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Restoration and Reclamation in Oceania

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Many examples of restorations and reclamations of vastly different ecosystems can be found throughout the world. There are some universal strategies that apply to all restorations and reclamations. These strategies are then often narrowed and applied to similar ecosystems or to correct problems created by similar disturbances. All of the examples discussed in this introduction can be found in the Oceania regions of the world. Some of the examples of restorations I will introduce use similar techniques, while some others use techniques that are quite unique. There are several examples of different habitat restorations in Australia, one from New Zealand, and one discussing mangrove restorations around the world. The restoration examples can also be grouped by the cause for restoration. In this case, the examples presented are caused by mining disturbance, exotic species invasion, and native habitat restoration.

The mine restoration and reclamation examples are located in Australia. Mine restorations and reclamations are difficult because of the size and extent of the disturbance to the original ecosystem. Before vegetation restoration can take place, the soil and hydrology must be restored. The most common challenge to mining restoration and reclamation is the absence and/or removal of topsoil. This can be overcome by stockpiling the removed topsoil while the area is mined, then spreading the stored soil and its associated organic matter, nutrients, microorganisms, and seeds back onto the disturbed area. This technique is further discussed in the "Restoration Following Bauxite Mining in Western Australia" paper by Paul Hinds. A problem unique to the "Reclamation at the Ranger Uranium Mine, Australia", by Shannon Oslund, is the presence of radioactive waste. One of the biggest concerns is how to dispose of the radioactive tailings that are produced as a result of the mining process. This example also requires preliminary soil and hydrology restoration, as well as remediation treatments, before reclamation can begin. This example is further complicated by the convergence of complex ecosystems in the area of mining disturbance. Many techniques for waste treatment and disposal, such as retention ponds and water filters, as well as monitoring techniques, hydrological restoration, and vegetation reclamation are further discussed by Shannon Oslund.

The two restoration examples caused by the invasion of exotic species are located in Australia and New Zealand. The original ecosystems and animals of the New Zealand coastal islands are very unique but ill-prepared to fend off aggressive introduced competitors, as is common for the delicate balance found on most islands. Introduced predators and plants to the islands have caused drastic reductions in native flora and fauna populations. About 400 species are near extinction. Cindy Fritchman gives examples for each of the three restoration techniques used on these islands in her paper "Restoration of New Zealand Coastal Islands". Michelle Marko discusses techniques to control the invasion of one particular shrub species that threatens agriculture, conservation of wetlands, and land use practices of native cultures in the Northern Territory of Australia in her paper "Controlling Invasion of the Exotic Shrub (*Mimosa pigra*) in Tropical Australian Wetlands". This particularly aggressive invader has successfully competed

for niches that were previously occupied by native species. For example, this invasive shrub is capable of transforming species-rich tropical wetlands, sedgeland, and grasslands into monospecific stands that exclude native birds, lizards, and vegetation.

The restoration examples that focus on restoring native vegetation are very different but display some similarities in goals and techniques. The paper "Restoration of Vegetation and Soil Patterning in Semi-Arid Mulga Lands of Eastern Australia" by Denice Nelson is an example of restoration used to correct a general degradation of the land. This example shows that an understanding of hydrology and soil nutrient cycling, as well as ecosystem dynamics, is essential for a successful restoration. The techniques developed for this restoration were innovative, rather easy to implement, and very successful once research was done to study the landscape and associated unique processes. The restoration techniques discussed in the paper "Seed Ecology: Implications for Restoration of Native Vegetation in Australian Habitats" by Pat Johnson are very similar to those mentioned previously. Restorations discussed in this paper were also started because of general land degradation in an area in southwestern Australia. It is interesting to compare the techniques and successes between the restorations discussed in these two papers. Suzanne Kreder discusses techniques to restore mangrove ecosystems in her paper "Restoration of Mangrove Swamps in Oceania". Mangrove swamps are very important to coastal marine environments and comprise a truly unique and intricate ecosystem. However, due to their location along shorelines, they are often disturbed by human activities. Often, hydrological disturbances and site stressors must be addressed before mangrove trees can be regenerated. A difficulty with the restoration of this particular ecosystem is that mangrove trees are difficult to regenerate. Many interesting new techniques for mangrove regeneration are explored.

Reclamations and restorations are often started to correct symptoms of the original disturbance, such as erosion, declining water quality, and extinction of native species. The examples of restoration and reclamations in the Oceania regions of the world address many original site disturbances. Some of these disturbances are large and potentially dangerous such as bauxite mining, while others are subtle such as introductions of exotic species to islands, while still others are simply correcting damage done by human caused degradation such as restoring native vegetation to an over-used area. The examples provided in the papers discussed previously provide an opportunity to learn about unique ecosystems, as a source of inspiration for new ideas, and to show hope that humans can correct much of the damage humans have caused to our surrounding environment.