RINHewS

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The President's Corner

by Richard W. Enser

This column eventually addresses data needs, but at the onset permit me a brief indulgence.

During the past twenty plus years I have been fortunate to be employed in the pursuit of natural history. The Rhode Island Natural Heritage Program, housed in the Department of Environmental Management, was established in 1978. Chris Raithel and I were hired as the biological staff charged with researching and documenting the state's rarest elements of biodiversity. Our positions afforded us the opportunity of not only verifying historical populations of rare species, but also of using the acquired knowledge to develop search images for locating additional populations. We both readily admit that it was a great job. Our combined experiences include lifting a board to find an Eastern Worm Snake; documenting the state's first nesting of Great Blue Heron; finding new locations for Wood Turtle, Spadefoot Toad, and Spring Salamander; confirming the first nesting of Prothonotary Warbler in New England; rediscovering nesting Northern Parula in the Great Swamp; documenting the first Rhode Island record of Long's Bulrush; finding the only Eastern population of American Burying Beetle; and documenting the Saltmarsh Tiger Beetle, and a whole lot more. We have also had the privilege of being guided in our efforts by such notables as Richard Champlin, Irene Stuckey, Richard Ferren, and too many more to have all their names included here.

Rhode Island has a rich tradition in natural history. The contributions of all the state's natural historians can be exemplified by a discovery made this past year by botanist Frances Underwood. From his workplace in East Providence, Frances often looked across the Seekonk River and wondered what special plants might be harbored in the Spartina fringe marsh below Swan Point Cemetery. He decided to investigate and found the diminutive plant *Lilaeopsis chinensis*, thought to be extirpated from the state, and previously known only from a casual remark in a 1903 article on the "Old-time Flora of Providence" by W. W. Bailey. The population, numbering thousands of individual plants, is testimony to the ability of some species to survive in what is generally considered to be a polluted environment; and its rediscovery exemplifies the tenacity of Rhode Island's biologists, both amateur and professional, in seeking out such finds.

But congratulating the accomplishments of Rhode Island's natural historians is not the sole purpose of this column. First, consider the biological diversity documented by their efforts. Then, ponder how much of the "iceberg" of knowledge still remains unknown. Collectively, we have derived some fairly accurate lists of the state's biota including, for some groups, atlases depicting statewide distributions. But in spite of these efforts a large number of invertebrate animal and nonvascular plant groups have received little attention. Moreover, even for the groups we assume to understand, there is little information concerning how species interact, the ecological processes inherent to the communities within which they live, and how these systems are impacted by human endeavors. Such data would provide the scientific community a greater ability to respond to specific problems and to help contribute solutions.

For example, passage of the "Open Space 2000" bond referendum and new opportunities

continued on p. 9

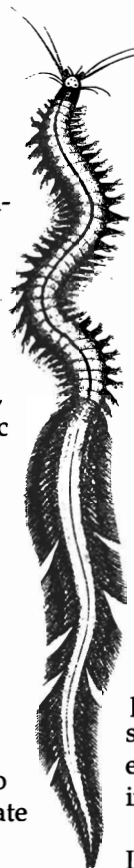
What's Inside?

Research Reports

The Biotic Communities of Sandy Beaches

by Howard S. Ginsberg and Jacqueline M. Steinback

The beach is a special place for many of us. On nice days, we may lie in the sun, enjoying the calming surf and watching the shorebirds tirelessly search for food. Some of us may even find the energy to dig for crabs with our children or search for small treasures cast ashore with the tides. In severe weather, we look on with awe as the surf pounds the coastline, glad that we can eventually seek shelter from nature's fury. However, even frequent beachgoers can overlook much of the action right beneath their feet. It's easy to miss the diverse community of sand-colored insects, spiders, and small crustaceans seeking shelter inside carefully crafted burrows, among blades of beachgrass, and within dead seaweed and carrion deposited by storm and spring tides. Finding information on these often nocturnal, small critters is not easy, for even the scientific literature on the dynamics of such communities is relatively sparse.



Due to their cryptic nature, sandy beach invertebrates were largely neglected by biologists until the 1930s (McLachlan 1983). Pioneer researchers quickly discovered that this ephemeral environment, with constantly shifting sand and no live intertidal plants, could support only highly mobile, opportunistic species. Thus, community interactions on sandy beaches were much more difficult to study than on rocky shores, where the substrate is more permanent. On rocky shores, large, visible organisms such as barnacles, mussels, and seaweeds can anchor themselves to the substrate, and communities are established with clear zonation based on duration of exposure. Some of the classic studies in ecology [e.g, Paine's (1966) work on the role of top predators, Connell's (1961) studies of competition for space] were possible because of the two-dimensional nature of rocky shorelines. On sandy beaches, ecologists are still struggling with ways to study biological interactions in a three-dimensional habitat that enables both horizontal and vertical partitioning (Defeo et al 1997).

Despite the hurricanes and nor'easters, the salt spray, temperature fluctuations, and threat of predation, beach invertebrates have evolved ways to exist under extreme conditions. A recent study of beach invertebrates on Fire Island, New York (Steinback 1999) found 217 species of invertebrates, about half of which were residents that could successfully spend their lives on the beach. The other half had wide habitat ranges that could encompass the beach. In addition, another 55 species were considered transients that had apparently been blown onto the beach by the wind or washed in with the tides.

The beach residents have adapted to their harsh environment in a number of ways: some live in the dune grass and move down onto the beach to forage, others live in moist burrows beneath the surface of the sand, some move up and down the beach with the tides, while others live primarily in the swash zone. This results in a zonation of critters on the beach, with insects, spiders, and other species with terrestrial affinities near the high tide line, and with amphipods, crabs, polychaete worms, and other species with marine affinities near the swash zone. Compared to the rocky shore, however, this is a very loose zonation, with many species having broad distributions that change with the tides and at different points in their life cycles.

The bulk of sandy beach invertebrates depend (either directly or indirectly) on wrack debris for survival. Wrack is a combination of plant and animal debris washed in by waves and deposited near the high tide line. On temperate beaches, the macrofloral component consists largely of eel grass (*Zostera marina*), saltmarsh cordgrass (*Spartina alterniflora*), and rockweeds (*Fucus* spp. and *Ascophyllum nodosum*). Driftwood, carrion from fish and crabs, and a multitude of microbes are also present. These decaying materials provide a rich source of nutrients, as well as a moist and protected environment, that is ideal for many of the beach invertebrates.

The most abundant species in the wrack on Fire Island is the beach hopper, *Talorchestia longicornis*. Unlike many of its marine cousins, these semi-terrestrial amphipods can venture high up on the beach and must live above water. However, to prevent desiccation, these crustaceans frequent moist clumps of wrack and maintain damp burrows. This species feeds on wrack material, so it plays a role in releasing nutrients from wrack to the beach community, and can serve as a food item for predatory species. A common species with terrestrial affinities is the tenebrionid beetle, *Phaleria testacea*. Adults of this species are found from the dune grass to the wrack line, while larvae are often found in the intertidal. This species is associated with decaying organic matter, including rotting wrack, and is often found buried in the sand near food sources. A wolf spider, *Arctosa littoralis*, patrols the upper beach at

night foraging for prey. This species will attack amphipods, flies, and beetles in the wrack during its nightly active period, but dwells in damp burrows beneath the sand surface or in damp seaweed during daylight hours. The silk-lined burrows offer protection from the severe surface environment, and it is here that these spiders fertilize and tend their eggs.

The natural history of these creatures is fascinating, and a great deal remains to be learned about how they survive in the beach environment. Perhaps more fundamental, though, is the question of how the beach community is structured, and how it fluctuates with changes in the surface substrate. Knowledge of the natural dynamics of this community is crucial to an understanding of how perturbations, such as off-road vehicle traffic, beach nourishment projects, or oil spills, affect the beach community. Such questions have further implications for conservation because these beach invertebrates provide the food base for many of the more familiar beach organisms, including rare species such as Piping Plovers and Beach Tiger Beetles. After the North Cape oil spill off southern Rhode Island, there were many attempts to assess the effects of this accident on the beach biota. Without solid baseline data, including quantitative knowledge of the natural variability of the beach fauna, this assessment was necessarily difficult and indirect. Therefore, basic study of the natural dynamics of this community, which is interesting in its own right, provides information that is essential if we wish to monitor and preserve the natural community of the shoreline.

We are currently engaged in a project at the Cape Cod National Seashore that is designed to answer some of these fundamental questions. The Fire Island data suggest that environmental factors such as elevation on the beach, composition of beach wrack, size of wrack clumps, and age of wrack, influence the invertebrate communities that dwell there. The Cape Cod study is using a combined observational and experimental approach to assess the effects of these various factors on the structure of the wrack community, and to develop methods to monitor the response of this community to artificial disturbance.

