BIBLIOGRAPHICAL ESSAY

Because this book has relied so heavily on materials drawn not only from primary documents but also from disciplines whose practitioners are not usually familiar with each other's work, I have tried in this essay to construct a brief guide for those who may wish to pursue further the issues I have discussed. My purpose is to indicate the sources which I myself found most useful, and to suggest the most likely routes of access for those trying to do ecological history in other places and other periods. I have discussed here only the most important materials I have used; readers interested in the details of specific arguments should consult the endnotes.

Primary Documents

Colonial descriptions of the New England landscape break into two broad groups: those written before about 1675, and those written after about 1740. There are surprisingly few materials available of a broadly descriptive nature for the intervening sixty-five years. The most important early accounts, with which any evaluation of colonial ecology must inevitably begin, are William Wood, *New England's Prospect* (1634), Alden T. Vaughan, ed., Amherst, 1977; Thomas Morton, *New English Canaan* (1632), Charles F. Adams, ed., Boston, 1883, which is especially good on Indian interactions with the environment; and John Josselyn's two books, *New-Englands Rarities Discovered* (1672), Edward Tuckerman, ed., *Transactions and Collections of the American Antiquarian*

Society, 4 (1860), pp. 105-238, and *An Account of Two Voyages to New-England* (1675), in *Massachusetts Historical Society Collections*, 3rd ser., 3 (1833), pp. 211-354. Though Josselyn's skills as a naturalist are not entirely reliable, his are among the most thorough seventeenth-century efforts at cataloguing New England plant and animal species.

Even richer than these southern New England sources are the writings of French explorers and missionaries in Nova Scotia, a region whose ecology is similar to that of northern New England. See Pierre Biard's *Relation* (1616) in Reuben Gold Thwaites, ed., *Jesuit Relations, III, Acadia*, Cleveland, 1897; Nicolas Denys, *The Description and Natural History of the Coasts of North America (Acadia)* (1672), William F. Ganong, ed., Toronto, 1908; Chrestien Le Clercq, *New Relation of Gaspesia* (1691), William F. Ganong, ed., Toronto, 1910; and Marc Lescarbot, *The History of New France* (1618), William L. Grant, ed., 3 vols., Toronto, 1907-14. All these works contain extensive details about northern Indian life. Important discussions of the New England coast and its Indian inhabitants prior to European settlement are contained in the earliest explorers' accounts, among which the most important are L. C. Wroth, ed., *The Voyages of Giovanni de Verrazzano, 1524-1528*, New Haven, 1970; H. P. Biggar, ed., *The Works of Samuel de Champlain*, 6 vols., Toronto, 1922-36; Henry S. Burrage, ed., *Early English and French Voyages*, New York, 1906; and Edward Arber, ed., *Travels and Works of Captain John Smith*, Edinburgh, 1910. General secondary reviews of this literature include David B. Quinn, *North America from Earliest Discovery to First Settlements*, New York, 1977; Samuel Eliot Morison, *The European Discovery of America: The Northern Voyages*, New York, 1971; Carl O. Sauer, *Sixteenth-Century North America*, Berkeley, 1971; and Douglas R. McManis, *European Impressions of the New England Coast, 1497-1620*, University of Chicago Geography Department Research Paper No. 139, 1972. One of the best collections of reproductions of early maps is Charles O. Paullin, *Atlas of the Historical Geography of the United States*, Baltimore, 1932.

Documents which speak directly to the settlement of especially southern New England include the two key histories written during the first half of the seventeenth century: William Bradford, *Of Plymouth Plantation*, Samuel Eliot Morison, ed., New York, 1952; and John Winthrop, *Winthrop's Journal*, James K. Hosmer, ed., New York, 1908, both of which give extensive detail

about all aspects of early colonial life. Less polished but sometimes at least as suggestive from an ecological point of view is Edward Johnson, *Wonder-Working Providence* (1654), J. Franklin Jameson, ed., New York, 1910. See also the much briefer Francis Higginson, *New-Englands Plantation* (1630), *Massachusetts Historical Society Proceedings*, 62 (1929), pp. 305-21. Documents which supplement these works are conveniently available in Alexander Young, ed., *Chronicles of the Pilgrim Fathers*, Boston, 1841; and Young, ed., *Chronicles of the First Planters of the Colony of Massachusetts Bay*, Boston, 1846. More recent collections of early letters concerning the first settlements are Sydney V. James, Jr., ed., *Three Visitors to Early Plymouth*, Plimoth Plantation, 1963; and Everett Emerson, ed., *Letters from New England*, Amherst, 1976. Samuel Maverick's "A Briefe Discription of New England," *Massachusetts Historical Society Proceedings*, 2nd ser., 1 (1884-5), pp. 231-49, is a valuable account of the New England settlements as they existed in about 1660. Key documents exemplifying the ideology which informed English settlement are the anonymous "Essay on the Ordering of Towns," *Winthrop Papers*, III, 1943, pp. 181-5; and the "Arguments for the Plantation of New England" (sometimes known as "Winthrop's Conclusions"), in the *Winthrop Papers*, II, 1931, pp. 106-49. Those who wish to reconstruct the patterns of English agricultural practice would do well to study Stanley H. Miner and George D. Stanton, eds., *The Diary of Thomas Minor, 1653-1684*, New London, CT, 1899; and *The Diary of Manasseh Minor, 1696-1720*, 1915. John Winthrop, Jr.'s essay on "The Culture and Use of Maize" (1678), reprinted by Fulmer Mood as "John Winthrop, Jr., On Indian Corn," *New England Quarterly*, 10 (1937), pp. 121-33, is a systematic account of maize agriculture as practiced by both Indians and colonists. As regards southern New England Indians, no book is more important than Roger Williams, *A Key into the Language of America* (1643), John J. Teunissen and Evelyn J. Hinz, eds., Detroit, 1973. This should be supplemented by *The Letters of Roger Williams*, John R. Bartlett, ed., Providence, 1874. Also extremely valuable is Daniel Gookin, "Historical Collections of the Indians in New England," *Massachusetts Historical Society Collections*, 1st ser., 1 (1792), pp. 141-227, which was written just prior to King Philip's War.

