Performance of US National Park Monitoring Networks as Aquatic Insect Conservation Reserves; Implications for Management Under Climate Change

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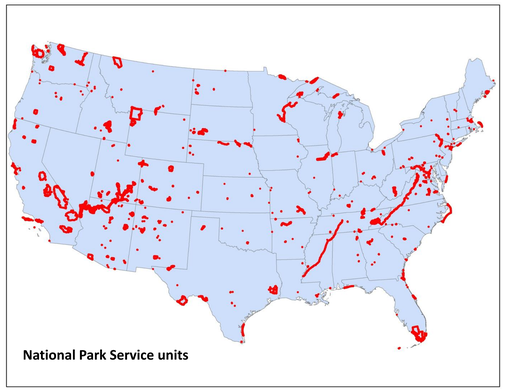
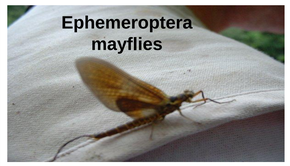
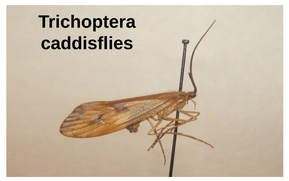


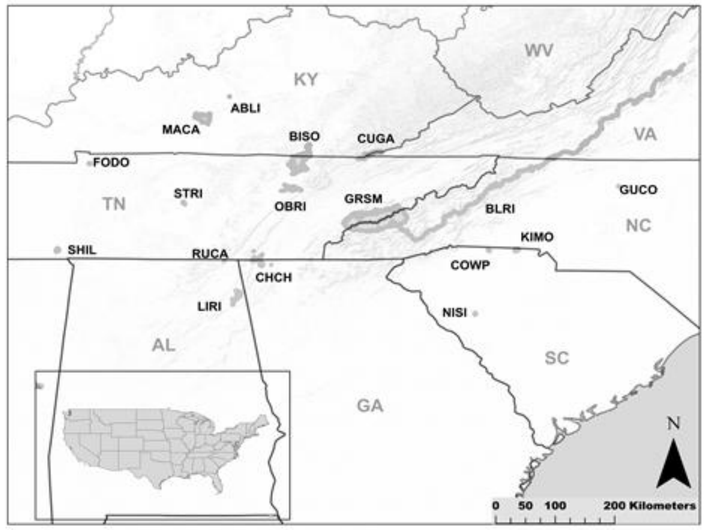
Little is known about the performance of U.S. National Parks (or other protected area networks) as "conservation reserves" for invertebrates, or as "climate reserves" that capture climate features rare or vanishing in the surrounding landscape.





EPT species (insect orders Ephemeroptera, Plecoptera and Trichoptera) were surveyed in parks across two National Park Service Monitoring Networks during all seasons, using multiple methods.

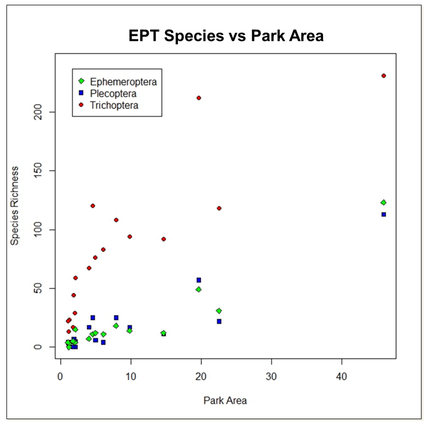
Appalachian Highlands, Cumberland Plateau and Piedmont Monitoring Networks



In these networks, larger parks have more EPT species. Parks with larger regional source pools also have more species.

Individually, these seventeen parks protect fewer rare species (G1 or G2 in Natureserve rankings) than would be expected in a random draw from the regional source pool.

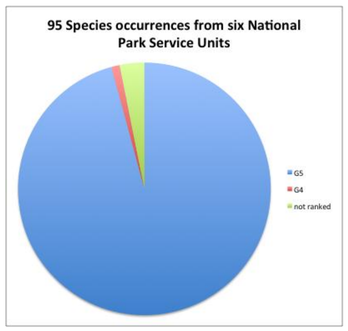
Most rare species in the region are not known from these seventeen parks. The distribution of many EPT species is poorly known, so we have developed models to predict species distributions using occurrence records from across the Midwest.

