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| <ul style="list-style-type: none"> Bike Route Wheelchair Accessible Boardwalk Council Ring Parking | <p>Community types</p> <ul style="list-style-type: none"> Horticulture Coniferous forest Deciduous forest Savanna Prairie Wetlands Open water Buffer zone |
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Water flows downhill, of course, and so does the main trail through the “world’s oldest ecologically-restored prairie.” This guide describes the path that water takes as it flows from an urban watershed of some 144 acres, where rainfall that cannot soak into the ground runs off rooftops, sidewalks and driveways--and collects in gutters that flow downhill toward Curtis Prairie. When the water approaches the Beltline Highway, it goes through a large culvert and into a broken, concrete flume, which carries the water and the contaminants it has gathered into a stormwater retention pond, called Curtis Pond. From there, the water flows onto the prairie through metal and concrete structures, along an eroded creek, and across a sedge meadow, exiting through the eastern culvert (Map A).

Our purpose in inviting visitors to walk this path is to explain how urban runoff sustains wetland vegetation but also brings in contaminants; we also explain how the wetland improves water quality by absorbing, denaturing and removing contaminants. This reciprocal relationship complicates the Arboretum’s need to follow rules about managing both runoff and prairie vegetation.

Prior to urbanization, none of the watershed had streets, sidewalks, or roofs (“hardscaping”), as rain and melting snow infiltrated into the soil well upstream of Curtis Prairie. There was no pond and no creek in Curtis Prairie. As runoff increased in quantity and decreased in quality, however, UW responded by excavating “Curtis Pond” in ~1979. Now, the Department of Natural Resources requires that UW “maintain” the pond. It is unclear how best to do so. How can the Arboretum reap the benefit of stormwater (which sustains wetlands in Curtis Prairie) while avoiding its hazards (unwanted contaminants)? Arboretum conservationists hope to minimize the use of engineered structures and maximize environmentally-friendly approaches.

1 Park at the Curtis Prairie lot and bring the beautiful Prairie Plants book, which describes ~230 plants that live in Arboretum prairies. The book is available at the Visitor Center. The map in this leaflet shows locations of posts.



2 Walk across the road to the “Curtis Prairie rock” (post C1) and then turn left and take the fire lane east until you see the intersection (post B4) with a north-south fire lane. Turn right toward the Beltline on the fire lane. Note the topography—you are heading downhill to the lowest point along the fire lane, where you see a large box culvert pipe and water exiting Curtis Pond. The box culvert was installed in 2010 after an earlier culvert washed out.

✿ The prairie’s 144-acre urban watershed discharges more water today than when it was rural. Urban runoff is highly “pulsed” because of extensive hardscaping.

3 Continue south upslope toward the Beltline until you see Curtis Pond just inside a berm to the west. The pond was created by excavating sediments from the prairie. The goal was to collect incoming sediments from stormwater, which it did. Within 2-3 years, the new sediments had to be removed.

✿ The sediments were not trucked off-site but were piled in a long mound southeast of the pond. Weeds established, and reed canary grass (*Phalaris arundinacea*) crowded out native plants. Reed canary grass is Wisconsin’s worst wetland weed, a distinction it earned by dominating ~500,000 acres of historical wetlands. Invasion by weeds is a typical unintended negative impact of construction projects (Leaflet 23).

✿ As you view the pond, make note of any birds or signs of wildlife. Stormwater ponds do not attract many native species. Limnologists at UW

call constructed impoundments “magnets for invasive species”, including tiny aquatic animals.

✿ Stormwater regulators are asking UW to re-dredge Curtis Pond to ~7.5 feet, because it no longer has the capacity to accept sediments that might accompany future storms. Conservationists at the Arboretum hope for minimum disturbance because (1) every construction project has unintended negative impacts (see Leaflet 23); (2) valuable nutrient-removal functions are provided by the shallow water and the small cattail marsh that formed where runoff enters the pond; (3) disturbance invites weeds to invade; and (4) the proposed modifications emphasize water control, not facilitation of processes that are critical to Curtis Prairie.