As I note in the first chapter, legal records can reveal much about a variety of practices which affected the colonial environment. The key colony-wide collections are Nathaniel B. Shurt-

leff, ed., *Records of the Governor and Company of the Massachusetts Bay in New England,* Boston, 1853; Shurtleff, ed., *Records of the Colony of New Plymouth,* Boston, 1855; Charles J. Hoadly, ed., *The Public Records of the Colony of Connecticut,* Hartford, 1850-90; John R. Bartlett, ed., *Records of the Colony of Rhode Island and Providence Plantation,* Providence, 1856; and Charles J. Hoadly, ed., *Records of the Colony or Jurisdiction of New Haven,* Hartford, 1858. Town records should be examined as well, but are too numerous to be listed here; the best bibliography I know which lists published town records is in Edward M. Cook, Jr., *The Fathers of the Towns,* Baltimore, 1976, pp. 237-65. Researchers should also note the helpful topical compilations of colonial laws in *Laws of the Colonial and State Governments Relating to the Indians and Indian Affairs,* Washington, 1832; and J. P. Kinney, "Forest Legislation in America Prior to March 4, 1789," *Cornell University Agricultural Experiment Station Bulletin,* 370 (1916), pp. 357-405.

Not until the late eighteenth century do we get extensive writings by American observers who describe the ecological changes going on around them. By far the most valuable of these is Timothy Dwight's *Travels in New England and New York* (1821), 4 vols., Barbara Miller Solomon, ed., Cambridge, MA, 1969; anyone interested in New England ecology could do no better than to read Dwight from cover to cover. Also very important are Peter Kalm's *Travels in North America* (1753-61, 1770), Adolph B. Benson, ed., 2 vols., New York, 1964, which although it deals with the mid-Atlantic colonies has very shrewd observations that can often be generalized to New England; Peter Whitney, *A History of the County of Worcester,* Worcester, 1793, which has extensive notes on the topography of the county's towns; and Jeremy Belknap's superb third volume to his *History of New Hampshire,* Dover, NH, 1812. A number of European travelers' accounts contain suggestive fragments about the New England environment; for references to these, readers should see my notes. On agriculture in the second half of the eighteenth century, three books stand out: Jared Eliot, *Essays upon Field Husbandry in New England and Other Papers, 1748-1762,* Harry J. Carman and Rexford G. Tugwell, eds., New York, 1934; Harry J. Carman, ed., *American Husbandry* (1775), New York, 1939; and Samuel Deane, *The New-England Farmer,* Worcester, MA, 1790. General James Warren's "Observations on Agriculture," *American Museum,* 2:4 (October 1787), pp. 344-8, is also well worth examining for its comparison of British and American agriculture. Finally, a unique document by a southern New England Indian is the "Extract from an Indian History," *Massachusetts Historical Society Collections,* 1st ser., 9 (1804), pp. 99-102.

Ecological Literature

Few of the sources listed above, obviously, adopt an explicitly ecological perspective on the places and economic practices they describe. (Readers wishing to investigate the state of colonial science and natural history might begin by consulting George Browne Goode, "The Beginnings of Natural History in America," *Proceedings of the Biological Society of Washington,* 3 [1886], pp. 35-105; Henry Savage, *Lost Heritage,* New York, 1970; W. M. and Mabel Smallwood, *Natural History and the American Mind,* New York, 1941; and Raymond P. Stearns, *Science in the British Colonies of America,* Urbana, 1970.) The best way for a modern historian to bring such a perspective to the documents is to get out and walk the landscape: no amount of library work can replace the field experience gained by exploring different habitats as they exist today. Even though such habitats are usually altered from their earlier conditions, learning to perceive ecological relationships within them is essential if a historian is to try to reconstruct past environments. A variety of field guides are available to help non-ecologists gain access to different plant and animal communities; it is to these that readers should turn if they are confused by my use of different species names in the body of the text. Two guides by Neil Jorgensen are superb on the overall ecology of New England: *A Sierra Club Naturalist's Guide to Southern New England,* San Francisco, 1978; and *A Guide to New England's Landscape,* Chester, CT, 1977. Equally good on coastal habitats is Michael and Deborah Berrill's *A Sierra Club Naturalist's Guide to the North Atlantic Coast,* San Francisco, 1981. On tree species, which any would-be ecological historian would do well to know, Elbert L. Little's *The Audubon Society Field Guide to North American Trees: Eastern Region,* New York, 1980, is beautifully illustrated and easy to use; George A. Petrides, *A Field Guide to Trees and Shrubs,* 2nd ed., Boston, 1972, in the Peterson series, includes shrubs and is

thus more complete, but its taxonomic keys may be harder for the inexperienced to use. Other field guides to flowering plants, birds, mammals, insects, and so on, are widely available in the Peterson, Golden, and Audubon series; readers should judge for themselves which of these will work best for them.

There are an increasing number of good textbooks on modern ecological theory. The standard volume for many years has been Eugene P. Odum's *Fundamentals of Ecology*, 3rd ed., Philadelphia, 1971, which is well written and encyclopedic, though now somewhat dated. Robert L. Smith, *Ecology and Field Biology*, 3rd ed., New York, 1980, has a more habitat-oriented approach that may make it more accessible to lay readers. Two older texts that are still excellent as brief introductions to the field are Eugene P. Odum, *Ecology*, New York, 1963; and Edward J. Kormondy, *Concepts of Ecology*, Englewood Cliffs, NJ, 1969. Texts which incorporate important recent developments from animal population studies include Robert E. Ricklefs, *Ecology*, 2nd ed., New York, 1979; Paul A. Colinvaux, *Introduction to Ecology*, New York, 1973; J. Merritt Emlen, *Ecology: An Evolutionary Approach*, Menlo Park, 1973; Charles J. Krebs, *Ecology: The Experimental Analysis of Distribution and Abundance*, New York, 1972; Boyd D. Collier, *et al.*, *Dynamic Ecology*, Englewood Cliffs, NJ, 1973; and G. Evelyn Hutchinson, *An Introduction to Population Ecology*, New Haven, 1978. A text which emphasizes human alteration of natural ecosystems in a wide-ranging (if sometimes polemical) fashion is Paul R. Ehrlich, *et al.*, *Ecoscience*, San Francisco, 1977; historians may find it particularly suggestive. More specialized discussions which I found helpful in constructing my own analysis were Stephen H. Spurr and Burton V. Barnes, *Forest Ecology*, 2nd ed., New York, 1973; Joseph Kittredge, *Forest Influences*, New York, 1948; and Richard Lee, *Forest Hydrology*, New York, 1980. Much of my understanding of forest nutrient export comes from the Hubbard Brook studies described by F. Herbert Bormann and Gene E. Likens in *Pattern and Process in a Forested Ecosystem*, New York, 1979. See also their more accessible "Catastrophic Disturbance and the Steady State in Northern Hardwood Forests," *American Scientist*, 67 (1979), pp. 660-9; and Bormann, *et al.*, "The Export of Nutrients and Recovery of Stable Conditions Following Deforestation at Hubbard Brook," *Ecological Monographs*, 44 (1974), pp. 255-77. On wildlife populations, see the excellent popu-

