USDA. After the war, the agriculture subcommittee of the Committee on Appropriations began handling the funding requests. The situation was almost bound to create confusion. Who would now authorize additional projects, the Agriculture or the Public Works Committees USDA submitted survey reports to both committees (page 106). Some members of the Public Works Committee frankly thought they detected "a perversion of the intent of the flood-control acts" to carry out the regular USDA conservation work "under the guise of flood control."[43]

However, it was not just the differing opinions within government involved in the stalemate over the Department of Agriculture's flood control surveys. Out in the countryside, what was known as the upstream-downstream debate was at full force. The big dam-small dam controversy raged in the Arkansas-Red-White Basin and the Missouri Basin for some understandable reasons related to climate and topography. The Washita River, one of the projects authorized in the 1944 act, for instance, presented a good case for the small dams. Clouds, swept up from the Gulf of Mexico, provided moderate annual rainfall, but rainfall often was delivered in thunderstorms. Geologic forces created an area of moderate relief with wide flood plains, which, when protected from the very frequent floods, were much preferred for cropland over the adjacent, more droughty slopes and crests. Advocates of small dams on the tributaries argued that a series of small dams would protect the valuable bottom, while large dams would inundate too much of it. Partisans of the upstream program trekked to see the small structures along the Washita. The concept represented by the Washita was the model lauded in the major proselytizing treatise of the era, *Big Dam Foolishness* (1954) by Elmer T. Peterson, an Oklahoma journalist.

The Washita-type program, of course, involved many hydrologic questions. The point at issue was no longer simply the effect of land treatment on flooding. Now it was a question of the value of a system of small dams, or the effects of the small dams on the function of the corps' larger dams. Could a system of small dams be substituted for larger dams? Some of the upstream forces advocated a system of land treatment and small reservoirs as an alternative to large downstream flood control structures. People who would lose farmland to the large reservoirs found this a particularly appealing idea.[44] While the Agriculture Department did not publicly promote this flood prevention program as the answer to downstream flooding, the Public Works Committee believed SCS was supplying the upstream forces with information which was misused and exaggerated in the debate.[45]

The Corps of Engineers began to voice objections that Soil Conservation Service small structures in the eleven authorized projects had not been coordinated with their work. But their primary objection was that such a program would call for another engineering agency, and that Congress should not create another agency. The upstream territory, like the downstream, would be theirs if there was really a need.[46]

The result of all this controversy was an impasse in the authorization of additional USDA flood control projects. According to Arthur Maass, two events broke the impasse and led to an entirely different method of approving watershed flood control work. One event was the election of an administration which was not wedded to the comprehensive planning and implementation of land treatment and flood control work. The other event was a congressional election in Kansas that alerted the administration to the desire of people in the headwaters for a small watershed program.[47]

Farmers and other residents had been lobbying for an upstream program, with some communities, especially in Kansas, forming watershed associations. The proponents had testified in 1951 before the subcommittee handling the Missouri Basin Agricultural Plan that they should not have to wait for complete river basin development to implement a small watershed program. The chairman of the subcommittee introduced a small watershed bill, but that bill did not reach the floor because Public Works Committee members stopped it in the House Rules Committee.[48] Kansas, along with the rest of the Missouri River Basin, was, in the early 1950s, debating the virtues of a proposed Missouri Valley Authority modeled after the TVA, as opposed to the Pick-Sloan plan, a combination of the U.S. Army Corps of Engineers plan and the Bureau of Reclamation plan. Part of Pick-Sloan included the Tuttle Creek Dam on the Big Blue River in Kansas to help protect Topeka, Lawrence, and Kansas City from flooding.

When the Missouri Basin Commission held hearings in Kansas in the summer of 1952 to gauge public sentiment, Bureau of the Budget observers found "a real and growing resistance and resentment toward the Pick-Sloan big dam approach as the solution of all the problems of Kansas."[49] With the cities still pressing for the Tuttle Creek Dam, the nature of the opposition in the valley of the Big Blue River became obvious when Howard S. Miller, a seventy-three-year-old farmer from Morrill, captured the normally safe Republican congressional seat in the 1952 elections.[50] Miller, who had campaigned almost exclusively on the issue of the dam, failed to stop it and lost the next election. But his election had alerted the new Republican administration to the desires of rural people for a small watershed program. After a change in administrations, Congress in 1953 authorized a $5 million "pilot" program on sixty-two watersheds. The following year Congress passed the Watershed Protection and Flood Prevention Act. Amendments to the act have made it possible to construct works for drainage, irrigation, fish and wildlife development, and municipal water supply.

Within the Agriculture Department the flood control work expanded rapidly after the passage of the 1954 act. The Forest Service cooperated on the forestry aspects of projects. Its work on private lands increased. Within SCS the new surveying, planning, engineering, and construction supervision in watershed protection and flood prevention grew to claim a partnership role with the soil conservation operations.

The influence of the activities carried out under the 1936 act in shaping the watershed protection and flood prevention program was obvious. Subjection of long-held assumptions to scientific inquiry created a coterie of believers in small floodwater-retarding structures and channel improvement as a part of the upstream program, and they prevailed in having these included in the program. Land treatment to help infiltration and to protect reservoirs from sedimentation was included in the plans for the watershed. But traditionally, at least until recently, USDA has not shared the cost of land treatment under the Watershed Protection and Flood Prevention Act. The Bureau of the Budget attitude prevailed. Currently, the Agriculture Department and Congress are approving "land treatment watersheds," which are mostly long-term cost-sharing agreements for land treatment without the floodwater-retarding structures. Economic analyses during the 1930s revealed the costs of upstream flooding and provided the economic rationale for an expanded program. Under the 1936 act survey parties designed a remedial project unique to the area. This procedure had a certain rational appeal; it left leeway for a greater number of objectives in project design. But project approval accelerated after the experience gained during the 1930s and 1940s was digested and used to write guidelines and criteria under which small watersheds would be examined for approval.

The agricultural interests had pressed for the program, and most of the projects were sent to the agriculture communities for approval. Projects that would benefit agricultural land received a more sympathetic hearing than those to reduce urban flooding. The new program had decreased emphasis on total river basin planning. After determining that a proposed project qualified under the laws and regulations, the willingness and ability of the local community and the state to pay was the crucial test. The map of the small watersheds projects reflected areas where the state and local community thought they had upstream flooding problems and were willing to pay their share to correct the problems.

Finally, there is the influence of the act on the Department of Agriculture and on the Soil Conservation Service in particular. The inclusion of a strong water resources program in SCS certainly broadened the base of disciplines. Hugh H. Bennett and Walter Lowdermilk viewed soil conservation as an interdisciplinary undertaking and included the many disciplines in the formative years. The water resources activity brought more hydrologists, engineers, geologists, and economists into the combined soil and water program than might have been expected. In response to the controversies arising from complying with the National Environmental Policy Act, more biologists were added. Furthermore, the method of planning and implementation under the flood control acts provides a basis, if not to ensure that each discipline participate in the joint soil and water conservation effort, at least to encourage such participation.

If there is a lesson for the future here, we should consider this aspect of the history. Currently, two of the important resource questions are ground-water quality and the off-site impacts of erosion and the contributions of agriculture to those problems. Both of these are highly complex scientific problems with complex solutions. The lesson from the experience under the Flood Control Act of 1936 was not to be too quick to extrapolate information from a field or experimental plot to an entire watershed, and that an interdisciplinary approach was needed to study the problems. That lesson should be borne in mind when confronted by other resources problems demanding understanding and calling for corrective measures.

Watershed Reports Submitted to Congress After World War II

(These reports were not authorized for works of improvement in flood control acts.)

Watersheds	Date Submitted	Referred to H. Committee	House Doc. Num.
Missouri River Basin	9/29/49	Ag.	373, 81/1
Green River, KY & TN	10/19/51	Pub. Works	261, 82/1
Grand (Neosho) River, OK	2/27/52	Pub. Works	388, 82/2
Brazos River, TX	3/10/52	Pub. Works	396, 82/2
Pee Dee River, VA, NC & SC	3/10/52	Pub. Works	395, 82/2
Sny, IL	3/10/52	Pub. Works	398, 82/2
Queen Creek, AZ	3/10/52	Pub. Works	397, 82/2
Delaware River, NY, NJ, PA, etc.	3/19/52	Pub. Works	405, 82/2
Sevier Lake, UT	3/19/52	Pub. Works	406, 82/2
Scioto River, OH	3/19/52	Pub. Works	409, 82/2
Pecos River, NM & TX	5/20/52	Pub. Works	475, 82/2
*Salt-Wahoo Creeks, NE	7/03/52	Ag.	530, 82/2
*Blue River, NE & KS	7/03/52	Ag.	530, 82/2
*Upper South Platte, CO & WY	7/03/52	Ag.	530, 82/2
*Osage River, KS & MO	7/03/52	Ag.	530, 82/2
*Five Mile Creek, WY	7/03/52	Ag.	530, 82/2

* Submitted as one document entitled "Supplemental Report, Missouri River Basin Agriculture Program."

Source: Arthur Maass, "Protecting Nature's Reservoir." In *Public Policy*, vol. 5, edited by C.J. Friedrich and J.K. Galbraith (Cambridge: Harvard University Press, 1954), 106.

Endnotes

[1] Quoted in Hugh Hammond Bennett, *Soil Conservation* (New York: McGraw-Hill Book Company, 1939), 869.

[2] Samuel P. Hays, *Conservation and the Gospel of Efficiency* (New York: Atheneum, 1979; originally published by Harvard University Press, 1959), 22-26, 199-208; and Harold T. Pinkett, *Gifford Pinchot: Private and Public Forester* (Urbana: University of Illinois Press, 1970), 96-101.

[3] Douglas Helms, "The Civilian Conservation Corps: Demonstrating the Value of Soil Conservation," *Journal of Soil and Water Conservation* 40 (March-April 1985): 184-188; and G.M. Granger and J.C. Kirchner's note about FDR's verbal instructions to them on the flood control phase of CCC work may be found in Item 29, April 8, 1933, Reference File, Records of the Civilian Conservation Corps, Record Group 35, National Archives and Records Administration, Washington, D.C. (hereinafter cited as RG for Record Group and NA for National Archives).

[4] Hugh Hammond Bennett, "Soil Erosion and Flood Control," Lecture III (Paper delivered at the U.S. Department of Agriculture Graduate School, February 3, 1928), mimeographed, copy at National Agricultural Library, Beltsville, MD. For other early discussions by Bennett on this topic, see *The Soils and Agriculture of the Southern States* (New York: Macmillan Company, 1928); and *Soil Conservation*, 596-616.

[5] Hugh Hammond Bennett, "The Relation of Soil Erosion to Flood Control" (Address before National Rivers and Harbors Congress, Mayflower Hotel, Washington, D.C., April 30, 1934), mimeographed copy at National Agricultural Library, Beltsville, MD.

[6] Walter C. Lowdermilk, *Conquest of the Land Through 7,000 Years*, Agricultural Information Bulletin No. 99 (Washington, D.C.: U.S. Department of Agriculture, 1951), 13-15. For references to some of Lowdermilk's writings about the influence of forests on runoff, see the endnotes in J. Douglas Helms, "Walter Lowdermilk's Journey: Forester to Land Conservationist," *Environmental Review* 8 (Summer 1984): 132-145.

[7] R.H. Davis to Bennett, November 3, 1933, File 243, General Correspondence, RG 114, Records of the Soil Conservation Service, NA. This file also includes correspondence with the U.S. Geological Survey about establishing gauging stations so that the influence of soil conservation work on sedimentation and flooding could be measured.

[8] H.S. Person, *Little Waters: Their Use and Relations to the Land* (Washington, D.C.: Soil Conservation Service, Resettlement Administration, and Rural Electrification Administration, 1936), n.p.

[9] Gilbert White, unpublished transcript of an interview by Martin Reuss, June 1985, Boulder, CO, 33-37. Office of History, Headquarters, U.S. Army Corps of Engineers, Ft. Belvoir, Virginia.

[10] *Headwaters Control and Use*, Papers presented at the Upstream Engineering Conference held in Washington, D.C., September 22 and 23, 1936 (Washington, D.C.: Soil Conservation Service, Forest Service, and Rural Electrification Administration, 1937), 178.

[11] Jean Christie, *Morris Llewellyn Cooke: Progressive Engineer* (New York: Garland Publishing, 1983), 191-192.

[12] U.S. Congress, Senate, *Congressional Record*, 74th Cong., 2nd sess., 1936, 80, pt. 7: 7575.

[13] Carl Hayden to Marvin H. McIntyre, May 1, 1936, Official File 2450 (Little Waters), Franklin D. Roosevelt Library, Hyde Park, NY.

