

Labels that limit: A framework for reducing sales of ornamental invasive plants

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Executive Summary: Invasive plants cost the US billions of dollars each year due to ecological and economic impacts as well as management costs. One of the most common pathways of introduction and spread of invasive plants is through ornamental plant sales. While solutions such as regulations and voluntary self-bans have been implemented in some instances to mitigate this problem, widespread adoption has not occurred. As such, new alternatives should be explored. Opt-in labeling programs are commonly used throughout the agricultural industry to better inform customers about the products they are purchasing. An opt-in labeling program that consists of a partnership between retailers and governments or non-profit organizations could help reduce the spread of invasive plants by influencing customer behavior. This approach would be less costly to retailers than regulations, create new invasive plant prevention opportunities for governments and nonprofits, and better inform consumers about specific invasive plant species.

I. Introduction

Invasive plants are non-native plants that are introduced, accidentally or intentionally, outside of their natural range where they are capable of persisting, growing, and spreading across that new region (Mack et al. 2000). While not all invasive plants are detrimental to their new region, certain invasive plants negatively impact ecological and economic systems. Between 1960 and 2020 the total cost of invasive plants within the US was \$190 billion (Fantle-Lepczyk et al. 2022). As per Fantle-Lepczyk et al. this figure has soared over time, as the average annual cost from all invasive species increased from \$2 billion in the 1960s to \$21.08 billion in the 2010s. These costs are a result of economic losses, such as reduced agricultural yield, loss of water availability, and the use of resources to manage infestation (Duncan et al. 2004), as well as ecological damages, such as impairment of ecological function and biodiversity loss (Mack et al. 2000). Given these costs, approaches that reduce spread of invasive plants are likely to be beneficial to ecosystem health,

invasive plant managers and policy makers, and society at large.

While non-native plants can be introduced to new regions through a variety of means, such as for agricultural or erosion control purposes, the ornamental plant trade represents a common pathway of introduction for non-native plants (Lehan et al. 2013). Ornamental plants are defined as plants that are used either strictly or at least in part for aesthetic purposes. (Reichard and White 2001). The number of invasive plants that were originally introduced for ornamental purposes is disproportionately high compared to other introduction pathways. Across the US, approximately 82% of the 235 invasive woody plants were introduced for ornamental purposes (Reichard 1994). Callery pear (*Pyrus calleryana*) (Culley and Hardiman 2007) and Japanese barberry (*Berberis thunbergii*) (Silander and Klepeis 1999) are two of the examples of non-native species sold for ornamental purposes that later became highly invasive plants. Even after an ornamental plant is

deemed invasive, which occurs through a non-legal process that determines if the impacts from a non-native species outweigh the benefits (Invasive Species Advisory Committee 2006) (Koop et al. 2012; Roy et al. 2014; Conser et al. 2015), it is common for that species to continue to be available for purchase (Beaury, Patrick, and Bradley 2021). The continued sale of invasive ornamental plants results in a greater number of invasive plants on the landscape, which increases the probability of spread and growth of new populations and their impacts and costs of these species over time (Dehnen-Schmutz and Touza 2008). Given this, there is a need to limit the sales of invasive ornamental plants.

II. Labeling program rationale

The policies surrounding the sales of invasive plants is a patchwork of federal and state regulations. At the federal level, the Plant Protection Act (7 U.S.C. §7701 et seq.) provides the US Dept. of Agriculture Animal and Plant Health Inspection Service (APHIS) with authority to regulate the importation and interstate movement of invasive plants but can only be applied to the sales of federally designated noxious plant species, a subset of invasive plant species. At the state level, the most common regulatory means of managing invasive plants is through the state's noxious weed list, but these lists are neither comprehensive (Beaury et al. 2021) nor entirely effective at preventing the sales of those species listed (Beaury, Patrick, and Bradley 2021). One study found that on average, state noxious weed lists only contained 19.6% of the species considered invasive by state or regional invasive plant working groups (Quinn et al. 2013).