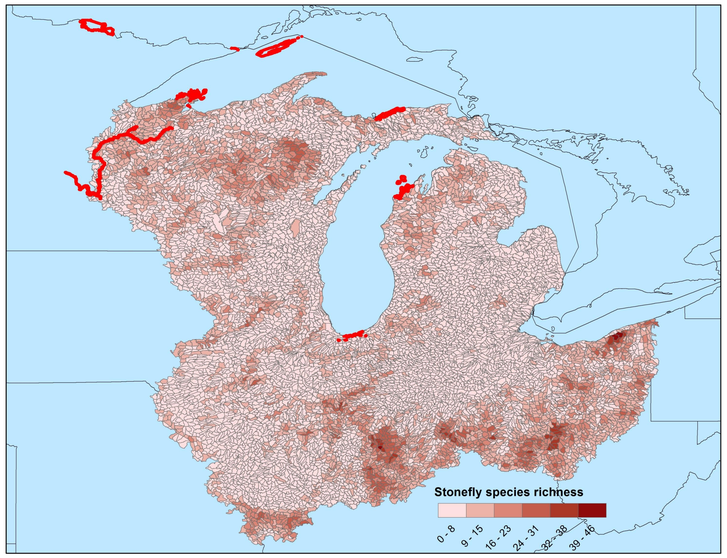


Do parks in the Great Lakes and Heartland Monitoring Networks protect rare species?

In our dataset, we have records of 95 EPT species occurring in the Apostle Islands, Cuyahoga Valley, Indiana Dunes, Isle Royale, Pictured Rocks, and St Croix River. Of these species, the vast majority (91) are ranked G5 (least imperiled) by NatureServe.

We'd like to systematically sample these parks, as we have in the Appalachian and Cumberland networks, to determine if Midwest parks do protect populations of rare species, and to empirically test the predictions of our distribution models.





Our research group has built a series of landscape scale models of the geographic distributions of over 90 stonefly species. This refines our expectation for the local pool of aquatic insect species (at sites or for protected areas) and describes a regional pattern of species richness.

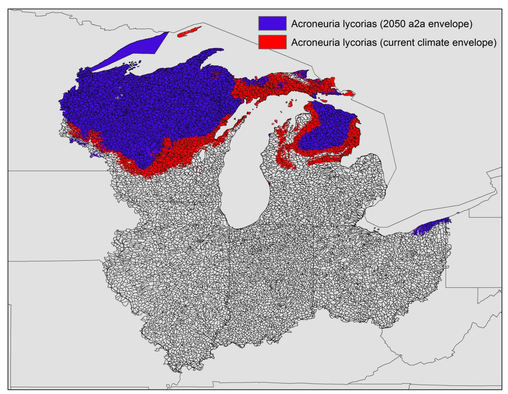
Several US National Parks in the Great Lakes Monitoring Network are in areas where models predict low stonefly species richness. These parks might have lower species richness than other parks yet still protect regionally rare species or habitats, even though to date, unstructured sampling in these areas has produced only common species of EPTs.

CLIMATE CHANGE

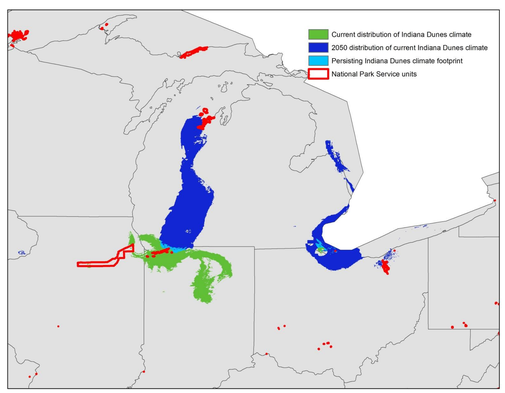
Our approach to understanding potential climate change effects on protected area biodiversity is to separate the two questions: Where will species go? Where will climates go?

Where will species go?

Species distributions might expand, contract, migrate or remain stable. In this example, the geographic range of the coolwater species *Acroneuria lycorias* might contract due to shifts in the distribution of the suitable climate envelope. Our modeling technique combines climate variables with vegetation, soils and geology to characterize the niche occupied by species.



Where will climates go?

Parks with unique climate features (relative to the surrounding landscape) might become more or less unique in future scenarios.

In this example, the climate features that occur in the Indiana Dunes National Lakeshore are predicted to persist, *in situ*, into 2050, even though the climate footprint changes significantly.