

SQUIRRELS IN EARLY WISCONSIN

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The tree squirrels are set apart from most rodents by their beauty and food value. East of the Mississippi River they were the staple game animals in pioneer times and continued in this role long after deer had become scarce, or disappeared. The observant knew when the gray squirrel was being served, for on cooking, its bones acquire a pink color.¹ When the Indian did not possess a rifle, or chose to be economical, he used the bow. Bullock² while at Tuscarora, New York, in 1827, met an Indian and his boy laden with nearly a hundred squirrels that had been killed with a short and simple bow. Some of the New York Indians hunted squirrels with the blowgun,³ a weapon undoubtedly brought in by the Tuscaroras when they migrated from the Carolinas.

White and Indian youth alike acquired skill in shooting by hunting squirrels. It was a point of pride with the hunter to kill his game by shooting it through the head or by "barking." The best marksmen in our armies through the Civil War were the men who had hunted squirrels since boyhood. The threat to southern Ohio by the Confederates in 1862 resulted in the call to arms of the "Squirrel Hunters" of that state.

Squirrels were a great problem to the early settlers due to their destructiveness to crops. The following statement is typical of conditions. "At that time [1823] it was an easy matter to raise grain and vegetables where the land was clear, but the great trouble was to save them. Squirrels, chipmunks and other vermin were so abundant that they would devour a field of corn almost entirely. . . . We used to have dead-falls for every fence corner, and some one of the family had to go around the field with a gun nearly all the time at certain seasons. I remember well that during warm weather, such was the stench from the carcasses of dead vermin, that it became nearly unbearable."⁴

The gray squirrel, due to its abundance, was particularly obnoxious. Massachusetts in 1740 voted a bounty of four pence on these animals.⁵ In 1741, 4,762 gray and "ground" squirrels were presented for bounty in the Town of Westford, Middlesex County, Massachusetts.⁶ The provincial government of Pennsylvania offered three pence per head for gray and black squirrels. After paying out 8,000 pounds, Pennsylvania currency, during the year 1749, the province retrenched to the extent of cutting the bounty in half.⁷ An act passed in 1807 gave a one and one-half cent bounty on squirrels in Western Pennsylvania. Eight additional counties were included in 1811.⁸ Most of the northern states at one time or another offered similar bounties.

A partial answer to the problem was the side hunt during which great numbers of squirrels were slain. During a two-day hunt in Madison County, Kentucky, 5,589 squirrels were killed.⁹ Thirty hunters, on Christmas day, 1833, killed 1,200 gray squirrels at Fulton, Missouri. The hunt was an annual affair to reduce the destruction of crops.¹⁰ Hall¹¹ mentions several side hunts in New York in which as many as 5,300 squirrels were killed; and one at Berlin, Vermont (?), that yielded 12,400. Other examples are given below.

Wisconsin had its side hunts but the numbers of squirrels killed were smaller than in some of the other states. There was the same problem of protecting the crops. As late as the fall of 1892, two men killed 188 squirrels in a cornfield of about ten acres near Viola, Richland County.¹²

Squirrels formed an item of importance in the game markets of Wisconsin. In the fall of 1876 the price ranged from \$.90 to \$1.25 per dozen in the Milwaukee market.¹³ They were so plentiful in 1882 that the price dropped from \$1.00 to as low as \$.25 per dozen.¹⁴ In 1890 they sold at two cents apiece in La Crosse.¹⁵ There appears to have been occasional demands from furriers. There was an offer at Grantsburg in 1901 to buy 150 gray squirrels, those having large, bushy tails bringing the highest price.¹⁶

Squirrel hunting remains an important sport as is shown by the recent annual kills in Wisconsin and Michigan given below.

WISCONSIN			
Year	Gray Squirrel	Fox Squirrel	Total
1940	606,372	399,104	1,005,476
1941	409,626	258,756	668,382
1942	445,283	316,817	762,100
1943	348,572	240,800	589,372
1944	433,420	262,275	695,695
1945	422,543	245,726	668,269

MICHIGAN			
Year	Gray Squirrel	Fox Squirrel	Total
1939	29,570	619,421	648,991
1940	34,980	725,565	760,545
1941	29,632	539,308	568,940
1942	44,602	644,825	689,427
1943	33,118	579,235	612,353
1944	48,315	700,330	748,645
1945	56,884	722,628	779,512

It will be noted that the gray is more abundant than the fox squirrel in Wisconsin, while the fox is far more plentiful than the gray squirrel in Michigan.

THE RED SQUIRREL

The red squirrel appears to have ranged formerly throughout most of the state. I have never seen it in Dane County and there are no satisfactory records from Rock County west to the Mississippi River. It was common in Jefferson County¹⁷ in 1856; however, the killing of one at Palmyra in 1887 evoked the comment that it was a rare species.¹⁸ In July, 1866, this squirrel invaded Green Bay¹⁹ and it was not uncommon to find half a dozen on one tree. It was very plentiful at Sturgeon Bay,²⁰ Stevens Point,²¹ and Black River Falls²² during the emigration of 1878; and at Marshfield²³ in 1883. In March of the latter year it was reported plentiful at Manitowoc.²⁴

The red squirrel emigrates but the movement is not often spectacular. An extensive emigration took place in Essex County, New York, in the autumn of 1851. Watson states: "It is well authenticated, that the red squirrel was constantly seen in the widest parts of the lake [Lake Champlain], far out from land, swimming towards the shore, as if familiar with the service."²⁵ This squirrel is a better swimmer than the fox or the gray. Watson adds: "Reaching land, they stopped for a moment, and relieving their active and vigorous little bodies from the water, by an energetic shake or two, they bounded into the woods as light and free as if they had made no extraordinary effort." Cole²⁶ remarks on the ease with which it swims.

Further information on the movements of this squirrel in the Adirondacks is given by Merriam. He says: "James Higby tells me that in June, 1877, he saw as many as fifty crossing Big Moose Lake, and they were all headed the same way — to the north. I am informed by Dr. A. K. Fisher that at the southern end of Lake George, in early autumn, it is sometimes an every-day occurrence to see Red Squirrels swimming across the lake from west to east — never in the opposite

direction. The chestnut grows abundantly on the eastern side of the lake, but is comparatively scarce on the western, and these extensive migrations always take place in years when the yield of chestnuts is large."²⁷

This species was frequently seen by Hardy²⁸ in emigration in Maine, swimming from east to west. Cole,²⁶ on September 18, 1921, found a red squirrel swimming southward across White Sand Lake, Vilas County, Wisconsin from a point where the lake was an eighth of a mile wide. The same autumn one was taken from the stomach of a great northern pike (*Lucius lucius*) at Lake Fanny Hoe, Keweenaw County, Michigan, where this squirrel was frequently seen to swim the lake.

The red squirrel has been losing ground gradually in the southern part of the state. The extent of its distribution southward was determined from information received from nearly one hundred residents within the vicinity of the present boundary (Fig. 1). Its persistence in southeastern Wisconsin appears to be due to the remnants of tamarack swamps. *Tamiasciurus hudsonicus loquax* occupies the state except in the northwest where it is replaced by an intergrade with *T. h. minnesotae*.

THE FOX SQUIRREL

The fox squirrel (*Sciurus niger rufiventer*) was not common in early Wisconsin but increased with settlement. "Atticus,"²⁹ writing in 1844, stated that gray and black squirrels were so common at Racine that a hunter could kill twenty of them in an afternoon. The fox squirrel was seen only occasionally, but he had killed several of them. During a hunting match that took place at Racine early in the winter of 1836, the red squirrel counted five, and black, gray and fox squirrels ten points.³⁰ Buck³¹ states that in 1836 the northern slopes of the bluffs on Oregon Street, Milwaukee, were covered with "a growth of poplar and hazel, a great resort for black, gray, and fox squirrels."

In 1850 Moses Barret³² settled on the Indian lands at Wautoma where he found red, gray, black, and fox squirrels. An occasional fox squirrel was to be found at Oshkosh³³ in 1859. Ficker³⁴ mentions only the gray and black squirrels as occurring in the town of Mequon, Ozaukee County, the winter of 1848-49. His "chipmunk" was evidently the red squirrel as it is described as very similar in coloration, but smaller than the German red squirrel. During a side hunt at Watertown in the fall of 1849, 235 black and gray, and 305 red

squirrels were killed by 20 hunters. The fox squirrel was not mentioned.³⁵ However, in 1856, the woods at Jefferson "are alive with squirrels — black, gray, fox and red that are committing sad havoc with our farmers' corn."¹⁷ A side hunt at this place in 1866 yielded "over 350 black, gray and fox squirrels, about 200 red . . ."³⁶ The red squirrel counted five and the other species ten points each, indicating that the fox squirrel was not sufficiently rare to secure a premium.

The fox squirrel was the most numerous species at Brodhead,

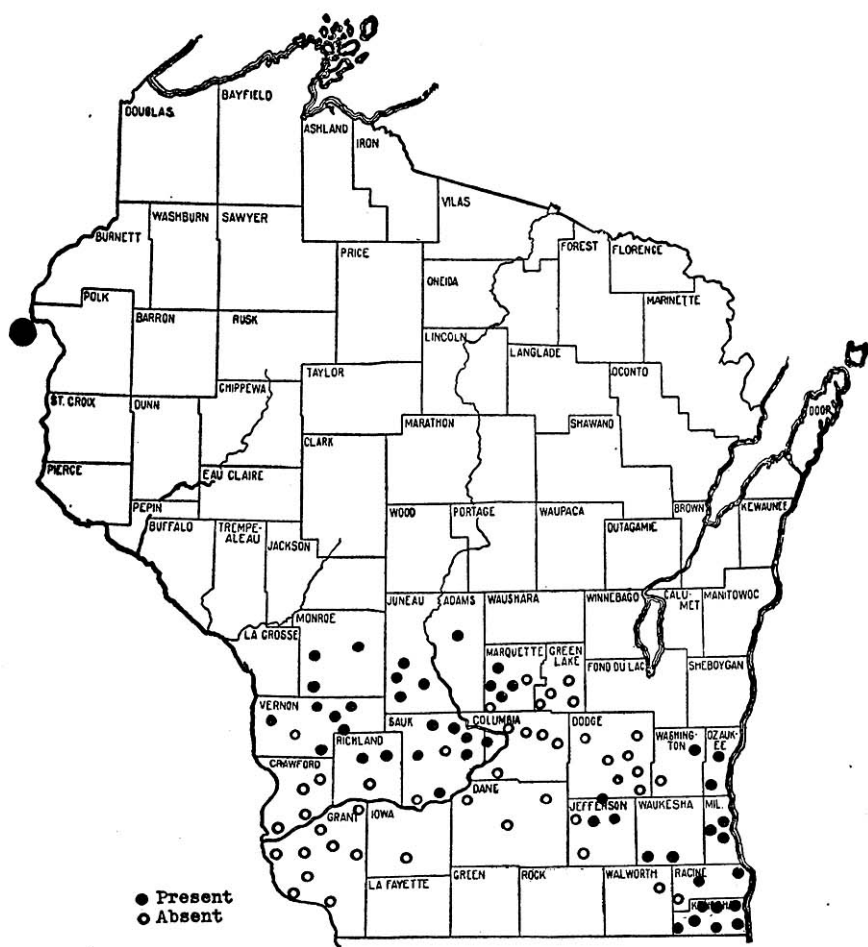


FIG. 1. Southern range of the red squirrel in Wisconsin.

Green County, in 1869.³⁷ Fox and gray squirrels were abundant, red few, and black rare, at Waukesha in 1879.³⁸ At this time Strong³⁹ limited the fox squirrel to the southern and eastern parts of the state. An opinion on the relative abundance of the various species in Richland County in 1882 may be formed from the points set for a side hunt: red 10, gray 25, black and fox squirrels 50 points.⁴⁰ In 1899 a hunter in this county is reported to have found 17 fox squirrels in one tree and to have killed 13 of them.⁴¹ During a side hunt at Plymouth, Sheboygan County, in 1890, 3 fox, 2 black, and 33 gray squirrels were killed.⁴²

Fox, gray and black squirrels occurred at Trempealeau in 1883, the gray predominating.⁴³ Kessinger,⁴⁴ in 1888, reported the status of the squirrels in Buffalo County as follows: fox, "not numerous"; gray, "more numerous"; black, occasional; and red, abundant. Fox, gray, and black squirrels occurred near Montello, Marquette County, in 1877.⁴⁵ In 1886 there were fox, gray, and red squirrels at Tustin, Waushara County.⁴⁶

A fox squirrel was shot in Outagamie County in 1904.⁴⁷ Komarek⁴⁸ in 1932 listed the fox, gray, and a few black squirrels for the Menominee Indian Reservation, northeastern Shawano County. I was told by Edward Puchner in 1942 that fox squirrels appeared near Wausau three or four years previously. A few black squirrels were to be found but the gray predominated.

There is at intervals a considerable variation in the ratio of fox to gray squirrel populations. During a residence of 40 years in Dane County, I have found that the fox squirrel has always been the more numerous, taking the county as a whole. The gray squirrel was uncommon in the city of Madison up to 1934. Since that time it has increased to the point of being about as plentiful as the fox squirrel. Joseph Henderson, who was born near Riley, Dane County, in 1884, informed me that when he was a boy nearly all the squirrels were gray, a fox squirrel being considered a "prize." A similar situation in Dodge County is reported by Snyder.⁴⁹ In 1888 the fox squirrel was rare and the gray common at Beaver Dam. By 1902 this condition was reversed.

