Wheat Explorer the World Over

Mark Carleton of Kansas

by Thomas D. Isern

Mark Alfred Carleton, a farm boy from north-central Kansas, contributed as much as any farmer or scientist in history to the development of suitable and profitable agricultural practices for the Great Plains. Best known for his travels as a plant explorer in Russia for the United States Department of Agriculture at the turn of the century, and for the resulting introduction of new hard red wheats and macaroni (durum) wheats to his home country, Carleton also boasted other related accomplishments, most of them concerned with farming on the Plains. His achievements resulted from a combination of scientific expertise, personal determination, and visionary thinking. His vision sprang from his remarkable grasp of regionalism and environmentalism, decades ahead of his contemporaries.

Carleton was a child of the Midwest but a man of the Great Plains. Born in 1866 in Ohio, he moved in 1876 with his parents to a farm in Cloud County, Kansas. His education there included attendance at rural schools and observation of the difficulties of raising winter wheat on the Central Plains, including the destruction frequently wrought by black stem rust. Carleton studied biology and chemistry at Kansas State Agricultural Col-

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Wheat explorer Mark Carleton, wearing black hat, expands his tireless research efforts from the Great Plains of America to the Steppes of Russia. This sketch of Carleton meeting with Russian farmers appears in a 1926 issue of Country Gentleman, *accompanying the article "Carleton The Wheat Hunter." The sketch is captioned "Then Carleton Wandered in His Fantastic Hunt for Wheat Up and Down the Black Earth of Russia."*

Mark Carleton came with his parents to Cloud County, Kansas, in 1876, where he developed an interest in the difficulties of raising winter wheat on the Central Plains. His passion for this topic took him first to Kansas State Agricultural College, Manhattan, and eventually to positions with the U.S. Department of Agriculture.

lege, Manhattan, receiving his B.S. degree in 1887. During 1888–1890 he was professor of natural history at Garfield University in Wichita. Garfield then suspended classes for lack of funds, and so in 1890–1891 Carleton, only nominally employed by Garfield, was in search of new employment.[1]

During this period Carleton combined tireless academic study with energetic field work. He learned Latin and Greek with tutors and collected sedges and fungi in the field. In the summer of 1889 he led a party of Garfield students on a botanical expedition to the Rocky Mountains of Colorado, Utah, Wyoming, and Montana. In the summer of 1891 he collected plants in southwest Kansas, southeastern Colorado, Indian Territory (present Oklahoma), No Man's Land (present Oklahoma Panhandle), and the Texas Panhandle. This excursion produced a descriptive bulletin published by the National Herbarium in which Carleton, contemplating the fauna of the region and anticipating his later insights in agronomy, remarked, "I have become especially interested in the fact commonly known that certain plants are usually associated with particular soils and climates."[2] Carleton read several papers to the Kansas Academy of Science and corresponded frequently with Elam Bartholomew, the noted farmer and botanist from Rockport, Kansas.[3]

The budding botanist returned to Kansas State Agricultural College to complete his M.S. degree in botany and

1. Arthur F. Swanson, "Mark Alfred Carlton—The Trail's End," *Agronomy Journal* 50 (November 1958): 722; Mark Alfred Carleton "Obituary," *Cereal Courier* (June 30, 1925): 169, "clipping," Hunt Institute for Botanical Documentation, Pittsburgh, Pa.; "Mark Alfred Carleton," *Proceedings of the American Society of Agronomy* 2 (1910): 8; "Mark Alfred Carleton," *Journal of the American Society of Agronomy* 17 (August 1925): 514; *Proceedings of the Botanical Society of America, Twentieth Annual Meeting, 1926* 90 (1926): 9–10; Paul de Kruif, *The Hunger Fighters* (New York: Harcourt, Brace, and Co., 1928), 4–6, the chapter on Carleton previously published as "Carleton—The Wheat Hunter," *Country Gentleman* 91 (November 1926): 12–13, 115–16, 118; Floyd Benjamin Streeter, *The Kaw: The Heart of a Nation* (New York: Farrar and Rinehart, 1941), 261; Helen H. Wood to Tom Isern, February 29, 1980, private collection of Thomas D. Isern, Fargo, N.D.

2. M. A. Carleton, "Observations on the Native Plants of Oklahoma Territory and Adjacent Districts," *Contributions from the U.S. National Herbarium* 1 (December 6, 1892): 226.

3. *Industrialist* (Manhattan), August 25, 1888; De Kruif, *The Hunger Fighters*, 6; M.A. Carleton, "List of Plants Collected by the Garfield University Expedition of 1889," in Kansas Academy of Science, *Transactions, 1891–92* (Topeka: Hamilton Printing Co., 1893), 50–57; Carleton, "Observations on Native Plants of Oklahoma Territory," 220–32; Carleton, "Characteristic Sand-Hill Flora," in Kansas Academy of Science, *Transactions, 1889* (Topeka: Kansas Publishing House, 1890), 32–34; Carleton, "Variations in Dominant Species of Plants," in ibid., *1891–92*, 24–28; Carleton, "A New Aecidium of Peculiar Habit," in ibid., *1893–94* (Topeka: State Printer, 1896), 44; Carleton, "Variations in Dominant Species of Plants–II," in ibid., 44; Carleton and Bartholomew letters, 1889–1894, Elam Bartholomew Collection, Library and Archives Division, Kansas State Historical Society.

horticulture and to serve as assistant botanist at the state experiment station. There he joined Professor A.S. Hitchcock, botanist of the experiment station, in research and writing on rusts of grains—a hot research topic of the day in both the United States and Australia. Of rust the botanists wrote, "It is rare that a field of wheat is entirely free from it, and often a large portion of the crop is destroyed," but the problem thus far had proved "impregnable" to students of plant diseases.[4] Hitchcock and Carleton worked out the life histories of several of these fungi, including their parasitic relationships with cereal grains and the barberry bush. They surveyed farmers as to their losses due to rust. They tested fungicides on rusts but with little success. They developed innovative laboratory methods for the bench study of fungi. Perhaps most important, they determined that the rusts infecting different species of cereal grains were themselves distinct species of fungi; oat rust, for instance, would not grow on wheat.[5]