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Cobble Beach Plant Communities in Narragansett Bay

by John F. Bruno

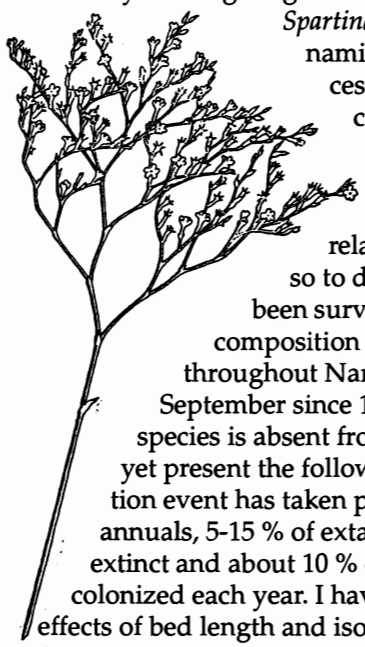
If you walk for more than a few hundred yards along the beach in Narragansett Bay you are likely to come to a bed of the common marsh grass, *Spartina alterniflora*. If the bed is long enough, you might also notice a dense aggregation of halophytic forbs (salt-loving, non-woody plants) such as *Suaeda linearis, Limonium carolinianum,* and *Salicornia virginica,* forming a band just behind the landward border of *Spartina*. I call this intertidal habitat the cobble beach plant community and have spent the last four years untangling its basic ecology. Despite being ubiquitous, when I started to work in this community it had not even been described. My first goal was to determine why cobble beach plants are only found behind *Spartina* beds. I performed a series of manipulative seed addition and adult transplantation experiments at Brown University's Haffenreffer Reserve in Bristol, RI, and on Prudence Island in the Narragansett Bay National Estuarine Research Reserve. My results indicate that *Spartina* facilitates (i.e., benefits or assists) the establishment of forb communities by reducing flow velocity and stabilizing the cobble substrate. This habitat modification reduces the burial of seeds and seedlings of other species that are unable to emerge and survive on portions of the shoreline not bordered by a *Spartina* bed. The tall, flexible grass shoots of *Spartina* and the peat base beneath (which can extend 10-200 cm above the substrate) act synergistically to reduce levels of physical disturbance within a narrow band behind the bed.

Because the dozen or so cobble beach forbs cannot form populations between beds, *Spartina* essentially creates habitat islands or patches that represent low-stress environments. However, most beds remain unoccupied and the frequency of occupancy by one or more species is strongly related to bed length, as small beds are much less likely to be

occupied than longer beds. For example, within Narragansett Bay, there is an occupancy rate of 87% for beds > 40 m, while only 13% of beds < 25 m are occupied. Field experiments have demonstrated that small beds are not inhabited because they do not ameliorate the environment enough to allow seedlings to emerge.

Another striking pattern in this system is that the longest beds are occupied by more species than medium-sized beds. Additionally, common cobble beach forbs such as *Salicornia europaea* and *Suaeda linearis* can inhabit beds longer than 25 meters, while less common species are generally only found behind beds > 75 meters. This so-called nested distributional pattern is almost universal in both terrestrial and aquatic habitats. However, very few experimental investigations have been performed to explain the factors driving nested species distributions. It is usually assumed that species that are rare on a landscape scale are poor dispersers or competitors, or are more susceptible to local population extinctions. Last year I performed a series of field experiments to test these and other explanations of rarity in the cobble beach plant system. I found that some species including *Salicornia bigelovii, Spergularia marina,* and *Atriplex arenaria* require a greater degree of habitat modification. The microhabitat required by these habitat specialists appears to be generated by the deposition of fine grain particles behind the center of the longest *Spartina* beds. Consequently, bed length is causally related to the distribution of forb populations along the shore and to forb species richness and composition.

More recently I have been working on the metapopulation dynamics of cobble beach plants. I am currently investigating how characteristics of *Spartina* beds affect dynamic population processes, including colonization and extinction. Such population transition events occur relatively infrequently, so to detect them I have been surveying the species composition of 350 beds scattered throughout Narragansett Bay each September since 1997. If a given species is absent from a bed one year, yet present the following year, a colonization event has taken place. For common annuals, 5-15 % of extant populations go extinct and about 10 % of vacant beds are colonized each year. I have quantified strong effects of bed length and isolation (the distance to the nearest neighboring population) on population colonization and extinction. Preliminary data indicate that beds that are far from a potential seed source are much less likely to be colonized than an empty bed in close proximity to an inhabited bed.



This and other recent investigations have highlighted the importance of positive interactions among species living in stressful environments. The cobble beach plant community, like many other benthic marine habitats including kelp forests, sea grass beds, and coral reefs, is dependent on the presence of habitat-forming or "foundation" species. The type and number of associated species that can live in these communities depends largely on characteristics of the foundation species (e.g. their size, age, or density). Identifying the mechanisms of facilitation in biologically generated habitats allows us to understand and protect them.

For more information:

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***John Bruno**, who received his PhD from Brown University this year, is currently doing a post doc at Cornell University, studying coral disease epidemics; he will join the faculty in the Department of Marine Sciences at the University of North Carolina in Chapel Hill in January 2001.*

Unsolved Waterlily Mysteries
by M.S. Hempstead

Not so long ago, botanical knowledge was advanced by painstaking field observations and ingenious, if lowtech, laboratory experiments — Classical Botany. Then came DNA. Botany and zoology departments were merged and botany professorships went unfilled. This does not mean, however, that all the good Classical Botany questions have been answered. I became aware of this while searching for a thesis topic on *Nymphaea odorata* (Fragrant Waterlily). I found a plethora of such questions. Feasibility studies showed that several questions, even though I didn't use them in the thesis, could be approached and probably answered for minimal sums albeit maximal labor. Some of the more intruiging ones, described below, involve waterlily rhizomes.

The rhizome is a horizontal stem, one-half to over an inch in diameter, shallowly buried in muck at the bottom of the pond. Starting in late April, leaves and flowers form at its growing tip, or apex, and grow toward the surface, one by one, at intervals of about two days. First a series of eight or nine leaves are formed, each bigger than its predecessor, then a flower, then three leaves, a flower, etc., for the rest of the summer. At the base of each leaf is a tuft of roots. All the while the rhizome is growing longer so that the leaves and flowers become spaced along it. Conard (1905), Cutter (1957), and Weidlich (1976) have described this process, but have only briefly mentioned branch formation.

A branch bud forms every now and then, in place of the expected leaf or flower, but appears to remain dormant until the rhizome has grown several centimeters beyond it. Each new branch eventually forms leaves, flowers, and more branches, in effect becoming a new rhizome, attached to the parent. In Belleville Pond, I have found floating, uprooted rhizomes as long as five or six feet, on which branches occurred each 10-20 centimeters. Each branch extended from the rhizome at an angle of 45° to 90° and had branches of its own. Figure 1 illustrates the rhizome complex that would result if a 10 cm rhizome were to grow for four years according to rules suggested by these observations:

- The rhizome extends 10 cm in each growing season in the direction of its apex.
- Each season one branch is produced on the 10 cm segment of the preceding year.
- Each branch projects at 90° from the segment that produced it.
- Each branch grows and produces branches in the same way as the original rhizome.

The structure formed in this way would increase not only in area but in density. Furthermore, a natural *N. odorata* bed following these rules would be more complex than that in the diagram, as branches grow up and down as well as sideways, giving rise to a three-dimensional net. There is evidence that waterlily rhizomes do form a dense mat. For one thing, when you walk out into a waterlily bed the rhizomes easily support your weight until you step into the occasional hole where the mat is less dense. Then you sink down a foot or two. Conversely, when you are looking for such holes, as when taking soil samples, they are annoyingly hard to find.

Some of the unknowns in this story are: Does the diagram resemble reality? How often and how regularly do branch buds form? Do the buds remain dormant and if they do, for how long? How fast do new branches grow, and how long are they before they produce new leaves and flowers of their own?

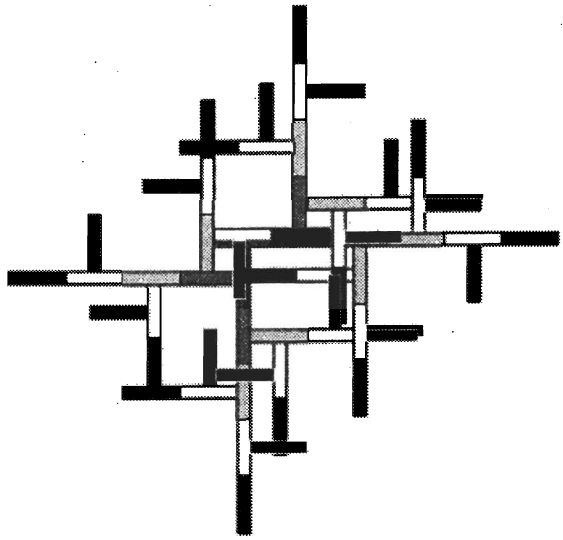

Figure 1. Waterlily rhizome complex after five years of growth according to hypothesized rules (see text). Same year segments have the same shade of gray. The original rhizome segment has a checkered pattern.

What is the longevity of a given location on a rhizome as the apex grows further and further away from it? Careful observation over several years of rhizomes growing in shallow plastic wading pools could provide some answers.

Rhizomes very likely store starch, inasmuch as staining a thin slice of rhizome with iodine will, under a microscope, reveal discrete starch granules. Wargo (1975) studied starch storage in maple tree roots in this way, but as far as I know the technique hasn't been applied to waterlily rhizomes. Knowledge of the effect of distance from a growing apex or the season of year on the amount of starch stored, as well as the total starch per kilogram of biomass, would be valuable in understanding waterlily physiology as well as the use of waterlilies as a wildlife food source.

Some of my thesis research showed that nitrogen in the soil in the center of a waterlily bed was one-half to one-third that outside the bed, yet the leaves and flowers in the center were alive and well, albeit up to thirty percent smaller than the outer rim of leaves (Sinden-Hempstead and Killingbeck 1996). Are nutrients supplied to the center rhizomes by those on the rim? Obtaining this answer this would be feasible but would require drastic measures, such as cutting the connections between the rhizomes at the outer rim of a bed and those in the center. Posi-

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tive results would imply that rhizomes are not only connected anatomically but interact physiologically, as a single unified plant.

How extensive are these plants in the field? Waterlily beds can cover acres, as in Upper Belleville Pond. How many (or how few) single plants make up such a bed? Alas, for a definitive answer, one would have to bow to progress and employ DNA analysis. Nevertheless, given the amount of information on waterlilies that can be gained literally in one's backyard, with the help of a few trips to the hardware store, access to an Edmund Scientific catalog, and a patient family, it is safe to say that Classical Botany is definitely not dead. And *Nymphaea odorata* is only one species.

