

Weed Susceptibility Modeling— Building a New GIS-based Model

i ADVANTAGES

Advantages of building a new model over adapting an existing model include:

- The ability to tailor the model to information you have available
- An inherent understanding of model assumptions and functionality

i DISADVANTAGES

Disadvantages of building a new model over adapting an existing model include:

- The model is only as good as your understanding of factors contributing to susceptibility
- More upfront work to research and develop the model

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Summary

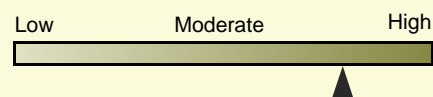
A susceptibility model predicts the risk of a weed species becoming established and invading specific locations, if introduced. Risk, or susceptibility to invasion, is based on the degree to which specific habitat requirements for establishment or growth are met in a particular area. Variables related to a weed's habitat requirements, which can be obtained as GIS data layers, can be incorporated into a model to predict susceptibility. These data layers may include elevation, water availability, disturbance, vegetation type, and others.

QUICK LOOK

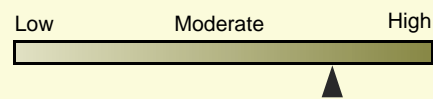
Objective:

This document outlines how to develop a basic weed susceptibility model for your specific weed and area.

Cost:



Expertise:



Major Steps

1. Identify habitat requirements and locate GIS data layers.
2. Develop and run the model.
3. Evaluate the susceptibility map and explore management options.

Identify Habitat Requirements and Locate GIS Data Layers

The most basic susceptibility models use a tally system. This type of model is based on the premise that the more habitat requirements that are met for a weed species, the more likely it is to invade if it is ever introduced into that area. A susceptibility layer can be derived by tallying the habitat requirements that are met in all areas of interest. The higher the score in a particular area, the greater the environmental suitability for weed establishment and growth.

The first step in developing a susceptibility model is to identify the weed's specific habitat requirements and the available GIS data layers that are related to the habitat requirements. GIS data layers that may be important for modeling include:

- Existing vegetation
- Elevation
- Slope
- Aspect
- Ecosystem stress
- Climate data
- Hydrology
- Disturbance
- Soil type and pH

Because weeds are very adaptive, they will have slightly different habitat requirements in different areas. Therefore, the model should be developed based



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on your knowledge of the weed's habitat requirements and spread characteristics in your specific area.

Once you have determined the habitat requirements, assemble or derive as many data sets as possible that are directly related to the weed's habitat requirements.

Develop and Run the Model

A model can be developed once data sets related to the weed's habitat requirements are assembled. The basic process of developing the model will be illustrated by discussing the development of a model for perennial pepperweed.

Suppose, for example, it has been determined that perennial pepperweed is not likely to establish itself more than 33 meters from a direct water source, such as a stream or marsh. The model would evaluate each cell individually on the hydrology GIS layer and determine the distance from the individual cell to a water source. If any portion of a cell is within 33 meters of a water source, then one point is added to that cell's score (see example, part A). The model repeats this step for each cell, scoring each one as it proceeds.



Perennial pepperweed
(Credit: Steve Dewey, Utah State University)

EXAMPLE: Perennial Pepperweed (Part A)

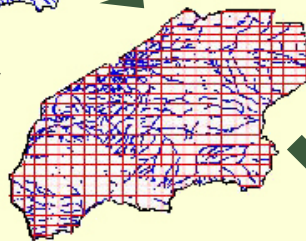
1) Determine the habitat requirements and associated GIS layers. For perennial pepperweed, proximity to water is important. Therefore, a hydrology layer is incorporated into the model.



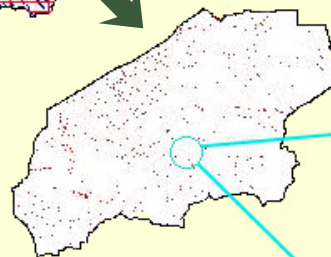
Hydrology layer

2) From field observations, determine specific water requirements. For example, it might be determined that perennial pepperweed will grow within 33 meters of a water source.

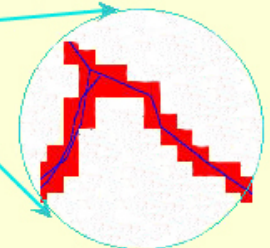
3) Convert hydrology layer to a 30 meter grid.



