To Plant, or Not to Plant?

Regulating Invasive Plant Species in the Mid-Atlantic States

A Social-Ecological System Case Study

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About the Author: Lea Johnson is an ecologist who joins basic research in plant ecology with applications to land management, particularly the conservation and restoration of biodiversity and ecosystem functions in urban and urbanizing regions. She has engaged students in experiential, project-based, and inquiry-driven science learning for more than fifteen years.

About the Case Study: This Case Study was developed with support from the National Socio-Environmental Synthesis Center, and NSF Grant DBI-1052875. This case is part of the SESYNC Case Study Collection: https://www.sesync.org/for-you/educator/case-study-collection

Abstract

Along the Atlantic U.S. coast, the states from Virginia to New York share many things: humid climate, warm summers, productive farmland, forested mountains, urban traffic, and invasive plant species. Invasive plants are introduced, intentionally or unintentionally, from other parts of the world, and cause economic or ecological harm. Some invasive plants are famous, like kudzu, the "vine that ate the South." Others are newly emerging problems. As these species spread rapidly across the landscape, growing costs of their economic and environmental impacts have sparked interest in regulating their sale and transport. Laws now prohibit the sale and movement of some species. State and local governments are drafting regulations that will affect horticulture, plant nurseries, and options for landscape design. Awareness of invasive plant species is slowly increasing among homeowners and professionals who make local-scale planting decisions, while panels of experts and industry representatives are being convened to decide which plants to restrict, and how. These important questions require synthesis of economic, social, and scientific information. This case study asks students to explore the problem system from a variety of perspectives, including business, policy, and ecological science.

Estimated time frame: Multiple class periods to a full unit. This activity is scalable, with multiple options.
Materials: Internet access, large paper, scissors, markers

Contents

Learning Goals and Objectives

SES Learning Goals	Case Learning Objectives	Activities
Understand structure and behavior of social-environmental systems	Understand social and ecological concepts central to the system, including: • Biological invasion as a process • Characteristics of invasive plant species • Economic and ecological impacts of invasive species • The roles of human actions and perceptions in species invasions • Regulatory approaches and their potential effects	Introduction Mental Models Risk and Regulation Role Play Policy proposal
Consider the importance of scale and context in addressing socio-environmental problems	• Understand ecological, socio-economic, and governance context of the system • Predict effects of actions that vary in spatial and temporal dimensions on system dynamics • Make recommendations for action at multiple levels of scale, considering species ranges and political boundaries. • Predict outcomes of management in relation to phase of invasion • Reflect on the roles of bias and uncertainty in decision making processes	Introduction Mental Models Risk and Regulation Role Play Policy Proposal
Co-develop research questions and models in interdisciplinary and transdisciplinary teams	• Create models of ecological, socio-economic and governance sub-systems • Integrate ecological, socio-economic and governance system models to create a model of the S-E system • Develop and research answers to questions that deepen understanding of stakeholder perspectives	Role Play Policy Proposal
Find, analyze and synthesize existing data and ideas or methods	• Integrate ecological, socio-economic and governance system models to create a model of the S-E system • Propose a synthesis solution, addressing proposed regulation, education, and industry self-regulation policies	Role Play Policy Proposal

Activity and Assessment Sequence

Activity	Overview	Activity Learning Objectives	Assessment
Introduction: Should I plant this species?	Students prepare for the case by reading about Kudzu, an invasive vine with large-scale impacts. An interactive lecture introduces central concepts of invasion biology and invasive plant management.	Compare definitions of native, non-native and invasive species Give examples of specific invasive species and their relationships to changing human values Understand the role of human perception in determining species invasiveness Describe the process of invasion over time, including the sequence of barriers species encounter Predict the influence of human actions on the invasion process for plant species, including transport and creation of favorable site conditions Suggest management approaches based on extent of spread of an invasive plant species	Quick Questions and discussions, integrated into lecture Concepts of this activity lay the foundation for following activities and are reflected in subsequent assessments
Mental models: Mapping the system from a stakeholder perspective	A lecture introduces mental modeling using system maps. Students create system maps from the perspective of a stakeholder group.	Understand that differences in perception of invasive species are based in varied logical arguments Create a mental model of the problem using system mapping Describe biological and economic values and impacts of invasive species Predict social and ecological outcomes of invasive species regulation	System map and narrative

