

# **Colby Hill Ecological Project**

*The design, development, and maintenance of monitoring programs  
require commitment and long-term vision.*

*The Report of the Ecological Society of America Committee  
on the Scientific Basis for Ecosystem Management, 1996*

## **Executive Summary 1998-2001**

The Colby Hill Ecological Project is a biodiversity inventory and monitoring project on 680 acres of “forever wild” conserved lands on the lower western slope of the Green Mountains in Lincoln and Bristol, Vermont. Initial inventories of landscape ecosystems, vascular flora, amphibians, reptiles, forest birds, large and small mammals, surface-active invertebrates, diurnal lepidoptera and odonates began in 1998 and 1999. Local landscape ecosystems have been hierarchically classified and mapped; the local ecosystem classification has also been cross-referenced to the Vermont natural community classification. The ecosystem classification and map provide a framework for sampling and understanding relationships among the flora and fauna and the variability of the landscape.

Among the highlights of species inventory results are numerous records for rare, uncommon and conservation-priority species. Three surface-active invertebrate species new to Vermont, two of which may be undescribed spider species, have been collected, in addition to one rare and one uncommon species of surface-active invertebrates. One rare dragonfly and five uncommon dragon- and damselflies have been recorded. A special concern turtle species was found from a drainage in which the species was not previously known to occur. Ten of the breeding birds on the property are regional conservation-priority species. Four vascular plant species observed are uncommon in the state.

The site consists of three parcels known locally as the Guthrie-Bancroft, Wells, and Fred Pierce farms. Together they comprise a characteristic slice of the Green Mountain’s lower west slope (780-1,850 feet elevation) – a sizable but little studied part of the Vermont landscape. The study lands have the typical Vermont land-use history of hill farms that, except for a few of the best hay meadows, have been taken out of agricultural production; the forest has regrown as various hay, crop and pasture lands have been abandoned at different times. Light timber management and wildlife habitat management have been practiced in the woods for 4-5 decades.

The project area is on the Lincoln Anticline and is underlain by three bedrock types. The principal types are schistose greywacke of the Pinnacle formation and schist and phyllite of the Underhill formation Fairfield Pond member. A band of sandy dolomite and limestone, the Forestdale member of the Underhill formation, crosses the Guthrie-Bancroft Farm. The surficial deposits are a combination of coarse-loamy basal and ablation tills. Deep and shallow soils are present across the landscape, and soil drainage covers a broad range from somewhat excessively drained very shallow soils to very poorly drained organic soils.

The Guthrie-Bancroft Farm is the primary research area; it is the largest and most diverse parcel, with 403 acres of forest, 33 acres of meadow, a farm pond and an emergent wetland/intermittent beaver pond. Detailed landscape ecosystem maps were developed for Guthrie-Bancroft Farm by an iterative process of landscape ecosystem classification and intensive field mapping using a Trimble Pathfinder GPS and ESRI GIS programs. Currently, the other two parcels have more generalized ecosystem maps.

Twenty local landscape ecosystem types have been mapped on Guthrie-Bancroft. Landscape ecosystems are based on geology (bedrock and surficial), soils, landscape position, and vegetation. They represent geographic, ecological units that have very similar physical environments and therefore similar biota and

ecological processes also. Ecosystem types repeat across the landscape in predictable locations where the appropriate physical conditions coincide. The 20 ecosystem types represent 12 Vermont natural community types or variants; several of the ecosystem types were found to have no representative correlate in the state natural community classification. Specifically, these are narrow first-order stream riparian forests and closed-canopy seepage forests—small components of the landscape with specific hydrology and vegetation, and likely specialized animal occurrence and utilization as well. Northern hardwood forest, red spruce-northern hardwood forest, rich northern hardwood forest, and red oak-northern hardwood forest are the principal natural community types; small hardwood and mixed swamp forests also occur on the parcel. The other two farms have many of the same ecosystem types that occur on Guthrie-Bancroft Farm, along with some types that are not found there, including hemlock forest in a small “gorge” and an alder swamp.