lar history by Peter Matthiessen, *Wildlife in America*, New York, 1959; A. W. Schorger, *The Passenger Pigeon*, Madison, 1955; and Schorger, *The Wild Turkey*, Norman, OK, 1966. Good general introductions to the techniques used in reconstructing past environments are Karl W. Butzer, *Environment and Archeology*, 2nd ed., Chicago, 1971; Butzer, *Archaeology as Human Ecology*, Cambridge, England, 1982; and John G. Evans, *An Introduction to Environmental Archaeology*, Ithaca, 1978. Historians interested in the intellectual history of ecology as a science should consult Donald Worster, *Nature's Economy*, San Francisco, 1977; and Ronald C. Tobey, *Saving the Prairies: The Life Cycle of the Founding School of American Plant Ecology, 1895-1955*, Berkeley, 1981. Those who wish to keep track of current literature in the field should at a minimum consult the journals *Ecology*, *Ecological Monographs*, and the *Annual Review of Ecology and Systematics*.

Those seeking good general accounts of New England ecosystems might begin with Betty Flanders Thomson's accessible and delightfully written *The Changing Face of New England*, Boston, 1958; an equally competent popular account of salt marsh ecology is John and Mildred Teal, *Life and Death of the Salt Marsh*, New York, 1969. Briefer but more technical descriptions are Douglas S. Byers, "The Environment of the Northeast," in Frederick Johnson, ed., *Man in Northeastern North America*, Papers of the Robert S. Peabody Foundation for Archaeology, 3 (1946), pp. 3-32; and John W. Barrett, "The Northeastern Region," in Barrett, ed., *Regional Silviculture of the United States*, 2nd ed., New York, 1980, pp. 25-65. Much more technical but encyclopedic in its coverage is E. Lucy Braun, *Deciduous Forests of Eastern North America*, New York, 1950; see also H. A. Gleason, *Plants in the Vicinity of New York*, rev. ed., New York, 1962. An older and more outdated source which historians may nevertheless find useful is George B. Emerson, *A Report on the Trees and Shrubs Growing Naturally in the Forests of Massachusetts*, Boston, 1846. The maps in Howard W. Lull, *A Forest Atlas of the Northeast*, Upper Darby, PA, 1968, will be helpful to those trying to visualize regional environmental patterns.

One way ecologists have sought to gain access to precolonial vegetational communities is to examine stands of old-growth timber. There are problems in doing this: virtually no uncut forests survive today, so that all existing stands are at least "second-

growth," and even the oldest of these have potentially been modified by a variety of human activities. (Still more troubling is the question of whether or not a very old stand of timber as it exists today accurately represents the forest mosaic of different successional stages which Indians inhabited and modified.) Studies of old forests can nevertheless be quite suggestive. For examples, see G. E. Nichols, "The Vegetation of Connecticut, II, Virgin Forests," *Torreya,* 13 (1913), pp. 199-215; H. J. Lutz, "The Vegetation of Heart's Content, A Virgin Forest in Northwestern Pennsylvania," *Ecology,* 11 (1930), pp. 1-29; Hugh M. Raup, "An Old Forest in Stonington, Connecticut," *Rhodora,* 43 (1941), pp. 67-71; A. C. Cline and S. H. Spurr, "The Virgin Upland Forest of Central New England: A Study of Old Growth Stands in the Pisgah Mountain Section of Southwestern New Hampshire," *Harvard Forest Bulletin,* 21 (1942); and F. H. Bormann and M. F. Buell, "Old Age Stand of Hemlock-Northern Hardwood Forest in Central Vermont," *Bulletin of the Torrey Botanical Club,* 91 (1964), pp. 451-65. Studies which attempt more general reconstructions of associations between tree species in the forest habitats of different New England regions include G. E. Nichols, "The Hemlock-White Pine-Northern Hardwood Region of Eastern North America," *Ecology,* 16 (1935), pp. 403-22; S. H. Spurr, "Forest Association in the Harvard Forest," *Ecological Monographs,* 26 (1956), pp. 245-62; and Ronald B. Davis, "Spruce-Fir Forests of the Coast of Maine," *Ecological Monographs,* 36 (1966), pp. 79-94. H. J. Lutz, "Trends and Silvicultural Significance of Upland Forest Successions in Southern New England," *Yale University School of Forestry Bulletin,* 22 (1928), is an excellent summary not only of associations, but of successional sequences on agricultural and pastured lands. A fine paper on the structure and evolution of New England salt marshes is Alfred C. Redfield, "Development of a New England Salt Marsh," *Ecological Monographs,* 42 (1972), pp. 201-37.

