
Commentary

A History of the Ecological Sciences, Part 22: Early European Naturalists in Eastern North America

Many explorers of foreign lands and seas brought back to Europe plants and animals for authorities to study and describe, but some explorers were also naturalists who published their own observations. Previously (Egerton 1976, 1977) I surveyed contributions by early naturalists to American natural history that might be of interest to ecologists. Now I will go into more detail about fewer naturalists, but before doing so, let us view them within a broader context.

George Basalla (1967) studied colonial science and found that it flourished to the same extent that it did in the mother country. In the New World, the Spanish had a head start in colonization over the British and French by a century; however, since science was not strongly supported in Spain, it developed slowly in its colonies (Verdoorn 1945, Beltran 1970, Egerton 2004b:112–114, de Asúa and French 2005). Science flourished about equally in Britain and France, and therefore one might expect that their colonial science would be comparable. The first book on North American plants was very well illustrated by a Frenchman, Jacques Philippe Cornut (or Cornuti [1635, 1966]), but Cornut found his subjects in Parisian gardens, not in Canada (Dickenson 1998:78–81). Soon, however, French explorers were providing first-hand observations of birds (Allen 1951:503–507, Ainley 1995) and other animals and plants (Chartrand et al. 1987). Especially noteworthy were two physician-naturalists, Michel Sarrazin (1659–1734) and Jean-François Gaultier (1708–1756). Sarrazin first went to Quebec as a surgeon in 1685, later returned to study medicine in Paris, and came back to Quebec as a physician in 1697 (Vallée 1927, Rousseau 1957:152–155, 1969). He became a corresponding member of the Académie Royale des Sciences, and for 20 years he sent her-

barium specimens back to Paris; they are still in the Muséum d'Histoire Naturelle. Sarrazin's manuscript list of Canadian plants is reproduced photographically by Vallée (1927:257–273). Five of Sarrazin's letters to Réaumur are also extant and are published by Vallée (1927:217–232). Gaultier made "observations botanico-météorologiques" at Quebec which he sent to the Académie royale des Sciences from 1744 to 1750; they were published in the Académie's *Histoire* (Boivin 1974). He also compiled an inventory of the important plants and animals of Quebec in 1749 at the request of the governor-general, Roland-Michel Barrin de la Galissonnière, and this was made available to Pehr Kalm (see below). In the rich sugar colony of Saint Domingue (Haiti) France even had a learned society (1784–1792), until a slave revolt drove out the French (McClellan 1992).

Various French explorers published travel accounts, often including natural history observations. A good example was the Jesuit professor Pierre-François-Xavier de Charlevoix (1682–1761). He left Paris to teach in Quebec, 1705–1709, and returned in 1720–1722 to explore the Great Lakes and then go down the Mississippi (Hayne 1974). His two volumes of travel accounts were not published until 1744, as part of his *Histoire et description générale de la Nouvelle France* (six volumes). The travel volumes were translated into English in 1761 and reprinted in 1923. Noteworthy is his Chapter V, on beaver, which runs to 18 pages in the 1923 edition (Charlevoix 1923, I:139–156), though the last two pages compare beaver and muskrat. His precise anatomical data came from a memoir on beaver anatomy by Sarrazin published by the Académie Royale des Sciences (1704; discussed and partly quoted in Vallée 1927:106–112). Charlevoix's account seems mostly reliable, excepting his information from the medical and theological faculties at Paris that beaver could be eaten as fish because of its scaly tail.

British military and political victories in America enabled its colonial science to develop more extensively than its rivals. Basalla identified three stages of colonial science: (1) inventory science by Europeans who published their findings in the mother country, (2) colonials educated partly in the mother country conducted similar studies, which were mostly published in the mother country, and (3) independent science, usually precipitated by a political break with the mother country, in which former colonists developed their own science education, institutions, and publications. There was some overlap between stages one and two. For example, the Reverend John Banister (1650–1692) was born in England, but became a colonial naturalist when he settled in Virginia in 1678 (Ewan and Ewan 1970). Yet other European naturalists continued to explore America and returned home to publish their findings throughout the 1600s and 1700s.

