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1986

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## ABOUT THE BARD COLLEGE CENTER

The Bard College Center, described by the Rockefeller Foundation's Report of the Commission on the Humanities as "a model of mobilizing the resources of the college and the community," was established in 1978 as the College's "public arm." Through workshops, national conferences, small group seminars, lecture series, summer institutes, publications, and exhibitions at the Edith C. Blum Art Institute, the Bard Center explores timely issues in the sciences, arts, humanities, and education—to the benefit of the Bard community, the Hudson Valley region, and educators and policy makers nationwide. The Institute for Writing and Thinking, part of the Bard Center, is recognized as one of the leading institutes for the instruction and methodology of writing. The Center's varied efforts are complemented by the work of Bard Center Fellows, distinguished artists, scientists, scholars, and writers appointed annually to serve as a "public faculty," who also teach Bard undergraduates.

# Mills & Minnows

## A WALK DOWN THE SAW KILL



BARD

Self-guided Nature Trail by Erik Kiviat  
Hudsonia Ltd., Bard College  
Annandale-on-Hudson, NY 12504

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Before you begin this tour, please be aware that *poison-ivy* is very common along the trails, and indeed is generally abundant on these and other similar disturbed clayey soils in sunny and partly sunny sites near the Hudson River. Recognize poison-ivy, which here rambles on the ground and over stumps and walls and climbs high in trees, by its clusters of three glossy leaflets each usually with 1 - 3 irregular large teeth, its aerial rootlets that look like hairs along the vines, and in fall and winter its 4 mm waxy whitish berries. These fruits, inedible for us, are eaten by several birds, most notably woodpeckers. At Bard, poison-ivy in heavily trafficked locations is controlled by cutting the vines at the base or by spraying herbicides on a plant-by-plant basis. It would be impractical and also damaging to the environment to attempt to control all the poison-ivy here. If you are allergic to poison-ivy (or if you are not sure how sensitive you are), stay on the middle of the trails and out of the foliage.

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Illustrations by Kathy Schmidt

Cover: Yellow iris with marsh marigold below

This trail guide contains information about the Saw Kill at Bard College, its geology, animals and plants, its history and its role in the modern college community. The text is designed to follow the route of the roads and trails leading from the Bard Water Plant, down the north bank of the stream to its mouth, over to the Bard Field Station, and back up the Field Station Road past the Sewage Plant to Blithewood Road. During this tour, you will read about mills, minnows, mud, mallards, marshes and many other things.



*Red maple leaves and fruits*

Start at the Bard College Water Plant, a gray cinder block building 150 meters south of Blithewood Road and 300 m west of Annandale Road. The Water Plant is reached by a dirt road leaving Blithewood Road to the south at a right angle (you will return up the Field Station Road which is the next dirt road going obliquely downhill). You may park across Blithewood Road in the parking area indicated; please do not block access to the Water Plant or the Field Station Road.

Proceed to the right and downhill on a dirt road through a young forest containing red and white oaks, red maple, white pine, white ash, hemlock, and other trees. A few trees are notably larger than the others (more about big trees later). When you reach the creek, you will see a small gray building—the pump house—on the left. Turn right and continue to follow the dirt road to the abandoned swimming pool. The road passes a waterfall about 4 m high and the plunge pool it has eroded into the creek bed. Bedrock at Bard

comprises alternating layers of hard blocky sandstone and weak flaky shale. Here a thick bed of the more resistant sandstone underlies the waterfall. On the opposite bank, small sandstone and shale cliffs support a natural rock garden with evergreen hemlock trees and abundant common polypody fern.