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Lichen Climate

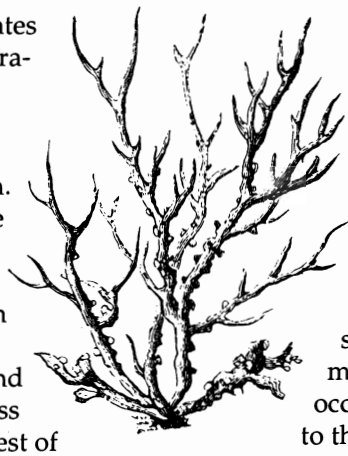
By Don Flenniken

It is well known that lichens are adapted to a wide variety of habitats, from the barrens of the Antarctic to lush tropical rain forests and from hot desert sands to rocks bathed by salt water. Able to establish on bare soil, rocks, and wood surfaces, lichens are pioneer organisms, filling a niche in the ecological environment where few other organisms are able to survive. Rhode Island is fortunate in that it shares several such niches within its borders: seashore rocks, deciduous forests, northern hardwoods, glacial boulders, bedrock outcroppings, pine barrens, dolomite ledges, and elevations ranging from sea level to 247.4 meters (812 feet). We tend to think of these habitats in the same light as the environment in which each is found: tropical, subtropical, temperate, mountainous, boreal, etc. A closer inspection of each habitat, however, shows an environment very different from what might be considered "the human climate."

Most lichens are more or less firmly attached to the substrate on which they are found, whether soil, rock, wood, or other material. Many of the foliose forms may penetrate a few millimeters into the surface, by their rhizines. Crustose forms become the surface of their substrates. The fruticose forms may ascend several millimeters upward into the air above the surface, and some may be pendulous and drape downward from their point of attachment, but remain in close proximity to the substrate surface. As a result, most lichens grow within a restricted zone from a few millimeters below the surface to, at most, a few centimeters above this surface. This zone is an area displaying the most adverse climatic conditions observed anywhere on the earth.

Climatological conditions under which lichens must live are completely different from those to which trees, wildflowers, butterflies, and humans are exposed. The transition between human climates and the climate near ground level generally occurs at an elevation of about 1 meter (Geiger 1957). The closer one approaches the surface, the more the climate differs. Measurements taken in August, 1963 in eastern Ohio (unpublished data from high school biology/ecology project) showed an air temperature of 32.7° C (91° F) at 1.27 meters (5 feet) above the ground. The air temperature had risen to 35.6° C (96° F) at 2.5 centimeters (1 inch) above the ground and to 38.3° C (101° F) at 5 millimeters (1/5 inch) above the ground. It was assumed that this air temperature continued to rise rapidly until a ground-level soil temperature of 54.4° C (130° F) was reached. The problem, however, is that near ground level, the

measuring instrument (thermometer) became the "surface," thus limiting additional data. At 1 centimeter (less than one-half inch) below the surface of the ground, the temperature had already dropped to 32.2° C (90° F). These measurements were taken in Ohio, but such conditions prevail elsewhere on sunny days in August and cloudy days in February, although the temperatures would be lower and the gradients less steep in February. Since lichens occupy only the closest few millimeters near the ground, or in some cases are the surface itself, their climate is extreme.



The climate at ground level alternates between the lowest and highest temperatures as a regular phenomenon. The dominant factors in this temperature fluctuation are incoming (solar) radiation and outward (nocturnal) radiation. Solar radiation is best developed in the middle of the sunny days in summer, while nocturnal radiation is associated with conditions that prevail at night. In the daytime about 75% of the sun's short-wave radiation reaches the ground surface. There may be a further 10% loss of this radiation by reflection. All the rest of this energy is transformed into an enormous amount of heat at ground level (Blair 1965). Part of this heat energy raises the temperature of the surface and part of it is transferred from the surface downward into the soil and upward into the overlying air. Thus, it is the lowest layer of the air, the surface itself, and the immediate area below the surface (that area where lichens grow) that reaches the highest temperatures at midday. We are all aware of this upon stepping barefoot onto the sidewalk, blacktop, or beach.

In the daytime, short-wave radiation passes through the earth's atmosphere with only relatively slight depletion. Nocturnal radiation from the earth behaves differently. Because the temperature of the earth is much less than that of the sun, the wavelengths of its radiation are appreciably greater. This long-wave radiation cannot pass through the atmosphere nearly so easily, being absorbed primarily by water vapor. A small amount (10%-20%) of this radiation from the earth may be lost into space (Rossby 1941). All the rest is absorbed by the water vapor of the atmosphere. This absorbed energy, changed to heat, raises the temperature of the air. In the daytime the ground surface is the locus of the highest temperature; at night it is the locus of the lowest temperature. The temperature becomes higher both upward into the lower levels of the air and downward into the soil. This is most easily observed as demonstrated by the formation of dew and frost on the surface, where lichens grow.

Water is constantly being evaporated from the earth's surface, accumulating in the lowest layer of the atmosphere, then being transferred upward into the drier layers by diffusion and turbulence. In this respect, the surface plays much the same role as with temperature. But whereas there is a maximum ground temperature in the daytime and a minimum at night, the relative humidity fluctuates in a direction directly opposite to the fluctuation of temperature. At the time of minimum nighttime temperature, the maximum humidity at ground level is very conspicuous, in the form of fog and dew (or frost).

But its minimum, at the time of maximum daytime temperature, is less conspicuous. The daily amount of moisture available to lichens displays two maxima and two minima. The first minimum occurs during the midday when the temperature is the greatest and evaporation has reduced, or depleted, the moisture from the surface. The second minimum occurs well into the night when moisture has been absorbed downward from the surface into the substrate. The first maximum moisture available to lichens occurs just as the evening temperatures cool to the condensation point and dew forms on the surface. The second maximum occurs in the morning just as the moisture is drawn from below the substrate to its surface by evaporation. Thus, twice each day, lichens experience an alternation between near zero humidity and 100% humidity.

Turbulent mixing of the air is most prevalent and air instability the greatest where heating is most intense, at ground level. This turbulence becomes noticeable as "dust devils," or "whirlwinds," when dust, twigs, leaves, and debris are carried aloft. That these miniature tornadoes are seldom seen is not because of their rarity, but only because they must carry particles of such size as to be seen. These eddies that form above the ground surface, and the lateral air currents that replace the vertically moving air, play an important part in lichen distribution by dispersing lichen fragments, soredia, and spores to new locations.

The latitude, inclination, and direction of slope have much to do with the amount of solar radiation the surface receives during the day. This, as we have seen, affects the temperature, humidity, and turbulence of the lichen habitat. A review of approximately 80 species of lichens known from Rhode Island (unpublished data) reveals the expected eastern species that include *Xanthoria parietina* (on maritime rocks); *Parmeliopsis subambigua* (of the Coastal Piedmont); *Flavoparmelia caperata*, *Hypogymnia physodes*, and *Punctelia rudecta* (of the deciduous forests); *Cladina stellaris*, *Cetraria arenaria*, and *Tuckermannopsis americana* (of the pine barrens); and

Umbilicaria mammulata, Vulpicida pinastri, and *Bryoria furcellata* (of the northern hardwoods). However, a variety of unexamined habitats may, indeed, yield additional and possibly unique species.

Detailed measurements in these habitats are still needed. Recent technology has made possible the recording of surface temperatures through remote viewing. Sensors have been developed tiny enough to be imbedded in lichen tissue for readings, not only of temperature and moisture, but also oxygen, carbon dioxide, etc. High-speed imaging is now available to record the effects of turbulence at ground level. Research of the lichen microclimate is still largely unexplored and further study is needed to establish these ecological extremes.

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Invasive Plant Control Project at Sachuest Point National Wildlife Refuge: Focus on Asiatic Bittersweet

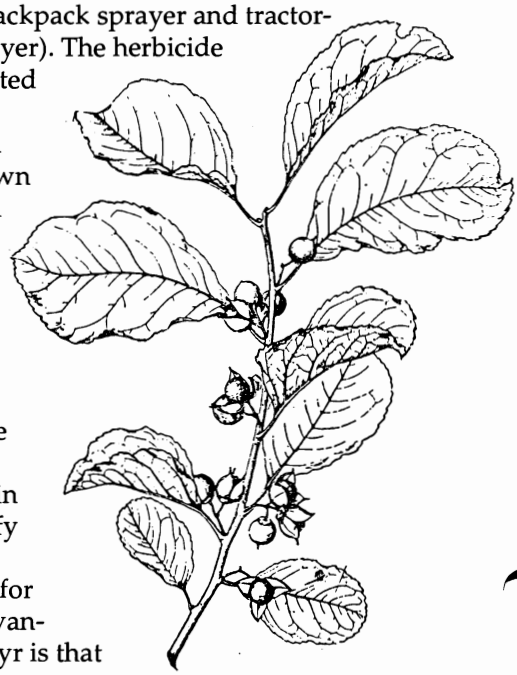
by Norma L. Kline

Late last year the Northeast U.S. Fish and Wildlife Service Invasive Species Working Group asked refuges if they needed control methods for any nonnative invasive plants. Requests for additional research on Asiatic Bittersweet (*Celastrus orbiculatus*) control were exceeded only by requests for Common Reed (*Phragmites*) management techniques (Northeast USFWS Invasive Species Working Group 2000). No wonder, given the Asiatic Bittersweet's ability to thrive in disturbed areas, open habitats, and woodlands! Once established the vine grows rapidly. Able to out-compete native vegetation for water, space, and nutrients, Asiatic Bittersweet degrades wildlife habitats by displacing native plants and eliminating more nutritional wildlife foods. In Rhode Island the vine dominates the vegetation on many islands and is abundant in coastal thickets and edges (Rhode Island Natural History Survey and Rhode Island Wild Plant Society 2000).