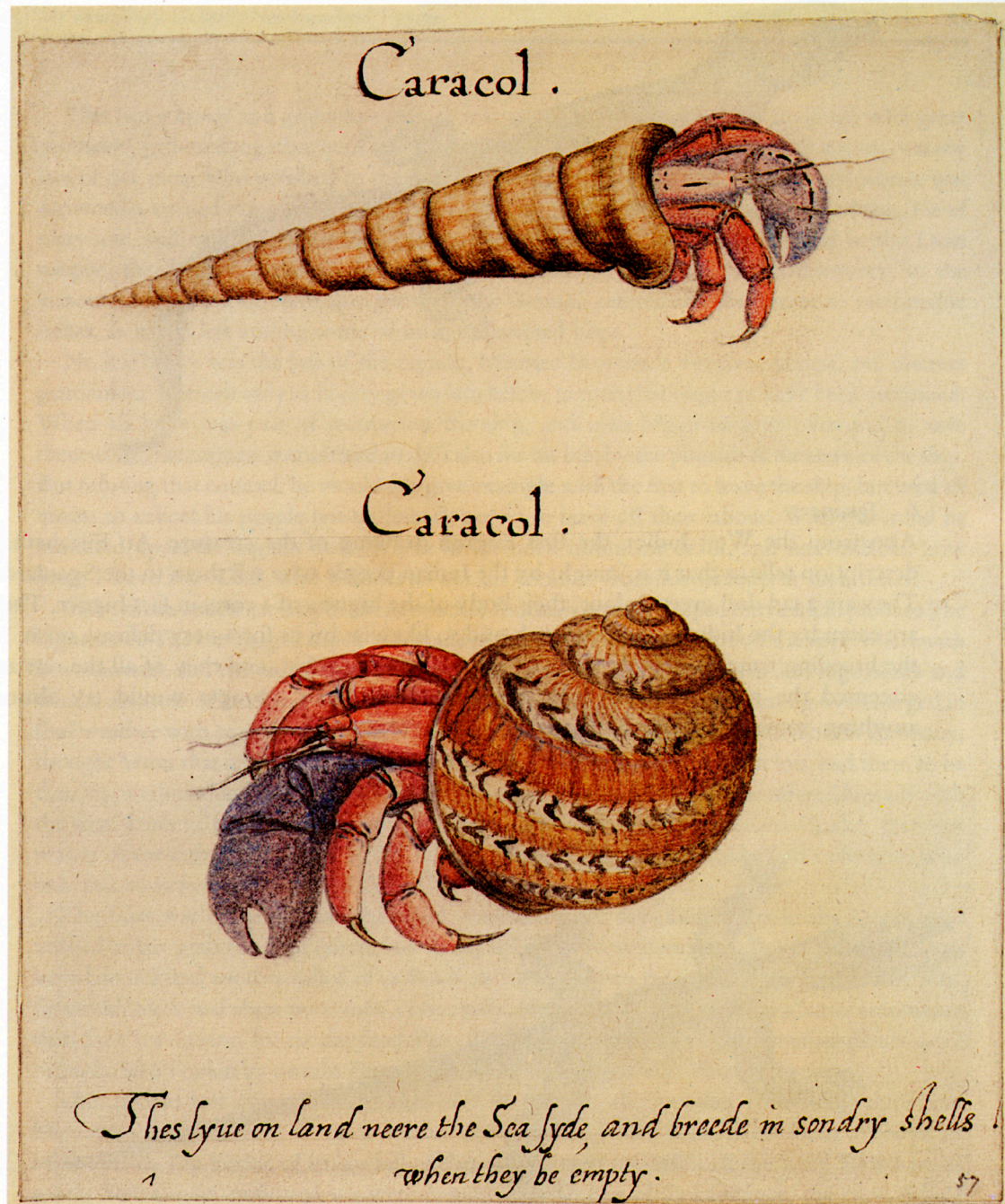
In 1585 Sir Walter Raleigh sent an English colony to Roanoke Island, North Carolina, but its members became discouraged and returned home with Sir Francis Drake in 1586. In 1587 Raleigh tried again and sent along mathematician–astronomer–surveyor Thomas Hariot (1560–1621) and also the artist John White (died about 1593) as governor. Hariot later published *A Brief and True Report of the New Found Land of Virginia* (1588, 1955) which described the colony’s climate and resources for prospective settlers. White made skillful paintings of Indians, birds, fish, crabs, and insects. Thomas Penny acquired four of White’s insect illustrations, which were later published in Thomas Mouffet’s *Insectorum* (1634:61, 88 [98], 112) and in its English translation, *The Theater of Insects* (1658: 936, 967, 978.) (I discussed Mouffet’s work in part 12, Egerton 2004a:29–30.) Four of White’s illustrations were also reproduced by Mark Catesby (see below and Raven 1964).

John Lawson (about 1650–1711) was possibly an apothecary (Stearns 1953:335), who sailed to America for adventure on 1 May 1700 (Lawson 1967:7). In December the Lord Proprietors of Carolina appointed him to make a survey of the colony’s interior, which he did, accompanied by five Englishmen and four In-

dians. It lasted from 28 December 1700 to 23 February 1701, and he estimated they covered 1000 miles; a modern estimate is 550 miles (Lefler 1967:xv). This exploration provided information for his map of North and South Carolina, which he published in *A New Voyage to Carolina, Containing the Exact Description and Natural History of that Country* (1709). A modern map indicating his route and his own map are both included in the most recent edition of his book (Lawson 1967:x, xxxviii).

From acquaintances in Charles Town (Charleston, South Carolina) Lawson learned that James Petiver, whom we met earlier (Allen 2004, Egerton 2005:309, 2006:117), collected natural history specimens, published lists of those received and the names of the senders, and provided some assistance to worthy collectors (Stearns 1953:257–264, 1970:305). Lawson sent him a letter on 12 April 1701 (printed in Lawson 1967:267) telling of his interest in collecting specimens for Petiver. This project was one incentive for collecting the information found in his book’s extensive discussion of plants and animals (Stearns 1970:306–315). Lawson devoted almost 25 pages (1967:96–120) to the trees, shrubs, and vines of Carolina. He was unconcerned about whether they were native or introduced, although most were native. He emphasized their uses but did not limit himself to utilitarian comments. For example, he identified three kinds of honeysuckle—which grew respectively in moist ground, clear and dry land, and in swampy woods—their only use being to beautify nature. His long discussion of the kinds and uses of oak trees included “Turkey-Oak,” whose only known use was to provide food for turkeys.

Aside from his map, his only illustrations were of seven mammals, three snakes, and a turtle shell. The bear is catching a fish, the raccoon is using its tail as bait to catch a crab, and a coiled snake is charming a squirrel out of a tree. He did not explicitly relate his illustrations to his text, which created some ambiguity, since the illustrations are not very precise. What kind of snake is charming which kind of squirrel? And in his illustration (Fig. 2), what kind of cat is attacking which kind of deer?



5 Land Hermit Crabs

These charming little drawings were probably made in the West Indies, though White uses them for decoration in his Virginia fishing scene.

Fig. 1. John White's painting of purple-clawed hermit crabs (*Coenobeta clypeatus*) of the West Indies living in borrowed shells of *Turritella variegata* (upper) and of *Natica canrena* (lower). Hulton and Quinn 1964, I:70, II: Plate 5.



Fig. 2. An ambiguous cat species attacking an ambiguous deer species. Lawson 1967:128.

He discussed four kinds of cat—panther, catamount, wild cat, tiger—which presumably are species now called cougar, lynx, bobcat, and jaguar, and he discussed three kinds of deer—elk, stag, and fallow deer—which presumably are only elk and white-tailed deer. The cat most resembles a bobcat, and the antlers resemble those of elk more than white-tailed deer. Bobcats are known to kill fawns, and also adult white-tailed deer in winter; whether they kill adult elk is less certain.

