

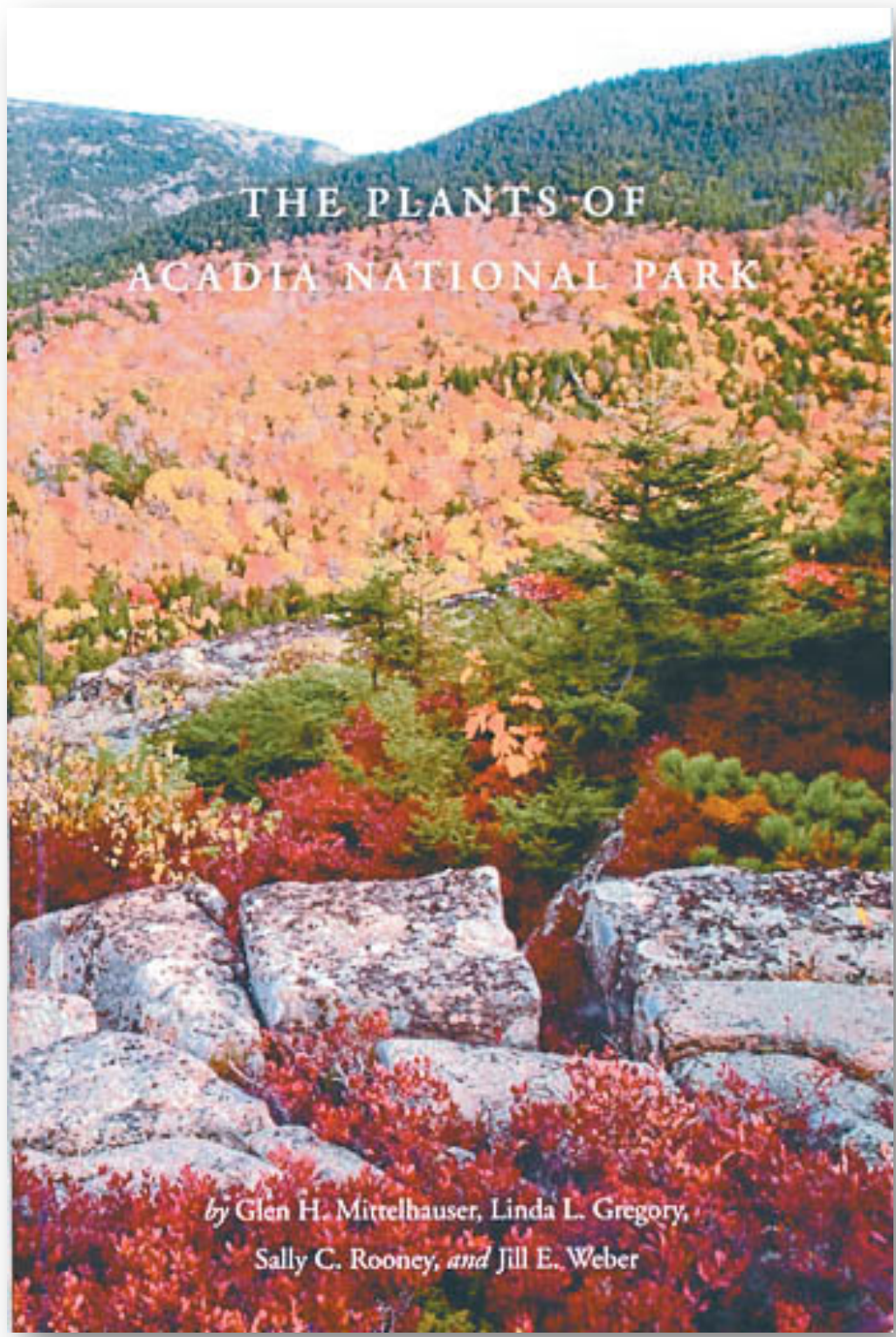
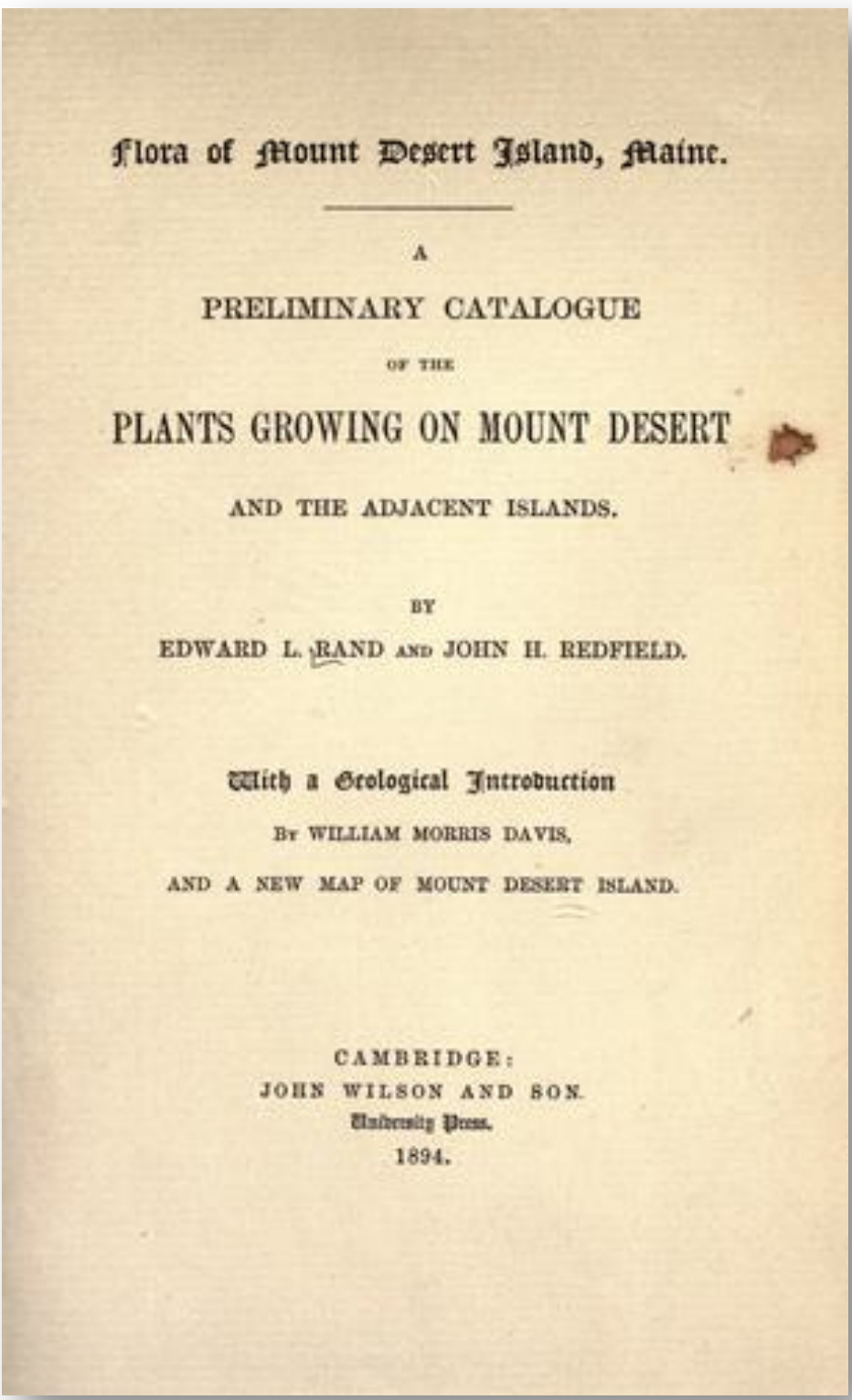
Changes in the flora of Acadia National Park

