APPENDIXES

APPENDIX A: Vermont Geography and Ecology

Vermont's environment has undergone major changes since European settlement began in the mid-1700s. The primeval forests were composed primarily of sugar maple, beech, birch, and hemlock, interspersed with other hardwoods and spruce. Oak and chestnut were prominent forest trees in the larger river valleys, particularly in the southern and western parts of the state. The sandy soil of the Champlain Valley supported forests of white, pitch, and red pine. White pine was also found in regenerating fire clearings. Openings in the original forest included marshes, beaver meadows, bogs, alpine mountain summits, and clearings created by the native Abenaki peoples. These open areas probably accounted for no more than 5% of the land in Vermont at the time of European settlement (Harper 1918). The higher elevations were dominated by forests of spruce, hemlock, and fir.

The first European settlers arrived in Vermont from the south, primarily along the Connecticut River and other waterways. As they arrived, settlers cleared the land for farms and villages. The wood from the forests was used for homes, tools, and fuel, or exported or burned. Most people were engaged in agriculture, and, as a result of their activities, hillsides became pastures for cattle and sheep, and valley bottoms became hay and grainfields. By the time Vermont became a state in 1791, the population had reached 85,000; by 1810, it had grown to 218,000 (Johnson 1980). By the 1880s, forests covered only about 35% of the state. The ridge of the Green Mountains and most of Essex County were the only areas in Vermont that remained unsettled (Harper 1918). By this time, large numbers of farms had been or were in the process of being abandoned—rocky soil and poor farming practices had led to impoverished soil and extensive erosion, and new, fertile land was available in the West. White pine invaded the abandoned fields and quickly formed dense stands. By the time the pines were clear-cut near the end of the 1800s, shade-tolerant trees such as sugar maple and American beech had established themselves in the understory; Vermont's present hardwood forest developed from these saplings and from seedlings left behind by the loggers. Currently, in an almost complete reversal, most of Vermont is covered by second-growth forest, and only 25% of the land is cleared (Johnson 1980).

Vermont has a highly varied landscape and encompasses an impressive array of habitats within a relatively small area. The state is 416.8 km (259 mi) long and 138.4 km (86 mi) wide at its widest point, with an area of 24,887 sq km (9,609 sq mi). It encompasses farmland, forests, and alpine mountaintops, and ranges from the rocky islands of Lake Champlain to the boreal forest of the Northeast Kingdom (as the northeast corner of the state is called). For further information, the reader is referred to *The Nature of Vermont* (Johnson 1980), *A Guide to New England's Landscape* (Jorgensen 1971), *The Geographic Regions of Vermont* (Meeks 1975), *The White-tailed Deer Resource of Vermont* (Dickinson and Garland 1974), and *A Guide to Bird Finding in Vermont* (Ellison 1981).

The physiographic regions used by the Atlas Project and in this book are based, with some variations, on those developed by the Vermont Fish and Game Department in their studies of the deer herd in Vermont. These physiographic regions are based on geology, topographical features, soil types, and vegetative cover (Dickenson and Garland 1974; Garland 1977).

The *Green Mountains*, the dominant physical feature of Vermont—form a long narrow strip bisecting the state from Canada to Massachusetts. Mt. Mansfield, 1,339 m (4,393 ft) and many of the state's highest mountains are in this range. The western boundary of the region is fairly well defined, but the mountains gradually merge with the hills to the east. The high elevation of the region gives it

the greatest annual rain and snowfall as well as a cool climate. The southern third of the region consists of a broad upland plateau, while to the north of Sherburne the Green Mountains divide into three parallel ranges. Much of the region is covered with northern hardwood forest, dominated by sugar maple, American beech, yellow birch, and eastern hemlock. As elevation increases, these trees are replaced by red spruce, white birch, and balsam fir. The spruce-fir forest becomes stunted at high elevations, and two of Vermont's mountains (Mansfield and Camels Hump) support small areas of alpine tundra. Forestry practices and the expansion of several ski areas in the region, accompanied by second-home development, will inevitably have some impact on the region's birdlife in the future.

The *North Central* and *East Central* regions, and *Eastern Foothills* have been treated as a single physiographic region by many geographers. For the Atlas Project they are divided because of latitudinal climatic differences and slight differences in topography and land use. All three are characterized by hills and valleys, forests and farms. Northern hardwood is the dominant forest type, although pockets of spruce-fir forest are common in the North and East Central regions, and oaks are an important forest component along the Connecticut River, especially in Windham and Windsor counties. The milder climate along the Connecticut River provides a corridor for range expansion by traditionally southern birds. Small lakes and beaver ponds are important water habitats in the two northern regions; small wetlands along backwaters of the Connecticut River influence the distribution of certain waterbirds in the Eastern Foothills. The area around Lake Memphremagog, in the North Central region, has characteristics similar to the Champlain Lowlands; there are delta marshes on Lake Memphremagog, and the flatter topography creates a landscape in which agriculture is very important. Farming has become marginal in parts of the other regions, and open habitats may become scarce during the next several decades.

