Biotic Invasions: Impacts on Natural and Urban Communities and Ecosystems

Impacts of Plant Invasions: Pervasive Examples, Elusive Generality, **JEFFREY M. DIEZ** (Department of Botany and Plant Sciences, University of California, Riverside, Riverside, CA 92521; jeffrey.diez@ucr.edu).

Plant invasions can have impacts on a wide range of ecological processes across levels of organization. Over the last several decades many convincing case studies have demonstrated the potential for non-native invaders to influence native plant species, above- and below-ground food webs, and ecosystem processes. Nonetheless, few generalities of how invasive species impact communities and ecosystems have been derived, complicating efforts at prediction and development of broad management guidelines. Instead, research shows how the impacts of plant invaders can be context-dependent, varying across ecosystems and subject to the particular match between invader and native species. In addition, efforts to quantify impacts are notoriously subject to the same challenges of spatial and temporal scale that permeate ecological research. For example, although experiments have shown that invasive plants can reduce native species' performance, native and non-native species diversity tend to be positively correlated at some spatial scales and few if any native species have become extinct due to plant invaders over observed timeframes. In this talk, I present a review of current efforts to conceptualize and quantify the impacts of plant invasions on communities and ecosystems. I then outline how recent advances in ecological theory and methods may offer new hope for understanding the conditions under which we should expect particular impacts.

Human-mediated Movement of the Bacterium Xylella fastidiosa has Resulted in a Range of Plant Diseases that Affects the Urban, Agricultural, and Native Environment, **LEONARD NUNNEY** (Department of Biology, University of California, Riverside, CA 92521; leonard.nunney@ucr.edu).

The human-mediated movement of live plant material can result in the introduction of pathogens exhibiting very limited dispersal into entirely new geographical regions. The plant pathogen *Xylella fastidiosa* provides examples of just how devastating the results can be. This bacterium infects xylem vessels and causes scorch and dwarfing diseases in many plant species, including many trees. It is native to the Americas, but limited regional movement has resulted in the evolution of distinct geographical subspecies over the last >20,000 years. Using genetic data, we have evidence of human-mediated movement from Central America to North America, from North America to South America, from South America to Central America, and from the Americas to Europe and Asia. Moreover, genetic data suggest that each of these invasions may have been due to a single introduction. In some cases, the results were predictable from plant hosts in the native range, such as the devastating effect of Pierce's disease of grapevines in the US following the introduction *X. fastidiosa* subsp. *fastidiosa* from Central America; but in other cases they were not, such as the current die-off of olive trees in southern Italy due to the South American *X. fastidiosa* subsp. *pauca*. Complicating the story further is evidence that following a new subspecific introduction in the Americas there can be large scale intersubspecific homologous recombination events that create bacteria with chimeric genomes capable of invading novel hosts, as exemplified by the infection of mulberry trees across the US.

Invasive Beetles as Vectors of Invasive Diseases: Threats to Urban and Native Forests, **T. D. PAINE** (Department of Entomology, University of California, Riverside, CA 92521; timothy.paine@ucr.edu).

Movement of wood, wood products, and living plant material with increased global trade has also resulted in the movement of wood-infesting beetles into new environments. Some of these species (e.g., Asian longhorned borer and emerald ash borer) have become very serious threats to native and urban forest systems in North America because of the direct feeding damage to infested trees. Other invasive species have been recognized as serious threats not because of direct damage, but rather because they introduce fungal pathogens into the host tree. The walnut twig beetle is native to the southwestern US and was previously considered innocuous. However, it has recently become associated with a fungal pathogen that is now transmitted between host walnut trees by the beetle. The new association represents a significant threat to native and commercial walnut species. Apparently native to Southeast Asia, the polyphagous shot hole borer is a new invasive insect that is killing host trees in California. It an ambrosia beetle that is associated with at least three different fungal symbionts. The beetle attacks more than 200 tree species, the fungi can colonize more than 100 species, and the insect can reproduce in more than 20 host species, including important agricultural species, urban landscape hosts, and native forest species. The interfaces between these three different environments and corridors of hosts within the environments facilitate movement of the beetles and increase the risks of tree mortality.

