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SAMUEL R. STALCUP
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PUBLIC INTEREST, PRIVATE LANDS:
SOIL CONSERVATION IN THE UNITED STATES, 1890-1940

A DISSERTATION APPROVED FOR THE
DEPARTMENT OF HISTORY

BY

Dr. Donald Pisani, Co-Chair

Dr. Sterling Evans, Co-Chair

Dr. Ben Keppel

Dr. Warren Metcalf

Dr. Robert Rundstrom

“. . . not every conservationist needs to study thoroughly the underpinnings of the movement. But some do. And those that do then need to help others understand conservation's ecological, historical, moral, and philosophical foundations.”

—Eric Freyfogle, *Why Conservation is Failing and How It Can Again Regain Ground* (New Haven: Yale University Press, 2006), 13.

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Finally, I want to thank my family—my father Steve, mother Janet, and sisters Caydee and Anna—for their faith in me and their unquestioning support over these many years. This project is dedicated to my wife, Mairead Todd, who has waited on me a long time to finish so we could get on with our lives together. Happy to say that now I am done.

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ABSTRACT

My dissertation is a history of soil conservation in the United States between 1890 and 1940. In a democracy founded, in part, on the principle of private property rights, how have Americans sought to protect the public interest in the private use of land? This is the central question that I seeks to answer. From the colonial period through the first decades of the twentieth century, the answer was to appeal to the enlightened self interest of individual land users. Faith was placed in farmers and grazers to recognize conservation's benefits and to adopt beneficial practices on their own initiative. By the start of the twentieth, while direct government intervention in private land use decisions remained beyond the political pale, there was growing public support for state sponsored research and education initiatives. Research and education alone, however, would prove insufficient to protect the land at the necessary scale. It would take the innovations of publicly financed programs of technical and financial assistance and creation of soil conservation districts during the New Deal to finally extend soil conservation measure across the American countryside.

I tell this story through a narrative that traces the development of the intellectual, technological, and institutional frameworks for soil conservation at the United States Department of Agriculture (USDA). I pay particular attention to discussions of the origins of modern understanding of the soil in the nineteenth century; the work of the Bureau of Soils to classify and map the soils of the United States during the 1910s; the campaign for soil conservation led Hugh Hammond Bennett during the 1920s; the soil erosion and moisture

conservation investigations initiated by the USDA in 1929; and the creation of the Soil Conservation Service (SCS) during the 1930s.

Introduction: The Public Interest in Private Lands

> While the management of our remaining public domain is still a most serious and important problem, the management of that portion of our territory that has become private property is a more serious problem. In fact, the old distinction between public and private is losing its sharpness, or is being eroded away, and for the sake of later generations it should be.
>
> — Paul Wallace Gates, "An Overview of American Land Policy" (1976)[1]

This epigraph from Paul Wallace Gates, the eminent historian of American land use, points to a critical problem in the history of conservation in the United States.[2] That is, we have many studies that focus on the protection of land in the public domain, but comparatively few on the conservation of privately owned lands. The present work is an attempt to rectify, in some small part, that imbalance. It is a history of soil conservation and the effort to prevent soil erosion on farm and range lands in the United States during the five decades between 1890 to 1940. During this time, Americans came to recognize that there is a public interest in the disposition of private lands. How they came to protect that interest through the development of knowledge, technology, and institutions to facilitate soil conservation in the countryside is the story it seeks to tell. In researching and writing this project, my central question has been: In the United States how have we sought to conserve soil located on privately owned lands? In

[1] Paul Wallace Gates, "An Overview of American Land Policy," *Agricultural History* 50 (January 1976), 229.

[2] By "America" and "American," I should say that I mean the United States and its inhabitants, who have appropriated a word that describes the entire hemisphere to signify themselves and their country alone.

a democracy founded, in part, on the principle of private property rights, how have Americans sought to exercise the public interest in the private use of land?

The history of soil conservation is part of the broader historiography of American conservation. Like the other strands of the "conservation movement" that developed in the United States during the decades after the Civil War, concern for the soil emerged as a response to the environmental degradation caused by the *laissez faire* use of natural resources. By the end of the nineteenth century, in agricultural fields and pastures from coast to coast the consequences of unrestrained use of the soil were evident in fallen yields, thin topsoil, gullies cutting across the landscape, and, downstream, rivers and harbors filled with sediment. But while, by the 1890s, popular support for conservation initiatives influenced the federal and state governments to take action to protect natural resources on public lands with the creation of parks, forests, and wildlife refuges, another generation would pass before there would be a comparable public initiative for the protection of soils on private lands. An important objectives of this study is to explain why this was the case. Why did soil represent a different challenge than the conservation of other types of natural resources?