Caitlin McDonough MacKenzie¹, Abraham Miller-Rushing², Richard B. Primack¹, and Glen Mittelhauser³

¹Boston University, ²Acadia National Park, ³Maine Natural History Observatory

BACKGROUND

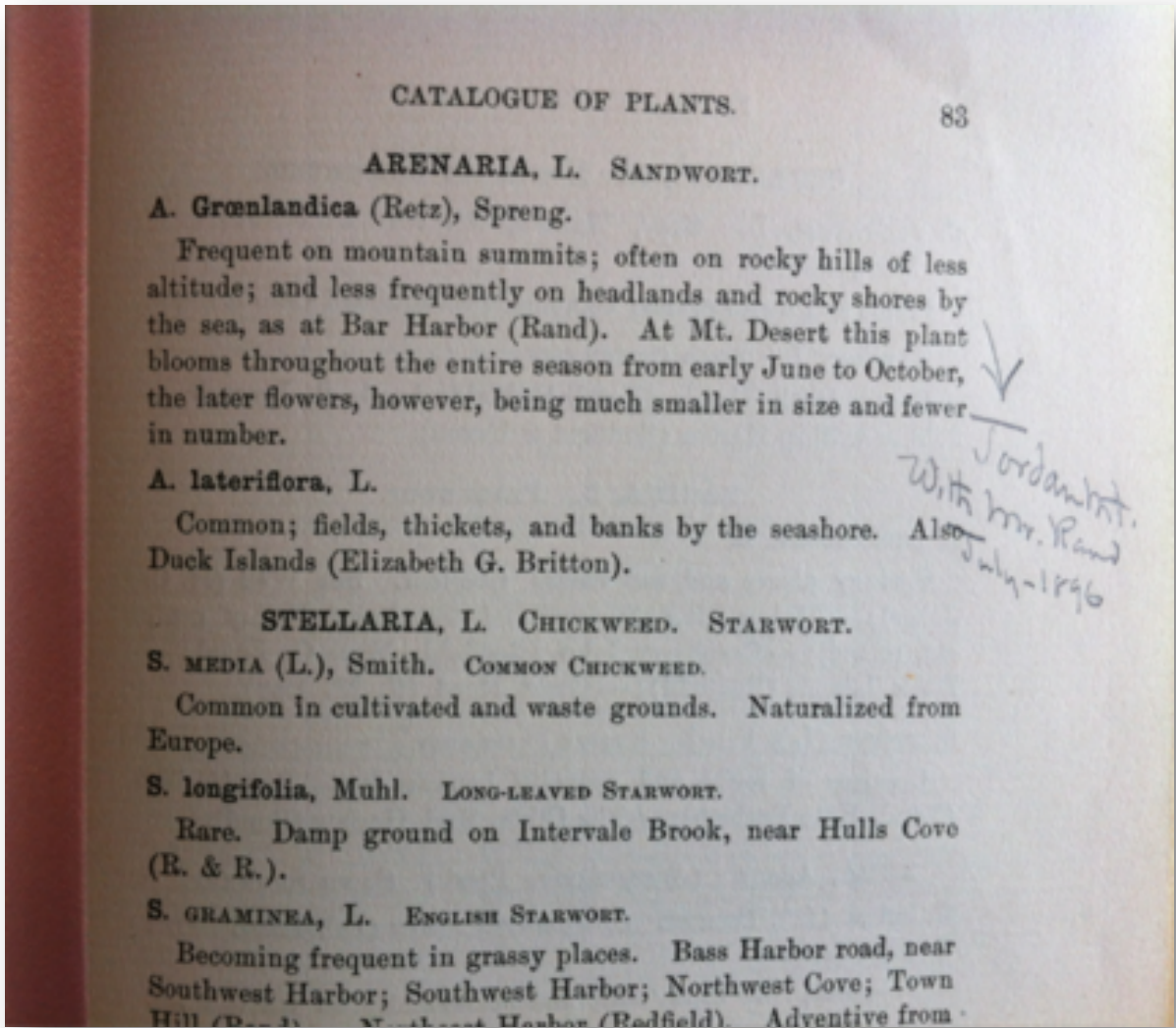
Mount Desert Island (MDI), the heart of Acadia National Park, is an iconic and biologically significant landscape. While the park accounts for less than 1% of the state of Maine’s land area, it supports over half of the state’s natural communities and more than half of its known plant species¹. This rich biological diversity has attracted a long history of botanical study Twice — in 1894 & 2010 — the flora of MDI has been thoroughly catalogued and published.