Activity	Overview	Activity Learning Objectives	Assessment
Risk and Regulation	Students prepare by reading about invasive plant risk assessment, and examining an assessment describing a plant species that will be the focus of activities in Part 4. A lecture gives foundations of the process for risk assessment and invasive plant determination processes, with emphasis on how uncertainty is incorporated in decision-making in national and state methods. Students investigate decision-making processes underlying laws and regulations that affect the sale and movement of invasive plants, by comparing Mid-Atlantic states with other states and/or international approaches.	Describe the relationship between laws and regulations, and identify national and state laws applicable to invasive species Explain the U.S. national-level APHIS Weed Risk Assessment process, and the Maryland filter Explain the rationale behind variables used to determine plant species invasion risk Understand the importance of risk and uncertainty in decision-making	Research summary comparing state laws and regulations Concept map of invasive plant risk assessment process
Role Play: Mock Council Meeting	Students research and present the view of a stakeholder group in a role play activity. In response to a scenario, students discuss the question of what, if any, actions should be taken to limit the spread of a particular invasive species, from the stakeholder perspective they have researched.	Understand the importance of risk, uncertainty, jurisdictional boundaries and economic concerns in management of ecological problems. Identify needs for additional information and conduct independent research. Recognize bias in their own and others' perspectives Predict outcomes of temporally and spatially variable factors on system dynamics, and consider consequences if stakeholders take no action, take action at specific place(s) and time(s), and with temporally variable conditions.	Presentation and discussion of stakeholder perspectives

Activity	Overview	Activity Learning Objectives	Assessment
Policy Proposal and Discussion	Students synthesize case study material to make reasoned proposals for policy, education, and self-regulatory actions addressing invasive plant species in the Mid-Atlantic States.	Reflect on what has been learned about the problem system. Propose legislative, educational and/or self-regulatory approaches to invasive plant spread. Justify proposals using logical arguments and evidence, place proposals in the context of current approaches, and evaluate potential effects and drawbacks of proposed actions.	Policy proposal with supporting logic and predicted outcomes Final system maps and narratives reflecting on changes in understanding

1. System Overview: Plant Invasions

Overview	*Activity Learning Objectives*	*Assessment*
Students prepare for the case by reading about Kudzu, an invasive vine with large-scale impacts. An interactive lecture introduces central concepts of invasion biology and invasive plant management.	Compare definitions of native, non-native and invasive species Give examples of specific invasive species and their relationships to changing human values Understand the role of human perception in determining species invasiveness Describe the process of invasion over time, including the sequence of barriers species encounter Predict the influence of human actions on the invasion process for plant species, including transport and creation of favorable site conditions Suggest management approaches based on extent of spread of an invasive plant species	Quick Questions and discussions, integrated into lecture Concepts of this activity lay the foundation for following activities and are reflected in subsequent assessments

An interactive lecture, activity and discussion introduces central concepts of the case, including definitions of invasive species, the process of biological invasion, and the role of human perception and actions in the process of invasion by non-native plant species. Students prepare for the case by reading an article from popular literature describing impacts of an invasive plant species with widespread impacts that is currently expanding its range in the Case Study area (Kudzu, *Pueraria montana* var. *lobata*). Student comprehension and muddy points are assessed using Quick Questions (short writing assignments) integrated into the lecture, and using discussion.

Suggested Readings: Plant Invasions

Lecture: Plant Invasions

Kudzu

- *Forest Invasive Plants Resource Center*
  http://na.fs.fed.us/spfo/invasiveplants/factsheets/pdf/kudzu.pdf
- *National Invasive Species Information Center*
  https://www.invasivespeciesinfo.gov/plants/kudzu.shtml
- *Invasive.org, University of Georgia Center for Invasive Species and Ecosystem Health*
  http://www.invasive.org/browse/subthumb.cfm?sub=2425
- *Bugwood.org, University of Georgia Center for Invasive Species and Ecosystem Health*
  http://wiki.bugwood.org/Pueraria_montana_var._lobata
- ***Discussion Questions:***
  - What type of plant is kudzu? Where did it originate? Why was it introduced to North America? Why is its continued spread cause for concern? In what phase of invasion is this species now? What broad category of management strategy might be appropriate, according to models of invasion curve and invasion process?

Suggested Readings: Plant Invasions *continued*

Invasion Process

The lecture includes diagrams describing biological invasion a *process*, with phases and barriers. This material builds upon Lockwood, Hoopes & Marchetti's *Invasion Ecology* (2nd ed., 2007, Wiley), particularly the introductory chapter. This book is a good source of readings on invasion for upper-level undergraduate or graduate students, and a solid text on the subject for a full course.