An important reason is that the sites of soil conservation are overwhelmingly located on private rather than public lands. This fact sets the soil apart from other phases of American conservation that developed during the Progressive Era. In the political economy of the United States, it is comparatively easy to re-categorize lands in the public domain into a protected status through legislative action, executive order, or an administrative decision.[3] It is a much more difficult thing to millions of individual land users to adopt conservation practices that will protect the soil in their fields and pastures. The reason is the traditional deference in the American system of government to the sanctity of individual property rights. Private ownership of land, under a "freehold" or "fee-simple" title, confers upon the owner "a bundle of rights," including, among them the right to use the resources on the land as they choose. There are exceptions to this—namely the public use provision in the "takings" clause of the Fifth Amendment to the U.S. Constitution, as well as regulatory and zoning authorities claimed by local, state, and federal governments—but, by and large, the prerogative of the property owner has reigned supreme in land use planning.[4]

Farmers and ranchers, past to present, are economic actors whose short term profit interests are often in conflict with the measures necessary for the long term care of the soil. When a resource is abundant, as land was in the United States during the nineteenth and early twentieth centuries, revenues from its rapid exploitation without regard for sustainability will most always exceed revenues from types of use that seeks to conserve the resource. It does not take an economist to grasp that in a nation founded on the promise of free land, soil

[3] The most famous example of the conservation of public lands through the redrawing of lines on a map of the public lands is President Theodore Roosevelt's last minute push to convert the public domain into national forests before his authority to do so expired in March 1907. See Douglas Brinkley, *The Wilderness Warrior: Theodore Roosevelt and the Crusade for America* (New York: Harper, 2009), 676-681. Another examples of a history that hinges on how public lands are categorized include Kevin R. Marsh, *Drawing Lines in the Forest: Creating Wilderness Areas in the Pacific Northwest* (Seattle: University of Washington Press, 2007).
[4] These are common terms in property law. For a general discussion of them in a humanities context see Harvey M. Jacobs, "Preface" in *Who Owns America: Social Conflict Over Property Rights*, ed. Harvey M. Jacobs (Madison: University of Wisconsin Press, 1998), x-xii.

was a great national disposable asset. While some nineteenth century observers warned that soil is ephemeral and finite and that its conservation is a prudent measure that mitigates against massive downside risks to the individual and society, warnings about the fragility of soil, with a few important exceptions, were heeded in the breach for much of America history. For soil conservation requires long term planning and comes with considerable costs in time, labor, and cash, as well as foregone income from lands made less immediately profitable by the adoption of conservation measures. For agriculturalists with debts to pay, mouths to feed, and uncertain market prospects, these investments might be possible one year, but not another. Soil conservation may be in the public interest, but is often not in the private interest of individual farmers and ranchers. During the period under study here, the central challenge for soil conservation was to reconcile the public and private interests in the use of land by persuading land users to adopt soil conservation practices. Does an individual land owner have a right to destroy the soil? Does society have a responsibility to intervene for its care? If so, what shape should those interventions take? These were the central questions in the development of modern concern for soil conservation. Between 1890 and 1940, there was a significant shift in the way Americans answered these questions.

My central objective with this study is to illustrate this shift in public attitudes towards the private use of land. In United States how have we sought to conserve soil on private lands? From the colonial period through the first decades of the twentieth century, the answer of those who would have thought to ask it would have been through appeals to the enlightened self interest of individual land users. Faith was placed in farmers and grazers to recognize conservation's benefits and to adopt beneficial practices on their own initiative. This was a view that had its roots in the agrarian yeoman ethic that framed the improvement of land as a responsibility of the individual to society. It was bolstered by informal networks of agricultural improvers who celebrated the improvement of land as a moral virtue. With the development of scientific knowledge about soil and the growth of state institutions in the decades after the Civil War, older forms of agricultural improvement were displaced by the ascendency of scientific ways of understanding the world and the institutionalization of knowledge. While direct government intervention in private land use decisions remained beyond the political pale, there was public support for state sponsored research and education programs. Research and education alone, though, were not sufficient. It would take the innovations of publicly financed programs of technical and financial assistance during 1930s to finally extend soil conservation measure across the American countryside.

The redefinition of the public interest in private land use is an expression of broader changes that took place across American society in the five decades between 1890 and 1940. Bookended in time by the close of frontier settlement and the start of World War Two, these five decades were a period of rapid change brought on by the modernization of American life, characterized by a progressive faith in scientific expertise, rational planning, and technical progress. Different words and phrases have been used to describe the changes that took place during the "Progressive Era", but all describe a centralization of power in new systems of political, economic, and cultural control: an "upwards shift," as the historian Sam Hays described it, in the locus of decision making in arenas across society away from the local grassroots to larger, more complex state and national networks. The history of soil conservation can be read as an expression of this broader change in the structure of everyday life. For modern soil conservation required the development of a scientific understanding about the character of soils, research on effective conservation practices, and an administrative structure capable of extending them to the countryside. The trend towards centralization was manifested in the creation of public agencies dedicated to the study of soil and its use in the United States Department of Agriculture (USDA). This is as much a history of the specialization of knowledge, the development of new technologies, and the growth of the state as it is about the soil itself.[5]

While the tendency in the development of the modern system of soil conservation in the United States was always towards centralization, countervailing forces remained strong at all times. A barrier exists at the property line across which public soil conservation initiatives can not reach without the voluntary cooperation of the landowner. This critical fact required

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[5] Samuel P. Hays, *Conservation and the Gospel of Efficiency: The Progressive Conservation Movement, 1890-1920* (New York: Atheneum, 1969), ix-x. For examples of works that discuss the centralization of authority in American life during the late nineteenth and early twentieth century, see Hays, *The Response to Industrialism, 1885-1914* (Chicago: University of Chicago Press, 1957); Robert Wiebe, *The Search for Order, 1877-1920* (New York: Hill and Wang, 1994); *Alan Trachtenberg, The Incorporation of America: Culture and Society in the Gilded Ag*e (New York: Hill and Wang, 1982); Alfred D. Chandler, *The Visible Hand: The Managerial Revolution in American Business* (Cambridge: The Belknap Press of Harvard University Press, 1977).