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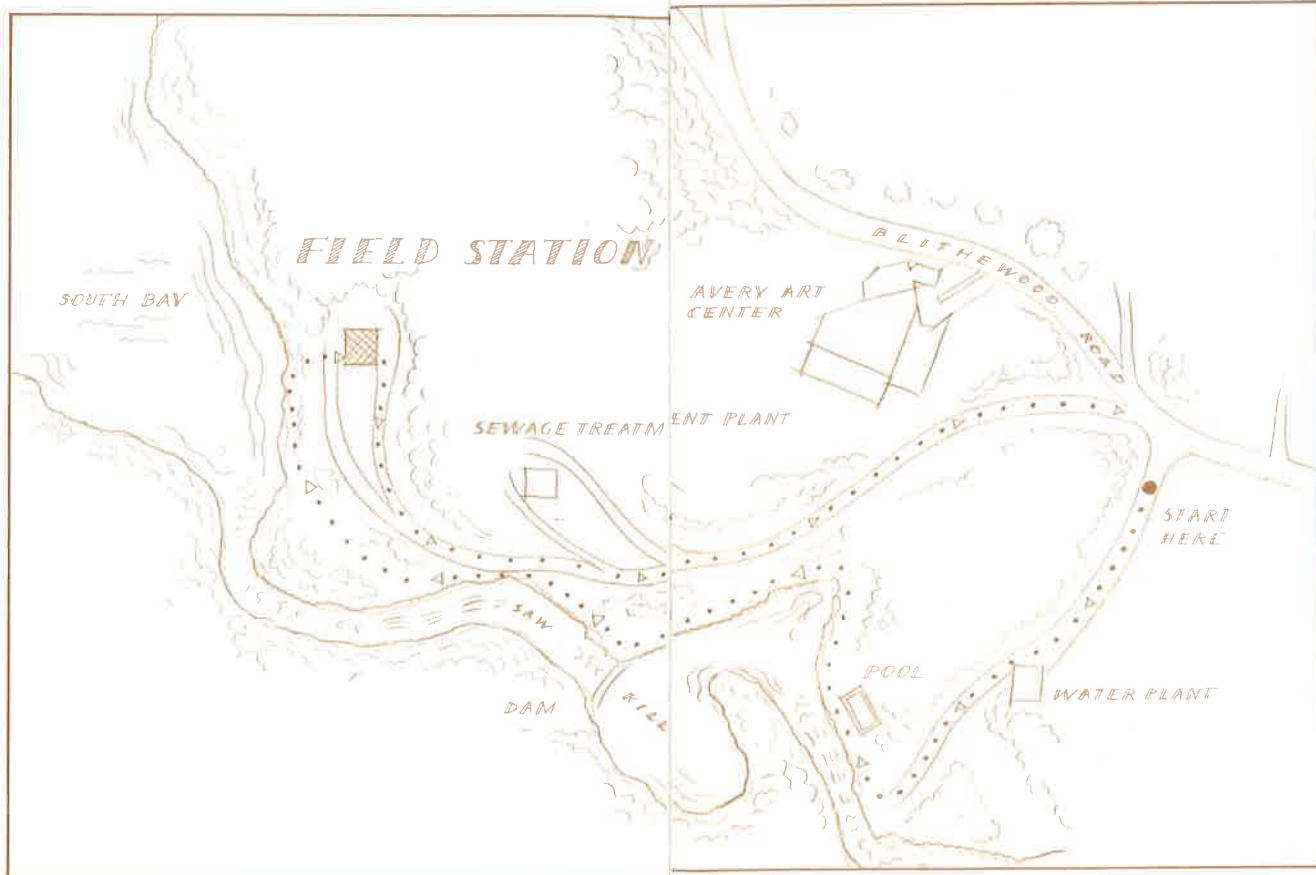
Bard's water supply is drawn from the Saw Kill at a pump station south of the Water Plant. Up to 130,000 gallons per day are treated in the Water Plant for virtually all water use in the college community. Treat-

ment consists of mixing alum (aluminum sulfate) with the water to flocculate silt, filtering the silt from the water, and chlorinating the clarified water to sterilize it. The filters are washed periodically and the wash water is returned to the creek after passing through a settling basin to remove silt.

The quality of Saw Kill water at the plant intake is good. The water is hard (i.e., contains abundant calcium, magnesium, and iron) which causes a white deposit to accumulate in cooking utensils. Hard water, however, is considered healthy for the cardiovascular system.

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Map by Mirko Gabler





*Purple loosestrife with  
American goldfinch*

At the foot of the plunge pool, there are usually several large logs and other plant materials and junk aggregated into "debris dams." Such accumulations of woody debris are a crucial part of the stream ecosystem, and play an important role in stream chemistry as well as providing habitat for aquatic insects, fish, and other organisms. You may see brown foam churned up by the falls and gathered against rocks and logs in the water. Although it is not possible to be sure without chemical analysis, this foam is probably the natural product of the decay of plant matter in the stream and is not necessarily a result of pollution.