Lawson discussed 27 kinds of “beasts” (mammals), though his list mentions two sorts of unspecified rats and two sorts of unspecified mice, 129 kinds

of birds, 42 kinds of saltwater fish (including whales, porpoises, and dolphins), 20 kinds of freshwater fish, 20 kinds of shellfish, and 22 kinds of “insects,” which were reptiles, with additionally unspecified frogs and worms listed as “insects”; there were no actual insects listed under that heading. Here is a sample of his accounts of birds, on the Carolina parakeet (Lawson 1967:146–147):

The Parrakeetos are of a green Colour, and Orange-Colour'd half way their Head. Of these and the Allegators, there is none found to the Northward of this Province. They visit

us first, when Mulberries are ripe, which Fruit they love extremely. They peck the Apples, to eat the Kernels, so that the Fruit rots and perishes. They are mischievous to Orchards. They are often taken alive, and will become familiar and tame in two days. They have their Nests in hollow Trees, in low, swampy Ground. They devour the Birch-Buds in April, and lie hidden when Weather is frosty and hard.

Encouraged by Petiver, he intended to write even more on American natural history when he returned there after publishing his book in London. He wrote a rather long letter from North Carolina in 1710 to Petiver outlining his plans (Lawson 1967:269–272), but those plans failed because he was killed by Tuscarora Indians in 1711. However, what he had already accomplished was considerable for the time: “the first major attempt at a natural history of the New World” (Feduccia 1985:8; see also Allen 1951:461–463). His most recent editor devoted more than two pages to a discussion of authors who plagiarized Lawson’s book (Lefler 1967:lii–liv).

Mark Catesby (1682–1749) was from a comfortably middle-class family, and he became interested in natural history through his acquaintance with John Ray (Frick and Stearns 1961:9), who lived not far from the Catesbys. Although not university educated, Mark Catesby became the greatest British natural history explorer of his time (Stearns 1970:315). One of his sisters, Elizabeth, married physician William Cocke; he took her to Virginia, where he developed a successful practice and became a prominent politician. It was convenient, therefore, for Mark to travel to Virginia to collect plants for English patrons and stay with the Cockes (Allen 1951:470–473, Brigham 1998:95–96). He arrived there on 23 April 1712 and did not return to England until October 1719. He was constantly exploring and observing plants and animals under natural conditions, but his only records of his findings were drawings of some plants and animals and the plants, alive or dried, which he sent to his patrons. However, he had been successful in what he had undertaken, and at a meeting of the Royal Society on October 19, 1720

the newly appointed governor of South Carolina, Francis Nicholson, offered Catesby a pension of 20 pounds a year to “Observe the Rarities of the Country for the uses and purposes of the Society” (Frick and Stearns 1961:18, Meyers and Pritchard 1998:6). This time he was committed to making written observations. He reached Charles Town on 23 May 23 1722 and stayed in the Carolinas until January 1725, when he went to the Bahama Islands for about a year before returning to England in 1726.

Upon arriving in South Carolina, Catesby “unexpectedly found this country possessed not only with all the animals and vegetables of Virginia, but abounding with even a greater variety” (Catesby 1985:137). In other words, his earlier experiences in Virginia provided a rich background for his new endeavor. His first year was spent on the coastal plain, where most colonists lived, but he later ventured into the piedmont and mountains with Indian porters and guides. Aside from collecting plants and animals, he enjoyed hunting “buffalo, bears, panthers, and other wild beasts” (Catesby 1731–1743:unnumbered “Preface,” 1985:137). The inventory natural history of the colonial era was never limited to identifying and describing species. His introductory discussion (Catesby 1731–1743:i–xvi, 1985:137–151) described the geography, climate, soil, rivers, and Indians of the Carolinas. He drew upon both his own observations and Lawson’s book, though only acknowledging the latter source when discussing Indians (Feduccia 1985:8). Catesby’s interest in placing species within their natural surroundings was symbolized by his very impressive color plates in *The Natural History of Carolina, Florida and the Bahama Islands* (1731–1743 [1729–1747]), the great majority of which have animals and plants portrayed together that are found together in nature. His 220 plates illustrate 109 birds, 33 amphibians and reptiles, 46 fishes, 31 insects, 9 quadrupeds, and 171 plants. Both his birds (Feduccia 1985) and his plants (Howard and Staples 1983) are identified and discussed by modern specialists. Publication of his *Natural History* was the major project of his life after he returned from America in 1726; it took 20 years to produce the book. He was a self-taught artist who learned how to engrave his il-

illustrations, and he also hand-colored them, with some assistance (Dickenson 1998:148–152). The work appeared periodically in sections of 20 plates plus text, 1729–1747, although the title pages of the two volumes give publication dates as 1729 and 1743. He was invited to the Royal Society to exhibit the first part on 22 May 1729, and he also exhibited later parts at subsequent meetings. It was on the basis of this achievement that he was voted a member of the Society on 26 April 1733 (Frick and Stearns 1961:37–38). All illustrations in Volume I are by Catesby, but he lacked enough of his own illustrations to fill Volume II. He borrowed copies of John White's illustrations from Sir Hans Sloane and plagiarized four fish (catfish, remora, globe or puffer fish, and gar, on plates 23, 26, 28, and 30, respectively), a land crab (plate 32), the Bahama iguana (plate 64), and the swallow-tail butterfly (plate 97) (Feduccia 1985:6). Also, with the artist's permission, Catesby based plates 61 and 85 on plant drawings by Georg Dionysius Ehret, and he combined

Ehret's drawings with his own on nine plates (Meyers 1997:23–23, 27, note 83).

In 1768 King George III bought a version of Catesby's *Natural History* that was bound in three volumes instead of two and was illustrated not with Catesby's 220 etched plates but with his 263 actual illustrations, either watercolor or pen and ink. This set is in the library of Windsor Castle, and in 1997 more than 50 of these original illustrations became the foundation for a traveling exhibition that toured five museums in two years. The illustrations displayed also became the basis for a book that reproduces and describes them, and compares the originals to the published illustrations (McBurney 1997).

Catesby's second plate shows the "Fishing Hawk" (Osprey) clutching a fish it has caught, and his first plate shows a Bald Eagle catching in midair a fish it has forced an Osprey to drop.



Fig. 3. Bald Eagle stealing fish from Osprey. Catesby 1731–1743, I: Plate 1.