the development of a different set of institutions and laws to govern conservation on private lands than those employed for conservation of public lands. The history of their development is a history of negotiation over the property line between the individual's right to do as they choose with their land and society's right to influence that use for the common good. Those who would centralize—scientists, bureaucrats, administrators, and politicians—had to accommodate those who resisted it—state and local governments, businesses, and landowners, among others. For Americans across society in the nineteenth and early twentieth centuries, the idea of state-directed soil conservation program violated what they saw as their right to do as they saw fit with the natural resources at their disposal. While these sentiments change over time to accept the technical and financial assistance programs first created in the 1920s and 1930s, they never disappeared. Decentralizing influences have always limited the extent to which soil conservation would be centralized and shaped what centralization did occur to conform with local preferences whenever possible. In other words the modern system of soil conservation that had developed by 1940 was a negotiated outcome between the interplay of interests inherent in the American system of federal government. While federal grew during this period, it was tempered by local, state, and regional prerogatives. Perhaps the best indicator of the relative success of these centrifugal forces is that, ultimately, rather than become a regulatory function of the government that compels compliance, soil conservation would be defined as a public use of land for which a landowner would be compensated through locally organized soil conservation districts.[6]

Soil conservation—its intellectual origins, technological innovations, and institutional development, as well as the biographies of the men and women who have championed it—remains a neglected aspect of the historiography of American conservation. Perhaps this owes to the centrality in the conservation literature of the West and Northeast, and the resource concerns of those regions, which subordinated soil to concerns about forests and water. Historians may also have had a preference for writing narratives about the preservation of public lands out of personal commitments, or simply convenience. It is certainly easier to tell stories about discrete areas such as national parks or wildlife refuges, than hundreds of thousands of individually owned parcels of land. The history of soil conservation, by contrast, is diffuse in character. Its range of objectives, the number of actors involved, and its extensive geographic scope defies easy understanding or synthesis. For these and other reasons much has been written about the history of public lands conservation, while comparatively few studies have examined the question of conservation on private lands. This does seem to be changing, however, as scholars have come to realize that old distinctions between the public and private domains are becoming less hard and fast.[7]

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[6] For examples of such decentralizing influences, see R. Neil Sampson, *For Love of the Land: A History of the National Association of Conservation Districts* (League City, Texas: National Association of Conservation Districts, 1985); Ibid., *With One Voice: The National Association of Conservation Districts* (Tucson, Arizona: Wheatmark, 2009).

[7] A classic work on the history of conservation on public lands is Roderick Nash, *Wilderness and the American Mind* (New Haven: Yale University Press, 1967). For an example of conservation histories that blur the boundary between public and private lands, see Peter S. Alagona, "Homes on the Range: Cooperative Conservation and Environmental Change on California's Privately Owned Rangelands," *Environmental History* 13 (April 2008): 325-349.

While there are comparatively few scholarly histories of the development of soil conservation in the United States, much has been written about the conservation of soil in general. There are countless technical treatises, public policy papers, government reports, and economic analyses that explore different aspects of the topic.[8] While this material is quite useful to the historian, it often lacks a critical perspective on the past, repeats accepted narratives, and, in cases, has a tendency to reflect the biases of its institutional origins. Because soil conservation is so bound up with the growth of a strong central government in the United States, what has been written about is most often told as a narrative about the state. What formal scholarly histories about soil conservation that have been written also tend to reflect this emphasis on institutions. They focus on advances in science and technology, the development of administrative structures, and the political process. In this literature a significant historiographical fault line lies between works that advocate the growth of centralized institutions to govern soil conservation and those that are more critical in their appraisal.

For the discussion of the permeability of political boundaries, see also Richard White, "The Nationalization of Nature," *The Journal of American History* 86 (December 1999): 976-986.

[8] Good examples include Hugh Bennett, *Soil Conservation* (New York: McGraw-Hill Book Company, 1939); Arthur R. Hall, "Early Erosion-Control Practices in Virginia," U.S. Department of Agriculture, *Miscellaneous Publication* 256 (1937); ibid., "The Story of Soil Conservation in the Soil Carolina Piedmont," U.S. Department of Agriculture, *Miscellaneous Publication* 407 (November 1940); ibid., "Terracing in the Southern Piedmont," *Agricultural History* 23 (April 1949): 96-109; Robert W. Parks, *Soil Conservation Districts in Action* (Ames: The Iowa State College Press, 1952); Sellars G. Archer, *Soil Conservation* (Norman: University of Oklahoma Press, 1956); R. Burnell Held and Marion Clawson, *Soil Conservation in Perspective* (Baltimore: Johns Hopkins University Press, 1965); Frederick R. Steiner, *Soil Conservation in the United States* (Baltimore: Johns Hopkins University Press, 1990); Stanley W. Trimble, *Man-Induced Soil Erosion in the Southern Piedmont, 1700-1900* (Ankeny, IA: Soil Conservation Society of America, 1974); and ibid., *Historical Agriculture and Soil Erosion in the Upper Mississippi Valley Hill Country* (Boca Raton: CRC Press, 2013).

