Will Current Protected Areas Harbour Refugia for Threatened Arctic Vegetation Types until 2050?

BACKGROUND

- The Arctic experiences accelerated climate warming
- Vegetation types influence local species and short-wave energy budgets
- Conservation efforts in the Arctic generally focus on species, rather than vegetation types
- Thus the effects of climate change on Arctic vegetation types and their protection status are less understood

OBJECTIVES

1. **Determine** the current distribution of Arctic vegetation types within protected areas.
2. **Predict** the distribution of Arctic vegetations types within protected areas in 2050
3. **Assess the vulnerability** of these vegetation types.
4. **Identify refugia** within and outside current protected areas.

MATERIALS

- Map of Arctic Protected Areas[1]
- Circumpolar Arctic Vegetation Map[2]
- New Raster Version of the Circumpolar Arctic Vegetation Map[3]
- Pearson et al (2013)'s Maps of Future Arctic Vegetation Distribution[4]
  - Random forest machine learning
  - CSIRO global climate model
  - IPCC A2 high emissions scenario
  - 20 km intermediate tree dispersal scenario
- IUCN Red List of Ecosystems

RESULTS

The Vegetation Types Present Within This Study

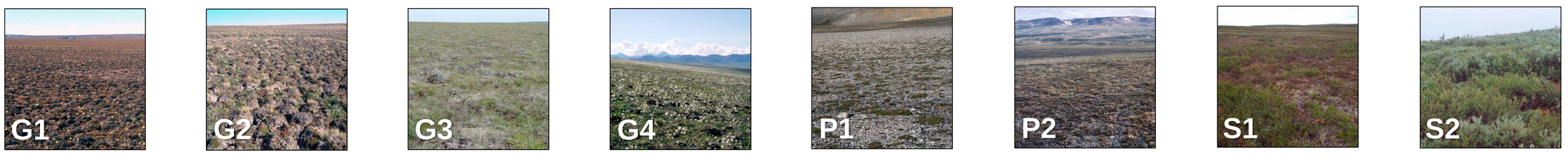


Figure 1. Image credit: D.A. Walker.

1 2 Present and Future Distribution and Protection Status of Arctic Vegetation Types

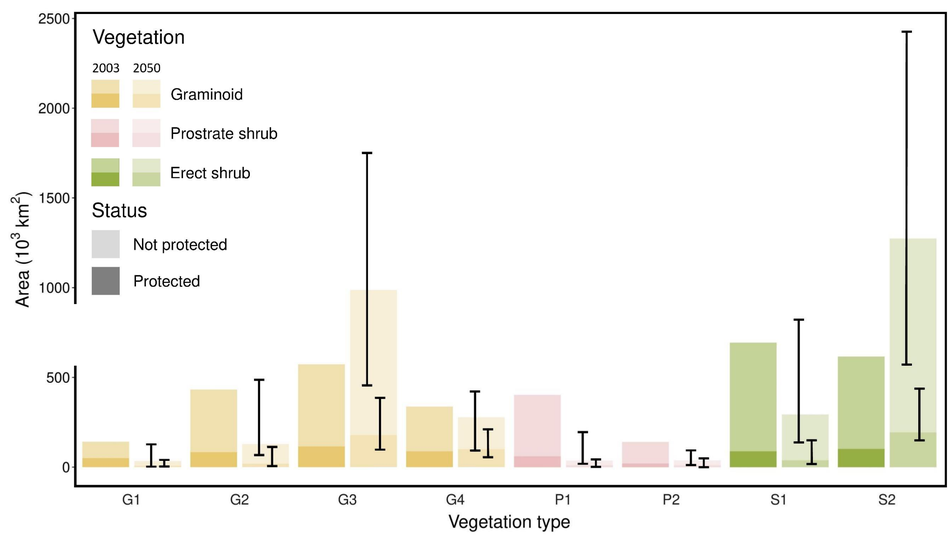


Figure 2. Comparison of current and future distribution as well as the protection status of 8 vegetation types. 'Prediction 2050' represents the model specified in Materials. The error bars show the range of the minimal and maximal distributions predicted by the other Pearson models.

3 Risk Assessment of Arctic Vegetation Types

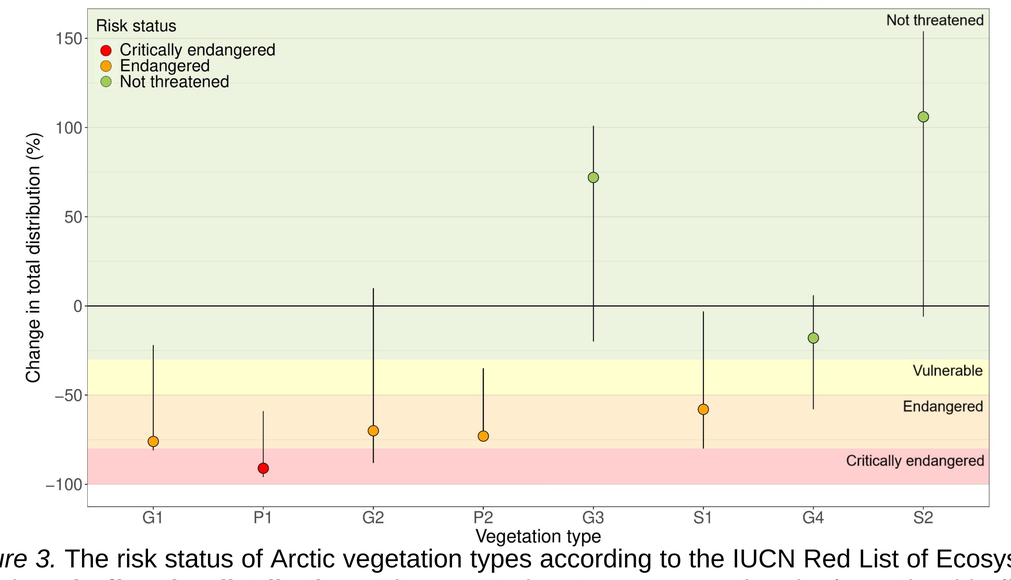


Figure 3. The risk status of Arctic vegetation types according to the IUCN Red List of Ecosystems criterion **decline in distribution.** The vegetation types are ordered along the bioclimatic subzones they occur in, from low to high summer temperatures.