This research on rusts was impressive enough to win Carleton appointment as assistant pathologist in the Division of Vegetable Physiology and Pathology of the United States Department of Agriculture. He moved to Washington in the spring of 1894, Hitchcock praising his departing assistant for work "excellent and faithful."[6] The Kansan was a bit out of place in his new office; he looked more like he belonged behind a plow. He was over six feet tall, burly, slope-shouldered, slow-moving, and moustachioed. His manner was brusque, intense, and tactless. He never joked. As one colleague put it, "He went at everything as if he was driving cattle."[7]

In his new position Carleton continued the pathological work on rusts. Abandoning his desk and local plots in 1894, he visited wheat fields in all states of the Great Plains to examine rust infestations. A key farmer/collaborator was B.B. Stimmel, near Salina, who gave him use of land for experiments. Carleton also placed experiments at the station in Manhattan, the cessation of which in 1897 led to accusations that his department was punishing college administrators for their Populist politics. Staying focused on the science at hand, Carleton's observations and analyses convinced him that contrary to prevailing opinion, most serious rust damage was the work of black stem rust, not orange leaf rust. Previous students of the problem had been working on the wrong species of fungi! His work, he found, closely paralleled that of Swedish scientist Jakob Eriksson. He conceded that his research produced no remedy for the affliction other than sowing varieties of grain that ripened early enough to avoid it. This frustration led him to search for new grains that would resist rust. From correspondents around the world he obtained nearly one thousand samples of wheats from many nations, which he tested in Maryland and then in Kansas. There the dry, cold winters and heavy black stem rust completely destroyed all but a few varieties.[8]

Far from discouraged, Carleton drew important conclusions. From the experiments and from personal observations of wheat-growing in nearly all wheat-producing states, he concluded that existing varieties of wheat were inadequate for the Great Plains. Rust resistance was only one concern. As Carleton argued in a major publication, *The Basis for Improvement of American Wheats*, the Great Plains demanded varieties of small grains that were hardier, more frost-resistant, more drought-resistant, more rust-resistant, and earlier-maturing than the best then available in the United States. Wheat farming on the plains, he noted, was plagued by many problems—technical, environmental, and economic. During the 1890s Carleton directed his attention to a range of concerns, from methods of tillage to improvements in milling, but he concluded that the focus of his work should be the improvement of wheat varieties. Further, he intended to concentrate on hard wheats, not on such soft wheats as had been tried in the nineteenth century: "The hard wheats are, as a

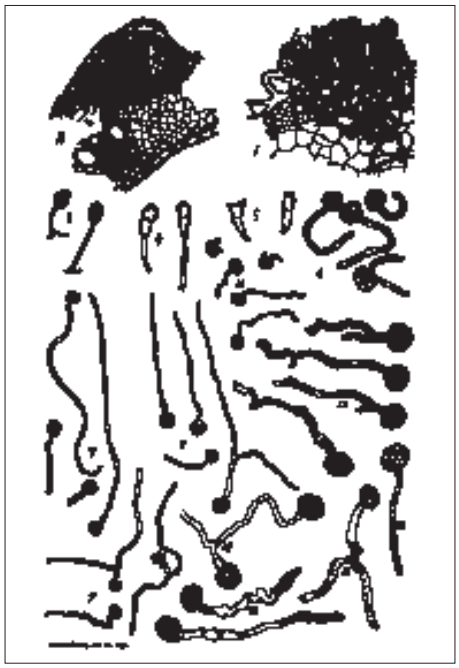
4. A. S. Hitchcock and M. A. Carleton, *Preliminary Report on Rusts of Grain*, Kansas Agricultural Experiment Station Bulletin 38 (Manhattan: Kansas State Agricultural College, March 1893), 1.

5. Ibid., 1–14; A. S. Hitchcock and M. A. Carleton, *Rusts of Grain II*, Kansas Agricultural Experiment Station Bulletin 46 (Manhattan: Kansas State Agricultural College, May 1894), 1–9; Carleton, "Studies in the Biology of the Uredineae," *Botanical Gazette* 18 (December 1893): 447–57; Carleton, "Culture Methods with Uredineae," *Journal of Applied Microscopy and Laboratory Methods* 6 (January 1903): 2109–14; Kansas State Agricultural College, *8th Biennial Report, 1890–92*, Historical Index, Special Collections, Hale Library, Kansas State University, Manhattan; Kansas Board of Regents Minutes, January 26, 1891, ibid.

6. Kansas State Agricultural College, *9th Biennial Report*, ibid.

7. Mark A. Carleton USDA Personnel file, box 2, Selected Personnel files, Series 184, Records of the Secretary of Agriculture, RG 16, National Archives, College Park, Md.; De Kruif, "Carleton–The Wheat Hunter," 13.

8. De Kruif, *The Hunger Fighters*, 7–11; Streeter, *The Kaw*: *The Heart of a Nation*, 262–64; *Industrialist*, June 1, 1895, August 12, 24, 1896, June 14, 1897, August 16, 1897; Kansas Board of Regents Minutes, September 2, 1897, Historical Index; E.M. Freeman, "Mark Alfred Carleton, 1866–1925," *Phytopathology* 19 (April 1929): 321; Mark Alfred Carleton, *Cereal Rusts of the United States*, U.S. Department of Agriculture, Division of Vegetable Physiology and Pathology Bulletin 16 (Washington, D.C.: Government Printing Office, 1899); Carleton, "Improvements in Wheat Culture," in U.S. Department of Agriculture, *Yearbook, 1896* (Washington, D.C.: Government Printing Office, 1897), 497–98; Carleton, *Investigations of Rusts*, U.S. Department of Agriculture, Bureau of Plant Industry Bulletin 63 (Washington, D.C.: Government Printing Office, 1904).