In classic accounts of the history soil conservation in the United States, the broadening government role in influencing land use decisions is assumed to be a positive good. These works share a technocratic optimism about the benefits of a national soil conservation programs. Quintessential examples include Donald Swain's "The Beginning of Soil Conservation" (1963) and the political scientist Robert Morgan's *Governing Soil Conservation* (1965). Swain's chapter on soil conservation in his book on the broader topic of conservation during the 1920s is the first scholarly history of the origins of the modern system of soil conservation. Swain traces concern for the soil from the end of the nineteenth century to the establishment of the first federally financed soil conservation research stations in 1929. Morgan picks up where Swain leaves off, with a blow-by-blow account of the bureaucratic turf battles that accompanied the growth of soil conservation programs within the USDA during the 1930s and 1940s. Both works focus on personalities, political outcomes, and institutional growth. Conflict is not over the development of state power *per se*, but rather over the shape that state power takes with emphases on institutional rivalries and political contingencies. While they acknowledge the importance of the local and state roles in this process, they suggest that the centralization of land use planning did not go far enough to extend soil conservation practices to the countryside. If anything, the implication in these works is that the decentralizing tendencies of American federalism are obstacles to making good policy.[9]

[9] Donald C. Swain, *Federal Conservation Policy, 1921-1933* (Berkeley: University of California Press, 1963), 144-179; Robert J. Morgan, *Governing Soil Conservation: Thirty Years of the New*

By contrast, in recent decades, scholars have become more critical of state directed soil conservation initiatives. Their critique draws on a scholarly literature that views conservation as "part of a state's strategy to control people and territory." It views natural resources conservation as part of a broader agenda to rationalize resource production by state bureaucracies and global capitalist entities. This interpretation was given its most famous form by the Yale political scientist James Scott in his book *Seeing Like a State*. State-directed schemes to make the environmental more "legible," as Scott and others argue, have tended to result in the coercion of local people and the radical simplification of natural systems. Echoes of this theme can be found in many of the more recent studies of soil conservation. In his book *Dust Bowl*, Donald Worster observed that by helping make agriculture possible on land that should never have been farmed, soil conservation programs established during the 1930s are part of the larger set of problems that contributed to the dust storms and continue to make the Plains vulnerable to future ecological disaster. In her excellent study of conservation during the New Deal, Sarah Phillips also points towards this critique when she writes how federal conservation programs came to encourage "farm out-migration, urbanization, and industrialization."[10]

Decentralization (Baltimore: The Johns Hopkins Press for Resources for the Future, 1965), ix. Other examples of the classic narrative of soil conservation include, D. Harper Simms, *The Soil Conservation Service* (New York: Praeger Publishers, 1970); and the essays in Douglas Helms, Anne B.W. Effland and Patricia J. Durana, eds. *Profiles in the History of the Soil Survey* (Ames: Iowa State Press, 2002).

[10] Quote is from Nancy Lee Peluso, '"Reserving Value: Conservation Ideology and State Protection of Resources" in *Creating the Countryside: The Politics of Rural and Environmental Discourse*, eds., E. Melanie DuPuis and Peter Vandergeest (Philadelphia: Temple University Press, 1995), 136. James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven: Yale University Press, 1998); see also Kate Brown, "Gridded Lives: Why Kazakhstan and Montana are Nearly the Same Place," *The American*

While many recent histories of soil conservation are critical of centralized state power, they also see it as a potential agent of reform. In particular, they view the precedent set by the New Deal in the 1930s as a viable alternative to the coercive forms of state power outlined by James Scott and others. During the 1930s, soil conservation was implemented as part of a larger policy of rural development to allay the economic depredations caused by the Great Depression. The fact that reformers failed to enact comprehensive land use regulations to protect the soil have caused some scholars to conclude that the New Deal represents, at best, a lost opportunity and, at worst, a failure by soil conservationists. In his 1995 study of the history of farmland preservation policy, Tim Lehman wrote that New Deal land planners viewed themselves to be "on the verge of a new historical era in which public stewardship would overtake private interests in land. The history of the next fifty years proved this hope to be far too optimistic." In an article examining the links between soil erosion and farm tenancy in Iowa, Chris Rasmussen concluded that ultimately, "the economic distress of the thirties challenged, but did not alter, Americans' commitment to the sanctity of private ownership of land, or their resistance to the regulation of land use in the name of protecting the 'national interest' or conserving natural resources." The result, he argued, was soil conservation policies that perpetuate the existing social, economic, and political status quo, which in turn doomed reform. The "hope that animated much of the New Deal's

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Historical Review 106 (February 2001): 17-48. For examples of this critique applied to soil conservation, see *Donald Worster, Dust Bowl: The Great Plains in the 1930s* (New York: Oxford University Press, 1979), 210-230; Sarah T. Phillips, *This Land, This Nation: Conservation, Rural America, and the New Deal* (Cambridge: Cambridge University Press, 2007), 17.

rural rehabilitation philosophy," as Sarah Phillips wrote, "faltered when confronted by the insurmountable difficulty of reconciling the needs of the poorest and smallest producers with the interests of their wealthier and more commercially oriented counterparts." Each of these interpretations views the system of soil conservation that developed after World War II as a betrayal of the New Deal's original promise of ecological planning, land preservation, and social justice.[11] The idea that the New Deal reforms did not go far enough in remaking society is an important critique, but by lamenting what did not happen, these narratives discount the significance of what did happen, by failing to grapple with the specific intellectual, technological, and institutional mechanisms by which soil conservation was extended to private lands.