[14] Walter C. Lowdermilk, Oral History Interview, Bancroft Library, University of California, 143-147; C.H. Southworth to

Major Burton P. Fleming, October 30, 1935, copy in History Office, Soil Conservation Service, Washington, D.C. For a discussion of the history of the passage of the Flood Control Act of 1936, see Joseph L. Arnold, "The Flood Control Act of 1936: A Study in Politics, Planning and Ideology," in Rosen and Reuss, eds., *The Flood Control Challenge: Past, Present, and Future*, and Arthur Maass, *Muddy Waters: The Army Engineers and the Nation's Rivers* (Cambridge: Harvard University Press, 1951), 81-86.

15 Henry A. Wallace, Memorandum for Chiefs of Bureaus and Offices, November 30, 1936, File 10-111, Office of the Land Use Coordinator (OLUC), Records of the Office of the Secretary of Agriculture, RG 16, NA.

16 Henry A. Wallace, Memorandum for Chiefs of Bureaus and Offices, May 13, 1940, File 10-12, OLUC, RG 16, NA.

17 Grover B. Hill to T.C. Burch, July 2, 1943, "Water 2-1," General Correspondence, RG 16, NA.

18 Ibid., Charles F. Brannan to Speaker of the House of Representatives, September 8, 1944; Hugh H. Wooten, "The Agricultural Flood Control Program: A Review of the Watershed Investigations and Reports," *Journal of Land & Public Utility Economics* 22 (February 1946): 35; and U.S. Congress, House, Subcommittee of the Committee on Appropriations, *Department of Agriculture Appropriations Bill for 1948, Hearings*, 80th Cong., 1st sess., 1947, 939.

19 Arthur C. Ringland, Memorandum for F.A. Silcox, November 3, 1939, File 10-14, OLUC, RG 16, NA.

20 For a discussion of the problems of implementing the economic analysis of the flood control survey, see Wooten, "The Agricultural Flood Control Program," 35-47; and Bernard Frank and E.N. Munns, "Watershed Flood Control: Performance and Possibilities," *Journal of Forestry* 43 (April 1945): 236-251.

21 Arthur C. Ringland, Oral History Interview, Bancroft Library, University of California, 197-205.

22 U.S., *Statutes at Large*, vol. 55, p. 651; and Sam R. Broadbent to the Director, September 12, 1941, Trinity River, Flood Control Surveys, Series 39.27, Records of the Bureau of the Budget, RG 51, NA.

23 "Washita River and Drainage Basin," mimeographed (Oklahoma City, OK: Division of Water Resources, 1938), 30-31. Copy at the Oklahoma Water Resources Board, Oklahoma City.

24 Don McBride to W.J. Theissen, January 25, 1940, "Washita Valley Improvement Association," Library, Oklahoma Water Resources Board, Oklahoma City.

25 Ibid., McBride to Dick Longmire, February 12, 1940.

26 Don McBride to Lula K. Pratt, October 23, 1940, reproduced in "Proceedings of the Second Annual Convention of the Washita Valley Improvement Association," mimeographed, p. 3. Copy at the University of Oklahoma Library, Norman.

27 Ringland Interview, 208-209.

28 Howard Cook, "Flood Abatement by Headwaters Measures," *Civil Engineering* 15 (March 1945): 127.

29 Wooten, "The Agricultural Flood Control Program," 41.

30 R.L. Webster to Marion T. Bennett, November 25, 1943, "Water 1-1," General Correspondence, RG 16, NA.

31 U.S. Department of Agriculture, *Report of the Chief of the Soil Conservation Service, 1947*, (Washington, D.C.: Government Printing Office, 1947), 40.

32 U.S. Department of Agriculture, *Report of the Chief of the Soil Conservation Service, 1949* (Washington, D.C.: Government Printing Office, 1949), 49.

33 Ibid., 49.

34 U.S. Congress, Senate, *Congressional Record*, 8lst Cong., 2nd sess., 1950, 96, pt. 8: 10482-10483.

35 U.S. Congress, House, *Department of Agriculture Appropriations for 1951, Hearings*, 8lst Cong., 2nd sess., 1950, 1152.

36 P.L. 81-759, September 6, 1950.

37 Interview with Jefferson C. Dykes, former assistant chief of SCS, College Park, MD, September 30, 1985.

38 S. 1812, 78th Cong., Records of the U.S. Senate, RG 46, NA; interview with Dykes, September 30, 1985.

39 Interview with Dykes, September 30, 1985.

40 U.S. Congress, *Department of Agriculture Appropriations, 1951*, 1146-1149.

41 Arthur Maass, "Protecting Nature's Reservoir," *Public Policy*, vol. 5 (Cambridge: Harvard University, 1954), 80.

42 S.R. Broadbent to Lee Dashner, January 16, 1951, Series 39.4a, "Water-Flood Control," Records of the Bureau of the Budget, RG 51, NA.

43 U.S. Congress, House, Committee on Public Works, *The Flood Control Program of the Department of Agriculture*, 82nd Cong., 2nd sess., 1952, House Committee Print No. 22, 41.

44 For a discussion of the controversy, see Luna B. Leopold and Thomas Maddock, Jr., *The Flood Control Controversy: Big Dams, Little Dams, and Land Management* (New York: Ronald Press Company, 1954).

45 *Flood Control Program of the Department of Agriculture*, 12-22; and Leopold and Maddock, *The Flood Control Controversy*, 89-92.

46 For a discussion of some of the technical disagreements between SCS and the corps, see "Supplement Information on Hydrologic Agreement and Coordination, Arkansas-White-Red Basins," mimeographed (Washington, D.C.: U.S. Department of Agriculture, Soil Conservation Service, September 1953), 45 pp. Copy in the Howard Cook Papers, Office of History, Headquarters, U.S. Army Corps of Engineers, Ft. Belvoir, Virginia.

47 Maass, "Protecting Nature's Reservoir," 96-97.

48 Beatrice Hort Holmes, *A History of Federal Water Resources Programs, 1800-1960*, Miscellaneous Publication No. 1233 (Washington, D.C.: U.S. Department of Agriculture, Economic Research Service, 1972), 28.

49 W.R. Vawter to John J. O'Neill, July 7, 1952, Series 52.1, P4-2, "Missouri River Basin," RG 51, NA.

50 Howard C. Miller to Paul Dodge, January 23, 1953, Series 52.1, P4-2, "Tuttle Creek Dam, Kansas," RG 51; Maass, "Protecting Nature's Reservoir," 96-97; and Elmer T. Peterson, *Big Dam Foolishness: the Problems of Modern Flood Control and Water Storage* (New York: Devin Adair Company, 1954), 62-64.

Watershed Program: Unique and Flexible

Reprinted from *Soil and Water Conservation News* 12, no. 4 (November-December 1991): 14-15.

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The crusade for soil conservation was linked first and foremost to the idea of maintaining the productivity of land for agriculture. But, those concerned with soil erosion on individual farms have long known the need for dealing with cumulative effects of soil erosion on the wider area--the watershed.

Before scientists began to measure such things, observers speculated that the conditions that created soil erosion also resulted in more rapid runoff of rainfall to streams. The sediment in streambeds reduced capacity, leading to more frequent floods. Sand deposited on small floodplains reduced their value as cropland or natural areas. Thus, the environmental conditions of the whole watershed began to deteriorate.

Most of the watershed activities of the Soil Conservation Service are conducted under the authorization of the Watershed Protection and Flood Prevention Act of 1954, except for 11 projects authorized in the Flood Control Act of 1944.

But even before this, farmers worked on watershed projects requiring group action under the provisions of their State soil conservation district laws. For example, during the 1930s, farmers in the Jones Creek Watershed in western Iowa found that dealing with some of the larger gullies required group action. In addition to conservation practices on the farmland, they needed earthen dams with concrete spillways to control gullies. The enrollees at a Civilian Conservation Corps camps working under the direction of the SCS built nine structures in the area to control large gullies.

After the passage of national legislation, the watershed work became a major activity in SCS, with a budget that was often more than one-third of SCS's total budget. The pressure from the countryside to pass the act was in large part an effort to develop flood control on the upstream watersheds.

Local groups sometimes promoted projects on these "small watersheds" as an alternative to larger, downstream structures that caused the inundation of farms and, in some places, whole towns. If the local people at times overestimated the cumulative value of many small structures for flood control downstream, the movement nevertheless included two important developments: The small projects involved a high degrees of local interest and involvement in planning, operation, and maintenance; and, the projects linked the notion of flood control to soil conservation work on the watershed lands.

Historically, watershed projects have had a wide variety of objectives such as flood control, land treatment, drainage, irrigation, municipal and industrial water supply, rural areas development, recreation, fish and wildlife enhancement, and water quality.

The breadth of the watershed project authorities leaves wide discretion for administrative decisions. Various administrations have seized on this and tried to shape the program to their own ends. The Kennedy and Johnson administrations of the 1960s emphasized rural development and recreational objectives that would bring additional income to rural residents, and working with communities and suburban areas.

During the 1980s, SCS and the U.S. Department of Agriculture established reducing soil erosion as their priority. Following that determination, SCS emphaadjust to the drought.[1] Also, McLaughlin saw the emergency employment programs under the Public Works Administration (PWA) and the Works Progress Administration (WPA) as an opportunity to expand snow surveys and provide a way for coordinated forecasting. The Great Depression and employment programs of the New Deal elicited hundreds of proposals for a more activist federal role in social and natural resources areas. Thus the economic conditions provided the climate in which the federal government expanded its responsibilities in numerous areas.

The Farm Bureau Federation endorsed McLaughlin's proposal in 1934, and he submitted a request for PWA funds for snow measuring stations, snow courses, shelters, equipment, and maintenance for the first year. Despite their inactivity to date, McLaughlin believed the Department of the Interior would make a similar request if USDA did not take the initiative.[2] McLaughlin specified mostly research projects in his proposal.

McCrory agreed that the drought and depression had indeed provided an excellent opportunity, but McLaughlin was taking the wrong tactic. The emphasis must be placed on actually providing forecasts to farmers and other water users, rather than on research.[3] McCrory knew how to spot opportunities. His agency was one of the smallest in USDA, and he had won a reputation for aggressively competing with larger agencies for funding. BAE had neither the manpower nor the large constituencies of agencies such as the Weather Bureau or the Forest Service.[4] In addition to the $36,000 requested from the Bureau of the Budget for research, McCrory requested $40,000 of the emergency drought funds from USDA for making snow surveys and forecasts.[5]

The Bureau of the Budget rejected both requests.[6] Having become a convert to the idea, McCrory pushed the issue. In November 1934 Secretary Wallace met with Harry Hopkins, head of the federal relief effort, to discuss money for snow surveys. Rather than having a large project at the federal level, Hopkins suggested requests for the snow survey work should come from the states through their regular procedure for requesting project approval.[7] Meanwhile, in late 1934 McLaughlin continued his campaigning in the West. The Association of Western State Engineers and the National Reclamation Association adopted resolutions calling on the Secretary of Agriculture to undertake a coordinated, comprehensive snow survey in the West. McLaughlin and his allies blocked moves to have the Weather Bureau and the Forest Service named as the agencies to lead the effort. They much preferred that the Secretary of Agriculture delegate the authority. In the interest of making sure that the Bureau of Agricultural Engineering was given the authority, McLaughlin reminded McCrory to keep the Secretary advised. "We must, however, put the matter up to the Secretary so he will be prepared for any move by Forestry or Weather Bureau. Forestry grabs at every thing all the time."[8]

Legislation

Having failed, at least temporarily, with the regular budgetary process and the emergency employment funds routes, the campaign now turned to the legislative process. Governor C. Ben Ross of Idaho wrote to U.S. Senator James P. Pope of Idaho to introduce him to McCrory.[9] McCrory kept the Secretary informed of these meetings and his activities to promote snow surveys.[10]

The western Congressional delegation was easily convinced of the need for snow surveys and requested funding in 1935. The Senate appropriations committee discussed the item, but did not include it in the bill submitted to the full Senate. They wanted to resolve the matter of who was going to be in charge of the snow surveys. Senator Frederick A. Steiwer of Oregon contacted Assistant Forester Earle H. Clapp and others in USDA, who told him that authority should be assigned to the Bureau of Agricultural Engineering. The amendment to the appropriations bill in the Senate gave BAE authorities and funding for "snow surveys and forecasts of irrigation water supplies."[11]

Designing the Program

Before the appropriations bill was signed on May 17, 1935, McLaughlin had already asked James C. Marr, a Division of Irrigation engineer at Boise, Idaho, to familiarize himself with snow surveys in the northwestern states.[12] McLaughlin travelled to Logan, Utah, to discuss snow surveys with George D. Clyde, a professor of engineering at Utah State University and head of Utah's snow survey effort. McLaughlin considered Clyde "the best informed man in the country on this subject." In addition to his expertise, Clyde already had "very pleasant contacts with other agencies," which would be crucial to the success of a cooperative snow survey effort.[13]

McLaughlin thought Clyde would be the only additional employee BAE would need for their new role in snow surveying. He would be a collaborator for two or three months each year. Marr would have general supervision of the snow survey work. Clyde and Marr worked on the general plan of action in early May, preparatory to visiting existing snow surveying operations and prospective cooperators. Clyde and Marr would locate the snow courses in the states selected for work the first summer.