Permanent forest ecosystem plots have been established at Guthrie-Bancroft Farm in three ecosystem types. Also in these ecosystems, long-term sampling protocols have been established for birds, invertebrates, small mammals and salamanders. The three ecosystems are: 1-Well drained, steeply sloping, south and west aspects, moderately shallow ablation till, fine sandy loam spodosol, beech-maple-red oak-sweet birch forest; 6-Moderately well drained, steeply to very steeply sloping, shallow to moderately deep ablation till, loam over fine sandy loam spodosol, seepy, rich northern hardwood forest; and 14-Somewhat poorly drained, gently sloping, deep basal till, stony silt loam to fine sandy loam inceptisol, red spruce-balsam fir-hemlock-yellow birch forest.

With a few exceptions, the flora of all three farms is typical of the central Green Mountains. A preliminary list of vascular plants includes 65 species of trees and shrubs and 237 herbaceous species. Four species that are uncommon in Vermont were found—large-leaved avens (*Geum macrophyllum*) (S3), blunt-leaved sandwort (*Arenaria lateriflora*, synonym *Moehringia lateriflora*) (S3), loose sedge (*Carex laxiculmis*) (S2S3), and drooping bluegrass (*Poa saltuensis*) (S2S3). Blunt-leaved sandwort is more typical of the Champlain Valley and occurs in a very moist, nutrient-rich ecosystem near outcrops of calcium-rich bedrock. Loose sedge is most frequently observed in the Champlain Valley on clay soils, but has in recent years been noticed at low- to mid-elevations in the western Green Mountains and northern Taconic Mountains. Large-leaved avens is more frequent in the northern Green Mountains and the Northeastern Highlands; it is often associated with open to moderately open areas with active groundwater seepage. Drooping bluegrass occurs in forested locations scattered throughout Vermont. An additional species of conservation interest is American chestnut (*Castanea dentata*), of which there is a single, large individual that produces occasional seedlings.

Large and meso-mammal habitat assessment discovered abundant sign of bear, moose, deer, fisher, bobcat, coyote, red fox, beaver and porcupine. Bear feeding and babysitter trees occur in a number of locations throughout the three parcels. Moose barking is abundant in locations where red maple and striped maple saplings occur. Buck rubs and deer winter habitat were noted. One fisher den was discovered. An abundance of soft mast—old apple trees, hawthorn, shadbush, and viburnum—grows throughout the lands, and hard mast—beechnuts and acorns—is available in several areas. The diversity of forest and wetland ecosystem types, along with the varying successional status of regrowing forests and old and maintained fields, provides varied habitat for these animals, as well as smaller mammals such as snowshoe hare and red and gray squirrels.

Small mammals have been sampled on all three parcels, but most intensively at Guthrie-Bancroft, where ten ecosystem types were sampled in 2000 and an additional three were sampled in 2001. In accordance with a long-term sampling strategy for both small mammals and surface-active invertebrates, small mammal trapping transects have been established in three ecosystem types. Eight species of rodents and three species of shrews have been trapped at Guthrie-Bancroft, none of which are considered rare or uncommon in Vermont. The most commonly trapped rodents were mice of the genus *Peromyscus*; approximately 70% of the salivary amylase-tested individuals were deer mice (*Peromyscus maniculatus*)

and 30% were white-footed mice (*P. leucopus*). Second most common was southern red-backed vole (*Clethrionomys gapperi*), followed by northern short-tailed shrew (*Blarina brevicauda*) and woodland jumping mouse (*Napaeozapus insignis*). Comparisons by ecosystem type will be made as multiple-year data become available. To date, one species of bat, northern long-eared bat (*Myotis septentrionalis*), was documented by netting on the parcel. Other bat species are very likely present; the sampling effort will continue in 2002.

Surface-active invertebrates have been sampled by pitfall trapping and litter collection in three ecosystem types, the same as those in which long-term small mammal traplines have been established. All adult invertebrate specimens collected were identified to the family level and three focal groups—spiders, ground beetles and ants—were further identified to the species level. After two years of sampling, 104 families have been documented. Focal group identifications have documented 33 species of spiders, 21 species of ground beetles, and 5 species of ants. Between-ecosystem (*beta*) diversity analyses suggest that each of the three ecosystems makes an essentially equivalent contribution to the overall family richness of the site. The terrestrial invertebrate researchers have made some exciting discoveries including species not previously known to occur in Vermont; it is interesting to note that all rare and uncommon species identified were collected in the seepy, rich northern hardwood forest ecosystem. Spiders of the genera *Bathyphanes* and *Ceraticelus* that were collected may represent undescribed species. The flightless carrion beetle, *Necrophilus pettitii*, had not previously been collected north of southern New York State. In addition to these rarities, a ground beetle uncommon in Vermont, *Pterostichus lachrymosus*, and a rarely collected arachnid, *Crosbycus dasyncnemus* (Ceratolasmatidae), were trapped in the seepy, rich northern hardwood forest; the ground beetle *P. lachrymosus* was also trapped in somewhat poorly drained mixed coniferous-deciduous forest.