LEFT: *Rusts of grains—a hot research topic of the early 1890s—consumed Carleton's interest. His drawing of wheat rust and its germination appeared in an 1893 bulletin of the Kansas State Experiment Station, accompanying an article Carleton co-authored with colleague A.S. Hitchcock.*

RIGHT: *Discovering the many problems that plagued wheat, Carleton focused his work on the hardier hard wheat varieties. In doing so, he recognized the success of German Russian Mennonites on the Plains, who had been raising hard red winter wheats for the past generation. The threshing scene, on the facing page, is on the farm of John Unruh, a Mennonite farmer of Marion County.*

rule, hardy and especially drought-resistant," he asserted.[9] He foresaw the day when demand would compel massive expansions of wheat acreage in the United States, mainly on the Plains, and he intended to lay down the genetic base for that expansion.[10]

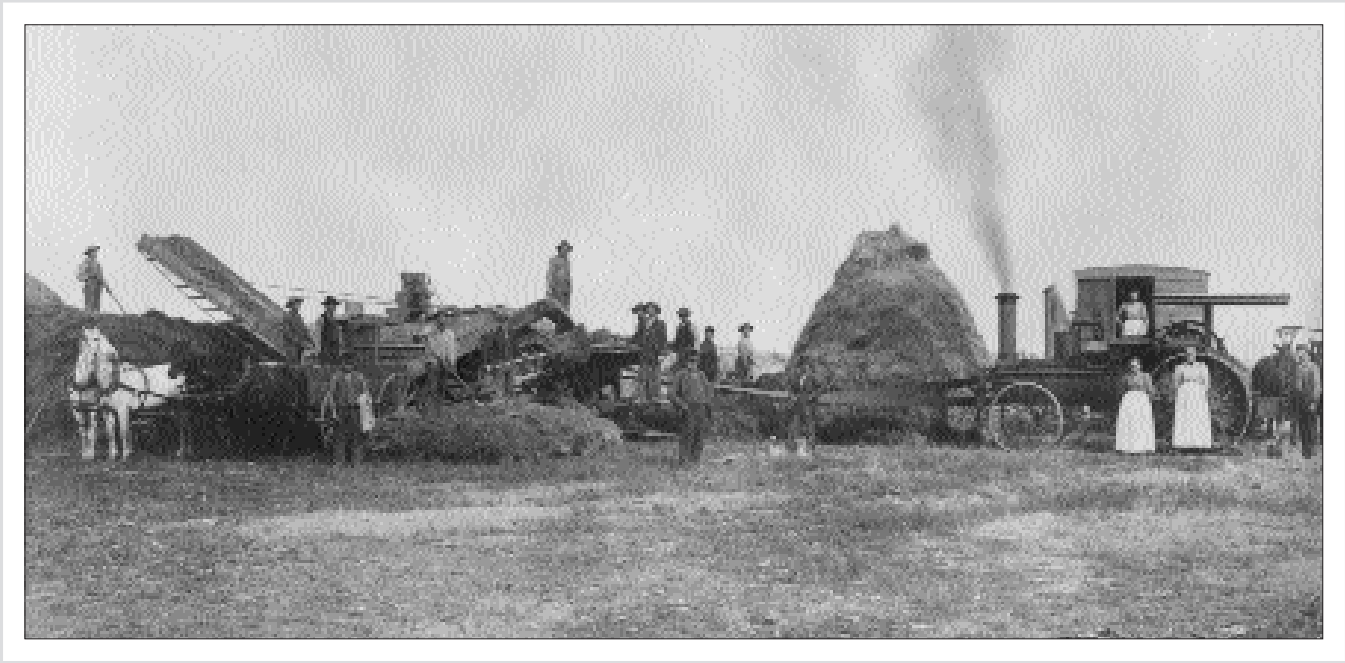
Contemplating this line of work, Carleton acknowledged inspiration from German Russian Mennonites on the Plains who had been raising hard red winter wheats for the past generation. Turkey wheat was the variety, he asserted, that "more than all others finally completely changed the status of wheat culture in the district."[11] The Mennonites of central Kansas, he pointed out, as well as the Volga Germans of western Kansas, "have always grown wheat quite extensively and with comparatively few failures. . . . When the wheat crop was almost an entire failure in large portions of the Great Plains, these farmers continued to have good harvests."[12] He had toured these districts during threshing season of 1896 and been greatly impressed.

Carleton's tests of varieties, as well as his knowledge of German Russian success in wheat farming, convinced him that Russian wheats were well suited to the American Plains. Although occupied with moving his tests to the Nebraska State Experiment Station at Lincoln, and although married late in 1897 to Amanda Elizabeth Faught, of Kingman, Kansas, he meanwhile began careful study of the climate, agriculture, and language of Russia. He compared the semiarid Steppes of that country with the semiarid Plains of his own. He believed that the similar climate of the Steppes, through centuries of selection, should have produced varieties of wheat even more suited than Turkey to the Plains. "I have made a pretty close study of Russia's climate, geography, and agriculture," he wrote in March 1898, "and my conclusion, after four years' study and trial, is that Russian and Siberian wheats are the wheats most admirably adapted to the Great Plains." A month later he remarked, "I am more and more convinced that the influ-

9. Carleton, "Improvements in Wheat Culture," 492.

10. M.A. Carleton, "Present Status of Cereal Culture," *Proceedings of the Society for the Promotion of Agricultural Science* (1895): 33–34, "clipping," Hunt Institute for Botanical Documentation; Carleton, "Improvements in Wheat Culture," 489–98; Carleton, *The Basis for Improvement of American Wheats*, U.S. Department of Agriculture, Division of Vegetable Physiology and Pathology Bulletin 24 (Washington, D.C.: Government Printing Office, 1900); Carleton, *Russian Cereals Adapted for Cultivation*, U.S. Department of Agriculture, Division of Botany Bulletin 23 (Washington D.C.: Government Printing Office, 1900), 3; Carleton, "Successful Wheat Growing in Semiarid Districts," in U.S. Department of Agriculture, *Yearbook, 1900* (Washington, D.C.: Government Printing Office, 1901), 529–42.

11. Carleton, *Basis for Improvement of American Wheats*, 39.



ence of soils and climate on the character of wheat varieties is a matter of the greatest moment to American agriculture."[13] Thus Carleton already had grasped the concept that when acted upon would bring him fame—the environmental connection between the Russian Steppes and the American Plains, a sweeping concept that flowed logically but not inevitably from his meticulous pathological and cultural research.[14]

Carleton began to pressure his superiors to send him to Russia to explore his theory. At this time David A. Fairchild, son of a president of Kansas State Agricultural College, was head of a newly created Section of Foreign Seed and Plant Introduction in the Department of Agriculture, dispatching plant explorers all over the globe to retrieve crop varieties that might prove useful in the United States. He recently had sent Niels E. Hansen to Russia to search for alfalfas and grasses to be raised on the Northern Plains. Hansen incidentally had brought back small samples of wheat. Fairchild and Carleton corresponded about testing these new varieties, after which Fairchild took up Carleton's cause and persuaded Secretary of Agriculture James Wilson to permit Carleton to go to Russia.[15]

On June 24, 1898, Fairchild wired Carleton in Lincoln and offered him a commission as a special agent of the Department of Agriculture to search for small grain varieties in Russia. "Your proposition was quite a surprise to me," Carleton replied. "It is what I have been wishing to do, however, for several years."[16] He accepted the assignment

12. Carleton, "Successful Wheat Growing in Semiarid Districts," 531.

13. Mark A. Carleton to David A. Fairchild, March 29, 1898, Letters Sent, Records of the Bureau of Plant Industry, Soils, and Agricultural Engineering, Series 29, RG 54, National Archives (hereafter cited as Letters Sent); Carleton to Milton Whitney, April 30, 1898, ibid.