4) Create a 33 meter buffer around all water sources.



5) Add 1 point to each cell that falls within the buffer. Suitable locations are shown in red.



Possible locations for perennial pepperweed based on hydrology

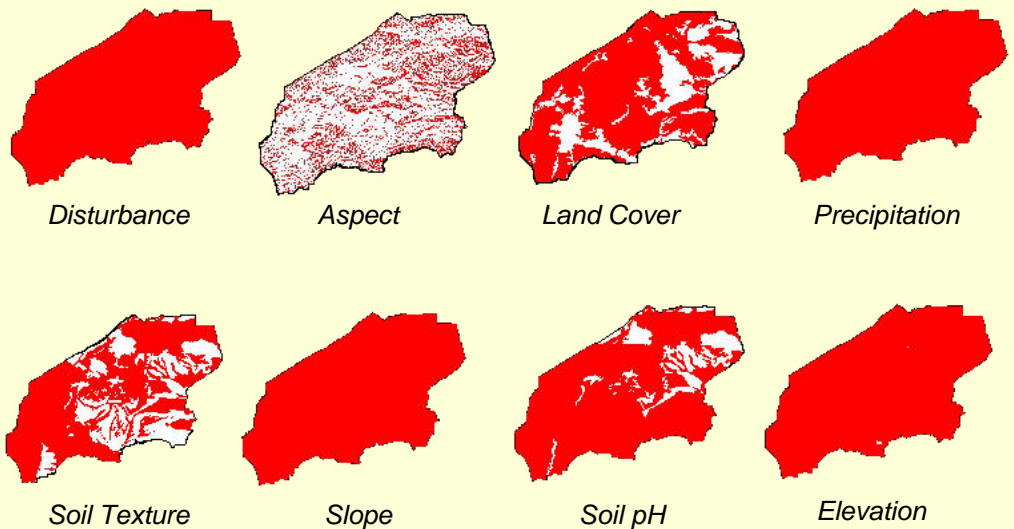


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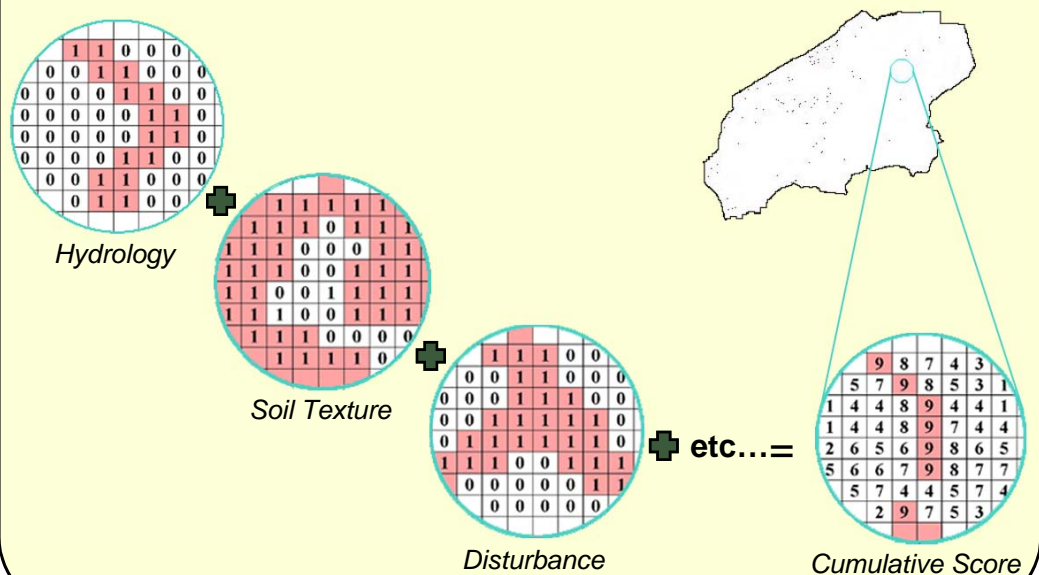
After all cells in the user-defined area have been scored for water availability, the model evaluates other environmental characteristics (such as soil type or disturbance factors) in the same manner. After all cells in the selected area have been scored for each GIS layer for the targeted weed species, cumulative scores are tallied and recorded for each of the cells (see example, part B).