This was his best action picture. Artistically, one of his best illustrations is of a very lifelike Blue Jay calling from a branch of smilax with berries.



Fig. 4. Blue Jay on smilax. Catesby 1731–1743, I: Plate 15.

His account of the Blue Jay is limited to a physical description, but his account of smilax is ecologically interesting (Catesby 1731–1743, I:15)

This plant is usually found in moist places; it sends forth from its root many green stems, whose branches overspread whatsoever stands near it, to a very considerable distance; and it frequently climbs over sixteen feet in height, growing so very thick, that in summer it makes an impenetrable shade, and in winter a warm shelter for cattle. The leaves are of the color and consistence of laurel, but in shape more like the bay, without

any visible veins, the middle rib only excepted.

The flowers are small and whitish. The fruit grows in round clusters, and is a black berry, containing one single hard seed, which is ripe in October, and is food for some sorts of birds, particularly this jay.

Catesby described and illustrated the Passenger Pigeon and Carolina Parakeet, which are now extinct, and the eastern subspecies of the Prairie Chicken, called the Heath Hen, which is also extinct, and the Ivory-billed Woodpecker, which is practically extinct.

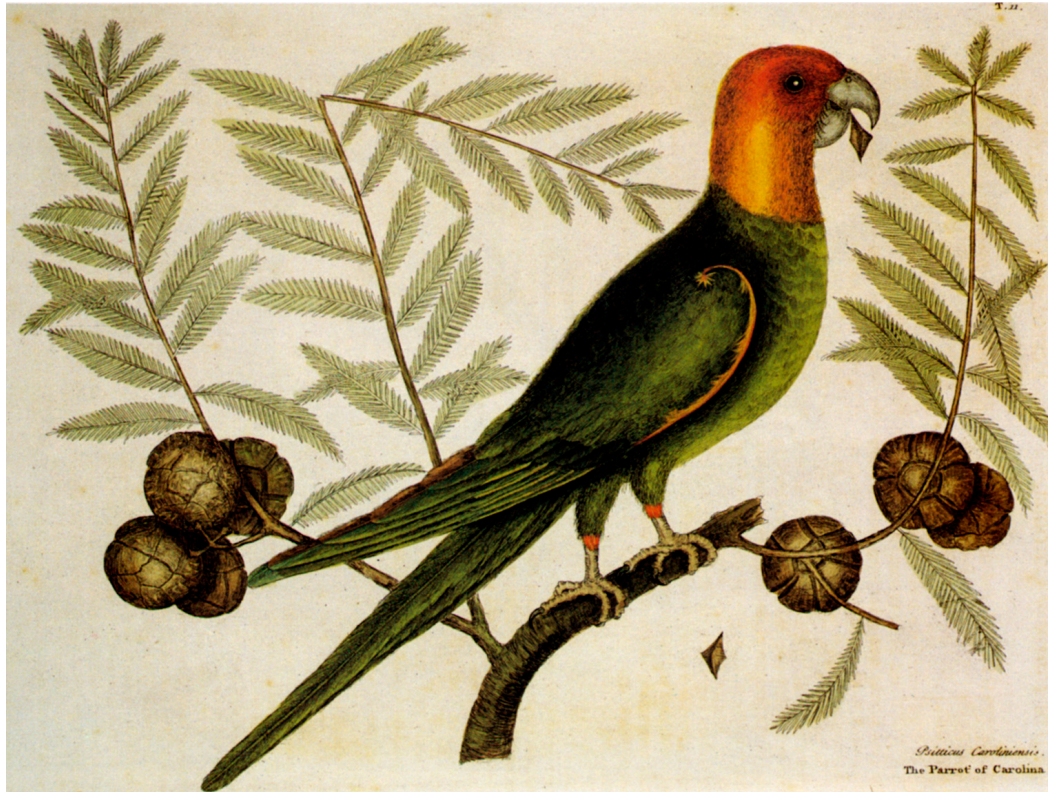


Fig. 5. Carolina Parakeet and bald cypress. Catesby 1731–1743:Plate 11.

Here is part of his account of the Carolina Parakeet, omitting his description of it, which is longer than Lawson's, quoted above (Catesby 1731–1743, I:11):

They feed on Seeds and Kernels of Fruit; particularly those of Cypress and Apples. The Orchards in Autumn are visited by numerous flights of them; where they make great destruction for their Kernels only: for the same purpose they frequent Virginia; which is the furthest North I ever heard they have been seen. Their Guts are certain and speedy poison to Cats. This is the only Parrot kind in Carolina: some of them breed in the Country; but most of 'em retire more South.

In Lawson's account quoted above, he claimed that the parakeet hibernated in winter. Despite John

Ray's dismissal of this notion in the 1670s (quoted in Egerton 2005:306), it remained a popular idea during the 1700s, but was also rejected by Catesby, who had known Ray. Catesby's skepticism was based not merely on Ray's judgment; while in the Bahamas he found evidence that when rice-birds (Bobolinks) disappeared from Carolina, they had merely flown south (Catesby 1731–1743, I:14, 1985:126)

In September 1725, lying upon the deck of a Sloop in a Bay at Andros Island, I and the Company with me heard, three nights successively, Flights of these Birds (their Note being plainly distinguishable from others) passing over our heads northerly, which is their direct way from Cuba to Carolina; from which I conceive, after partaking of the earlier crop of Rice at Cuba, they travel over sea to Carolina, for the same intent, the Rice there being at that time fit for them.

This observation was buried in a natural history book where it might not have received wide notice, but he also wrote a more general and detailed article on bird migration, which was published by the Royal Society (Catesby 1747). Catesby's contributions were important enough to earn him the title of "founder of American ornithology" (Allen 1951:463–478).