14. Carleton, *Basis for Improvement of American Wheats*; Carleton, "Successful Wheat Growing in Semiarid Districts"; Carleton correspondence, 1898, Letters Sent.

15. De Kruif, *The Hunger Fighters*, 11–13; Mark A. Carleton to David A. Fairchild, March 29, 1898, Letters Sent. For an outline of Hansen's explorations, *see* Thomas D. Isern, "Niels Ebbesen Hansen: Plant Explorer for the Northern Plains" (paper presented at the Northern Great Plains History Conference, 1985). For a discussion of the general origins of the USDA's plant exploration program, *see* Isern, "The Erosion Expeditions," *Agricultural History* 59 (April 1985): 181–91. A monograph providing basic information on the plant exploration program is Nelson Close, *America's Crop Heritage: The History of Foreign Plant Introduction by the Federal Government* (Ames: Iowa State College Press, 1950). Carleton and several other explorers from Kansas are treated briefly in A.L. Clapp, "Kansas Plant Hunters," in Kansas State Board of Agriculture, *Twenty-ninth Biennial Report, 1933–1934* (Topeka: Kansas State Printing Plant, 1935), 179–82.

16. Mark A. Carleton to David A. Fairchild, June 27, 1898, Letters Sent.

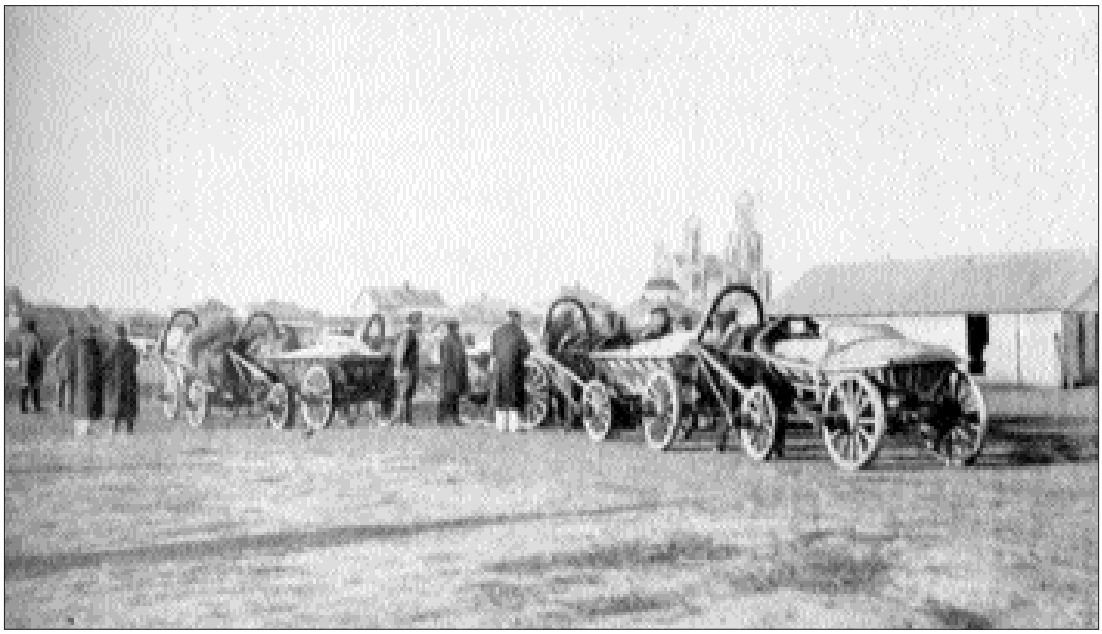
In 1898 Carleton was offered a commission as a special agent of the U.S. Department of Agriculture to travel to Russia to examine grain varieties and foster the development of American agriculture. These two photographs, taken by Carleton while in Russia are: LEFT: *A camp of Kirghiz harvesters near Uralsk, on the Siberian border; and* RIGHT: *Kubanka wheat is brought to market by Kirghiz farmers at Uralsk.*

enthusiastically, confiding to a colleague, "A trip to Russia is what I have been working to make above all others."[17] He intended not only to gather seed samples but also to examine the whole relationship of grain and environment in Russia. Secretary of Agriculture Wilson sent him a commission advising all concerned, "Be it known that Mr. M.A. Carleton, Agricultural Explorer of the United States Department of Agriculture, is about to proceed to Europe and Western Asia to promote the development of American Agriculture."[18]

Carleton settled his affairs in Lincoln and within a month was in England, stopping a few days to observe the operations of cereal breeders there. His itinerary led thence to major cities in France, Brussels, Germany, Denmark, Sweden (Stockholm, to confer with Eriksson about their common interest in rusts), Austria, Hungary, and Rumania—quite a junket for a Kansan who never previously had left the United States—before he turned east to commence plant exploration proper. His Russian itinerary began near the Black Sea, in the heart of hard red winter wheat country, at Odessa; ranged through Ukraine and the Volga River valley; swung back east and south as far as Baku; and exited the empire at Odessa. Return home again was by way of Poland, Germany, France, and England.[19]

Carleton's explorations in Russia produced few letters; developments largely are traceable only indirectly through references in his bulletins. He was not one to confide how he stammered his broken Russian at wealthy landowners, poor peasants, and governmental officials who helped him find the grains he sought. To carry back to the United States, he chose twenty-three varieties of cereal grains, one of buckwheat, two of forage plants, and many of garden plants. On the Kirghiz Steppes the awkward American obtained seed of several spring wheats. One of these, Kubanka durum wheat, which flourished in loose, gray soils, Carleton (mistakenly) thought appropriate for the High Plains from Texas to Colorado; other durums he thought adaptable to the Dakotas. Still more spring wheats he found in the most northerly reaches of the Volga River basin. There he also secured varieties of oats, including the Swedish Select Oat, and quantities of barley, millet (or broomcorn), and emmer, an ancient wheat cultivar useful mainly as a feed grain. Carleton spent little time in the