EXAMPLE: Perennial Pepperweed (Part B)

- 6) Evaluate the suitability of the remaining GIS layers for perennial pepperweed establishment and growth. Suitability is indicated in red.



- 7) Tally scores across all data sets for each cell. Areas having the highest cumulative scores are the predicted areas of greatest susceptibility.



The perennial pepperweed example does not incorporate weighting of the environmental factors. One factor may weigh more heavily on a weed's establishment than the others. Weighting can be accomplished by adding more than one point to a cell when scoring the suitability for establishment and growth of specific environmental layers.

Evaluate the Map and Explore Management Options

One way to use the susceptibility map is to display the legend with only the highest scores colored on the map (see example, part C). This allows you to initially view the areas most susceptible to invasion. Using this map combined with a topographic layer, a land manager can quickly evaluate which areas are likely "hot spots" for potential weed invasions, and prioritize these areas for field surveys. By changing the map legend and displaying each score as a different color, a contoured susceptibility-to-invasion map can be evaluated easily and efficiently, showing the manager an estimated level of risk for invasion.

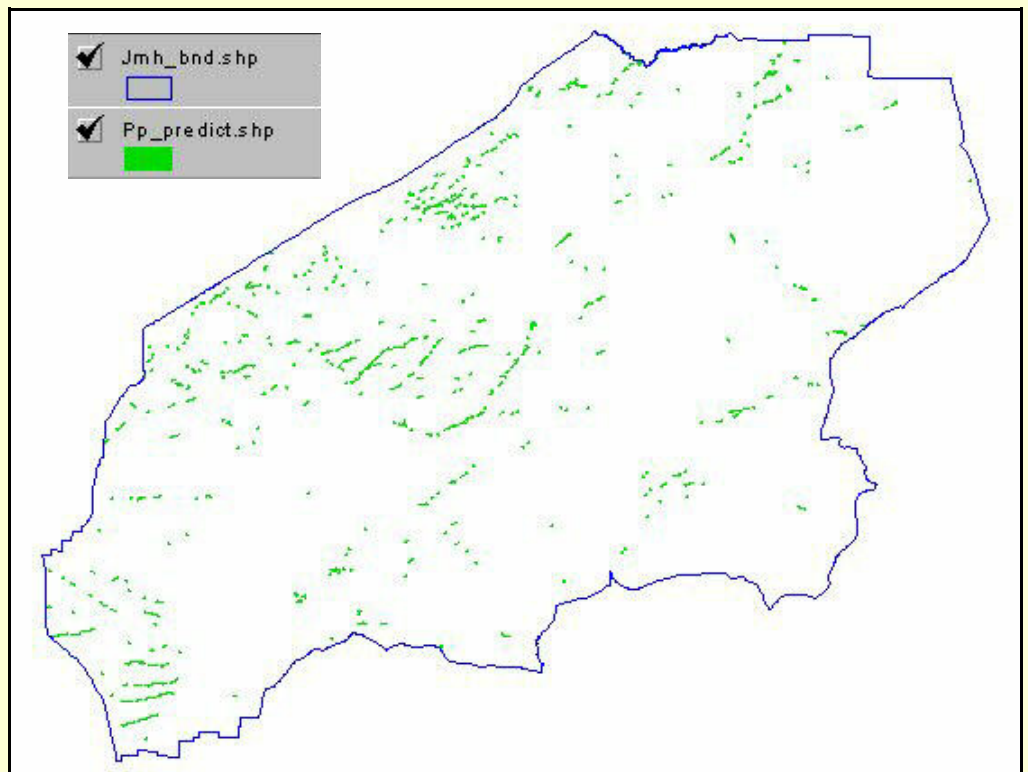


CAUTION

Remember, a susceptibility map is only a theoretical prediction. Evaluate it carefully before making management decisions.

EXAMPLE: Perennial Pepperweed (Part C)

- 8) By displaying only the cells with the highest scores, the areas predicted to be most susceptible to invasion can be quickly identified to guide management decisions.



i ASSISTANCE?

For more information or assistance, please contact

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