The fox squirrel is less numerous than the gray in the state. There were 245,700 fox squirrels killed in 1945. There was one fox squirrel killed to 1.7 gray squirrels. The fox squirrel was decidedly superior numerically to the gray in Calumet, Fond du Lac, Green, Richland,

and Rock counties, less so in Brown, Dane, Outagamie, and Winnebago counties.

The upper range of the fox squirrel, Green Bay to the northern end of Lake Pepin, as given by Hamilton⁵⁰ in 1943, is too conservative. The movement of squirrels in northwestern Wisconsin in the fall of 1946 showed that the fox squirrel was common at Hudson and that a few were resident at Osceola, Polk County.⁵¹ Prof. J. R. Jacobson, Central High School, Superior, informed me that this species



now occurs 20 miles south of Superior. It is fairly common in southern Marinette County, though Allen⁵² reported it absent in Menominee County, Michigan. C. H. Richter wrote me that it has been at Oconto for at least 20 years. The present range is given in Fig. 2.

A fox squirrel with black markings is now comparatively rare in the state. A century ago fox squirrels with black bellies seem to have been fairly common. When Dr. P. R. Hoy⁵³ was in St. Louis in 1854 he noticed in the window of a barber-shop a black-bellied fox squirrel such as was found in the vicinity of Racine, Wisconsin. On inquiry he learned that it was obtained on the Wisconsin River.

Kennicott wrote: "A variety of this species is occasionally met with in which the tail and upper parts are of the usual colors, but with the entire under parts of the body perfectly black. It has only been observed in Southern Wisconsin and Northern Illinois."⁵⁴ Mrs. H. A. Main, Fort Atkinson, has a memo left by Thure Kumlien listing a male black-bellied fox squirrel, taken at Busseyville, August 26, 1880, as of possible interest to the University of Wisconsin. He valued it at \$2.00. Snyder⁴⁹ had in his collection three specimens with the underparts black and states that three examples of complete melanism have been found in Dodge County. H. E. Reed, Ashippun, told me that about November 1, 1944, while hunting at Auroraville, Waushara County, with his son, the latter killed a black-bellied fox squirrel. He had never seen one before.

It has been generally assumed that the fox squirrel does not emigrate even when the gray squirrels are moving en masse. Porter⁵⁵ states that during an immense emigration of gray squirrels in Butler County, Pennsylvania, the fox squirrel, though common in eastern Pennsylvania, was not seen. Kennicott⁵⁴ remarked that this species will migrate singly but not in large companies; and that it has been known to cross "a prairie in summer four or five miles in width, to reach timber upon the other side." Brown and Yeager⁵⁶ found no evidence of an emigration of this squirrel in Illinois.

Authentic cases of emigration are rare in the literature. Britton,⁵⁷ when a boy, mentions seeing about 100 fox squirrels moving southward on the ground and along rail fences. Bennitt and Nagle⁵⁸ record small but very definite emigrations in Missouri in recent years.

On October 1, 1946, Harry Strobe gave to Aldo Leopold information obtained from his father on a movement of squirrels in the 1880's (probably 1883). The observations were made on Strobe's Island, an area of 90 acres situated in the Fox River three miles

south of Appleton, Wisconsin. Squirrels also crossed the river four or five years after this date. The movements, starting in August and continuing into September, lasted over a period of three to four weeks. The crossing, always westward, took place during the entire day, and 25 to 30 squirrels could be seen swimming at one time. "About 80 to 90 percent of the squirrels were grays and the rest were black and fox squirrels. Sometime after 1890 the fox squirrels replaced the gray squirrels and the numbers of squirrels declined."

Under date of October 19, 1938, Aldo Leopold sent me some information, furnished by Earl Schultz, Oregon, Wisconsin, on an emigration of fox squirrels at Reed's Landing at the lower end of Lake Pepin in September, 1903. The movement lasted for two weeks and no gray squirrels took part. The squirrels crossed daily from noon to 3:00 P. M. The direction was westward. When a squirrel was pushed off the eastern side of a boat, it invariably oriented itself and continued westward. On September 3, 1944, Cyril Kabat observed a movement of fox squirrels in the Puckaway Marsh, at the eastern end of Lake Puckaway, Green County, Wisconsin. "As many as 20 fox squirrels were observed attempting to swim across the Fox River and adjoining marsh waters . . . The movement was from west to east. The water area was about half a mile wide at this point." The distance from the timber from which the squirrels apparently started to the next hardwoods in the line of march was at least two miles.

The fox squirrels moved en masse during the squirrel emigration in northwestern Wisconsin in the fall of 1946.⁵¹ In western Jackson County, where the direction of the movement was southwesterly, Warden Werner Radke saw "approximately fifty fox squirrels while traveling a mile of road in the towns of Albion and Springfield."

THE GRAY SQUIRREL

Range. It is not possible to determine accurately how far north the gray squirrel occurred a century ago. While at Lac du Flambeau in 1804, Malhiot⁵⁹ wrote in his journal that the squirrels were doing much damage in the corn fields. This probably refers to the red squirrel. Kennicott^{54a} in 1856, stated on the authority of Dr. Hoy that it did not occur in northern Wisconsin but was abundant in the southern part of the state. It was very abundant at Appleton⁶⁰ in 1854 and at Green Bay⁶¹ in 1856, so that it must have occurred in this latitude prior to settlement. It is reasonable to assume that it was indigenous to all the northern counties. Richardson²⁶ stated in

1829 that the black squirrel was not uncommon on the northern shores of Lakes Huron and Superior, the gray never being seen. He mentions a specimen secured at Fort William, northeast of the present Minnesota boundary.

The increase northward has been induced by agriculture and the replacement of conifers by hardwoods. It was in Lincoln County by 1893. Through the felling of a tree a litter of six young was taken near Merrill⁶³ in August. The shooting of a gray squirrel at Florence in 1886, and again in 1895, in both instances induced the remark that this species was very rare in Florence County.⁶⁴ In October, 1895, a hunter killed 8 gray squirrels at High Ridge, 15 miles south of Ashland. They were supposed to be the first killed in that part of the state.⁶⁵ Chief Justice Marvin Rosenberry informed me in 1939 that about 25 years previously, while hunting deer at Star Lake, Vilas County, he shot a black squirrel and brought it into camp since it was a rarity. It has been reported from Duluth,⁶⁶ and in the fall of 1946 a few grays appeared in the city of Superior. Today it is found in all of the northern counties, but is rare in the immediate neighborhood of Lake Superior. (Fig. 3).

Most of the state is occupied by *Sciurus c. leucostis*. The status of the races in northern Wisconsin has not been worked out. The planting of *leucostis* in Vilas County in the years 1934-36 complicates the problem.⁶⁷ Burt⁶⁸ refers all the gray squirrels of the Northern Peninsula to *S. c. hypophaeus*, but in an earlier paper he thought that this race might be only a color phase.⁶⁹ The occurrence of *hypophaeus* in Dodge County, as reported by Snyder,⁴⁹ is open to question since no specimens appear to have been taken. Presumably the squirrels of northernmost Wisconsin are *hypophaeus*. On September 13, 1839, Bachman wrote to Audubon: ". . . the ever varying Squirrels seem sent by Satan himself to puzzle the Naturalists." The latter have advanced to the stage where they seek bedevilment.

White Phase. Albinism appears to occur most frequently in regions where there is melanism. I am indebted to Prof. Leon J. Cole for some correspondence on the two color phases in the state. About the year 1913, three white squirrels were captured at Westfield, Wisconsin.* In the fall of 1940, Warden Hartwell Hope, Westfield, reported the presence of about 17 black squirrels in one locality and 7 black and one white in the town of Lincoln, Adams County. The same fall Carl L. Brosius, Acting Commandant, reported 30 to 35 black and 4 white squirrels on the grounds of the Grand Army

Home for Veterans, at Waupaca. On March 13, 1947, Gordon L. Paeske wrote to me that there were two white squirrels near the campus of Northwestern College, Watertown. There has been for many years a large colony of white squirrels at Olney, Illinois. Harvey D. Hays informed me that the present population of about 500 albinos stems from a pair introduced in 1902.

Black Phase. While predominating formerly in certain regions,

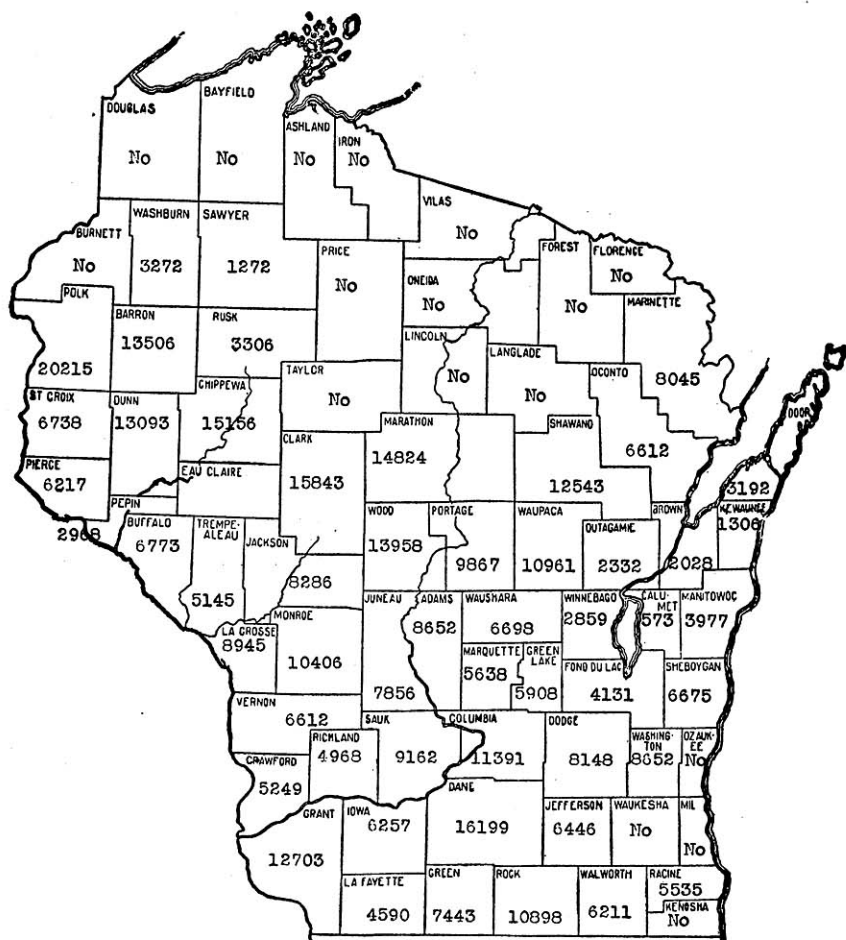


FIG. 3. Kill of gray squirrels in Wisconsin by counties in 1946. "No" shows no open season.

the black phase of the gray squirrel, for some unknown reason, becomes rare or disappears with the advance of civilization. It may be stated that in general the black phase increases as the northern limit of the species is approached. On October 15, 1749, Kalm wrote: "Yesterday and today we saw black squirrels in the woods. This squirrel is quite common about Fort St. Frédéric, but north of Montreal it is rather scarce and hard to find. They have these instead of the gray squirrel."⁷⁰

Weeks writing of Salisbury, Vermont, said: "Grey-squirrels were rarely met with before the commencement of the present century, though they are now quite numerous; while black-squirrels, though now nearly if not quite extinct, were then found in quite large numbers."⁷¹ The same trend at Weare, New Hampshire, was noted by Little.⁷²

The black squirrel was very destructive to crops in New York, the gray arriving with settlement.⁷³ In the Genesee River region, black and red squirrels were common in 1804 but the gray was rare.⁷⁴ Some information on the disappearance of the black squirrel at Le Roy, New York, is given by Comstock.⁷⁵ This phase declined from about 90 percent to 2.5 percent from about 1850 to the period 1884-90. Dr. L. F. Hawley informed me that the ratio of black to gray was three to one at his home, Salamanca, New York, in 1900 and that on going to Ithaca only the gray was to be found.

The black squirrel, about 1800, was abundant in Crawford County, Pennsylvania, the gray arriving with settlement.⁷⁶ According to Beck,⁷⁷ the black squirrel, known locally as the "stump-ear", has been replaced almost entirely by the gray in Lancaster County, Pennsylvania.

The black squirrel was the dominant form in southwestern Michigan.⁷⁸ According to Evermann and Clark,⁷⁹ a large proportion of the squirrels in southern Michigan were black, while in middle Indiana a black squirrel was seldom seen. Kennicott^{54a} mentions that of a lot of nearly fifty squirrels shot near the Rock River, Illinois, all were black. As late as 1872 black and gray squirrels were reported plentiful in the woods north of Freeport, Illinois.⁸⁰

The cause of melanism has been discussed by Rhoads. He suggests that, "the original status of the black squirrel is dependent on an environment combining the climate and flora of the Upper Transition and lower Canadian life zones, in which coniferous and nut-

bearing trees were normally in the proportion of about ten to one. As these conditions through human agency revert to those of the Lower Transition and Upper Austral zones, with a corresponding increase in population, the ratio of blacks to grays decreases."⁸¹ Rhoads' theory seems entirely inadequate since the black squirrel was once abundant in regions where conifers were entirely absent. The gray squirrel is characteristic of deciduous rather than coniferous forest. In this connection it is of interest that Spärck⁸² in Denmark found a direct correlation between the dark phase of *Sciurus vulgaris* and deciduous forest.