A corrective to the tendency of the literature's focus on the growth of centralized state power is the recent trend towards writing the history of soil conservation from the ground up. In a country as large and diverse as the United States, the way soil conservation played out varied considerably from place to place. These differences reflect unique social, cultural, economic, and environmental factors that influence the ways soil conservation was adopted and developed in different regions of the country. Good examples include Neil Maher's 1996 article on the coming of federal soil conservation programs to Jewel County, Kansas, as well as Chris Rasmussen's article on the establishment

[11] Tim Lehman, *Public Values, Private Lands: Farmland Preservation Policy, 1933-1985* (Chapel Hill: The University of North Carolina Press, 1995); Chris Rasmussen, "'Never a Landlord for the Good of the Land': Farm Tenancy, Soil Conservation, and the New Deal in Iowa," *Agricultural History* 73 (Winter 1999): 72; Phillips, *This Land, This Nation*, 17. See also, Richard Lowitt, "Agricultural Policy and Soil Conservation: Comment" *Agricultural History* 59 (April 1985), 325.

of soil conservation programs in Iowa. Book length examples include Lynne Heasley's *Thousand Pieces of Paradise*, which examines the relationship between soil conservation programs and land tenure in the loessial valleys of southeastern Wisconsin. A forthcoming dissertation from Joshua Nygren at the University of Kansas discusses how national soil conservation initiatives were carried out at the local and regional levels in the upper and lower Mississippi River valleys. Attempting to tell a national story about soil conservation from a local perspective, however, is like a blind man trying to identify an elephant by its tail. The details of the modern soil conservation state varied considerably as they were applied from place to place across the American landscape. While the present work draws from and seeks to compliment local histories of soil conservation, it seeks to do so through a national narrative that traces the development of the ideas, institutions, and technologies around which modern soil conservation is organized.[12]

An important critique of much of the literature on soil conservation is that it neglects the role of the soil as a contingent historical agent. By focusing so exclusively on the growth of state power this literature ignores how the physical characteristics of soil influenced the development of efforts to conserve it. In much writing on the history of soil conservation, the soil is merely a backdrop against which authors project intellectual, institutional, and political

[12] Neil M. Maher, "'Crazy Quilt Farming on Round Land': The Great Depression, the Soil Conservation Service, and the Politics of Landscape Change on the Great Plains during the New Deal Era," *The Western Historical Quarterly* 31 (Autumn 2000): 319-339; Lynne A. Heasley, *Thousand Pieces of Paradise: Landscape and Property in the Kickapoo Valley* (Madison: The University of Wisconsin Press, 2005). The tentative title of Joshua Nygren's dissertation is "Nature's Utility: Soil, Water, and the American State since 1920" (Ph.D. diss., University of Kansas, 2014).

narratives. These works have their merits, but by subordinating soil to other concerns—be it American liberalism, the origins of organic agriculture, or the preservation of land from urban development, to cite several recent examples—they do not grapple with the history of soil conservation on its own terms.[13] An important recent exception is Paul Sutter's excellent article "What Gullies Mean" that explores the cultural and environmental valences of a giant gully dubbed "Georgia's little Grand Canyon." Sutter moves beyond state-driven narratives of the New Deal period, to root soil conservation in the characteristics of soil itself by portraying erosion as part of a complex of environmental change influenced by social, economic, and political factors.[14]

While soil conservation did not emerge in its modern form until the 1930s, when the New Deal opened space for the political innovation necessary for direct public interventions in private land use decisions, the ideas behind soil conservation and the individuals who championed them were active long before. That is where this story begins. In its form and content it hearkens back to the classic style of soil conservation history in which institutional and bureaucratic politics are front and center, but it seeks to move beyond the limitations of earlier works. The present study differs from other treatments of the topic in several ways. First, is its approach to periodization. Most of what has been written on the history of soil conservation focuses on the New Deal period.

[13] For the importance of knowledge of soil as a thing in itself, see Eva-Maria Swidler, "The Social Production of Soil," *Soil Science* 174 (January 2009): 2-8. Examples of works that use soil conservation to illustrate broader theses are Phillips, *This Land, This Nation*; Lehman, *Public Values, Private Lands*; and Randal S. Beeman and James A. Pritchard, *A Green and Permanent Land: Ecology and Agriculture in the Twentieth Century* (Lawrence: University of Kansas Press, 2001).
[14] Paul S. Sutter, "What Gullies Mean: Georgia's 'Little Grand Canyon' and Southern Environmental History," *The Journal of Southern History* 76 (August 2010): 579-616.

Fewer works that examine the history of soil conservation during the Progressive Era, and almost none that examine the decades that followed it. By focusing on the period between 1890 and 1940, it seeks to demonstrate continuities between the Progressive Era and the New Deal and to show in contrast what is different between them. Second, rather than celebrate or lament centralization of control over the use natural resources, I seek to show how the public institutions that evolved to administer soil conservation in the United States are a product of the tension between centralized authority and local control inherent in the American system of federal government.

Finally, I seek to show how the development of understanding of the physical characteristics of soil provided the foundation for the ideas, technologies, and institutions that have shaped efforts to conserve it. Soil conservation, however, is a broad subject that encompasses manifold topics. I have attempted to touch on many of these, but, due to the limits of space, it is unavoidable that some subjects will be emphasized at the expense of others.