Invasion Curve

The invasion curve is descriptive model of the relationship between phase of biological invasion and cost of management. It is used internationally as a framework for prioritizing action to manage invasive species.

- Invasion curve animation: Biosecurity Council of Western Australia, Dept. of Agriculture and Food https://www.youtube.com/watch?v=Ho2oXhtGmNQ
  This short video introduces the concepts of phases of invasion, management options at different phases, and the social, economic, and ecological dimensions of biological invasion, from an Australian perspective. Language used is security-oriented. This video could be used in class to start discussion.
- *National Invasive Plant Surveillance Framework* (2013), an Australian government report using the invasion curve. This report is context for the video above, and describes an Australian approach. http://wildmatters.com.au/wp-content/uploads/2014/04/NIPSF_Final_JUNE-26-2013.pdf
- Hobbs, Richard J. and Stella E. Humphries, 1995. An Integrated Approach to the Ecology and Management of Plant Invasions. Conservation Biology Vol. 9, No. 4, pp. 761-770 http://www.jstor.org/stable/2386985
  This frequently-cited paper describes the curve in different terms.
- *Discussion Questions:*
  - What is the invasion curve? Why do management options change along the curve?
  - What other meanings and contexts do the words used to describe invasive species and their management have?
  - How does the invasion curve model differ from the invasion process model for describing biological invasions? What is the emphasis or focus of each?

Variation: Multi-Species Jigsaw Activity

Weeds Gone Wild: Alien Plant Invaders of Natural Areas https://www.nps.gov/plants/alien/

This Plant Conservation Alliance site contains fact sheets for many invasive plant species. A variation on the activity can be done using a jigsaw format in which groups of students read about and discuss different species, and then report back in mixed-species groups. Similar questions to those used above for kudzu can be used for this variation.

2. Mental Models: Mapping the Problem from a Stakeholder Perspective

Overview	Activity Learning Objectives	Assessment
A lecture introduces mental modeling using system maps. Students create system maps from the perspective of a stakeholder group.	Understand that differences in perception of invasive species are based in varied logical arguments Create a mental model of the problem using system mapping Describe biological and economic values and impacts of invasive species Predict social and ecological outcomes of invasive species regulation	System map and narrative

A lecture introduces the process of using system maps as mental models of complex problems. Students are then assigned a stakeholder perspective and given information about a specific invasive species, stakeholder needs, resources, and interests. Resources provided describe the invasive species Oriental bittersweet (*Celastrus orbiculatus*) an ornamental vine with bird-dispersed seeds. Stakeholder groups are based on membership of the State of Maryland's Invasive Species Council, including ecological, socio-economic and governance perspectives. Students work in teams to create a mental model of the problem system using system mapping. The assignment for the Mock Council Meeting (Part 4 of this Case Study) can be given at the end of this class meeting.

During this process, students identify additional information they need to present the perspective in the Stakeholder Role Play (below). Pairs of teams explain their maps to each other and describe the connections they have made between elements of the system.

Variation: Map Integration

Students from each team present maps in integrated jigsaw groups. Integrated groups synthesize perspectives of all stakeholders into a map of the whole problem system.

Variation: Capture for Final Reflection

Capturing the concept maps made at this phase can be part of a reflective exercise at the end of the case study, in which students review and reflect on how their concept of the problem system has changed.

Lecture: Mapping S-E Systems

Variation: Mapping Systems with Online Tools

Mental Modeler http://www.mentalmodeler.org/

This website can be used as a demonstration in class, or as a tool for students to use outside class. Specifically designed for mapping social-ecological systems, this website (and downloadable application) features boxes for system elements, easy-to-connect uni- or bi-directional arrows, and a plus/minus feature to show strength of positive and negative interactions. Students can capture a screenshot of their work or save their maps.

Activity: Mapping a Socio-Ecological Problem from a Stakeholder's Perspective

Using information provided about the non-native invasive species Oriental bittersweet (*Celastrus orbiculatus*) and about stakeholder perspectives, create a system map of the social and ecological dimensions of the spread of this species and its potential regulation, from the perspective of your stakeholder group.