To varying degrees, each of the refuge units that comprise the Rhode Island National Wildlife Refuge Complex (RINWRC) contains infestations of Asiatic Bittersweet. The vine poses a threat to rare species and other wildlife habitats within the refuge complex. At Sachuest Point National Wildlife Refuge (NWR), Asiatic Bittersweet is present on 80 percent of the refuge. It is the dominant vegetation in large open fields and extensive shrub thickets. While other invasive plants such as Multiflora Rose (*Rosa multiflora*), Common Reed, and Knapweed (*Centaurea* spp.) occur at Sachuest Point NWR, Asiatic Bittersweet is the most pervasive of the invasives (U.S. Fish and Wildlife Service 1999, 2000).

RINWRC has a keen interest in identifying techniques to manage Asiatic Bittersweet, an interest shared by the Rhode Island Wild Plant Society, Rhode Island Natural History Survey, and Connecticut College. This common concern brought together the four organizations. Refuge volunteers stationed at Sachuest Point NWR readily joined the endeavor. Early this year the project partners applied to the National Fish and Wildlife Foundation for a grant. In mid-April the National Fish and Wildlife Foundation awarded funds for the Rhode Island Invasive Plant Control Project.

The Asiatic Bittersweet management techniques being tested have been researched and developed by Glenn Dreyer. Dreyer, director of Connecticut College Arboretum, has successfully managed Asiatic Bittersweet in the arboretum. The challenge at Sachuest Point NWR is to test control methods that will work in a natural setting and at a large enough scale to enable wildlife habitat restoration. Based on a review of current literature and building on previous research, Dreyer has developed a research design and methodology to test three elements of Asiatic Bittersweet control: timing of herbicide application (early summer and late summer); herbicide concentration (a stronger and a weaker solution of herbicide); and spraying method (backpack sprayer and tractor-mounted boom sprayer). The herbicide Garlon 3A was selected for use. The active ingredient in Garlon 3A, triclopyr, is known to effectively control (i.e., rootkill) Asiatic Bittersweet (Dreyer 2000). However, at Sachuest Point NWR, a weaker solution than that known to control the nonnative invasive vine is being tested in an attempt to identify the least amount of herbicide necessary for control. Another advantage to using triclopyr is that



the herbicide does not adversely affect grasses, a component of maritime early successional habitats. These are the habitats targeted for restoration at the refuge.

On-the-ground implementation of the project began in May. Final results of the project will not be known until data collected this year and next growing season are analyzed. Anticipated results of the Rhode Island Invasive Plant Control Project include: identification of the most effective amount of herbicide needed to control Asiatic Bittersweet; determination of the best techniques to manage Asiatic Bittersweet to allow establishment of native vegetation and habitats; and dissemination of useful data to other conservation organizations. Increased public understanding of the import of invasive plant control is another focus of the project. To this end, a brochure has been prepared and distributed to various conservation organizations to promote awareness of how control of Asiatic Bittersweet and other invasive plants can improve wildlife habitats.

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***Norma L. Kline** is the Refuge Biologist at the Rhode Island National Wildlife Refuge Complex.*

The President's Corner, *continued from p. 1*

for Federal funding will provide large infusions of money to an already active open space preservation program in Rhode Island. Interest in conservation is high, as evidenced by 42 applications totaling more than $8 million in requested funds received this past September from municipalities and land trusts for just $2.1 million in state open space grants. As conservation activity continues to escalate there is a critical need for information concerning which parcels of land should be targets of protection, what the biological resources of these lands are, and once acquired, how they should be managed to perpetuate their identified natural values.

Similarly, there is increasing interest in the restoration of destroyed or degraded natural communities. Restoration teams have identified numerous potential projects in both wetland and terrestrial habitats, but the biological information needed to help prioritize these efforts is incomplete or lacking.

Lastly, the advent of West Nile virus and other maladies has resulted in public concern for controlling vector mosquito populations. Although pesticide use has been fairly localized to date, future outbreaks may result in calls for statewide applications of broad spectrum chemicals. The efficacy of spraying adulticides for controlling mosquitoes is debatable, but it is clear that many nontarget species of vertebrates and invertebrates are also at risk from these procedures. However, data concerning which species are most vulnerable and the potential impacts to natural community dynamics is almost nonexistent.

Filling the knowledge voids in order to respond effectively to these and other issues is challenging. I am reminded of the words of Chico Marx in the movie *Duck Soup* when he remarked, "How am I gonna find out what I gotta find out if he can't find out what I gotta find out." All the ways of finding out may not yet be identified, but the Rhode Island Natural History Survey is poised to facilitate the process. The framework is in place and specific actions on each of the issues outlined above are currently being addressed by the Survey. Watch this and other editions of *RINHewS* for more details.

Bioblitz 2000!

Thirty-four enthusiastic scientists and citizens gathered at Roger Williams Park in Providence, RI from 3:00 p.m. on Friday, June 9 to 3:00 p.m. on Saturday, June 10 to conduct Rhode Island's first Bioblitz. Assisted by RWP Zoo and Museum staff, RINHS set up headquarters on the Museum lawn and spent 24 hours counting everything that could be found. Whether paddling on the park's ponds, scouring tree bark and old brick for mosses and lichens, black-lighting for moths and beetles, listening for birds, or peering through microscopes at nematodes, algae, bacteria, and phytoplankton, everyone who attended had a great time.

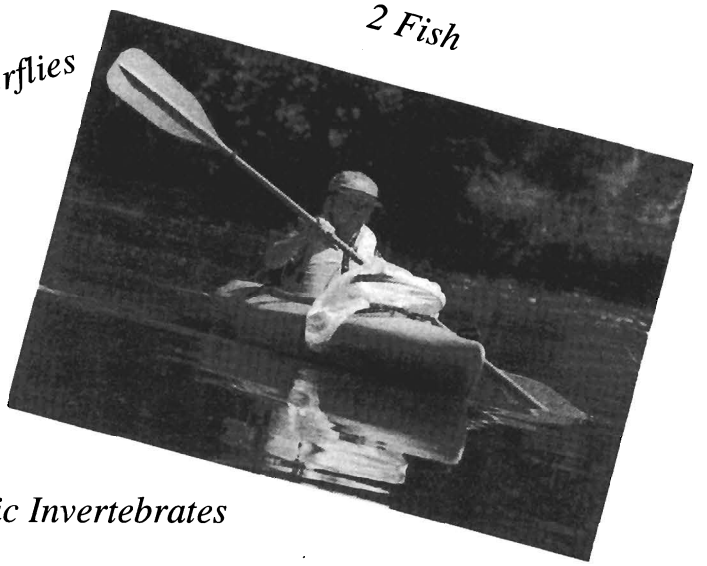
For an urban park, the results were pretty impressive: 665 different organisms were identified! RINHS is currently making plans for *Bioblitz 2001* and hopes to attract an even broader representation of taxonomic specialists and interested citizens.

We are grateful to the Roger Williams Park, Zoo, and Museum for cosponsoring *Bioblitz 2000*; they provided tally boards, tables, refreshments, and planning for the event. See pages 10-11 for images of *Bioblitz 2000.*

Bioblitz 2000!