Pollen studies are another method ecologists have used to reconstruct precolonial environments. A standard textbook on palynology is K. Faegri and J. Iversen, *Textbook of Pollen Analysis,* 3rd ed., Copenhagen, 1975; readers seeking a less daunting introduction might try consulting Margaret B. Davis, "Palynology and Environmental History During the Quaternary Period," *American Scientist,* 57 (1969), pp. 317-32, which uses New England examples, or her "On the Theory of Pollen Analysis," *American Journal of Science,* 261 (1963), pp. 897-912. Pollen analysis has proved to be most useful in inferring the character of long-term vegetational and climatic shifts in the postglacial period: useful syntheses of this material can be found in Margaret B. Davis, "Phytogeography and Palynology of Northeastern United States," in H. E. Wright and David G. Frey, eds., *The Quaternary of the United States,* Princeton, 1965, pp. 377-401 (an excellent article); H. E. Wright, "Late Quaternary Vegetational History of North America," in Karl K. Turekian, ed., *Late Cenozoic Glacial Ages,* New Haven, 1971, pp. 425-64, which covers most of North America; and Thompson Webb III, "The Past 11,000 Years of Vegetational Change in Eastern North America," *Bioscience,* 31 (1981), pp. 501-6, which contains an excellent series of climatic maps. (The French historian Emmanuel Le Roy Ladurie has used pollen data in conjunction with a wide variety of other sources to reconstruct European climates since A.D. 1000 in his well-known *Times of Feast, Times of Famine,* New York, 1971.) Unfortunately, the very success of American pollen scientists in analyzing climates of the relatively distant past has led them until recently to devote little attention to changes in pollen composition following the European arrival in North America. The advent of radiocarbon dating has now made studies of the post-European period more feasible. The most important of these for New England is R. B. Brugam, *The Human Disturbance History of Linsley Pond, North Branford, Connecticut,* Ph.D. Thesis, Yale University, 1975, which is summarized in part in Brugam's "Pollen Indicators of Land-Use Change in Southern Connecticut," *Quaternary Research,* 9 (1978), pp. 349-62; see also Emily W. Russell, *Vegetational Change in Northern New Jersey since 1500 A.D.: A Palynological, Vegetational, and Historical Synthesis,* Ph.D. Thesis, Rutgers University, 1979. Other studies which devote some attention to the influence of human beings on pollen and sediment deposition rates include Margaret B. Davis, "Pollen Evidence of Changing Land Use around the Shores of Lake Washington," *Northwest Science,* 47 (1973), pp. 133-48; her "Erosion Rates and Land Use History in Southern Michigan," *Environmental Conservation,* 3 (1976), pp. 139-48; and Thompson Webb III, "A Comparison of Modern and Presettlement Pollen from Southern Michigan," *Review of Palaeobotany and Palynology,* 16 (1973), pp. 137-56.

Historians will probably gain the most by reading those stud-

ies in which ecologists have tried to analyze the effects of human activity on forests and other natural communities. A brief survey of this literature can be found in Stephen Spurr's "The American Forest Since 1600," in his *Forest Ecology*, pp. 475-93. Two classic articles which must not be overlooked are Stanley W. Bromley, "The Original Forest Types of Southern New England," *Ecological Monographs*, 5 (1935), pp. 61-89; and Gordon M. Day, "The Indian as an Ecological Factor in the Northeastern Forest," *Ecology*, 34 (1953), pp. 329-46, both of which deal at length with the effects of fire on forest habitats. The literature on fire ecology is large; those seeking nontechnical introductions to it should see Charles F. Cooper, "The Ecology of Fire," *Scientific American*, 204:4 (April 1961), pp. 150-60; and D. Q. Thompson and R. H. Smith, "The Forest Primeval in the Northeast—A Great Myth?" in *Proceedings of the Annual Tall Timbers Fire Ecology Conference*, 10 (1970), pp. 255-65. Richer but more technical are Silas Little, "Effects of Fire on Temperate Forests: Northeastern United States," in T. T. Kozlowski and C. E. Ahlgren, eds., *Fire and Ecosystems*, New York, 1974, pp. 225-50; William A. Niering, *et al.*, "Prescribed Burning in Southern New England," *Proceedings of the Annual Tall Timbers Fire Ecology Conference*, 10 (1970), pp. 267-86; and all of the articles in the superb October 1973 (3:3) issue of *Quaternary Research*, especially the fine introduction by H. E. Wright and M. L. Heinselman, pp. 319-28. An excellent recent history of fire is Stephen J. Pyne, *Fire in America*, Princeton, 1982.

Several older ecological studies attempt to write the history of particular forests in New England. These include Hugh M. Raup and Reynold E. Carlson, "The History of Land Use in the Harvard Forest," *Harvard Forest Bulletin*, 20 (1941); Raup's more popular "The View from John Sanderson's Farm," *Forest History*, 10 (1966), pp. 2-11; J. Wilcox Brown, "Forest History of Mt. Moosilauke," *Appalachia*, 24 (1958), pp. 23-32, 221-33; H. I. Winer, *History of the Great Mountain Forest, Litchfield County, Connecticut*, Ph.D. Thesis, Yale University, 1955; and J. G. Ogden, "Forest History of Martha's Vineyard: I. Modern and Pre-Colonial Forests," *American Midland Naturalist*, 66 (1961), pp. 417-30. Three more recent studies which make fascinating use of the decaying plant materials in forest floors to reconstruct stand histories are C. D. Chadwick and E. P. Stephens, "Reconstruction of a Mixed-Species Forest in Central New England," *Ecology*, 58 (1977), pp. 562-72; J. D. Henry and J. M. A. Swan, "Reconstructing Forest History from Live and Dead Plant Material," *Ecology*, 55 (1974), pp. 772-83; and Rebecca Ellen Bormann, *Agricultural Disturbance and Forest Recovery at Mt. Cilley*, Ph.D. Thesis, Yale University, 1982. Ecologists have long been using the federal land survey records to map out precolonial vegetation patterns, but of course such data are available only in northern New England; the only New England studies to make use of such records are Thomas G. Siccama, "Presettlement and Present Forest Vegetation in Northern Vermont with Special Reference to Chittenden County," *American Midland Naturalist*, 85 (1971), pp. 153-72; and Craig G. Lorimer, "The Presettlement Forest and Natural Disturbance Cycle of Northeastern Maine," *Ecology*, 58 (1977), pp. 139-48. Historians working in the trans-Appalachian West should be aware that a large literature exists using land survey data, and might at least familiarize themselves with these techniques by reading E. A. Bourdo's classic "A Review of the General Land Office Survey and of Its Use in Quantitative Studies of Former Forests," *Ecology*, 37 (1956), pp. 754-68.

