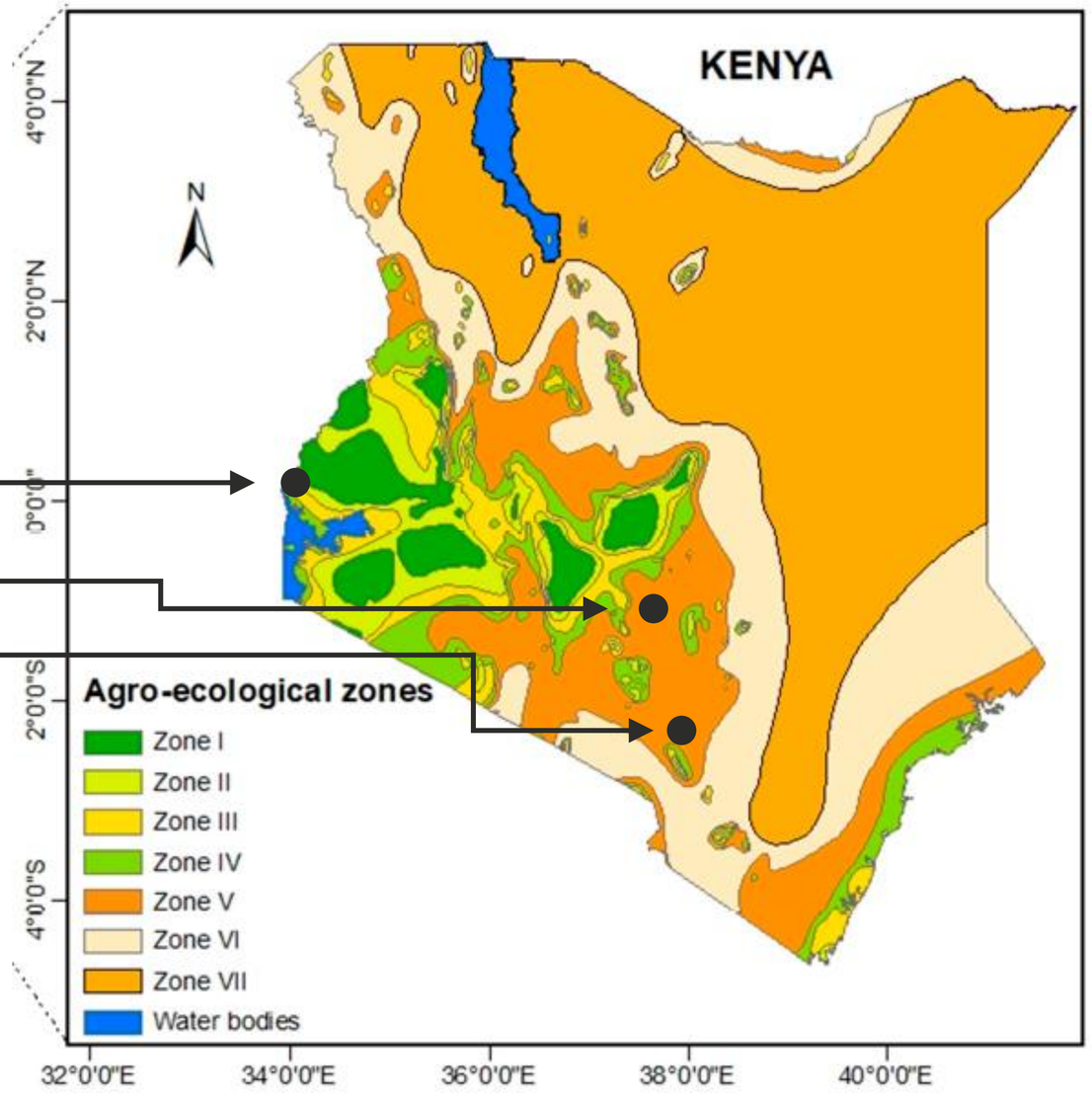
RAMOGI

KITUI

KIBWEZI



Kenya agroecological zones, Kogo et al., 2019

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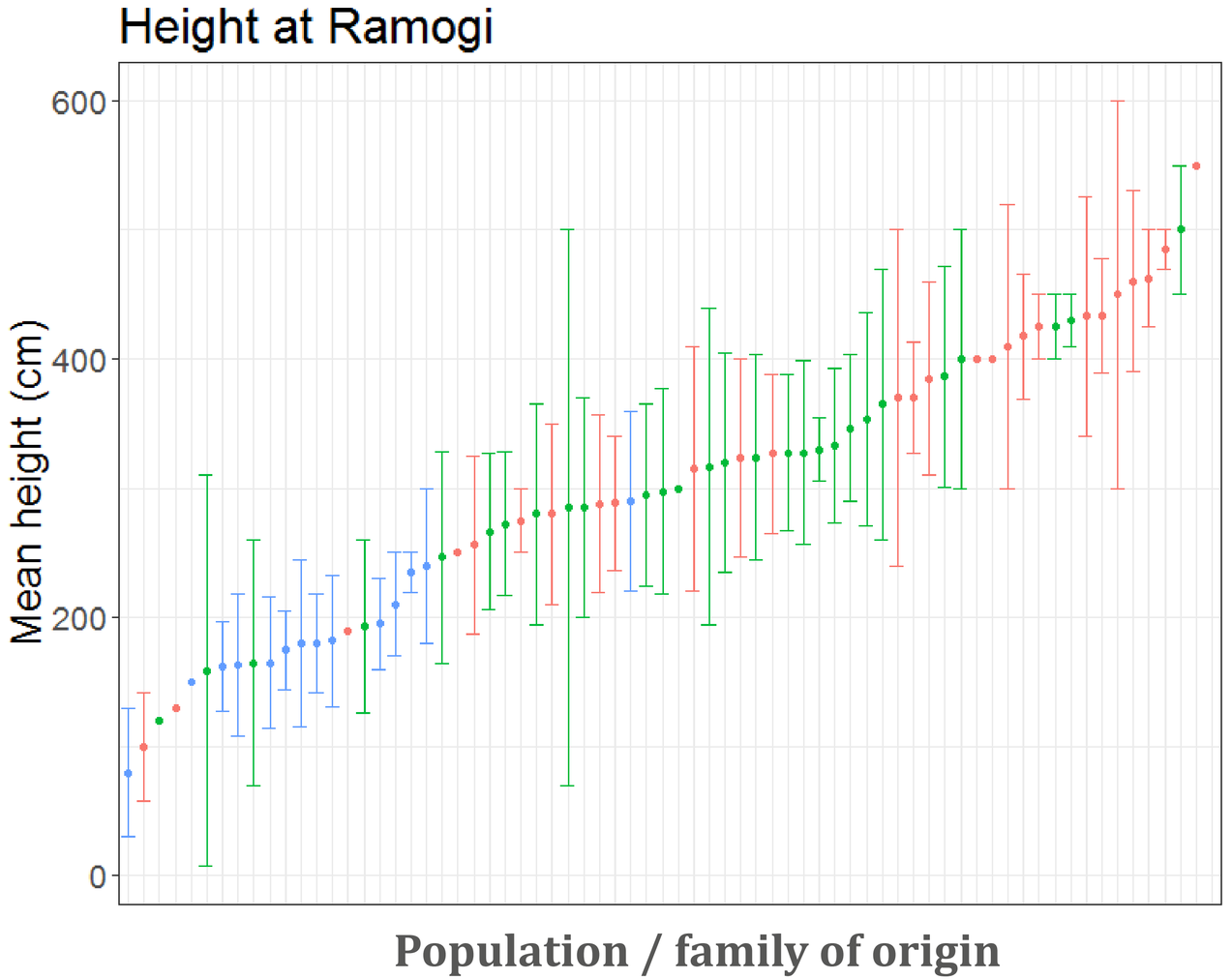
Test

- High genetic variation for
  - Height
  - Productivity
  - Pest tolerance
  - Drought tolerance
- Geographic variation evident
- Next steps:
  - Protect
  - Use (downstream trials)



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Conclusions

- A link from conservation to use can be valuable
- Genetically diverse populations offer high potential for selection
- Systematic link from wild gene pools to production can help secure genetic diversity
- Test widely to bring into use: multiple traits & sites

Issues:

- Urgent need to extend approach to more species
- Need to make process more dynamic & responsive, especially in the light of rapidly changing environment – genomic tools?
- How to handle areas of high diversity?
- Balance effort with potential use – prioritise species with high end use potential

Acknowledgements

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Projects

***new*LEAF, PROTREE, B4EST, GENTREE, GAPI & II**

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