Gardening with Glaciers

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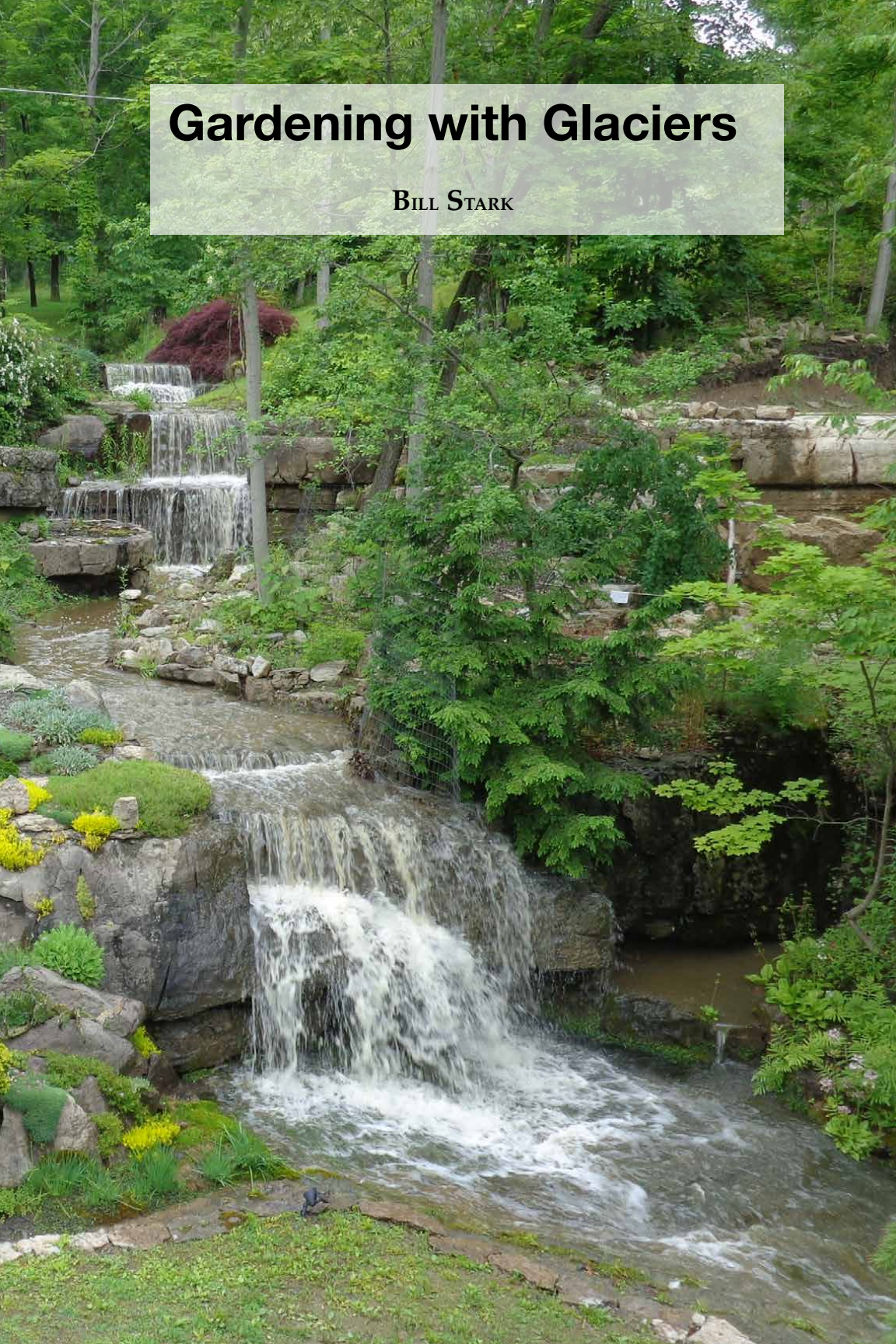

MARY AND I garden on the edge of a glacier-cut canyon that's over a thousand feet (300 m) deep. Over the thousands of years since the last glacier retreated from upstate New York, the canyon has filled with sediment and a trillion gallons of water to form Cayuga Lake. Ithaca and Cornell University, at the Southern end of the lake, will be the site of the 2020 NARGS Annual General Meeting and we will be on the garden tour. This article describes our gardens and some of the challenges we've faced creating them. Streams flow the 1,500 foot (457 m) length of the property and a variety of gardens are built on either side of the main stream. I'll describe the gardens in the same order as the water flows.

At the steeply sloped top of our property, streams have eroded 75 foot (23 m) deep ravines in the second-growth forest. There are traces of old logging roads and the remains of barbed wire deeply embedded in the trees. We've recently cut dirt roads and woodland paths through this difficult-to-access area and built an overlook over the north ravine. Downhill is an abandoned red pine plantation which is our best area for growing rhododendrons and mountain laurels. Further downhill, the north creek flows past a bamboo grove that we're trying to get under control and then falls into the upper pond. The waterfall outlet of the pond feeds a series of waterfalls with a total drop of 18 feet (5.5 m).