The black phase was at one time the sole or prevailing form in the northern part of the range of the gray squirrel and pioneered in the extension of territory.⁸³ Seton states that, "melanism increases in frequency northward, until in Canada, the black is the rule; there, at most, 5 percent are gray."⁸⁴ Bachman⁸⁵ noted that both grays and blacks were to be found in the same litter. Black is a recessive character and tends to disappear. The gray form carries the genes producing black, so that when the proper combination of genes is produced in the mating of grays, the black phase may appear after several generations of grays. The heterozygous nature of the gray squirrel has been discussed recently by Shorten.⁸⁶ Gray squirrels were introduced at Woburn, England, in 1890, the black phase being introduced later. Shorten found that in a litter of four young produced by a pair of grays one was black; and a black female was found suckling a single black young.

The disappearance of the black phase is an intriguing problem. The cause is possibly climatic. I believe that it is logical to assume that melanism developed on the borders of the glaciers during the Pleistocene when the climate was cold and moist. The line of maximum glaciation runs approximately from New York to St. Louis. Pleistocene remains are of little assistance since only a few of *Sciurus carolinensis* have been found, and these in Pennsylvania and Maryland.⁸⁷ The southern range of the northern gray squirrel at the time of the appearance of white explorers in the Ohio Valley is not determinable. In fact the first acceptable approximation of its range is that given by Allen⁸⁸ in 1877. He stated that it extended south to about isotherm 50° F., where the two forms were not readily distinguishable. Presumably he used the isotherm of Schott.⁸⁹ Allen gave but two definite localities, Washington and St. Louis, for the southern limits of *leucostis*. In Illinois and Indiana the line of maximum gla-

ciation and the above isotherm coincide roughly but in the other states there is considerable deviation. This is due largely to the Appalachian range. As is well known, increase in altitude has the same effect as increase in latitude on faunal distribution.

The southern form of the gray squirrel, according to Hamilton,^{50a} extends at the present time to central Illinois, Indiana, and Ohio. On the other hand Lyon⁹⁰ states that except for the two northern tiers of counties all the gray squirrels of Indiana are referable to the southern form. He makes the following pertinent comment: "The frequency with which black squirrels were reported in the early days from comparatively southern portions of the state leads to the belief that the Northern Gray Squirrel extended farther south than recent writers indicate."

The black squirrel was rather uncommon directly along the Ohio River during the early 1800's. Of the squirrels crossing the Ohio in 1803, "many" were black.⁹¹ There were also black squirrels in the emigration of 1817;⁹² however, Blane informs us that these were considered invaders from the north. He wrote that, "they knew from seeing the black or Canadian squirrel, that they were to expect vast multitudes; since the animals of this species do not make their appearance, unless in times of the failure of the mast . . . in the Northwestern forests."⁹³ This statement loses significance since the distances travelled in the migrations are unknown.

Palmer,⁹⁴ in 1817, found the black squirrel near Cincinnati. No migration is recorded for this year. Maximilian⁹⁵ spent the winter of 1832-33 at New Harmony, Posey County, Indiana. He was informed by Le Seur that during several years residence he had seen but one example. On the other hand Haymond wrote in 1869: "The black squirrels were common — forming about one-third of the total number of squirrels in southeastern Indiana [Franklin County] at the period of its first settlement. Now they have completely disappeared."⁹⁶ When the Kanawha Valley was first settled, gray and black squirrels were very numerous and every few years they migrated from west to east in countless numbers.⁹⁷

Black Squirrel in Wisconsin. The first highway surveyed in southern Wisconsin, according to John Trumbell,⁹⁸ ran from Racine to Janesville. In August, 1839, he travelled this road in a light wagon "shooting black squirrels by the way." He remarked that Walworth County, in comparison with Racine, was "a little better timbered."

At that time the road from Racine to Milwaukee ran through a strip of heavy timber about 15 miles wide. Black squirrels emigrated from Dane County in 1856.⁹⁹ One was shot in this county in November, 1899.¹⁰⁰ Bade¹⁰¹ relates that during the early days at Plymouth he and a companion killed 67 gray and black squirrels in the town of Mosel, Sheboygan County, in a day's hunt. The black phase was not plentiful. Black and gray squirrels were reported abundant in Sheboygan County in 1894.¹⁰²

When Featherstonhaugh was near the foot of Lake Pepin in September, 1835, he observed a great many gray squirrels, "but no black ones, which I have seen abound so much in Upper Canada."¹⁰³ This is curious since the black phase occurred throughout western Wisconsin. A party hunting 15 miles north of La Crosse in 1863 killed 13 gray and 9 black squirrels.¹⁰⁴ By 1888 only a few black squirrels were to be found in Buffalo County,⁴⁴ but they are not yet extinct.¹⁰⁵

Black squirrels were abundant at Prescott¹⁰⁶ in 1868, at Hudson¹⁰⁷ in 1878, and at New Richmond¹⁰⁸ in 1895. They were quite plentiful at Rice Lake, Barron County, in 1880.¹⁰⁹ At this time Strong³⁹ reported it as occurring rarely throughout the range of the gray squirrel. A black squirrel with the terminal half of the tail white was killed at Friendship,¹¹⁰ Adams County, in 1871.

This squirrel was common at Grand (Wisconsin) Rapids¹¹¹ in 1883. At this place on the afternoon of September 25, 1895, two hunters killed two black and 18 gray squirrels. Black and other squirrels were common at Stevens Point¹¹³ in 1878 and at Marshfield¹¹⁴ in 1883. In the fall of 1886 the woods near Neenah were "full of black squirrels."¹¹⁵ Hamilton¹¹⁶ mentions the killing of 19 black and gray squirrels at Sturgeon Bay in 1894. By 1901 the shooting of a black at this place was worthy of note.¹¹⁷

Today the black squirrel is very rare south of Baraboo and Reedsburg. North of the latitude of these places it is nowhere abundant, but may be considered fairly common locally.

Emigration. The early emigrations* of the gray squirrel were so impressive as to be recorded frequently by travelers. Kalm devoted several pages to this animal and said that, "it is peculiar that in some years a greater number of squirrels come down from the higher countries into Pennsylvania and other English colonies. They commonly come in autumn . . ."^{7a} An emigration occurred in the autumn of 1749 while he was in America.

Col. Joseph Barker, one of the founders of Marietta, Ohio, in

1788, wrote: "The migration of the gray squirrel is a very curious phenomenon, and not easily accounted for. In the autumn of certain years they become itinerant, traveling simultaneously in millions from north to south; destroying whole fields of corn in a few days, if not immediately gathered . . . traveling forward without stopping long in any place; swimming large rivers; and perhaps before winter, returning again by the same route toward the north."¹¹⁸

Notable emigrations occurred on the Canadian border. Weld wrote in September, 1796: "The squirrels this year, contrary to the bears, migrated from the south, from the territory of the United States. Like the bears, they took to the water on arriving at it, but as if conscious of their inability to cross a very wide piece of water, they bent their course towards Niagara River, above the falls, and at its narrowest and most tranquil part crossed over into British territory. It was calculated that upwards of fifty thousand of them crossed the river in the course of two or three days, and such great depredations did they commit on arriving at the settlements on the opposite side, that in one part of the country the farmers deemed themselves very fortunate where they got in as much as one third of their crops of corn. These squirrels were all of the black kind said to be peculiar to the continent of America."^{3a}

There seems to have been a general movement of animals in 1796. Rev. Zeisberger wrote at Fairfield, on the Thames, Canada: "With game too it has been unusual. Raccoons, squirrels, bears, wolves, and wild turkeys came in great number, and did great harm to the fields . . . Besides all sorts of vermin came from the south, tried to get over the river, and were drowned, whole heaps of which could be seen."

Another extensive emigration took place in 1807. Featherstonhaugh, in Upper Canada, "met the most surprising quantities of fine glossy black-skinned squirrels . . . : they had spread over an immense district of country, and were evidently advancing from Lake Huron to the south."^{103a} This year Schultz found black squirrels astonishingly numerous on the north shore of Lake Erie. On August 16, 1807, he wrote that, "they were literally in small flocks upon the trees; on some we found ten, twelve and fifteen, and L. even killed five of them at one shot. Indeed, it was hardly necessary to shoot them, as you would frequently find three or four upon a little bush not more than twelve or fifteen feet in height. We shot one hundred and eighty-seven in less than three hours. They were exceedingly fat . . . It is somewhat singular that on the American side, you may range a day through

the woods, and scarcely pick up half a dozen of these animals, while there are such innumerable flocks on the opposite shore; an evident sign, I think, that the present multitudes . . . have migrated from the interior of the north-west, until their further progress south-eastwardly was arrested by the broad and rapid stream of Niagara."^{92a}

Beardsley describes an emigration that took place at Niagara Falls in the fall of 1815: "All along the river, the trees and fences were covered with black squirrels, and thousands were swimming from the Canadian to the other side. I never saw them so plenty, anywhere before; and have never seen them in such numbers in our own state [New York] as they were that year."¹²⁰ During the early 1800's there were huge movements in the opposite direction. The squirrels were killed with sticks as they landed on the Canadian shore.¹²¹ Talbot¹²² states that in the summer of 1820 squirrels were so numerous as to destroy about one thousand acres of corn in the township of London, Ontario.

An emigration of gray squirrels took place in eastern New York in 1808 or 1809. Judging from the descriptions of Bachman¹²³ of some of the squirrels, the grays were accompanied by chipmunks. They crossed the Hudson between Waterford and Saratoga, and stopped in the mountains of Vermont. Many remained in Rensselaer County, east of the Hudson, where they were numerous for several years. There was no evidence of a return.

A French officer stationed at Fort Duquesne (Pittsburg) wrote that in August, 1755, black and gray squirrels were crossing the rivers. They crossed two and three times daily, and as many as 700 to 800 being seen at one time. He stated that they took to the water due to an itching on the head and added: "We had to throw the heads away because they had worms in their brains, which caused them to blacken and make the animals somewhat crazy."¹²⁴ When Schoepf¹²⁵ was at Pittsburg in early September, 1783, unbelievable numbers of gray and black squirrels were emigrating from the frontiers toward the coast. Vast numbers were killed. Two boys at Wheeling shot 219 in three days.

Emigrations of the greatest magnitude took place in the north central states where the preponderance of mast-bearing trees led to high populations. Rev. Cutler¹²⁶ on September 10, 1788, caught a great number of squirrels that were swimming the Ohio below the mouth of the Little Muskingum. On September 11, 1803, at Sunfish Creek, about 117 miles below Pittsburg, Captain Lewis recorded

in his journal that squirrels were crossing the Ohio, "universally passing from the W. to the East shore they appear to be making to the south."⁹¹ On the 13-15th the squirrels were swimming from the northwest to the southeast, only one being observed to swim in the opposite direction. On the 15th they camped 201 miles below Pittsburgh so that the migration covered a front of 84 miles.

Another emigration occurred in 1807, only four years later. Schultz wrote on October 6: "This country appears to be completely overrun with innumerable quantities of black and grey squirrels. The river (Ohio), since we left Marietta, has afforded us an abundant supply of these animals, without any trouble on our part, as our boat had continually five or six of them on board . . . I have counted no less than forty-seven at one time swimming across the river in different directions. The shores on each side of the river are literally lined with drowned squirrels; and I suppose that one third at least of those who take to the river perish in the water. They all appear to be migrating to the southward. Higher up the river we found them very fat . . . but they have now become too poor to be eatable."^{92b} The Ohio was polluted by the thousands of dead squirrels on its surface and its banks. Cuming¹²⁷ was in Adams County, Ohio, near the Ohio River on August 8, 1807, when he found the woods "alive" with squirrels. This shows that the movement extended over a period of at least two months.

The emigration of 1807 is mentioned by Hildreth. In a paper dated January 17, 1809, he states that "last" year crops were injured by myriads of gray squirrels. They appeared to be "migrating from the north to the south — hundreds could be seen crossing the Ohio, where it was nearly a mile wide; in this attempt thousands were drowned."¹²⁸ This undoubtedly refers to 1807 for in a later paper he mentions the years 1807, 1822, and 1843 as memorable for the emigrations and depredations of this squirrel.¹²⁹

Scott¹³⁰ quotes Col. Keys as stating that the squirrels began to appear in Highland County early in the spring of 1807 and that by the first of May the whole of southern Ohio was inundated. The planted corn was taken up almost entirely. Jones¹³¹ also states that the squirrels emigrated in 1807 directly after corn-planting and that the crop was a failure over a large part of the country. Spring emigrations were unusual. As mentioned above there was an emigration in Ontario this year. The emigration of 1807 is accordingly remarkable for duration and extent of territory.

The next huge emigration took place in 1822. Blane has given us the following graphic description: "I could scarcely believe my eyes, when I saw the immense number of these animals, who were busily employed in destroying a field of Indian corn, and who, on our approach, took refuge in the neighboring thicket. We shot eleven out of one tree; from which also several others, alarmed at the noise of the rifles, jumped out and escaped. These little animals had that year done incalculable mischief to the Indian corn, throughout the States of Ohio and Indiana. They also swam the Ohio river by myriads, and ravaged the shores of Virginia and Kentucky. I found that this host of squirrels had in many places destroyed the whole crop, and that the little fellows were sometimes seen, three or four upon a stalk, fighting for the ear. In parts of Ohio, the people attempted to destroy them by means of guns, dogs, and clubs. One party of hunters, in the course of a week, killed upwards of 19,000. In most places, however, there were such multitudes of them, that the inhabitants quite despaired of being able to rid themselves of this plague. Whole legions of these animals when crossing the river were killed by boys and dogs; but their numbers did not appear to be sensibly diminished, until they came to the open and cultivated parts of Kentucky, where, as they had no longer the trees to take shelter in, they were easily destroyed. The farmers with whom I conversed, told me that the oldest settlers had never recollected seeing so many. But about fifteen years before [1807] they were almost equally plagued."⁹³ The effect of the destruction of the crops was acutely felt at Chillicothe, Ohio, in the spring of 1823, where the farm animals, particularly hogs, were starving to death. This shows that there was no mast left in the woods.