Here the road narrows to a path. The trail has been shored up with logs on the downhill side, and farther along you will cross small footbridges. This trail is used by Bard's cross country running team as well as for nature study and enjoyment. The creek begins to widen where it is ponded by a dam. Where the trail detours northward around a backwater of the creek, notice the 2 m tall purple loosestrife with its spikes of showy flowers, growing amid various swamp shrubs including spicebush, alder, silky dogwood and elderberry. There are a few scattered clumps of the tall yellow iris in this general reach of the stream; it is a European plant that apparently escaped from cultivation on Cruger Island many years ago. You will pass under several tall Norway spruces with their short, stiff leaves and drooping branchlets, another introduced European plant. Native conifer trees along the trail are hemlock and white pine.

The first footbridge crosses a rivulet carrying the overflow from the water plant settling basin mentioned earlier. The swampy backwater has been largely filled with reintroduced silt from the water plant since the late 1960s.

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The old Bard swimming pool on the other side of the road has not been used since about 1971. Its deep end contains a small artificial but unintentional marsh, the result of a stopped drain and rainwater flooding the hay that was used to insulate the pool when it was drained for the last time. The paint inside the pool contains a mercury compound to inhibit the growth of algae on the inside of the pool. Nonetheless, many kinds of plants (cattail, purple loosestrife) and animals that become trapped in the concrete basin (painted turtles, green frogs) or visit the pool (green-backed heron, flying insects) are able to survive at least a while there.

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*Snapping turtle*

As you approach a 1 m diameter white pine (on the right side of the trail) with many dead lower branches and a carpet of needles beneath, pause to look back across the pond to the upper waterfall.

Soon you will see a concrete dam across the creek—this is the barrier that ponded the waters almost up to the old swimming pool. While there was presumably a dam at this site for many decades, it was most recently rebuilt in the present century to provide water through the big pipe on the south bank to turn a small electrical power plant at Montgomery Place south of the creek. This power plant was abandoned during the severe drought of the mid-1960s. In the 1970s, Bard considered renovating this plant to generate electricity for the college, but the machinery was no longer useable.

The millpond provides habitat for a variety of aquatic organisms that use relatively still waters rather than the more swiftly flowing waters above and below the pond. From the dam, at the right seasons, you may see waterweed and water-celery under the water just above the dam, as well as fish, a dense floating carpet of duckweeds and water-chestnut in the southern backwater, largemouth bass, bluegill sunfish and redbfin pickerel, an occasional snapping turtle, and two kinds of large aquatic snails, a round one and a conical one. During the first warm sunny days of spring, I have counted 75 or more painted turtles basking on the logs among the duckweed in the southern backwater. In a 1936 state government biological survey of the

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At various times through post-European history, there were milldams at about a dozen locations on the Saw Kill—not all of them at Bard! Like most Mid-Hudson tributaries, dams were built wherever there was enough head (drop in streambed elevation) to power sawmills, gristmills and textile mills. At the turn of the present century, a water-powered chocolate factory was still operating on the creek just below Annandale. The ruins of this mill were used as the foundation of an interesting Bard faculty home.

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lower Hudson watershed, an introduced mid-western sunfish, the warmouth, was collected from the Saw Kill; the warmouth survived in this pond at least as recently as the early 1970s. (A New York State fishing license is required to fish in the Saw Kill.)



*Mourning cloak*

The dam is a nice place from which to sit and watch. In the spring you can see swallows in flight dipping at the surface of the water. One day I accidentally discovered a ruby-throated hummingbird visiting its nest on a low branch of a white ash over the dam. I have also seen belted kingfishers and spotted sandpipers foraging for small fish and insects, respectively. The rush of water over the dam makes a soothing sound. In late summer and early fall the flow is often reduced to a trickle. Once during this low flow period, I discovered a large number of web-spinning caddisfly larvae on top of the dam where their funnel-shaped webs were collecting bits of edible material from the sheet of gently flowing water.

In spring or summer you might see a water snake along the creek, grayish or brownish colored or occasionally with a striking reddish diamond-like pattern, sunning on a log or the bank. Water snakes are fish eaters and have a very weak venom in their saliva. They are harmless to humans, however, and are not normally considered "poisonous," although they will bite if handled or stepped on. There are apparently no truly poisonous snakes at Bard College, Montgomery Place, or the Tivoli Bays Unique Area, although copperheads occur within several miles of the college north and south, in very rocky or sandy areas. If you see

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It is characteristic of smaller streams in the Northeast that seasonal high flows average 10 - 20 times greater than seasonal low flows, with an even greater range from extreme flood to extreme drought. We must therefore be cautious about depending upon small streams for water supply or water power, as our needs may be greatest when the streams can supply the least. The organisms that live in the streams are adapted to this seasonal (and random) variation in flow and water level. Many aquatic plants, for example, flower at the water surface during the summer when the water is lower and the current less forceful and thus less potentially damaging to these delicate plant parts.