Probably the best educated explorer-naturalist who came to America in the 1700s was Pehr Kalm (1716–1779), who studied under Carl Linnaeus and became a professor at the University of Åbo in Finland (Granit 1973). In 1748, the Royal Swedish Academy of Sciences sent him to North America to collect useful plants that could survive in Scandinavia. On the way, he stopped in London, visited the Royal Society and met Catesby on 21 April, and visited his home on 23 May, where Catesby advised him on collecting and preserving plants and animals in America (Kalm 1892:17, 51–52, 118–119, Frick and Stearns 1961:47–48). Kalm reached Philadelphia in September and left for home in February 1751. Although his Swedish sponsors expected him to spend most of his time in Canada, he preferred the Philadelphia region. The city was the intellectual center of America, and there was a Swedish colony nearby in New Jersey, where he found a wife. He did journey to Canada twice, in 1749 and in 1750, but his discoveries were more important to natural history than to Scandinavian agriculture and forestry (Skottesberg 1957). This trip was the great adventure of his life, and he spent much of his time afterwards publishing his travel journal and related scientific articles. His Swedish *En Resa til Norra America* (three volumes, 1753–1761) was translated into German (three volumes, 1754–1764), English (three volumes, 1770–1771), and Dutch (two volumes, 1772). A French travel book (Rousselot de Surgy 1768) was also based largely on Kalm's book. Two of the three sets of dried plants that he collected are preserved at the Linnean Society of London and at the University of Upsala, and are listed by Juel and Harshberger (1929); the list includes 60 species new to science.

Kalm's observations on American plants and ani-

mals supplemented those by Lawson and Catesby, being made significantly farther north than theirs. Since I previously discussed some of his observations of ecological interest from his travel book (Egerton 1976:313–314, 1977), here I discuss four of his six articles (one on Pennsylvania's natural history and climate, two on animals, and three on plants) translated into English. The first article, published in a Swedish journal in 1749, was a letter on his trip from London to Philadelphia and his first impressions of America in 1748. He was very impressed with the greater variety of plants in Pennsylvania than in Scandinavia. The fact that shells were found in rock strata, revealed when wells were dug, convinced him that the coastal plain had once been under the sea and that "the water is subsiding yearly in this part of the world" (Kalm 1943:173). Members of the Royal Society of London had asked him to investigate why plants from North America grown in Europe bloom so late that their seeds seldom ripen. Kalm concluded that the reason was difference in climate (1943:174).

The heat here is usually dreadful during the summer and lasts further into autumn. The months of September and October are neither hot nor cold and tend to be the loveliest of the year...September resembles most closely the month of July in Sweden and October the month of August. There are seldom cloudy days. The winds are rarely strong. The weather is usually calm or the breeze is mild. . . . During these months and late in the autumn, if it can be so called, most plants are at their best.

He obviously considered climatic data as among the most important he should collect, and he included daily weather reports in his book from August 1748 (a month before his arrival) until January 1750 (Kalm 1937, II:738–769).

In May 1749 large numbers of the 17-year locust (cicada) emerged from their subterranean abodes, shed their nymphal cases, and then crawled up trees to await the drying of their wings. A man digging a pit re-



Fig. 6. Pehr Kalm after he returned from America.

ported the nymphs at a depth of 12 feet. Kalm did not know what they ate underground, but some speculated that they ate dirt. The noise the adults made was so loud that no one could miss their time of appearance. They had previously appeared in 1715 and 1732, but further away they appeared in different years. He left for Canada before they disappeared, but he was told they had stayed about six weeks, then disappeared. While they were abundant, they were eagerly eaten by swine, chickens, forest birds, particularly shrikes, and Indians. Kalm thought this species was probably the same as Réaumur described from France in his *Mémoires pour servir à l'histoire des insectes*, V: Memoir 4. Kalm carefully observed egg-laying (Kalm 1953:140–141):

The insects slit the fine moist bark of small branches with the ovipositor; which later penetrated deep into the branch, depositing eggs or other material. As a result, large numbers of branches dried up. A type of mucus is deposited on the branch by the ovipositor at the time of penetration. Although the bark on the young twigs of nearly all trees may be slit, the insects seem to prefer that of oak and apple. The ovipositor can not penetrate thick rough bark. The year following the infestation, large quantities of branches died and fell to the ground because of this bark injury. I could detect no other damage, but some said entire trees dried up. This might well happen to young trees where all the bark is tender and can be penetrated by the ovipositor. Permanent damage might result if too many young twigs on a large tree were destroyed just before a hot spell, or a long dry one.

It is generally believed that the insect shreds the bark in order to deposit eggs. I can not say for certain if this is the case, although it would seem to be so.

Kalm's article appeared in a Swedish journal in 1756 and was probably unknown in America or England. One of his Philadelphia acquaintances, John Bartram, independently sent specimens and his own observations on the same species to Peter Collinson in England, who published an article on it in 1764 with an illustration of Bartram's specimens (Fig. 7).

Impressive as the numbers of this cicada were, the numbers of Passenger Pigeons were even more impressive. They had already been described by Lawson (1967:145–146) and Catesby (1731–1743, I:23, 1985:60–62), each of whom reported that they nested farther north than he had traveled. Kalm reported in 1759 that they did nest in Pennsylvania and New Jersey, where they were especially abundant in February and March. They appeared in much greater numbers in a few occasional years, including 1729 and 1740, than usual, which Kalm attributed to two reasons (Kalm 1911:58–59):