17. Mark A. Carleton to A.F. Woods, June 27, 1898, ibid.
18. Commission, July 1, 1898, Carleton USDA Personnel file.
19. M.A. Carleton itinerary, 1898, "Explorations Itinerary, 1897–1932," Plant Introduction Records, vol. 149, Records of the Bureau of Plant Industry, Soils, and Agricultural Engineering, RG 54.



winter wheat regions of Russia in 1898, largely because of a severe drought there. He hoped, however, that regional officials later would send him seed from Crimea and the Caucasus. Not until February 1899 did Carleton return to Washington.[20]

Once there his feet barely touched the ground. He tossed off a report entitled *Russian Cereals Adapted for Cultivation in the United States* and hastily embarked on a tour of grain-producing areas of the Trans-Mississippi West, studying rusts and general methods of culture. Returning in the fall, he accepted an assignment to supervise cereal exhibits by American producers at the Paris Exposition of 1900. He embarked for Paris in January 1900. Serving also as a juror of cereal exhibits, Carleton was occupied at the exposition until the end of June.[21]

This was more than just a trip to the fair, for Carleton laid plans also to return to Russia, this time to secure the winter wheats that had eluded him earlier. In July he reached Odessa and began a survey of the Caucasus and Crimea. The search was easier this time, for he had a better command of the language, reporting with pride he was "accomplishing things much faster than on my other trip, as I know the country and language. I will soon speak the Russian as much as the German I think. I have now letters to several men in North Caucasus who speak only Russian, and expect to buy wheat from them."[22] He collected numerous winter wheats, including one called Kharkov, for the Department of Agriculture and arranged a private shipment of Crimean wheat to some farmers in Kansas who had requested it. He took hundreds of photographs. By September the work was finished. "My work in Russia has been very satisfactory indeed," Carleton wrote from Budapest. "Everything has been obtained (and more too)

20. Carleton's few letters of travel in 1898—none of them from Russia—are in Letters Sent and in General Correspondence, Records of the Division of Vegetable Physiology and Pathology, Records of the Bureau of Plant Industry, Soils, and Agricultural Engineering, Series 155, RG 54. The catalog of plant introductions resulting from his 1898 expedition is *Cereals and Forage Plants Collected in Russia by Mr. M.A. Carleton for the Section of Seed and Plant Introduction*, U.S. Department of Agriculture, Division of Botany Inventory 4 (Washington, D.C.: Government Printing Office, 1899).

21. Mark A. Carleton to Beverly T. Galloway, January 30, 1899, Letters Sent; Carleton to Galloway, February 1899, ibid.; Carleton to Galloway, July 2, 1899, ibid.; Carleton to Galloway, July 18, 1899, ibid.; Carleton to A.F. Woods, March 7, 1900, ibid.; Carleton to Galloway, March 18, 1900, ibid.; Carleton to Woods, June 3, 1900, ibid.; Carleton to Galloway, June 6, 1900, ibid.; Carleton to Galloway, June 18, 1900, ibid.; Carleton to Woods, July 11, 1900, ibid.

22. Mark A. Carleton to Beverly T. Galloway, August 7, 1900, ibid.

that I went for, and I have a large number of pictures, and still more information of value."[23]

Carleton's impressive publications and energetic travels did not go unnoticed: in 1901, after a reorganization of the Department of Agriculture, he became cerealist in charge of all grain investigations for the Bureau of Plant Industry. Inasmuch as he earlier had concluded that improvements in cereal culture would be slight until new varieties came into use, his first priority in this job was to test and promote the grains he had introduced from Russia. To conduct the tests Carleton established cooperative ties between his office and the state experiment stations of the Great Plains, unprecedented in any earlier research efforts of the Department of Agriculture. He distributed seed to the stations, as well as to selected farmers, to be tested in competition with other varieties. The tests were impartial, but Carleton viewed them with a partisan eye. The acceptance of Russian varieties on the Plains became an obsession with him. Although he fostered careful research, his personal concern was with the promotion of his grains.[24]

This attitude was particularly evident in his activities on behalf of durum wheats, most prominent among them his darling, Kubanka durum, originally brought by Carleton from near Orenburg on the Kirghiz Steppes. In 1901 he published a thick bulletin, *Macaroni Wheats*, which pointed out that durum wheats had been grown in the country prior to his introduction of them, but that "these wheats have been received with but little favor. In spite of their excellent yields and hardiness the lack of a market made their establishment a practical impossibility."[25] Durums were exceptionally hard spring wheats chiefly used for macaroni. They were not only hard but also hardy: "The greatest endurance of drought," averred Carleton, "is exhibited by wheats of the durum group, commonly called macaroni wheats."[26] Because millers and elevator men in the northern part of the country refused to handle this "goose wheat," as they called it, American macaroni makers used soft white wheat flour and produced an inferior product—pale, pasty pasta, not the good, yellow, rubbery kind. Much macaroni was imported from Europe. Carleton believed that the United States should produce enough durum to supply its domestic demand and to enter the European export market.[27]

Reports from stations on the Plains clearly showed the drought-resistance and general hardiness of Kubanka and its relatives, but unless millers accepted them, the experiments were in vain. Carleton attacked this problem head-on. He conducted milling tests and chemical analyses to prove the superiority of durum semolina for macaroni. He compiled lists of macaroni manufacturers to show millers that a market was available. He crusaded for enlightened culinary customs, expressing frustration with American misuse of pasta. Mourning "the general ignorance throughout this country of the proper methods of preparing and serving macaroni," he wrote, "The most common form in which macaroni is served in this country is a very white, pasty, doughy mass of sticks, served in dilute tomato sauce. The most enthusiastic lover of macaroni would have very little if anything to do with a dish of that kind."[28] Carleton went so far as to collect European chefs' recipes using durum semolina, filling a bureau of plant industry bulletin with recipes for croquettes, spaghetti, timbale, vermicelli—even semolina fritters.[29]

In 1904, a wet crop year over much of the Plains, Carleton's old antagonists, the fungi, gave his promotional efforts a boost. By this time farmers, farm organizations, and agricultural college scientists had commenced a rhetorical attack on the milling industry and on the millers' trade journal *Northwestern Miller*, which returned fire, disparaging Carleton and his grains. Then the spring wheat region in 1904 suffered the worst epidemic of black stem rust in history. Carleton gleefully pointed out that of spring wheat varieties, only durums successfully had resisted the blight. Surely he waved his index finger in the air as he lectured, "The writer has for several years called attention to the fact that durum wheats resist rust very much more than the common varieties."[30] Farmers in the Red River valley of

23. Ibid., September 13, 1900.

24. Appointment as cerealist, July 1, 1901, Carleton USDA Personnel file; De Kruif, *The Hunger Fighters*, 18–20.

25. Mark Alfred Carleton, *Macaroni Wheats*, U.S. Department of Agriculture, Bureau of Plant Industry Bulletin 3 (Washington, D.C.: Government Printing Office,1901), 9.