Finally, a handful of non-New England case studies, written principally by historians and geographers, should be mentioned as potential models for future efforts at writing ecological history. An extremely rich volume containing examples from around the world should be among the first books consulted by anyone interested in this subject: William L. Thomas, ed., *Man's Role in Changing the Face of the Earth*, Chicago, 1956. A more recent volume that is similarly comprehensive is Andrew Goudie, *The Human Impact: Man's Role in Environmental Change*, Cambridge, MA, 1981. Also worth consulting are George Perkins Marsh's classic *Man and Nature* (1864), David Lowenthal, ed., Cambridge, MA, 1965; and Lucien Febvre, *A Geographical Introduction to History*, New York, 1925. Nearly all the writings of Carl O. Sauer are valuable, but probably the most important are *The Early Spanish Main*, Berkeley, 1966; and the two collections of essays, *Land and Life*, Berkeley, 1963; and its companion, the misleadingly titled *Selected Essays, 1963-1975*, Berkeley, 1981. A contemporary of Sauer's whose work has been undeservedly neglected is James C. Malin; see his *Winter Wheat in the Golden Belt of Kansas*, Lawrence, KS, 1944; and *The Grassland of North America*, Lawrence, KS, 1947. Four historians have recently written works which make significant contribu-

tions to ecological history. Alfred W. Crosby's *The Columbian Exchange: Biological and Cultural Consequences of 1492*, Westport, CT, 1972, is a thorough analysis of the exchange of species between the Old World and the New, with particular emphasis on diseases. Readers can get a quick introduction to his approach in his "Ecological Imperialism: The Overseas Migration of Western Europeans as a Biological Phenomenon," *Texas Quarterly*, 80 (1978), pp. 10-22. William H. McNeill has pursued a similar thesis on a global scale, analyzing the movement of disease organisms among human communities around the world: see his *Plagues and Peoples*, New York, 1976; and *The Human Condition*, Princeton, 1980. E. L. Jones has sought to explain the development of modern Europe by using concepts drawn from ecological population theory in his *The European Miracle*, Cambridge, England, 1981; American readers will also be interested in his "Creative Disruptions in American Agriculture, 1620-1820," *Agricultural History*, 48 (1974), pp. 510-28. Calvin Martin has offered an ecological interpretation of North American Indian life in his *Keepers of the Game*, Berkeley, 1978; in addition to the criticisms of it I offer in my text, readers should consult Shepard Krech III, ed., *Indians, Animals and the Fur Trade: A Critique of Keepers of the Game*, Athens, GA, 1981. Six works which choose smaller geographical units of analysis for their histories of ecological change are Andrew Hill Clark, *The Invasion of New Zealand by People, Plants and Animals*, New Brunswick, NJ, 1949; David Watts, "Man's Influence on the Vegetation of Barbados, 1627-1800," *University of Hull Occasional Papers in Geography*, 4 (1966); John W. Bennett, *Northern Plainsmen*, Chicago, 1969; Donald Worster, *Dust Bowl*, New York, 1980; Richard White, *Land Use, Environment, and Social Change: The Shaping of Island County, Washington*, Seattle, 1980; and William L. Preston, *Vanishing Landscapes: Land and Life in the Tulare Lake Basin*, Berkeley, 1981. White's book in particular seems to me a model for future work in this field. There is a large body of literature written by European historians which bears on the problem of doing ecological history, but I cannot survey it here.

Ecological and Economic Anthropology

Anthropologists have engaged in extensive discussions of how ecological theory should be incorporated into the study of human

populations. The literature here is quite large, but non-anthropologists can survey it in one of four recent textbooks: John W. Bennett's theoretical essay, *The Ecological Transition: Cultural Anthropology and Human Adaptation*, New York, 1976; Robert McC. Netting's brief examination of case studies in *Cultural Ecology*, Menlo Park, 1977; Donald Hardesty's general survey text, *Ecological Anthropology*, New York, 1977; and Emilio Moran, *Human Adaptability: An Introduction to Ecological Anthropology*, North Scituate, 1979. Hardesty in particular has an extensive bibliography. Those who wish a more technical review of the literature can turn to any of a number of bibliographical essays that have appeared in the last two decades. The most extensive is probably James N. Anderson, "Ecological Anthropology and Anthropological Ecology," in John J. Honigmann, ed., *Handbook of Social and Cultural Anthropology*, Chicago, 1973, pp. 179-239, although this is now quite dated. More recent are Robert McC. Netting, "Agrarian Ecology," *Annual Review of Anthropology*, 3 (1974), pp. 21-56; Andrew P. Vayda and Bonnie J. McCay, "New Directions in Ecology and Ecological Anthropology," *Annual Review of Anthropology*, 4 (1975), pp. 293-306; and Benjamin S. Orlove, "Ecological Anthropology," *Annual Review of Anthropology*, 9 (1980), pp. 235-73. Older essays that are still worth examining include Marston Bates, "Human Ecology," in A. L. Kroeber, ed., *Anthropology Today*, Chicago, 1953, pp. 700-13; Julian Steward's seminal *Theory of Culture Change*, Urbana, 1955, esp. pp. 30-42; June Helm, "The Ecological Approach in Anthropology," *American Journal of Sociology*, 67 (1962), pp. 630-9; Marshall D. Sahlins, "Culture and Environment: The Study of Cultural Ecology," in Robert A. Manners and Donald Kaplan, eds., *Theory in Anthropology*, Chicago, 1968, pp. 367-73; Andrew P. Vayda and Roy A. Rappaport, "Ecology, Cultural and Noncultural," in James A. Clifton, ed., *Introduction to Cultural Anthropology*, Boston, 1968, pp. 477-97; and Roy A. Rappaport, "Nature, Culture, and Ecological Anthropology," in Harry L. Shapiro, ed., *Man, Culture and Society*, New York, 1971, pp. 237-67. A useful collection of readings in the field is Andrew P. Vayda, ed., *Environment and Cultural Behavior*, Garden City, NY, 1969.

