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Project title: Floral Visitation in Two High-Elevation Rock Outcrop Communities

In the southern Appalachian Mountains, sparsely distributed rock outcrop communities harbor a significant number of rare and endemic plants. Unique communities of plants are found on rock outcrops of differing bedrock, including montane redcedar plant communities, occurring over mafic bedrock, and granitic dome and rocky summit plant communities, occurring over felsic bedrock. Many plants in these communities rely on insect pollination, a mutualistic exchange of resources and services which is fundamental to the resilience of many ecosystems. There is concern that disturbance on rock outcrops, like anthropogenetic climate change, might result in temporal mismatches between insect and plant partners. Study on the pollination of rock outcrop flora has been limited and, to improve the understanding of plant-pollinator relationships in these unique communities, my study asked: 1) Are flowering plant and floral visitor communities on MRC and NMRC rock outcrops distinct? 2) Do diversity and richness of floral resource communities vary seasonally on MRC or NMRC rock outcrops? 3) Does floral visitor activity and diversity vary seasonally on MRC or NMRC rock outcrops? 4) Is there evidence for specialization in flower-visitor relationships on MRC or NMRC rock outcrops? 5) Do floral resources or floral visitors function as keystones within seasonal networks on MRC and NMRC rock outcrops? and, 6) Does the topology of rock outcrop visitation networks vary by outcrop type and/or by season?

In the year 2020 I evaluated floral resource availability and floral visitation in continuous two-week blocks, between April and October, on three montane redcedar (MRC) rock outcrop communities and three granitic dome (NMRC) rock outcrop communities in the Highlands-Cashiers Plateau in North Carolina. By the end of my study season, I had completed sixty site visits and conducted 702 surveys of floral visitor activity.

I found that, over the full season, flowering plant species composition differed between MRC and NMRC outcrops, supporting that these plant communities are distinct, while floral visitor communities were similar between outcrop types. Diversity and richness of flowering plant and floral visitor communities was consistent across spring, summer, and fall on both MRC and NMRC outcrops. Turnover patterns in flowering, however, indicated that species composition of floral resources is seasonally distinct and suggests that spring and fall flowering on rock outcrops is more significant than previously reported.

Abundance of floral visitors and dominant floral visitor orders also demonstrated seasonal patterns: floral visitor abundance peaked in spring and fall in NMRC communities but was greatest in the summer in MRC communities. Further, the dominant insect orders differed by season and outcrop type. Notably, while Hymenopteran floral visitors were typically the most abundant insect order observed on both outcrop types, Dipteran visitors stood out as the most abundant visitors on MRC outcrops in the spring.

Floral visitation networks generated from interactions between flowering plant species and floral visitors on MRC and NMRC outcrops across the entire season indicated that networks were generalist overall. Interactions in networks generated for spring, summer, and fall, however, were unique both across seasons and between outcrop types. Five families of floral visitor were

identified as central to these networks (Apidae, Syrphidae, Halictidae, Formicidae, and Chrysomelidae), and select floral visitor families demonstrated high fidelity to the flowers of single plant species during specific seasons. In particular, I was interested to observe that Syrphid flies appeared to specialize on *Micranthes petiolaris* var. *petiolaris,* but only in the spring and only on MRC outcrops.

Overall, both seasonality and outcrop type influence diversity, composition, and plant-pollinator interactions in rock outcrop communities. While generalist interactions suggest lower susceptibility to temporal mismatches between plants and pollinators with climate change, some species and families were identified as playing unique roles within the network: short-term specialization may have important implications for pollination, and species central to the networks are likely integral to the maintenance of network structure.

The full findings of this study were recorded in my M.S. thesis, completed at Western Carolina University in 2022. This work was possible due to the generous support of the North Carolina Native Plant Society.

Cedar Cliffs in June

Research assistants on Satulah

Carson Ellis conducting surveys on Rock Mountain