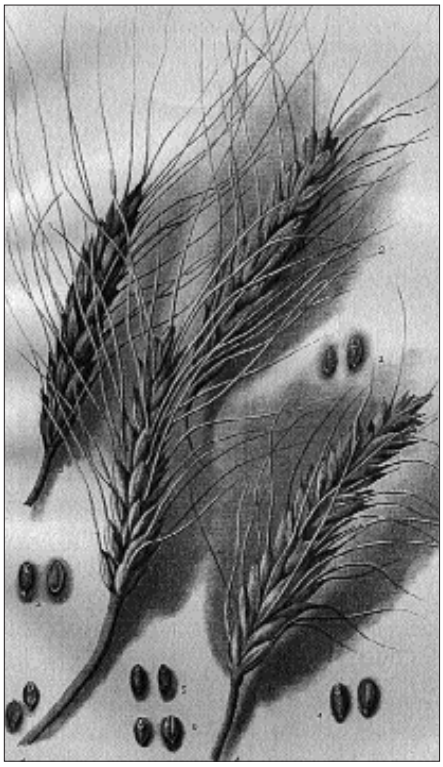
26. Carleton, "Successful Wheat Growing in Semiarid Districts," 536.

27. Carleton, *Macaroni Wheats*; Carleton, "Successful Wheat Growing in Semiarid Districts," 536–37; Carleton, *Russian Cereals Adapted for Cultivation in the United States*, 11–16; Carleton, *A New Wheat Industry for the Semiarid West*, U.S. Department of Agriculture, Division of Vegetable Physiology and Pathology Circular 18 (Washington, D.C.: Government Printing Office, 1901).

28. Mark Alfred Carleton, *The Commercial Status of Durum Wheats*, U.S. Department of Agriculture, Bureau of Plant Industry Bulletin 70 (Washington, D.C.: Government Printing Office, 1904), 20–21.

29. Carleton, *New Wheat Industry for the Semiarid West*; Carleton, *Commercial Status of Durum Wheat*; Mary W.M. Hargreaves, "The Durum Wheat Controversy," *Agricultural History* 42 (July 1968): 212–13.

30. Mark Alfred Carleton, *Lessons from the Grain-Rust Epidemic of 1904*, U.S. Department of Agriculture, Farmers' Bulletin 219 (Washington, D.C.: Government Printing Office, 1905), 9.



Drought-resistant wheats. LEFT: *Hard winter varieties. A Turkey spike is at lower left.* RIGHT: *Macaroni varieties. A Kubanka spike is at center, bottom row.*

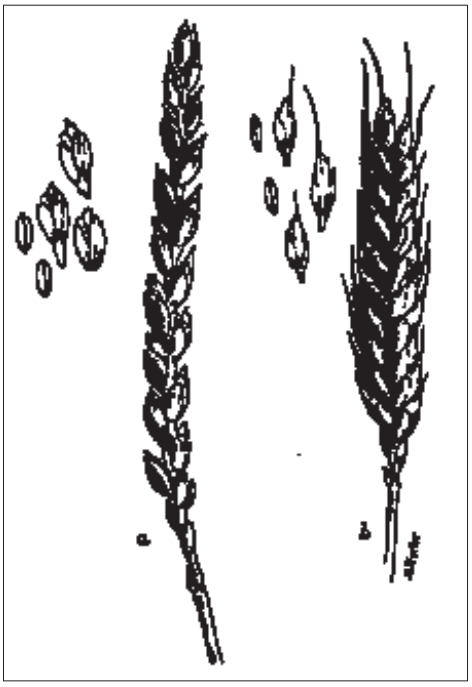
the north—not on the High Plains to the south, as Carleton earlier had expected—rapidly converted to raising durum, mainly Kubanka. Meanwhile Edwin F. Ladd, of the North Dakota Agricultural Experiment Station, was using his position as state chemist to mount a legal assault on the millers, contending that they were discounting durum when they bought it, bleaching it and blending it with top-grade wheats and pocketing the profits. Millers finally were forced to accept durum and convert mills to handle it. Carleton was vindicated.[31]

Acceptance of hard red Russian winter wheats came easier because farmers and millers of the winter wheat region already were familiar with Turkey wheat. Carleton's importation of 1900, Kharkov, surpassed local Turkey in trials and was broadly distributed through experiment stations on the Central Plains. In the course of a decade, however, Kharkov no longer was a distinct variety, it having been mixed and confused with Turkey and other Russian importations. Carleton's role in the expansion of acreage of hard red winter wheat raised on the Central Plains was partly facilitator, partly storyteller. He found his variety, Kharkov, in the Starobelsk district of that province and brought it into experiment station trials on the Plains. He also brought in larger amounts of seed for more general distribution. Meanwhile a group of farmers and millers headed by Bernhard Warkentin of Newton, Kansas, following leads to suppliers given them by Carleton, imported carload lots of hard red wheat that they called Turkey.[32]

As these twentieth-century developments unfolded, Carleton carefully nursed the historical tie to the nineteenth century linking Kansas to Crimea through Mennonite migration. "A traveler on the plains of Kansas, if suddenly transported while asleep to southern Russia and deposited in Crimea, would discover very little difference in his surroundings, except as to the people and the char-

31. Carleton, *Lessons from the Grain-Rust Epidemic of 1904*; Hargreaves, "The Durum Wheat Controversy," 213–26.

32. Mark Alfred Carleton, "Hard Wheats Winning Their Way," in U.S. Department of Agriculture, *Yearbook, 1914* (Washington, D.C.: Government Printing Office, 1915), 397–405; Carleton, "Wheat Improvement in Kansas," in Kansas State Board of Agriculture, *Thirteenth Biennial Report, 1901–1902* (Topeka: Kansas Department of Agriculture, 1903), 514–15; De Kruif, *The Hunger Fighters*, 24–25.