The naturalist, Godman, also witnessed the emigration in Ohio in the fall of 1822. He states: "Fortunately for the farmers these animals are not at the same time equally numerous in different parts of the country. We found the squirrels in 1822, most numerous throughout the country lying between the Great and Little Miami rivers; they became evidently fewer as we advanced towards Chillicothe, and beyond that place were so rare as to be seldom seen."¹³² Blane's account shows that Godman arrived at Chillicothe after the emigration had passed. It extended beyond Columbus where squirrels were so numerous that a county-wide hunt was organized.¹³³ This took place early in September and 19,900 scalps were produced.

This was not the total kill since a great many hunters did not report.

The direction of the emigrations in Ohio was usually southeast or south. The irregular emigrations passing through Dayton, Ohio, originated in the northwest.¹³⁴ Bushnell,¹³⁵ in his annals under the year 1816, mentions a large emigration of squirrels towards the southeast in Licking County, Ohio. The movement across the Ohio River was not always southward. Jacob Hoffner informed Dury¹³⁶ that in the autumn of 1816 great numbers crossed the river from Kentucky below Covington.

An emigration lasting about 20 days took place in Miami County, Ohio, "about the year 1828-29", and passed from west to east.¹³⁷ One of the last large emigrations in Ohio took place in 1843. Hildreth states: "In addition to the other calamities which befell us . . . the gray squirrels commenced their depredations on the corn as soon as it was fairly in the milk, and continued them till it was gathered. They were most numerous in September and October, migrating from the woods in the interior in countless hosts; one man could kill a hundred and more in a day. . . . Thousands of them swam across the Ohio River."¹²⁹

Indiana was as well populated with gray squirrels as Ohio. Flint relates that in the emigration of 1811, "they emigrated from the north towards the south by thousands, and with a front of some regularity, along the lower part of the state of Ohio, and the whole of Indiana."¹³⁸ This emigration is mentioned briefly by Latrobe.¹³⁹

While on a collecting trip in 1819, Audubon observed large numbers of gray squirrels swimming the Ohio. The emigration began 100 miles below Cincinnati and extended to within 100 miles of the mouth of the Ohio; accordingly on a front of about 125 miles. "At times they were strewed, as it were, over the surface of the water."⁸⁵

Hamilton County was over-run in 1826. The squirrels passed from west to east for a period of two weeks.¹⁴⁰ The year 1834 was remarkable for the number of squirrels throughout Indiana. Hahn¹⁴¹ states that in Wabash County they emigrated northward, crossing the Wabash River in countless numbers. The woods and prairies near Crawfordsville, Montgomery County, swarmed with them for a period of two to three weeks.¹⁴² According to Banta¹⁴³ this was an exceptionally bad year for squirrel depredations in Johnson County. Hahn mentions that in a great squirrel hunt in Bartholomew County the champion killed 900 squirrels in three days. The next largest score was 783. He also stated on the authority of E. J. Chansler that

the squirrels emigrated from Knox County this year and again in 1836 and 1837.

It is stated that Kentucky was invaded by squirrels in great numbers early in the spring of 1850. The great southward emigration across the Ohio into Kentucky in 1822 is also mentioned.¹⁴⁴ In September, 1877, Harrison and adjoining counties in Indiana were overrun by squirrels. The movement was northward.¹⁴⁵ A much larger emigration was said to have taken place in 1833.

Large emigrations have occurred west of the Mississippi and south of the Missouri. Galland, writing of Iowa in 1840, stated: "The common grey squirrels are found plentifully in the woods, with a few scattering fox squirrels, but no black ones . . . neither have I discovered the singular phenomenon of migration and emigration, profusion and scarcity, of these little animals, which are so remarkable in the early settlement of the Ohio valley."¹⁴⁶

The middle of September, 1859, "hundreds of thousands" of gray squirrels appeared along the Merrimac River, Missouri, crossed the Mississippi, worked their way down the river, then crossed to Cape Girardeau in "countless myriads".¹⁴⁷ The old French settlers said that similar hordes were encountered in 1834 and 1852. It was the year 1834 that Townsend¹⁰ found the gray squirrel so numerous in Missouri.

There has been a great number of comparatively small emigrations of the gray squirrel during the past 100 years. A few of these movements will be mentioned subsequently to emphasize a particular point.

Nature and Cause of Emigration. One of the most striking features of the movement of gray squirrels was the persistence with which these animals adhered to a course when it became set. They would not be turned aside by prairies, rivers, lakes of moderate size, or even villages. Before entering the water, they were said to climb trees to view the hazard ahead. Attempts to cross a stretch of water more than a couple of miles wide were rarely made. No instances were found where they blindly entered the Great Lakes. Crossings between Ontario and New York were made at the Niagara River. A hunter told Comstock¹⁴⁸ that in September, 1848, he saw "two acres" of black and gray squirrels crossing Seneca Lake, New York, at a place where it was five miles wide. They crossed from east to west. The next year these animals were plentiful on the west side and absent on the east.

A good account of the crossing of a lake is given by De Voe. He states: "It is said that they always travel to the east, often hundreds of miles, and when necessary to cross a river or lake they enter the water like dogs, if it is quite smooth. In the month of September, 1851, I arrived at Lake George [N. Y.] where I found the gray and black squirrels had been travelling for several days and were still moving. Early one morning I discovered three or four at several distances, swimming from the western to the eastern shore of the lake, which at that time was as smooth as glass. I watched them as long as I could see the ripples which they made, and supposed they succeeded in crossing the lake, which at this point was more than a mile wide. They will not enter the water when there is a ripple, as they swim very deep and of course drown easily; sometimes they are caught out in the rivers or lakes with a sudden breeze, just enough to agitate the water, when it drowns them, without they are lucky enough to catch a floating piece of bark or wood to mount upon, and with their tails curled up they are blown or wafted ashore. (People finding them in this situation are led to believe that they started with a float)." ¹⁴⁹

One writer remarks that he had frequently seen black squirrels crossing the Niagara River and that they "swam across, when the morning first began to dawn. On reaching the opposite shore they would appear greatly fatigued, and if unmolested would take a pretty long rest preparatory to their setting off for the neighboring woods." ¹⁵⁰ There seems, however, to be no particular time of day chosen to cross water. Schultz, ^{92b} while floating down the Ohio, encountered them throughout the day.

The gray squirrel was considered by Bachman ¹²³ to be a clumsy swimmer. Those that crossed the Hudson swam deeply and awkwardly, their bodies and tails being wholly submerged. On the other hand Lewis wrote that, "they swim very light on the water and make pretty good speed." ⁹¹ Weld ^{3a} states that no animal swims better and that when pursued he has seen them take to the water voluntarily. On reaching shore the first task is the drying and dressing of the fur. ⁸⁵

The fanciful assertion that in crossing a body of water each squirrel provides itself with a piece of wood or bark in which it sets sail is alluded to by many writers. I have traced this tale back as far as 1728, when William Byrd ¹⁵¹ had it from an Indian. When Linnaeus ¹⁵² was on the island of Gottland in 1741, he was told by

the inhabitants that the squirrels crossed lakes on chips and pieces of bark. This is an interesting case of the same folklore having independent origins.

The direction of the emigrations was seldom, if ever, the same in any region. There is little specific information on the size of the area involved in the movements and the distances travelled by individual squirrels. During the emigration of 1807, Featherstonhaugh^{103a} thought that the squirrels that he encountered were advancing from Lake Huron. Since, at the same time, great numbers were crossing the Ohio into Kentucky, it is possible that they were moving in a line 400 miles in length from north to south.

Kennicott^{54a} states that he has never known them to migrate "except when exceedingly abundant" and adds: "After one of these grand migrations, very few of the species are found in the localities from which they have moved, and these, as if alarmed at the unusual solitude, are silent and shy." The term abundant is scarcely applicable to the emigrations of the present day and there is serious doubt that mere numbers caused the exodus.

The squirrels as a rule were in good condition at the outset of emigration. Mass hysteria pushed them onward to die of exhaustion, disease, or starvation. At times they were heavily infested with the larvae of *Cuterebra emascuator*, that may have set them in frenzied motion. About one-half of the 50 chipmunks collected by Merriam¹⁵³ at Lake Champlain in October, 1885, contained this parasite. The last stage of an emigration in southern Ohio is described by Hildreth. He states that, "they were much emaciated, and most of them covered with running ulcers, made by worms of the *grub* kind. By the first of January they mostly disappeared; after that, and to this time, it was observed that on cutting hollow trees, their usual habitations, they were found in a manner filled with the bones and hair of squirrels; some trees containing as many as 40 or 50. By this it would seem they had died of some disease; for had they died of famine, they would have been found in the fields instead of hollow trees."¹²⁸

The great scarcity of squirrels in Vermont in 1811 was attributed by Gallop¹⁵⁴ to destruction by "pestilence".

There was a southward emigration of black squirrels in Clinton County, Pennsylvania, in October, 1865. Seton⁸⁴ was informed that less than 40 percent of the animals shot were free from warbles. Chapman¹⁵⁵ found that an average of 12 percent of the gray squirrels

in southeastern Ohio in the years 1935-37 were infested by *Cuterebra*, the percentage being highest when squirrels were abundant. Only one squirrel out of 326 was infested with mange mites. During the emigration of 1883, the squirrels shot at Eau Claire, Wisconsin, were reported to be "wormy."¹⁵⁶

Some of the gray squirrels in August, 1933, at the beginning of the emigration from Connecticut, showed bare patches on the body, and hairless tails.¹⁵⁷ Dr. Erwin Jungherr, pathologist of the Connecticut State College found that the skin lesions resembled papilloma. The symptoms strongly suggest infestation by the mange mite (*Sarcoptes*). Errington¹⁵⁸ found that a high percentage of the *Sciuridae* taken by the red-tailed hawk in southern Wisconsin in April and May, 1930, had mange. A fox squirrel found dead in the woods was completely hairless. Mange is common in the squirrels in Madison and is more prevalent in the city than in the country. Allen^{52a} found mange to occur mostly in winter and spring, and it seemed to be closely associated with malnutrition. There is no evidence that any parasite is the direct cause of emigration.

The stimulus for emigration has long engrossed the attention of travelers and naturalists. In 1838 Hall wrote: "At the commencement of their march they are very fat; but towards its conclusion they become poor and sickly. After such an event they are scarce for several years, then multiply, emigrate, and perish as before. The cause of this phenomenon has never been explained. It cannot be want of food, for the districts they leave are often as fruitful as those to which they direct their course, and the healthy condition in which they set out, leaves no room to suppose that the danger of starvation has driven them from their home."¹⁵⁹

Half a century later Merriam wrote in a similar vein: "Scarcity of food very probably gives rise to the disquieting impulse that prompts them to leave their homes, but the true motives that operate in drawing them together, and in determining the direction and distance of their journeys, are as little understood to-day as they were before the discovery of the continent on which they dwell."^{27a}

Early opinion is preponderately in favor of a shortage of food as the cause of emigration. Kalm states that nuts were extremely plentiful in Pennsylvania in the fall of 1748. The following autumn great numbers of squirrels moved into southeastern Pennsylvania and "it appeared that their migration was occasioned by the scarcity

of nuts and acorns, which happened that year in the higher parts of the country, and obliged them to come hither for their food."^{7a} The emigration of 1783 in western Pennsylvania,¹²⁵ and that across the Ohio from Kentucky in 1816,¹³⁶ was also ascribed to the absence of mast.

A few writers believed that the exodus was not due necessarily to lack of food. Schultz⁹² gave no information on mast during the migration of 1807. He found the squirrels very fat in Ontario and on the upper Ohio, but very poor lower down the river. Lewis,⁹¹ who witnessed the emigration across the Ohio in 1803, concluded that they were not traveling in search of food since walnuts and hickory nuts were abundant on both banks. It is obviously incorrect to assume that because squirrels are found traveling in a region where mast is abundant that the movement began in one equally well supplied with food. Dr. Hoy informed Kennicott^{54a} and Wheaton¹⁶⁰ that the squirrels emigrated at Racine in the years 1842, 1847, 1852, and 1857. Mast was stated to have been abundant in these years and the squirrels in excellent condition. If many squirrels took part in these emigrations, it seems strange that none of the latter are mentioned in the Racine newspapers.

Regarding the emigration in southern Ohio in 1822, Blane⁹³ states that the black squirrels do not appear unless there is a failure of mast in the northwestern forests. Beardsley¹²⁰ ascribed the exodus of squirrels from Canada to New York in the fall of 1815 to the unusually large crop of mast in this state.

It has been mentioned that in 1834 Indiana and Ohio were overrun with squirrels. A satisfactory cause has been found. This year was noted for late frosts in the north central states. Maximilian,¹⁶¹ writing in June, stated that all the mast had been destroyed at Princeton, Indiana. In Seneca County, Ohio, the woods had the appearance of winter on the first of June and Staib added: "In the summer of 1834 we were pestered greatly with squirrels, the woods were literally filled with them."^{4a} Forest fruits were "annihilated" by the frost at Marrietta, Ohio.¹⁶²

In southern Ohio, in the autumn of 1843, "the forests produced no nuts or acorns, and the poor squirrels were forced to travel in quest of food or perish."¹²⁹ Fortunately it is possible to substantiate the statements of Blane and Hildreth that there was no mast in Ohio in the years 1822 and 1843. Jackson¹⁶³ kept a nearly complete record

of mast at Cincinnati during the years 1814-48 and states that there was none in 1822 and 1843.