Despite McLaughlin's original intentions, he also signed on James Edward Church to help get the cooperative snow survey program started in the summer of 1935. Church's interest in snow led him from his fairly obscure position as a classics professor at the University of Nevada in Reno to being the most renowned figure on snow surveying in the United States. Undoubtedly, it was a wise move to solicit Church's advice and to add his reputation to the cause. Unlike Clyde, who immersed himself in developing the structure of the program and laying out snow courses, Church conferred with officials in the various states and explored the areas where cooperation could be had. He talked to the hydroelectric power interests in Los Angles, the irrigators in the Imperial Valley, and the Forest Service and National Park Service people in Arizona. One of the cooperators referred to Church's "goodwill tour." Church liked the term and continued the tour at Marr's behest.[14]

Church was a willing cooperator. If he resented the fact that Clyde had a greater hand in designing the coordinated system, he did not betray it in writing to McLaughlin or Marr. Furthermore there was much in the operations of the new group to enhance his reputation. Church felt that the Weather Bureau had rebuffed his earlier efforts to prod them into developing a national system. Worse, some of the Weather Bureau people preferred snow stakes for measurement, rather than Church's snow courses and tube sampling. (McLaughlin's group would use Church's methods.) Finally, Church held that streamflow forecasting required engineering, rather than meteorological analysis. Accordingly, most of the recent conferences have been held with engineers rather than meteorologists.[15]

Early Decisions on Standardization

The survey was obviously going to rely on a great deal of cooperation. But McLaughlin believed some of the methods and equipment must be standardized. His group decided to spend their scant funds, $15,000, on equipment. A standard type would be selected and purchased in volume so as to reduce costs. His group well understood that experience in the field would lead to improvements and correction of defects. Nonetheless they intended to start out with established standards for the equipment and methods. They would use Church's method for snow cover measurements rather than the stake method. The former involved taking a core sample of the snow so as to measure volume and water content. The stake method simply measured snow depth without regard to density or water content. Another Church contribution, "the Mount Rose tube in its original form or as modified in Utah," would be used.[16] The scale to measure the weight of the snow sample would also be standardized. As two of the innovators of snow surveying equipment, Church and Clyde both had a personal interest in the writing of standards. During the first year the Bureau of Agricultural Engineering purchased 150 sets of snow sampling equipment with half going to Marr and the other half to Clyde for distribution.[17] But when they received the equipment, Clyde and Church both had some objections. Church found a deficiency in the weighing mechanism; Clyde found fault with the sampling tube from Nevada. McLaughlin wryly noted that snow surveyors from Colorado had no difficulty in using the equipment, and attributed "some of the comments of Clyde and Church to a little prejudice. This is only natural, since we all have our weakness in this regard."[18] In addition to the snow sampling tubes and the weighing mechanism, the group also supplied skis and snow shoes in some cases.[19]

Organization

The absence of long-term data plus the need to emphasize the cooperative nature of the work influenced McLaughlin's organizational decisions. There would be regional offices, rather than a national one. Without historical data, personal knowledge of the rivers and streams would be required if the snow survey group expected to make worthwhile forecasts in the first few years. They needed, and wanted, to make their presence known. They definitely planned to make forecasts from the new snow course data the first year. After some years' accumulation of data, McLaughlin believed it would be possible to have a national office. But there was another reason for regional structure. McLaughlin wanted to have the state agencies involved not only in the surveying, but also in the forecasting. The matter of organization illustrated the sensitivity required in federal-state cooperation on the project and how such cooperation could best be achieved. McLaughlin thought his bureau should insist on being involved in all local forecasting. He wrote to McCrory, "Otherwise the work would soon drift out of our hands and we would find ourselves in a position of supplying funds and some state agency making the forecasts."[20]

Establishing Snow Courses

The first year McLaughlin planned to expand existing networks in the key drainages and the most accessible areas of Oregon, Idaho, Utah, Wyoming, Colorado, Nevada, and California. As Clyde and Marr travelled about, locating snow surveys, they were "to interest local and state agencies and stimulate an interest in local agencies for snow surveys so they will demand the work."[21]

McLaughlin's group hoped, and suggested, that the cooperators in Nevada, California, Utah, and Oregon who already had extensive networks of snow courses would establish additional ones as well as surveying and mapping existing courses. BAE was to supply the additional snow surveying equipment needed. During the summer of 1935, Marr concentrated on the Snake River and Clyde on the Colorado in establishing new snow courses in Wyoming, Idaho, and Colorado.[22] In selecting the new snow courses, the two considered serviceability, accessibility, and the key areas in a statewide plan, as well as the most urgent requests from cooperators.[23]

During the first ten days of August, 1935, Marr covered 2,300 miles over little travelled roads and trails as he established snow courses in Wyoming and Yellowstone National Park. To avoid the cost of installing a course, he selected areas where little construction work would be needed. Where work was needed he managed to get the cooperation of the Civilian Conservation Corps. Thanks to the cooperation of agencies, the only cost to BAE would be the snow sampling equipment.[24]

Marr's enthusiasm for the work even brought a reaction from McCrory in Washington. He advised McLaughlin to "put on the brakes on a little in his case. He is working so hard that I am afraid he faces a nervous breakdown if he does not ease off somewhat."[25] At the end of 1935, Marr thought the snow surveying group had about a fourth of the 1,000 courses they would eventually need.[26]

Cooperation with Other Federal Agencies

McLaughlin believed the Forest Service, as part of their cooperation, would clear and mark courses, build and equip snow shelters at their own expense and with CCC labor.

He hoped that some of the cooperating state agencies such as the state engineers would be able to use CCC labor and successfully apply for Federal Emergency Relief Act funds for similar work. McLaughlin planned to use all of the scant $15,000 appropriation for equipment. To establish the whole network in the West would eventually require about $100,000 to $300,000.[27]

The Division of Irrigation group never quite secured the large allocation of emergency funding with which to rapidly expand the network by clearing snow courses, building snow cabins, and doing other construction work. Thus they tended to work through the states or with the federal land management agencies. Marr helped Idaho prepare applications for funds to work on snow courses.[28] The federal land management agencies eventually did much of the construction on the lands in their charge. Seeing that BAE had only $15,000 to get the work started, the other agencies knew well that success depended upon their cooperation. Evan w. Kelly, the U. S. Forest Service's regional forester in Missoula, Montana, wrote to his forest supervisors: "The Bureau of Agricultural Engineering is pitifully short of the necessary appropriation from which to finance this important activity;...the various agencies of the Government directly or incidentally interested, must cooperate to the fullest practical extent."[29] The Bureau of Agricultural Engineering had reason to be pleased with the degree of cooperation the first year. They wrote not only to cooperators, but also to their supervisors thanking them. Success the first year accelerated the degree of cooperation. The Corps of Engineers had been doing some snow surveying work on the watershed of the Missouri River. In 1936 they contributed $3,000 so that BAE could set up courses on the Columbia River basin.[31]

Expansion of Work

Following the forecasting work in the spring of 1936, BAE expanded the program in the summer. In all the states there was cooperation with the state engineer and the land-grant agricultural college. Each of the district representatives of the Division of Irrigation made arrangements for the snow cover surveys, provided the equipment, and stocked the cabins. Essentially they handled all of the operations in their state. They reported the snow survey data to the Berkeley office and the Boise office. Clyde handled the work in Utah while Church handled Nevada. Marr, at Boise, and Louie T. Jessup at Yakima, Washington, did Idaho and part of the Columbia drainage. Ralph Parshall at Ft. Collins was responsible for Wyoming and Colorado; and temporarily responsible for New Mexico and Arizona. Arch Work surveyed Oregon and northern California from his office at Medford, Oregon. The state engineer of California did the rest of that state. The district engineer of the U. S. Geological Survey at Helena, Montana, did the Missouri River. The Berkeley and Boise offices jointly publicized the information.[32]

By the second season they had perfected the publicity arrangements. They made measurements monthly from January 1 to May 1. Water supply forecasts were made following the February measurement and the April or May measurement, depending on the state. Broadcasts of information went out on the Farm and Home Hour and various state stations. The cooperating agencies, usually the state engineer or the state agricultural college, put out mimeographed releases. The Weather Bureau also published the data for the federal government. As part of the original agreement with the Weather Bureau, BAE supplied information to them for flood predictions. Sampling for flood predictions required additional visits to the snow courses. The snow survey work was actually a part-time duty for the BAE people, except Marr, who would work full-time on it until no longer needed.[33]

Winter Sports Radio Broadcasts

By the second year of forecasts, the snow survey group began receiving requests for information from winter sports enthusiasts. McLaughlin wanted to get immediately involved since it was a public service and was another "most worthwhile public contact for us...."[34] Initially McCrory resisted, believing that BAE had to strictly limit itself to the authority in the legislation for forecasting irrigation water.[35] Never easily discouraged, McLaughlin managed a meeting with Paul Appleby, Assistant to the Secretary of Agriculture, and got his endorsement. Following the meeting with Appleby, McLaughlin worked out an agreement with the National Broadcasting Company to devote five minutes each Friday on the Farm and Home Hour to reports from each state. Also, many of the state weather bureaus and state highway departments agreed to issue the forecasts. As far a McLaughlin was concerned the service was "an excellent contact with the public."[36]

Different Visions

The issue of the winter sports forecasts illustrated some of the differences in outlook, or zeal, between McCrory and his people in the West. McCrory saw the value for irrigated agriculture and strongly supported the work, but he saw it as only one aspect of BAE's work. When he thought he detected Marr and others working exclusively on the snow survey project, yet charging a large part of their salaries to other accounts, he chided them. He warned McLaughlin to stay within the appropriation for snow surveys and vowed not to siphon funds from other work for it.[37] He wanted to adhere strictly to the authorization for predicting irrigation water supplies. As far as he was concerned, the agreement with the Weather Bureau was well understood by both parties, and each group would cleave honorably to the agreement.

In practically all these matters, McLaughlin had a different view. Success in the snow survey required a quick success the first year and thus demanded almost undivided attention. Though an irrigation engineer by training, he understood the other uses and potential for the snow survey and moved aggressively into those areas. Given the sparse BAE staff in the West, compared to other Federal agencies, McLaughlin cherished the publicity value and resulting clout that came from activities such as the winter sports radio broadcasts. McLaughlin's operation depended upon the cooperation of the land management agencies, but he also viewed them as potential competitors for the snow survey prize. In his opinion the Weather Bureau had to be watched at every turn. Offers of cooperation must be analyzed closely for ulterior motives.[38] For all these reasons McLaughlin and his people in the Division of Irrigation zealously set out to make the program a success.

Summary

More than fifty years after federal coordination of snow surveys was begun, its value is recognized more than ever. The competition for water in the West due to the explosion in population, industry, and agriculture created a demand to know as precisely as possible the amount of water available from snowmelt. The various enterprises whose operations cut across political boundaries demand the basinwide information that a coordinated system produces.

In retrospect, many of the decisions made by McLaughlin and his colleagues were wise beyond their time. One thing they wanted, but did not get, was a large appropriation or allotment from the emergency employment funds to rapidly clear snow courses, build snow cabins, and do other types of construction associated with snow surveys. Would this have changed the course of the history of snow survey? It is difficult to know. As it developed, the enforced reliance on the state and other federal agencies to do much of the work probably was beneficial to the strength of the program. Although the snow survey is operated under the Soil Conservation Service, it is responsible to, and draws strength from, all the cooperating agencies. In a sense it has a separate existence. The users and gatherers of the snow survey information seem likely to continue to demand some coordination at the federal level for the foreseeable future.

Endnotes

1 Walter Wesley McLaughlin to Samuel Henry McCrory, July 25, 1934, File 3-234,

General Correspondence, 1931-1939, Records of Bureau of Agricultural Engineering, Record Group 8, National Archives and Records Administration, Washington, D.C. All of the correspondence cited in this article is from the same file.

[2] McLaughlin to McCrory, August 6, 1934.

[3] McCrory to McLaughlin, August 23, 1934.

[4] Wayne Rasmussen, former historian of USDA, knew McCrory and provided this characterization. Conversation with Rasmussen, March 25, 1991.

[5] McCrory, Memorandum for the Secretary, September 4, 1934.

[6] McCrory to McLaughlin, November 18, 1934.

[7] McCrory to McLaughlin, November 27, 1934.

[8] McLaughlin to McCrory, December 8, 1934.

[9] C. Ben Ross to James P. Pope, December 27, 1934.

[10] McCrory, Memorandum for the Secretary, January 31, 1935.

[11] U. S. Congress, Senate, *Congressional Record*, 74th Cong. 1st. sess., 1935, 79, pt. 5: 4699.; Public Law No. 62, 74th Congress.

[12] James C. Marr to M. R. Lewis, April 26, 1935.

[13] McLaughlin to McCrory, May 6, 1935.

[14] James Edward Church to McLaughlin, July 23, 1935.

[15] Quotes of a letter from Church to McLaughlin found in McLaughlin to McCrory, August 9, 1935.