A separate study found that across the US, 146 regulated plant species were still available for purchase in the states in which it is specifically illegal for them to be sold (Beaury, Patrick, and Bradley 2021). While state level programs that regulate the sales of certain invasive ornamental plants exist, such as Maryland's mandatory invasive ornamental plant labeling program (COMAR 2020), or Maine's ban of selling invasive plants via 'do not plant' lists (Maine Department of Agriculture, Conservation and Forestry 2022), these programs are patchwork across the US, varying in approach, scope, and existence from state to state.

In addition to government driven solutions, the ornamental plant trade industry also plays a key role in limiting sales of ornamental invasive plants. As recently as 2020, the American Society for Horticultural Science held a workshop examining the broad topic of invasive ornamental plants (Schnelle and Gettys 2021). Despite opposition to outright bans (Hulme et al. 2018), there is evidence that members of the ornamental plant trade industry are interested in addressing this issue. One survey conducted of Maine nursery professionals found over 80% of respondents agreed that the horticultural trade played a role in the introduction of invasive plants. 98% of respondents said they would be willing to participate in a preventative measure to reduce the sale of invasive species (Burt et al. 2007). A separate industry survey found 65.3% "agreed" or "strongly agreed" that they would be willing to label invasive ornamental plants for sale (Coats, Stack, and Rumpho 2011).

Given both the patchwork regulatory environment and difficulty of the ornamental plant trade industry to implement self-bans, an alternative approach is needed. To that end, an opt-in collaborative program between industry and a certifying entity that involves labeling ornamental invasive plants may be an effective solution. This approach not only allows for retailers, governments, and/or non-profit organizations to work together to find appropriate solutions to this problem, but also brings in an additional party previously left out of this process - the consumer.

III. Labeling program evidentiary support

Labeling programs in the agricultural industry are commonly used to better inform customers about the product they are buying and aid sellers with creating new markets for their products (Golan et al. 2001). Examples of agricultural labeling programs can be found at the federal level (e.g., Agricultural Marketing Service 2000) and state level (e.g., Colorado Department of Agriculture 2022). Non-profit organizations also use labels to certify agricultural products that comply with program standards (e.g., Rainforest Alliance 2020; Fairtrade International 2022). Labeling is also already used as a tool to prevent the spread of invasive species. The Federal Seed Act (7 U.S.C. §1551 et. seq) requires that noxious weed seed contaminants be disclosed via label when agricultural seed mixes are sold.

Maryland's Department of Agriculture has their own mandatory labeling program for high-risk invasive ornamental plants (COMAR 2020).

The effectiveness of a labeling program to reduce ornamental invasive plant sales is supported by scientific literature. Half of nursery customers from urban and suburban areas preferred native or non-invasive horticultural plants to invasive ones (Yue, Hurley, and Anderson 2012). A study in Portugal found that an individual's opinions on whether an invasive plant should be removed from the landscape depended upon whether they knew the plant was invasive (Cordeiro et al. 2020). When deciding whether a plant should be removed from a landscape, invasiveness was found to be more important than other factors, such as personal value or ecosystem services. This is also evidence to suggest that retailers could charge more for the sales of non-invasive plants, mitigating the costs of a labeling program. Nursery customers were willing to pay small but statistically significant premiums when offered the choice between a native, non-invasive plant versus a non-native, invasive plant (Yue, Hurley, and Anderson 2011). The willingness to pay for non-invasive plants was objectively small - invasive plants were preferred when they were discounted by \$1.01-\$1.66, but it does suggest that if a non-invasive option is offered at comparable prices, customers may opt to purchase the non-invasive alternative. This price differential may also undersell opportunities for retailers, as 67% of customers were "never" or "seldom" told if the plant they were purchasing was invasive (Yue, Hurley, and Anderson 2012). Collectively, this evidence suggests that disclosing a plant's invasiveness status via labeling may alter customer preference and result in customers purchasing non-invasive plants, even when sold at a small premium.

IV. Labeling program benefits

Evidence suggests that a labeling program may be effective at changing customer behavior and reducing invasive ornamental sales. However, retailers may still be hesitant to adopt the program due to the uncertainties of operational costs and revenue changes. This is where collaboration between retailers and government/non-profit organizations becomes important. First, when a product is certified by a third-party organization, it

results in greater program credibility (Golan et al. 2001). As such, government/nonprofits serving as the certifying entity would provide more authority for interested customers compared to self-certification by retailers.

