

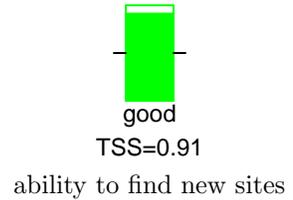
Scirpus ancistrochaetus

Species Distribution Model (SDM) assessment metrics and metadata

Common name: Northeastern Bulrush

Date: 30 May 2017

Code: sciranCI



This SDM incorporates the number of known and background locations indicated in Table 1, modeled with the random forests routine [1, 2] in the R statistical environment [3, 4]. We validated the model by jackknifing (also called leave-one-out, see [5, 6, 7]) by element occurrence for a total of 139 groups. The statistics in Table 2 report the mean and variance for these jackknifing runs.

Table 1. Input statistics. Polys = input polygons; EOs = element occurrences (known locations); Groups = element occurrence BG points = background points; PR points = presence points placed throughout all polygons.

Name	Number
polys	219
EOs	139
BG points	31254
PR points	1352

Table 2. Validation statistics for jackknife trials. Overall Accuracy = Correct Classification Rate, TSS = True Skill Statistic, AUC = area under the ROC curve; see [8, 9, 6].

Name	Mean	SD	SEM
Overall Accuracy	0.96	0.13	0.01
Specificity	0.92	0.25	0.02
Sensitivity	0.99	0.04	0.00
TSS	0.91	0.26	0.02
Kappa	0.91	0.26	0.02
AUC	0.99	0.03	0.00

Validation runs used 58 environmental variables, the most important of 86 variables (top 75 percent). Each tree was built with 2 variables tried at each split (mtry) and 750 trees built. The final model was built using 2000 trees, all presence and background points, with an mtry of 2, and the same number of environmental variables.

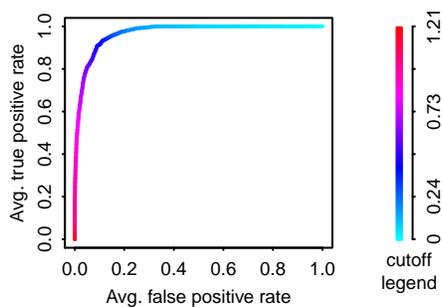


Figure 1. ROC plot for all 139 validation runs, averaged along cutoffs.