LEFT: *In Carleton's 1918 report,* Emmer: A Grain for the Semiarid Regions, *the emmer species of wheat, right, is shown to be a much hardier plant than the spelt.* RIGHT: *Two unidentified varieties of durum wheat introduced by Carleton appear in the Kansas State Board of Agriculture's* Twenty-ninth Biennial Report, 1933–1934.

acter of farm improvements and live stock," he wrote. "Even these last would be of the same kind if he were transported from certain localities in Kansas, where Russian immigrants now live." More specifically, he emphasized, "The history of hard winter wheat is closely associated with the movement of Russian Mennonite immigrants to the middle Great Plains. . . . There is an interesting feature of this introduction of a great crop in the fact that the crop and the people who knew best how to grow it migrated together."[33] Carleton was statesmanlike in that he knew acceptance of hard red winter wheats would be more likely if presented as a cultural continuity rather than as a scientific innovation.

Carleton promoted other grain crop importations with mixed results. The Swedish Select Oat was another success story for Carleton. This large-grained, white, prolific oat excelled in trials after Carleton introduced it in 1898. Farmers in Wisconsin, Minnesota, North Dakota, and Montana within ten years made it the principal oat variety of their region. Its importance faded, of course, with the adoption of tractors and diminishment of farm horses. Carleton was less successful in an effort to persuade farmers of the virtues of emmer. He promoted winter and spring varieties of emmer as feed crops for semiarid regions because of their high drought resistance. Sorghums produced better, however, and in more humid areas, barley and oats.[34]

Cerealist and world traveler, no longer just a pathologist, Carleton after 1900 not only promoted his importations but also published new works offering a broader view of wheat-growing and of farming in general in semiarid regions. In two prominent articles he gave his views on the long-term capacity of the United States to feed itself and answer world demand for cereal grains. There was a common popular belief that land productivity was declining, population was growing, and shortage was inevitable. Carleton pointed out that productivity was increasing, especially with improved varieties, and that acreage was expanding, with new lands being broken for wheat. He pre-

33. Carleton, "Hard Wheats Winning Their Way," 398–99.

34. M.A. Carleton, "Improvement of the Oat Crop," in Kansas State Board of Agriculture, *Fourteenth Biennial Report, 1904–1905* (Topeka: Kansas Department of Agriculture, 1905), 32–42; Carleton, *Ten Years' Experience with the Swedish Select Oat*, U.S. Department of Agriculture, Bureau of Plant Industry Bulletin 182 (Washington, D.C.: Government Printing Office, 1910); Carleton, *Emmer: A Grain for the Semiarid Regions*, U.S. Department of Agriculture, Farmers' Bulletin 139 (Washington, D.C.: Government Printing Office, 1901); Carleton, *Winter Emmer*, ibid. 466 (1911).

dicted accurately that there would be no shortage of wheat. In fact by 1915, skeptical of the doctrines of what he termed "so-called dry farming," he feared that the expansion of wheat acreage on the Plains was going too far, that it was proceeding "with reckless disregard of adaptation or facilities for market." He warned that on the Southwestern Plains "not the least difficult problem is to convince the farmer that he should eliminate wheat entirely. In this district straight stock-raising is the only dependable occupation."[35]

During this time Carleton was at the pinnacle of his profession—indeed, he was defining it. In 1908 he became the founding president of the American Society of Agronomy, the major national association for scholars of plant breeding and crop husbandry. He devoted his presidential address to definition of the field, which he considered broad. The science of agronomy, he said, "investigates anything and everything concerned with the field crop." On the other hand, expertise would advance only through individual focus. "Specialization as to subjects or area," he allowed, "is thus the only salvation for the agronomist in order to do thorough work." Finally, mindful of his academic roots in Manhattan, Kansas, he defended the honor of America's agricultural colleges as seedbeds for the new science, insisting that they were equal to, perhaps better than, the more renowned universities of Germany.[36]

Other activities also occupied Carleton's time. He continued to publish widely, including, as befit his stature in the field, two influential articles on the principles and practice of wheat breeding. He was chairman of the jurors of cereal exhibits at the St. Louis Exposition in 1904. In 1912–1913, drawing on his expertise in fungi, he took leave from the Department of Agriculture to manage the work of the Pennsylvania Chestnut Tree Blight Commission, developing cultural methods to resist the blight. Finally, in 1916, he published a masterly textbook entitled *The Small Grains*. Not surprisingly the struggle for establishment of hard wheats on the Plains figured prominently in the work. "The hard wheats stand to-day in the highest class, in most countries," Carleton wrote with satisfaction. "Both the wheat and the flour sell at the highest prices."[37]

Carleton presided for years over a growing and respected cereal grain program in the Bureau of Plant Industry of the Department of Agriculture. His bureau chief, Beverly T. Galloway, recommended a raise in pay and praised his record in 1906, waxing eloquent over his specific contributions to the durum industry and oat breeding and also over his general grasp of issues in cereal grain farming. Internal correspondence of the bureau during the years through 1917 shows Carleton continually on the move, visiting problem areas in the wheat belt, organizing research programs, commanding the respect of peers and superiors alike. In 1917 he was drafting plans to raise wheat for the Allies on lands in Russia and Manchuria.[38]

A surprisingly negative note appeared in the Carleton personnel file in 1916, however. A recommendation for a raise in salary came back rudely stamped, "Disapproved by Sec. of Ag." It was reconsidered and finally approved, but something was amiss, foreshadowing that Carleton's productive career would end early and sadly. What was happening was that Carleton had become financially embarrassed. He drew an annual salary of some three thousand dollars, and with four children, he saved little. When one of his daughters developed infantile paralysis, he borrowed heavily and traveled frequently for her medical treatments. He attempted ineptly and disastrously to raise money by operating a wheat farm in Texas—his personnel file recorded several unexplained leaves of absence in that region—and a fruit farm in Florida. For a time he neglected almost entirely the supervision of his staff of cerealists. A departmental committee investigated his malfeasance in 1917 but declined to take action because of his reputation. Then one of his sons underwent surgery for mastoid disease; another daughter sickened and died in five days; the

35. M.A. Carleton, "The Future Wheat Supply of the United States," in U.S. Department of Agriculture, *Yearbook, 1909* (Washington, D.C.: Government Printing Office, 1910), 259–72; Carleton, "The Future Wheat Supply of the United States," *Science*, new ser. 32 (August 5, 1910): 161-71; Carleton, "Problems of the Wheat Crop," *Journal of the American Society of Agronomy* 7 (March–April 1915): 78–84, quotes on 78, 81.