48 Moths & Butterflies

2 Fish

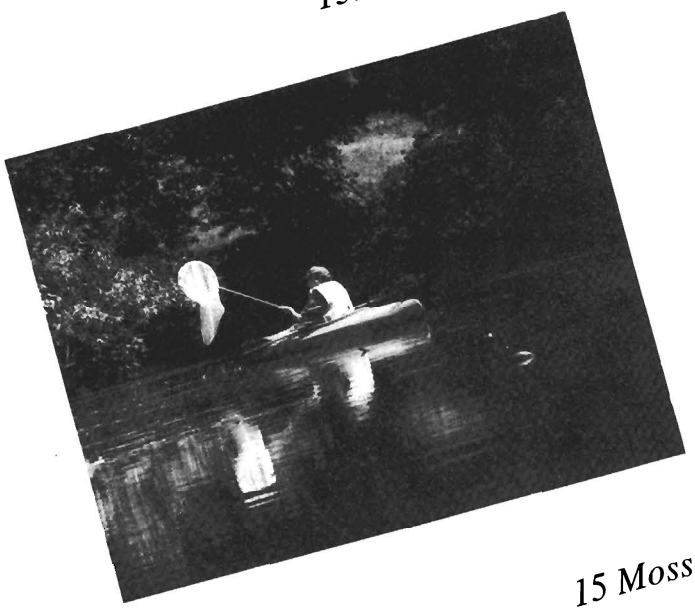


17 Aquatic Invertebrates

6 Ferns & Fern Allies

7 Soil Invertebrates

139 Beetles



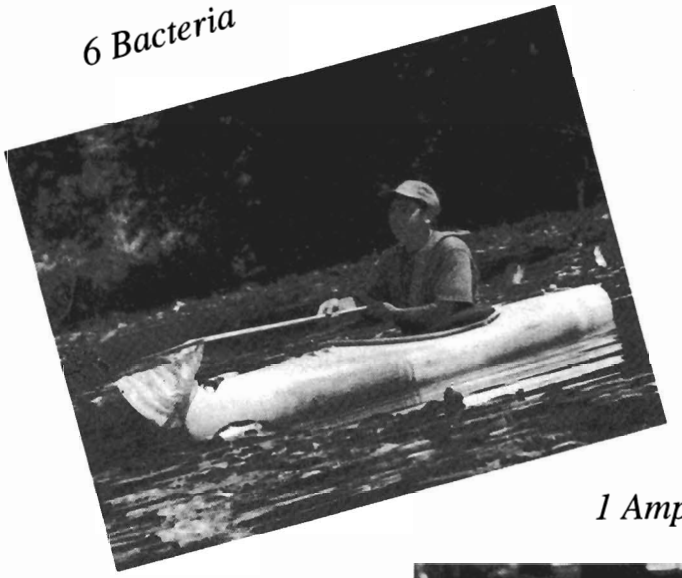
41 Birds

25 Lichens

15 Mosses

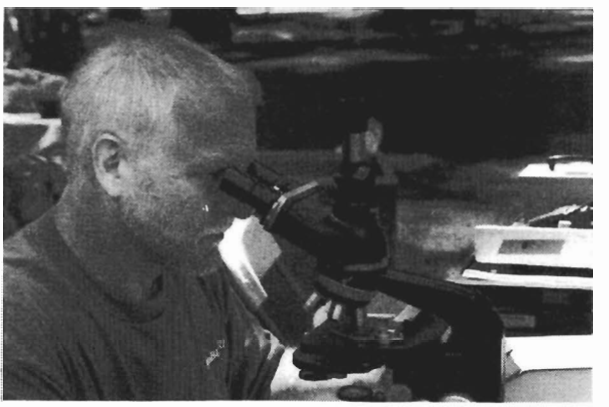
Photos by Meggan L. Gould

6 Bacteria



1 Amphibian

152 Herbaceous Plants



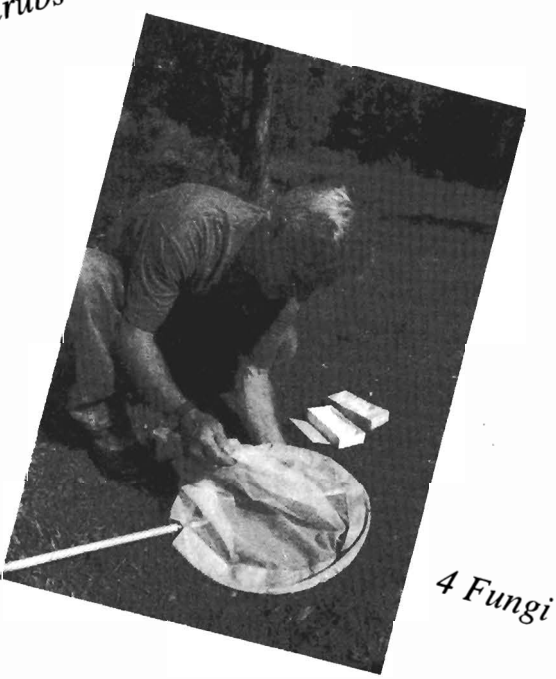
8 Mammals

17 Odonates

12 Other Insects

114 Trees & Shrubs

1 Virus



3 Reptiles

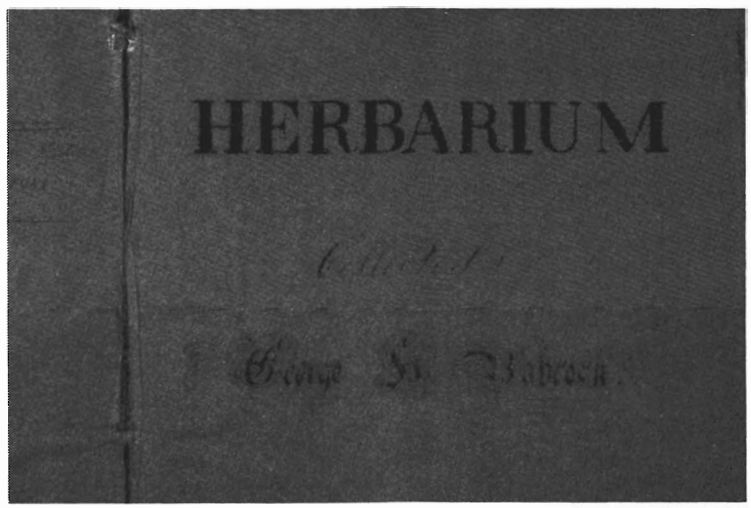
44 Algae

4 Fungi

Rhode Island Collections

The Herbarium at Rhode Island School of Design

A book of brittle yellowed paper, with the words "HERBARIUM" scripted on the opening page, instantly drew me into studying the entire contents of the metal case from which it came: the herbarium at the Rhode Island School of Design. Although I do not know much about botany, I have, as an artist, observed and appreciated the beauty and complexity of the plant life around me. I had never seen an herbarium before. I was not only intrigued by the qualities of the papers, the antique style of handwriting and the arrangements placed on the page, but also impressed by this amazingly well-preserved collection of singular plant specimens, which was so carefully documented and organized at one time.



The small herbarium, of over a thousand specimens, came to RISD from the Westerly Public Library. It is now housed in the recently renovated basement of the RISD Nature Lab, which could be described as a combination of natural history museum, library, and laboratory for the use of artists. The Nature Lab is an important resource for RISD students, both in design and fine arts, for the close study of structures, colors, and the diversity of over 20,000 objects in the collection, which includes skeletons, seed pods, shells, animals, and other natural life.

I was lucky enough to get a complete tour of the lab a year ago September from Karen Idoine, the curator, for a class called "Nature, Art, and Design." Her tour included the locked cabinets and closets, microscopes and dissecting equipment, as well as the back room in the basement, which houses sliding storage of furs and human skeletons (among other things), a freezer full of various dead creatures, and finally the herbarium.

Unfortunately the herbarium had been neglected for many years and was in disarray when I first saw it. But as Karen pulled out a stack of folders and revealed a few of the pressed plants, she hinted that she had been waiting for someone to take on the task of reordering and caring for these old specimens. My curiosity was sparked. I became a monitor, once a week, helping students and teachers with use of the lab. I was excited, also, to spend part of my time working with the herbarium.

Initially having little knowledge or experience of plant names, identification, and classification systems made my job a challenge, but also a rewarding learning experience. The specimens and their folders were completely out of order when I began my work in March. Many specimens of unrelated genus, family, and order were grouped together in the wrong folders. I found stacks of empty, labeled folders as well. Therefore, I have spent most of my time since then going through each folder, researching and putting the specimens back together into correctly labeleded folders. The process has taken five months. The folders are currently in alphabetical order by order, family, and genera.

Consulting with Karen, contacting knowledgeable sources through email, and reading the small amounts of information I could find in our library, slowly led me along in my work. Thanks to the assistance of Marilyn Massaro, curator at the Roger Williams Park Museum of Natural History, an excitement in the historical significance of the collection gave momentum to the project. Apparently a few members of the Systematic Collections Committee for the RINHS had been asking about the whereabouts of the "missing" herbarium from the Westerly Public Library. After an initial visit, Marilyn brought the Committee along with her for a second meeting, offering their support for our collection. Peter Lockwood, Alex Frost, and Keith Killingbeck, as well as Marilyn, Karen, and myself, gathered around the worktable to view a few specimens and discuss the progress and future of our herbarium.

I have yet to find records on the herbarium's history or of its various collectors. It is a composite of many collectors' work, partially integrated and re-labeled into one collection by the Westerly Public Library. The information I do know comes from observing each label, noticing the dates, locations, collectors' names, and miscellaneous handwritten notes on the specimen sheets.

The specimens, which date from the 1840s to the 1950s, are from Rhode Island and across the United

States, as well as other countries. There are well over 1,000 specimens and almost all are in excellent condition. Some individual specimens are in fragments and their pieces lost, but the most apparent damage to the collection, including mold and layers of dust or soot on the pages and folders, could be fixed with proper care.

Of greatest local significance, William W. Foster and James Brown, both of Westerly, Rhode Island, collected a majority of the specimens. Mr. Foster's collection includes specimens mostly from New England, but also from the mid-west and abroad; they date from the 1870s to the 1890s. James Brown collected in the 1940s and 1950s, but rarely gave the location of his finds. Another collector from Westerly, George Babcock, made a small herbarium book form, the one I mentioned earlier, which dates to 1848.

We have a beautiful collection by John Gibbs Lemmon (1870s-1880s) and a small collection of L.G. Yates, both representing the western states of California, Nevada, and Arizona. Lemmon was a Civil War prisoner, who moved out west after he was released and developed his interest in botany simply by being curious about some plants he did not recognize outside his door. He eventually sent these plants to the east coast to be identified, addressed to Harvard botanist Asa Gray. He continued to correspond frequently in this way and began to make a living exploring and collecting in California and Arizona (Reifschneider 1964).

A majority of our collection of ferns is foreign, but we do have some beauties from Rhode Island. There are several types of Ceylon ferns collected by James M. Southwick, the first director of the Natural History Museum at the Roger Williams Park in Providence. William W. Foster also traveled abroad and collected in Ceylon and Switzerland. Our second book herbarium is Flintoff's *Collection of the British Ferns in the English Lake District*, undated. Other foreign specimens come from the Sandwich Islands and Chile.

A small part of our collection includes specimens from Herbert Tetlow of Massachusetts (1895), C. Edwin and Walter Faxon of Vermont (1890s), C.H. Denison (1879), and the Herbarium of Memorial Botanical Association (1894). Finally, the remainder of our collection includes: thirty-five unlabeled specimens, roughly identified, from Westerly and Switzerland; twenty unidentified mounted specimens from Westerly (1890s); and four unlabeled pondweed specimens from Stonington, CT (1893).

I am hopeful that another interested student will continue where I left off. These plant specimens are a rich resource for scientific and artistic study. The various textures, shapes, colors, patterns, and artful arrangements have certainly influenced my own work and I hope will inspire others as well. As Marilyn Massaro commented, these collectors were artists themselves, in the way these plants are placed on the page and in their passion for the beauty and variety of plants. The foundation of RISD's Nature Lab is the relationship between art and science. Anyone interested in visiting the Nature Lab to look through our herbarium or other collections is welcome.