Previous pages: Waterfalls dropping over carefully exposed rock.
Above: Mary cleaning out a crevice created by a glacier.

Bill helping the excavator slide a limestone block with his come-along

Most of the bedrock and stone that you see in the photo on the previous two pages was originally buried under 10 feet (3 m) of clay. The clay has been removed after 20 years of digging and used to build berms and hills that enhance the natural ravine and our hill and pond stroll garden

The waterfalls flow over 375-million-year-old, Devonian-era Tully limestone that was torn apart by the glaciers, leaving a nine-foot (2.7 m) high top cliff, a flat mid-level shelf of bedrock where we've built our largest rock gardens and a five-foot (1.5 m) high bottom cliff. Stone ramparts on the top cliff are reminiscent of medieval fortifications and allow visitors to safely walk along the edge of the cliff and look down on the gardens. The ramparts project was the first time we engaged in extensive quarrying. (See DIY Quarrying at the end of this article.)

The hard limestone is divided by horizontal seams of a soft clay/shale material and by deep vertical fissures that were formed 250 million years ago when Africa collided with the North American tectonic plate and the Appalachian Mountains were formed. As a result of these weak planes, the glaciers easily broke off thousands of blocks of limestone which we've used to build rock gardens, rustic walls, and sculptures. We haven't built classical rock outcroppings in the disordered debris field left by the glaciers. Instead, our stonework looks like it's been disturbed by either nature or man. We highlight unusual water-eroded rocks and look for inspiration in the archeological sites that we've visited. As you walk through the gardens, you may recognize an area styled after a Pictish hill fort in Scotland, a Neolithic tomb built out of 12 foot (3.6 m) slabs, or vertical stones from a stone circle or standing door lentils in the ruins of an ancient village. All the stone in the gardens was found on site with the exception of the tufa, most of which came from Ilion, New York.

The last glacier arranged nine-foot (2.7 m) high limestone blocks on the mid-level bedrock shelf to form a passageway that we call The Canyon. The entrance of the canyon is shown below. We're enhancing and lengthening The Canyon to 160 feet (49 m) by placing about 60

Entrance to The Canyon, which has been enlarged by careful rock placement.

Ilex crenata 'Sky Pencil' planted at the edge of a crevice garden.

tons of limestone (so far). All the stone to the right of the small tufa wall in the photo was placed by us while rocks to the left were placed by the glacier. The soft horizontal seams on the left side have been eroded into wide cracks where we tried to grow plants for years. Frosts and rain would erode the soil and the plants would fall or dry out so we made planting pockets by mortaring one and a half-inch (3.8 cm) high stones to the bottom of the cracks to retain a small amount of soil. Roots can then grow many feet into the horizontal seam material. These high pockets are the one place where campanulas are safe from our woodchucks.

We had originally planned to build stairs to connect the different levels of the Tully limestone, but as we uncovered the mid-level bedrock, we discovered that the glacier had sheared the edge of the lower cliff into the start of a ramp. So we built a zig-zag path with a crevice garden at the lower end and the entry gate at the top. Ramps are better for wheelbarrows and they're a better architectural solution here. They created a dynamic passage where tall accent plants and stonework define foreground, midground, and background planes that are constantly shifting, hiding, and revealing as you twist through the space. That's why we took the unusual step of planting a tall *Ilex crenata* 'Sky Pencil' at the end of a crevice garden filled with small rock garden plants.

Three vertical steel pipes are set at ground level between stones in the crevice garden. Posts can be inserted into the pipes to stabilize a gardener working there. On the other side of the path across from the crevice garden is a tall assemblage of two highly eroded limestone blocks that a visitor christened "Dragonstone." We planted a Kabschia saxifrage cutting in a pocket of the bottom stone in rock garden soil. It's been healthy for 3 years now, perhaps because it's in the rain shadow of the top stone. Close by, the hardy banana, *Musa basjoo*, has multiplied to 20 plants, thanks to the moisture from an adjacent spring. Visitors are often surprised to see bananas growing 80 miles (130 m) from the Canadian border, but Cayuga Lake, 48°F (8.8°C) spring water, and our massive bedrock creates a favorable microclimate where winter and summer extremes are muted.

Returning to following the water, the north creek then flows from the Tully limestone onto the Moscow shale. Artesian springs at the base of the limestone flow year-round at 48°F (8.8°C) so the subsequent waterfalls never freeze in the winter. The creek flows past Pride Rock, at 39,000 pounds (17690 kg), one of the largest rocks that we've moved. The tip of Pride Rock is splattered with tar that melted off the roof of a cottage that burned down in the 1950s. We're building our new house over the old foundation. A crack in Pride Rock is planted with *Daphne* x *medfordensis* 'Lawrence Crocker', one of the first of many daphnes planted throughout the garden.

A water-eroded limestone slab.