✿ Stormwater has altered Curtis Prairie by expanding wetland habitat. Now that the prairie has a large wetland, it is neither necessary nor beneficial to eliminate urban runoff. It is, however, a high priority to continue weed control using approaches that conserve ecosystem services.

✿ In water sampling during 2011, we found higher concentrations of nutrients in the water entering Curtis Pond than in its outflow.

4 Keep walking south along the chain-link fence that protects visitors from falling onto the remains of a concrete flume designed to carry runoff into Curtis Pond. When tree and shrub leaves are dense, the damaged flume is hard to see. The flooding of 1996 broke up the concrete, eroded the channel, and created a gully in, around, and under the concrete.

✿ Arboretum conservationists would like the flume to be replaced with a buried pipe, with native vegetation planted over the pipe and with minimal damage to the marsh at the south end of Curtis Pond.

✿ Cattails in shallow water have underground stems and roots that leak oxygen into the soil, creating ideal conditions for “denitrifying” bacteria to convert harmful nitrates to harmless nitrogen gas (air). Cattail marshes are extremely effective at nitrogen removal, an ecosystem service that protects downstream wetlands and waters.

✿ Most stormwater treatment facilities are designed for sediment and phosphorus removal; this makes sense when the resource to be protected is a lake where adding phosphorus will cause algae to proliferate. But Curtis Pond is 1.4 miles upstream from Lake Wingra and the needs of wetlands between the Beltline and Lake Wingra should have priority for protection. If nitrogen is not removed by Curtis Pond, more weeds can be expected downstream. A priority for Curtis Pond should be to maintain its ability to remove nitrogen.

5 Make a U-turn and walk north again. Note that the berm supports native plants and a few persistent weeds, such as leafy spurge. Conservationists would make the pond edge more uneven, more able to remove nitrogen, and more friendly to wildlife, with minimal impact and low risk of further weedy invasions. Perhaps you have more ideas to share!

6 A side trip along a short loop trail (post B7) around the “limestone prairie” offers a great view of Curtis Prairie toward the east. The land slopes gently toward the center, with wetland where the topography is flatter. Over centuries, sediments moved downslope, accumulating until the ground became level and water slowed its flow and spread more broadly. The resulting habitat favors wetland plants, which are highly productive, create microtopographic depressions, and trap inflowing water.

✿ There is a positive feedback, with water facilitating wetland vegetation that acts as a sponge for water.

7 At post B5, take the trail east, downslope and parallel to Curtis Creek, which formed after stormwater was trapped by the pond and its outflow was restricted to a “point source discharge.” Forcing the surface flow into a culvert allowed the water to erode a creek that now extends half way through Curtis Prairie.

8 Walk east on the trail and take a side trip to the left at post B2. You can cross Curtis Creek on the boardwalk and look west to view the 2000-sq-yard area that became dominated by reed canary grass in response to stormwater ponding. Just why stormwater ponds there is a matter of debate, but scientists hypothesize that excess water carrying road salts washed fine soil particles through the surface soil and deposited a thin layer of clay at about 2.5 feet depth. That clay layer impounds runoff.

✿ Invasion by reed canary grass is an unintended negative impact of excess water inflows. Confining stormwater to a point-source discharge also created a creek with bare banks where this weedy grass could establish and spread.

✿ This same area supported important research on a control method for reed canary grass. In a 3-year study, a herbicide temporarily stunted but did not kill the invader. However, the stunting did allow several native species seeded by researchers to establish and spread. Continued spot herbiciding

will contain the reed canary grass, an effort that is less damaging than structures such as a graded, bermed channel.

9 While standing on the boardwalk, look to the east for evidence of herbivory on reed canary grass. If you see a patch of stubble, see if the grass stems have been cut at a 45° angle. This is the “signature” of rabbits. Wouldn't it be great if native herbivores would help us control an invasive weed!