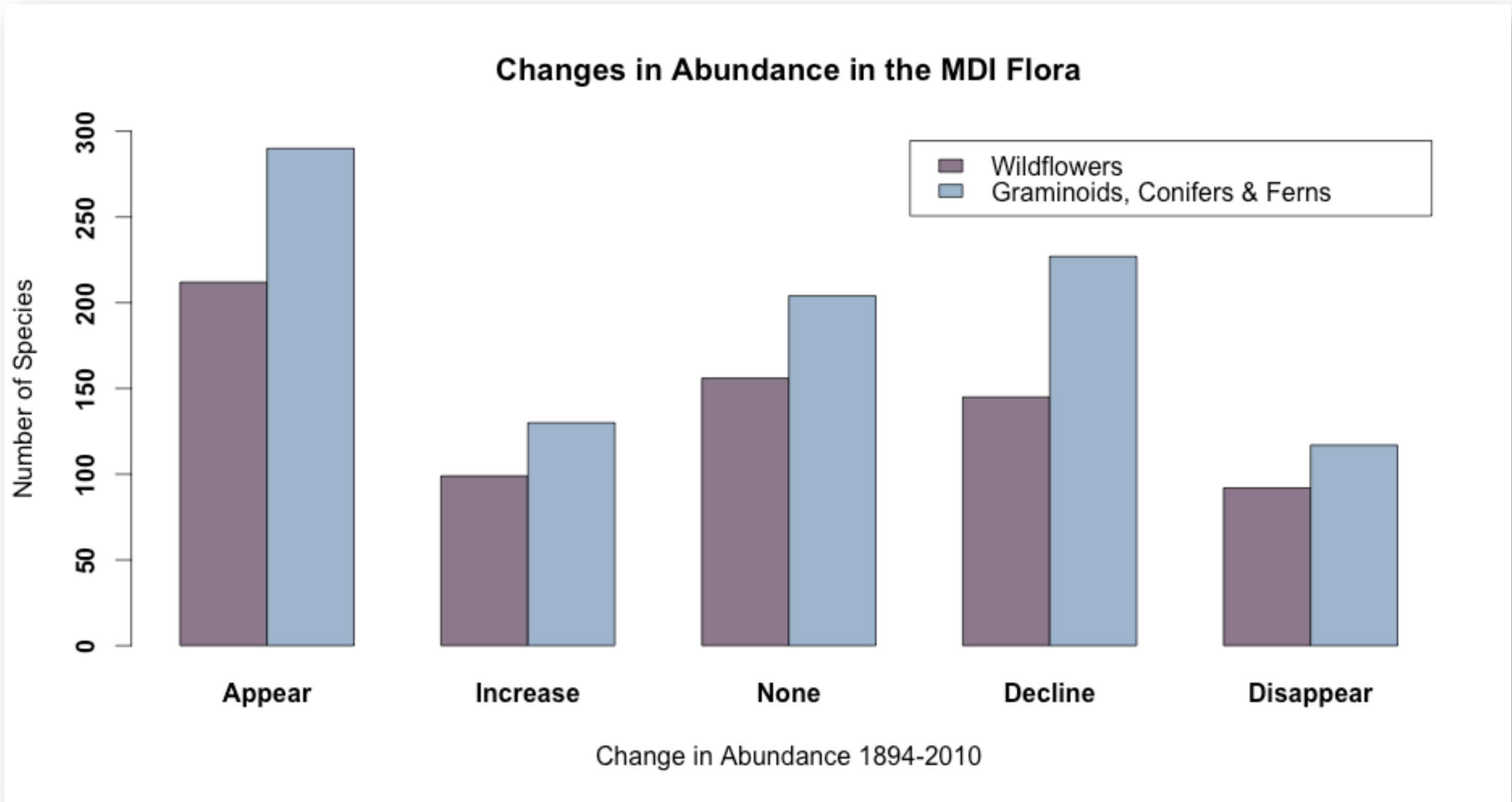
Left: *The Flora of Mount Desert Island Maine*, Rand & Redfield 1894.
Right: *Plants of Acadia National Park*, Mittelhauser, Gregory, Rooney & Weber 2010.

Repeated censuses of plant populations provide a unique opportunity to assess changes in the flora. Such catalogue comparisons have chronicled species loss, rates of decline, and the appearance of non-native species over the past century in Massachusetts towns including Worcester², Concord³, and Needham⁴. Abundance records from Rand and Redfield were calibrated to fit into one of the four abundance categories used in *Plants of Acadia*, to allow abundance comparisons between 1894 and 2010.

Left: a page from Rand & Redfield 1894
Right: a photograph of Rand’s fellow Harvard students and MDI naturalists from the summer of 1880 (courtesy of Northeast Harbor Library)