Second, a collaborative effort would ensure that the cost of administering this program would not fall entirely upon retailers, as would happen in a voluntary code of conduct. Cost, lack of resources, and lack of personnel are all cited as barriers for industry adoption of successful preventive measures regarding the sales of invasive plants (Burt et al. 2007). The cost of a labeling program could be partially funded by the certifying agency either directly (i.e. grant funding) or indirectly (i.e. providing materials, program outreach/education efforts, etc.). By having multiple entities collaborate, costs associated with the program can be dispersed among partner organizations.

Third, a labeling program stands to benefit all participating parties. Retailer program adoption may not only prevent the passage of more costly regulation but also can fulfill other key company objectives. Small scale, specialty retailers can use program participation to cater to environmentally conscious customers. Large scale retailers could use program participation to better satisfy corporate sustainability pledges. Certifying partners can reduce the spread of ornamental invasive species through means that are typically not accessible to them outside of strictly regulatory means. Customers stand to benefit by increasing their knowledge of a key ecological issue and becoming an active participant in the development of a solution. By making this program collaborative, it increases program validity, avoids making retailers solely responsible for programmatic costs, and provides tangible benefits to all parties involved.

V. Labeling program framework

We conducted interviews with program representatives, industry professionals, and relevant governmental personnel, and used previously cited literature to create a programmatic framework (Figure 1) for an opt-in labeling program for ornamental plants. Each step in the framework is detailed below but left sufficiently vague to be adapted to fit the needs of different collaborating organizations. Additionally, several existing

programs can be looked to as examples of the collaborative approaches between multiple organizations that address the issues of invasive plants within the horticultural industry. Elements from each of these programs can be drawn upon and serve as models for creating a labeling pilot program:

- The Plant Right (PlantRight 2022) program created and managed by the non-profit Land California Alliance, identifies ornamental invasive plants, educates retailers and customers about their risks, and provides alternative species across California. Plants are determined to be invasive based on the data driven findings of the Plant Risk Evaluator tool (Conser et al. 2015) and are assessed on a regional basis. Once invasive plants have been regionally identified, the organization builds relationships with both retailers and customers to better inform all parties about the issues associated with invasive ornamental plants and what alternative species exist. Over the last seven years, surveys conducted by PlantRight found that listed ornamental invasive plants carried by retailers decreased from 44% to 20% (Lee 2021).
- An alternative multiorganizational approach can be found by examining the certified weed-free products program administered by the non-profit North American Invasive Species Management Association (NAISMA) (NAISMA 2018). In this approach, governmental or pseudo-governmental entities may opt into the NAISMA program. Participants receive standardized training on how to meet program standards and become certifiers for the program, capable of administering inspections and certifying participating product producers. Producers within the program area then have the choice to opt in and receive certification when their practices align with program standards. This program has expanded to 27 states and includes product inspection and certification for forage, hay, gravel, and mulch.
- The Systems Approach to Nursery Certification (SANC) program (National Plant Board 2020) serves as an excellent example of how a voluntary, opt-in approach to a

public-private partnership program can be created and implemented. This program is a result of government, academic, and industry representatives collaborating to create programmatic standards to reduce plant pests within the plant trade industry. Plant production facilities may opt into this program, volunteering to adhere to program standards and receiving audits by government partners to ensure program compliance.

A final note, a key distinction between the Plant Right program and this framework is that the Plant Right's program abstains from a labeling approach and instead aims for the outright removal of a plant species from a retailer's inventory. While the outright removal of an invasive plant from sale is preferable, a label-driven approach is more likely to gain industry participation. This allows partners to continue to sell potentially profitable invasive species while also informing customers about the impacts of that purchase. The goal of this approach is to create a lower friction transition away from invasive plants, as evidence suggests a percentage of informed customers will choose non-invasive alternatives over time (Figure 1).