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***Molly Fallon** is a member of RINHS and a recent graduate of the Rhode Island School of Design, with a Bachelor of Fine Arts in Painting.*

RINHS Collections Program

by Alex Frost

The RINHS Systematic Collections Committee is now establishing a more formal program to help preserve natural history collections in Rhode Island. Some of the specific services and goals of the program are to:

- Create a more comprehensive database of Rhode Island natural history collections
- Evaluate and identify collections threatened by lack of proper storage
- Provide advice to help people understand and take care of their collections
- Continue the cabinet lending program, and possibly provide other resources
- Manage access to special resources and equipment to help rehabilitate and maintain collections
- Help facilitate the sharing of resources among collection owners in the state
- Provide temporary and permanent storage for collections from Rhode Island
- Help facilitate the placement of RI collections in other permanent repositories
- Create and manage teaching collections, tours of collections, and specimen loans

Since its inception, one of the goals of the Rhode Island Natural History Survey has been to help facilitate the preservation and use of natural history collections from Rhode Island. In 1995, the survey compiled basic information on over 150 public and private collections of local flora, fauna, and geological specimens in the RINHS publication, *A Natural History Directory for the State of Rhode Island*. The Directory has served as an important reference to help locate specimens in the state, and has also helped us to understand the breadth and diversity of collections in Rhode Island. These natural history

continued on p. 15

Focus on RINHS Organizational Members:

Moses Brown School

The Evolution of an Outdoor Laboratory at Moses Brown School

by Barbara W. Heavers

This summer two thousand native trees and shrubs were planted on the grounds of Moses Brown School in Providence, RI. The plants grace the borders of a new roadway and parking areas and are part of a dream coming true. I still have the memo that I wrote to our Headmaster in 1991. I wanted students to learn about plants in their natural places, but our urban school was far from such environments. Why couldn't we plant native species instead of the standard nursery fare whenever we had the need? My idea finally took root in the spring of 1998 when the School decided to make the development of an Outdoor Laboratory the focus of a foundation grant that would support the students' study of the biology of native species. We asked for funds to build a greenhouse and a nature walk that would link five or six habitats ranging from the Rhode Island shore to the mountains of New Hampshire. We didn't receive the grant, but the idea survived. Four science teachers formed a committee and started looking for opportunities to get the project started.

Our first opportunity came the next spring with the plan to build a softball field. The new field required the building of a three hundred foot long retaining wall. Kevin Perry, our physical plant manager, was happy to show me blueprints of the wall design and samples of the earth tone and gray blocks that were to be used. He said that landscaping was planned and we might be able to build a design in the wall using colored blocks.

Some years ago we took our biology classes to visit the Cape Cod National Seashore where we hiked a trail that began at the dunes and led us across scrub oak forest to a white cedar swamp. We used a National Park Service brochure that pictured a vertical cross section of the topography of the mile-long walk from the ocean to the swamp. After my visit with Kevin, I recalled that brochure. What if we built a design into the wall that captured the changes in topography across a portion of New England? The image would identify the scope of the Outdoor Laboratory.

The next day I bought a copy of TOPO, a clever software package that allows hikers to create a profile of the landscape that they plan to walk. It was simple to "walk" with my mouse across the map on the screen, from Newport to the top of Mt. Washington. A few clicks later and the profile was on my screen. It

was perfect! The blueprint specified a wall three feet tall at its western end rising to sixteen feet on the east. I took a copy of the profile to Kevin. He laughed. He didn't know what it would cost or how the builders would ever figure it out, but he didn't say no. With the help of a couple of imaginative computer managers at our School, within a couple of weeks the profile was transformed from a hand-scaled graph paper image to a digitized blueprint. Kevin spent the summer with that digitized blueprint in hand as he supervised the building of a unique perspective of New England into the Moses Brown Wall.

Last fall the Rhode Island Foundation gave us a planning grant so that we could seek professional help in designing the Outdoor Laboratory. We began to outline a master plan based on advice from the RI Wild Plant Society and others familiar with native species. Our second opportunity soon followed. The construction of the road and parking areas on the School grounds was to begin in June. The landscape architect retained for the construction work helped us select appropriate native species for the borders of all the disturbed areas and designed short fieldstone walls and slopes for the first model habitat, the coastal Scrub Oak landscape. This model is being developed with donated Scrub Oaks (*Quercus ilicifolia*), Pitch Pines (*Pinus rigida*), and Bayberry (*Myrica pensylvanica*) along with plants from local nurseries. The nature walk will begin in the Scrub Oak habitat and continue uphill into an existing stand of oaks with a new understory of native species. Because the School has an extensive renovation and building program for the next several years, the Outdoor Laboratory will certainly proceed in related phases. As the habitats begin to take shape, our students are creating a permanent record of the trees and shrubs, both old and new, as a first step toward promoting their knowledge of the native plants and places in New England. We are seeking the support and participation of the larger community and need more advice on gardening techniques, volunteers to work with students, and perhaps even the donation of native plants. We welcome all inquiries and hope that in the years to come that many who share the vision of this project will visit our School.

***Barbara Heavers** is Chair of the Science Department at Moses Brown School.* Just before going to press she gave an update: 21 Scrub Oaks, 14 Pitch Pines, and 8 Bayberries were planted in late October. The School is still searching for sources of Black Huckleberry (*Gaylussacia baccata*), Broom Crowberry (*Corema conradii*), Golden Heather (*Hudsonia ericoides*), and Beach Heather (*Hudsonia tomentosa*).

RINHS Collections Program, *continued from p. 13*

collections have great scientific value to taxonomists and are one of the most important resources to help us understand the impact on RI ecosystems of invasive species and changes in land use. These collections can also have great artistic, historical, and educational value.

We now know that the 150 or so collections recorded in the first edition of the *Directory* are only a small portion of the collections in Rhode Island; that the value of most collections is being lost because of a lack of information, communication, or access; that many collections themselves are being lost because of inadequate storage conditions; and that important collections are being sent out of the state because Rhode Island has not had the resources to adequately house them. Beyond the publication of the *Directory* and its upcoming second edition, the survey has already taken some important steps to help preserve collections. The survey is now providing temporary and permanent storage for several collections and has always given advice to help amateurs and professionals understand and maintain their own collections (see Molly Fallon's article on the RISD Nature Lab Herbarium, page 12). With funding from the Champlin Foundations, we have established a successful program to provide modern storage cabinets for collections in need throughout the state. The establishment of a more formal Collections Program will help these services to continue and expand to meet the goals listed above.

To get all this done, we plan to put the collective knowledge and wisdom of the Survey membership to use. If you are interested in participating in this program as a consultant to evaluate collections in your area of expertise, let us know. If you are responsible for a natural history collection, what needs do you have? In addition, please spread the word and contact us if you know about an orphaned collection or know others that might benefit from this program.

***Alex Frost** is director of the Biology Editors Company and serves on the RINHS Board of Directors.*

We're moving!

The Rhode Island Natural History Survey office will soon be moving into new quarters in the brand new Coastal Institute building on URI's Kingston campus. We'll have more space, and if all goes as planned, we will even have an area available for people to sit and use our ever-growing reference collection. We will also be closer to the offices of the RI Agricultural Experiment Station, which has been very supportive of RINHS activities, and with whom we are working to develop the Rhode Island Invasive Species Council (there'll be more on that in the April 2001 *RINHewS*).

RINHS October Conference a Great Success

Over 140 people attended *The Ecology of Rhode Island's Islands: Focus on Block Island,* including many Block Islanders who braved high seas and strong winds to spend the day at RINHS's 6th conference.

The day began by presenting Prentice K. Stout with the 2000 RINHS Distinguished Naturalist Award; posthumous awards were also given to Elizabeth Dickens and Mark D. Gould. Keynote speaker Frank Moore of the University of Southern Mississippi initiated the scientific talks, which ranged from the geology, geography, and hydrology of Block Island to flora, fauna, and conservation issues on the island. For abstracts of the talks and information about the Distinguished Naturalists, visit the RINHS website at www.uri.edu/ce/rinhs. The proceedings of the conference will be published in 2001.

National Council for Science and the Environment

The Committee for the National Institute for the Environment (CNIE) has changed its name to the National Council for Science and the Enviroment (NCSE), declaring victory in translating its goals for improving science information for environmental decision-making into National Science Foundation (NSF) initiatives. CNIE formed in 1989 with the goal of establishing a new federal science funding agency--the National Institute for the Environment (NIE)--but in recent years shifted toward establishment of a semi-autonomous NIE within NSF. The National Science board recently finalized a report calling for a tripling of NSF funding for environmental research, knowledge assessment, and education as well as structural changes to implement the report *Environmental Science and Engineering for the 21st Century: Role of the National Science Foundation* (NSB 99-133). Because the NSB recommended implementation of most of the activities initially proposed for a National Institute for the Environment, the CNIE announced that it fully supported implementation of the NSF report and was suspending its call for the creation of a NIE. The newly named NCSE will work to improve the scientific basis for environmental decision-making through: 1) support for NSF and related initiatives, 2) activities to bring stakeholders together to develop a common understanding of science related to environmental issues, and 3) an online information dissemination system through which users can find understandable, science-based information about the environment. Website: www.cnie.org

Note: RINHS members were pleased that NCSE's Senior Scientist, David Blockstein, was able to attend the RINHS Annual Meeting in September and tell us in person about the recent activities of NCSE.

Upcoming Conferences & Seminars

November 15. ***Grassland Restoration in Rhode Island: A Hands-on View,*** **an RINHS lecture** by Jason Ringler of the U. S. Fish & Wildlife Service, 7:30 p.m., C. H. Kirk Center for Advanced Technology, URI Kingston Campus. Free. (401) 874-5800 or RINHS@etal.uri.edu for information.

