Using complex models to support every-day biosecurity decisions for aquatic invasive species

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AIS explorer
Data-driven approach to informed decision making
AISexplorer.umn.edu

OVERVIEW

Invasions of aquatic invasive species (AIS) have imposed significant economic and ecological damage to aquatic ecosystems across the globe. Once an invasive population has established in a new habitat, eradication can be financially and logistically impossible, motivating management strategies to rely heavily upon prevention measures aimed at reducing introduction and spread.

To be effective, on-the-ground management of aquatic invasive species requires decision-making surrounding the allocation of limited resources.

Watercraft inspection is one activity that most AIS managers counties engage in to prevent or limit the spread of non-native aquatic species in Minnesota. During inspections, survey data is collected about the location of boating activities, which has been used to develop models to inform county-level watercraft inspection plans.

OBJECTIVE

To be effective, on-the-ground management of aquatic invasive species requires decision-making surrounding the allocation of limited resources.

The objective of this study was to develop an interactive web-based dashboard to support watercraft inspection planning to maximize the number of inspected watercrafts that move from AIS infested to uninfested lakes, within and outside of counties in Minnesota, USA.

STUDY LOCATION

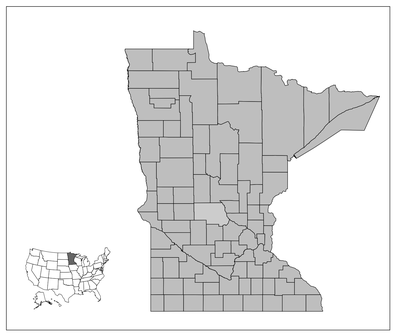

Figure 1: Counties of Minnesota, USA.

In the US, local, state, and federal agencies have invested in boat inspection and education programs. The Minnesota AIS Prevention Aid program provides $10 million a year to counties to prevent the introduction and limit the spread of AIS (1).

Funding is allocated based on each county's share of watercraft trailer launches and parking spaces.

Counties may allocate their funds to a variety of allowed activities at their discretion, including watercraft inspection, education, population assessment, and rapid response.

DATA

Infested waters list

Lakes were classified as infested or uninfested based on Minnesota Department of Natural Resources (MNDNR) Infested Waters List (2).

If a lake was positioned on the border of a neighboring county, the lake was included in the analysis.

A network of boater movement was created using more than 1.6 million reported lake-to-lake connections from inspection surveys. The connections between pairs of lakes were directional and weighted based on the estimated number of boats moving between them.

Using the predicted network of boater movement, boats were designated as "risky" if they moved from an infested waterbody to an uninfested waterbody.

MODEL

Lakes involved in the "risky" boat movements were ranked based on the number of boats moving into or out of another waterbody. The lake with the highest rank was recorded and removed from the list. The sum of the remaining movements was calculated, and the lakes were reranked.

The output of the model was a list of waterbodies removed from the list in descending order, representing the order in which lake inspectors could be deployed to maximize the inspection of the number of boats that move from infested to uninfested lakes.

AIS explorer houses two models that can be used to support surveillance activities. The watercraft inspection model can be accesses by selecting the "Prioritization for Watercraft Inspections" tab.

Users can select a county throughout the entire state of Minnesota.

Users can select up to four risk species and any combination thereof.

AIS managers can select a management goal which described the percentage of boats that move from infested to uninfested waterbodies.

The chart lists the lakes in order from the highest (Rank 1) to lowest priority until the management goal is reached.

The chart is exportable as a comma separated values (csv) file. In addition, users can export a map describing the location of lakes for prioritization and a chart of diminishing returns.

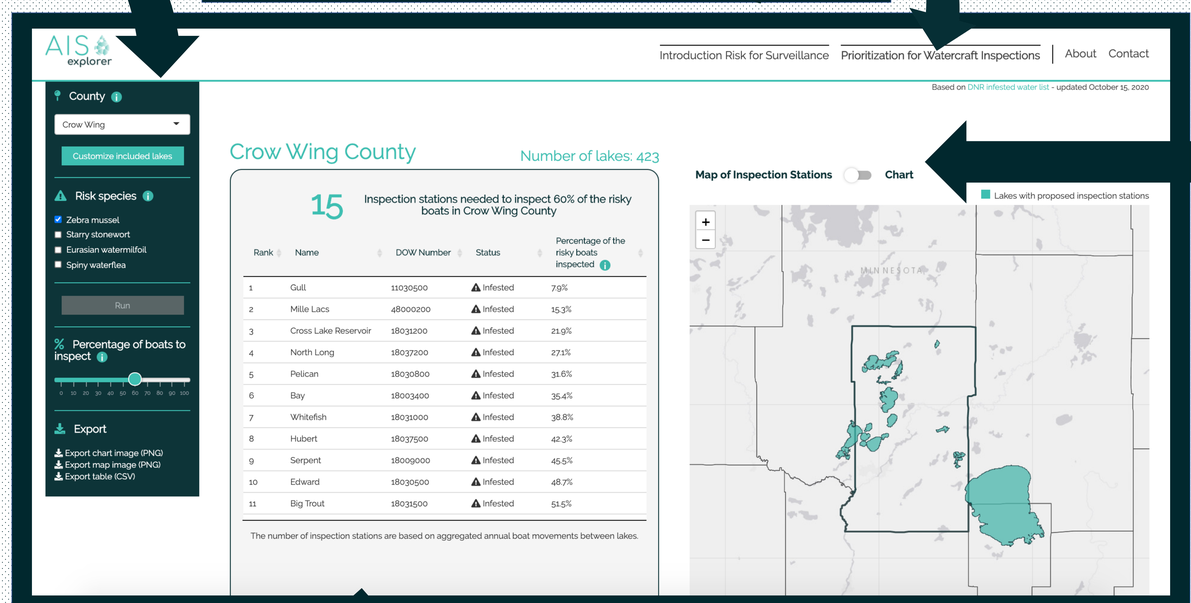

Figure 2. Depiction of the AIS explorer dashboard Prioritization for Watercraft Inspections. Model outputs account for "risky" boat movements that occur within, out of, and into the county of interest and is available for every county throughout Minnesota, USA.

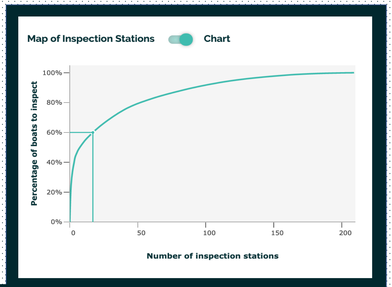

Figure 3. Toggling to the right allows users to visualize the chart of diminishing returns. This chart describes the percentage of boats inspected by the number of inspection locations, allowing mangers to visualize the incremental gains or losses in increasing or decreasing the number of inspection locations.

The map highlights the county of interest with the lakes chosen as inspection locations in teal. The map is exportable as a portable network graphics (PNG) file.

REFERENCES AND ACKNOWLEDGEMENTS

1. Minnesota Department of Natural Resources. Local Aquatic Invasive Species Prevention Aid.
2. Minnesota Department of Natural Resources. (2019). Infested Waters List. Retrieved October 15, 2020, from website: https://www.dnr.state.mn.us/invasives/ais/infested.html

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FUTURE DIRECTIONS

Future studies will quantify the benefits of state-level coordination and between-county cooperation in watercraft inspection plans to support decision-making in watercraft inspection programs.

The outputs of this activity will be integrated into AIS explorer to foster cooperation, or the sharing of information and resources, across counties and ultimately lead to more efficient use of resources.