The *Taconic Mountains* are generally not as high as the Green Mountains, although several peaks in the Vermont part of the range exceed 914 m (3,000 ft), and two, Equinox and Dorset, exceed 1,128 m (3,700 ft). This region is sometimes also referred to as the Western Foothills. The highest ridges support spruce-fir forest, while most slopes are covered with northern hardwoods. The climate of the Taconics is warmer than that of the Green Mountains; here oaks, and in some places hickories, are an important forest component. The range is cut by several rivers whose flat valleys provide agricultural land. The eastern edge of the Taconic Mountains is the geographically distinct Valley of Vermont, a narrow, low valley extending from the Pownal-Bennington area north to the Champlain Lowlands. Its lower elevation acts as a corridor for several bird species that are excluded from cooler, mountainous areas.

The *Champlain Lowlands* have a flat or gently rolling landscape, calcareous bedrock, and deep soils. Much of the region is open agricultural land, with fields, pastures, orchards, and scattered small woodlots. More extensive wooded tracts are found on the steeper hills and on swampy land along rivers and the lakeshore. Upland forests in the Champlain Lowlands are mainly northern hardwoods, with northern red and white oaks and shagbark hickory replacing hemlock and yellow birch. White pine is also common. Silver maple, swamp white oak, and cottonwood predominate in the swamp forests. A few isolated northern white cedar and black spruce wetlands affect the distribution of certain birds with northern affinities. The most extensive cattail marshes in Vermont are located in this region; they are, indeed, some of the finest inland marshes in the eastern United States. The rain shadow created by the Adirondack Mountains to the west make this the driest region in Vermont. Its low elevation and the ameliorating effect of Lake Champlain make it the warmest as well. Since the 1960s, the area around Burlington has experienced rapid growth, with extensive suburban development and consequent changes in habitat.

The *Northeast Highlands* are the Vermont portion of the granitic dome system centered in the White Mountains of New Hampshire. The region's mountains are significantly higher than those in the adjacent North and East Central regions, with eight named peaks over 914 m (3,000 ft) high. The region's acidic soils and cool climate support extensive stands of boreal forest dominated by balsam fir and red spruce, and replaced by black spruce in wet forests. The boreal forest provides habitat for northern birds either not found or very rare in other regions of Vermont. Northern hardwood forests grow at middle elevations and near the Connecticut River. Clear-cutting is a widely used logging technique in the region, creating habitat for birds of edge and second growth, while reducing habitat available for boreal forest species.

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APPENDIX B: Plants Cited in the Text

alder *Alnus rugosa/serrulata/crispa*
alfalfa *Medicago sativa*
apple *Pyrus malus*
ash *Fraxinus* spp.
aspen *Populus tremuloides/grandidentata*

bee-balm *Monarda didyma*
beech, American *Fagus grandifolia*
birch *Betula papyrifera/lutea/lenta*/etc.
  white *B. papyrifera*
  yellow *B. lutea*
blackberry *Rubus allegheniensis*/etc.
blueberry *Vaccinium* spp.
box elder *Acer negundo*
butternut *Juglans cineria*
buttonbush *Cephalanthus occidentalis*

cattail *Typha latifolia/angustifolia*
cedar *Thuja occidentalis/Juniperus virginiana*
  red *J. virginiana*
  white (northern white) *T. occidentalis*
cherry *Prunus pensylvanica/serotina/virginiana*/etc.
  black *P. serotina*
  pin *P. pensylvanica*
chestnut *Castanea dentata*
clover *Trifolium pratense/repens/arvense/hybridum*/etc.
corn *Zea mays*
cottonwood, eastern *Populus deltoides*
crabapple *Pyrus prunifolia/baccata/* etc.
(bald) cypress *Taxodium distichum*

dogbane *Apocynum* spp.
dogwood *Cornus stolonifera/obliqua/racemosa/amomum*/etc.

elm, *Ulmus americana/rubra*
  American *U. americana*

fern Osmundaceae/Polypodiaceae
fir, balsam *Abies balsamea*
fireweed *Epilobium angustifolium*
fungus, Dutch elm disease *Ceratocystis ulmi*
  heart rot *Spongipellis pachyodon*
  hoof or tinder *Fomes igniarius*

grape *Vitis* spp.
grass Gramineae
  reed Canary *Phalaris arundinacea*

hardhack *Spiraea tomentosa*
hawthorn *Crataegus* spp.
heath Ericaceae
hemlock, eastern *Tsuga canadensis*
hickory *Carya cordiformis/ovata*/etc.
  shagbark *C. ovata*
hobblebush *Viburnum alnifolium*
holly *Ilex* spp.
honeysuckle *Lonicera tatarica*

jewelweed *Impatiens capensis*
juniper *Juniperus communis*

larch *Larix* spp.
(mountain) laurel *Kalmia latifolia*
leatherleaf *Chamaedaphne calyculata*
lichen Ascomycetes: Lecanorales
  (used in nest decoration: *Parmelia* spp.)
  old-man's-beard *Usnea* spp.
lilac *Syringa vulgaris*
linden *Tilia americana*