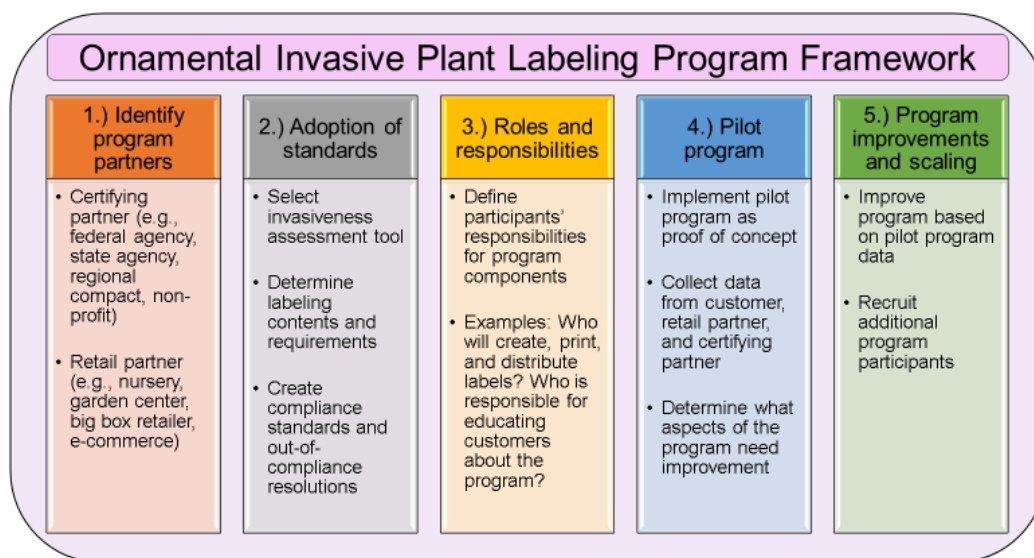


Figure 1: Five step framework detailing the process of creating a collaborative, opt-in invasive ornamental plant labeling program.

i. Step 1 - Identify program partners

The initial step is to identify and contact interested relevant parties. At a minimum, one retail partner and one certifying partner are required. Retailers can vary in size and may specialize in ornamental plants or be a more general retailer. E-commerce retailers should not be overlooked as potential partners, as their participation may yield large dividends given the sizable number of invasive ornamental plants available for online purchase (Beaury, Patrick, and Bradley 2021). Program participation can be extended to wholesale vendors as well. Many options exist for certifying partners, depending on the scale of the program. Partnerships with federal entities such as with the USDA's Animal and Plant Health Inspection Service or the Agricultural Marketing Service may be feasible. State partners may be found at the Department of Agriculture, Department of Natural Resources, or even academic or extension institutions. Alternatively, quasi-governmental (e.g., regional invasive plant councils), non-profits, or arboretum/botanic gardens may also serve as a credible certifying agency. Non-governmental organizations vary in terms of geographic reach, funding, and expertise, but often have greater flexibility than government

entities in their ability to create and oversee programs such as this one.

ii. Step 2 – Collaborative adoption of programmatic standards

Once parties have agreed to discuss the creation of a labeling program, a series of collaborative events such as meetings, workshops, or summits, should be held to achieve consensus among participants regarding programmatic structure and standards. Standards pertaining to label contents, compliance standards/out-of-compliance resolution, and risk assessment tools should be a key area of focus. Invasive species risk assessment tools rank a species' invasiveness using a combination of life history, species origin, climate matching and other ecological information. The use of these standardized decision-making tools ensures that the determination of a plant's invasive status is evidence-based and transparent. Several invasiveness assessment methods currently used for screening imported exotic plants to determine their invasiveness (Koop et al. 2012; Roy et al. 2014; Conser et al. 2015) can be used "out of the box", adapted by partners for regional purposes, or a new assessment method can be created whole cloth. Labels will be used to either signify plants

that are non-invasive or invasive or be applied to all species sold to display their invasiveness status. Compliance standards and out of compliance resolutions are critical to agree upon prior to program execution, so all parties know how compliance issues will be handled. Compliance resolutions could range from a “stick”, the loss of programmatic support from certifying entities until compliance is again achieved, to “carrot”, offering additional resources to enable programmatic compliance.