4 Potential 2050 Refugia for Vulnerable Arctic Vegetation Types

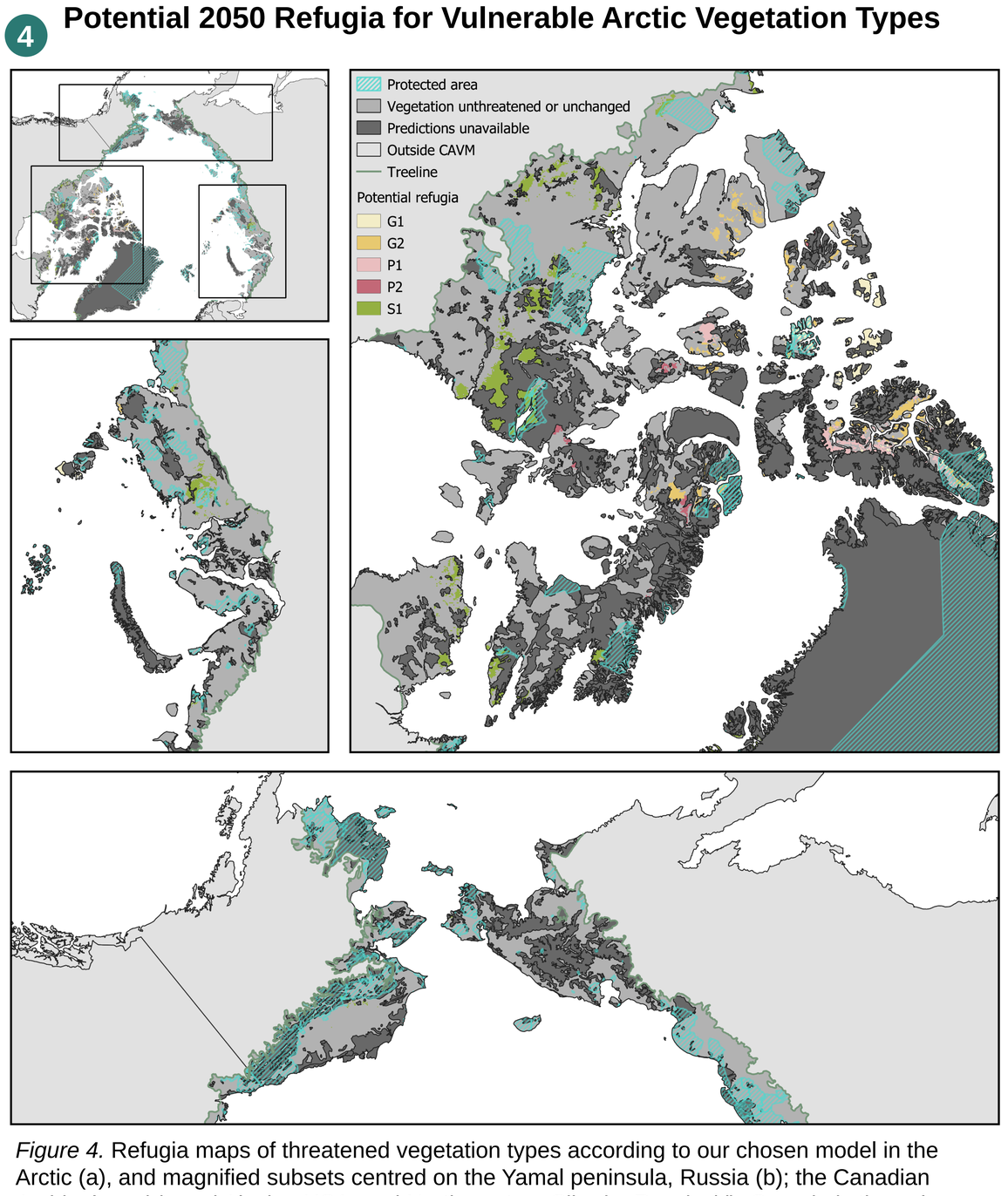


Figure 4. Refugia maps of threatened vegetation types according to our chosen model in the Arctic (a), and magnified subsets centred on the Yamal peninsula, Russia (b); the Canadian Archipelago (c); and Alaska, USA, and North-eastern Siberia, Russia (d). Canada is the only country contained refugia for all five threatened vegetation types.

CONCLUSIONS

- We **establish** that current conservation efforts are insufficient to protect threatened Arctic vegetation types
- We **provide insight** into an Arctic management approach which shifts the focus from single species to whole species communities, and **advocate** for the establishment of protected areas in refugia

REFERENCES

[1] CAFF and PAME. (2017). Arctic Protected Areas: Indicator Report: Flora and Fauna and the Protection of the Arctic Marine Environment, Akureyri, Iceland.

[2] Walker et al. (2005). The Circumpolar Arctic vegetation map. *J. Veg. Sci*., 16(3), 267-282.

[3] Raynolds, M.K. and Walker, D.A. (2018). *New Raster Version of the Circumpolar Arctic Vegetation Map (CAVM).*

[4] Pearson, R.G. et al. (2013). Shifts in Arctic vegetation and associated feedbacks under climate change. *Nat. Clim. Change*, 3(7), 673-677.

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