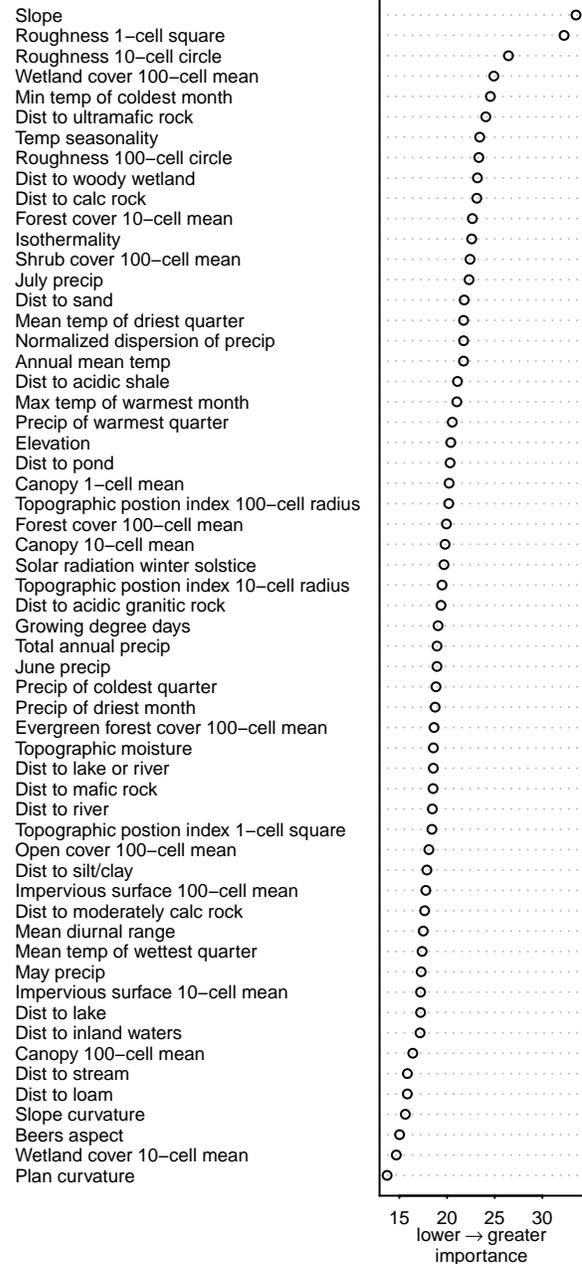


Figure 2. Relative importance of each environmental variable based on the full model using all sites as input. Abbreviations used: calc = calcareous, CP = coastal plain, dist = distance, fresh = freshwater, precip = precipitation, temp = temperature, max = maximum, min = minimum.