Plantings on top of Pride Rock, including a blooming *Daphne* x *medfordensis* 'Lawrence Crocker'

Moisture-loving plants thrive in the ravine garden.

A seating area under a wisteria-covered arbor.

After cutting through five feet (1.5 m) of the soft shale, the creek enters the kitchen pond where we've planted a *Laburnum* x *watereri* 'Vossii' on its west bank. Golden chain trees are problematical in upstate New York, but we're hoping that our microclimate will protect it. Leaving the kitchen pond, the creek goes over another waterfall and enters the ravine garden.

The ravine garden is a moist shady area where candelabra primroses and *Ligularia japonica* grow like weeds. Gravity powered water pipes from the kitchen pond feed artificial springs and a fountain which then flows into rills and small ponds so that we can grow more moisture-loving plants. We've been experimenting with what will grow in the shale walls of the ravine. Above the water, a stunted *Acer palmatum* var. *dissectum* 'Waterfall' is growing horizontally out of a crack in the eastern vertical shale wall bedrock. On the west side, we cleared off the top of the shale and planted a rock garden which has done surprisingly well in pure bedrock.

The creek then flows into the large lower pond. A rocky peninsula planted with a Japanese maple and a string of small islets suggests a Japanese landscape. A small dock and seating area are at the far end of the pond. The lower pond, ravine garden, and kitchen pond were conceived as a hill and pond stroll garden. Encircling paths provide dramatic views of the ravine waterworks, Cayuga Lake and the plantings. Scattered along the garden paths are lightweight troughs based on the tough synthetic stucco wall technology used in many commercial buildings.

A lightweight, yet very strong, stucco trough,

The stucco trough in the photo above is two feet by three feet (0.6 x 0.9 m) and weighs 19 pounds (8.6 kg) when empty. It's lightweight because the walls are formed with insulation foam. It's strong because the walls are wrapped with fiberglass mesh and then coated with fiber-reinforced surface bonding cement. To save further weight, the interior of the trough is filled like a crevice garden with one-inch (2.54 cm) sections of a lightweight soil mix separated with two-inch (5 cm) thick vertical foam panels. Tufa in each of the three levels has been drilled for plants and for drip irrigation lines, with the emitters hidden in the base. We've been building and refining stucco troughs for 15 years and we've never had one break. We think it's time to share this knowledge, so I'll give a five-minute demo on building stucco troughs towards the end of the garden tour. Mary will give a one-minute demo of splitting a limestone boulder with feather wedges. We'll be under the pop-up tent.

Mary and I are looking forward to welcoming our NARGS visitors in June. Our garden has many level changes and stairs, so please wear sensible shoes or boots. The house and garden are still under construction and heavy equipment may be present during your visit. Be careful of the cliffs, uneven ground, loose gravel and deep fissures in the bedrock.

DIY Quarrying

The glacier buried a 20-foot (6 m) long and nine-foot (2.7) high, 125,000-pound (57 metric ton) rock where we had to build our driveway. Our contractor suggested breaking it up with jackhammers. Instead, we moved the top four feet (1.2m) to the entry garden, the middle three feet (0.9 m) was used to build 72 feet (22 m) of ramparts wall, and pieces of the bottom two feet (0.6 m) were used throughout the property. Here's how we did it.

The top: I spent three days on my knees digging out material from a half-inch (1.3 cm) wide seam that was four feet (1.2 m) down from the top, and then slid a three-inch (7.6 cm) flat water hose into the crack. Pressurizing the hose to 90 psi with air generated nearly 100,000 pounds (45 metric tons) of force and lifted the 50,000 pound (22 metric ton) top about one and a half inches (3.8 cm). The hose only burst once! Using wood spacers, I incrementally lifted the top until I could slide hydraulic jacks and then rollers in the seam. Pulling the top with an excavator turned into an expensive nightmare of broken equipment and endless jacking. After a near miss by a snapping chain, Mary started calling the egg-shaped top "Bill's white whale." We finally hauled the top 32 feet (9.75 m) to our entry garden where it's now half of the house's and garden's entry gate.

The middle: Using an SDS Max hammer drill, I drilled one inch (2.5 cm) holes 16 inches (40 cm) deep every 12 inches (30 cm) and filled them with expanding demolition grout (from Amazon). In about 24 hours, the expanding grout cracked the stone 37 inches (94 cm) vertically down to a weak seam. The crack then went sideways, forming 20-inch (51 cm) wide and 37-inch (94 cm) high flat-bottomed blocks that were perfect for building the rampart walls along the top cliff.

The bottom: That left a 20 foot (6 m) long by 20 inch (50 cm) thick pancake of limestone that I cracked vertically with expanding grout and horizontally with feather wedges. Feather wedges are ancient and easy to use devices for cracking rocks. I drilled five-eighths inch (1.6 cm) holes four inches (10 cm) deep every six inches (15 cm) along the intended break line, inserted the feather wedges into the holes and then lightly tapped them with a hammer in sequence until the rock split. The serious limitation of feather wedges is that they can only reliably split a rock that is up to four to six times their length.