Title: Evaluation of invasive aquatic species in Texas

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Abstract

Research on invasive aquatic species in Texas, funded through the USGS and the W.G. Mills Memorial Endowment, began last year and is currently ongoing. The time frame for this report is June 1, 2012 through February 28, 2013. The focus of this research is to evaluate aquatic invasive species in the state of Texas. Upon speaking with representatives from the Texas Parks and Wildlife Department and the Lady Bird Johnson Wildflower Center, it was determined that a risk assessment tool for aquatic invasive plants that is tailored to the state of Texas would be beneficial. The risk assessment will serve as a useful predictor of future potential invasive plant species, as well as prioritize existing invasive aquatic plants for management purposes, and will therefore be applicable to policy makers in determining which species to prohibit, as well as for managers deciding which species deserve the highest priority in management and control efforts.

Problem and Research Objectives

Determining which non-native aquatic plants have the greatest potential to invade a new area, and prohibiting those species prior to their introduction, is the key to preventing future serious infestations. The vast majority of non-native plants, either aquatic or terrestrial, are intentionally introduced to an area for purposes such as food crops, ornamental gardening, or as novelties. Once established in captivity, many plants are accidentally or intentionally released into the environment. The majority do not pose a serious threat of infestation, however a select number can quickly become well established and cause severe damage to both the ecosystem and the economy. Each year, millions of dollars are spent in an attempt to control these invaders in the United States. Additionally, invasive plants cause a multitude of negative impacts, such as reduced biodiversity, increased transportation costs, changes water chemistry, and decreased land values. Weed Risk Assessments, tools for determining the invasive potential of a plant species, have been developed and are currently being used around the world to screen non-native plant species and identify those which are likely to be invasive and should be excluded. Most notably, a risk assessment was developed for Australia in 1999 as a biosecurity tool, which is referred to as the Weed Risk Assessment or WRA. The Australian system is regarded as a highly accurate tool for screening non-native terrestrial plants prior to their introduction. This model has been widely adapted to screen for both terrestrial and aquatic plants in a number of other countries including New Zealand, Chile, and the United States, as well as individual states in the US such as California and Hawaii.

A tool specifically tailored to the unique ecosystems of Texas has not yet been developed, however. Texas is a major hub in the aquatic plants trade and has conditions, like a temperate climate, which are favorable for plant invasions. In fact, one of the most common

sources of aquatic ornamental plants is internet sale, and Texas is home to some of the largest retailers in the country. So, developing and implementing an effective risk assessment tool is imperative to reducing future invasions. This study will review the models that are currently available, the New Zealand and United States models in particular, and adapt them to develop a tool that will accurately identify those aquatic species which should be prohibited from entering the state of Texas, while recognizing those which should be safe to import. The new tool will be referred to as the Texas Aquatic Plant Risk Assessment, or TX APRA, and will be comprised of two models: a questionnaire-style risk assessment which will give each plant an invasiveness score, and a stochastic model which will show potential plant growth and spread of over time.

Materials/Methodology

The research began with assessing existing risk assessments models that have been developed and are currently in use, specifically the New Zealand Weed Risk Model and the United States Weed Risk Assessment. The models are questionnaire-style assessments with a number of weighted questions which address various aspects of plant ecology, reproductive abilities, potential environmental and economic impacts, and history of invasion in other areas, among others. Questions include temperature tolerance, resistance to management, and aesthetic value. Upon completion of the questionnaire, each plant is given a score of invasiveness potential; the higher the score, the more likely the plant is to become invasive.

The risk assessment currently being developed for Texas, part one of the Texas Aquatic Plant Risk Assessment or TX APRA, will be similar to these previous models, however changes will be made so that the parameters accurately reflect conditions in Texas. The TX APRA will also likely be divided into regions, based on the USDA Plant Hardiness Zones Map. Each region will reflect environmental conditions in that area thus providing a more accurate predictor of aquatic plant invasive potential. To test for model accuracy, a number of plants which are known to have been previously introduced into Texas ranging from highly invasive, to slightly invasive, to exotic but not invasive will be scored to ensure that the model can correctly distinguish between the three categories.

Part two of the TX APRA will be a stochastic model which will show predicted rates of growth and spread of non-native plants over time. Both existing invasive plants and those which have not yet been introduced to Texas could be modeled. Annual extreme temperatures, water depth, and the plant's invasiveness score from part one of the tool are all components that will likely be included. Once the model is developed and validated, management techniques like manual removal, herbicide application, bio-control, or a combination of techniques could also be incorporated and the control technique's effectiveness could be predicted. A stochastic model of predicted growth and spread of aquatic plants has not been developed in any of the previous risk assessments and will be highly useful in aiding managers when deciding the best plan of action for controlling existing aquatic invasive plants.

Principal Findings

The TX APRA is still in the developmental stages, so testing and model validation has not yet been performed. Existing risk assessments in New Zealand and the United States have been tested, and both report a high level of accuracy in correctly distinguishing between plant species which are highly invasive, moderately invasive, or exotic but not invasive. We expect the

TX APRA to be at least as accurate as its predecessors, thus providing a highly beneficial tool in the fight against invasive species in Texas.

Significance

Implementing an accurate risk assessment tool in the state of Texas will be highly useful to policy makers. Prevention through prohibition is the most effective way of ensuring that new, potentially devastating invasive species do not enter our state's waters. With this tool, policy makers will be able to accurately determine those species which have a potential to be highly invasive and should be prohibited, while still allowing entrance of species which do not pose a serious threat.

The TX APRA will also benefit managers and those working to control and manage existing invasive species. The stochastic model of plant growth and spread will allow managers to model various control techniques and determine what the most effective course of action will be. Modeling control efforts prior to testing them in the field could prove very cost effective, as time spent in the field and money spent on control efforts could be saved by narrowing down the best plan of action.

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