Seton⁸⁴ was strongly of the opinion that the large emigrations were due to overpopulation and likened them to those of the lemming (*Lemmus lemmus*). The food problem must be considered. Elton makes the following remarks on the lemming cycle: "The danger-signals are not long delayed in a community dependent upon the exiguous supplies of a northern land. Vegetation is denuded of the reserves built up in the previous time of lemming scarcity." And again: "The three factors that spring at once to the mind — food shortage, epidemic, and emigration — probably all play a part in the lemming crash."¹⁶⁴

The emigrations of recent years are attributed to lack of food. In 1933 the squirrels traveled westward from Connecticut into New York. More than a thousand swam the Connecticut River between Hartford and Essex, a front of about 35 miles, on September 24; and hundreds crossed the Bear Mountain Bridge over the Hudson. Anthony¹⁶⁵ offered no explanation for this movement, but suggests overcrowding and mentions the coincidence of the rise and fall of animal populations with the periods of sun-spot maxima and minima.

This emigration has been described in considerable detail by Goodwin. After crossing the Connecticut on September 24, the main body did not reach the Bear Mountain Bridge until about December 10. Since 75 days were taken to cover a distance of approximately 85 miles, the rate of travel was slightly more than a mile a day. He states: "A general census of available data indicates that lack of suitable food in some places, correlated with a fairly large squirrel population started the migration. Neighboring districts with a sufficient supply of food to support their own squirrel population were not able to stand the added burden of greatly increased numbers, and the intruders were either driven out or more likely, all were forced to join the advancing army when the food supply was exhausted. Once a stampede was started, it would not be long before the recruits numbered several thousands, and of necessity the rate of travel would be accelerated."¹⁵⁷

There was a westward movement of gray squirrels in the fall of 1936 that extended over most of Vermont.¹⁶⁶ A late frost in the spring destroyed the potential crop of nuts. Gray squirrels were abundant in western Massachusetts in 1934 and 1935, and were reported to have migrated in the latter year.¹⁶⁷ The direction was

westward. Jackson¹⁶⁸ stated that 2000 were found dead on the western shore of the Hudson between Albany and the Rip van Winkle Bridge. Food conditions in New England in the fall of 1935 were investigated by Hoover,¹⁶⁹ who found that there was a very light crop of acorns, beechnuts, and other nuts. Since there was a light mast in New England in 1935, and again in Vermont in 1936, the emigration in the latter state could not have been induced by mere numbers.

Gray squirrels, according to Hamilton,^{50b} were unusually plentiful in central New York prior to the influx from New England. The second brood of young had appeared by early July, 1935. A third brood was produced that year, and possibly also in the year preceding. The number of young in a brood was also "noticeably increased." He suggests that the New England squirrels were equally productive and that the emigration was caused by over-population. No information on food conditions is given by Hamilton; however, I have been informed by Robert W. Damer,¹⁷⁰ that 1935 was a poor mast year, particularly for beechnuts. He added that while most of the squirrels were traveling westward, many were moving in the opposite direction at the same times and places. The observations were made principally at Lake Champlain, the Hudson River below Albany, and the Gilboa Reservoir on Schoharie Creek.

It is obvious that a high squirrel population will cause a rapid depletion of food even in a good mast year. Hahn¹⁷¹ states that at the University Farm, Mitchell, Indiana, 80 acres were heavily wooded with white oaks and that an additional 100 acres had a considerable stand of this species. The acorn crop was very large in the fall of 1906, and he estimated that each of the large oaks produced from 2000 to 8000 acorns. This immense crop was harvested so completely by the gray squirrels by the first of November that only an occasional acorn could be found by searching. Unfortunately we do not know how many acorns were consumed by the squirrels and how many were buried for winter consumption.

The movements of the red squirrel, like that of the other squirrels, seems to be governed largely by the food supply. In the fall of 1881 there was a good yield of beechnuts in the Adirondacks. The following fall the beechnut crop failed and scarcely a red squirrel was to be found.^{27b} Hatt, from his study of the red squirrel, concludes: "It is probable that such migrations occur only in times of maximum population and of food shortage, for certainly there are no regular

seasonal movements of all the red squirrels. The migrations appear to be overflow movements due to an urge of hunger."¹⁷²

Recent emigrations of the gray and fox squirrel in Missouri have been recorded by Bennitt and Nagel.⁵⁸ The year 1934 was very dry and there was a shortage of food. They suggest that the emigration of the gray squirrel is cyclic. There was a shortage of young of this species that year but not a "commensurate shortage of food." However, regarding the movements of the fox squirrel, they state "We believe they were due only secondarily to population pressure, through failure of the food or water supply. . . . Their movements seem to have followed exhaustion of the food supply."

Late frosts destroyed the mast on the Bankhead National Forest, Alabama, both in 1939 and 1940. Gray squirrels remained abundant the winter of 1939-40. About October 1, 1940, they began moving northward only to return about two months later. The southward movement was so complete that not a squirrel was left in the forest. The very limited food supply seemed to Moore¹⁷³ to be the cause of the emigration. In the fall of 1944, hundreds of fox squirrels, and a few gray squirrels crossed the Lake of the Ozarks, Missouri, moving in all directions.¹⁷⁴ The mast had failed. The extensive movement of squirrels in northwestern Wisconsin in the fall of 1946 was very plainly due to lack of acorns.⁵¹

Three abstracts from the Russian literature, kindly furnished by Dr. Charles Elton, Oxford University, show that the emigrations of the European squirrel (*Sciurus vulgaris* L.) are due to failure of the food supply. They are sufficiently important to be given in full.

"Squirrel migrations are widespread in the northern taiga zone of the U.S.S.R. but their effect on population dynamics is only large in certain years. When food is abundant in typical nesting stations only small changes of place are affected by young leaving the nest and when food is abundant everywhere dispersal of young takes place to a rather greater extent. Only when there is a shortage of food do mass migrations, accompanied by mass destruction, take place in the second half of the summer."¹⁷⁵

"After the period of nesting and of family life is over, first the young squirrels, and then the adult ones, scatter through the stations not occupied before. This is due to the fact that the conditions of safety presented by the former stations cease to be of the same importance as during the reproduction and shedding seasons. In the

period of dispersion and of the redistribution of the squirrels among the different stations, the question of food resources is the principal factor. In years when the crop of staple food — the seeds of conifers (cedar, fir, spruce, and pine) — is a bad one this redistribution of the squirrels takes the form of mass migrations. Such migrations occurred during the investigations. They found their reflection in the numerical fluctuations of the squirrels, especially at the stations not characterized as belonging to the period of the sedentary existence of these rodents."¹⁷⁶

"Hunting publications of the 19th and early 20th centuries are strewn with complaints from places in which the squirrel has 'suddenly' disappeared and with news of a mass appearance the animal has made in other areas. A. Cherkasov (1867) writes in 'Journal of a hunter in East Siberia': 'The number of squirrels in these parts is extremely variable . . . since it depends on the food crop the squirrel is not a settled animal: it wanders every year from one place to another. . . .'

"Wanderings occur in all areas occupied by the squirrel and in some parts they recur regularly every so many years. The migrations take place mainly at the end of the summer and during the autumn. They may be caused by drought and forest fires (central and eastern Siberia) but in the majority of cases are due to a bad crop of the squirrels' main foods. . . . The squirrel has been known to make journeys of 250-300 kilometers when migrating, venturing into forest-tundra, crossing the bare parts of mountains, steppes and ploughland, passing through villages and even large towns. It undertakes the crossing of wide rivers such as the Northern Dvina, the Ob, Yenesi, and Amur and starts to swim across the Tatar Strait, Lake Baikal, Tazor Bay, the Gulf of Finland and Mezen Bay. In these crossings and in the unfavourable conditions of the districts in which they find themselves during the winter, thousands of squirrels die."¹⁷⁷

In a previous paper¹⁷⁸ I have cited references to the literature showing that emigrations of bears, gray squirrels, and even turkeys, have occurred simultaneously. The coincidence of the emigrations of bears and squirrels in Wisconsin is impressive. Since the two species compete for mast, it is improbable that they would emigrate simultaneously for any reason other than lack of food. It will be shown later that there are considerable data for Wisconsin to support this contention.

It should be mentioned in connection with emigration that there

is a far greater shifting of squirrel populations than is generally supposed. Unless there is a mass exodus, this phenomenon readily escapes notice. A forest near Cleveland studied by Williams¹⁷⁹ had a large yield of beechnuts and seeds of the sugar maple in the autumns of 1930 and 1931. About 50 gray squirrels occupied the area the winter of 1931-32. The fall of 1932 all but one squirrel left the nearly foodless tract. Edminster¹⁸⁰ found that on the Pharsalia Refuge, Chenango County, New York, the gray squirrels decreased from a population of 1,172 in 1935 to 371 in 1936, and to 107 in 1937. During the three years the populations of the refuge and of a public shooting area five miles distant both declined 91 percent.

Allen^{52b} found a high population turn-over of fox squirrels in Michigan. In fact shifting seems to have been a continuous process. Fox and gray squirrels were equally abundant in the summer of 1936 on an area in Oklahoma studied by Blair.¹⁸¹ In June, 1937, both species were equally scarce. Goodrum¹⁸² paid particular attention to the food supply and found that the gray squirrel population in Texas was directly related to it. The squirrels shifted from one locality to another where their favored food was abundant.

The fall dispersal of fox squirrels in Ohio is attributed by Baumgartner¹⁸³ to intra-specific intolerance since it occurs at a time when food is most abundant. It is doubtful if intolerance is an adequate reason. The fall dispersal is a phenomenon secondary to emigration. It occurs regardless of the size of the squirrel population and the abundance of food. The autumn kill of squirrels by motor cars is higher than at any other season.

There are many cases where squirrels have shown a remarkable tolerance to dense populations as long as the food lasted. Browning and his uncle were hired to shoot the squirrels destroying corn in a field at Uniontown, Pennsylvania, in the autumn of 1798. He states: "The next day we started off before day-light, and as soon as we could see, found ourselves surrounded by the greatest number of squirrels I ever saw, which were running by the hundreds in all directions."¹⁸⁴ The uncle left on the fifth day and Browning continued shooting for nine and one-half days before the animals were exterminated.

While traveling in southwestern Ohio in July, 1817, Palmer⁹⁴ sometimes saw 50 or 60 squirrels at a time dash out of fields of grain. Porter says: "The myriads of squirrels that are to be found on a few

acres of favorable feeding-ground during the season of plenty is almost incredible to those who have not witnessed it."⁵⁵

Food Supply and Squirrel Populations. The breeding potential of the northern gray squirrel is very high. Normally it produces two litters a year, in March-April and September, of two to six young each. A pair, allowing eight young annually, could lead to a population of 6250 squirrels at the end of five years, if there were no casualties. Kennicott^{54a} mentions the probability of three litters annually; and Seton⁸⁴ cites a case of a captive squirrel in Toronto that had three litters in one year. However, Hamilton^{50b} appears to be the only observer to determine that three litters are sometimes produced in the wild.

It was pointed out by Thompson¹⁸⁵ that a high squirrel population resulted from a mild winter preceded by a summer productive of food. The beech in New York, between 1871-1883, showed a bearing cycle of two years. Gray squirrels were most numerous in a year when there were no nuts. This was attributed to the influx of squirrels from distant parts during a good nut year, and they remained to breed the following spring. Merriam continues: "During the summer and early autumn a multitude of young, now nearly full grown, mingle with the parent stock. Hence the species attains at this time, its maximum in numbers. But this is the year when the next crop is a failure. Therefore, as the fall advances and they find that there is a scarcity of provision for the winter, many of them migrate — we know not where."^{27a} The biannual exodus would not necessarily take place in regions where the mast is diversified.

It is obvious that a high squirrel population is dependent upon an adequate supply of food, but it is not always simple to show that the rise and the fall of populations are related unquestionably to the food supply. Linnaeus,¹⁵² while in Gottland in 1741, was informed that the squirrels had a seven year cycle of abundance. Blomquist¹⁸⁶ thought that there was a 6 to 7 year cycle in the production of seed by pine and spruce in Finland. He found that seed was produced heavily in the years 1839, 1846, 1854, 1860, 1871, and 1875, spruce seeding a year prior to the pine. The abundance of seeds paralleled closely that of the squirrels. In Russia the number of squirrels shot annually follows seed production so closely that it has been suggested as a method for evaluating seed years.¹⁸⁷ The Siberian "cedar" (*Pinus cembra sibirica*) bears seeds very irregularly, but when there is a good seed year, the squirrel population rises rapidly.¹⁸⁸

No cycle of approximately constant duration has been established for the gray squirrel. Hoy found a cycle of exactly five years for four migrations at Racine. Chapman¹⁵⁵ gives data for the years 1901-1935 showing that this species in the middle west probably reaches peak populations every five years. The extensive emigrations of the early days show no such regularity. The movements in Wisconsin show a 5 to 7 year cycle.