The other major subfield of anthropology which examines human interactions with the environment is economic anthropology. Relations and systems of production in human communities inevitably entail manipulation of surrounding environ-

ments, and our best point of departure for explaining why different peoples have different effects on an ecosystem is to examine their respective economies. Economic anthropology has been split since the mid-1950s between so-called formalists and substantivists. The former believe that the abstract, market-oriented principles of neoclassical economics can be fruitfully applied to most non-Western societies; the latter reject this as an ahistorical claim, arguing that each society possesses a more or less unique economic logic which must be considered on its own conceptual terms. The classic formalist textbook is Melville J. Herskovits, *Economic Anthropology*, New York, 1952. The substantivist critique was first articulated in the now famous volume edited by Karl Polanyi, Conrad Arensberg, and Harry Pearson, *Trade and Market in Early Empires*, New York, 1957. Polanyi is the leading figure of the school, and his emphasis on the economy as an instituted process is one that some ecological anthropologists have found fruitful. His essays have been collected in *Primitive, Archaic, and Modern Economies*, George Dalton, ed., Boston, 1968; and S. C. Humphreys has evaluated his contribution in "History, Economics, and Anthropology: The Work of Karl Polanyi," *History and Theory*, 8 (1969), pp. 165-212. Polanyi's chief disciple is George Dalton, whose work can be sampled in *Economic Anthropology and Development*, New York, 1971; and "The Impact of Colonization on Aboriginal Economies in Stateless Societies," in Dalton, ed., *Research in Economic Anthropology*, Greenwich, CT, 1 (1978), pp. 131-84, an essay that is particularly relevant to this book. Dalton has also edited a useful collection of articles that are primarily substantivist in their orientation: *Tribal and Peasant Economies*, Garden City, NY, 1967. This should be compared with the essays in Raymond Firth, ed., *Themes in Economic Anthropology*, London, 1967.

The substantivists, for all of their cogency in pointing out the absurdity of too simple a transfer of Western economic concepts to non-Western societies, have been criticized, I think rightly, for throwing the baby out with the bathwater, denying even the possibility of a theoretical framework for cross-cultural comparisons of political economy. One of the early critics to point this out was Scott Cook, "The Obsolete 'Anti-Market' Mentality: A Critique of the Substantivist Approach to Economic Anthropology," *American Anthropologist*, 68 (1966), pp. 323-45; see also Edward

E. LeClair, Jr., "Economic Theory and Economic Anthropology," *American Anthropologist*, 64 (1962), pp. 1179-1203. The substantivist counterattack was David Kaplan's "The Formal-Substantive Controversy in Economic Anthropology," *Southwestern Journal of Anthropology*, 24 (1968), pp. 228-51; to which Cook replied in "The 'Anti-Market' Mentality Reexamined," *Southwestern Journal of Anthropology*, 25 (1969), pp. 378-406. By the early 1970s, it was clear to many that the debate was becoming sterile, and Cook's review essay, "Economic Anthropology," in John J. Honigmann, ed., *Handbook of Social and Cultural Anthropology*, Chicago, 1973, pp. 795-860 is an excellent survey of the literature up to that time. Efforts at synthesis have tended to look to ecology and to the structuralism of the French Marxist anthropologists for possible ways of integrating the two positions. Marshall Sahlins, "Economic Anthropology and Anthropological Economics," *Social Science Information*, 8:5 (1969), pp. 13-33 made early suggestions about the utility of ecological formulations, and Scott Cook's "Production, Ecology, and Economic Anthropology," *Social Science Information*, 12:1 (1973), pp. 25-52, made these still more explicit. Sahlins's work has been very rich in this respect: see his *Tribesmen*, Englewood Cliffs, NJ, 1968, for a general survey that is helpful for fitting the New England Indians into a broader context; and his seminal *Stone Age Economics*, Chicago, 1972, which should be supplemented with the valuable collection by Richard B. Lee and Irven Devore, eds., *Man the Hunter*, New York, 1968. Ester Boserup's much criticized *The Conditions of Agricultural Growth*, Chciago, 1965, can also be quite fruitful for those trying to assess the ecological effects of non-Western societies. Those interested in examining recent Marxist work in these areas should begin with the very useful collection edited by David Seddon, *Relations of Production: Marxist Approaches to Economic Anthropology*, London, 1978. Marx's own work on noncapitalist societies is conveniently collected in *Pre-Capitalist Economic Formations*, Eric J. Hobsbawm, ed., New York, 1964; Marx and Engels, *The German Ideology*, New York, 1970, is also worth examining. Seddon's collection should be followed by a reading of Maurice Godelier's *Rationality and Irrationality in Economics*, New York, 1972; and *Perspectives in Marxist Anthropology*, Cambridge, England, 1977. A brilliant if abrasive Marxist critique of an overly functionalist ecological anthropology is Jonathan Friedman's "Marxism,

Structuralism and Vulgar Materialism," *Man,* n.s., 9 (1974), pp. 444-69; this should be read in conjunction with Roy Rappaport's response, "Ecology, Adaptation and the Ills of Functionalism," *Michigan Discussions in Anthropology,* 2 (Winter 1977), pp. 138-90. The collection edited by Philip C. Burnham and Roy F. Ellen, *Social and Ecological Systems,* New York, 1979, is valuable in suggesting possible lines of synthesis.

The New England Indians

The starting point for any research on New England Indians must be the superb fifteenth volume of the new *Handbook of North American Indians* (Washington, 1978), which is entitled *Northeast* and edited by Bruce Trigger. Its eighty-three-page bibliography is comprehensive. Also of use in surveying the literature is Elisabeth Tooker, *The Indians of the Northeast: A Critical Bibliography,* Bloomington, 1978. The continent-wide *Ethnographic Bibliography of North America,* edited by George Peter Murdock and Timothy J. O'Leary, 4th ed., 5 vols., New Haven, 1975, is often helpful. Recent review essays which survey the historical literature are Bernard Sheehan, "Indian-White Relations in Early America," *William and Mary Quarterly,* 3rd ser., 26 (1969), pp. 267-86; Francis Jennings, "Virgin Land and Savage People," *American Quarterly,* 23 (1971), pp. 519-41; and James Axtell, "The Ethnohistory of Early North America," *William and Mary Quarterly,* 3rd ser., 35 (1978), pp. 110-44. An interesting collection of essays about the environmental relationships of North American Indians generally is Christopher Vecsey and Robert W. Venables, eds., *American Indian Environments,* Syracuse, 1980.