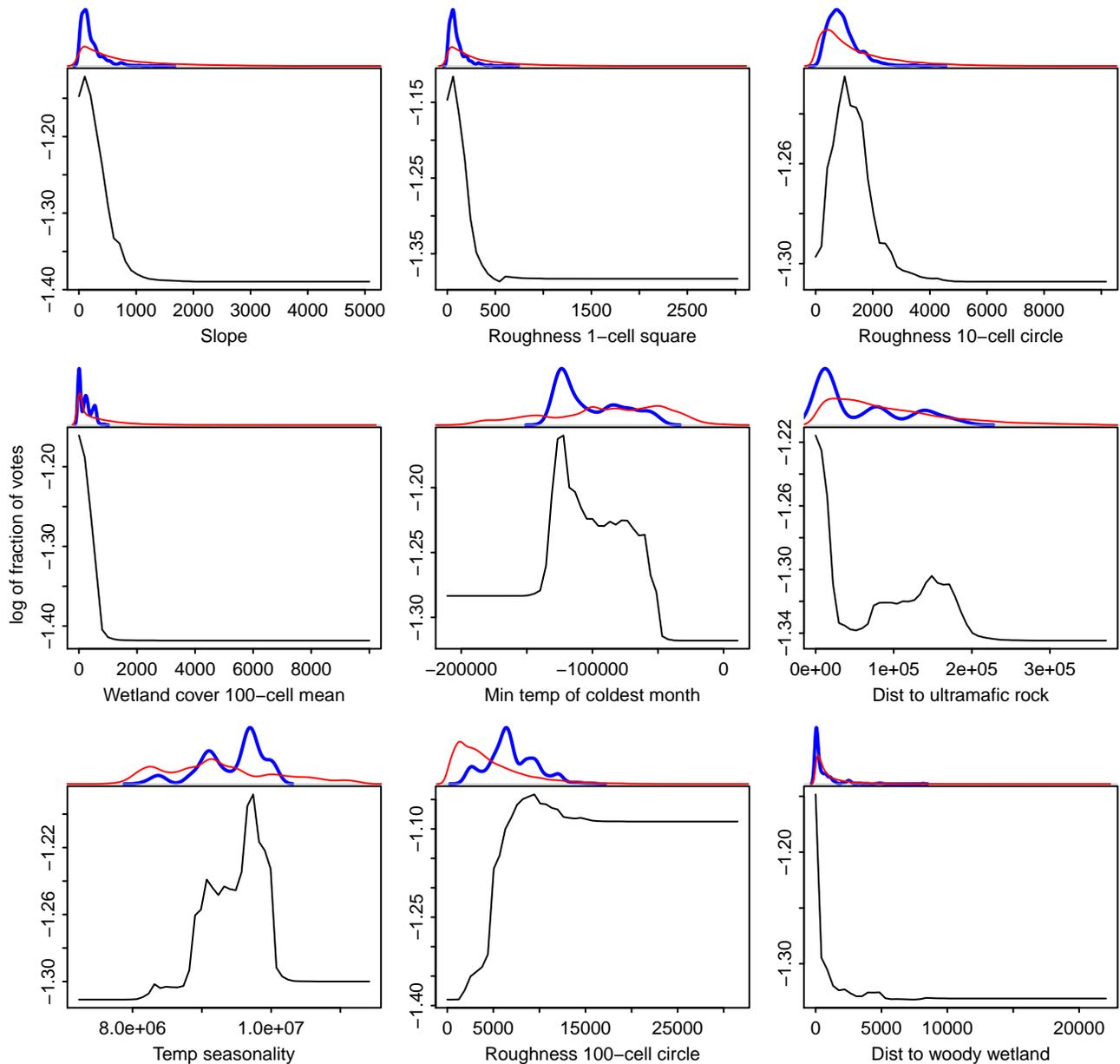


Figure 3. Partial dependence plots for the 9 environmental variables with the most influence on the model. Each plot shows the effect of the variable on the probability of appropriate habitat with the effects of the other variables removed [3]. Peaks in the line indicate where this variable had the strongest influence on predicting appropriate habitat. The distribution of each category (thin red = BG points, thick blue = PR points) is depicted at the top margin.

Element distribution models map places of similar environmental conditions to the submitted locations (PR points). No model will ever depict sites where a targeted element will occur with certainty, it can *only* depict locations it interprets as appropriate habitat for the targeted element. SDMs can be used in many ways and the depiction of appropriate habitat should be varied depending on intended use. For targeting field surveys, an SDM may be used to refine the search area; users should always employ additional GIS tools to further direct search efforts. A lower threshold depicting more land area may be appropriate to use in this case. For a more conservative depiction of suitable habitat that shows less land area, a higher threshold may be more appropriate. Different thresholds for this model (full model) are described in Table 3.

Table 3. Thresholds calculated from the final model. For discussions of these different thresholds see [11, 12]. The Value column reports the threshold; EOs indicates the percentage (number in brackets) of EOs within which at least one point was predicted as suitable habitat; Polys indicates the percentage (number) of polygons within which at least one point was predicted as having suitable habitat; Pts indicates the percentage of PR points predicted having suitable habitat. Total numbers of EOs, polygons, and PR points used in the final model are reported in Table 1.

Threshold	Value	EOs	Polys	Pts	Description
Equal sensitivity and specificity	0.598	100(139)	99.5(218)	99.6	The probability at which the absolute value of sensitivity minus specificity is minimized.
F-measure with alpha set to 0.01	0.440	100(139)	100(219)	100	The harmonic average of precision and recall, with strong weighting towards recall (classifying presence points as suitable habitat).
Maximum of sensitivity plus specificity	0.602	100(139)	99.5(218)	99.6	The probability at which the sum of sensitivity (true positive rate) and specificity (true negative rate) is maximized.
Minimum Training Presence	0.440	100(139)	100(219)	100	The lowest probability value assigned to any of the input presence points. 100% of input presence points are classified as suitable habitat.
Minimum Training Presence by Element Occurrence	0.910	100(139)	93.2(204)	76	The lowest probability value assigned to any of the input presence element occurrences. This calculation first summarizes EOs by their maximum and then finds the minimum of these values.
Minimum Training Presence by Polygon	0.553	100(139)	100(219)	99.8	The lowest probability value assigned to any of the input presence polygons.
Tenth percentile of training presence	0.829	100(139)	97.3(213)	89.9	The probability at which 90% of the input presence points are classified as suitable habitat and 10% are classified as unsuitable.

