

Identification of goldenseal (*Hydrastis canadensis* L.) habitat and indicators in Pennsylvania, U.S.A: the influence of climate and site on in situ conservation of an edge of range plant species.

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Abstract

Aim Goldenseal (*Hydrastis canadensis* L.) is a perennial herbaceous plant native to eastern North America. Commercial harvesting for the medicinal plant trade and habitat loss have led to international conservation concerns. This study aimed to gain an understanding of habitat predilections for the purpose of guiding in situ conservation efforts.

Location This study was conducted in Pennsylvania, within natural range of the species in the northeastern U.S. The state's variation in geology and biogeographic location an opportunity to examine the influences of edaphic, topographic, and climatic factors on goldenseal habitat suitability here.

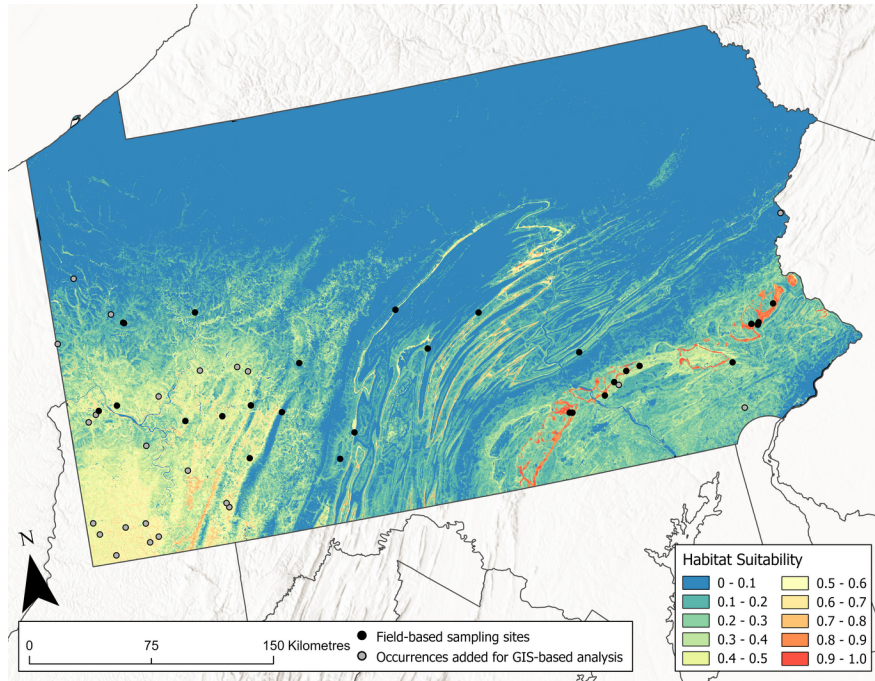
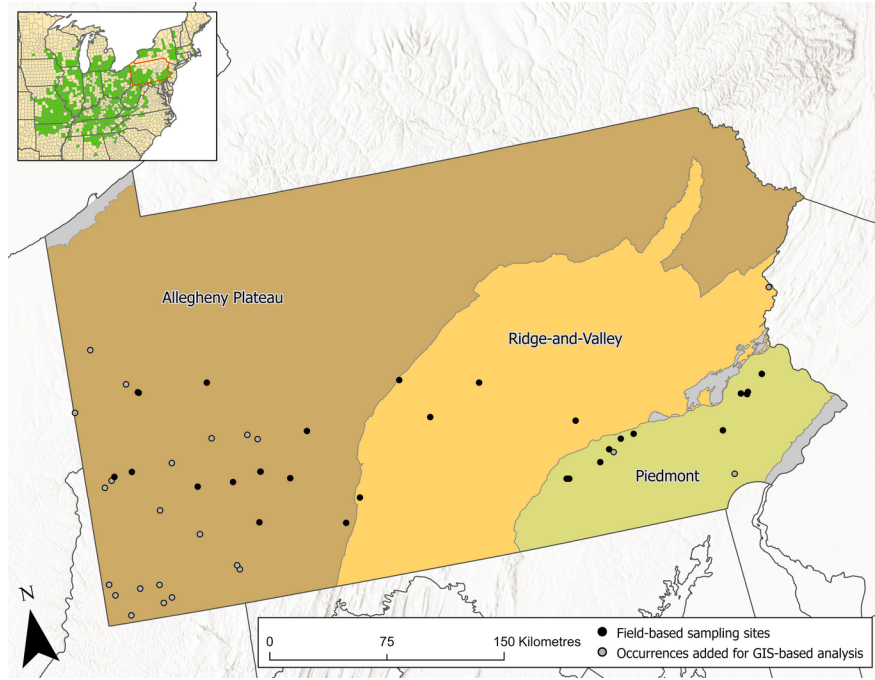
Methods GIS-based Maximum Entropy (Maxent) modeling using known occurrence points (n=51) was combined with field plot data (n=28) to identify potential factors governing goldenseal's distribution in PA and identify vegetative indicators of supportive habitat.