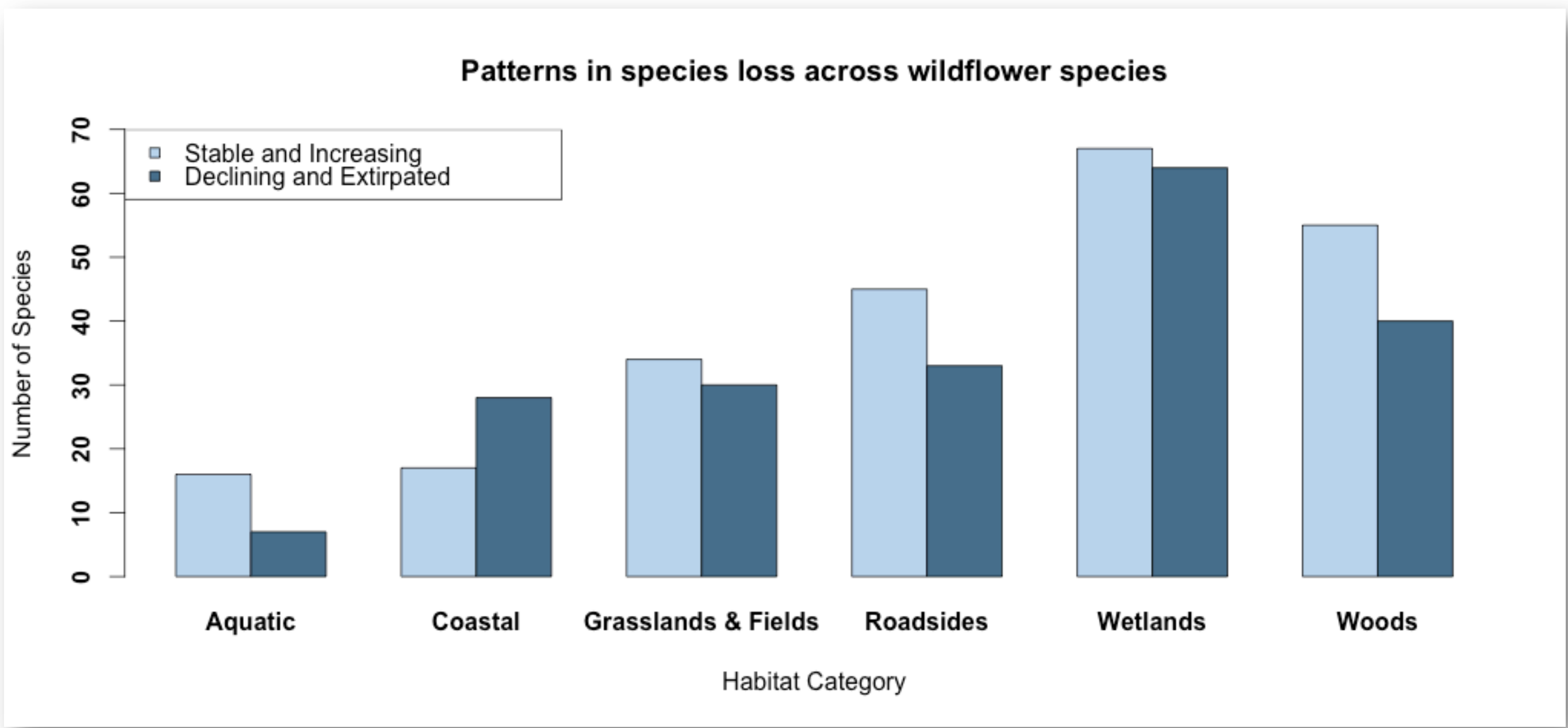
CHANGES IN ABUNDANCE



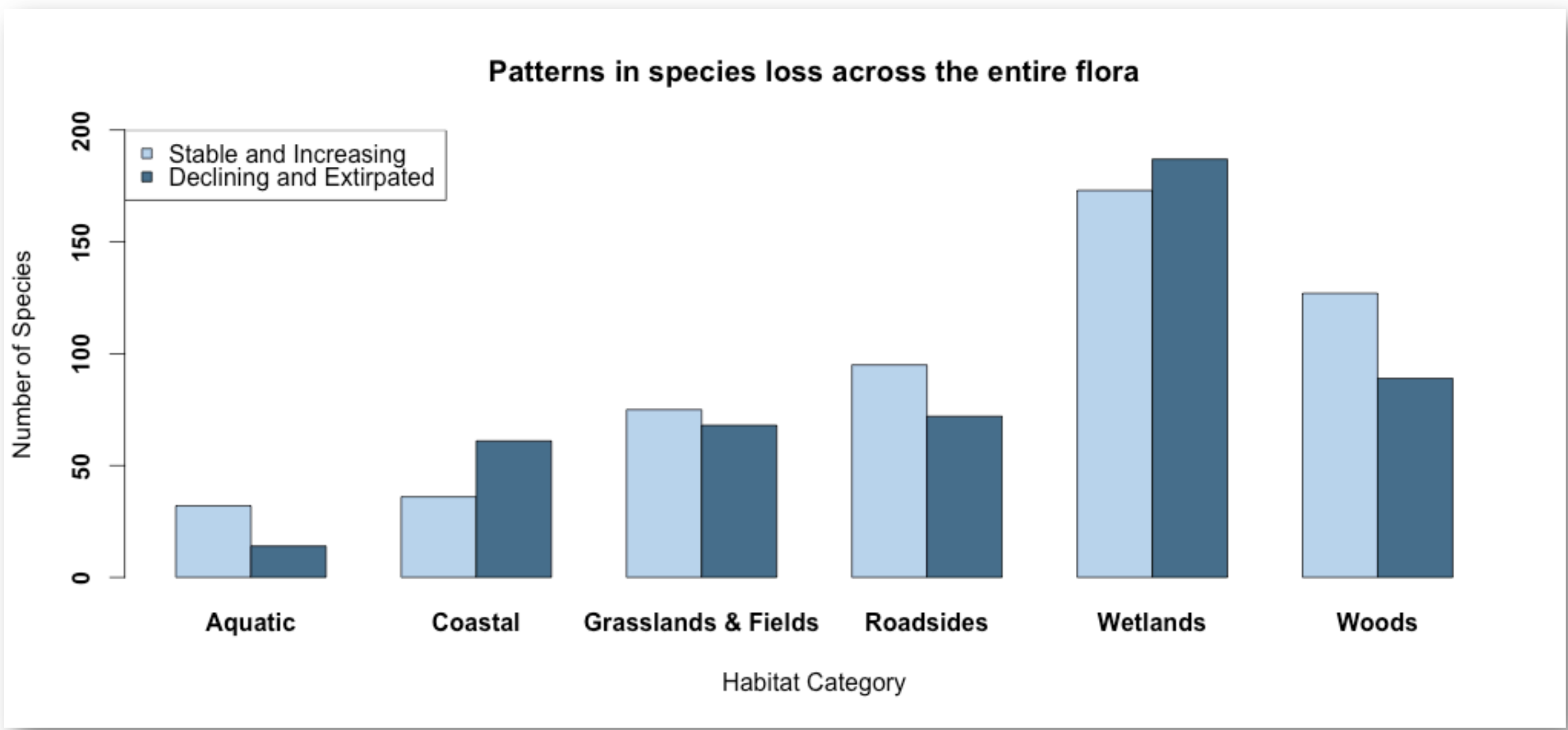
MDI’s historic and present-day flora is comprised of 704 wildflowers. From Rand & Redfield’s catalogue of 492 wildflower species in 1894, the island experienced a rate of species loss of 18.7% (92 species), while an additional 29.5% (145) of the species in the flora declined in abundance since 1894. Rand & Redfield also catalogued 678 species of graminoids, conifers, and ferns. 17.3% (117) of those species have disappeared, and an additional 33.5% (227) declined in abundance since 1894.

We hoped that an analysis including habitat type, habit, taxonomy, and abundances might allow us to discern the drivers of local flora changes and identify the most sensitive species. Directing monitoring efforts towards species that we know to be more likely to become rare or disappear could improve efforts to protect these sensitive species. We hypothesized that changes in habitat, specifically the loss of open areas to reforestation, would show grassland habitats suffering greater species losses and declines, while woodland species experienced the opposite.

HABITAT & SPECIES LOSS