A. Mapping the Problem System

1. Read and discuss the invasive plant species profile and your stakeholder perspective with your group.
2. As you work, make a list of additional information you would need, and questions you would need answered to understand this perspective more fully.
3. Identify and list elements of the system. Write them on small pieces of paper or sticky notes.
    - Boundaries
        - Where is the species? Where might it be regulated? What is the spatial scale?
    - Stakeholders
        - How is your group affected by the species, and by limitations on its sale and movement? Is your group interested in in the increase or decrease of this species in the landscape? What factors motivate this interest?
    - Ecological elements of the problem
        - Effects of the problem on the biological and physical environment (+/-)
        - Effects of biological and physical environment on the problem (+/-)
    - Social elements of the problem
        - How do institutions, power, and other social patterns and processes increase or limit the spread of this species?
4. Arrange elements
    - Cluster similar elements
    - Leave room for interactions
5. Draw interactions between elements with arrows
    - Arrow direction = direction of influence
    - Write a verb on the arrow to describe the interaction (e.g. "outcompetes", "eats")

B. Map Sharing

Partner with another group. Each group shares their map with the other by explaining the interactions. Use active verbs to describe the interactions.

C. Writing a Map Narrative

Write a brief (no more than one page) narrative summarizing the information in your diagram. Focus on the most important interactions, using the verbs that you put over the arrows. Can you group different types of interactions? Include a snapshot or copy of your map with the assignment.

Species Profile Resources

Weeds Gone Wild: Alien Plant Invaders of Natural Areas https://www.nps.gov/plants/alien/

This website has many brief factsheets on invasive plant species; for this exercise, see the factsheet on Oriental bittersweet (*Celastrus orbiculatus*): https://www.nps.gov/plants/alien/fact/ceor1.htm

An interesting perspective can also be gained by looking at invasive species on gardening and botanical websites. The following sites have profiles for many species:

- Missouri Botanical Garden: http://www.missouribotanicalgarden.org/plantfinder/plantfindersearch.aspx
- Dave's Garden: http://davesgarden.com

Stakeholder Perspectives

This exercise is the first step in preparing you to present your Stakeholder Perspective in a Mock Committee Meeting, which will take place in class on _____.

Stakeholder perspectives in this exercise are based upon the membership of the Maryland Invasive Plant Advisory Committee (http://msa.maryland.gov/msa/mdmanual/10dag/html/dag.html#invasive), which advises the State Secretary of Agriculture on regulating invasive plants and preventing them from entering Maryland. In the Mock Council Meeting, you will present your stakeholder perspective on the question of potential responses to the expanding range of an invasive species. Today, we will practice system mapping by considering the problem of an invasive vine, Oriental bittersweet (*Celastrus orbiculatus*), from a variety of perspectives.

Perspective Overview:

State Regulators - Departments of Natural Resources, Transportation, and Agriculture

When the Federal or State government creates or changes a law, it must be interpreted for application. Officials within Departments of the state government are often charged with this task. They rely on a broad range of experts from universities and the public and private sectors, representatives of interested groups, and the general public for input on both regulations and to advise on new legislation. Each department is responsible for a different function of state government, and works with different groups of the population that may hold different views and have different priorities.

As a representative of state regulators, your task is to understand the forces shaping decision-making in the public interest. These include laws, rules, and regulations, decision-making processes, sources of information, and the views of constituency groups.

The three Departments you will focus on serve different economic and social interests, and have jurisdiction over different types of land within the state. Intersections, coordination and differences between these interests and jurisdictions can be very important. All three must apply the law as it affects the types of land and activities in their purview.

Perspective Overview: Ornamental Horticulture and Nursery Industries

The Maryland Nursery, Landscape and Greenhouse Association estimates that Maryland nursery growers generate more than $770 million in annual wholesale and retail sales. Landscape installation and maintenance account for 46% of this total, with retail sales making up 25% and grower sales 29%. Woody plants generate more than twice the annual revenue of annual plants. Nursery production and sales occupy 29,980 acres of land in Maryland, including 495 acres of greenhouse space, and the industry employs nearly 30,000 people, 60% of whom are employed more than 150 days per year. Average wage rate for both experienced and non-experienced laborers is above the federal minimum wage.

(Source: MNLGA 2016, mnlga.org)

The ornamental horticulture and nursery industries are an important economic force in the state of Maryland. These industries are directly affected by any restrictions on the sale or movement of plant species, especially those that are popular for ornamental use. There is increasing demand from the public for native plants and environmentally beneficial landscaping, and growing awareness about invasive species. Although most introduced species don't become invasive, several major problem species have been introduced via this industry. Invasive species impact agricultural and forest production, and taxpayers contribute to removal costs.