10 Return to the main trail and proceed downstream (east) to two more boardwalk bridges. Note that Curtis Creek splits into two forks. A map of reed canary grass shows that the infestation is limited to the edges of the forks, offering encouragement that selective herbiciding could control this plant. A graded channel, in contrast, would only create more habitat for weeds.



11 Continuing along the trail, you walk through a mixture of prairie grasses and forbs until you approach a stand of sandbar willows (*Salix exigua*). Just before you reach the willows, the trail comes very close to the wetland, where our native Canada bluejoint grass (*Calamagrostis canadensis*) occurs just south of the trail.

✿ Our research shows that nutrient-rich wetlands are dominated by just a few species, and we are working to determine why this is the case. Possibilities are that a few species are “superplants” that outcompete others, or that only a few seeds of native plants reach the site, or that herbivores or plant diseases attack native seedlings.

12 Just north of the trail is a monitoring station where temperature and carbon dioxide data help us track carbon storage in the soil. The restored prairie is storing carbon but it has not yet caught up to the wetter prairie remnant to the east. The eastern part of Curtis Prairie was never plowed, and its soil stores carbon as undecomposed organic matter. In contrast, the rest of the prairie was plowed, which exposed soil organic matter to the air, where it was easily oxidized to carbon dioxide (a greenhouse gas).

✿ An important benefit of stormwater inflow is the increased area of wet soil and Curtis Prairie's increased capacity to store carbon.

As you walk next to the willows, note that there is little vegetation under them. The willows produce dense shade, excluding grasses and forbs. The lack of grass "fuel" in the understory explains why control burns do not carry well. As a result, willows have expanded substantially over the past decade, and our field staff needs to use herbicides to control them.

✿ Woody invaders reduce grass cover, and grass cover reduces the ability of fire to control woody invasions in a negative feedback relationship.

13 Cross the fire lane at post A6 and continue walking east at A5 through the unplowed portion of Curtis Prairie. It is a true privilege to experience a remnant prairie of such high quality.

✿ The most species-rich vegetation in all of Curtis Prairie occurs in this unplowed remnant.



14 Turn right (south) when you reach the easternmost fire lane of Curtis Prairie. Note the wet soil west of the fire lane. The raised fire lane impounds water that would otherwise flow east. Willows grow well in standing water. To the east, you also see cattails (*Typha latifolia*), Canada bluejoint and tussock sedge (*Carex stricta*).

✿ Native cattail allows native plants to co-exist, by being less dense than invasive hybrid cattails. In this spot, it is likely that denitrification combats eutrophication, so that cattails do not outgrow other species.

15 Just before the fire lane curves eastward, you encounter a culvert, where stormwater exits Curtis Prairie. Compare the size of this small culvert to the large box culvert upstream. Water that rushes out of Curtis Pond is greatly modified both in quantity and quality by its trip through the prairie. Some water infiltrates, some evaporates, and some is taken up by plants. Some of the nutrients are taken up by plants, and some nitrogen is returned to the air as harmless nitrogen gas.

✿ The nutrient content of flowing water at this point is low compared to that upstream. Curtis Prairie cleans stormwater effectively, and any construction projects that would alter this ecosystem service should undergo strong, science-based evaluation.

16 If you continue south (toward post A8), you will find a path leading to the Stormwater Management Research Facility discussed in Leaflet #23.

17 Alternatively, make a U-turn and walk from post A7 to F1 to F2 toward Teal Pond (F3), a natural pond that receives inflows of water from the entire Curtis Prairie watershed.

✿ Along your walk, you have seen where urban runoff sustains wetland vegetation, and where water samples show that the resulting wetland improves water quality. The potential mechanisms for "improvement" include absorbing, denaturing and removing contaminants; these mechanisms are yet to be determined.

Although it is difficult to manage both the runoff and the prairie, Arboretum conservationists aim (1) to accommodate existing urban runoff so that the wetlands can continue to improve the quality of through-flowing water and (2) to manage Curtis Pond so that it can remove nitrogen and make it easier to control reed canary grass.



References to research can be found at uwarboretum.org (see menu for "Scientific Papers").

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