Several works perform the very useful function of collecting and, in effect, indexing the available primary documents in order to depict some aspect of New England life. Charles C. Willoughby surveys New England archaeological objects in his *Antiquities of the New England Indians,* Cambridge, MA, 1935. Froehlich G. Rainey collates most of the major primary sources in his helpful "A Compilation of Historical Data Contributing to the Ethnography of Connecticut and Southern New England Indians," *Bulletin of the Archaeological Society of Connecticut,* 3 (April 1936), pp. 1-89. Regina Flannery performs the same function for

the entire East Coast, albeit in a more schematic format, in her "An Analysis of Coastal Algonquin Culture," *Catholic University of America Anthropological Series,* 7 (1939). Catherine Marten's "The Wampanoags in the Seventeenth Century: An Ethno-Historical Survey," *Occasional Papers in Old Colony Studies,* 2 (1970), pp. 1-40, is thorough in its survey of the early evidence from the Massachusetts Bay area.

The most comprehensive studies yet published of seventeenth-century New England Indians are Alden T. Vaughan, *New England Frontier: Puritans and Indians, 1620-1675,* rev. ed., New York, 1979, which draws a picture so partial to the colonists as to be almost an apology for them; and Francis Jennings, *The Invasion of America: Indians, Colonialism, and the Cant of Conquest,* Chapel Hill, 1975, which sometimes argues dangerously from negative evidence and perhaps goes too far in the opposite direction in its polemic against colonial injustices, but basically gets the story straight. Between the two, I'd choose Jennings. T. J. C. Brasser's "The Coastal Algonkians," in Eleanor Leacock and Nancy Lurie, eds., *North American Indians in Historical Perspective,* New York, 1971, pp. 64-91, is a good brief survey of all the coastal Algonquians. Three more recent books concentrate on narrower themes. Karen Ordahl Kupperman, *Settling with the Indians,* Totowa, NJ, 1980, is useful in pointing to the *similarities* rather than the *differences* between Indians and colonists, similarities which my own account tends not to emphasize. (Kupperman basically elaborates a point made about the Virginia Indians by Nancy Lurie in her classic essay "Indian Cultural Adjustment to European Civilization," in James M. Smith, ed., *Seventeenth-Century America,* Chapel Hill, 1959, pp. 33-60. P. Richard Metcalf's "Who Should Rule at Home? Native American Politics and Indian-White Relations," *Journal of Amerian History,* 61 [1974], pp. 651-65, makes a similar argument but seems to me to overlook structural economic differences between Indian and European societies.) James Axtell's collected essays in *The European and the Indian,* New York, 1981, deal less with economic and ecological relationships between Indians and colonists than with religious and cultural ones, but are nevertheless essential reading. Neil Salisbury, *Manitou and Providence,* New York, 1982, is extremely detailed in his readings of Indian-colonial interaction in the first four decades of the seventeenth century, and pays some attention to ecological ques-

tions. Those interested in northern hunting peoples may wish to consult Frank G. Speck, *Penobscot Man*, Philadelphia, 1940, which is based more on ethnographic than on historical sources; Alfred Goldsworthy Bailey, *The Conflict of European and Eastern Algonkian Cultures, 1504-1700*, 2nd ed., Toronto, 1969; Kenneth M. Morrison, *The People of the Dawn: The Abnaki and Their Relations with New England and New France, 1600-1727*, Ph.D. Thesis, University of Maine, 1975; and Cornelius J. Jaenen, *Friend and Foe: Aspects of French-Amerindian Cultural Contact in the Sixteenth and Seventeenth Centuries*, Toronto, 1976. Calvin Martin, *Keepers of the Game*, deals with the same groups.

Archaeologists have been among the most perceptive analysts of interactions between New England Indians and their environments. Dean R. Snow's *The Archaeology of New England*, New York, 1980, is the best way of gaining access to this literature, and is a superb synthesis. William A. Haviland and Marjory W. Power, *The Original Vermonters*, Hanover, NH, 1981, is limited to a single state but is a full-scale scholarly synthesis as well. Susan Gibson, ed., *Burr's Hill*, Providence, 1980, and William C. Simmons, *Cautantowwit's House*, Providence, 1970, are well-illustrated and well-written records of the excavations of Indian burial grounds from the postcontact period, and are especially useful in their discussions of European trade goods. Two doctoral dissertations use archaeological data to examine changes in Indian settlement patterns on Long Island Sound as a result of Indian-European interaction: Lorraine Williams, *Ft. Shantok and Ft. Corchaug: A Study of Seventeenth Century Culture Contact in the Long Island Sound Area*, Ph.D. Thesis, New York University, 1972; and Lynn Ceci, *The Effect of European Contact and Trade on the Settlement Pattern of Indians in Coastal New York, 1524-1665*, Ph.D. Thesis, City University of New York, 1977. Finally, Peter A. Thomas's doctoral dissertation stands in a class by itself as a very sophisticated assessment of the different ecological relationships of Indians and colonists: *In the Maelstrom of Change: The Indian Trade and Cultural Process in the Middle Connecticut River Valley, 1635-1665*, Ph.D. Thesis, University of Massachusetts, 1979. Anyone wishing to pursue ecological history in New England should regard this thesis as essential reading, but a quick summary of its argument can be obtained in Thomas's "Contrastive Subsistence Strategies and Land Use as Factors for Understanding Indian-White Relations in New England," *Ethnohistory*, 23 (1976), pp. 1-18.

A variety of good studies examine the material culture and economies of New England Indians. Howard S. Russell, *Indian New England Before the Mayflower*, Hanover, NH, 1980, although basically antiquarian and uninformed by anthropological theory, is very thorough in its coverage of all aspects of Indian material life; the book's bibliography is undigested but extraordinarily extensive. Two doctoral dissertations are especially fine for their ethnographic discussions: Robert Austin Warner, *The Southern New England Indians to 1725: A Study in Culture Contact*, Ph.D. Thesis, Yale University, 1935, deals with the agricultural peoples of the south; and Bernard Hoffman is excellent on the ecological relationships of northern Indians in his *Historical Ethnography of the Micmac of the Sixteenth and Seventeenth Centuries*, Ph.D. Thesis, UCLA, 1955. See also his "Ancient Tribes Revisited: A Summary of Indian Distribution and Movement in the Northeastern United States from 1534 to 1779," *Ethnohistory*, 14 (1967), pp. 1-46. James Axtell's *Indian Peoples of Eastern North America*, New York, 1981, is a useful collection of primary documents dealing mainly with gender relationships in Indian communities. Several articles analyze Indian diets. Eva L. Butler, "Algonkian Culture and Use of Maize in Southern New England," *Bulletin of the Archaeological Society of Connecticut*, 22 (December 1948), pp. 2-39, is quite thorough and quotes extensively from the primary sources. William S. Fowler, "Agricultural Tools and Techniques of the Northeast," *Massachusetts Archaeological Society Bulletin*, 15 (1954), pp. 41-51, is mainly useful for its archaeological illustrations of agricultural tools. M. K. Bennett's "The Food Economy of the New England Indians, 1605-1675," *Journal of Political Economy*, 63 (1955), pp. 369-97, is an economist's effort to reconstruct the caloric content of Indian diets but has numerous statistical problems which I discuss in my endnotes. Frederic W. Warner, "The Foods of the Connecticut Indians," *Bulletin of the Archaeological Society of Connecticut*, 37 (1972), pp. 27-47, combines historical and archaeological data in a competent analysis of the whole range of foodstuffs used by southern New England Indians. On Indian agriculture, Lynn Ceci, "Fish Fertilizer: A Native North American Practice?" *Science*, 188 (1975), pp. 26-30, caused quite a stir by denying that New England Indians had used fertilizer; replies to her article are in *Science*, 189 (1975),