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a water snake (or one of the other species that occurs here—garter snake, milk snake, brown snake, ringneck snake or black racer) please do not injure or kill it.



*Winter stonefly*

**B**elow the dam there is another swift reach. The fast, rocky stretches of the stream support fishes such as the cutlips minnow, an indicator of good water quality, and a diversity of aquatic insects

including species of mayflies and stoneflies.

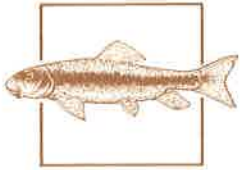
On certain days in late winter you might be lucky enough to encounter a "hatch" of winter stoneflies, when these 2 cm long, blackish, winged insects emerge from the stream to crawl slowly about on the snow and dead leaves of the banks, then deposit their eggs again in the water.

Continue along the trail to where it merges with the dirt Field Station Road, walk a short distance farther, then turn left over the small masonry bridge that spans a small dry channel, at this point well above the actual creek level. I find it sad that the stone railings of this bridge have been torn apart during the last fifteen years by people whose best use for a rock is as something to throw into the water! This channel was apparently cut for a wooden sluice that carried water from the millpond to the earliest Saw Kill mill near the mouth of the creek. We know from news accounts that a sawmill was operating here in the mid-1700s. (Please don't clamber up and down the ravine wall in this area; much treading erosion of the shale beds has occurred recently, and this damages both the bank and the creek itself.)

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**Bard's Sewage Treatment Plant outfall pipe enters the creek here, just above the larger, lower waterfall, where the treated sewage effluent is maximally aerated by the turbulence of the waterfall. You will see the plant itself inside its cyclone fence when you return up the Field Station Road. Treatment is by the activated sludge process, in which a culture of microorganisms (bacteria, protozoa, fungi) degrades the organic matter of the sewage under controlled conditions. A properly functioning sewage plant smells musty, something like rotting hay or a compost pile. The effluent is chlorinated before entering the creek, which kills most microorganisms. About 50,000 gallons per day of treated sewage is released when college is in session.**

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*White sucker*

The lower waterfall, with an overall drop of nearly 10 m, is one of the most exciting natural features of the Bard campus. Here, over 8,000 years or so since the recession of the last

glaciers, the creek has cut down through clay and rock to create the modern ravine. If you listen carefully to the sound of the water, you may distinguish both a high hissing sound and a low rumbling sound indicative of the erosive power of the rushing water. The great majority of the erosion and transportation of soil and rock by streams occurs during the highest flows - the periods of snowmelt and heavy rainstorms. In counterpoint to the sound of water in spring you can hear the loud ringing song of the Louisiana waterthrush, a warbler that hunts for insects along the water's edge and builds its nest under an exposed tree root not far above the creek. As you proceed to the often cool, humid mouth of the Saw Kill, you might hear the very high pitched, very long rollicking song of a winter wren, a tiny brown bird that forages and nests among fallen timber in cool, moist forests.

The foot of the falls is a barrier that marks the highest ascent of fishes that swim upstream to spawn. When the ice is melting at winter's end you might be lucky enough to find smelt here. In April, there are many white suckers, and an occasional northern hog sucker, a much rarer fish in the Hudson. May sees large numbers of alewives here; these fish are netted in creek mouths up and down the river to make the local variety of pickled herring. A real rarity in the Hudson Valley is the American brook lamprey, a small eel-like fish that has been collected only once in this region—in the mouth of the Saw Kill. One other fish, the very common American eel, can

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Across the creek are the Montgomery Place North and South Woods, part of a historic estate, Montgomery Place, restored and operated by Sleepy Hollow Restorations. These hemlock - sugar maple - oak forests have not been cut in 200-300 years and are now as well developed (in species composition and size of trees) as any forest in Dutchess County. The anomalous scarcity of large standing dead and down trees is explained by the reported collection of dead wood for fuel and esthetic reasons until a few decades ago. On the Bard side of the creek, cattle and/or sheep were probably pastured, while selected ornamental trees were planted or allowed to grow spontaneously. The huge trees along the lower portions of the Field Station Road and here and there elsewhere in the Bard forest have survived from the estate period, but many of these are now losing branches or dying.

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actually slither up the falls to colonize the creek and ponds upstream; but eels are here to grow up and return to spawn in the Atlantic Ocean east of the Caribbean Sea.