December 1. *Valuing Rhode Island Natural Resources,* a lecture by Dr. Timothy Tyrell, professor in URI's Department of Environmental and Natural Resource Economics. 3:30 p.m., 102 Ballentine Hall, URI Kingston campus.

December 11. *Global Biodiversity,* a lecture by Jon Whitman, Brown University. 4 p.m., lecture hall of URI's Biological Sciences Center, Kingston, RI. Sponsored by the URI Department of Biological Sciences. Inquiries: BOB@uri.edu

January 13, 2000. *Spring Ephemerals & Early Woodland Wildflowers,* a lecture by William Cullina, New England Wild Flower Society. 1-3 p.m. Free. Sponsored by the Rhode Island Wild Plant Society; for location and more information, call (401) 783-5895 or email riwps1@altavista.com.

January 25. *Preserving Biodiversity in Rhode Island,* a lecture by Virginia Carpenter, Director of Science and Stewardship at Rhode Island's office of The Nature Conservancy. 7-9 p.m. Free. Sponsored by the Rhode Island Wild Plant Society; for location and more information, call (401) 783-5895 or email riwps1@altavista.com.

February 7. ***Mineralogy of the Lime Rock Area, Lincoln, Rhode Island: A Study of Rhode Island's Most Prolific Quarries,*** **an RINHS lecture** by Michael Kieron, Rhode Island Mineral Hunters, 7:30 p.m., Roger Williams Park Museum of Natural History, Providence, RI. Free. (401) 874-5800 or RINHS@etal.uri.edu for information.

February 14. *Using a paleolimnological approach as a tool for understanding aquatic ecosystems,* by Peter Siver of the Botany Department, Connecticut College. Sponsored by the Connecticut Institute of Water Resources and held at 4 p.m., Rm 207 W. B. Young Building, University of Connecticut, Storrs CT. For information contact (860) 486-2840 or visit the website at www.citwr.uconn.edu

February 25-27. *Taking Nature Seriously: Citizens, Science, and Environment,* University of Oregon, Eugene, OR. An interdisciplinary conference to bring together scientists, community activists, and science studies scholars who are working on environmental issues. Website: http://darkwing.uoregon.edu/~tns; telephone (541) 346-5399; email tns@darkwing.uoregon.edu.

April 11. ***Findings of the First Rapid Assessment Survey of Marine Bioinvasive Species in Narragansett Bay, Rhode Island, August 12-18, 2000,*** **an RINHS lecture** by Kevin Cute, Coastal Resources Management Council, 7:30 p.m., Center for Economic & Environmental Development, Roger Williams University, Bristol, RI. Free. (401) 874-5800 or RINHS@etal.uri.edu for information.

April 11. *An Analysis of DOT Constructed Wetlands and Ponds,* by Steve Ladd, Senior Transportation Planner, CT Department of Transportation. Sponsored by the Connecticut Institute of Water Resources and held at 4 p.m., Rm 207 W. B. Young Building, University of Connecticut, Storrs CT. For information contact (860) 486-2840 or visit the website at www.citwr.uconn.edu

RINHS Organizational Members: Special News & Events

Roger Williams Park Museum of Natural History & Planetarium is featuring the following exhibitions: *All Things Connected: Native American Creations; Natural Selections; Circle of the Sea;* and *Stone Masons of South County and Their Walls* (through January 2001). Planetarium shows are held on Saturday and Sunday at 1:30 and 3:00 p.m.; contact the Museum at (401) 785-9457 for more information.

Roger Williams Park Zoo was honored with a significant achievement award at the 76th annual American Zoo and Aquarium Association conference recently held in Lake Buena Vista, Florida. The Zoo received the award for its recovery program for the American Burying Beetle.

The Zoo's Winter 2001 Conservation Lecture Series includes: *Zoo Veterinary Medicine* (January 14, 2 p.m.), *Griffin Vultures in Israel* (January 21, 2 p.m.), *How to Care for a Polar Bear* (January 28, 2 p.m.), *Notes from the Field: Conservation and Education in Papua New Guinea* (February 4, 2 p.m.), *The Bushmeat Crisis* (February 8, 7 p.m., RWP Museum of Natural History), *The Dating Game* (February 11, 2 p.m.), *Mating Systems in Gray Seals* (February 18, 2 p.m.), and *Madagascar: The Eighth Continent* (March 8, 7 p.m., RWP Museum of Natural History). The 2 p.m. lectures are all free with Zoo admission, and will be held at the Meller-Danforth Education Center. The evening lectures require a fee and pre-registration; call (401) 785-3510 x 358 to register.

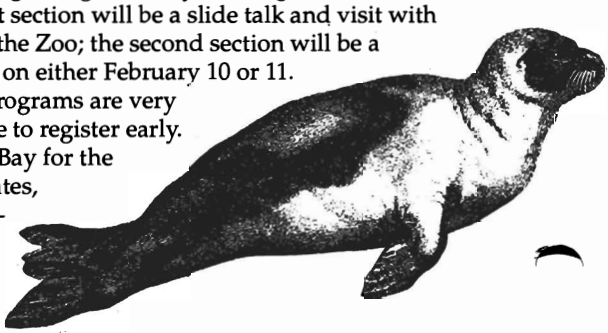
Rhode Island Wild Plant Society offers a wide variety of walks, lectures, and workshops throughout the winter and into the spring. For a complete listing, contact RIWPS at (401) 783-5895 or email riwps1@altavista.com

Rose Island Lighthouse Foundation is offering sealwatching tours from January through March. Hour-long boat tours to Citing Rock off Rose Island are scheduled near the time of low tide, weather permitting. For fees and schedules, call (401) 847-4242 or visit the website at www.RoseIslandLighthouse.org

Save The Bay is offering sealwatching tours in January, February, and March 2001. The *Brandaris* will set sail from Wickford Harbor, to learn about and observe the seals that return each fall to Narragansett Bay. The most common seals to visit our shores are the Harbor Seals; however, the occasional Harp Seal, Hooded Seal, or Gray Seal, as well as other marine life, may be seen.

Polar Bears and Harbor Seals: Adaptation and Natural History of Aquatic Mammals will be the subject of a two-section program beginning February 3 at Roger Williams Park Zoo. The first section will be a slide talk and visit with the polar bears at the Zoo; the second section will be a sealwatching tour on either February 10 or 11.

All of these programs are very popular, so be sure to register early. Contact Save The Bay for the full schedule of dates, costs, and registration information. (401) 272-3540 or savebay@savebay.org



Natural History Opportunities

Massachusetts Audubon Society (200 South Great Road, Lincoln MA 01773) seeks interns and monitors: 1) **Coastal Waterbird Interns (20)** are needed to help protect Piping Plovers and terns at 50+ sites. Responsibilities include: collecting behavioral and other biological data, erecting and maintaining protective fencing, and teaching beachgoers about the birds and threats to their survival. Applicants must have strong interpersonal skills, be in good physical condition, and have their own vehicle. Experience in biological data collection and coastal bird identification helpful but not necessary. These internships are excellent opportunities to gain field experience and receive college or graduate credit. Additional research and office-based internships available year-round. There is a $50/week stipend provided for food and gas. To qualify for free housing, interns will be expected to work 35 hours per week for a minimum of 10 weeks. Internships available from April 1 to September 15.
2) **Coastal Waterbird Monitors/Naturalists (2)** needed for the Sampson's Island Wildlife Sanctuary on Cape Cod. Responsibilities include monitoring, protecting, and collecting data on nesting terns and Piping Plovers; leading nature walks; and collecting fees from island visitors. Prior experience as a naturalist and handling a small boat is preferred. Positions begin in mid-April and continue through early September. Assistants will be expected to work full-time in exchange for weekly stipend of $270. Housing may be available.
3) **Piping Plover/Tern Monitors (5)** needed on Cape Cod, North and South Shores, Buzzard's Bay, Martha's Vineyard, and Nantucket to monitor, protect, and conduct research at tern and plover nesting sites. Applicants should have some experience identifying, monitoring, or protecting Piping Plovers or terns, and interacting with the public. Field activities include independently erecting and maintaining protective fencing, collecting data on field forms, talking with beachgoers about endangered species and conservation, and occasionally coordinating volunteers. These full-time assistantships begin between April 15 and May 15 and end around August 15. Assistants will be expected to work full-time in exchange for a weekly stipend of $270. Housing may be available.

To receive an application for all positions, send a self-addressed envelope to Mary Hopkins c/o the Coastal Waterbird Program, Massachusetts Audubon Society, Lincoln, MA 01773 by April 1, 2001.

The Nature Conservancy (Rhode Island Field Office, 159 Waterman Street, Providence, RI 02906) is looking for volunteers to monitor Piping Plover and Least Tern sites in Rhode Island; a minimum commitment of a half-day training session and 2 days of monitoring is expected. Unique opportunity to help endangered species! Call Cheryl Swinconeck at (401) 331-7110.

TNC would also like volunteers to help with field, lab, and clerical work for the Odonata atlas being compiled by Virginia Carpenter, and Jane Jackson is seeking volunteers to help inventory TNC properties for birds, herptiles, invertebrates, etc. Contact Ginger and Jane at (401) 331-7110.

Roger Williams Park Museum of Natural History (Elmwood Avenue, Providence RI 02905) has several curatorial projects for knowledgeable volunteers or student interns, including taxonomic updating, identification, cataloging, and organizing the herbarium and mollusk collections. Opportunities to work with other collections exist as well. Student research or internships that earn academic credit are encouraged and welcomed. For information contact Marilyn Massaro, Curator, at (401) 785-9457 ext. 248.

Roger Williams Park Zoo (1000 Elmwood Avenue, Providence RI 02907) is looking for outgoing, friendly people who share an interest in animals and wildlife preservation to join the *Zoo's Docent Program.* Docents are volunteer teachers who strive to increase the public's appreciation of wildlife through education about animals, conservation, and the role of the modern Zoo. Docent training is a 13-week course, running from January – April 2001. Classes are held on Thursdays or Saturdays.