As a representative of this industry, your task is to be knowledgeable about industry participation in the development of laws and regulations affecting species in the trade. You should be familiar with current laws and regulations, able to describe commonly held views (note that there may be multiple views from different segments of the industry) about invasive species regulation. You should be expert in the cultivation history and use of the plant we will be discussing.

Perspective Overview: Ecological Science

Ecology is the scientific discipline that is concerned with the relationships between organisms and their past, present, and future environments. These relationships include physiological responses of individuals, structure and dynamics of populations, interactions among species, organization of biological communities, and processing of energy and matter in ecosystems.

(Ecological Society of America 2016, esa.org)

As a representative of ecological science, your task is to present factual information firmly grounded in evidence. Your responsibility to the public and to the scientific community is to give the best, most current, and most complete picture possible of the problem as it affects ecosystems, including ecosystems on which all people rely for their well-being. Ecology is a branch of biology, and you should focus on becoming well versed in the effects of invasive species – and invasive species management – on ecosystems and biodiversity. You are the expert on the life cycle, impacts, management techniques, and species interactions surrounding the invasive plant that we are focused on.

3. Risk and Regulation

Overview	Activity Learning Objectives	Assessment
Students prepare by reading about invasive plant risk assessment, and examining an assessment describing a plant species that will be the focus of activities in Part 4. A lecture gives foundations of the process for risk assessment and invasive plant determination processes, with emphasis on how uncertainty is incorporated in decision-making in national and state methods. Students investigate decision-making processes underlying laws and regulations that affect the sale and movement of invasive plants, by comparing Mid-Atlantic states with other states and/or international approaches.	Describe the relationship between laws and regulations, and identify national and state laws applicable to invasive species Explain the U.S. national-level APHIS Weed Risk Assessment process, and the Maryland filter Explain the rationale behind variables used to determine plant species invasion risk Understand the importance of risk and uncertainty in decision-making	Research summary comparing state laws and regulations Concept map of invasive plant risk assessment process

Lecture: Risk and Regulation

Suggested Readings: Risk and Regulation

Koop, A.L., Fowler, L., Newton, L.P., Caton, B.P., 2012. Development and validation of a weed screening tool for the United States. Biological Invasions 14:273–294. http://dx.doi.org/10.1007/s10530-011-0061-4

- A detailed description of the methods supporting USDA APHIS Weed Risk Assessment process.

USDA APHIS Weed Risk Assessments

- https://www.aphis.usda.gov/aphis/ourfocus/planthealth/plant-pest-and-disease-programs/pests-and-diseases/sa_weeds/sa_noxious_weeds_program/ct_riskassessments/
- Recommended: students read the WRA for glossy buckthorn (*Frangula alnus*), the species that will be used in the Role Play activity in Part 4 of the SES Case Study.
- APHIS WRA Guidelines: This document gives a detailed description of the WRA process. https://www.aphis.usda.gov/plant_health/plant_pest_info/weeds/downloads/wra/wra-guidelines.pdf

Invasive plant regulation resources for Maryland

- Maryland Invasive Species Council: http://www.mdinvasivesp.org
- Maryland laws and regulations: https://www.invasivespeciesinfo.gov/laws/md

US EPA

- Basics of the Regulatory Process: https://www.epa.gov/laws-regulations/basics-regulatory-process
- Laws and Regulations: https://www.epa.gov/laws-regulations

US Law

- Executive Order on Invasive Species: http://www.invasivespeciesinfo.gov/laws/execorder.shtml

Activity: Comparing Legal and Regulatory Approaches to Invasive Plant Species

Instructions
Find up-to-date information about laws and regulations affecting the sale, labeling and movement of invasive plant species in the states listed below. Write the name of the law or its code. Date is the day on which the law was signed. Write the number of species banned or requiring mandatory labeling in each state. If you come across complicating factors or can't find information about a particular state, attach additional information. Make a list of the URLS you used for each state.
Suggested search terms: state (or US) + invasive plant + law (or + list)

	Year(s)	Banned #	Labeled #	Other Action Prescribed	Penalties
US					
MD					
VA					
DE					
PA					
NY					
WV					
NJ					
CA					

Helpful links:
https://www.invasivespeciesinfo.gov/laws/intl.shtml
https://www.invasivespeciesinfo.gov/laws/statelaws.shtml
http://nationalplantboard.org/laws-and-regulations/

Activity: Weed Risk Assessment

The US Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) has developed a tool for estimating the probability that a plant will become invasive, known as a Weed Risk Assessment (WRA). This tool uses multiple sources of evidence to determine relative risk. The State of Maryland has adopted a protocol for assessing the risk of invasion by plant species that combines the APHIS WRA with a Maryland Filter.

