Wetlands occupy <10% of the earth’s surface but provide far more than 10% of the world’s renewable ecosystem services. Wetlands are worth much more than their area predicts!

Robert Costanza, a prominent ecological economist, has just updated his 1997 estimates of the value of global annually renewable ecosystem services, which I described in Leaflet #10. Now, with more research on value and less undeveloped land, what’s left is worth substantially more per hectare! Costanza et al. (2014) now estimate (in 2007 US dollars) that four types of global wetlands provide $125,521 per hectare per year in services that lead to human well-being. That amount is 25x the average for all other biomes. And if we just compare the estimate for inland freshwater wetland ecosystem services ($25,681/ha/yr) with that for cropland ($5,441/ha/yr), the ratio is 4.6x--still much greater for wetlands.

Over time, wetlands have become relatively more important providers of global ecosystem services as other lands have been converted to alternative uses, such as agriculture and urbanization. As land uses changed between 1997 and 2011, global ecosystem services dropped some $4.3 - $20.2 trillion/yr (ibid.).

The Arboretum should take special note of wetland values and services because we have a wealth of wetlands. About a fourth of our ~485 hectares of Arboretum land in Madison collect water in what is a watershed “sink.” And while collecting water, the wetlands help improve water quality, abate flooding, support biodiversity, and store carbon—all of which benefit human well-being.

The nation’s wetlands receive protection under the Clean Water Act, which requires that any materials to be discharged into wetlands must be avoided; if they cannot be avoided, then discharges need to be minimized; and if they cannot be minimized, then impacts must be compensated.

To aid recognition of—and appreciation for—wetlands, this summary focuses on the Arbortum’s diverse wetlands, the diverse services they provide, and the places where you can see them. They may be hidden from your view as you drive or jog through the Arboretum, but most are in plain site once you take a trail a few steps beyond the main road or fire lanes:

Diverse wetlands

Each type of wetland supports some unique plants and animals, although many wetland species are widely distributed, making it difficult to classify individual sites. The Arboretum wetlands represent at least seven historical types, plus novel ecosystems, such as wetlands that are dominated by exotic species or were constructed in ways that do not mimic nature.
The Arboretum also has several novel wetlands that were designed to collect urban runoff; all attract aggressive invasive plants, such as reed canary grass and hybrid cattails. Plans to remove invasive plants and replace them with native species require a long-term commitment to management.

A diversity of types

**Sedge Meadow**
Sedges (genus *Carex*) dominate many wet meadows that have a wet phase in spring followed by water drawdown in summer-fall. Tussocks are often present.

**Wet Prairie**
Tall grasses and forbs characterize this type of wetland, which is a transition from prairie to wet meadows dominated by sedges.

**Marsh**
Persistent shallow water favors emergent vegetation such as native cattails.

**Ponds**
Continuous standing water supports emergent and floating vegetation.

**Fens**
Where groundwater discharges continually, a species-rich wetland develops and peat accumulates.

**Springs and groundwater seeps**
Continuous groundwater discharge is sufficient to create a creek.

**Bog**
In northern areas that support acid-producing mosses, unique bog species occur and peat accumulates.
Diverse services

Among wetland ecosystem services is their ability to convert harmful nitrate to harmless nitrogen gas. To sustain such values, wetlands have some protection from filling and pollutant discharges under the Clean Water Act.

Diverse and important services provided by inland wetlands:

**Biodiversity support**
- Wildlife: Birds, mammals, amphibians
- Vegetation: Vascular plants, moss, algae, fungi
- Microorganisms: Denitrifying bacteria, methanotrophs (which consume methane) and thousands more

**Water quality improvement**
- Denitrification: Conversion of nitrate to harmless nitrogen gas
- Methanotrophy: Oxidation of the potent greenhouse gas, methane
- Sediment accumulation: Burial of phosphorus and other potential pollutants

**Flood abatement**
- Retention of flood waters
- Delayed flood peaks

**Carbon storage**
- Peat formation: Long-term burial of organic carbon
- Tussock formation: Aboveground storage of organic carbon