Interested persons, 18 years of age or older, can contact Debbie Richmond, Coordinator of Volunteer Resources, at 785 – 3510 ext. 356 for information on the application, orientation, and interview process.

Rose Island Lighthouse Foundation (P. O. Box 1419, Newport RI 02840) needs volunteers to help gather data on snakes, ticks, plants, seals, and nesting birds at appropriate times of the year. The Foundation will provide transportation. Contact Charlotte Johnson at (401) 847-4242 or charlotte@RoseIsland.org

Save The Bay (434 Smith Street, Providence RI 02908) has *internships* available for fall, spring, and summer terms. Opportunity areas include Communications (PR & Marketing; Internet & Graphic Design), Habitat Restoration, Legislative Outreach, Membership & Marketing, Program Planning/Development, Public Programs & Field Education, and Puppetry/Art. All internships are offered for academic credit with the hourly commitment per week varying by position.

Save The Bay's offices are fast-paced; they seek interns who are organized, able to establish priorities, and work well independently.

Save the Bay also invites people to join the *Bay Discovery Corps of Volunteer Docents* in the field and classroom.

Opportunities, *continued from page 17*

To apply for internships and volunteer positions, contact Stan Dimock, Volunteer & Internship Coordinator, at sdimock@savebay.org or (401) 272-3540 ext. 130.

URI Watershed Watch (Woodward Hall, URI, Kingston RI 02881) is seeking volunteer monitors for the 2001 season! URI Watershed Watch is a citizen volunteer water quality monitoring program, sponsored by URI Cooperative Extension and also by a number of municipalities, watershed and lake organizations, and the Narragansett Indian Tribe. Volunteers receive classroom and field training in the basics of aquatic science, and detailed instructions on how to monitor a lake, pond or stream. No prior scientific experience is expected of volunteers, just the time to devote to monitoring and an interest in the water quality of a favorite lake or pond.

Volunteers spend 1-2 midday hours per week from early May through late October monitoring their location. Volunteers must provide their own boat/canoe/kayak, anchor, and personal flotation device (life preserver.) To find out more, check out our web site at www.edc.uri.edu/uriww, email us at uriww@etal.uri.edu, or phone us at 401-874-2905.

U. S. Fish & Wildlife Service (RI National Wildlife Refuge Complex, Shoreline Plaza, Route 1A, P. O. Box 307, Charlestown RI 02813). Ninigret, Trustom Pond, John H. Chafee at Pettaquamscutt Cove, Sachuest Point, and Block Island National Wildlife Refuges offer many volunteer opportunities, including visitor services, trail maintenance, biological monitoring and surveys, and environmental education. Contact Kimberly Hayes, volunteer coordinator, at (401) 364-9124 ext. 29.

RINHS Welcomes New Board Members

The RINHS Nominating Committee, under the careful guidance of committee chair Julie Sharpe, worked successfully to produce a fine new slate of directors this year. At the September Annual Meeting, RINHS was pleased to welcome to the Board of Directors: Katherine Horoschak (Development Officer for URI's College of the Environment and Life Sciences and the Graduate School of Oceanography), Neil Sharpe from the Rhode Island Wild Plant Society, and Martine Villalard-Bohnsack from the Department of Biology at Roger Williams University.

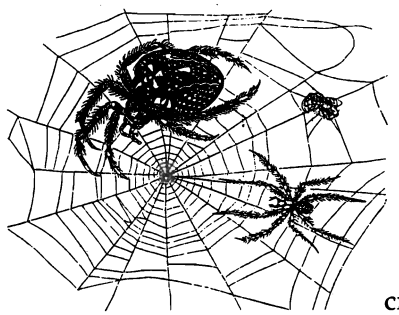
Joining the RINHS Advisory Board are Robbie Fearn, Curator of Education at Roger Williams Park Zoo, and Ed Wood, former director of the Rhode Island Department of Environmental Management.

Check Out Our Website!

The Rhode Island Natural History Survey is pleased to announce its newly designed web pages, created by Meggan L. Gould. Go to: **www.uri.edu/ce/rinhs** and let us know what you think!

Rhode Island Natural History Survey, Inc.
c/o Cooperative Extension Education Center
3 East Alumni Ave., URI, Kingston, RI 02881
Telephone: (401) 874-5800; Fax 401-874-2259
Email: rinhs@etal.uri.edu
Website: http://www.uri.edu/ce/rinhs

Weaving the Web: Electronic Resources



Connecticut Invasive Plant Working Group has a new website: www.eeb.uconn.edu/invasives

Ecological history of New Bedford Harbor website: www.epa.gov/nbh/

Germplasm Resources Information Network's (GRIN) Plant Taxonomy Homepage provides nomenclature for all plants of interest to the U. S. Department of Agriculture. In addition to scientific names, this database includes common names, native distribution, economic impacts, literature citations, and links to accessions when these are available. www.ars-grin.gov/npgs/tax/

Habitat Suitability Index models are now available in PDF format on the National Wetlands Research Center Library website at www.nwrc.gov/wdb/pub/hsi. The models in this series reference numerous literature sources in an effort to consolidate scientific information on species-habitat relationships.

Mammalian Phylogeny and Taxonomy on-line database: www.nceas.ucsb.edu/~alroy/nafmsd.html

Noxious Weed Lists from the lower 48 U.S. states and six Canadian provinces can be viewed at http://invader.dbs.umt.edu/Noxious_Weeds

The Smithsonian Institution has a new listserv, PERMIT-L, that strives to facilitate discussion and information about the ever-changing world of biological collecting permits, import-export laws, etc. It will eventually include issues pertaining to geological and cultural collections as well. To join, contact Sally at shelton.sally@nmnh.si.edu

Soil ecosystem websites:
Soil as habitat: http://museum.ednet.ns.ca/mnh/nature/nhns/t9/t9-3.htm
The soil ecosystem: www2.nrcs.usda.gov/teachers/soil_ecosystem.htm
Life in the soil--soil biota in relation to agriculture: http://www-crcslm.waite.adelaide.edu.au/soillife.htm
Analysis and function of soil food webs: http://soilfoodweb.com

U. S. Department of Agriculture, Agricultural Research Service has developed a user-friendly, sophisticated computer model to help engineers, scientists, and students understand how water and chemicals move in soil and groundwater. A demonstration version of HYDRUS is available online at www.ussl.ars.usda.gov/MODELS/HYDRUS2D.HTM

U. S. EPA's *Lake and Reservoir Bioassessment and Biocriteria, Technical Guidance Document* provides managers and field biologists with functional methods and approaches for bioassessment and biocriteria of lakes and reservoirs. Website: www.epa.gov/owow/monitoring/tech/lakes.html

USGS Water Quality Data Warehouse is a new online database of 6.5 million records: http://water.usgs.gov/nawqa/data

Wildlife Crossings is a website developed by the U. S. Department of Transportation's Federal Highway Administration to help protect wildlife along highways. The site describes some of the effects that transportation has on wildlife and ecosystems, and highlights projects and processes that help reduce those impacts. Website: www.fhwa.dot.gov/environment/wildlifecrossings

Benefits of membership in the Rhode Island Natural History Survey

For Individual, Family, and Student Members

RINHewS, the newsletter
Free membership list
10% discount on all publications
Discount on annual conference fee
20% discount on subscription to the journal *Northeastern Naturalist*

For Institutional Members

RINHewS, the newsletter
2 free membership lists
Listing in Program for Annual Conference
10% discount on all publications
1 free registration at annual conference
20% discount on subscription to the journal *Northeastern Naturalist*

RINHS Seeking New Administrative Assistant

RINHS will soon (and sadly) be needing a new administrative assistant, as Elizabeth Dowing will be moving into a full-time job.

Duties include data entry, bookkeeping and accounting, processing book sales, helping with mailings, maintaining the RINHS membership files, preparing for RINHS conferences and events, interacting with the public, and other general office work. The work is fast paced and varies from day to day. Necessary computer skills include word-processing, database management, and familiarity with Quick Books and Excel; expertise in PageMaker and Photoshop would also be helpful.

The position is part-time, for 15-20 hours per week, beginning in March 2001. To apply, send a cover letter and curriculum vitae to the RINHS office.

Thanks!

The Rhode Island Natural History Survey is very grateful for the following donations to our library: *Ecology of Red Maple Swamps in the Glaciated Northeast: A Community Profile*, from Frank Golet; *A Guide to the Literature on the Lichen Flora and Vegetation of the United States, The Lichen Flora of the United States*, and *The Lichen Book: Handbook of the Lichens of the Northeastern United States*, from Roger Goos; and *Scientists on Biodiversity*, from Julia Sharpe.

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Photos on pp. 10-11 by Meggan L. Gould; photo on p. 12 by Molly Fallon. Line drawings from *Animals: 1491 Copyright-Free Illustrations*, by Jim Harter, 1979, New York: Dover Publications, Inc., *The Plant Kingdom Compendium*, by Jim Harter, 1988, New York: Bonanza Books, and *How To Know the Wildflowers*, by Mrs. W. S. Dana, New York: Dover Publications, Inc.

Naming the Animals

Having commanded Adam to bestow
Names upon all the creatures, God withdrew
To empyrean palaces of blue
That warm and windless morning long ago,
And seemed to take no notice of the vexed
Look on the young man's face as he took thought
Of all the miracles the Lord had wrought,
Now to be labelled, dubbed, yclept, indexed.

Before an addled mind and puddled brow,
The feathered nation and the finny prey
Passed by; there went biped and quadruped.
Adam looked forth with bottomless dismay
Into the tragic eyes of his first cow
And shyly ventured, "Thou shalt be called 'Fred.'"

by Anthony Hecht

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