*Water-chestnut*

Continue down the foot-path overlooking the ravine. On the right is a vast bed of a small, rambling ground cover called periwinkle or "myrtle", spread from ornamental plantings many years ago. In spring, and to a lesser extent through the rest of the growing season, periwinkle produces 3 cm wide blue or whitish flowers with five petals, each petal obliquely "cut" at the tip like a miniature windmill blade. In May, the abundance of periwinkle flowers here is astounding.

Bear right through the periwinkle to the loop at the end of the Field Station Road, and head northward toward the building. Go left on the old dirt road down to the canoe landing at the edge of South Bay. You will be standing at sea level on the shoreline of the Hudson River estuary. An estuary is a transition zone between fresh non-tidal waters and the ocean. On the left is the mouth of the Saw Kill, a rocky and gravelly cove rich in a variety of birds, fish, and their invertebrate food organisms such as scuds, crayfish, and snails. Larger fish such as white perch, striped bass, and largemouth bass swim into this cove at high tide to feed on invertebrates and small fish, such as the killifish you will probably see if you examine the shallows in warm weather. Diving ducks also move in with the tide to catch similar prey. Out on the bay at appropriate seasons you may see great blue herons (especially common in late summer and

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South Bay and its companion North Bay (north of the Cruger Island Road) are the Tivoli Bays, one of four sites in the Hudson River National Estuarine Sanctuary/Research Reserve. South Bay is shallow water with some mudflats exposed at low tide. From June to September, South Bay is covered with a dense mat of European water-chestnut. Water-chestnut has small diamond-shaped floating leaves in 30 cm diameter rosettes, long trailing stems, and a 4 cm wide, four-pronged nutshell anchoring the plant in the mud. The old shells drift on shore where they are objects of great curiosity (and pain, if you step on them barefoot!). Not to be confused with the unrelated Chinese water-chestnut, this plant was brought to the Hudson watershed a century ago. It covers all the sheltered shallows from Albany to Bear Mountain. Because it is nearly impossible to move a boat through a dense water-chestnut bed, or fish in it, the plant is widely regarded as a serious pest. There are many fish and many fish-food organisms associated with water-chestnut beds, however, and I suspect that it is good habitat for fish but not for fishers; water-chestnut's ecological role in the Hudson has not been well studied.

In addition to the water-chestnut in South Bay, in summer and early fall you can see wild-rice (the tall grass in the inner cove), arrowheads with their showy white flowers, dotted smartweed, and in mid-bay, round patches of pickerelweed and bulrush gradually invading the mudflats. Some day, South Bay will probably become a cattail marsh like North Bay, but how soon is anyone's guess because of the vagaries of sediment deposition, erosion by storms and ice, disturbance by fish and humans, and other factors. The railroad, built on fill in 1850, separates South Bay from the river's main channel except for 3 small openings. This barrier has retained much of the sediment deposited by the river tides and the Saw Kill, speeding the transition from open water to marsh.

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early fall), all manner of ducks and geese (including Canada goose, black duck, mallard, wood duck, common merganser, common goldeneye and bufflehead), three species of gulls (herring, ring-necked, and great black-backed), and an occasional double-crested cormorant. Osprey, which have made a comeback since DDT was banned but are still listed as a threatened species in New York, perch on large limbs near the Saw Kill mouth and dive for alewives and goldfish.



*Osprey*

**G**o back up the landing road, and walk over to the Field Station. This laboratory facility is shared by Bard College, the Hudson River National Estuarine Sanctuary/Research

Reserve, and Hudsonia Ltd. People from these and other organizations use the Field Station to conduct ecological research and interpret scientific information to the public. As well, the Field Station houses undergraduate courses in ecology and field biology, and the proposed Master of Science in Environmental Studies program.

Inside the building are educational exhibits treating the ecology and history of the area, and interpreting research in progress. Please view these but remember that the people working in the building are likely to be busy - do not distract them unnecessarily. A schedule of Field Station open-house days is available. If you have seen anything unusual or rare here, leave a message at the Field Station with your name and phone number.

A selection of trees has been labeled near the building and on your return route up the Field

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You may see the eastern front of the Catskill Mountains beyond the South Bay, the railroad, the main river, and the low hills of the far shore. Although air quality here is generally quite good, during warm weather a layer of moist and somewhat polluted air often hangs over the river and reduces visibility considerably. This is a lovely spot to see the sunset (don't stare directly at the sun under any weather conditions; the ultraviolet light can damage your eyes). Hudson River sunsets, storms, and the mountains inspired many dramatic paintings by artists of the renowned "Hudson River School."

