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Impact of invasive species on island ecosystems and strategies for their control: Lessons to share from Hawai'i

Brian Yamamoto (Kaua'i Community College, University of Hawai'i, Hawai'i)

Approximately 5.8 million years ago, the main island of Hawai'i began emerging from the mid-Pacific volcanic hotspot in the earth's crust. This isolated location is more than 4,000 km (2,500 miles) from North America and more than 6,000 km (3,700 miles) from Japan. This geographic position of isolation provided the 1,000 or so original ancestors of the flora and fauna of Hawai'i to develop into more than 10,000 unique native species.

Twenty five percent of the founding species of plants and animals and most of the marine life arrived by ocean currents from other islands or continents. Another portion consisted of unaided flyers (e.g. birds, bats, and insects) that purposely traveled to Hawaii. Wind storms and/or the jet streams brought many of the smaller insects and plants with light seeds. Avian dispersal, especially of plants with heavier seeds that were either ingested by migratory birds or stuck on them, also contributed to these founding species. During this evolutionary period, many plants and animals lost their natural defense mechanisms or ability to migrate easily. They also coevolved and developed unique interdependent strategies for survival, such as, pollinator-plant interactions or unique habitat requirements or food sources.

Around 350 AD the first Polynesian voyagers from the Marquesas Islands colonized Hawai'i. Utilizing double-hulled canoes, this group of ocean navigators established the first human settlement in Hawai'i. These early Hawaiians began changing the natural environment by introducing agriculture to the lowland ecosystem. They also introduced *canoe plants and animals* to the native environment. These *canoe plants and animals* were from other islands and were transported here as food, fiber, and medicine to supplement what was found here.

In 1778, Captain James Cook, an English explorer, *discovered* the Hawaiian Islands and represents the first non-Polynesian arrival to the islands. He and subsequent European explorers would change the landscape by introducing feral animals, such as, goats, pigs and eventually cattle to the islands. These animals were free ranging and had a direct impact on the natural environment. The time of Cook's landing is used to mark the modern introduction of non-native species, sometimes referred to as exotic introductions. Following Cook, other explorers, missionaries that changed the spiritual beliefs of the native people, and agriculturalist growing sugarcane and pineapple came to Hawai'i. With them, they brought new crops, the agriculture industry, and eventually tourism. These endeavors have changed the landscape of Hawai'i and its ecosystem. Also introduced were alien plants and animals from throughout the world. Many of these alien introductions were made with good intentions or by accident; however, several of them have now become invasive species.

Invasive species reproduce quickly, spread rapidly, and alter the environment that is detrimental to the native ecosystem. They are successful in competing with native species for sustenance and habitat; they cause injury to the native environment as they act as diseases or pests; and, they alter habitat so that native species can no longer survive. The continuing problem of invasive species introduction threatens the unique flora and fauna, impacts local agriculture, and can harm human health. In order to address these invasions, the State of Hawai'i developed a comprehensive program focused on prevention, early detection and rapid response, ongoing control of existing pests, and education. We need to adequately fund such programs, acknowledge and fix gaps or shortfalls, and have committed leaders and the public protect our fragile and unique island treasures.