The breeding rate of squirrels rises when food is plentiful and falls rapidly when it is scarce. The white and black oaks in Michigan failed to bear during the summer of 1940, so that the fox squirrels suffered from malnutrition during the following winter. Of 52 females handled by Allen^{52c} between March and June, 1941, only one was pregnant. Following the failure of mast in Missouri in 1944, the female squirrels did not have the usual spring litter in 1945.¹⁸⁹

Several factors may govern the rise and fall of animal populations. McAtee¹⁹⁰ has shown how difficult it is to prove that a population is limited by the means of subsistence. Space, or intolerance, may be equally important. Errington writes: "There are scant grounds for challenging the reality of the subnormal food supplies, the heavy infestation by parasites, the mortality from predators or disease, the losses of the immature during adverse weather, the miscellaneous factors to which competent investigators have ascribed the declines of wild vertebrates in 1936 and 1937. . . ." ¹⁹¹

It will suffice to point to a few clear and spectacular cases of the decline of population through failure of the food supply. Approximately every four years the population of lemmings and related rodents crashes, resulting in the reduction of the numbers of the arctic fox and snowy owl through migration and death. The cycle of the lynx is a striking example. Elton and Nicholson state: "This cycle is a real one in lynx populations, which are dependent upon the snowshoe rabbit (*Lepus americanus*) for food, and which starve when the rabbits disappear periodically."¹⁹²

The opinion is expressed by Elton and Nicholson that climate may be partially responsible for controlling the ten-year cycle in the lynx. It had been previously suggested by Weaver and Clements¹⁹³ that the ten-year cycle of some mammals was dependent upon rainfall, that in turn is influenced by sun spots. The rainfall influences the amount of food and cover, hence the animal population. If climate is the factor determining the long cycle as well as the shorter and differing cycles of the various rodents, it would seem to lose para-

mount significance. The effect of climate upon the food supply is beyond question.

No known disease seems to be responsible for the die-off of the snowshoe hare. Green makes this impressive suggestion: "Dense populations may 'seed' something into the ground, the extent of which builds up with increasing populations, or the increasing population may eradicate certain plants that contain food elements essential for the maintenance of healthy populations."¹⁹⁴ Dennis Chitty told me recently that if, during a die-off or *Microtus* in England, some of the animals are trapped and given succulent foods, they survive. It appears therefore that a nutritional deficiency may be directly responsible for the die-off of certain species of mammals. Also, Wald and Jackson¹⁹⁵ have shown that nutritional deprivation in rats stimulates activity in the form of running. They suggest that this represents the behavioral basis of mammalian emigration and that, "This is recognized to be motivated primarily by nutritional need."

The data available support strongly the belief that squirrel populations and movements are governed by the food supply.

EMIGRATIONS IN WISCONSIN

1842

Gray squirrels emigrated at Racine, according to Hoy, though mast was "exceedingly abundant." They moved southward in large numbers for about a month.

The population north of Racine was not depleted greatly or it recovered quickly. Two years later, 1844, a man shot 84 black and gray squirrels in the town of Oak Creek, Milwaukee County, during a hunt, the duration of which was not stated.¹

1. Milwaukee *Courier*. In Lancaster *Herald*, Dec. 7, 1844.

1847

They again emigrated at Racine, according to Hoy.

Squirrels were very plentiful at Watertown in 1849.¹

1. Watertown *Chronicle* Sept. 5, 1849.

1852

There was an emigration at Racine.

Black and gray squirrels were very abundant at Appleton the autumns of 1853 and 1854.¹

1. Appleton *Crescent* Oct. 22, 1853; Sept. 16 and 23, 1854.

1855

Thousands of gray and black squirrels moved eastward, following the old rail fences. Unfortunately Trigg¹ does not give the locality.

In October of this year, during a large-scale hunt in the town of Greenville, Outagamie County, about 500 squirrels were killed.²

1. J. S. Trigg, *Madison State Journal*, July 23, 1900, 7.

2. W. A. Goodspeed, *et al.* History of Outagamie County, Wisconsin. [1911] p. 1299.

1856

Black squirrels emigrated from Dane County.⁹⁹

Thousands of squirrels visited the cornfields at Jefferson¹ and Green Bay² where nuts were scarce. The woods at Milwaukee³ and at Neenah⁴ were "full" of squirrels.

1. Jefferson *Jeffersonian* Sept. 11, 1856. 2. Green Bay *Advocate* Aug. 28, 1856. 3. Milwaukee (w) *Wisconsin* Oct. 15, 1856. 4. Neenah and Menasha *Conservator* Sept. 4, 1856.

1857.

Squirrels emigrated at Racine for the last time, according to Hoy.

They were abundant at Oshkosh¹ in 1859; and in 1863 black squirrels were "swarming in the woods" at Appleton.²

1. Oshkosh *Courier* Sept. 16, 1859. Appleton *Crescent* Aug. 22, 1863.

1866

There were movements in the eastern portion of the state. Grays were abundant at Sturgeon Bay the middle of July and swam across the bay.¹ At the same time an unusual number of red squirrels appeared in the city of Green Bay.² Squirrels of all species were "never more abundant" at Appleton³ where the red squirrel and chipmunk were reported moving northward.

Squirrels were abundant around Lake Winnebago, especially on the eastern side, where four men shot 198 in one day.⁴ A boy at Wautoma⁵ shot 10 gray and black, and 2 red squirrels with an hour. West Bend⁶ reported gray squirrels "thick as hops." During a side hunt, 350 black, gray, and fox, and about 200 red squirrels were killed at Jefferson.⁷

In 1868 black and gray squirrels appeared in great numbers at Prescott;⁸ and at Richland Center⁹ they were never "so abundant". In 1870, though no definite migration was reported, black and gray squirrels swarmed at Sturgeon Bay.¹⁰ A hunter at Mishicott killed 83 in one day.¹¹ They were very abundant at Appleton.¹² Prairie du Chien¹³ reported the greatest gray squirrel season ever known; and at La Crosse¹⁴ two men killed 45 in three and one-half hours.

1. Sturgeon Bay *Advocate* July 19, 1866. 2. Green Bay *Advocate* July 12, 1866. 3. Appleton *Crescent* Aug. 11, Sept. 22, 1866. 4. Fond du Lac *Reporter* Sept. 1, 1866. 5. Wautoma *Argus* Sept. 27, 1866. 6. West Bend *Post* Sept. 1, 1866. 7. Jefferson *Banner* Oct. 10, 1866. 8. Prescott *Journal* Sept. 25, 1868. 9. Richland Center *Sentinel*. In *Madison State Journal* Oct. 17, 1868. 10. Sturgeon Bay *Advocate* Sept. 15, 1870. 11. Manitowoc *Tribune* Nov. 24, 1870. 12. Appleton *Crescent* Sept. 3, Oct. 1, 1870. 13. Prairie du Chien *Courier*. In *Madison State Journal* Oct. 14, 1870. 14. La Crosse *Leader* Dec. 3, 1870.

1871

Gray squirrels in large numbers attempted the crossing of the Mississippi near La Crosse. The captain of the ferry-boat reported that, "the river is full of them swimming to the Minnesota shore."¹ The exodus was attributed to the shortage of nuts in Wisconsin. They were very plentiful at Osceola.² Near Oshkosh black and gray squirrels were moving northward, swimming the Wolf River, where acorns and nuts were reported plentiful.³ They were again reported abundant at Appleton.⁴

1. La Crosse *Democrat* Sept. 19; Milwaukee *Daily News* Sept. 23, 1871. 2. Osceola *Press*, Sept. 15, 1871. 3. Oshkosh *Times* Sept. 6, 1871. 4. Appleton *Post* Oct. 5 and 26, 1871.

1873

A westward emigration was reported at Beaver Dam,¹ where squirrels were unusually plentiful the autumn of 1872.² Black River Falls,³ in June, had more squirrels than ever known previously. In October they congregated in large numbers at Prescott.⁴

Gray squirrels "abounded" at Princeton,⁵ and at Sheboygan⁶ a man shot 55 in one day in the beech woods. A side hunt by 28 men at Oshkosh⁷ produced 88 gray and 63 red squirrels. They were not plentiful at Lancaster.⁸

In 1875 four men shot 555 gray squirrels in one afternoon in Crawford County.⁹ A hunter at Reedsburg¹⁰ killed 26 in one day. They were unusually numerous at De Pere,¹¹ and Richland Center;¹² and "swarmed" at Sheboygan.¹³

Squirrels were very plentiful in 1876 at De Pere,¹⁴ Green Bay¹⁵ Hartford,¹⁶ and Sheboygan.¹⁷ At the latter place they entered the town. They were scarce at Oshkosh.¹⁸

1. *Forest and Stream* 1 (Nov. 27, 1873) 243. 2. *Beaver Dam Citizen* Oct. 31, 1872. 3. *Black River Falls Banner* June 14, 1873. 4. *Ellsworth Herald* Oct. 8, 1873. 5. *Princeton Republic* Sept. 6, 1873. 6. *Sheboygan Herald* Oct. 31, 1873. 7. *Oshkosh Times* Oct. 15, 1873. 8. *Lancaster Herald* Nov. 6, 1873. 9. *Boscobel Dial* Nov. 5, 1875; cf. Aug. 25, 1876. 10. *Reedsburg Free Press* Nov. 11, 1875. 11. *De Pere News* Oct. 16, 1875. 12. *Richland Center Republican* Oct. 14, 1875. 13. *Sheboygan Herald* Oct. 8 and 22, 1875. 14. *De Pere News* Sept. 16, 1876. 15. *Green Bay Advocate* Aug. 31, Dec. 7, 1876. 16. *Hartford Republican* Sept. 28, 1876. 17. *Sheboygan Herald* Aug. 18, Sept. 1, 1876. 18. *Oshkosh Northwestern* Oct. 28, 1876.

1878

In view of the abundance of squirrels in certain localities in 1875 and 1876, and the very high populations of 1878, it seems strange that squirrels were reported numerous in only four localities in 1877.¹ Movements took place over much of the state in 1878. This was the banner for squirrels and none like it has occurred since. It was a very poor year for mast.

In the eastern portion of the state, squirrels were unusually plentiful at Green Bay,² Two Rivers,³ Sheboygan,⁴ Oconto,⁵ Menasha,⁶ Sturgeon Bay,⁷ Manitowoc,⁸ Oshkosh,⁹ Appleton,¹⁰ Montello,¹¹ Grand Rapids,¹² and West Bend.¹³ Due to the scarcity of acorns, they were crossing open country at Winneconne,¹⁴ and "over-running" the region about Stevens Point.¹⁵

Damage to corn was especially heavy in the western counties where squirrels were very numerous. Exceptional numbers were reported at Richland Center,¹⁶ Dodgeville,¹⁷ Arcadia,¹⁸ Durand,¹⁹ Whitehall,²⁰ Baldwin,²¹ River Falls,²² Menomonie,²³ and Mondovi.²⁴ The three latter places stated that there was nothing in the woods for the animals to eat. Both Black River Falls²⁵ and Hudson²⁶ claimed that gray, black, and red squirrels were never more numerous. The town of Spring Lake thought that it had the highest population of red squirrels and chipmunks in Pierce County.²⁷

Hunters at Alma²⁸ brought in about 1000 squirrels in a period of a week. Side hunts at Tomah²⁹ and Viroqua³⁰ resulted in the killing of 280 and 485 squirrels respectively. They were killed by the "thousands" at Dodgeville.³¹ Madison³² had them in abundance.

Squirrels emigrated at Sparta,³³ Prairie du Chien,³⁴ and La Crosse.³⁵ Nor-

beck³⁶ reported that at La Crosse squirrels "can be had by the barrel." No squirrels were observed to cross Lake St. Croix, but it was presumed that they did so since they were very plentiful in St. Croix and the surrounding groves.³⁷ Crossing of the Mississippi, however, began in Pierce County and extended down the river through Vernon County, a distance of about 130 miles.

It is probable that only a small portion of the army of squirrels that attempted to cross Lake Pepin from Pierce and Pepin Counties reached the Minnesota shore. A statement from Lake City reads: "We are informed that there are thousands of black and gray squirrels over on the Wisconsin shore of the Lake—all the squirrels in Wisconsin seeming to have determined to 'go west' and take a tree claim. Scores of them have been seen swimming the lake to this side, a distance of two and a half miles, and Captain Murray, of the steamer Pepin, says there is certainly a general emigration going on among them, from Wisconsin to Minnesota. Many of them are found drowned along the shore, the big fish get many more, and doubtless many survive the perilous voyage and arrive safely at the shore of our Gopher State."³⁸

They were "very numerous" at Winona,³⁹ Minnesota, about a hundred being killed within the city. Bunnell⁴⁰ mentions that several times within his memory squirrels arrived at Winona after a long swim across the Mississippi, but he gives no dates.

Squirrels in "immense numbers" were swimming westward across the La Crosse River at West Salem during the third week in August.⁴¹ Although the woods near La Crosse "have for some weeks past been literally full of gray squirrels", only a small number were moving here in comparison with Vernon County where men in boats scooped them in by the dozen as they were crossing the Mississippi westward.⁴²

By 1882 the squirrel population had become exceptionally high again at Oshkosh,⁴³ Richland Center,⁴⁴ Boscobel,⁴⁵ Sparta,⁴⁶ Chippewa Falls,⁴⁷ Galesville,⁴⁸ Chetek,⁴⁹ and Durand.⁵⁰ Three men at Prairie du Sac⁵¹ shot 41 squirrels in one day; and at Elroy⁵² eleven men killed 145.