36. M.A. Carleton, "Development and Proper Status of Agronomy," *Proceedings of the American Society of Agronomy* 1 (1907–1909): 17–23, quotes on 20, 22.

37. M.A. Carleton, "Fundamental Requirements for Grain Breeding," *Proceedings of the American Breeders' Association* 2 (1906): 129–35; Carleton, "Field Methods in Wheat Breeding," ibid. 5 (1909): 185–207; Carleton, "Fighting the Chestnut Tree Blight Disease in Pennsylvania," *American Fruit and Nut Journal* 6 (September–October 1912): 78–79; Carleton, "Report of the General Manager for the Latter Half of the Year, 1912," Historical Society of Pennsylvania, Philadelphia; Carleton, "The Fight to Save the Chestnut Trees; Final Report of the General Manager," [1913], ibid.; Carleton, *The Small Grains* (New York: Macmillan, 1916), quote on 166.

38. Galloway recommendation, January 1, 1906, Carleton USDA Personnel file. Other routine personnel recommendations and actions throughout the period in ibid; Carleton file, General Correspondence of the Office of the Chief, 1900–1908, Records of the Bureau of Plant Industry, Soils and Agricultural Engineering, Series 1, RG 54; ibid., General Correspondence of the Office of the Chief, 1908–1939, Series 2, RG 54.

In his quest to prove the superiority of durum wheats for use as macaroni, Carleton conducted milling tests and chemical analyses. He even went so far as to visit European chefs, collect their recipes using durum semolina, and fill a Bureau of Plant Industry bulletin with recipes for croquettes, spaghetti, timbale, and semolina fritters.

Carletons lost their home to a mortgage foreclosure. Desperate, Carleton borrowed money first from his co-workers, then from several grain dealers. This raised a conflict of interest with his job. Worse yet, the lenders were Republicans. Secretary of Agriculture David Houston furloughed him in 1918—in effect fired him, for Carleton would never regain his position, resigning instead the same year. (Carleton covered the resignation form with a note to Houston, "The enclosed paper is handed to you, not because in my own mind I have anything to resign for, but out of regard for yourself, as I understand that my present financial relations with certain others are embarrassing to the department administration.") Friends pled his case with the secretary. Congressman W.A. Ayres fairly wept, "He has been compelled to sell his little home and sacrifice everything in order to pay up all his debts," while Mrs. Carleton, "a very estimable lady," had been compelled to take in boarders and roomers. Ayers asked a "personal favor" on behalf of Carleton, because as he said, "at heart he is not a bad man." All such pleas were to no avail.[39]

Carleton's remaining years were listless. He spent two years as an agent of the United States Grain Corporation. From 1920 to 1924 he studied diseases of bananas in Panama and Honduras for the American Fruit Company and other American companies. In 1924, on the invitation of a wealthy cotton planter in Peru, he traveled to the Cotocaos valley of that nation to seek a solution to an infestation of pink boll weevils. There, on April 25, 1925, Carleton died of heart disease complicated by malaria. He was buried on a hill overlooking the little fishing village of Paita, Peru.[40]

Writers of obituaries for Carleton struggled with how to chronicle his accomplishments without detailing his financial reverses and administrative malfeasance. Most dutifully chronicled his accomplishments and said little of later problems. They were respectful but not affectionate in their eulogies. Most accurate and succinct was the writer for *American Midland Naturalist* who said, "Mr. Carleton was a very energetic

39. Specifics of the Carleton dismissal are in Carleton USDA Personnel file; De Kruif treats them generally in *The Hunger Fighters*, 25–28.

40. On Carleton's final years, *see* Swanson, "Mark Alfred Carleton—The Trail's End; Carleton "Obituary"; De Kruif, *The Hunger Fighters*, 28–30. D.L. Watson, United Fruit Company, La Lima, Honduras, to author, May 14, 1980, confirms Carleton's employment with that company from 1920 to 1922, Isern collection.

man, full of inspiration and always active, and his keen eye for nature guided him to accomplish what he did. He performed his work in a purely scientific, very simple and quiet way, with his mind completely concentrated on whatever problem he had in view."[41] Several colleagues at Kansas State Agricultural College remembered him, among them President F. D. Farrell. Farrell said it was "not true that his work was not appreciated," but Carleton put himself into "an impossible situation, and there was nothing the department could do, finally, except let him go." Despite Carleton's tendency to borrow money from his old friends, Farrell admired him, saying, "His greatest characteristic was absolute inability to realize that he was whipped."[42]

Carleton had a flawed personality and bad judgment, but viewed in retrospect, his achievements outweighed his shortcomings. He was not intellectually brilliant, but he had a sort of genius deriving from focus and single-mindedness. His work on cereal rusts stood the scrutiny of later investigations. Carleton deserves chief credit for the foundation of the durum wheat industry on the Northern Plains, which was well established by 1910 and continues today. He contributed significantly to the improvement of winter wheat varieties in cultivation on the Central and Southern Plains. Although his Kharkov was eclipsed by other Russian importations, breeders would not have sought those varieties had not Carleton shown them where to search. The Swedish Select Oat was of regional importance until tractors diminished the need for such a feed grain.

Carleton, founding father of the American Society of Agronomy, was first of all a scientist. His scientific investigations, combined with a germ of regional environmentalism, led to his plant explorations. His explorations brought him acclaim. His subsequent activities as chief cerealist in the Department of Agriculture established him as the nation's foremost authority on cereal grains and made him the most respected agronomist in the country. Through all these successes ran the consistent thread of Carleton's perseverance—even plain bull-headedness—that perhaps also was the cause of his downfall.

Carleton was devoted to science and traveled the world in its service, but he remained personally rooted in the culture and agriculture of the Great Plains of North America. His own science told him that organisms partook of their environment, and he was, after all, a plainsman. Those of his letters that derive from desk service are mere mumbles; those that come from the field are breathy psalms. Carleton loved exploring the Steppes and loved likewise ranging the Plains, talking with farmers about their problems and aspirations. This is why it is so sad for him to lie in death so far from Kansas, with no memorial back home on the Plains proclaiming what he did for his home country.

41. Theodore Holm, "Obituary," *American Midland Naturalist* 10 (January 1926): 48.

42. *Kansas City Star*, December 9, 1928.