Usurpation of Plant - Pollinator Mutualisms by Introduced Ants, **DAVID A. HOLWAY** (Division of Biological Sciences, MC 0116, University of California San Diego, La Jolla, CA 92093; dholway@ucsd.edu).

Ant invasions are a geographically widespread and ecologically disruptive phenomenon. The establishment and spread of introduced ants result in the displacement of native ants, the disruption of dispersal and protection mutualisms, and the erosion of habitat suitability for some vertebrate species. Introduced ants often visit flowers to obtain nectar and could thus also affect plant-pollinator interactions, but surprisingly few experimental studies address the effects of floral visitation by introduced ants. The first part of this presentation will summarize three recently completed studies that each show reductions in seed set for plants experiencing floral visitation by the introduced Argentine ant. These results suggest that negative effects of floral visitation by introduced results are likely more widespread than previously thought. Plant species may vary with respect to their susceptibility to floral visitation by introduced ants. The second part of this presentation will thus synthesize the results of existing studies to draw general conclusions regarding the circumstances under which floral visitation by introduced ants will be most likely to compromise plant reproduction.

Multi-trophic Effects of an Invasive Generalist on Endemic Arthropod Communities, **ERIN W. RANKIN[1]*, DAVID J. FLASPOHLER[2], TADASHI FUKAMI[3], CHRISTIAN GIARDINA[4], JESSIE L. KNOWLTON[2], and DANIEL S. GRUNER[5]** ([1]Department of Entomology, University of California, Riverside,

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Biological invasions, one of the main drivers of global environmental change, disrupt species interactions and can contribute to the collapse of trophic systems. Consequently, there is growing interest in how such trophic cascades drive community and ecosystem processes. While there has been much interest in the effects of individual factors such as fragmentation and introduced predators on ecosystem stability and trophic function, we are interested in assessing the interactive effects as well. In a naturally fragmented Hawaiian forest system, we are investigating the trophic effects of an invasive omnivore (*Rattus rattus*), which links detrital and higher grazer resource pools within endemic communities that evolved in the absence of any functional analog to rats. Thus invasive rats with their broad diet spanning multiple channels may indirectly impact key services within invaded ecosystems, such as decomposition and nutrient cycling. Specifically we (i) assessed how forest fragmentation alters arboreal arthropod food web structure and the vertical distribution of canopy arthropods, and (ii) quantified the predator pressures exerted by native and invasive predators on these arboreal arthropod communities.

Sahara Mustard, Brassica tournefortii: Trophic Impacts on a Desert Sand Dune Community, **CAMERON W. BARROWS** (Center for Conservation Biology, University of California Riverside, Riverside, CA 92521; cbarrows@ucr.edu).

Invasive species are believed to be one of the leading threats to biodiversity, but not all weeds impacts are equal. Informed triage, providing managers decision tools to focus weeds with the greatest negative impacts is critical.

Sahara mustard, *Brassica tournefortii*, was noted in southern California's Coachella Valley in 1927. From that introduction it spread throughout the southwest. Along roadsides, agriculture margins, and areas of high aeolian sediment transport, Sahara mustard can become dominant. In 2005 I established a mustard removal experiment on 15 0.1 ha plots. Those data demonstrated that the mustard inhibits reproductive success in native annual plants; after multiple years the seed bank of the natives can become depleted, increasing dominance of the mustard. The loss of desert wildflowers has financial cost on desert communities whose economies benefit from people coming specifically to see the colorful blooms. Beyond those costs, there is an environmental question: what is the impact of the mustard on other trophic levels? Does a loss in annual plant diversity really matter to primary consumers, detritivores and their predators?

Long-term data have shown that arthropod species richness and abundance have declined on those sites with high and/or increasing mustard densities. Annual plant diversity does matter, due to a loss in seed size diversity and due to a change in the structure of the detritus accumulations, both critical resources to the detritivore-granivore based arthropod community. Current analyses have revealed population growth in arthropod predators, specifically a threatened endemic lizard, is inhibited by mustard dominance as well.