1. Appleton *Crescent* Oct. 13; Montello *Express* May 17, Sept. 22; West Bend *Democrat* Oct. 17 and 24; Darlington *Republican* Oct. 26, 1877. 2. Green Bay *Gazette* Oct. 5; Fort Howard *Review* Oct. 8, 1878. 3. Two Rivers *Chronicle* Sept. 3, 1878. 4. Sheboygan *Herald* Sept. 27, 1878. 5. Oconto *Reporter* Aug. 10, 1878. 6. Menasha *Press* Sept. 19, 1878. 7. Sturgeon Bay *Advocate* Sept. 26, 1878. 8. Manitowoc *Pilot* Sept. 12, 1878. 9. Oshkosh *Times* Sept. 28, 1878. 10. Appleton *Post* Sept. 5, Oct. 3; *Crescent* Aug. 17, Sept. 14, Oct. 12, 1878. 11. Montello *Express* Aug. 31, 1878. 12. Grand Rapids *Reporter* Sept. 12, 1878. 13. West Bend *Democrat* Sept. 11 and 18, Oct. 9, 1876. 14. Winneconne *Item* Sept. 21, 1878. 15. Stevens Point *Gazette* Sept. 4; *Journal* Sept. 7, 1878. 16. Richland Center *Republican* Sept. 5 and 19, 1878. 17. Dodgeville *Chronicle* Sept. 20, 1878. 18. Arcadia *Republican and Leader* Sept. 15, 1878. 19. Durand *Times* Oct. 4; *Courier* Nov. 2, 1878. 20. Whitehall *Messenger* Sept. 18, 1878. 21. Baldwin *Bulletin* Sept. 14, 1878. 22. River Falls *Press* Aug. 22 and 29, Sept. 19, Oct. 3; *Journal* Aug. 22 and 29, Sept. 12, Oct. 3 and 10, 1878. 23. Menomonie *News* Aug. 31, Sept. 7 and 28, Oct. 5 and 12, 1878. 24. Mondovi *Herald* Sept. 21, 1878. 25. Black River Falls *Banner* Sept. 6, 1878. 26. Hudson *Star and Times* Aug. 30, 1878. 27. River Falls *Journal* Aug. 29, 1878. 28. Alma *Express* Aug. 29, 1878. 29. Tomah *Democrat* Nov. 30, 1878. 30. Viroqua *Censor* Sept. 18,

1878. 31. Dodgeville *Chronicle* Sept. 3, 1878. 32. Chicago *Field* 10 (Nov. 2, 1878) 186. 33. Sparta *Herald* Sept. 3, 1878. 34. Prairie du Chien *Union* Sept. 12, 1878. 35. La Crosse *Republican and Leader* Aug. 24, 1878. 36. C. Norbeck. Chicago *Field* 10 (Sept. 28, 1878) 97. 37. Hudson *Star and Times* Aug. 30, 1878. 38. Squirrels coming by thousands. Lake City (Minn.) *Leader* Aug. 24, 1878. 39. Winona (Minn.) *Herald* Sept. 20, 1878. 40. L. A. Bunnell. Winona and its environs. Winona (1897) p. 332. 41. La Crosse (w) *Republican and Leader* Aug. 24, 1878. 42. *Ibid.* Sept. 21, 1878. 43. Oshkosh *Times* Sept. 23, 1882; *American Field* 18 (1882) 198. 44. Richland Center *Republican and Observer* Sept. 14, 1882. 45. Boscobel *Dial* Oct. 27, 1882. 46. Sparta *Herald* Oct. 17; La Crosse (w) *Republican and Leader* Sept. 23, 1882. 47. Chippewa Falls *Herald* Oct. 13, 1882. 48. Galesville *Independent* Sept. 28, Oct. 5, 1882. 49. Chetek *Alert* Oct. 27, 1882. 50. Durand *Courier* Oct. 20, 1882. 51. Prairie du Sac *News* Oct. 14, 1882. 52. Elroy *Tribune* Nov. 17, 1882.

1883

This was the last year of great abundance and extensive movement of squirrels. It was also a year of great scarcity of mast. In the eastern part of the state squirrels were very plentiful at Peshtigo,¹ De Pere,² Appleton,³ Oshkosh,⁴ Stevens Point,⁵ Grand Rapids,⁶ and Manitowoc.⁷ Three men at Green Bay⁸ shot 30 squirrels in a day's hunt; and near Racine⁹ two men shot 56 in 7 hours.

The western part of the state again showed the highest population. Squirrels were abundant at Richland Center¹⁰ and entered the town. Due to the "great scarcity of acorns" they were feeding on corn at Richland Center and Spring Green. Food was so scarce in the woods at Prairie du Chien¹¹ that they invaded the cornfields in the country and the gardens in the city. The same condition prevailed at Elroy.¹²

Squirrels were abundant at Eau Claire,¹³ Chippewa Falls,¹⁴ Montfort,¹⁵ Ellsworth,¹⁶ Phillips,¹⁷ New Richmond,¹⁸ Durand,¹⁹ Hudson,²⁰ and River Falls.²¹ They were very plentiful at Soldiers Grove²² where a man is reported to have shot 76 in an afternoon. Three men at Dodgeville²³ killed over 50 in a day's hunt; and four hunters at Mauston²⁴ shot 101. A hunter at Alma²⁵ brought in 18.

These animals were abundant and emigrating at Lancaster,²⁶ Mineral Point,²⁷ and Trempealeau.²⁸ At the latter place the squirrels were gray, black and fox, the former predominating. Some crossed the Mississippi from the Minnesota side. The direction of the movement at Menomonie,²⁹ Whitehall,³⁰ and Potosi³¹ was southward. A year later, 1884, squirrels were very scarce at Potosi³² and Richland Center.³³

In the fall of 1887, squirrels were plentiful at Necedah,³⁴ Racine,³⁵ Richland Center,³⁶ Prairie du Chien,³⁷ and New Richmond.³⁸

1. Marinette and Peshtigo *Eagle* Oct. 13, 1883. 2. De Pere *News* Sept. 15, 1883. 3. Appleton *Post* Sept. 20 and 27, 1883. 4. C. M. B. *American Field* 20 (Sept. 29, 1883) 294. 5. Stevens Point *Journal* Sept. 15, 1883. 6. Grand Rapids *Tribune* Sept. 15, 1883. 7. Manitowoc *Pilot* March 8, Sept. 13, 1883. 8. Green Bay *Gazette* Sept. 29, 1883. 9. Racine *Journal* Dec. 12; *Post* Dec. 13, 1883. 10. Richland Center *Republican and Observer* Aug. 30, Sept. 20, 1883. 11. Prairie du Chien *Union* Sept. 14; *Courier* Sept. 4 and 11, 1883. 12. Elroy *Tribune* Sept. 14, 1883. 13. Eau Claire (w) *Free Press* Oct. 4 and 25; (d) *Leader* Oct. 20, 1883. 14. Chippewa Falls *Independent* Sept. 20, 1883. 15. Montfort *Monitor*

Sept. 6, 1883. 16. Ellsworth *Herald* Oct. 3, 1883. 17. Phillips *Badger* Sept. 5, 1883. 18. New Richmond *Republican* Sept. 26, 1883. 19. Durand *Courier* Sept. 28, 1883. 20. Hudson *Star and Times* Sept. 14, 1883. 21. River Falls *Journal* Sept. 27, 1883. 22. Soldiers Grove *Journal* Sept. 5, 1883. 23. Dodgeville *Chronicle* Sept. 28, 1883. 24. Mauston *Star* Nov. 22, 1883. 25. Alma *Journal* Nov. 22, 1883. 26. Lancaster *Teller* Sept. 6, 1883. 27. Mineral Point *Tribune* Sept. 13, 1883. 28. Arcadia *Republican and Leader* Sept. 27; Whitehall *Times* Oct. 4, 1883. 29. S. J. B. *American Field* 20 (Oct. 20, 1883) 366. 30. Whitehall *Times* Sept. 20, 1883. 31. Lancaster *Herald* Sept. 20, 1883. 32. *Ibid.* Sept. 25, 1884. 33. Richland Center *Rustic* Oct. 18, 1884. 34. Necedah *Republican* Oct. 7, 1887. 35. Racine *Journal* Dec. 21, 1887. 36. Richland Center *Rustic* Sept. 17, 1887. 37. Prairie du Chien *Courier* Oct. 4, 1887. 38. New Richmond *Republican* Sept. 14, 1887.

1888

An emigration for this year was not well defined; however, 1888 was outstandingly the best squirrel year between 1883 and 1895. In the fall of 1888 the bears moved southward.

Squirrels were numerous at De Pere,¹ Appleton,² Baraboo,³ Richland Center,⁴ Boscobel,⁵ and Neillsville.⁶ Racine⁷ reported that the autumn "crop" was the best ever known. Hunters commonly killed 20 to 30 daily, but two hunters killed 83 in one day.⁸

1. De Pere *News* Oct. 13, 1888. 2. Appleton *Crescent* Nov. 10, 1888. 3. Baraboo *Republic* Oct. 17, 1888. 4. Richland Center *Rustic* Oct. 13, Nov. 24, 1888. 5. Boscobel *Dial* Sept. 27, Dec. 6, 1888. 6. Neillsville *Republican and Press* Sept. 27, 1888. 7. Racine *Journal* Nov. 7, 1888. 8. Racine *Daily Times* Oct. 29, 1888.

1895

There were unusual numbers of squirrels at Green Bay¹ and Manitowoc,² at which places they were traveling southward. The black and gray squirrels arrived from the north at Green Bay where the dock swarmed with them. After several years of scarcity at Chilton,³ squirrels came from "the north in droves." Gray and black squirrels "were never so thick" at Oconto.⁴ They were abundant at Two Rivers⁵ where a man shot 22 gray squirrels within two hours. A hunter at Shawano⁶ killed 36 in a day's hunt; and a man at Sheboygan Falls⁷ shot 23 in one day. There were squirrels in abundance in the beech woods at Kewaunee⁸ in the fall of 1894; and in the fall of 1895 the hunting was "excellent."

Squirrels were very plentiful at Viroqua,⁹ Trempealeau,¹⁰ and New Lisbon.¹¹ New Richmond¹² had a big influx of gray and black squirrels, and Prairie du Chien¹³ received gray squirrels from the north in "droves."

1. Green Bay *Advocate* Sept. 5, 1895. 2. Manitowoc *Pilot* Sept. 12, 1895. 3. Chilton *Times* Sept. 14, 1895. 4. Oconto *Reporter* Oct. 11, 1895. 5. Two Rivers *Chronicle* Sept. 3, Oct. 8, 1895. 6. Shawano *Advocate* Aug. 15, 1895. 7. Sheboygan Falls *News* Oct. 30, 1895. 8. Kewaunee *Enterprise* Nov. 3, 1894; Sept. 20, 1895. 9. Viroqua *Censor* Oct. 9, 1895. 10. Trempealeau *Herald* Sept. 27, Oct. 4, 1895. 11. New Lisbon *Press* Aug. 29, 1895. 12. New Richmond *Republican* Sept. 5, 1895. 13. Prairie du Chien *Courier* Sept. 24, 1895.

1897

A southward emigration of gray squirrels took place at Baraboo¹ in September. The fox squirrels did not participate. The rate of travel was stated to be one-

half mile per day. The last exodus was said to have been eight years previous. Hough,² referring to the movement of 1897, remarked that to his personal knowledge, the past two seasons had been very good squirrel years in southern Wisconsin.

1. Baraboo News Sept. 25, 1897. 2. E. Hough. *Forest and Stream* 49 (Oct. 9, 1897) 288; cf. A. H. Gouraud, *ibid.* 60 (Feb. 14, 1903) 125.

1903

The crossing of the Mississippi at Reed's Landing by fox squirrels was mentioned previously.

1905

In the autumn of this year gray and black squirrels crossed the Mississippi, some remaining in Winona, Minnesota. Jackson¹ states that the direct cause of the emigration was a shortage of nuts on the Wisconsin side. A crossing to Minnesota also took place this year in the vicinity of La Crosse.²

1. H. H. T. Jackson, *Bull. Wis. Nat. Hist. Soc.* 8 (1910) 87. 2. La Crosse *Press-Leader* Sept. 17, 1907, 8.

1907

In September hundreds of squirrels crossed the Mississippi from Minnesota due to the scarcity of nuts in the latter state.¹ Warden G. L. Kingsley stated that they rested on French Island, near La Crosse, before proceeding to the Wisconsin shore.

1. La Crosse (d) *Chronicle* Sept. 18; (w) *Argus* Sept. 21, 1907.

1914

Owing to the shortage of acorns in Wisconsin, "hundreds" of squirrels crossed the Mississippi to Minnesota from the neighborhood of La Crosse¹ in the autumn of 1914. Jackson² records an emigration of gray squirrels from Pepin westward across Lake Pepin in the early fall of 1914 or 1915. Since he was informed that acorns, nuts, and corn were abundant on the Wisconsin side, we have a contradiction on the food supply, granted that both accounts refer to the same year.

1. La Crosse (d) *Leader-Press* Sept. 4, 1914, 9. 2. H. H. T. Jackson. A recent migration of the gray squirrel in Wisconsin. *J. Mamm.* 2 (1921) 113-4.

1925

Thousands of squirrels crossed the Mississippi to Iowa, in the vicinity of Prairie du Chien according to a press item from Prairie du Chien dated October 16, 1925. This was quoted by Fryxell.¹ I have been unable to find any mention in the Prairie du Chien papers of an emigration of squirrels in the fall of 1925, nor could I find any inhabitant who had heard of it.