This work is organized into five chapters. Each, in its way, can be read as an answer to the question: how in the United States have we sought to manage the public interest on private lands? The first chapter grounds the history of soil and conservation in the scientific debates and politics of the Progressive Era. It begins with a discussion of the physical characteristics of soil and the process erosion. It then explores the emergence of the modern concern for the soil as an ephemeral and finite natural resource in the writings of

Nathaniel Southgate Shaler and Thomas Chrowder Chamberlin, who each articulated early expressions of the modern case for soil conservation.

Soil conservation, as it developed at the end of the nineteenth and the start of the twentieth century, drew on an older agrarian tradition, but during this period it became implicated in broader progressive imperative to rationalize the use of natural resources. While progressives recognized the problem of soil conservation, they were handicapped in their ability to address it. The reason was that the vast majority of threatened soils (western range lands excepted) were located on private lands, and public intervention in private land use decisions was beyond the scope of public policy. Instead concern for the soil was channeled into research, education, and appeals to the "enlightened self interest" of individual land users. All domains that belonged to the USDA.

The second chapter traces the origins of soil conservation to the efforts of the USDA's Bureau of Soils to systematically survey and classify the soils of the United States between 1900 and 1920. It examines the contributions of the pioneering soil scientists, Milton Whitney and Curtis Marbut, who, during this time, helped to establish the intellectual framework for our modern understanding of soils as unique physical bodies that vary across time and space. From this understanding of the characteristics of different soil types, the Bureau of Soils began to make recommendations for their most appropriate uses. The most prominent soil surveyor during this period was Hugh Hammond Bennett. Bennett is one of the recurring figures in the history of soil conservation in the United States. From his background as a son of the plantation South to his nearly fifty year career at the USDA, first as a soil surveyor, then as a crusader for conservation, and finally as Chief of the Soil Conservation Service (SCS), his life and career provide a narrative line that traces the emergence and development of soil conservation in the United States. While the present work is not a biography of Bennett, he figures prominently in its narrative. Through his experiences as soil surveyor in the United States and abroad, during the time period covered in this chapter, Bennett began to see erosion on the landscape as symptom of the inappropriate use of soil.[15]

The third chapter examines emergence of soil erosion as a problem of national concern. It begins in the middle 1920s, when the USDA initiated a campaign to promote soil conservation. Led by Hugh Bennett, it sought to raise awareness about the threats of soil erosion as a way to motivate private and public action for soil conservation. Using Bennett's writings and speeches from this period, it explores the economic and moral arguments on which the campaign for soil conservation rested. His major point was that erosion represents both a cost to the individual, in the loss of valuable topsoil and the

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[15] Hugh Bennett's life and career have not been explored in the detail they deserve. While there is a large literature about Bennett published during his life about his leadership role in the soil conservation movement; much of it borders on hagiography, or it least lacks the perspective of time on its subject. Bennett was also the author of many official publications of the U.S. Department of Agriculture, as well as many popular articles in magazines, and several book-length treatises. A comprehensive list of works authored by Bennett can be found in the bibliography. By far the most extensive collection of material documenting Hugh Bennett's life and career is located in Record Group 114, the Records of the Soil Conservation Service, at the National Archives in College Park, Maryland and in the different regional branches of the National Archives. The National Archives also holds material concerning Bennett in Record Group 54, the records of the Bureau of Chemistry and Soils, and Record Group 16, Records of the Secretary of Agriculture, Record Group 48, Records of the Department of the Interior. Other significant caches of primary materials relating Bennett can be found in the Southern Historical Collection at the University of North Carolina in Chapel Hill, in the Special Collections Department at Iowa State University, and in the Denver Public Library's Conservation Collection.

burying of bottomlands with sediment, and to society as a whole, ultimately, in the potential destruction of the agricultural foundation on which civilization depends. It also includes a discussion of the role played by the great Mississippi River floods of 1927 in raising the profile of soil conservation in the United States. It concludes with a discussion of the influence of the soil conservation crusade on state-level initiatives to prevent erosion.

The fourth chapter examines the passage of the Buchanan Amendment to fund the establishment of soil erosion and moisture conservation experiment stations in 1929. Between 1929 and 1933, erosion research was begun at ten experiment stations located in significantly eroded areas around the country. The research done at these experiment stations produced valuable data on the different dimensions of erosion as a physical process and the relative effectiveness of conservation practices used for its control. These experiments contributed to the refinement of a comprehensive suite of conservation measures that combined engineering practices like terraces and check dams with agronomic practices like strip cropping and cover cropping as part of whole-farm conservation plans adapted to local conditions. It explores the tension that developed between these dueling engineering and agronomic approaches to protecting soil and their implications for the national system of soil conservation that would developed after 1933. Finally, at the nadir of the Great Depression, it explores how soil and water conservation techniques came to be seen as an instrument for the restructuring of land utilization in the United States as a pathway to renewed prosperity.

The fifth chapter begins in 1933 with the election of the Franklin D. Roosevelt and the coming of the New Deal. It traces the development of the public institutions created for soil conservation during the 1930s from the creation of the Soil Erosion Service to the establishment of watershed demonstration projects in critically eroded areas around the country. During this time the need for public action for soil conservation was underlined by the Dust Bowl crisis on the Great Plains and the broader suffering of agricultural areas during the Great Depression. By 1935, there was a growing sense that a permanent solution should be found to extend public conservation assistance to all privately owned agricultural lands. While there were some who advocated for a centralized system of conservation planning for the country, what developed instead was a decentralized system that merged the older tradition of voluntary cooperation between the landowner and the USDA with newer modes of public assistance to subsidize the cost of conservation planning and the installation of conservation practices. After 1935, three key developments gave the American system of conservation on private lands its modern shape. These were the creation of the Soil Conservation Service in the USDA. The establishment of the Agricultural Conservation Program (ACP), the first financial assistance program for conservation in 1936, and the establishment in the states of locally-organized soil conservation districts empowered to cooperate with the USDA through SCS after 1937.