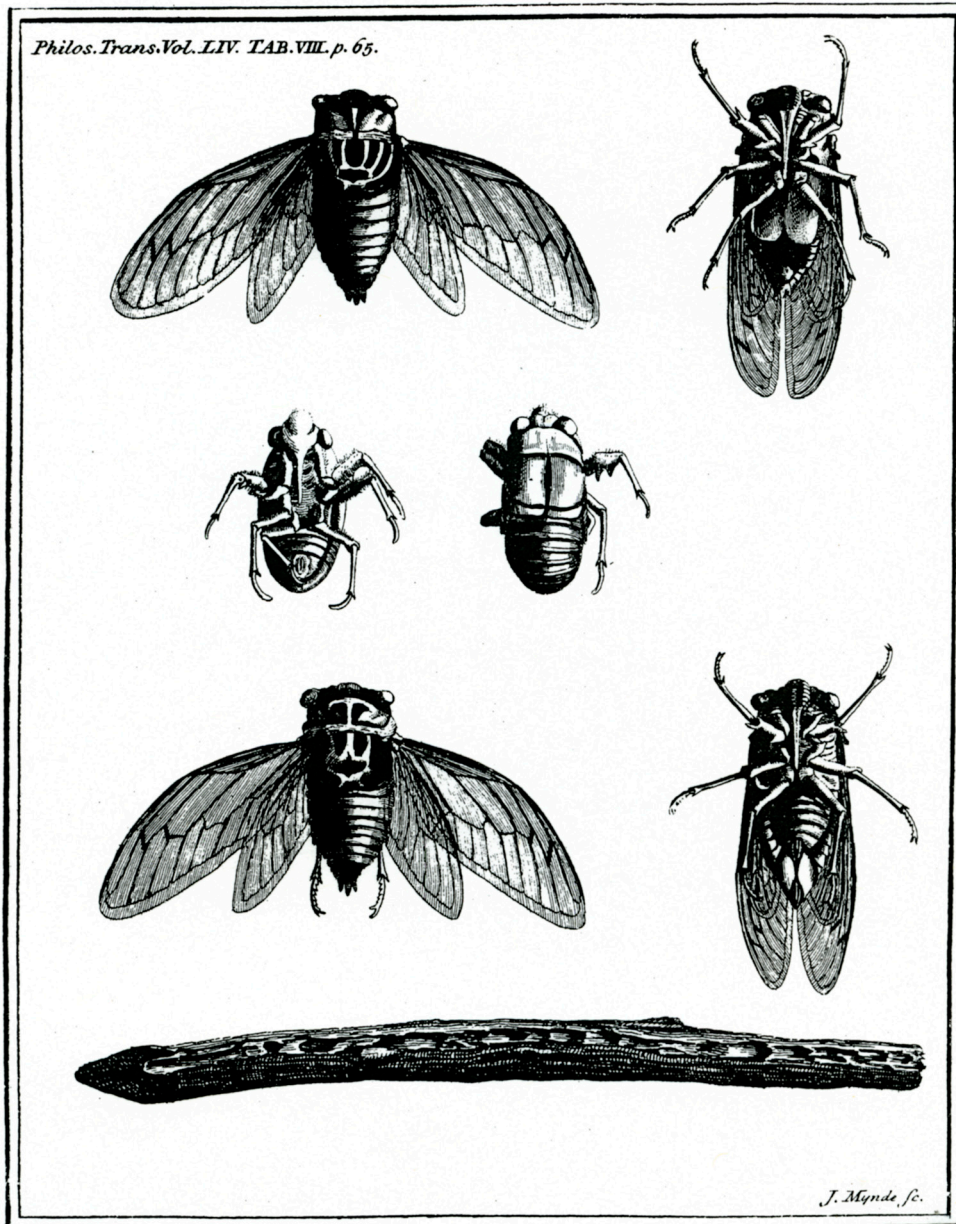


Fig. 7. 17-year locust (cicada), *Magicicada septendecim*. Collinson 1764, 54:65.

First, when there is a failure of the crop of acorns and other fruit in the places where they otherwise generally spend the winter, thus rendering their supply of food insufficient to last until the ensuing summer; and second, and chiefly, when an unusually severe winter with abundant and long remaining snow hap-

pens to occur in their customary winter haunts, thus covering the ground and making it impossible for them to secure the acorns, beech-nuts and other fruit and seeds on which they otherwise feed at this season: in such cases they are forced to leave these localities and seek their food down along the sea coast where the win-

ters, owing to the sea air, are always milder, and the ground more and earlier free from snow.

From talking to older persons, he learned that there had once been even more Passenger Pigeons in New Sweden than when he was there, which Kalm attributed to the woods being cleared, more people, and more cultivated land. When he went to Canada in June

1749, he beheld pigeon roosts that were undisturbed by humans.

They were crowded onto trees so densely that they caused even big trees to collapse. He found that the pigeons' northern boundary was determined by the northern range of oak and beech trees. Kalm listed their food seeds in Pennsylvania in the order in which



Fig. 8. Passenger Pigeon. Kalm 1937:252.

their seeds matured: maple at the end of May, elm in the beginning or middle of June, mulberries (their favorite) in early June, rye (not favored) and wheat (very favored) in midsummer, buckwheat in mid-September, and acorns in September and later. Beechnuts also matured in September, but they were sparse south of Canada. They also ate the soil at salt springs. They usually remained in Canada until snow covered their food, and returned there when the snows melted.

In the English translation of Kalm's *Travels* (three volumes, 1770–1771), the last 30% is devoted to his observations in Canada. On 2 July 1749 the governor of Fort St. Frederic showed Kalm a lengthy inventory on the plants, animals, and minerals of Canada compiled by Gaultier at the request of Governor-General Galissonière, who himself added to Gaultier's manuscript. This manuscript survives and is discussed by Bonnault (1957) and Rousseau (1966). In Quebec City he met Gaultier on 8 August, and three days later they hiked out of town to collect plants. Kalm was impressed with how seriously the Canadians took natural history.

Kalm reported in a 1776 article that the red mulberry trees (*Morus rubra*) grew from the Carolinas to Niagara, though less commonly in New York State than farther south. He found they grew in various kinds of soils, and "Scarcely any tree can be found which thrives as well on poor soil as this one," (Kalm 1950:222). Birds ate the berries and spread the seeds in their dropping—to the disgust of farmers who considered the seedlings as the worst pests in their fields. Kalm observed that when these trees grew in dense forests, they generally did not bear fruit, but the ones at the forest edge bore abundant berries. John Bartram told him that he had a red mulberry in his yard that bore only female flowers until 1750, when it bore many male flowers, but Kalm was skeptical and suspected that Bartram had not observed it closely enough before 1750. In Pennsylvania and New Jersey, this species grew leaves in early May and flowered shortly thereafter. In 1750, the berries ripened there by 10 June, but at Albany, not all berries were ripe on 10 July. Mulberries were among the first to lose leaves in the fall, and in Pennsylvania they were bare by 22

October 1750. Severe cold could kill its shoots but not its roots, which send up new shoots in the spring. Passenger Pigeons were fond of mulberries, as were Indians, who ate some while fresh but also dried some and used them later when baking bread. Kalm thought the mulberry leaves could be used to raise silkworms, but Americans thought that would be too much trouble. His articles on black walnut and butternut trees (Kalm 1942) and hickory (Kalm 1945) contain similar information.