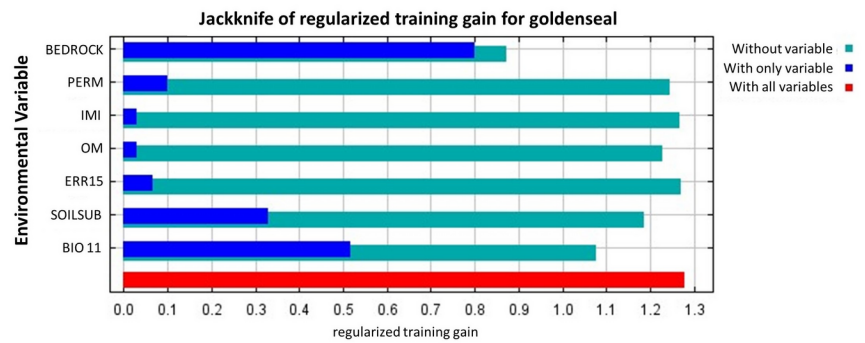
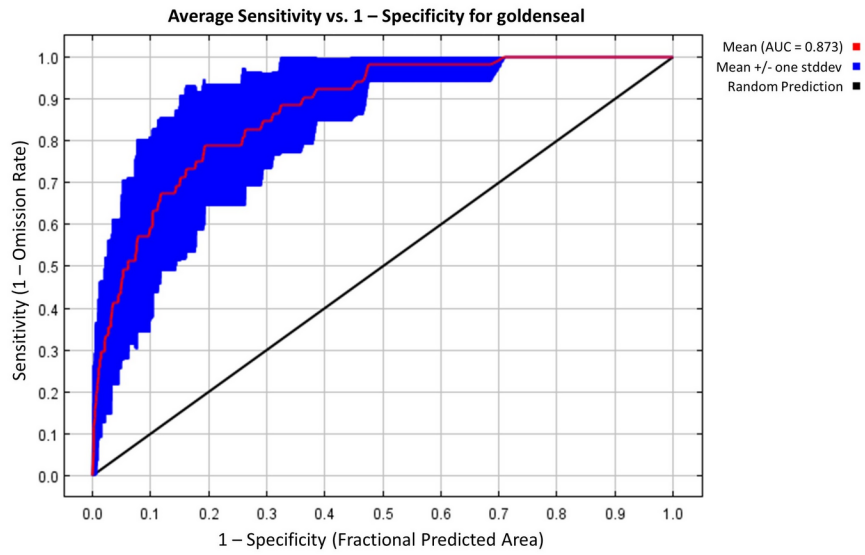
Results Bedrock type and winter temperature were the best predictors of habitat suitability. Suitable bedrock types were base-rich; a trait confirmed in the field by soil test results showing high calcium and pH levels. However, the influence of bedrock is complicated by overlapping land use legacy. Suitability increased with average winter temperature, peaking at 1.0°C toward upper end of winter temperatures in PA. Community analysis identified 159 woody and herbaceous associates, including indicators of the following supportive rich mesic forest types: "Tuliptree-Beech-Maple," "Red Oak-Mixed hardwood," and "Central Appalachian Rich Cove".

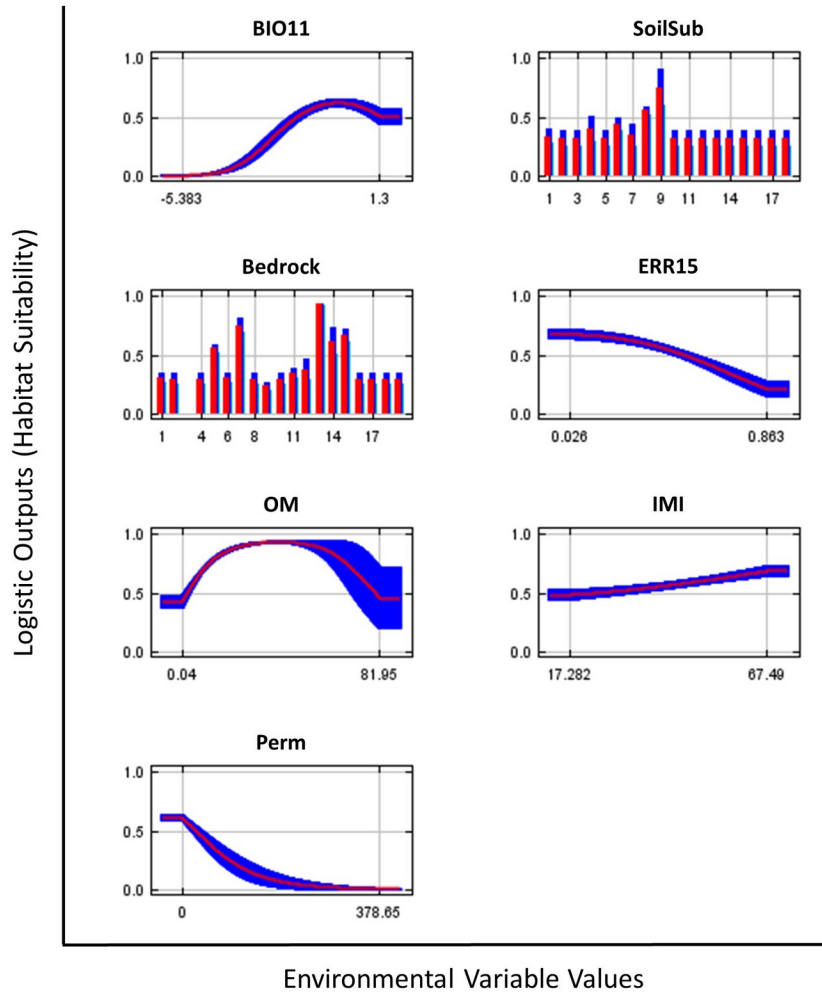
Main Conclusions Model and field results can be used in tandem to assess site suitability, which was found to be greatest within forestlands with slightly acidic to neutral loamy soils underlain by base-rich bedrock types on moist, lower slope positions. Vegetative "indicator" species of these rich-mesic forests including *Liriodendron tulipifera*, *Acer saccharum*, *Lindera benzoin*, *Arisaema triphyllum*, and *Botrypus virginianus* appeared to be useful field indicators of supportive habitat for in situ conservation efforts.

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