As time has passed the scope of public conservation concern initiatives has expanded beyond its original focus on soil, erosion, and floods to include a broad range of other natural resources concerns. However, the basic framework of publicly provided technical and financial assistance for soil conservation remains the same. This system has its limitations, but it is the system that we have created to protect the public interest in private lands in the United States. Understanding its origins and development is important for the lessons it has to tell us about how we may address the environmental concerns of our day. It is a story that begins with the development of knowledge of the soil itself.

1. Soil and Conservation

> It is most important that the conditions of this rapid erosion, which is likely to take place on a large part of the lands of the earth, should be clearly understood and its consequences distinctly apprehended.
>
> Nathaniel Southgate Shaler, "The Origins and Nature of Soils" (1891)
>
> [I]f the loss of soils proceeds at the present rate and the number of inhabitants continues to increase as now, the value of the residue of tillable land which will remain after a few centuries will so appreciate as to force extreme measures for its conservation.
>
> Thomas Chrowder Chamberlin, "Soil Wastage" (1908)[16]

When most people think of soil erosion, they imagine the giant dust clouds that swept east over the Great Plains during the Dust Bowl years of 1930s. Ironically, it was not wind erosion, but water erosion, the kind that occurs when water runs over unprotected fields and carries the soil away with it, that represented the biggest threat to the soil on American farms. Modern concern for the soil emerged in the last decade of the nineteenth century and the first decades of the twentieth. Its development is bound up with the accelerated modernization of American life that took place in these two decades expressed in ascendency of scientific ways of knowing the world and the development of systematic methods for using natural resources. This chapter examines the origins the understanding of soil erosion in texts by Nathaniel Southgate Shaler and Thomas Chrowder Chamberlin. In their writings on soil, which bookend the

[16] Nathaniel Shaler, "The Origin and Nature of Soils," *Twelfth Annual Report of the United States Geological Survey, 1890-91* (Washington, D.C.: GPO, 1891), 332; and Thomas C. Chamberlin, "Soil Wastage," in *Proceedings of a Conference of Governors in the White House* (Washington: GPO, 1909), 82.

period under scrutiny here, Shaler and Chamberlin raise the central questions in the history of its conservation. Both men apprehended the threat of erosion and placed its prevention at the center of the case for conservation. They are articulated for the first time an understanding of the soil as a finite and ephemeral natural resource. This represented a significant departure from a previous emphasis on the amelioration of exhausted soils. These writings on the problem of soil erosion would become touchstones for the next generation of soil conservationists. Many of the practical ideas they advocated would be implemented over the following decades. Although their approach to soil erosion represented an advance over previous knowledge, it was also decisively handicapped by the degree that Shaler and Chamberlin held on to nineteenth century perceptions of the boundary between the public and private domains.

Soil Knowledge and the Problem of Erosion

Conservation of the soil requires knowledge of the soil. For much of American history, the production and distribution of edaphic wisdom was the work of informal networks of agricultural innovators comprised of individual farmers, agricultural societies, and the rural press. An understanding of the soil was derived from the direct experience of working a piece land. Individual farms functioned as laboratories for their proprietors to test new practices and to transmit successful results to their neighbors by word of mouth, through the rural press, and agricultural societies. These agricultural innovators succeeded in accumulating a broad fund of knowledge about the soil and its care, but the conservation systems they advocated had unseen limits. For one, they were expensive. Conservation practices that emerged from these networks were expressions of the cultures that produced them and of the environments to which they were applied. In the North, where glacial soils supported rich pastures, conservation was closely associated with the practice of manuring to replenish nutrients removed from the fields by natural cycles of plant growth. In the un-glaciated South, where soils tend to be mineral deficient and acidic, conservation came to mean the addition of amendments like marl, phosphate, gypsum, lime, and guano to replenish these deficiencies and adjust the pH level.

While methods of early American soil conservation varied, their shared objective was the enhancement of soil fertility. Underlying this older tradition of improvement was the assumption that soil is a permanent physical resource that simply required the addition of fertilizers and amendments to be made fertile. While erosion was not unknown to early settlers in the Atlantic colonies, it was seen, if it was seen at all, as a natural geologic process about which little could be done. Individuals, here and there, sometimes with the guidance of agricultural reformers, and sometimes not, experimented with measures to hold the soil in place, but these efforts tended to be haphazard and varied in their effectiveness.[17]

[17] Two recent books that discuss soil improvement in the nineteenth century are Steven Stoll, *Larding the Lean Earth: Soil and Society in Nineteenth-Century America* (New York: Hill and Wang, 2002) and Benjamin R. Cohen, *Notes from the Ground: Science, Soil, and Society in the American Countryside* (New Haven: Yale University Press). See also Angus McDonald, "Early American Soil Conservationists," U.S. Department of Agriculture, Soil Conservation Service, Miscellaneous Publication 449 (1941); Hall, "Early Erosion-Control Practices in Virginia"; Ibid., "The Story of Soil Conservation in the South Carolina Piedmont 1800-1860"; Ibid., "Terracing in the Southern Piedmont," 96-109; Trimble, *Man-Induced Soil Erosion in the Southern Piedmont*; Ibid., "Perspectives on the History of Soil Erosion Control in the Eastern