Only a few European naturalists managed to come to America, collect specimens and observations, and return home to publish important findings, but the ones who did, including Lawson, Catesby, and Kalm, found a receptive audience among fellow naturalists and the educated general public. Among these three, Catesby's work made a strong impression because of the 220 color plates (Wilson 1978:123–185), but the plates also made it the most expensive. Consequently, Lawson and Kalm's books were more widely available. Naturalists had a keen interest in the differences between European and American species, including information on the conditions under which American species flourished. This curiosity encouraged observations on what we call ecological aspects of life histories.

Literature cited

- Ainley, M.G. 1995. The emergence of Canadian ornithology—an historical overview to 1950. Pages 283–302 in W. E. Davis, Jr. and J. A. Jackson, editors. Contributions to the history of North American ornithology. Nuttall Ornithological Club Memoirs, Cambridge, Massachusetts, USA.
- Allen, D. E. 2004. James Petiver (1663–1718), botanist and entomologist. Oxford Dictionary of National Biography.
- Allen, E. G. 1951. The history of American ornithology before Audubon. American Philosophical Society Transactions **41**:385–591.
- Basalla, G. 1967. The spread of Western science. Science **156**:611–612.
- Beltran, E. 1970. Fuentes Mexicanas en la historia de la ciencia. Anales de la Sociedad Mexicana de

- Historia de la Ciencia y de la Tecnología Mexico **2**:57–115.
- Boivin, B. 1974. Jean-François Gaultier (Gautier, Gauthier or Gaulthier), physician, Naturalist, 1708–1756. *Dictionary of Canadian Biography* **3**:675–681.
- Bonnault, C. de. La Galissonnière et sa contribution à la botanique du Canada. Pages 171–177 in *Les botanistes Français en Amérique du Nord avant 1850*. Centre National de la Recherche Scientifique, Paris, France.
- Brigham, D. R. 1998. Mark Catesby and the patronage of natural history in the first half of the eighteenth century. Pages 91–146 in A. R. W. Meyers and M. B. Pritchard, editors. *Empire's nature: Mark Catesby's New World vision*. University of North Carolina Press, Chapel Hill, North Carolina, USA.
- Cantwell, R. 1960. A legend comes to life: Mark Catesby. *Sports Illustrated*, 31 October:70–80.
- Catesby, M. 1731–1743 [1729–1747]. *The natural history of Carolina, Florida and the Bahama Islands: containing the figures of birds, beasts, fishes, serpents, insects, and plants: particularly, the forest-trees, shrubs, and other plants, not hitherto described, or very incorrectly figured by authors, together with their descriptions in English and French, to which are added observations on the air, soil, and waters*. W. Innys and R. Manby, London, UK.
- Catesby, M. 1747. Of birds of passage. *Royal Society of London Transactions* **44**:435–444.
- Catesby, M. 1974. *The natural history of Carolina, Florida and the Bahama Islands*. [Reprint of the second edition, 1771.] Beehive, Savannah, Georgia, USA.
- Catesby, M. 1985. *Catesby's birds of colonial America*. A. Feduccia, editor. University of North Carolina Press, Chapel Hill, North Carolina, USA.
- Charlevoix, P. F. X. de. 1923. *Journal of a voyage to North America*. Anonymous translation. L. P. Kellogg, editor. Two volumes. Caxton Club, Chicago, Illinois, USA.
- Chartrand, L., R. Duchesne, and Y. Gilngas. 1987. *Histoire des sciences des Québec*. Boréal Express, Montreal, Canada.
- Collinson, P. 1764. Some observations on the cicada of North America. *Royal Society of London Philosophical Transactions* **54**:65–68.
- Cornut [Cornuti], J. P. 1635. *Canadensium plantarum aliarumque nondum editarum historia*. Simonem le Moyne, Paris, France.
- Cornut [Cornuti], J. P. 1966. *Canadensium plantarum aliarumque nondum editarum historia*. J. Stannard, introduction. Johnson Reprint, New York, New York, USA.
- De Asúa, M., and R. French. 2005. *A new world of animals: early modern Europeans on the creatures of Iberian America*. Ashgate, Burlington, Vermont, USA.
- Dickenson, V. 1998. *Drawn from life: science and art in the portrayal of the New World*. University of Toronto Press, Toronto, Ontario, Canada.
- Egerton, F. N. 1976. Ecological studies and observations before 1900. Pages 311–351 in B. J. Taylor and T. J. White, editors. *Issues and ideas in America*. [This article is reprinted in Egerton 1977.] University of Oklahoma Press, Norman, Oklahoma, USA.
- Egerton, F. N., editor. 1977. *History of American ecology*. Arno Press, New York, New York, USA.
- Egerton, F. N. 2004a. A history of the ecological sciences, part 12: invertebrate zoology and parasitology during the 1500s. *ESA Bulletin* **85**:27–31.
- Egerton, F. N. 2004b. A history of the ecological sciences, part 13: broadening science in Italy and England, 1600–1650. *ESA Bulletin* **85**:110–119.
- Egerton, F. N. 2005. A history of the ecological sciences, part 18: John Ray and his associates Francis Willughby and William Derham. *ESA Bulletin* **86**:301–313.
- Egerton, F. N. 2006. A history of the ecological sciences, part 20: Richard Bradley, entrepreneurial naturalist. *ESA Bulletin* **87**:117–127.
- Ewan, J., and N. Ewan. 1970. *John Banister and his natural history of Virginia, 1678–1692*. University of Illinois Press, Urbana, Illinois, USA.
- Feduccia, A. 1985. Introduction, notes, and bibliography in Catesby 1985.
- Frick, G. F., and R. P. Stearns. 1961. *Mark Catesby: the colonial Audubon*. University of Illinois Press, Urbana, Illinois, USA.
- Granit, R. 1973. Pehr Kalm (1716–1779). *Dictionary*

