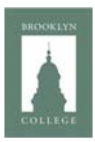


PREDICTING THE MAXIMUM RANGE OF *ROSA MULTIFLORA* USING SECONDARY DATA ANALYSIS AND GIS

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Abstract

The goal of this study was to help scientists, land-use planners and others predict the maximum range of *Rosa multiflora*, commonly known as Multiflora Rose, and determine regions where the plant is most and least likely to spread based on soil characteristics. This species is a dominating invasive plant found in the Tri-State area that has been shown to affect biodiversity, exclude native species for its own growth and decrease vegetation that is essential to inhabiting fauna. Using the Brooklyn Botanic Garden's herbarium collection for occurrence data, we used GIS as a tool to create and analyze soil maps, and identified the most probable associations between *R. multiflora* occurrence data and soil types found in the Tri-State area.

Introduction

The ability to determine new geographic areas where an invasive species is likely or unlikely to proliferate is useful for the prediction of an invasive species maximum range. Our hypothesis was that areas with a higher proportion of favorable soil suborders of *R. multiflora* will show a greater likelihood of species invasion.

To determine which soil suborders may facilitate the spread of *R. multiflora*, we obtained occurrence data from the BBG's herbarium collection. When GPS data for the locations was not indicated, narrative descriptions were translated to precise coordinate using Google™ Earth. To retrieve soil suborders associated with the growth of *R. multiflora*, coordinate data was entered in the USDA Web Soil Survey. ArcMaps was then used to spatially analyze and identify potential patterns for the entire Tri-State area. Although we faced methodological issues using secondary data, our research suggests *R. multiflora*'s maximum range will spread and begin to proliferate most rapidly in geographical areas with the soil suborder FLUVENTS and least likely in areas of the suborder UDEPTS. It is hoped that we will be able to continue our pursuit of additional data from other US herbaria and obtain finer-grained soil classification data for the Tri-state area.



Figure 1. Current Distribution of *R. multiflora* in the US and Canada

Materials and Methods

Prior to the initiation of the secondary research, samples of *R. multiflora*, were collected from 1942 to 2007 and placed in the BBG Herbarium. The majority of the herbarium specimens lacked spatial coordinates; however, they were labeled with descriptive data of the area where the flora was located.

Completing Spatial Data for *R. multiflora* Specimens

For specimens that lacked spatial coordinates to indicate the collection site, descriptive (free-text) location information was entered in Google™ Earth. Using background knowledge of the common growth patterns attributed to *R. multiflora*, coordinates were approximated. Specimens that had incomplete spatial coordinates were placed into Google™ Earth without the description and only their coordinates and were approximated in the same fashion.

Identifying Soil Series, Orders, and Suborders for Herbarium Specimens

To retrieve the soil series associated with each specimen's collection site, complete coordinate data was entered in the [USDA Web Soil Survey](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soil/) website (Figure 1)¹. Using the Quick Navigation and View Extent (set for contiguous US) menus, the Area of Interest (AOI) tool and the Soil Maps feature, a soil assessment was generated for each specimen location.

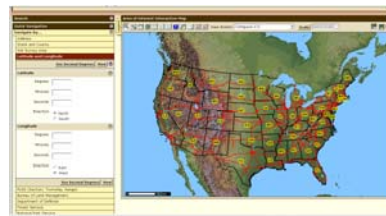


Figure 1. USDA Web Soil Survey Interface

After collecting all the soil series, soil orders and suborders were identified using the [USDA-NRCS Soil Series Classification website](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soil/)². The name of the soil series was entered into web-based interface and the soil order and suborders were provided for each herbarium sample.

Creating Analytical Maps using ArcGIS software: ArcMaps

Data were collected and stored using spreadsheet and database software. The final table was imported into ArcMaps, and was used to spatially represent the occurrence and soil data collected and used in the analysis.

Discussion and Results

Overall, soil data was collected for 82 herbarium specimens (Figure 3). Six of the specimens were collected in Connecticut; 36 of the specimens were collected in New Jersey and 40 of the specimens were collected in New York.

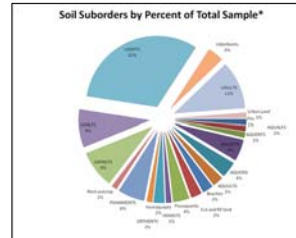


Figure 3. Soil Suborders by Percent Total Sample*

Specimen location and soil suborder data was imported into ArcMaps to create a visual and graphical representation and to compare the suborders associated with *R. multiflora* with all soil suborders present in the Tri-State area. (Figure 2 and 3). In Figure 2, the specimens were crosslinked with their relevant orders and suborders. Each crosslink of soil orders and suborders was given an individual symbol and chromatic specification. Figure 2 projects the locations of the 82 specimens collected.



Figure 2. Soil Types of *R. multiflora* BBG Herbarium Specimens*

*Other soil types for which no suborder could be obtained are included

The most dominant soil suborder in which *R. multiflora* was collected was UDEPTS, present at 32% of the specimen locations. The second most represented soil suborder was UDULTS, present at 11% of the sampling locations. Based on the Natural Resources Conservation Service website, UDEPTS are drained soils that have an udic and at times a perudic moisture regime, which means they have an extreme humid, moisture period most of the time or during the entire year. UDULTS have a drained soil characteristic as well as an udic moisture regime. In addition, these types of soils are usually used for agriculture. From this information, it is interpreted that *R. multiflora* tend to proliferate in more disturbed moist soils, mainly UDEPTS and UDULTS.

Although our data suggest *R. multiflora* proliferates in UDEPTS and UDULTS, we felt that it would be additionally effective to identify soil suborders that may be negatively associated with proliferation. Using a Tri-State county map that represented the value of each soil suborder by square acres, we identified several soil types where no specimens of *R. multiflora* were collected. Of these, all but one were located in northern New York, which is significantly a large distance away from our samples. The only suborder which qualified for our assessment was FLUVENTS which is detailed in Figure 4.

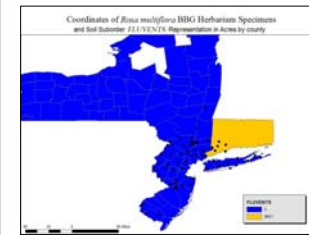


Figure 4. *R. multiflora* BBG herbarium specimens and Soil Suborder FLUVENTS Representation in Acres by county.

In closing, the data did support the hypothesis. *R. multiflora* range may be influenced by the existence of any UDULTS and UDEPTS soil types, as well as soils which follows an udic and/or perudic regime because they seem to be a hot spot for the plant. We may infer that FLUVENTS may prevent the plant's ability to maneuver, however due to lack of evidence we are not able to conclude this statement.

Additional research could be taken to analyze FLUVENTS. In addition, we propose that if the collection was taken more extensively throughout the Tri-state area then we would be able to provide more evidence about the range of *R. multiflora*.

Resources

1. "Web Soil Survey." 25 Apr. 2009. <http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>
2. "USDA-NRCS Soil Series Classification View By Name." 25 Apr. 2009. <http://ortho.ftw.nrcs.usda.gov/cgi-bin/sc/scname.cgi>.

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