[16] McLaughlin to Church, August 3, 1935.

[17] McLaughlin to George R. Boyd, Acting Chief, Bureau of Agricultural Engineering, August 3, 1935.

[18] McLaughlin to McCrory, January 23, 1936.

[19] Mc McLaughlin to McCrory, October 19, 1935.

[20] McLaughlin to McCrory, December 30, 1935.

[21] McLaughlin, Memo--Snow Surveys, July 5, 1935.

[22] Marr to H. P. Boardman, August 12, 1935.

[23] McLaughlin to McCrory, December 30, 1935.

[24] Marr to McLaughlin, August 12, 1935.

[25] McCrory to McLaughlin, August 12, 1935.

[26] McLaughlin to McCrory, December 30, 1935.

[27] McLaughlin to McCrory, May 6, 1935.

[28] Marr to H. P. Boardman, August 12, 1935.

[29] Evan W. Kelly to Forest Supervisors, July 24, 1936.

[30] McLaughlin to McCrory, August 12, 1936.

[31] McLaughlin to McCrory, August 10, 1936.

[32] McLaughlin to McCrory, January 23, 1937.

[33] McLaughlin to McCrory, January 23, 1937.

[34] McLaughlin to McCrory, February 3, 1937.

35 McCrory to McLaughlin, February 6, 1937.

36 McLaughlin to McCrory, July 13, 1937.

37 McCrory to McLaughlin, January 6, 1937 and January 18, 1937; McLaughlin to McCrory, January 12, 1937.

38 McLaughlin to McCrory, December 21, 1936, McLaughlin to George R. Boyd, Acting Chief, Bureau of Agricultural Engineering, August 16, 1937.

Snow Surveying Comes of Age in the West

by Douglas Helms
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Presented at the Western Snow Conference, Jackson, Wyoming. The author thanks David Balentine (volunteer), Anne Henderson, J. D. Ross, and Jon G. Werner of the Soil Conservation Service for their assistance.

Snow surveying and water supply forecasting entered a new era when the U. S. Department of Agriculture abolished the Bureau of Agricultural Engineering and transferred the Division of Irrigation to the Soil Conservation Service (SCS) on July 1, 1939. The Division of Irrigation was headquartered at Berkeley, California, with Walter W. McLaughlin as chief. The irrigation engineers in field offices in the western states had been in charge of the federal coordination of snow surveys since the U. S. Congress appropriated money for the work in 1935. Previously existing networks, such as those in Nevada, Utah, and California continued under the agricultural experiment station or a state agency as was the case in California (Helms, 1991). The individuals who eventually came to be called snow survey supervisors were James C. Marr in Boise, Idaho, R. A. "Arch" Work at Medford, Oregon, Ralph Parshall in Fort Collins, Colorado, and Lou T. Jessup at Yakima, Washington. They generally operated independently, though Marr was the acknowledged leader. Since the beginning of snow surveys, Marr had devoted all of his working hours to building up the snow surveying activities and had dropped his irrigation work (Marr correspondence).

The early years had been a time of rapid expansion--laying out snow courses, working out agreements with cooperators and users, compiling data, making forecasts, and reproducing the forecasts for distribution. Arch Work recalled that the group had decided working independently was the most efficient operation.

> We were pretty decentralized. I understand perfectly the need to centralize snow survey work under SNOTEL....But in those early days, we believed it was more practical and more profitable, in terms of public relations, to decentralize. I think it was a profitable position to take because they weren't restricted by regulations superimposed upon them by someone who didn't know very much about the business (Work interview, 1989).

The group created enough interest that the requests for additional snow courses eventually exceeded the meager appropriation and manpower available (Work interview, 1989; Marr correspondence).

The move to the Soil Conservation Service increased the area covered by snow courses as well as the application of forecasts (Work, 1989). The Soil Conservation Service had begun in 1937 to encourage the creation of conservation districts under state law. The districts had locally elected supervisors and directors. After a district signed a cooperative agreement with USDA, the Soil Conservation Service would assign staff to work with the district. The move added a large number of SCS employees as potential snow surveyors. Also, snow survey offices were opened at Reno, Nevada and Logan, Utah (Work, 1948).

In terms of applications the Soil Conservation Service had become the primary agency of USDA advising farmers on technical matters concerning the storage, movement, and use of water on the farm. SCS assumed responsibility for advising farmers on irrigation and drainage along with water supply forecasting. Working through the field staffs and the conservation districts, there was great potential for using snow surveys in irrigation.

Arch Work believed that the snow surveying generally received strong support from the leadership of SCS, especially Chiefs Hugh Hammond Bennett and Don Williams, as well as the important staffs in administration, engineering, and public information (Work, 1989). The public information group especially appreciated the romance of "snow surveys" as a means of publicizing the agency. When most research functions of the Soil Conservation Service were transferred to the Agricultural Research Administration effective November 15, 1952, the water supply forecasting remained in SCS.

Snow Surveying Publication

The Division of Irrigation group realized that future expansion of the snow courses and water supply forecasting would be greatly enhanced by a snow survey manual. When the Division of Irrigation got involved in the work, the division's field people learned from experienced snow surveyors George D. Clyde and James E. Church (Helms, 1991). Also, literature on the subject was accumulating since the Western Interstate Snow-Survey Conference, begun in 1933, published articles on methods and procedures in its proceedings. But new snow surveyors and forecasters needed a manual, a compendium of the existing knowledge on snow surveys. James C. Marr, who had general supervision of the snow surveying work from his Boise, Idaho office, called upon the experts in the field for help in writing a manual on principles, purposes, and procedures of snow surveying. *Snow Surveying* (USDA Miscellaneous Publication No. 380) appeared in 1940. In addition to his own experiences Marr solicited information from the other snow survey supervisors (Parshall, Jessup, and Work) as well as George D. Clyde, J. E. Church, O. W. Munson, and Harold Conkling, the deputy state engineer of California. The manual described the care and use of equipment, snow sampling procedures, field office work, uses of water supply forecasts, maintenance of snow courses, stocking shelters, winter travel, and other topics (Marr, 1939; Marr, 1940). Prior to the use of aircraft, expansion of snow surveys depended in part on making cabins available. Snow surveyors needed cabins in order to make a trip of several days to remote snow courses. In the 1939 *Transactions, American Geophysical Union*, Arch Work and Ralph Parshall published a guide for the construction of snow survey cabins (Work and Parshall, 1939).

Snow Survey Network

The snow survey work expanded throughout the late 1930s. By the spring of 1940 approximately 753 snow surveyors made readings at 14,295 sampling points on 1,000 snow courses. The brunt of the snow surveying work fell on the rangers of the U. S. Forest Service and the National Park Service. Snow surveyors had available some 339 shelters. Only a portion of those had been built specifically for snow survey work. Others belonged to mining companies, power companies, and lumber interests. As the groups worked to add new cabins they tried to locate them about 16 miles apart, the average day's journey. Altogether the Division of Irrigation had about 50 cooperating federal, state, and local agencies and companies (McLaughlin, 1940; Work, 1989).

The network of snow courses developed rapidly. By 1943 there were 829 snow courses being surveyed. There had been about 1,000 courses, but the group eliminated some of these as unnecessary. There were 177 active cooperators. The surveyors had about 266 shelter cabins available to them, 77 of which were owned by the federal government. The network stocked 115 of these with food. In addition to the mimeographed releases there were some 153 radio broadcasts made during 1943 (McLaughlin, 1943).

Publicity

Winter sports enthusiasts recognized the value of the snow surveys for skiing and other activities. In the summer of 1937, the Division of Irrigation was asked to provide information on conditions for winter sports. The snow supervisors took to the airwaves on the National Broadcasting Company. The offices at Berkeley, Medford, Boise, Fort Collins, and Logan collected information on 64 winter sports areas and had the information ready for a Friday broadcast at 9:00 pm. The National Broadcasting Company carried "Snowcasts" on the San Francisco station as well as two stations in Idaho, two in Washington, four or five in Utah, and one in Colorado (Work, 1989; Work, n.d.; McLaughlin, 1940).

Actually some of the broadcasts contained more than just the information on snow. For instance James Marr in Boise received information from the U. S. Forest Service and the Sun Valley Lodge. Listeners to Winter Sports Broadcast on December 31, 1937 over KIDO in Boise would have heard that a new ski lift and two new ski hills would open at the Payette Lakes winter sports area. At Sun Valley the University of Washington and Dartmouth College competed in a ski meet. Marr encouraged McLaughlin to include the Sun Valley forecast in the broadcast from San Francisco since the lodge drew many of its patrons from the West Coast, and in fact preferred them to local clientele. He wrote to McLaughlin, "In fact, the presence there of local people is looked upon as an obligation rather than an asset. That is, they are taken care of but their coming is not overly encouraged" (Marr correspondence).

The snow survey scored a major publicity triumph in 1942 with the appearance of "Engineers Survey Snow" in the April 1942 issue of *Life* magazine. Readers saw photographs of Arch Work and Jack Frost surveying near Oregon's Crater Lake. *National Geographic* featured snow surveys in their November 1949 issue. Arch Work assisted one of the magazine's writers, Leo Borah, in 1946 when he transported Borah to Crater Lake in a "Sno-Cat." Work suggested to Borah that a trip from the California-Oregon border along the crest of the Cascade range to the Columbia River would provide National Geographic with a splendid article. The Tucker Sno-Cat Company furnished the transportation and a mechanic-driver (the son of the owner) for the 23-day trip. The party of seven included Work, writer Andrew H. Brown, *National Geographic* photographer Jack Fletcher, SCS photographer Robert F. Branstead, Jasper Tucker, Harvey Woods, and Gaeton Sturdevant. The trip commenced in mid-March presumably after the heaviest snows. But snow fell all but two days during the trip. It snowed about ten feet along the journey. While publicity was an unannounced motivation, there was an operational objective. During the snow surveying season, surveyors ascended to various points near the crest of the Cascade range from the valley floor. The snow survey group had conjectured that one trip along the spine of the range in "Sno-Cats" might be a more efficient method of surveying. The trip convinced the group to stick with the earlier method (Work, n. d.; Brown, 1949).

<u>Accuracy of Forecasts and Improvement of Methods</u>

Some of the long-time users of snow surveys in the West were dedicated believers in their value. After the beginning of federal coordination in 1935, the snow survey supervisors added new cooperators and users rapidly. Credibility with these new users rested on the reliability of forecasts. The group chose to use the percentage method developed by James E. Church, which assumed that normal snow cover produced normal runoff. Snow course measurements were correlated with streamflow data collected by the U. S. Geological Survey and used in succeeding years to predict streamflow from the snow course measurements. The method assumed that the most important factor was precipitation and that losses could be grouped together and given a fixed value depending upon the particular watershed. The accumulation of several years or decades of records would supply values pertinent to the watershed. (Clyde, 1939). Snow surveyors believed they needed at least 10 years of data for reasonably reliable forecasts (Work, 1989).

However, where there was no historical record, and there was none for many of the courses, the methods sometimes did not work well in the seasons of subnormal or above-normal snowfall. In these cases when the forecast was off it could be off 30 to 60 percent; in a few cases it was off by 100 percent (McLaughlin, 1943). Also the reliability of forecasts varied from one region to another, as the forecasters quickly realized when they moved into the southwest. The variability of spring and summer rainfall meant that forecasts for New Mexico generally had a 55.7 error rate (Beaumont, 1957).

Early snow survey supervisors realized there were many factors which could influence total runoff as well as distribution, but were not taken into account in the percentage method. The proceedings of the Western Interstate Snow-Survey Conference, later the Western Snow Conference, included numerous articles on attempts to accommodate these various factors in forecasting.

First of all, not everyone agreed that snow surveys were the best indicators of streamflow. The Weather Bureau maintained that precipitation, even if it came from the valleys rather than the mountain, was just as good an indication. In commenting on a paper by George D. Clyde and Arch Work at a Western Interstate Snow Conference in 1943, Merrill Bernard of the Weather Bureau's Washington office made the case for relying on precipitation:

> It is not in accord with known facts to discredit the "Valley Station" as a significant index to precipitation at higher levels. Precipitation-event (storm periods) have within themselves a unity which expresses itself in a high degree of dependency of precipitation measured at points of different elevation (including those below and within significant distance of the average snow-line), even though the character of the precipitation (rain or snow) is different at the points compared (Clyde and Work, 1943, Discussion by Bernard).

While the snow survey supervisors disagreed with this attitude, they did come to acknowledge the value of snow courses below the permanent snow pack.

Low flows, peak flows, and distribution of flows concerned users for a variety of reasons and involved many interrelated and complicated factors. On rivers without large storage reservoirs, the concern of irrigation farmers was not merely the total supply but the daily distribution of flow. Using historical records for the Logan, Ogden, Weber, and Provo Rivers in Utah, George D. Clyde developed a daily hydrograph and was then able to relate it to forecast curves (Clyde, 1939). One result of this concern was that the groups began forecasting for the date of the low flow in addition to the streamflow forecasts for April through September (Work, 1989).