Amphibians and reptiles have been sampled by an initial reconnaissance-level inventory and subsequent, more detailed site-specific work. The initial inventory documented six species of salamanders—eastern red-backed (*Plethodon cinereus*), northern two-lined (*Eurycea bislineata*), spotted (*Ambystoma maculatum*), northern dusky (*Desmognathus fuscus*), spring (*Gyrinophilus porphyriticus*) and eastern newt (*Notophthalmus viridescens*). Five frog species were observed—wood (*Rana sylvatica*), green (*R. clamitans*), spring peeper (*Pseudacris crucifer*), gray treefrog (*Hyla versicolor*) and American toad (*Bufo americanus*). Reptiles observed during the initial inventory were common gartersnake (*Thamnophis sirtalis*) and milksnake (*Lampropeltis triangulum*). Two additional species, wood turtle (*Clemmys insculpta*), a special concern species in Vermont, and red-bellied snake (*Storeria occipitomaculata*) were later documented at Guthrie-Bancroft Farm. In 1999, annual egg-mass counts were begun in four man-made ponds to monitor spotted salamander and wood frog, two species that deposit conspicuous egg-masses. Data from these locations will be analyzed along with data from other Vermont sites in the Green Mountains. Additional salamander monitoring has been initiated with the installation of cover-board arrays, which provide shelter primarily for eastern red-backed salamander. The salamander cover-board sample sites are in seepy, rich northern hardwood forest and moderately well drained northern hardwood forest. A separate array of slate snake covers has been installed in an experimental effort to monitor snake populations; these are located along the margin of a hay meadow near moderately well drained, slightly enriched sugar maple-white ash northern hardwood forest and well to somewhat excessively drained, bedrock knoll, rich northern hardwood forest.

A forest bird monitoring transect has been established on Guthrie-Bancroft Farm as part of a statewide program administered by Vermont Institute of Natural Science. The transect crosses through four types of northern hardwood forest. The bulk of the transect is in seepy, moderately well to well drained, rich northern hardwood forest; listening stations also occur in moderately well drained northern hardwood forest; well drained northern hardwood forest; and well drained red oak-northern hardwood forest. To date, data have been collected for four consecutive years. Thirty-four species have been observed during transect sampling, with an additional 22 species noted in other areas of the property. Ten of the 34 species are conservation-priority species per Partners In Flight regional bird conservation plans. The top three

most abundant birds are all conservation priorities—red-eyed vireo, ovenbird, and yellow-bellied sapsucker. Within the top ten most abundant, there are an additional two priority species—blue-headed vireo and veery. Two exotic species, the European starling and the midwestern U.S. species, brown-headed cowbird, occur on the property, but not in the forest bird transect.

Odonate inventory has been conducted throughout all three parcels since 1999. Sampling is conducted via random walks that span the growing season. In the first two years of data collection, 36 species of dragonflies and damselflies were observed. In the second year, 11 species not reported in the initial year were observed, and four species seen the first year were not observed. Five of the observed species—spotted spreadwing (*Lestes congener*), crimson-ringed whiteface (*Leucorrhinia glacialis*), red-waisted whiteface (*L. proxima*), ski-tailed emerald (*Somatochlora elongata*), and band-winged meadowhawk (*Sympetrum semicinctum*)—are considered uncommon (S3) in Vermont, and one, black-tipped darner (*Aeshna tuberculifera*), is ranked as rare (S2), but may be more common statewide than initially thought. A farm pond at Guthrie-Bancroft is used as a site for studies of odonate diurnal activity and behavior.

Butterfly sampling has been carried out simultaneously with odonate surveys. Forty species have been observed in the first two years. All species seen the first year, plus three additional species, were observed the second year. No rare or uncommon species have been recorded.

The Colby Hill Ecological Project is intended to be a baseline site for biodiversity monitoring. It is expected that, in conjunction with other such sites in different landscapes across the region, the body of data will yield important information about the ecosystems and organisms of northern New England. The information will help all natural resource professionals and landowners make land-management decisions based on scientific information.

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