**Shoreline stabilization**
- Protecting beaches from waves and storms

Combining wetland diversity and ecosystem services

The Arboretum aims to conserve and restore its wetlands for their biodiversity and ecosystem services. To achieve multiple objectives, we test alternative approaches in an adaptive restoration framework: learning while restoring. For example, sedge meadow vegetation is being restored at Teal Pond Wetland while testing the need to enhance microtopographic variability and to add diverse seed mixes while establishing the matrix dominant, tussock sedge (see Leaflet #33);

Ambitious field experiments show the value of using several approaches just in case the results differ in relation to annual variations in weather. In Doherty’s (2013) experiment, plantings in peat-pots thrived in a dry year (2012) by capturing and retaining more rainfall; mounded plantings thrived in a wet year by keeping plantings from becoming waterlogged and stressed (as occurred in depressions).

Sedge meadow vegetation is being restored at Teal Pond Wetland; Simultaneously, we are testing new approaches in an adaptive restoration framework: learning while restoring.
Where can I see Arboretum wetlands?

Where can I see marshes? Cattails are extensive in Gardner Marsh, behind the trees and shrubs along Arboretum Drive. The boardwalk near the Mills St. entrance provides an access system. Willows, giant reed, and buckthorn are also visible along the edges. This wetland was once a diverse sedge meadow (Leaflets 6, 11), but it converted to cattails following water level stabilization by dams and berms. Also along the lake, Wingra Marsh has remnants of native vegetation but no easy access. The rim of McKenna Pond supports cattails and bur reed, although area changes with variable water levels.

Where can I see springs and seeps? The big spring at the base of Wingra Woods is the most impressive and easy to see. At Ho-Nee-Um Pond (Leaflet 25), two small springs arise near the path and converge to flow into the pond. The smaller spring has a “boil” where the sand swirls in response to groundwater discharge.

Where can I see wet prairie? Curtis Prairie appears to support remnant wet prairie as well as plantings (Curtis 1951). It has several patches of Canada bluejoint and prairie cordgrass. Wet areas are highly visible now that willows have been removed along the east fire lane. Willow control also has a long history; a 1949 map shows where 2-4D was applied (ibid.). Outside Madison, Faville Prairie is a natural remnant of wet prairie; it varies in composition along a gradient from the Crawfish River edge to sedge meadow to wet prairie to a shrubby transition to upland.

Where can I see sedge meadows? Tussock sedge (Leaflets 2, 22) is easy to see in east-central Curtis Prairie, especially along Coyote Pond, near the east fire lane. Also, a corner of Southeast Marsh, parts of Wingra Marsh, and Greene Prairie support tussock sedge. Hub City Bog and Faville Prairie (Leaflet 14) have remnant sedge meadows.

Where can I see ponds? Most accessible is Teal Pond, which has a dock over the water. Others are Coyote Pond in Curtis Prairie, Ho-Nee-Um Pond off Monroe St., and McKenna Pond near Cross Plains.

Where can I see a fen? Our best remnant fen is at Ho-Nee-Um Pond along Monroe Street and Alder Drive (Leaflet 25). Wingra Fen and South Shore Fen (Leaflet 17), which were sampled by Curtis (1959; Vegetation of Wisconsin), are now degraded and dominated by invasive plants.

Where can I see a bog? Bogs are northern ecosystems; our only example is the recently-acquired Annan Bog, adjacent to Finnerud Forest (Leaflet 18). Although called a bog, Hub City Bog is a mixture of sedge meadow and invasive species.

Where can I see riparian wetlands? Anderson Bottomlands along the Wisconsin River is a remnant riparian woodland.

Where can I see novel wetlands? Most of our wetlands are novel in some way, but the most un-natural are the constructed stormwater ponds, e.g., Pond 2 and swales (Leaflet 27) and Pond 4 near the railroad track, and various low-lying lands that receive excess urban runoff (Leaflets 24, 26) and support mostly invasive plants, e.g., 3.6 hectares of reed canary grass in Greene Prairie (Leaflets 1, 5).

References:


This leaflet was compiled by Joy Zedler with artistic layout by Sarah Friedrich and leaflet logo by Kandis Elliot. Leaflets can be downloaded free from http://uwarboretum.org/research - see publications menu.