Operators of multiple-purpose reservoirs particularly needed information about total flow and peak flow so as to make the maximum use of reservoirs for flood control, irrigation water storage, and hydroelectric power production. Fred Paget of California's Division of Water Resources believed temperatures at low elevation stations could be indexed to mountain temperatures and be used to assist in operation of reservoirs for flood control on the Kings River (Paget, 1943). Quite a number of the Soil Conservation Service group, such as Arch Work and Moreley Nelson, and others in university and state agencies published various articles pointing out the influence of soil moisture, groundwater levels, rainfall and temperature on streamflow. Work summarized many of the considerations in his *Stream-Flow Forecasting From Snow Surveys* (Work, 1953). Collectively the early group of snow surveyors knew many of the factors that influenced runoff. Essentially, they knew the right questions to ask. Relying on monthly snow surveys, however, did not give them timely information on soil moisture, temperature, and precipitation. The current SNOTEL system can provide not only the information on snow pack but also information on precipitation, temperature, soil moisture, and other factors on a timely basis to be used in forecasting.

More powerful computers allow forecaster today to assess the relative importance of various factors in streamflow.

Uses of Snow Surveys

Although water supply forecasters perceived a need to refine and improve forecasting methods, the percentage method was sufficient to make dramatic demonstrations of the value of snow surveys. The forecasters gradually accumulated examples of the value of snow surveys. George D. Clyde of the Utah Agricultural Experiment Station had made the most dramatic demonstration of the value of snow surveys. Clyde's April 1934 forecast predicted most watersheds in Utah would receive only 25 to 50 percent of their normal streamflows. The governor immediately made Clyde his special representative to contact all the water users to assist them in developing plans to use the limited amount of water that would be available (Clyde, 1934). Evidently Clyde performed admirably in getting farmers to adjust their planting schedules and acreage planted. This demonstration was one of the reasons Congress provided for federal coordination of snow surveys. In the late 1940s Clyde, a longtime professor of engineering at Utah State University, became the head of the Division of Irrigation and Water Conservation in the Soil Conservation Service. He moved the office from Berkeley to Logan, Utah.

The snow survey supervisors gradually added to these examples and used these in their publicity. Agencies doing construction and rehabilitation work on rivers needed streamflow information in order to determine the type measures needed to protect the construction. When the area below Elephant Butte Reservoir was going to be worked on in 1942, New Mexico wanted to know the total runoff from the Upper Rio Grande into the Elephant Butte Reservoir. The prediction was 1,941,000 acre-feet and the actual total was 1,938,000 acre-feet. Another forecast of the flow of the Columbia River allowed the Corps of Engineers to avoid unnecessary protection work for their construction near The Dalles (McLaughlin, 1943).

Even the most ardent believers in snow surveys could not predict all the uses. They received inquiries, especially in times of water shortage, from financial institutions, mercantile companies, eastern wholesale houses, power-companies, mines, municipalities, navigational interests, and agriculture (McLaughlin, 1943). In agriculture of course the main interest was in being able to adjust the timing as well as the amount of acreage planted. The sugar beet companies soon learned to await the water supply forecasts before signing contacts and adjusting the acreage contracts to the forecasts (McLaughlin, 1943.) In 1946 snow surveys in early spring indicated that the water supply for Deschutes and Cook counties, Oregon, greatly exceeded normal. Farmers were able to plant an additional 6,500 acres of land. The value of the produce was about $500,000 (Work, 1953). The information was particularly valuable in operating multiple-purpose reservoirs which stored irrigation water as well as producing some hydroelectric power. With good information the reservoir manager could maintain the maximum irrigation water and use the surplus to produce power for sale.

Flooding

Although the water supply forecasting group was not to be involved in flood forecasting, the value of the forecast for determining volume and as well as peak flows was recognized. In fact the early reports mentioned specifically the flood hazard. The value of snow surveys for assisting in flood prediction was made dramatically evident in the Columbia River flood of 1948. The May 1, 1948, forecast by James C. Marr from Boise, Idaho read:

> Retarded snow melt and above normal precipitation during April will increase the amount and rate of runoff throughout the northern and western parts of Columbia River Basin. The outlook a month ago in these areas for greater than normal runoff with possible flood hazard has changed to certainty of runoff of flood

> proportions with attendant damage in vulnerable areas.... Also extra high water may be expected on all of these streams during the latter part of May and June. This same situation may also extend to lower Columbia River.

The 1948 Columbia flood resulted in more than 50 deaths and property damage of 100 million dollars. (Clyde and Houston, 1951).

The weather in 1948 provided the exact combination for flooding. The snow cover was above normal in water equivalent. There was cold weather during the early part of the melting period, and above normal temperatures in the latter part of the melting period followed by above normal precipitation during the melting period. The Columbia River flood of 1948 had all of the above conditions. Arch Work used this and other conditions in writing *Stream-Flow Forecasting From Snow Surveys* (Work, 1953).

The snow courses provided information from the higher elevations, above the line where melting usually occurred in the winter, while most of the Weather Bureau's precipitation data stations were located in the lower elevations. Regardless of the agreement on flood forecasting, the important fact was that the operators of reservoirs, namely the Corps of Engineers and the Bureau of Reclamation, used the information in storing and releasing water. According to the Corps of Engineers and the Bureau of Reclamation, warnings in 1950 allowed the operation of reservoirs so that $5,600,000 in flood damages could be avoided (Clyde and Houston, 1951). The 1950 estimates had been for heavy snow pack. During 1956 the Corps of Engineers believed they had saved $37 million in flood damages by taking protective measures due to the water supply forecast (Beaumont, 1967). SCS believed that water supply forecasts had been used to avert $70 million in flood damages along the Columbia during the period 1956-1962 by use of reservoir control (Work and Shannon, 1964).

Another case of using snow surveys to lessen flood damages occurred in 1954 on the Kootenai River in Idaho. The April 9 forecast mentioned a potential flood and the May 10 survey predicted a 35.5 foot river crest. The town was evacuated and the dikes reinforced with the assistance of federal troops. The river crested at 35.55 feet. (Work, 1955).

The Bonneville Power Administration, in the early 1970s, estimated an annual value of $385,000 for extra power generated in three reservoirs studied. The U. S. Bureau of Reclamation in 1968 estimated they had avoided $495,000 in flood damages from Bull Lake, Pilot Butte, and Boysen Reservoirs in Wyoming. Similarly the Salt River Project believed it had prevented $600,000 in flood damages in 1960. The snow survey was used to operate the reservoirs in the Columbia River Basin. The average annual savings between 1956-1962 was $9.8 million (Soil Conservation Service, 1973).

<u>Maturation of Program</u>

By the late 1940s the program had reached a high degree of maturation. In 1948 the Division of Irrigation and the cooperating agencies made forecasts at approximately 176 gaging stations. About 1,000 snow surveyors made 2,400 different surveys at 950 courses. There was equipment to be repaired, cabins to be built, maintained and stocked with food. As soon as surveys were made the information had to be tabulated, forecasts made, and meetings held with forecast committees and local groups of water users.

Snow survey supervisors made forecasts for the Columbia River Basin (5), Rio Grande River basin (4), Oregon (4), Utah (1), Nevada (2), California (4) by the California Division of Water Resources, Colorado River Basin (4), Missouri & Arkansas River Basin (4), Montana (3), Arizona (3), and British Columbia (4) by the British Columbia Government.

Snow survey supervisors sent out 5,000 mimeographed copies of forecasts. Just as one example of publicity within a state, 56

Oregon newspapers and 13 radio stations publicized the results. At least three magazines published reports covering the entire West, *Reclamation Era, Western Construction News,* and *Electrical West* (Work, 1948).

At the end of the first two decades the snow survey supervisors were generally pleased with the operations. They wanted to expand the system of forecast committees but believed that additional information and snow survey personnel would be needed. One goal of the group in Arch Work's words was to "provide dependable streamflow forecasts for the benefit of farm operators on the smallest tributaries and on downstream industrial developments on major streams" (Work, 1948). The accumulation of data for over ten years made some of this possible, but the group was beset by the time-consuming calculations necessary to deal with the mass of data.

The snow survey supervisors continued to test and promote different modes of mechanizing the snow surveys. They tested over-snow machines produced by private as well as government agencies. They made more use of airplanes to reach high altitude snow markers. In time the water supply forecast group helped develop some of the technology to gather information more rapidly and easily.

Current technology, rather than diminishing our appreciation of snow survey achievements in the decades from 1930 to 1950 helps enhance it. Working with a meager budget, but much cooperation, the snow survey group along with California's Division of Water Resources proved the feasibility of regionwide snow surveys and set the stage for public support of mechanization of the operations.

References

Beaumont, R. T. 1957. "Cooperative Snow Surveys and Water Supply Forecasting," *Journal of Soil and Water Conservation* 12: 115-119.

Brown, Andrew H. "Sno-Cats Mechanize Oregon Snow Survey," *National Geographic Magazine* 96 (November 1949): 691-710.

Clyde, George D. May 1934. *Report of Water Conservation Program and Drought Situation In Utah.* Typescript copy in George D. Clyde Papers, Department of Special Collection and Archives, Utah State University, Logan.

-------. 1939. "Forecasting Stream Flow from Snow Surveys," *Civil Engineering* 9: 237-239.

Clyde, George D. and Houston, Clyde E. 1951. "Benefits of Snow Surveying," Prepared for the Western Snow Conference. Copy in Papers of George D. Clyde, Department of Special Collection and Archives, Utah State University, Logan.

Clyde, George. D. and Work, R. A. 1943. "Precipitation-Runoff Relationships As A Basis For Water Supply Forecasting," *Transactions, American Geophysical Union* Vol. 24, Part 3: 43-55.

"Engineers Survey Snow," April 20, 1942. *Life* 12 (16): 49-52.

Helms, J. Douglas. 1991. "Bringing Federal Coordination to Snow Surveys," *Proceedings of the Western Snow Conference*, pp. 119-125.

Marr correspondence. Division of Irrigation. Bureau of Agricultural Engineering, Records of the Bureau of Agricultural Engineering, Record Group 8, National Archives and Records Administration, Washington, D.C.

Marr, James C. 1939. "Status of Proposed Bulletin On Principles and Practice Of Snow Surveying," *Transactions, American Geophysical Union* Vol. 20, Part 1: 53-55.

-------. 1940. *Snow Surveying.* U. S. Department of Agriculture Miscellaneous Publication No. 380. Washington, DC. 45 pages.

McLaughlin, Walter. W. 1940. "Problems Of The Division Of Irrigation In Forecasting Water Supplies," *Transactions, American Geophysical Union* Vol. 21, Part 1: 131-134.

-------. 1943. "Some Accomplishments in Snow-surveying," *Transactions, American Geophysical Union* Vol. 24: 38-42.

Paget, Fred. 1943. "The Use Of Snow Surveys As An Aid In Flood-Control Operation Of Reservoirs," *Transactions, American Geophysical Union* Vol. 24, Part 3: 28-36.

Soil Conservation Service, April 1973. *The Soil Conservation Service Snow Survey and Water Supply Forecast Program.* Portland, Oregon.

Work, R. A. n. d. Recollections of R. A. ("Arch") Work Concerning Snow Surveys In Western States."

-------. 1948. *Stream Flow Forecasting.* Typescript. 18 pp. Merrill G. Burlingame Special Collections, Montana State University Libraries, Bozeman.

-------. 1953. *Stream-Flow Forecasting From Snow Survey.* Circular No. 914 U. S. Department of Agriculture, Washington, DC.

-------. 1955. "Measuring Snow To Forecast Water Supplies," *Yearbook of Agriculture* U. S. Department of Agriculture, Washington, DC

-------. 1989. Interview conducted by Douglas Helms for the Soil Conservation Service, Ashland, Oregon, May 12, 1989.

Work, R. A. and Parshall, R. L. 1939. "Construction Of Snow-Survey Shelter-Cabins, *Transactions, American Geophysical Union* Vol. 20, Part 1: 125-134.

Work, R. A. and Shannon, W. G. 1964. "Snow Survey Reports Help West In Years of Floods or Drought," *Soil Conservation* 29: 213-215.

Conserving the Plains: The Soil Conservation Service in the Great Plains

Reprinted from *Agricultural History* 64, no. 2 (Spring 1990): 58-73.

