Habitat Preferences of Nitrophila Species

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Abstract
Nitrophila occidentalis and Nitrophila mohavensis are both members of the same Family and Genus, and they are both found in the Great Basin region. They are the only members of the Genus Nitrophila native to the United States. Nitrophila occidentalis flourishes in the Great Basin, but Nitrophila mohavensis is endangered and limited to a few populations. Habitat analysis was done on the two species using GIS (Geographical Information Systems) to gain some new insight on how to preserve this endangered species. A discrete difference in soil alkalinity preference was found, which may help in saving N. mohavensis.

Introduction
The genus Nitrophila is in the family Chenopodiaceae, and there are two species, Nitrophila occidentalis and Nitrophila mohavensis, belonging to this genus that are native to the United States. They are rhizomatous, perennial herbs, found in moist alkaline soils, and they are good indicators of a shallow water table. Nitrophila occidentalis, also known as the common niterwort, is found abundantly among the Great Basin region, where as Nitrophila occidentalis was federally declared endangered in 1986, and it is only found among the Carson Slough of the Ash Meadows in the Amargosa Desert along the Nevada/California border.

Carson Slough is a wetland consisting of abundant springs and seeps, a carbonate aquifer charged by the Spring Mountains, and it is a watershed for winter run off. Although the streambeds are dry for most of the year, the area is characteristic of a shallow water table, usually between 3 to 6 inches below the surface. Carson Slough has decreased in size recently due to human activities that threaten the habitat of N. mohavensis including mining activities (such as peat mining), construction, farming, livestock grazing, and road construction. Although, the largest threat to the habitat of N. mohavensis is water depletion due to human activities. In consequence, N. mohavensis faces another threat of competition by saltgrass, which can tolerate dryer conditions and is found in close association with N. mohavensis.

A report published by the Soil Ecology and Research Group, stated that N. mohavensis was found most abundant on the alkali mud flats of the Carson slough where there existed a layer of encrusted salt over the top soil. The group also found that N. mohavensis preferred sandy loam soil with an approximate pH of 8.4. In a walk through of the study area, they also reported observing an intermediate form which showed characteristics of both N. mohavensis and N. occidentalis. This was explained as being either a member within one of the species or indicative of hybridization.

Literature on the comparison of the two species is scarce, so we performed an analysis of the habitats of both native species in North America. We were interested to see if any differences in habitat preferences could be detected between the wide ranging N. occidentalis and the endangered N. mohavensis through GIS (Geographic Information Systems) analysis.

Materials and Methods
ArcView 9.3 was the program used for data processing. Thirty one species of N. occidentalis were used from the New York Botanical Gardens collection of georeferenced herbarium specimens. Georeferences for species of N. mohavensis were used from the Calflora database. All N. mohavensis species were located in Inyo County, California, and of the 6 georeferenced species of N. mohavensis, one was a documented specimen, one was a reported location, and four of the locations were cited from literature. These georeferenced species were used to create a shapefile in ArcView. Raster spatial data sets on sodium and chloride concentration maps were downloaded from the Great Basin Center for Geothermal Energy at UNR. All downloaded datasets were Lambert Conformal Conic projections, and the concentration maps were produced using an inverse distance weighted interpolation method.

Results
When layered in ARCView, the species points and concentration maps showed a clear pattern. The species of N. mohavensis were clearly restricted to areas of the highest sodium and chloride concentrations, where as the wide ranging N. occidentalis showed a range of habitat preferences as demonstrated in Table 1. Some were found in high concentration areas, and some were found in low concentration areas.

<table>
<thead>
<tr>
<th>Species</th>
<th>Water Table</th>
<th>Sodium Concentration</th>
<th>Chloride Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>N. occidentalis</td>
<td>High</td>
<td>Intermediate-High</td>
<td>Low-High</td>
</tr>
<tr>
<td>N. mohavensis</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
</tbody>
</table>

Discussion
Most literature on N. mohavensis suggests the best action to be taken in preserving the few populations is to regulate ground water levels of Carson Slough closely. In this study, we assessed the habitat specifications of N. mohavensis compared to N. occidentalis to gain further insight into the habitat preferences of N. mohavensis. Both species seem to have similar preferences to water availability, but a clear distinction can be drawn between the two species and their soil preferences. N. mohavensis prefers much more alkaline soil than N. occidentalis. This insight may be used to take conservation a step further, past the efforts of the present, to locate possible sites that would be a suitable habitat for N. mohavensis populations.

References