1. F. M. Fryxell. Squirrels migrate from Wisconsin to Iowa. *J. Mamm.* 7 (1926) 60.

1946

There was an extensive movement of gray and fox squirrels extending along the Mississippi for about 180 miles and eastward for about 60 miles. The general direction was westward across the Mississippi.¹ Statements obtained from wardens and other sources² agree that an exceptional shortage of acorns caused the emigration.

1. A. W. Schorger, *J. Mam.* 28(1947)401. 2. Milwaukee *Journal* Oct. 3, 5, and 27, 1946.

Lack of food may cause an emigration at any season. In March, 1876, hundreds

of gray and black squirrels were observed moving southward near the Eau Galle woods, Dunn County.¹⁹⁶ They were in poor flesh. Near Montello¹⁹⁷ in February, 1882, sixty squirrels were counted in the distance of a mile.

A severe winter depletes the population. The winter of 1874-75 was marked by deep snow and extreme cold. During this winter squirrels practically disappeared from the vicinity of the Red River near Green Bay.¹⁹⁸ Two squirrels were found frozen to death in a hollow tree near Montello.¹⁹⁹ The following statement illustrates the effect of a severe winter: "Forest, Richland County, August 7, 1870. Squirrels are getting very plenty in the woods. Last winter they were the most numerous ever known. Fields of unhusked corn were literally alive with them. Mr. Benj. Starkey, of Sylvan, killed 23 at one time on one tree, and enough more on two other trees to make 33 in all . . . Toward spring their feed became scarce, some starved, and others became so poor they could be easily caught by boys and dogs. Many were killed that way."²⁰⁰

FOOD CONDITIONS IN WISCONSIN

Oaks of various species form so large a portion of the trees of southern Wisconsin that acorns are by far the most important squirrel food. Beech is limited to a narrow strip along Lake Michigan. The butternut, walnut and hickories were widely but sparsely distributed and their nuts were of little influence on the food supply except in a few localities. Years when the passenger pigeon nested are given since it is a reasonable assumption that the nestings were based on a crop of acorns or beechnuts the previous autumn.

The data on mast are too few to give a satisfactory picture of food conditions during the nineteenth century, but there are some definite cases of large migrations of squirrels resulting from lack of forest foods.

1836

Hogs lived in the woods at Kenosha the winter of 1836-37 without being fed.²⁰¹

1837

"In July of '37, Ephraim Perkins . . . drove two hundred hogs from Illinois into Sugar Creek woods, in Spring Prairie (Walworth County), and left them to fatten on acorns."²⁰²

1841

Squirrels were cutting acorns and beechnuts at Racine.²⁰³

1842

According to Hoy, "mast was exceedingly abundant" at Racine.^{54a}

1844

"The cold season at the north blasted the mast . . ."²⁰⁴

1847

Mast was "very abundant" in Grant County and at Racine, but

scarce north of the lower end of the Wisconsin River. Hazelnuts were quite plentiful in Jefferson County.

1848

Hazelnuts plentiful in Jefferson County.

1852

Mast abundant at Racine.

1853

Beechnuts plentiful in Manitowoc County.

1854

Deer were very fat in Jefferson County due to the abundance of "shack". Acorns were more abundant than usual in Outagamie County. There was a large nesting of pigeons in Waupaca County in 1855.

1856

"Scarcity of most kinds of nuts" at Green Bay.

1857

Butternuts were plentiful in Dodge County, and hazelnuts very abundant in Dane County. Pigeons nested in Outagamie and Oconto Counties in 1858.

1858

Hickory nuts abundant in La Crosse County, acorns exceptionally abundant in Iowa County, and a large crop of beechnuts in Door County.

1859

Acorns were reported scarce north of Berlin, but plentiful at Tomah. Hickory nuts were offered in large amounts in the Milwaukee market. Cravath²⁰⁵ states that at Whitewater there was frost during every month of the summer and that very little corn matured.

1860

Acorns abundant in Dane County. The pigeons nested in Green County in 1861.

1861

Large crop of butternuts and hazelnuts in Richland County. The pigeons nested in Green County in 1862.

1862

Butternuts plentiful in Dane County.

1863

There was a large nesting of pigeons along the Kickapoo River, Vernon County, and in southwestern Monroe County in 1864.

1864

The pigeons nested in Fond du Lac County in 1865.

1865

Hickory nuts and hazelnuts were unusually plentiful in Dodge County, and nearly all kinds of nuts were plentiful in Fond du Lac County. The crop of beechnuts in Door County was exceptionally heavy.

1866

There was an abundance of "shack" in Adams County. The pigeons nested in Fond du Lac County in 1867 and flew westward for food.

1867

Hickory nuts were abundant in Outagamie County and hazelnuts in Polk County. The pigeons nested in Outagamie County in 1868.

1868

There were large nestings of pigeons in Green, Monroe, and Fond du Lac Counties in 1869.

1869

Walnuts were plentiful in Rock County. In Jackson County the crop of hazelnuts was abundant, but that of butternuts was spotty. Butternuts were unusually plentiful in Jefferson and Fond du Lac Counties. All kinds of nuts were reported plentiful in the latter county. Shawano County had beechnuts.

1870

There were no butternuts in Outagamie County. Acorns were abundant in Dane and Fond du Lac Counties and in the center of the state. The large pigeon nesting extending from Kilbourn to Sparta in 1871 was due to the abundance of acorns in the fall of 1870.

1871

Butternuts were abundant in St. Croix, Polk, Dunn, Jackson, Richland, and Fond du Lac Counties; black walnuts in Fond du Lac, Dane, and Richland Counties; hickory nuts in Brown and Fond du Lac Counties; and hazelnuts in Door County. Acorns and nuts were plentiful in Winnebago County. The squirrel migration at La Crosse was attributed to a shortage of nuts.

1872

There was a good crop of butternuts at Racine, but other kinds of nuts were a failure. Hickory nuts were scarce over most of the state; however in Outagamie County butternuts, hickory nuts, and hazelnuts were reported plentiful.

A professional pigeon trapper stated that few pigeons nested in the state in the spring of 1873 due to the great scarcity of mast.

1873

There were a few walnuts in Walworth County. Hickory nuts were abundant in Walworth, Green Lake, Winnebago, and Brown Counties; butternuts in Walworth and Calumet Counties; and hazelnuts in Walworth County. Butternuts were selling at 25 cents a bushel at Lake Geneva in the spring of 1874. Nuts were reported plentiful at De Pere and the woods alive with squirrels.

Deer were stated to be eating the acorns of the black oak in Dunn County. So few pigeons appeared in 1874 that a small crop of acorns in 1873 is indicated.

1874

Butternuts were abundant in Marathon County. The woods in Portage County were full of acorns. The pigeons nested in Pierce and Wood Counties in 1875.

1875

This was a remarkable year for nuts. Walnuts, hickory nuts, butternuts, beechnuts, and hazelnuts were all abundant.

There was a nesting of pigeons in La Crosse County in 1876.

1876

Hickory nuts were abundant in Dodge, Outagamie, and Columbia Counties; and acorns in Rock and Dunn Counties. The pigeons nested in Monroe County in 1877.

1877

This was another year in which the hazel, walnut, hickory, butternut, and beech yielded abundantly.

There was a bountiful crop of red oak acorns in St. Croix County. Acorns were plentiful in Dunn and unusually abundant in Eau Claire County. "Unusual quantities" were reported for the state. The pigeons nested in Adams County in 1878.

1878

This was a very poor year for mast. There were but few hickory nuts in Rock County, and in Oconto County acorns and beechnuts were scarce. Winnebago, Chippewa, Buffalo, Dunn, and Pierce Counties reported a great scarcity of nuts and acorns. There were no hazelnuts in Wood County.

1879

There was a large crop of beechnuts in Door County. It was an excellent season for all kinds of nuts throughout the state. Acorns were abundant in Pierce, Chippewa, Walworth, and Kenosha Coun-

ties. Some oak trees in the latter county yielded three to five bushels of acorns.

1880

There were no beechnuts in Door County. It is unusual to have two successive years in which the nut trees bear heavily, but this was another year in which walnuts, butternuts, hickory nuts, and hazelnuts were plentiful. Acorns were plentiful in Barron and Pierce Counties.

1881

Hickory nuts were abundant in Kenosha, Racine, Green Lake, Fond du Lac, and Waushara Counties. "Nuts" were also abundant in Iowa County. Squirrels were reported plentiful in Waushara County due to the "large crop of nuts and acorns". The butternut crop in Trempealeau County was about one-fourth that of 1880. Hazelnuts were plentiful.

This year was marked by the abundance of acorns throughout the state, in the central portion of which the crop was described as "immense" and as yielding "thousands of bushels". There were large nestings of pigeons near Sparta, Tomah, and Kilbourn in the spring of 1882.

1882

Beechnuts were plentiful in Sheboygan County. Hickory nuts were abundant in Rock, Walworth, Green Lake, Outagamie, Winnebago, and Trempealeau Counties. The crop in the latter county was exceptionally large. "Nuts" were quite plentiful in Brown County. Butternuts and walnuts were abundant in Rock County, and hazelnuts in St. Croix and Richland Counties. No information on acorns was found.

1883

This year was one of great scarcity of mast. Hickory nuts, walnuts, and butternuts were scarce in Walworth County; and hickory nuts were scarce in Kenosha and Waupaca Counties. A man at Reedsburg is stated to have gathered 50 bushels of black walnuts from a grove planted 24 years previously. The acorn crop was a failure in Richland, Iowa, Juneau, and Dunn Counties.

1884

Walnuts, butternuts, hickory nuts, and hazelnuts were plentiful to abundant. Though nuts were very plentiful at Potosi, squirrels were scarce. The pigeons nested in the southeastern corner of Langlade County in 1885.

1885

Hickory nuts were abundant but in Racine, Walworth, Green Lake, and Sheboygan Counties only a few nuts had meats in them. The crop of walnuts and butternuts was good to fair. Hazelnuts were plentiful in Iowa and Buffalo Counties. Green Lake reported an "immense acorn crop".

1886

All sections of the state reported unusually large yields of walnuts, butternuts, hazelnuts, and hickory nuts, especially the latter. There was a large crop of acorns in Waupaca County. In the spring of 1887, the pigeons attempted to nest near Wautoma.

1887

There was an immense yield of beechnuts in Oconto, Kewaunee, Manitowoc, and Sheboygan Counties. Butternuts were plentiful in Sauk, Juneau, and Jackson Counties. The crop of hazelnuts was enormous throughout the state. Nuts were not as plentiful in Rock County as the previous season and many of them did not fill. Acorns were reported abundant in Sheboygan County.

1888

Hickory nuts, walnuts, butternuts, and hazelnuts were abundant. No information on the yield of acorns was found.

1889

Shawano County reported beechnuts plentiful while Manitowoc County had none. Butternuts were plentiful in Rock County. There were no hazelnuts in St. Croix County.

1890

Hickory nuts were plentiful in Walworth and Juneau Counties. Nuts of all kinds were exceptionally scarce in Iowa County. No reports on the yield of acorns in Wisconsin were found. Near Chicago acorns were abundant on the species of oaks fruiting biennially.²⁰⁶

1891

There was a large crop of beechnuts in Sheboygan, Manitowoc, Brown, Oconto, and Shawano Counties. Hickory nuts were plentiful in La Crosse and Sheboygan Counties; butternuts in Pierce, Crawford, Richland, Jackson, Kewaunee, and Brown Counties; walnuts in Crawford County; and hazelnuts in St. Croix and Richland Counties.

No information on the acorn crop in the state was found. There was a medium yield near Chicago, but from 50 to 75 per cent of some species were destroyed by weevils.²⁰⁶

1892

The yield of hickory nuts in Dane County was poor. This was also true of beechnuts and hazelnuts in Oconto and Kewaunee Counties. Kewaunee reported that squirrels were visiting the farmyards, and even the city, for food, and on the other hand that acorns were plentiful in the woods.

1893

Beechnuts were plentiful in Manitowoc County. Walnuts, butternuts, hickory nuts, and hazelnuts were abundant in most regions. The hazelnuts in Juneau County were heavily parasitized.

1894

A heavy crop of beechnuts was reported from Manitowoc, Kewaunee, and Brown Counties. Butternuts were plentiful in Waupaca County.

1895

Walnuts were abundant in Vernon and Dane Counties. Hickory nuts were scarce in Trempealeau, plentiful in Calumet, and a drug on the market in Florence County. Hazelnuts were a large crop. Only a few were parasitized in Juneau County.

ADDENDA

I. A. Lapham lists the gray squirrel for Ashland in his Diary (Library Wis. Hist. Soc.) under date September 6, 1858.

There is the following additional information for the emigration of 1834 for southern Illinois: "The gray squirrel (some individuals black) was very plentiful in early day . . . In the fall of 1834 there was a great immigration of squirrels from Kentucky, which crossed the Ohio River by swimming, and made their way northward through Gallatin and White counties, over-running the country and doing immense damage to the corn crop." Near Phillipstown in September, during a hunt of ten men on a side, each side killed 4,000 to 5,000 squirrels. Near Christmas they produced nearly 30,000 scalps on each side. — Anon. History of White County, Illinois. Chicago (1883) pp. 209-10.

"In Sept., 1801, an astonishing emigration of squirrels took place, from Kentucky across the Ohio river. As many as 500 per day were killed as they crossed the river." — L. Collins, History of Kentucky. Covington, Vol. 2 (1874) 468.

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* The correspondent wrote: "We think it is caused by the white weasel chasing the mother and frightening her." ?Quien sabe?

* Emigration is more correct than the customary term, migration.