Instructions

1. Read the description of the APHIS screening tool by Koop and colleagues, and read a complete Weed Risk Assessment provided by your instructor (glossy buckthorn, *Frangula alnus*).

2. Make a diagram of the process for assessing the risk of an introduced exotic plant in Maryland. (Hint: the Maryland Filter is the last step.) Steps in the process, identity of decision-makers, and criteria for assessment should be included in your diagram.

3. Uncertainty is part of all decision-making. How is uncertainty incorporated in the APHIS and Maryland risk assessments for potentially invasive plant species?

Variation: Research Paper Comparing Governance Approaches

This activity can be extended to include a research paper comparing state approaches for invasive plant risk assessment and rule-making. Maryland can be compared with other Mid-Atlantic States, or with laws local to the location of the course. California, Hawaii and New York have been early adopters of statewide risk assessment and regulation. Comparing US national-scale approaches to those of other countries is also an interesting topic for investigation, in which geography plays a role. Australia's approach has been a model for others.

4. Role Play: Mock Council Meeting

Overview	Activity Learning Objectives	Assessment
Students research and present the view of a stakeholder group in a role play activity. In response to a scenario, students discuss the question of what, if any, actions should be taken to limit the spread of a particular invasive species, from the stakeholder perspective they have researched.	Understand the importance of risk, uncertainty, jurisdictional boundaries and economic concerns in management of ecological problems. Identify needs for additional information and conduct independent research. Recognize bias in their own and others' perspectives Predict outcomes of temporally and spatially variable factors on system dynamics, and consider consequences if stakeholders take no action, take action at specific place(s) and time(s), and with temporally variable conditions.	Presentation and discussion of stakeholder perspectives

In these activities, students explore a stakeholder perspective in depth and present it by representing that perspective in a mock council meeting. Stakeholder perspectives are based upon interests represented in the membership of the Maryland Invasive Plants Advisory Committee, which advises the Secretary of Agriculture on regulating invasive plants and preventing them from entering the State of Maryland. Three stakeholder groups are outlined below. Each could be differentiated into sub-groups to give students individual topics if the instructor desires.

Individually, or in teams established in Part 2, students prepare before class to present the view of their stakeholder group by identifying needs for additional information and conducting independent research. In the role play, mixed stakeholder groups address the question of what action, if any, should be taken regarding an invasive plant species. Mixed groups contain one or two members representing each perspective.

The species of concern in this activity is one that was not banned for sale or transport at the time of this writing in 2016, but which was considered high risk for invasion and considered highly invasive in nearby states: glossy buckthorn (*Frangula alnus*, formerly *Rhamnus frangula*). Other species could easily be substituted in this activity; a widespread invasive with broader horticultural use such as Japanese barberry (*Berberis thunbergii*) would also make an interesting plant for discussion.

Integrated groups synthesize perspectives of all stakeholders into a map of the whole problem system. Teams create a narrative explaining their map and connections between elements of the system.

Suggested Readings: Stakeholder Perspectives

Maryland Invasive Plants Advisory Committee

http://msa.maryland.gov/msa/mdmanual/10dag/html/dag.html#invasive

Ecological Science Perspective

Students researching this perspective should be prepared to encounter primary scientific literature, and to summarize findings.

- Ecological Society of America (ESA): http://www.esa.org/esa/
- *Biological Invasions: Recommendations for U.S. Policy and Management* (available for $3 from ESA)

http://www.esajournals.org/doi/pdf/10.1890/1051-0761%282006%29016%5B2035%3ABIRFUP%5D2.0.CO%3B2

Economic Perspectives: Ornamental Horticulture and Nursery Trades

These readings provide both a historical view of the role of horticulture in invasive plant introductions and industry-generated solutions.

- Maryland Nursery, Landscape and Greenhouse Association website: http://www.mnlga.org/
- Niemiera, A.X. and Von Holle, B., 2009. Invasive plant species and the ornamental horticulture industry. In Management of Invasive Weeds (pp. 167-187). Springer Netherlands. http://dx.doi.org/10.1007/s10530-007-9090-4
- Reichard, S.H., White, P., 2001. Horticulture as a Pathway of Invasive Plant Introductions in the United States Most invasive plants have been introduced for horticultural use by nurseries, botanical gardens, and individuals. BioScience 51, 103–113. http://bioscience.oxfordjournals.org/content/51/2/103.short
- Burt et al. 2007Burt, J.W., Muir, A.A., Piovia-Scott, J., Veblen, K.E., Chang, A.L., Grossman, J.D., Weiskel, H.W., 2007. Preventing horticultural introductions of invasive plants: potential efficacy of voluntary initiatives. Biological Invasions 9, 909–923. doi:10.1007/s10530-007-9090-4 https://link.springer.com/article/10.1007/s10530-007-9090-4

Governance Perspectives: Departments of Natural Resources, Transportation, and Agriculture

MD Department of Natural Resources Invasive Species website

- http://dnr2.maryland.gov/invasives/Pages/default.aspx

MD Department of Agriculture website

- Maryland Invasive Plants Prevention and Control http://mda.maryland.gov/plants-pests/Pages/maryland_invasive_plants_prevention_and_control.aspx
- Noxious Weeds: http://mda.maryland.gov/plants-pests/Pages/noxious_weeds_in_md.aspx

MD Department of Transportation, State Highway Administration

- Invasive Plant Control http://www.roads.maryland.gov/Index.aspx?PageId=316 (information via links at bottom of page)
- Seed transport by vehicles http://wssa.net/2011/10/unlikely-stowaways-weed-seeds-travel-to-faraway-places-on-cars-trucks-and-atvs/

Activity: Mock Council Meeting

Instructions

You have been assigned a stakeholder role. In class on _____, you will play the role of a stakeholder in a discussion of the following question:

Should the sale and transportation of glossy buckthorn (Frangula alnus) be restricted?

You will be asked to consider several policy scenarios, and to discuss them with other stakeholders. Prepare to explain your assigned perspective on this question. Use both the information provided in class and your own research to become knowledgeable about your stakeholder perspective. You'll need **factual information from reliable sources** on which to base your statements, and a clear idea of the **reasonable opinions** of your stakeholder group, based on **logic** and solid information.

During the role play exercise, **your purpose is to convey information** – you don't need to act if the perspective is not one you share. However, you need to stay on topic and on message for your stakeholder group during the exercise. Save your other thoughts for the end. Remember that the other students are doing this too, and **focus on information** presented rather than the person conveying it.

Preparation Questions for Everyone

Everyone should answer the following questions, in addition to their perspective-specific ones. You'll turn in a copy of your answers to these questions before class, so keep a copy or notes for yourself too.

1. What is the mission or goal of professionals in this group? (Hint: look for mission statements, charters, and self-definition.) What are the group's areas of expertise and concern? Do members of the group directly manage land? If so, what type? What actions, if any, does this group take related to invasive species?
2. Who is served by this group? How and when might this group's constituencies, or members of the group, disagree? If so, how is conflict resolved in this group's decision-making? Do legal and financial mandates guide their actions?
3. What relationship does the group have to the species of interest? How might the group's activities affect or be affected by this species?

Stakeholder Perspective-specific Questions

Answer the questions below for your stakeholder perspective.

Ecological Science Perspectives

- What are the documented impacts of invasive plant species on natural areas?
- What options are currently available to stop invasive plant species spread?

Economic Perspectives: Ornamental Horticulture and Nursery Industries

- Why are invasive plant species being sold?
- What initiatives have horticultural professional organizations proposed to address invasive plants?
- How do these industries engage in the development of legislation and lawmaking on this topic?

Governance Perspectives: Department of Natural Resources, Department of Transportation, and Department of Agriculture

- What segment of the public is served by each department? How might the interests of these conflict?
- How is decision-making and rule enforcement about invasive plants organized in these departments?
- How do these departments come to a resolution when there are conflicting values?

Mock Council Meeting Instructions

The Council has been asked to make recommendations regarding a non-native plant species with an expanding range. Your task is to make sure that the perspective of your stakeholder group is presented in the discussion, and to participate in the decision-making. A rubric for participation is provided.

Today's Question:

Should the sale and transportation of glossy buckthorn (Frangula alnus) be restricted?

Goals of the Meeting

The council's task is to:

1. Provide an explanation of the likely outcome of each of the following scenarios on the Maryland distribution, spread, and total North American range of this species, and
2. Recommend a course of action.

Scenarios

A. No action is taken regarding glossy buckthorn
B. Sale and transport of the plant is banned in both the U.S.A. and Canada
C. Removal efforts are initiated in New Jersey only
D. Sale of the plant is banned in Maryland only
E. Congress provides funding for removal efforts focused on this species in all locations where it occurs in the U.S. for one year

Rules of Discussion

Only the person holding the microphone may speak. (The "microphone" may be a pen.)
Don't speak until you have the microphone.
If you are given the microphone, it is your turn to speak.
If you wish to speak next, raise your hand.
Everyone must speak, and all stakeholder perspectives must be represented.
All speakers must be treated with respect.

Rubric for Mock Council Meeting Participation

Speaking	Information	Presentation
Spoke clearly and concisely. Actively participated in discussion without prompting.	Information presented was factually correct, and logic supporting opinions was presented.	Presentation gave a clear and well-rounded representation of stakeholder perspective.
Participated only when prompted, speaking was difficult to hear and/or overly brief.	At least one factual error, and/or presentation of some opinions without logical justification.	Presented an incomplete representation of stakeholder perspective, and/or strayed off topic.
Did not participate in discussion.	Multiple factual errors, information lacking, and/or opinions presented without logical justification.	Presentation did not represent the stakeholder perspective and/or led the discussion off topic.

5. Policy Proposal and Discussion

Overview	Activity Learning Objectives	Assessment
Students synthesize case study material to make reasoned proposals for policy, education, and self-regulatory actions addressing invasive plant species in the Mid-Atlantic States.	Reflect on what has been learned about the problem system. Propose legislative, educational and/or self-regulatory approaches to invasive plant spread. Justify proposals using logical arguments and evidence, place proposals in the context of current approaches, and evaluate potential effects and drawbacks of proposed actions.	Policy proposal with supporting logic and predicted outcomes Final system maps and narratives reflecting on changes in understanding

Final Products

This summative activity requires students to synthesize what they have learned from the previous activities, to recommend policy actions, and to predict outcomes of their decisions. Students review and compare existing and proposed legislation and legal regulations for invasive plant species, as well as alternative approaches including public education and industry self-regulation.

Using understanding gained from previous activities and their own research, students propose policies addressing legislation and regulation, public education, and/or industry self-regulation. The final product includes a concept map of the problem, a summary of their recommendations supported by logical explanations, and predictions of their proposals' positive effects and drawbacks.

Discussion

Discussion can be structured in multiple ways, including whole-class discussion led by the instructor, small group discussion in which trios of students compare their approaches, and/or by grouping students proposing different policies to discuss differences in their reasoning. All should reflect on decision-making process in the context of uncertainty.

Variation: Policy Presentations

Discussion can be sparked by presentation of policy ideas. The assignment can be varied to have students focus in on specific types of policies in groups; other options include having select students, or students with very different ideas, present.

Extension: Revision and Reflection

The activity can be extended with a reflective revision of the system map and/or proposal. This can be in response to whole-group, small-group, or opposing-view discussions described above, peer review, or instructor feedback.

Activity: Policy Proposal

This assignment brings together perspectives and information on invasive plant species and their regulation that we have worked with. You are expected to make use of the full range of material that we have read and discussed.

Policy Recommendations, Justifications, and Predictions

How should invasive species be regulated in Maryland? Propose actions in one or more of three areas: law and regulation, public education, and industry self-regulation. Your proposals should answer the following:

1. What do you propose? How is it different from the status quo?
2. How are your policies similar to and different from those used elsewhere? Give examples of policies enacted outside Maryland.
3. How do your recommendations address the needs and interests of the stakeholder groups we have discussed and the general public?
4. All proposed ideas must address uncertainty. How will incomplete information be handled?
5. What are the intended positive effects of your proposals?
6. Why do you think your proposals going to work? Justify your recommendations using factual information. If you use a source not provided by your instructor, include a full citation.
7. What negative consequences your proposed actions are likely and/or possible? Consider effects on both social and environmental variables.

Final System Map

Using the understanding of the problem system that you have gained from this case study and your experience, create a system map that shows interactions between the major elements of the system. System boundaries, stakeholders, and ecological and social elements should be included. On a separate page, reflect briefly on how your understanding (and your map) of the system have changed.