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Hugh Hammond Bennett, in early April of 1935, found himself on the verge of achieving an ambition that had dominated his professional life for years, the establishment of a permanent agency dedicated to soil conservation. True, his temporary Soil Erosion Service in the Department of the Interior had received some of the money Congress appropriated to put people back to work during the Depression providing him an opportunity to put some of his ideas about soil conservation to work in demonstration projects across the country. But this had never been the ultimate objective; he had from the beginning yearned for something that would survive the Depression and attack soil erosion until it was eliminated as a national problem.[1] Friends of the soil conservation movement had introduced bills into Congress to create a specific agency for that purpose. Now, as Bennett sat before the Senate Public Lands Committee, he needed to make a convincing case. The sky darkened as dust from the plains arrived. The dust cloud's arrival was propitious, but not totally unexpected--at least not to the main witness. The Senators suspended the hearing for a moment and moved to the windows of the Senate Office Building. Better than words or statistics or photographs, the waning daylight demonstrated Bennett's assertion that soil conservation was a public responsibility worthy of support and continuing commitment to solve one of rural America's persistent problems. Bennett recalled that, "Everything went nicely thereafter."[2]

In the beginning, as so often would be the case in the future, the Great Plains seemed to be at the center of developments in soil conservation policies. Probably the soil conservation bill would have passed in any event. Bennett's crusading zeal converged with the opportunity offered by the Depression to get the work started, but the situation in the Great Plains provided the final impetus for legislation. The Depression awoke the nation to the interrelated problems of poverty and poor land use. The public glimpsed some of this suffering in the South in the photographs of the Farm Security Administration and those in Walker Evans and James Agees, *Let Us Now Praise Famous Men*, that told a tale of poor land, poor people, complicated by tenancy and racism. But it was the Great Plains that captured the national attention. Newspaper accounts of dust storms, the government-sponsored documentary classic, *The Plow That Broke the Plains*, and John Steinbeck's novel, *Grapes of Wrath*, evoked powerful images. For Americans, the Dust Bowl set the image of the human condition complicated by the problem of soil erosion. It remains a powerful historical touchstone for the public's ideas about soil erosion. We may collect data, analyze, and argue, as we do about the relative seriousness of soil erosion in our most productive agricultural regions like the Corn Belt or the wheat region in the Palouse. Occasionally stories appear in newspapers on salinity on irrigated land. But none of these situations compares with the inevitable question that accompanies each prolonged drought in the Great Plains: Is the "Dust Bowl" returning?

The Dust Bowl also proved to be the most popular area in the United States for historians studying soil erosion. Within the past decade historians have produced three books on the Dust Bowl--that section of the plains encompassing western Kansas, southeastern Colorado, northeastern New Mexico, and the panhandles of Oklahoma and Texas. If the wheat and grass sometimes wither in the plains, historical interpretation seems to flourish where the fates of man and land are so intertwined and subjected to the vagaries of climate. To summarize the themes briefly, Donald Worster in *Dust Bowl: The Southern Plains in the 1930s* found the Dust Bowl to be the result of a social system and an economic order, capitalism, that disrupts the environment and will continue to do so until the system is changed.[3] For Paul Bonnifield in *The Dust Bowl: Men, Dirt, and Depression*, plains farmers struggled successfully not only against drought and depression, but also against too much government idealism, whose most threatening manifestation was the soil conservation district with its potential to make plainsmen "tenant farmers for an obscure and distant absentee landlord."[4] R. Douglas Hurt in *The Dust Bowl: An Agricultural and Social History* believed that farmers in general learned from the Dust Bowl and adjusted their farming practices, so that when drought returned in the 1950s so did wind erosion, but not the black blizzards."[5] These volumes detailed many of the specific farming practices that the Soil Conservation Service advocated in the Great Plains. In this article, I will concentrate on some of the later developments since the Dust Bowl. Finally, on pain of being labeled a geographical determinist, I want to make a few points as to how the Great Plains influenced national soil conservation programs and policies.

The establishment of the Soil Conservation Service created a locus for pulling together all the information on the best methods of farming, but farming safely within the capabilities of the land. The Soil Conservation Service at first worked through demonstration projects and the Civilian Conservation Corps camps. President Franklin Roosevelt in 1937 encouraged the states to pass a standard soil conservation districts act. Afterward, the U.S. Department of Agriculture could sign a cooperative agreement with the district. Much of the SCS's contribution to the districts has been providing personnel to the district. In this manner an agency concentrating on conservation established a presence in the countryside working directly with farmers and ranchers in a relationship that had two fortunate results. First, it made all the disciplines work together on common problems. Thus on the demonstration projects, it drew together the engineers, agronomists, and range management specialists. They were to work together on common problems rather than concentrating solely on their own discipline. Second, the Soil Conservation Service provided a means to work on what we now call technology transfer from both ends of the spectrum. This seemed particularly appropriate in the plains where farmers had struggled with wind erosion and devised a number of methods to combat it. State agricultural experiment stations and later USDA stations specializing in soil erosion provided answers. When SCS began operations, there were already some ideas on answers. To provide vegetative cover SCS advocated water conservation through detention, diversion and water spreading structures and by contour cultivation of fields and contour furrows on rangeland. The vegetative strips in stripcropping and borders of grass, crops, shrubs, or trees served as wind barriers. The young soil conservationists also encouraged the adaptation of crops and cultural practices to fit the varying topographic, soil, moisture, and seasonal conditions. Organic residues should be used to increase organic content and they should also be kept on the surface, as in the case of stubble-mulching, to prevent wind erosion. Critically erodible land should be returned to permanent vegetative cover. Rangelands could be improved by good range management through distribution, rotation, and deferment of grazing. Probably the most far-reaching recommendation was that farmers shift from extensive cash crop farming, wheat in particular, to a balanced livestock and farming operation, or that they shift to a livestock operation and the growing of livestock feeds only.[6] While technology has changed through the years, these essential elements still guide the soil conservation program.

In retrospect, progress in using rangeland more within its capabilities seems one of the more obvious achievements since the 1930s. By most measures, the condition of rangeland in the Great Plains and elsewhere has improved since the 1930s. Henry Wallace's preface to the Western Range report in 1936 predicted it would take fifty years to restore the range to a condition that would support 17.3 million livestock units. That goal was reached in the mid-1970s. Other assessments by the Soil Conservation Service over the last twenty years reveal improvements in rangeland conditions.[7]

It would be difficult to attribute responsibility for this to particular agencies, be they federal or state. Even today, SCS works with approximately half of the ranchers in the Great Plains, though many of those not participating are part-time farmer-ranchers, with other sources of income. What is clear is a growing appreciation for the principles of range management in livestock raising. That is a definite shift from the attitude of the early-twentieth century when the concept that rangeland could be grazed too intensively was anathema to many cattlemen. The controversy about grazing intensity was such that Secretary of Agriculture James Wilson in 1901 wrote on the manuscript of a USDA bulletin on the subject: "all too true, but not best for us to take a position now."[8] Shortly after the dust storms in 1935, SCS Associate Chief Walter C. Lowdermilk was addressing a group of plains cattlemen only to have them terminate the meeting when he mentioned the baleful term "overgrazing."[9]

It has been quite a journey from that attitude to general acceptance of range management as being in the interest of the land and the rancher. Several elements seemed crucial to the development. SCS people working with local soil conservation districts and ranchers had to convince them that range management was in their best interests. The field people work for the most part with owner-operators and consequently in a less adversarial climate than the Forest Service and Department of the Interior range specialists, who had to try to improve range conditions by imposition of stocking rates and grazing fees on federal lands. Also, knowing that an educational job lay ahead, the range specialists had to develop a system to promote range management that was understandable to the SCS field technicians and ranchers alike. That necessity took what had generally been regarded as a research activity into the farm and ranch setting. The key for ranchers in wisely using rangeland was to know the condition of the range, so as to know when and how much it might be grazed without further deterioration. Thus, SCS needed to develop a system of range condition classification, based on scientific principles, that field staff of SCS and ranchers could understand and use.

Early range management pioneers recognized that the composition of the range changed with heavy grazing as cattle selected the taller, more palatable grasses, leaving the shorter, less palatable ones.[10] Following thirteen years of research on National Forest rangelands in the West, Arthur W. Sampson elaborated on this concept and observed that the surest way to detect overgrazing was by observing succession, or the "replacement of one type of plant by another." Furthermore, the grazing value of rangelands was highest where "the cover represents a stage in close proximity to the herbaceous climax and lowest in the type most remote from the climax."[11] Sampson's research prefaced the application of Frederic Clement's ideas about plant communities to practical range problems. A pioneer in prairie ecology, Clement theorized that grasslands were a community of plants in various stages of plant succession progressing toward a climax stage.

Range management experts in the Soil Conservation Service needed a classification system that could be used in the field in working with ranchers. Most range management systems in the 1930s and 1940s recognized the validity of ecological concepts for range management. The distinctiveness of the SCS system was that it would be a quantitative system that applied ecological concepts to range classification and management. Other systems were judged to be too qualitative for practical application in the field. The idea was to develop floristic guides of plant population for the various range condition classes. For instance, as rangeland is grazed by animals certain plants will show an increase in the percentage of cover under heavy grazing; others will decrease, and in other cases heavy grazing leads to an invasion of plants onto the site. Thus, SCS field staff learned to inventory rangeland for particular "decreasers, increasers, and invaders" in determining whether the range condition fell into one of four categories--poor, fair, good, or excellent.

So as not to make too general a recommendation that would be of limited value, SCS added the concept of "range site" to the study of range management and improved range management practices. Foresters had originally developed the concept of site as an ecological or management entity based on plant communities.[12] Soil type, landscape position, and climate factors would be involved in determining the climax vegetation and should be taken into account when making recommendations for using rangeland following general instructions the local SCS soil conservationists had to delineate range sites in their soil conservation district. Field staff could then work with ranchers to develop a conservation plan that included advice on how best to use the land for grazing and at the same time maintain or improve range condition. In working with farmers SCS tried to ensure that ranchers understood the key plants and their response to light or heavy grazing and deferment. Overall the system was not supposed to focus solely on those plants that benefited cattle most. In concept it adhered to the suggestion of Clement that "There can be no doubt that the community is a more reliable indicator than any single species of it."[13] Advice to farmers might also include information on fencing, development of water supplies, and rotation grazing as range management theories changed over the years. But the reliance on range site and condition as the foundation has persisted to the present.

The range management experience illustrated two important points about the desirability of an interdisciplinary approach to problems and the need to link scientific theory to practical application. Because of its large field staff, SCS was able to test its ideas about using ecological quantification for range classification at numerous sites in the Great Plains. Isolated researchers have no such means for testing theory and classification in practice. The other point involves the emphasis on soil in range classification. Certainly the early ecologists emphasized soil as a part of the biotic environment. Nonetheless, it is quite likely that having both soil scientists and range managers in the same agency led to greater recognition of the importance of soil in site identification than might have been the case otherwise. Range management was but one of the cases in which the so-called action agencies such as SCS had to translate the scientific into the practical. In so doing it removed the prejudice often held toward what was considered strictly research or theoretical musings. The ecological emphasis and the recognition of the other values of rangeland for wildlife and water, not just the forage produced, seem to have increased the popularity of range management with ranchers.

Cultural practices, especially tillage methods, that reduced wind erosion found favor with farmers. Subsurface tillage, or stubble-mulch farming, eliminated weeds that depleted moisture during the summer fallow period while at the same time leaving wheat stubble on the surface to control wind erosion. Farmers employed the rotary rod weeder, or the large V-shaped Noble blade, or smaller sweeps in this work. Developments in planting and tillage equipment and in herbicides have added a whole array of planting and cultural methods that leave crop residues on the surface as well as increasing the organic content of the topsoil. These practices, such as no-till, ridge-till, strip-till, mulch-till, and reduced tillage fall under the general rubric "conservation tillage." The Conservation Technology Information Center, which promotes conservation tillage, estimated in 1988 that 23 percent of the acreage in the southern plains and 32 percent of acreage in the northern plains was planted with conservation tillage.[14] Larger farm equipment can have some adverse effects on conservation, but the powerful tractors make for timely emergency tillage operations to bring moist soil to the surface to control wind erosion.

SCS's work in the Great Plains always emphasized retiring the most erodible soils to grass. Thus they worked on introducing grass and devising planting methods for the range. The land utilization projects provided a means to test some of these methods. But some plains farmers and absentee owners have continued to use erodible soils for cropland that would be better suited to rangeland or pasture. Nonetheless, as farmers have learned about their land through the hazards of erosion or poor crop production potential, or perhaps through the teachings of the Soil Conservation Service, there have been some adjustments from the homesteading days or the World War I era of wheat expansion. The system of land capability classification developed by the Soil Conservation Service in the late 1930s and recent surveys of land use provided some clues to this shift. In making recommendations to farmers, SCS learned to classify land. In class I are soils with few limitations that restrict use, class II soils require moderate conservation practices, class III soils require special conservation practices, and class IV soils have very severe limitations that require very careful management. Soils in class V and VI are not suited to common cultivated crops. The system takes into account several limitations on use. Where the major limitation is susceptibility to erosion, the subclass designation "e" is used. Generally less than 20 percent of the land in the worst classes, VIIIe and VIe is currently used for cropland, and less than half of the IVe land is used for cropland.[15] So there have been some adjustments.