The vertical tide range is 1.2 m here, but the water is strictly fresh. Fresh-tidal reaches of rivers are extensive on the mid-Atlantic Coast where riverbeds below sea level permit the tide wave to propagate upriver, but ample freshwater runoff evenly distributed through the year keeps ocean salinity from intruding too far. Most of the extensive fresh-tidal wetlands are in rapidly urbanizing or industrializing areas, and research on these ecosystems began in earnest little more than a decade ago.

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Station Road. Many of these are native species, a few introduced, but remember that many of the larger individuals were planted or cared for during the last century.



*Pennsylvania sedge*

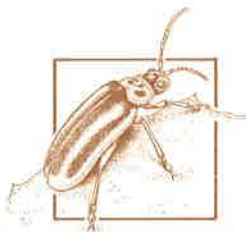
When you leave the area of the building and return to the larger road loop, walk 65 paces up the northern, higher side of the road loop. Find a 25 cm dia-

meter sugar maple with a large vehicle scar on the left side of the road. On both sides of this tree are small outcrops of bedrock which illustrate the interbedded gray shale and gray sandstone that underlies the glacial deposits of the Bard area and most of northwestern Dutchess County. These rocks were formed some 450 million years ago during the Middle Ordovician period. There is sandstone to either side of the tree, with shale between (some of the shale is hidden by leaf litter and soil). The sandstone is hard and blocky-looking, and if you examine it carefully you can make out the individual sand grains with the naked eye. The shale is soft and flakes into small flat pieces, and its component clay particles are microscopic. Here the beds are tilted at a steep angle from the horizontal due to folding that occurred during ancient mountain-building episodes. The points, islands, waterfalls, and other emergent features of the Bard landscape are generally underlain by the sandstone which is more resistant to erosion than the shale; the shale underlies many of the topographic lows and recesses.

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The building was built in 1972 and expanded in 1986. It occupies an old building site that was discernible by topography and vegetation, perhaps associated with the old mill at the creek mouth. If you are interested in the weedy but colorful and interesting plants of roadside and disturbed soil, prowl around the outside of the Field Station. In September 1986 I noted red clover, pigweed, smartweeds, barnyard grass, foxtail grass, common ragweed, three-seeded mercury, bladder campion, dock, poke, plantains, galingale, white lychnis, purple loosestrife, vervain, cinquefoil, moth mullein, Queen Anne's lace, garlic-mustard, goldenrods, white snakeroot, white aster, black nightshade, butter-and-eggs, burdock, and seedlings of tree-of-heaven and smooth sumac. Most of these are introduced species, primarily from Europe. There are a great many introduced plants that thrive in disturbed habitats of this type, unlike the native species that make up the vast majority of the flora of shady woods and wetlands.

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*Waterlily leaf beetle*

The Field Station Road will lead you back to your starting point at Blithewood Road. You have seen a special part of the college property, a glimpse of the Tivoli Bays natural

area, and Bard's environmental science laboratory. Please come back. I hope that your actions will contribute to the best care of this beautiful area. Recognition of the importance of this portion of the east bank of the Hudson River has resulted in the designation of federal and state historic districts, a State Scenic Area, the Tivoli Bays Unique Area/ Wildlife Management Area (part of the National Estuarine Sanctuary/Research Reserve), a Tivoli Bays - Bard College Field Station Experimental Ecological Reserve, and a county Significant Area. Much research and conservation work remains to be done to provide the basis for sound environmental planning, so that future generations of Bard people and visitors can use and enjoy the creek.

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Please don't throw this booklet away! You may keep it, give it to a friend, or drop it off at the Field Station.

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Through the entire area of the lower Saw Kill (below the 50 m or 150 ft contour, or west of Annandale Rd), there are heavy clay soils formed on silty clays deposited in "Lake Albany" when the channel of the Hudson was dammed by ice and rock debris during the melting of the last glaciers. These soils are impermeable to runoff, slippery when wet and hard when dry, and occasionally unstable on the steep slopes of the bluffs along South Bay and in tributary ravines. Much slumping and sliding has occurred here, especially where the vegetation or leaf litter has been damaged by human activities. The old (and once again popular) custom of clearing vistas ("viewways") from the river mansions through the vegetation on the bluffs must be done with great care to reduce the likelihood of serious soil erosion.

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