Learning from a Landfill: ecological restoration and education at Seattle's Union Bay Natural Area

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Located between the University of Washington's 72,500-seat football stadium, a golf driving range and acres of surface parking lies one of Seattle, Washington's most unique urban ecosystems, the Union Bay Natural Area. At 73.5 acres, the Union Bay Natural Area is Lake Washington's second largest 'natural' ecosystem and one of Seattle's largest public green spaces, a mosaic of forest, scrub-shrub, grassland, and wetlands on a former landfill. The Union Bay Natural Area drains the last reaches of two of Seattle's urban watersheds, Ravenna and Yesler Creeks, both of which flow south into Lake Washington. A trail network links 35 restoration projects that have, among other outcomes, created early-successional forests and converted a gravel parking lot into oak savanna and wetland. Bird watchers commonly gather to view the diversity of shore birds that congregate here throughout the winter, a green island among a densely populated urban landscape. Students, faculty and visitors revere the site as a keystone of local ecological education, outreach and service.

photo courtesy of the College of Forest Resources Alumni Association

To fully appreciate the value of the Union Bay Natural Area (commonly referred to as the UBNA), the site's unique setting and history must be considered: A century ago, the UBNA was a lakeshore emergent marsh where Ravenna, Kincaid and Yesler Creeks met Lake Washington. At the time, what is now the UBNA, like the rest of Lake Washington's historic shoreline, was entirely underwater. Forty-years ago, the mature trees and expansive grasslands present today did not exist, there was only a large landfill receiving maritime debris and Seattle's public waste. Today the UBNA exists within an incredibly dense urban matrix: Seattle has a population density of 7,075 people per square mile and 592,800 total residents (Washington OFM, 2008). Within the UBNA though, the most obvious signs of human activity are orange flags delineating ecological research plots or blue tree tubes where students and volunteers have planted native trees and shrubs. So how did a freshwater wetland transform into landfill and later into the University of Washington's flagship laboratory for the research and teaching of restoration ecology?

Only through a century of degradation and two decades of restoration has the UBNA come to assume its present state as a natural area and outdoor classroom. The site began shifting towards its current state in 1911 after Ravenna Creek's water source was lowered and the creek was diverted to Seattle's sewer system. In 1916 the United States Army Corps of Engineers lowered Lake Washington three meters to match the water levels of Lake Union and the Puget Sound for navigation and commerce. Reclamation of the marshy site for development was not feasible with the technologies of the day, so the newly exposed site was used as a landfill by the city of Seattle from 1925 until 1966. The in filling with trash caused subsidence of a large peat deposit below the marsh, a driving factor in the formation of wetlands now present on the surface of the site.

Following landfill use, the UBNA was capped with clay from a nearby construction site, graded and seeded with European pasture grasses through 1971, formally beginning the UBNA's life as a novel ecosystem. In1972 the University of Washington assumed ownership and management of the UBNA—managing the capped landfill as a natural area would soon prove to be a daunting task. Native riparian deciduous trees, red alder (Alnus rubra) and black cottonwood (Populus trichocarpa) colonized the wet fringes and subsiding depressions of the landfill, however the densely compacted clay soil used to cap the landfill was not conducive to the broad reestablishment of native vegetation. In the absence of native recruitment, invasive species, particularly Himalayan blackberry (Rubus armeniacus) and Scotch broom (Cystisus scoparius), established and thrived until restoration efforts began 20 years later. A 1986 vegetation survey predating restoration found that a majority of the 150 flowering plant species were non-native (Huang 1988). Invasive species have historically inhibited the establishment of native vegetation and continue to be the primary disturbance targeted in ecological restoration activities within the UBNA.

Early in the University's management of the site, it became apparent that ecological restoration would be critical to the site's management as well as an outstanding educational opportunity. Inherently, restoration became a primary tool in reaching management goals for the site: increase and retain native biodiversity, control invasive species, and provide educational and service opportunities to students and the public. In 1990 active ecological restoration began with manual removal of the invasive purple loosestrife (Lythrum salicaria) from Shoveler's Pond, an ephemeral pond on the UBNA's eastern edge

that had been almost entirely invaded. Loosestrife management was not completed until the Washington State Department of Agriculture and the King County Noxious Weed Board employed a biological control, the Gallerucella beetle, a coleopteran genus that feeds on loosestrife within its native range. With the introduction of the beetle, Shoveler's Pond and adjacent wetlands shifted from a loosestrife-dominated state to their current mixture of sedges, rushes and shrubs.

photos courtesy of Justin Howell

Since that first effort to restore Shoveler's Pond, the UBNA has hosted numerous restoration projects creating forest, wetland and grassland ecotypes with a total area of 14.4 acres having been actively restored since 1990. Projects at the UBNA are commonly collaborations between student groups in one of the University of Washington's many restoration ecology courses and faculty within the University of Washington Botanic Gardens. By linking the adaptive management of the UBNA to ecology and design theory, students from across academic disciplines get a firsthand opportunity to apply ecological and restoration concepts as they design, build and install ecological restoration projects. These experiences are seen as 'multiplier' opportunities in which every restoration project on the UBNA is valued not only for its ecological merit, but also for the educational experience offered to students who will then go on to apply their restoration knowledge elsewhere in the world. These experiences build the foundation of the University of Washington's Restoration Ecology Network (UW-REN), a professional certificate in restoration ecology that has been recognized by the journal Science, the University of Washington and the Society for Ecological Restoration International. Thus far, at least 1500 students have participated in restoration ecology coursework at the UBNA through UW-REN or other courses.

Ecological restoration at the UBNA has long-targeted the restoration of autogenic processes that allow for the establishment of native vegetation and the suppression of invasive species. Dr. Kern Ewing, professor of restoration ecology at the University of Washington Botanic Gardens, has researched and taught plant and restoration ecology in the UBNA using this philosophy since the early 1990's. Dr. Ewing and his collaborators have assessed restoration outcomes and used experimental trials to test the efficacy of different regionally common ecological restoration techniques. These techniques include using densely planted willow live-stakes to shade out invasive grasses in wetlands, creating mounds to modify microclimates and establish diverse grassland communities, and using sheet mulch to increase soil moisture around tree plantings. Many of the techniques researched within the UBNA are used throughout the region and are taught in coursework as a result of these experimental trials.

While restoration ecology students and researchers have created a majority of the Union Bay Natural Area's restoration sites, the UBNA is also used as an outdoor classroom for an array of volunteers, visitors and non-restoration students. Tours of the UBNA are often given to build local interest in urban ecology while exposing individuals to the concepts and practice of ecological restoration. During the 2008-09 academic year alone, the UBNA received 593 visitors for guided tours or volunteer work parties, logging 2000 individual hours. Ideally these tours and class field trips build a base of future volunteers who will go on to play a critical role in the maintenance of restoration projects.

The Union Bay Natural Area shares a unique history with the teaching and practice of ecological restoration at the University of Washington. From an in tact ecosystem to a waste repository to an outdoor laboratory, the UBNA has changed dramatically and will undoubtedly continue to do so over time. There are numerous goals for the site: to monitor vegetation communities and assess how succession proceeds within systems, to look at how subsidence alters hydrology across the landscape and to continue adaptively managing existing restoration projects to ensure project success. Most importantly, the UBNA will remain a free and public gateway to ecological restoration for visitors, and continue to train and inspire future generations of restoration ecologists and practitioners.

For more information, including a detailed site history, management plan and bibliography, see the Union Bay Natural Area and Shoreline Management Guidelines, 2009: http://depts.washington.edu/urbhort/html/plants/ubna.html

References:

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