pp. 944-50. Readers should compare my account of shifting agriculture in New England with anthropological descriptions of swidden agriculture in the tropics. The literature is enormous, but the classic articles are by Harold C. Conklin, "An Ethnocultural Approach to Shifting Agriculture," *Transactions of the New York Academy of Science*, Series II, 17 (1954), pp. 133-42; and "The Study of Shifting Cultivation," *Current Anthropology*, 2 (1961), pp. 27-61. Indian burning practices can be examined in the previously cited article by Day; in Hu Maxwell, "The Use and Abuse of Forests by the Virginia Indians," *William and Mary Quarterly*, 1st ser., 19 (October 1910), pp. 73-104; Calvin Martin, "Fire and Forest Structure in the Aboriginal Eastern Forest," *Indian Historian*, 6:4 (1973), pp. 38-42, 54; and in Emily W. B. Russell, "Indian-Set Fires in the Forests of the Northeastern United States," *Ecology*, 64 (1983), pp. 78-88. On Indian place-names, see the dictionary by John C. Huden, "Indian Place Names of New England," *Contributions from the Museum of the American Indian*, Heye Foundation, New York, 18 (1962).

The literature on the size of Indian populations at the time Europeans arrived continues to grow. The original estimates were those of James Mooney, "The Aboriginal Population of America North of Mexico," *Smithsonian Miscellaneous Collections*, 80:7 (1928), pp. 1-40. These were very low, but were accepted as authoritative for nearly forty years; they continue to appear in some of the literature. (On Mooney's techniques of estimation, see Douglas H. Ubelaker, "The Sources and Methodology for Mooney's Estimates of North American Populations," in William M. Denevan, ed., *The Native Population of the Americas in 1492*, Madison, 1976, pp. 243-88.) Mooney's figures came under serious attack in Henry F. Dobyns, "Estimating Aboriginal American Populations," *Current Anthropology*, 7 (1966), pp. 395-416, which argued on the basis of disease mortality rates that population estimates should be increased by an order of magnitude or more. Subsequent efforts to revise Mooney drastically upward for the whole continent can be traced in Dobyns, *Native American Historical Demography: A Critical Bibliography*, Bloomington, 1976; Wilbur R. Jacobs, "The Tip of the Iceberg: Pre-Columbian Indian Demography and Some Implications for Revisionism," *William and Mary Quarterly*, 3rd ser., 31 (1974), pp. 123-32; and Douglas H. Ubelaker, "Prehistoric New World Population Size," *American*

Journal of Physical Anthropology, 45 (1976), pp. 661-6. New England estimates can be found in Jennings, *Invasion of America*, pp. 15-31; S. F. Cook, *The Indian Population of New England in the Seventeenth Century*, Berkeley, 1976; and Snow, *Archaeology of New England*, pp. 31-42. On the nature of the epidemics which killed so many Indians, see John Duffy, "Smallpox and the Indians in the American Colonies," *Bulletin of the History of Medicine*, 25 (1951), pp. 324-41; Sherburne F. Cook, "The Significance of Disease in the Extinction of the New England Indians," *Human Biology*, 45 (1973), pp. 485-508; and Billee Hoornbeck, "An Investigation into the Cause or Causes of the Epidemic which Decimated the Indian Populations of New England, 1616-1619," *New Hampshire Archaeologist*, 19 (1976-77), pp. 35-46.

Those wishing to investigate Indian property systems might begin with Imre Sutton's comprehensive bibliography, *Indian Land Tenure*, New York, 1975. As I mention in the endnotes to Chapter 5, the debate about whether Indian individuals and families "owned" hunting territories has been going back and forth since the early twentieth century. The early position was that of Frank G. Speck, who argued (in opposition to a crude Marxist doctrine of primitive communism) that precolonial Algonquian families had in fact owned their hunting territories. See his "The Family Hunting Band as the Basis of Algonkian Social Organization," *American Anthropologist*, 17 (1915), pp. 289-305; "Land Ownership Among Hunting Peoples in Primitive America and the World's Marginal Areas," *Proceedings of the 22nd International Congress of Americanists*, 2 vols., Rome, 1928, pp. 323-32; and, co-authored with Loren C. Eiseley, "Significance of Hunting Territory Systems of the Algonkian in Social Theory," *American Anthropologist*, 41 (1939), pp. 269-80. Important elaborations of Speck's argument can be found in John M. Cooper, "Land Tenure Among the Indians of Eastern and Northern North America," *Pennsylvania Archaeologist*, 8 (1938), pp. 55-9; Cooper, "Is the Algonquian Family Hunting Ground System Pre-Columbian?" *American Anthropologist*, 41 (1939), pp. 66-90; Anthony F. C. Wallace, "Women, Land and Society: Three Aspects of Aboriginal Delaware Life," *Pennsylvania Archaeologist*, 17 (1947), pp. 1-35; and Wallace, "Political Organization and Land Tenure Among the Northeastern Indians, 1600-1830," *Southwestern Journal of Anthropology*, 13 (1957), pp. 301-21. A. Irving Hallowell, "The Size of Algonkian Hunting