-
- of Scientific Biography 7:210–211.
- Hariot, T. 1955. A brief and true report of the new found land of Virginia. Pages 317–387 in D. B. Quinn, editor. *The Roanoke voyages, 1584–1590*. Hakluyt Society, Series 2, Number 104.
- Harrison, T. P. 1964. John White and Edward Topsell: the first watercolors of North American birds. University of Texas Press, Austin, Texas, USA.
- Hayne, D. M. 1974. Pierre-François-Xavier de Charlevoix, Jesuit priest, teacher, author, 1682–1761. *Dictionary of Canadian Biography* 3:103–110.
- Howard, R. A., and G. W. Staples. 1983. The modern names for Catesby's plants. *Arnold Arboretum Journal* 64:511–546.
- Hulton, P., and D. B. Quinn, editors. *The American drawings of John White, 1577–1590*. Two volumes. British Museum, London, UK.
- Juel, H. O., and J. W. Harshberger. 1929. New light on the collection of North American plants made by Peter Kalm. *Academy of Natural Sciences of Philadelphia Proceedings* 81:297–303.
- Kalm, P. 1770–1771. *Travels into North America; containing its natural history, and a circumstantial account of its plantations and agriculture in general, with the civil, ecclesiastical and commercial state of the country*. J. R. Forster, translator. Three volumes. [Edition 2, 1772, two volumes.] T. Lowndes, London, UK.
- Kalm, P. 1892. Kalm's account of his visit to England on his way to America in 1748. J. Lucas, translator. Macmillan, London, UK.
- Kalm, P. 1911. A description of the wild pigeons which visit the southern English Colonies in North America, during certain years, in incredible multitudes. S.M. Gronberger, translator. *Auk* 28:53–66.
- Kalm, P. 1937. *Travels in North America*. J. R. Forster, translator; A. B. Benson, revisor. Wilson-Erickson, New York, New York, USA.
- Kalm, P. 1942. Pehr Kalm's observations on black walnut and butternut trees. E. L. Larsen, translator. *Agricultural History* 16:149–157.
- Kalm, P. 1943. Pehr Kalm's observations on the natural history and climate of Pennsylvania. E. L. Larsen, translator. *Agricultural History* 17:172–174.
- Kalm, P. 1945. Pehr Kalm's report on the characteristics and uses of the American Walnut tree which is called hickory. E. L. Larsen, translator. *Agricultural History* 19:58–64.
- Kalm, P. 1950. Pehr Kalm's description of the North American mulberry tree. E. L. Larsen, translator. *Agricultural History* 24:221–227.
- Kalm, P. 1953. Description of the periodical cicada, *Magicicada septendecim* L. E. L. Larsen, translator. *Ohio Journal of Science* 53:138–142.
- Lawson, J. 1967. *A new voyage to Carolina*. H. T. Lefler, editor. University of North Carolina Press, Chapel Hill, North Carolina, USA.
- Lefler, H. T. 1967. Introduction, notes, and appendixes to Lawson 1967.
- McBurney, H. 1997. Mark Catesby's *Natural History of America: the watercolors from the Royal Library, Windsor Castle*. Merrell Holberton, London, UK.
- McClellan, J. E., III. *Colonialism and science: Saint Domingue in the Old Regime*. Johns Hopkins University Press, Baltimore, Maryland, USA.
- Meyers, A. R. W. 1997. "The perfecting of natural history." Mark Catesby's drawings of American flora and fauna in the Royal Library, Windsor Castle. Pages 11–27 in Mark Catesby's *Natural History of America: the watercolors from the Royal Library, Windsor Castle*. Merrell Holberton, London, UK.
- Meyers, A. R. W., and M. B. Pritchard, editors. 1998. *Empire's nature: Mark Catesby's new world vision*. University of North Carolina Press, Chapel Hill, North Carolina, USA.
- Raven, C. E. 1964. John White's significance for natural history. Pages 47–52 in P. Hulton and D. B. Quinn, editors. *The American drawings of John White, 1577–1590*. British Museum, London, UK.
- Rousseau, J. 1957. Michel Sarrazin, Jean-François Gaultier et l'étude prélinnienne de la flore canadienne. Pages 149–157 in J. F. Leroy, introduction. *Les botanistes Français en Amérique du Nord avant 1850*. Centre National de la Recherche Scientifique, Paris, France.
- Rousseau, J. 1966. Le mémoire de La Galissonnière aux naturalists Canadiens de 1749. *La naturaliste canadien* 93:669–681.
- Rousseau, J. 1969. Michel Sarrazin (Sarrasin), surgeon, doctor, and naturalist, 1659–1734. *Dictionary of Canadian Biography* 2:593–600.
-

- Rousselot de Surgy, J. P. 1768. Histoire naturelle et politique de la Pensylvanie et de l'établissement des Quakers dans cette contrée. Garneau, Paris, France.
- Skottsberg, C. 1957. Linné, Kalm et l'étude de la flore Nord-Américaine au XVIIIe siècle. Pages 179–187 *in* Les botanists français en Amérique du Nord avant 1850. J.F. Leroy, introduction. Centre National de la Recherche Scientifique, Paris, France.
- Stearns, R. P. 1953. James Petiver, promoter of natural science. *American Antiquarian Society Proceedings* 62:243–365.
- Stearns, R. P. 1970. Science in the British colonies of America. University of Illinois Press, Urbana, Illinois, USA.
- Vallétt, A. 1927. Un biologiste Canadien: Michel Sarrazin, 1659–1735, sa vie, ses Traveaux et son temps. LS-A. Proulx, Quebec, Canada.

Verdoorn, F., editor. 1945. Plants and plant science in Latin America. *Chronica Botanica*, Waltham, Massachusetts, USA.

Wilson, D. S. 1978. *In the presence of nature*. University of Massachusetts Press, Amherst, Massachusetts, USA.

Acknowledgments

For their assistance I thank Jean-Marc Drouin, Muséum National d'Histoire Naturelle, Paris; and AnneMarie Drouin-Hans, Université de Bourgogne.

Frank N. Egerton
Department of History
University of Wisconsin-Parkside
Kenosha WI 53141
E-mail: frank.egerton@uwp.edu