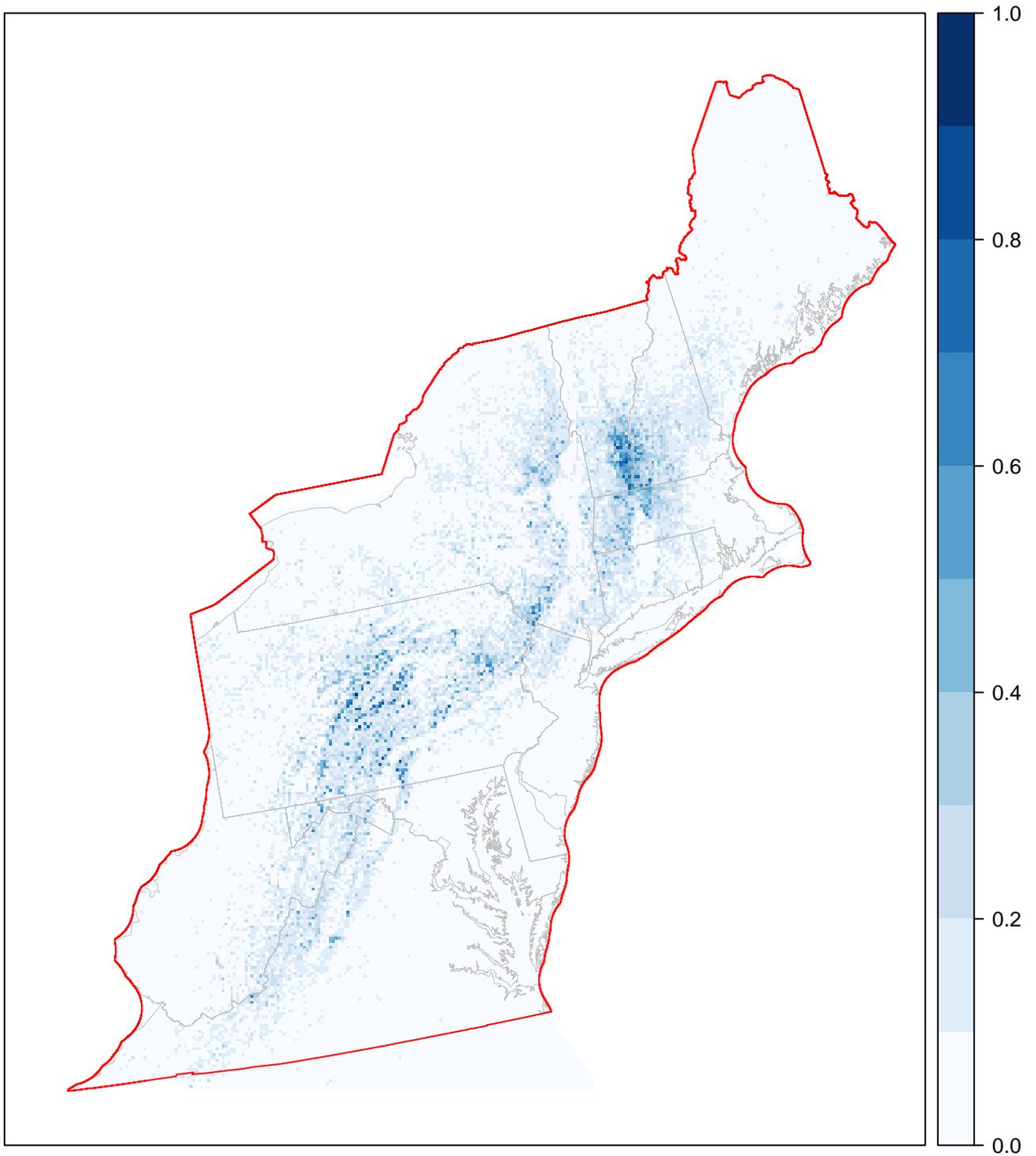


Figure 5. A generalized view of the model predictions throughout the study area. State boundaries are shown in black. The study area is outlined in red.

This distribution model would not have been possible without data sharing among organizations. The following organizations provided data:

- Maryland Natural Heritage Program, Maryland Department of Natural Resources, Wildlife and Heritage Service
- Massachusetts Natural Heritage and Endangered Species Program, Massachusetts Division of Fisheries & Wildlife
- New Hampshire Natural Heritage Bureau
- New Jersey Natural Heritage Program
- New York Natural Heritage Program
- Pennsylvania Natural Heritage Program
- Vermont Wildlife Diversity and Natural Heritage Inventory, Vermont Fish and Wildlife Department
- Virginia Natural Heritage Program
- West Virginia Natural Heritage Program

This model was built using a methodology developed through collaboration among the Florida Natural Areas Inventory, New York Natural Heritage Program, Pennsylvania Natural Heritage Program, and Virginia Natural Heritage Program. It is one of a suite of distribution models developed using the same methods, the same scripts, and the same environmental data sets. Our goal was to be consistent and transparent in our methodology, validation, and output. This work was supported by the US Fish and Wildlife Service, and the South Atlantic Landscape Conservation Cooperative.

Please cite this document and its associated SDM as:

Pennsylvania Natural Heritage Program. 2017. Species distribution model for Northeastern Bulrush (*Scirpus ancistrochaetus*). Created on 30 May 2017. Western Pennsylvania Conservancy, Pittsburgh, PA.

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