Wind erosion is still a problem on the plains. While dust storms are not common generally, several years of drought, such as occurred recently can still set the stage for dust storms such as the one that occurred in Kansas on March 14, 1989.[16] The 1988-1989 wind erosion season was the worst since 1954-1955 when SCS started keeping records.[17] Nonetheless, one can perceive the cumulative effects of conservation practices that break up the flat, pulverized landscape and thus prevent dust storms from gathering force uninterrupted. Chief among them seem to be leaving crop residues on the surface, higher organic content of the soil, wind stripcropping, field windbreaks, and interspersed grasslands. The Conservation Reserve Program, authorized in the 1985 farm bill, that pays farmers to keep highly erodible land in grass has proven most popular in the Great Plains. This is not surprising, because the plains influenced it as they did so many other conservation programs.[18]

The drought that struck the Great Plains in the 1950s led once again to emergency drought measures, but also eventually to new soil conservation programs and policies. The Colorado legislature made $1,000,000 available to plains farmers in March 1954. The U. S. Department of Agriculture spent $13.3 million on emergency tillage in 1954, and another $9,275,000 in 1955. The Agricultural Conservation Program spent $70,011,000 on drought emergency conservation measures in twenty-one states during 1954-1956. Colorado, Kansas, Oklahoma, New Mexico, and Texas used $37,848,000 of the funds. Additional funds went to other drought relief measures.[19]

As it turned out, the 1950s drought provided an opportunity for SCS to promote a new program for dealing with conservation and drought in the Great Plains. They suggested to USDA's drought committee that any financial assistance be used to assist farmers to convert cropland back to grassland by paying 50 percent of the cost with the proviso that it remain in grass at least five years.[20] The full committee's report seized on the idea of long-term contracts for restoring grass. It went even further in saying that to discourage a subsequent plow-up it might be necessary to use "restrictive covenants and surrender of eligibility for allotments, loans and crop insurance."[21] Meanwhile, USDA representatives met with members of the rejuvenated Great Plains Agriculture Council to work on a program. It called for measures it was hoped would prove more lasting than the cyclical assistance in emergency tillage and emergency feed and seed programs. The report called for "installing and establishing those practices which are most enduring and most needed but which are not now part of their normal farm and ranch operations."[22] President Eisenhower introduced the bill that was to become the Great Plains Conservation Program into Congress on June 19, 1956. Under the bill, the Secretary of Agriculture could enter into contracts, not to exceed ten years, with producers. No contract could be signed after December 31, 1971. The Secretary was to designate the counties in the ten Great Plains states that had serious wind erosion problems. The contracts were to stipulate the "schedule of proposed changes in cropping systems and land use and of conservation measures." The House Committee reported favorably on the bill with a few reservations. Only one major farm group showed up to testify in favor of the bill. John A. Baker of the National Farmers Union favored the bill, but even he reported that plains' farmers and ranchers had "some qualms and some apprehensions about these master plans."[23]

After the President signed the bill on August 7, 1956, (Public Law 84-102) Assistant Secretary Ervin L. Peterson designated the Soil Conservation Service to implement the program.[24] Cyril Luker, a native Texan who had worked in Amarillo in charge of erosion control practices, chaired an inter-agency group that would write the basic guidelines and program structure. Jefferson C. Dykes, Assistant Administrator and a student of the history of the Great Plains, chaired the work group on farm and ranch planning. Donald Williams, Administrator of the Soil Conservation Ser-vice, ordered the state conservationist of the ten Great Plains states to make proposals to the inter-agency group.[25] The government officials also held meetings with cattle- and sheep-raising groups as well as farm groups.[26]

In working with the inter-agency committee, SCS wrapped nearly two decades of experience into the program guidelines. Essentially, they wanted the individual contracts with farmers to bring about soil conservation while at the same time assisting in the development of economically stable farm and ranch units. Though he did not work on the Great Plains program, H. H. Finnell, former head of SCS's regional office at Amarillo, wrote in *Soil Conservation*, the official magazine of the Soil Conservation Service:

> A more logical and permanent remedy would be the development of an intermediate type of agriculture to use marginal land. This land is just as capable of being efficiently operated as any other lands, provided the demands made upon it are kept within its natural moisture and fertility capabilities. Ranching is not intensive enough to resist economic pressures; while grain farming is too intensive for the physical limitations of the land. A special type of agriculture for marginal land is needed. It must use the land more intensively than ranching and at the same time more safely than grain farming. Men of stable character and more patience than those who ride on waves of speculation will be needed to work this out.[27]

The contracts with farmers certainly did not dictate what was to be done; there would be mutual agreement. But it would nonetheless be a contract, and the contract would promote the idea of soil conservation and stability. The idea of risk reduction through diversification was certainly not new in the plains, or to other agricultural areas of the United States. Diversification helped farmer-ranchers withstand fluctuations in weather and prices. Surveys during the 1930s showed that failure in the plains came primarily among two groups, strict dry farmers who had no cattle, and cattlemen who grew no feed. Those who combined ranching and farming most often succeeded.[28] SCS people such as Luker and Dykes recognized that stability was good for soil conservation. The Great Plains Conservation Program was to aim for both. The debate in the work group about farm and ranch planning over sharing the cost of irrigation illustrated the emphasis on the stability of operating units. Many members of the work group believed irrigation should be ineligible for cost-sharing, since it could not be considered a soil conserving practice. Dykes, however, argued that irrigation would be needed on some of the small ranches to achieve the goal of economic stability by providing supplemental feed.[29]

Irrigation was of course only one of the farming and ranching practices that contracts with the Great Plains Conservation Program would include. USDA would share the cost of some of these practices with the farmer. Assistant Secretary Patterson also decided that SCS should be responsible for making the cost-sharing payments for soil conservation practices to farmers and ranchers. It was a decision to which SCS attached the utmost importance. USDA began paying part of the cost of soil conservation practices under the Agricultural Conservation Program which was provided for in the Soil Conservation and Domestic Allotment Act of 1936. USDA seized on the soil conservation rationale to reenact production controls after the Supreme Court invalidated portions of the Agricultural Adjustment Act of 1933. Farming practices that were eligible for conservation payments became a point of contention between SCS and the agencies responsible for administering the Agricultural Conservation Program. Currently it is the Agricultural Stabilization and Conservation Service. SCS regarded some practices, such as liming, as annual production practices. SCS preferred sharing the cost of "enduring" soil conservation practices, such as terracing, that brought long-term benefits. Another long-held preference SCS people brought to their task was the matter of the whole farm conservation plan. Since the 1930s they taught that farmers should regard all their needs and concerns in planning for soil conservation while at the same time taking the need for cash crops, pasture, forage, and other needs into account. Of course, farmers could start using this plan at the rate they preferred. But the Great Plains program would involve a contract that provided for rather generous cost-sharing. Thus, it was required that the farmers and ranchers have a plan for the whole farm and that they install all the conservation measures, though the government might not be sharing the cost of all of them.

The three- to ten-year contracts called for a number of conservation practices--field and wind stripcropping, windbreaks, waterways, terraces, diversions, erosion control dams and grade stabilization structures, waterspreading systems, reorganizing irrigation systems, wells and water storage facilities, fences to distribute grazing, and control of shrubs. But by far the greatest emphasis was on converting cropland on the erodible sandy and thin soils back to grassland and improving rangeland and pastures to further diversified farming-ranching in the plains.[30] A recent program appraisal revealed that 53 percent of the GPCP contracts had been with combination livestock-crop farms, 30 percent with principally livestock farms or ranches, and just over 10 percent with crop and cash grain farms. About 85 percent of the units were under the same management when the contracts expired.[31]

The Great Plains, and more especially the Great Plains Conservation Program, influenced national soil conservation policies and programs as the long-term contracts to maintain cost-shared conservation practices became the standard procedure in other conservation programs. Soil conservation district people and SCS looked on the concept of a special program designed for a special conservation problem area as a model that could be used in other sections. Congress never approved any of the proposed programs for other sections of the country. The Agriculture and Food Act of 1981 included a section on Special Areas Conservation Program based in part on the GPCP experience. USDA did not request funds for the special areas, but did target some problem areas for extra funds.

The Great Plains, its climate, geography, and history, influenced another national program, the small watershed program as it is generally called. The Watershed Protection and Flood Prevention Act of 1954 made USDA one of the federal participants in flood control work. SCS took the leadership in working in upstream tributary watersheds of less than 250,000 acres. The flood control side of the project provided federal funding for floodwater retarding structures, channel modifications, and other engineering works to reduce flooding along streams. Watershed protection involved soil conservation practices on farms and ranches in the watershed to reduce the sediment moving to the streams and reservoirs. For much of its history, SCS has generally added soil conservationists to these watershed project areas to assist farmers with the soil conservation practices. USDA has been involved in 1,387 projects covering more than 87 million acres.

The Flood Control Act of 1936 gave USDA authority to work on flood control in the upstream areas. Some SCS people certainly favored retarding structures as part of the program to be submitted to Congress for approval, but they were stymied at the department level. The Flood Control Act of 1944 authorized eleven projects for work by the Department of Agriculture. SCS did build a few retarding structures, but the USDA General Counsel ruled against building any additional ones. In the late 1940s and early 1950s SCS was having difficulty getting additional programs approved. There the matter rested until floods hit the Missouri River in the early 1950s. Kansas City, Topeka, and Omaha demanded completion of the Pick-Sloan plans for flood control on the tributaries of the Missouri. Farmers and residents who would lose their farms and homes stridently resisted. They offered soil conservation and small dams in the headwaters as an alternative. The most vocal were the residents of the Big Blue Valley, north of Manhattan, Kansas. They were joined by residents of Lincoln, Nebraska, who had formed a Salt-Wahoo group to promote a small watershed program. Elmer Peterson, a journalist from Oklahoma, promoted small dams as an alternative in *Big Dam Foolishness.*[32]

That this debate should emanate from Oklahoma, Kansas and Nebraska was in part related to the climate and geography of the plains where farmers could raise corn in the moist bottomland to supplement the hilly grasslands that were too dry to support crops. A small watershed program would provide flood protection to land already used for agriculture, while large dams would inundate the best agricultural land and leave the land suited to grazing or wheat. Because of soil type and moisture the flood plains of the Missouri River tributaries were prized by farmers. Consider the case of N. A. Brubaker, who had 283 acres of land on the Vermillion River in Kansas. The 83 acres of bottom land that supplied feed for his livestock were about to be lost to the Tuttle Creek Dam. His 200 acres of hill land was nontillable. He posed this dilemma to Senator Arthur Capper, "Now if my bottom land will be effected by the water from the Dam, and taken away from me, what use would I have for the 200-acre pasture, as I would not have any land to raise feed for the live stock, and as there would be so much pasture land left in the same way, there would not be much chance of leasing it."[33] A chemistry professor at nearby Kansas State College believed similarly, that the bottomland was the only productive cropland in the Blue River watershed. "The Flint Hills upland provides grazing for cattle but is useless for cropping. There farmers must raise corn on bottomland to finish their cattle. This combination of bottom land for corn and truck farming, and upland for grazing has made the Blue Valley a productive, prosperous region. Without bottom land the entire region will be impoverished and depopulated."[34] The Tuttle Creek Dam and others of the Pick-Sloan plan were built, but the small watershed forces persisted. They met with President Eisenhower and secured his blessing. The small watershed program, authorized in the Watershed Protection and Flood Prevention Act of 1954, spread to the rest of the country. In addition to flood control on agricultural land, it has been used for protection of rural communities, small towns, recreation, water supply, irrigation, and drainage.

The Great Plains also influenced the conservation provisions in the recent Food Security Act of 1985. The plains have been central to questions of landowners' responsibilities to neighbors in not letting erosion impact on their farms. This, of course, can happen with water erosion, with one farmer in the upper part of the watershed influencing the runoff and sedimentation taking place on a farm in the lower part of the watershed. But the most dramatic examples are usually wind erosion from cropland affecting a neighbor's fields. Generally the cases cited have laid the blame on outside investors looking for a quick profit in wheat. Whether this is an accurate portrayal in all cases, the breaking of rangeland for cropland did in part speed passage of some drastic changes in soil conservation laws and policies. It was undoubtedly one of the factors influencing the conservation provisions of the Food Security Act of 1985.

Probably the opening wedge in events that would change the conservation programs took place with the rise in grain prices following the large Soviet grain deals in the early 1970s. Grain exports for 1973 were double those of 1972, and the price quadrupled from 1970 to 1974.[35] At the time Secretary of Agriculture Earl L. Butz released production controls, including the annual set-aside acres. He declared, "For the first time in many years the American farmer is free to produce as much as he can."[36] Farmers in many sections of the country responded, but the plains received the most publicity, mostly for the removal of wide windbreaks for center pivot irrigation system.[37] A Soil Conservation Service survey later found that new, narrower windbreak plantings between 1970 and 1975 offset the losses.[38]

As stories of increased soil erosion spread, groups that had played a large role in the environmental movement increasingly turned attention to soil erosion. They--along with allies in Congress--questioned the effectiveness of existing soil conservation programs. The Soil and Water Resources Conservation Act of 1977 mandated studies of the soil and water conservation programs and the development of new policies to attack the problem. The lobbying and studies resulted in some changes in policies, but the drastic changes came with the 1985 farm bill. Events in the plains played a key role in the new conservation authorities that would appear in the bill. Between 1977 and 1982 wheat farmers planted large tracts of grassland in Montana (1.8 million acres), South Dakota (750,000 acres), and Colorado (572,000 acres). In some places the resulting wind erosion proved a nuisance to neighbors. Some vocal and effective local landowners such as Edith Steiger Phillips of Keota, Colorado, wanted action. The Coloradans persuaded Senator Williams Armstrong in 1981 to introduce a bill that would deprive those who plowed fragile lands of price support payments. Such payments have long been seen as inducing speculation and reducing normal caution in planting very erodible land to wheat. Mainline groups like the Colorado Cattlemen's Association and the American Farm Bureau Federation supported the legislative effort. Several counties in Colorado, including Weld County where Edith Phillips lived, and Petroleum County in Montana passed ordinances to try to prevent plowing on grasslands.