We explored the relationship between changes in abundance and habitat across the wildflowers and the entire flora. In a preliminary analysis, we categorized 88% of Rand and Redfield’s flora into six habitat types. We used Chi-square analyses to test the significance of these relationships; a significant p-value would reflect a pattern of losses and declines concentrated in certain habitats. There was no significant relationship between habitat type and losses and declines among wildflower species ($X^2=8.4$, $df=5$, $p=0.13$). However, when the graminoids, conifers, ferns were added to the wildflowers, a significant relationship emerged ($X^2=22.1$, $df=5$, $p<0.05$).



1. Greene, C. W., Gregory, L. L., Mittelhauser, G. H., Rooney, S. C. & Weber, J. E. Vascular flora of the Acadia National Park region, Maine. *Rhodora* **107**, 117–185 (2005).
2. Bertin, R. I. Losses of native plant species from Worcester, Massachusetts. *Rhodora* **104**, 325–349 (2002).
3. Primack, R. B., Miller-Rushing, A. J. & Dharaneeswaran, K. Changes in the flora of Thoreau’s Concord. *Biological Conservation* **142**, 500–508 (2009).
4. Standley, L. A. Flora of Needham, Massachusetts — 100 Years of Floristic Change. *Rhodora* **105**, 354–378 (2003).

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Contact Caitlin



MacKenzie: