

Research Needs for Invasive Plant Management and Ecology

Discussion leader: Dr. Edith Allen, UC Riverside

Notetaker: Heather Schneider, UC Riverside & Cal-IPC Student Chapter

Attendees: Sara Jo Dickens, Chelsea Carey, Ellen Cypher, Erin Degenstein, Claudia Allen, Ginger Bradshaw, Peter Warner, Seta Cherbajian, Kristina Schierenbeck, Christiana Conser, Charles Blair, Jeremiah Mann, Gavin Archbald

A discussion on invasive plant research needs for managers, researchers, and regulators. Cal-IPC recently developed a framework on research needs for invasive plant management and ecology, including regulatory and social issues (www.cal-ipc.or/ip/research/researchneeds.php). However, managers are continually faced with local, site-specific issues for invasive species control and new species are introduced with unknown ecological characteristics. This discussion is an opportunity to help set the invasive species management research agenda for California. We will also discuss finding and developing sources of funding to carry out the research.

An executive summary of the Cal-IPC Research Needs Assessment was distributed to all attendees and discussions were based off of these topics, as well as introduced topics from attendees.

The importance of determining which pathways of entry are facilitating introductions to California

- The USDA Q-37 guidelines address this issue.
- The USA doesn't always do a good job of patrolling what comes into the country as far as biological pollution.
- People are aware of the problems with possible modes of introduction, but there is little work on which sources are the most problematic or how to change it.
- Sources of aquatic invasions are especially important and should be evaluated more quantitatively, aside from the aquarium trade and ballasts, which are known methods of entry.
- Moderator: Is anyone here trying to work on pathways of introduction?
 - No one in the group is working on pathways currently.
 - One problem with studying pathways is that right now, the problem is addressed piecemeal at different levels and by a range of different agencies.
 - There is also a problem of scale. Should we address pathways at the country, state, or local scale? Where is the starting point?
 - The "Leading Edge Program" is another initiative helping with this issue.
 - There is a problem of moving propagules. Even some species native to one part of California become invasive in other areas of the state. *Lupinus arboreus* is one example.
 - Most often, people move propagules.
 - It is also important to consider geographical and cultural pathways. There has not been much work done on this.

- There is a lot of knowledge on this topic, but it isn't always shared appropriately and used to make management plans.
- There is a need for greater information sharing.
- Cleaning up waterways is a good way to address aquatic invasions.
- Illegal dumping of garden debris is a source of introductions. There should be more strict regulation and enforcement of illegal dumping and refuse disposal.
- The interface between social and biological research is a black box that needs to be explored because both play a role in invasion.
- We don't really know how often animals are sources of invasive dispersal.
- There is a paradox of endangered species being invasive elsewhere.
- Climate and geographic matching models evaluate potential spread of invasives. The CLIMEX model is one example of this. However, climates do not always match and there is work going on to study this and help improve models.
- Invasive spread has not become a predictable science.

Genetics

Moderator: What issues should we consider dealing with genetics?

- Kristina Schierenbeck – “because we don't know about so many things, like hybridization of brooms, blackberries, etc., we shouldn't plant anything that has a native congener because we don't know what can hybridize and become invasive. *Spartina anglica* is an example of hybridization and this needs more research and political attention.”
- The nursery industry develops 'sterile' cultivars, but we don't really know how stable they are and the definition of 'sterile' is questionable.
- We still don't understand what makes plants become invasive.

Weed Lists

- This is a major focus of Cal-IPC.
- Weed lists are always incomplete and require constant updates.
- Aquatic weed lists need more attention.
- The Invasive Species Council of California Advisory Committee will make a state weed list. Of course, it will be incomplete and always require updating, but it will be a valuable list.
- Two attendees, Kristina Schierenbeck and Christiana Conser, are both on the advisory committee and are looking for good criteria for weed lists.
- **Attendee:** How do you define a weed?
 - How do you define native and non-native?
 - Plants can be exotic invasives, native invasives, exotic weeds, or native weeds. These words can mean many things.
 - There are a lot of grey areas in classification and nomenclature for weeds.
 - The terminology often depends on the person (ie farmer vs. land manager). For example, *Amsinckia* is a weedy native that ranchers often dislike, but restorationists like it because it can compete with invasives.
 - It is important to make sure that invasive plants are no longer planted for any purpose.

- Attendee: What do the ‘younger’ people in the room find the most interesting in terms of research?
 - Ginger Bradshaw: There is a statistical model for tamarisk habitat, but it’s very hard to determine how, why, and when a plant will invade. How do we know when a model is good enough? It’s important to compare models with data and validate them extensively.
 - Sara Jo Dickens: The effects of exotic invasion on soils and soil microbes as it applies to restoration is an interesting subject. This information will help tell us what needs to be done in regards to soil to ensure effective restoration, if anything. This links into the need for more study on ecosystem effects of invasions.
 - Chelsea Carey: Soil manipulations for restoration is a new area of research for invasive ecology that is interesting. She also worked on mulching versus tilling effects and nitrogen mining with *Rhamnus cathartica* in Chicago. They used corn as a cover crop for 3 years to remove nitrogen and then restore natives. It’s important to manage for self-sustaining habitats.
 - Charles Blair: Effects of nitrogen on serpentine soils. Heather Schneider gave a talk on nitrogen deposition effects and invasives in the desert today.
 - It would be interesting to study the effects of yellow star thistle on soil microbes. This area is understudied, although some *Centaurea* species are thought to be allelopathic.
 - More research is needed on soil invertebrates.
 - Effects of treatment of invasives on soil and ecosystem effects of fire, herbicide, weeding, etc. should be studied.
- One issue with restoration is that people often try to restore with a late successional stage when it is inappropriate for the state of the soil.
- Soil nitrogen does decrease over time, but weeds often come up in the mean time. Mulch and sugar treatments to reduce soil nitrogen can’t be used on a large scale. More research is needed to determine proper courses of action for decreasing soil nitrogen.
- When non-native and invasive species are used for economic purposes, it gives them value and more people will plant them. Are there cases where the benefits outweigh the costs?
- Land managers have to apply general principles from research to specific sites and test them. We need more site and species-specific information.
- Cal-IPC and other organizations should steer us away from biofuels because it is still burning carbon.
 - There is an issue of new vs. old carbon.
 - Are biofuels really carbon neutral because of carbon uptake by plants?
 - We know pumping CO₂ into soil doesn’t work.
 - Onsite biofuel machines could take out existing *Arundo* and harvest the biomass to make biofuel without the need for planting fields of biofuel crops.

- Algal biofuel uses a harvest smokestack of CO₂ that is pumped into the algal lagoon.
- Attendee: If we aren't killing all of the weeds in areas where they are treated, how do we know we're not making the weeds stronger?
 - Treating weeds aboveground is not genetically altering them.
 - Even if all of the weeds aren't killed, treatment decreases the ability to create propagules and giving natives a better chance of survival.
 - Herbicide resistance could become an issue, but there is no resistance to hand-pulling and solarization probably won't select for stronger plants.
- More research on outreaching to kids is becoming increasingly important. More people now live in cities than anywhere else and children are not as connected to nature as they used to be.
- Educating the public about management practices helps keep them informed and supportive of invasive control efforts.
- Social issues should be better studied.
- There is a need to develop more specific, less general knowledge via site-specific studies.

There are many areas that need continued research. The need for collaboration between social and biological research was highlighted, as well as involving the general public in exotic control efforts. Many of the areas touched on in the discussion have been studied to some degree and dissemination of information is important. Soils are an understudied topic in the invasion ecology literature. Invasive plant ecology is a multifaceted, unpredictable science with numerous opportunities for continued research.