iii. Step 3 - Detail and define roles and responsibilities

In addition to developing the program’s structure and standards, the roles and responsibilities of each participating organization should also be defined. The main roles of a retailer within this program may include collaborating on programmatic standards, labeling plant products, and adhering to program compliance standards. Additionally, retailers could provide education and outreach to customers about the impacts of invasive plants and alternatives that are available for purchase. The roles and responsibilities of certifying partners will include program compliance, training retailers and certifying entities on compliance standards, quality control, maintaining and administering a database of plant invasiveness assessment, and education and outreach. Continued education and outreach from certifying partners to retailers should be considered a critical component, as it has been found to increase compliance among retailers in similar programs (Oele et al. 2015). Additionally, certifying partners could also provide funding in the form of grants, if financially feasible, to retailers to improve program compliance by mitigating costs.

iv. Step 4 - Pilot program and data collection

Once programmatic standards and organizational roles are agreed upon, a pilot program should be implemented to evaluate the program with one or a small number of retailers. During this time, partners can collect information such as customer purchasing preferences, customer knowledge of invasive plants, and programmatic costs and barriers for retailers. The goal of the survey is to collect data to improve program performance and

identify problem areas prior to scaling up the program.

v. Step 5 - Program improvements and program scaling

Using the information collected via surveys as well as general “lessons learned” from the pilot program, the program can be improved and scaled. Data should be continually collected to ensure program effectiveness. Collected data will also allow the program to be evaluated and act as “proof of concept” for future partners or labeling programs. This feedback improvement mechanism will help to ensure the continued participation of all parties.

While this framework is designed to be adaptable to many different entities at different scales, ideally the scale of such a program would be regional. The rationale for a regional approach is both ecological and administrative. As invasive plants are only invasive within specific ecoregions, a regional approach would optimize the ecological benefits of such a program without overregulating species in areas in which they simply are not invasive. A regional approach would also be beneficial administratively, as a regional certifying entity composed of several states or a regional invasive species council would be able to pool greater resources and disperse program costs to help. While a state or national level program would still be immensely useful, a regional approach is ideal due to the intrinsically regional nature of the problem.

A key challenge for an opt-in labeling approach at any scale is industry adoption of the program. No business is likely to opt into a program where the costs outweigh the benefits. To address this issue, certifying entities need to ensure that the cost of the program is outweighed by program benefits. Initially targeting businesses that cater to customers with an environmental focus and/or have well stated sustainability goals would be ideal. Ornamental plant sellers that cater to more environmentally focused clients, e.g. smaller specialty nurseries, or big box stores with stated sustainability goals that also sell ornamental plants, e.g. Walmart, would be ideal partners for an opt-in labeling program that can be designed to clearly meet those businesses’ needs. Additionally,

certifying entities should consider the spectrum of options available to them to incentivize participation. Monetary, such as grants or tax incentives, or non-monetary, business promotion incentives should be considered depending on the type of certifying entity that is participating.

VI. Conclusion

While previous approaches such as industry codes of conduct (Baskin 2002), outright bans on ornamental invasive plants (Hulme et al. 2018), mandatory taxes for ornamental invasive plants (Knowler and Barbier 2005), and mandatory ornamental plant labeling programs (COMAR 2020) have been proposed, these approaches have not been successful due to industry opposition, insufficient political capital required to create such a program, and/or insufficient funding required to enforce such programs (Burt et al. 2007; Hulme et al. 2018). Given that no one regulatory program has been found to be widely successful, our

proposed framework for creating an opt-in labeling program may be a valuable, alternative policy tool. The proposed opt-in labeling approach is one method that draws upon previously suggested policy solutions while bringing in retailers and customers as active participants in this process. The proposed framework is a starting point to design and adopt a pilot labeling program, while still deferring specific programmatic decisions to the collaborating organizations. While this programmatic framework is by no means a “silver bullet”, it stands to leverage an underutilized means of reducing the spread and sales of invasive ornamental plants and in turn reduce their management and impact costs.

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