The Armstrong bill, finally dubbed the "sodbuster bill" did not become law. USDA wanted to wait for the next reauthorization of the general farm bill to consider any new provisions, but the pressure from the Great Plains gave some grass roots support for changes in the conservation provisions. The Food Security Act linked soil conservation to eligibility for other USDA programs. The act included sodbuster as well as other conservation provisions. The framers of this act especially wanted to eliminate the possibility that commodity price support programs encouraged poor soil conservation practices. Under the conservation compliance section farmers have until 1990 to begin applying a conservation plan on highly erodible land, and until 1995 to fully implement the conservation plan in order to stay eligible for other USDA programs.

The sodbuster provision applies to any highly erodible field that was neither planted to an annual crop nor used as set-aside or diverted acres under a USDA commodity program for at least one year between December 31, 1980 and December 23, 1985. If farmers wish to bring such land into production, they would lose eligibility for USDA programs unless they applied an approved conservation system to control erosion on the fields. The swampbuster or wetland conservation stipulated that farmers would lose eligibility for USDA programs if they drained wetlands after December 23, 1985, the date of the passage of the act. A conservation coalition that lobbied for this provision included old-line soil conservation organizations like the Soil and Water Conservation Society of America and the National Association of Conservation Districts as well as environmental groups. Prominent officials in USDA such as John Block and Peter Myers favored many of the provisions. But the grass roots examples of support from the plains influenced Congress even more. This is a prime example but not the only one of the way commodity programs instigated the use of land for cropland that would be better suited to rangeland. Emotionally, the conversion of rangeland to cropland has an appeal that catches the public attention more than erosion from cropland in the humid east. The 1985 provisions are some of the most far-reaching we have seen in agriculture. They are premised on the idea that some USDA programs induced the use of erodible land that would not have occurred otherwise. The Great Plains, as they so often did, served as the prime example for changes in soil conservation policies.[39]

Endnotes

1 Hugh H. Bennett, *The Hugh Bennett Lectures* (Raleigh, North Carolina: The Agricultural Foundation, Inc., North Carolina State College, 1959), 23.

2 This episode is agency folklore around the Soil Conservation Service. I was skeptical of its veracity. In the records of the Soil Conservation Service in National Archives, I located some telegrams which indicated that Bennett was usually informed about the location of dust storms. Then I found that Bennett had told fellow North Carolinian and author Jonathan Daniels about the episode. Another variation of the story, which I have not confirmed, is that Bennett had the Senate hearing delayed until the dust storm's anticipated arrival. Jonathan Daniels, *Tar Heels: A Portrait of North Carolina* (New York: Dodd, Mead & Company, 1941), 188. Wayne Rasmussen also investigated this question and concluded from Senate hearings that the story was probably true. Wayne D. Rasmussen, "History of Soil Conservation, Institutions and Incentives," in Harold G. Halcrow, et al., eds., *Soil Conservation Policies, Institutions, and Incentives* (Ankeny, Iowa: Soil Conservation Society of America, 1982), 7.

3 Donald Worster, *Dust Bowl: The Southern Plains in the 1930s* (New York, N.Y.: Oxford University Press, 1979), 5.

4 Paul Bonnifield, *The Dust Bowl: Men, Dirt, and Depression* (Albuquerque: University of New Mexico Press, 1979), 130.

5 R. Douglas Hurt, *The Dust Bowl: An Agricultural and Social History* (Chicago, Illinois: Nelson-Hall Publishers, 1981), 156.

6 Hugh Hammond Bennett, *Soil Conservation* (New York, N.Y.: McGraw-Hill Book Company, 1939), 739.

7 Donald T. Pendleton, "Home, Home on the Range," *Journal of NAL Associates* 7 (1982): 78-93.

8 Russell Lord, *To Hold This Soil*, USDA Miscellaneous Publication No. 321 (Washington, D.C.: U.S. Department of Agriculture, 1938), 67.

9 Lord, *To Hold This Soil*, p. 67.

10 Donald T. Pendleton, "Range Conditions and Secondary Succession as Used in the Soil Conservation Service," in press, 4.

11 E. J. Dyksterhuis, "Condition and Management of Range Land Based on

Quantitative Ecology," *Journal of Range Management* 2 (July 1949): 104.

12 Thomas N. Shiflet, "Range Sites and Soils in the United States," in *Arid Shrublands: Proceedings of the Their Workshop of the United States-Australian Rangelands Panel* (Tucson, Arizona, 1973), 26-33.

13 Dyksterhuis, "Condition and Management of Range Land," 111.

14 *National Survey, Conservation Tillage Practices, 1988* (West Lafayette, Indiana: National Association of Conservation Districts, 1988), 6.

15 Data Base, National Resources Inventory, 1982. Soil Conservation Service, Washington, D.C.

16 *Salina* (Kansas) *Journal*, March 15, 1989, 1.

17 "Wind Erosion Worst in Over 30 Years,.' USDA News Release 789-89. June 19, 1989.

18 For a view that questions the presumptions of the early soil conservationists working in the Great Plains see especially James Malin's "Men, the State of Nature, and Climate," and other essays in Robert P. Swierenga, James C. Malin, *History and Ecology: Studies of Grassland* (Lincoln: University of Nebraska Press, 1984), 1-374.

19 R. Douglas Hurt, "Return of the Dust Bowl: The Filthy Fifties," *Journal of West* 28 (1979): 89-90; "Federal Cost-Sharing for Drought Emergency Conservation Measures, 1954-1956, Agricultural Conservation Program," Drought File, General Correspondence, Records of the Office of the Secretary of Agriculture, Record Group 16, National Archives and Records Administration, Washington, DC.

20 Recommendations of the Soil Conservation Service to the Departmental Committee on Land Use Problems in the Great Plains, May 12, 1955, Historical SCS Reports File, Great Plains Conservation Program Files, Soil Conservation Service, Washington, D.C.

21 Preliminary Report of the U.S. Department of Agriculture on Possible Solutions for Agricultural Problems of the Great Plains, May 1955, Historical SCS Reports, Great Plains Conservation Program Files, SCS, Washington, D.C.

22 *Program for the Great Plains*, U.S. Congress, House Document No. 289, 84th Cong. 2d. sess., 1956, p. 4.

23 *Great Plains Conservation Program*, U.S. Congress, House, Hearings before the Committee on Agriculture, 84th Cong., 2d. sess., 1956, pp. 1-36.

24 Interview with Ervin L. Peterson, September 9, 1981, History Office, Soil Conservation Service. Washington, D.C.

25 Minutes. Great Plains Inter-agency Group, December 17, 1956, Great Plains Conservation Program Files, Soil Conservation Service, Washington, D.C.

26 Minutes, Great Plains Inter-agency Group, December 17, 1956 and February 17, 1957, Great Plains Conservation Program Files, Soil Conservation Service, Washington, D.C.

27 H. H. Finnell, "Pity the Poor Land," *Soil Conservation* 12 (September 1946): 31-32.

28 John T. Schlebecker, *Cattle Raising on the Plains, 1900-1962* (Lincoln: University of Nebraska Press, 1963), 149.

29 J. C. Dykes and J. B. Slack, A minority report from the Farm and Ranch Planning Task Force, February 19, 1957, Great Plains Inter-agency Group, Great Plains Conservation Program Files, Soil Conservation Service, Washington, D.C.

30 Douglas Helms, *Great Plains Conservation Program* (Washington, D.C.: Soil Conservation Service, 1981), 1-22.

31 *Great Plains Conservation Program Evaluation: Part II: Background and Summary Statistics* (Prepared mainly by James A. Lewis) (Washington, D.C.: Soil Conservation Service, 1987), 19-20.

32 Douglas Helms, "Small Watersheds and the USDA: Legacy of the Flood Control Act of 1936," in *The Flood Control Challenge: Past, Present, and Future* (Chicago, Illinois: Public Works Historical Society, 1988), 67-88; Homer E. Socolofsky, "The Great Flood of 1951 and The Tuttle Creek Controversy," in John D. Bright, ed., *Kansas: The First Century,* Vol. II. (New York, N.Y.: Lewis Publishing Company, Inc., 1956), 494-502.

33 N. A. Brubaker, Bigelow, Kansas, to Arthur Capper, January 24, 1946, Albert Cole Collection, Kansas State Historical Society. Topeka, Kansas.

34 J. L. Hall, Department of Chemistry, Manhattan, Kansas to Clifford R. Hope, May 7, 1953. Clifford R. Hope Collection, Kansas State Historical Society, Topeka, Kansas.

35 Sandra A. Batie, *Crisis in America's Cropland* (Washington, D.C.: Conservation Foundation, 1983), 5.

36 Earl L. Butz, "Produce and Protect," *Journal of Soil and Water Conservation* 28 (1973): 250-251.

37 Kenneth E. Grant, "Erosion in 1973-1974: The Record and the Challenge," *Journal of Soil and Water Conservation* 30 (1975) : 29-32.

38 *Field Windbreak Removals in Five Great Plains States, 1970 to 1975* (Washington, D.C.: Soil Conservation Service, 1980), 1-15.

39 Douglas Helms, "New Authorities and New Roles: SCS and the 1985 Farm Bill," in press. In an issue titled *Implementing the Conservation Provisions of the Food Security Act of 1985* (Ankeny, Iowa: Soil and Water Conservation Society).

The Great Plains Conservation Program, 1956-1981: A Short Administrative and Legislative History

Reprinted from *Great Plains Conservation Program: 25 Years of Accomplishment*. SCS National Bulletin Number 300-2-7. November 24, 1981.

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Enthusiastic supporters of the Great Plains Conservation Program recently gathered to celebrate the 25th anniversary of the authorizing legislation, signed August 7, 1956. The program was the latest of the nearly three-quarters of a century of local, state, and federal efforts to deal with drought, dust storms, and the resulting agricultural instability on the Great Plains. The novel feature of the program was that it provided for the government's sharing the cost of conservation measures with farmers and ranchers under a contract.

Settlement and Early Droughts

The proponents of this new concept had reason to believe that something new was needed to adjust man's agricultural endeavors to the climatic and geographic realities of the plains. Most had witnessed the drought of the 1930s and had heard tales of the ones in 1887-97 and 1910-13. The emphasis in the new program on developing enduring conservation practices rested on an understanding that drought would return to the Great Plains. A review of earlier periods of climatic stress is important because the understanding of recurring drought shaped the thinking of the people who devised and administered the Great Plains Conservation Program.

Reports from 19th century military expeditions led Americans to regard the area between the 100th meridian and the Rocky Mountains as the "Great American Desert." Major Stephen H. Long, after crossing the area, declared it "almost wholly unfit for cultivation, and of course uninhabitable by a people depending upon agriculture for their subsistence." Soldiers returning from the Civil War had plenty of the fertile tall grass prairie left to settle.[1] Eventually settlement pushed westward to the plains as promoters tried to dislodge the notion that the region was not fit for agricultural settlement. The few who had pushed out onto the plains in the mid-1870s had to withstand both drought and grasshoppers.[2]

With the return of favorable weather in the 1870s, movement into western Kansas and Nebraska intensified. In Ellis County, Kansas, it was observed that "incessant breaking for wheat can be seen in all directions."[3] The boom in settlement peaked in the mid-1880s. There were 3,547 homestead entries in Kansas in 1884. New entries in 1885 and 1886 numbered 9,954 and 20,688, respectively. As the boom receded in Kansas it continued in Colorado. There had been only 1,808 homestead entries in 1886; the number increased to 5,081 in 1887 and peaked at 6,411 the following year. During the latter two years, 4,217,045 acres, predominantly in the plains, were filed under the Homestead Act and the Timber Culture Act. The lack of capital and insufficient knowledge about farming in semiarid conditions took its toll when the drought resumed in the late 1880s. That many settlers had departed and that many never took up residence on their claims was evident in the 1890 census. There were only 3,535 farms reported in fifteen eastern Colorado counties. Quite a number of these farms were along the Arkansas and Platte rivers.[4]

The western movement was turned back with the drought that began in the late 1880s and lasted ten years with a few good years interspersed. Population statistics revealed the impact but not the suffering involved. Western Nebraska had a decline of 15,284 residents during the decade of the 1890s. During the same period the western Kansas population dropped from 68,328 to