Soil conservation as it developed in the United States in late nineteenth and early twentieth century drew on this older tradition of knowing the land, even as it sought to replace the older individual and improvised understandings of the world it represented with formal and institutional systems of knowledge. In an agrarian society resource management decisions fall on the land user. It is their responsibility to make a living from the resources at their disposal. The farmer must use his own ingenuity to solve problems, utilizing the resources at hand. As agrarian societies are drawn into the modern world of technological agriculture and its capital intensive markets, their members are compelled to trade autonomy for expert knowledge and state assistance. This is part of a broader change from an organic worldview that had prevailed in Western culture since the classical period to a mechanistic view of the world that has come to define contemporary times.[18]

In his book, *Notes from the Ground*, the historian Benjamin Cohen describes how modern agriculture knowledge gained cultural authority among agrarian people during the nineteenth century. For the soil, this shift was expressed in the rise of a new class of experts employed by universities and government agencies whose job it was to study soils and to make recommendations for their use. Concern for soil grew in parallel with the growth

United States," *Agricultural History* 59 (April 1985): 175; Weymouth T. Jordan, "The Peruvian Guano Gospel in the Old South," *Agricultural History* 24 (October 1950): 211-221; and Gregory T. Cushman, *Guano and the Opening of the Pacific World: A Global Ecological History* (New York: Cambridge University Press, 2013).

[18] This contrast between the organic and mechanistic views of the world has been discussed by many authors. See Donald Worster, *Nature's Economy: A History of Ecological Ideas*, 2d ed. (New York: Cambridge University Press, 1994); Carolyn Merchant, *The Death of Nature: Women, Ecology, and the Scientific Revolution* (San Francisco: Harper & Row Publishers, 1980).

of the authority of science in agriculture during the nineteenth century.[19] Soil conservation is a product of the scientific turn, but it never completely lost a moral component that draws on older agrarian ideal of land stewardship.

In the 1890s, the leading authority on soils in the United States was Nathaniel Southgate Shaler. Shaler had been born to a prominent family in Newport, Kentucky, in 1841. He left the South in the years before the Civil War to attend Harvard's Lawrence Scientific School where he earned a degree with a specialization in geology in 1862. The Lawrence Scientific School was the first institution of higher learning in the country dedicated exclusively to scientific research in the pursuit of knowledge, a mission that departed significantly from the theological orientation of the curriculum taught at American colleges up to that point. At Harvard, Shaler came under the tutelage of Louis Agassiz, the charismatic Swiss scientist and philosopher, who served as the Lawrence School's director from the time it opened in 1847 until his death in 1873.

Agassiz, who had made his name with the discovery of the Ice Age, taught his students to seek knowledge in direct experience with the natural world. He is famous for forcing new pupils to stare at the carcass of a fish for weeks on end until he was satisfied that they had observed its every conceivable detail. Shaler took Agassiz's method to heart. It inculcated in him a life long faith in the scientific method, or, as he put it, "the incessant revision of facts" in the face of new knowledge.

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[19] An example of the making of such authority is described by the historian Benjamin Cohen in his book *Notes from the Ground*, 1-14.

After the Civil War, during which he commanded an artillery battery for the Union Army in Kentucky, Shaler returned to Harvard, where he would remain, aside from a professional sojourn as the Kentucky state geologist from 1873 to 1880, rising eventually to become dean of the Lawrence Scientific School, a position he held until his death in 1906. From this perch he helped lay the foundation for modern soil science in the United States. Many of his students would go to become influential in the field. And, in his writings he would articulate a modern concern for soil focused on the threat of soil erosion.[20]

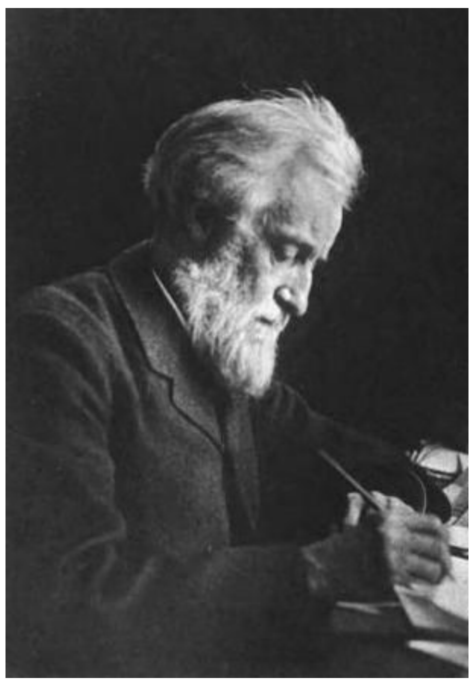

Figure 1. Photograph of Nathaniel Shaler, c. 1900 (*The Autobiography of Nathaniel Southgate Shaler*, 1909)

[20] The citation for the quote is Nathaniel Southgate Shaler, *Outlines of Earth's History: A Popular Study in Physiography* (New York, D. Appleton and Company, 1910), 5. For biographical information see Southgate Shaler and Sophia Penn Page Shaler, *The Autobiography of Nathaniel Southgate Shaler with a Supplementary Memoir by His Wife* (Boston: Houghton Mifflin, 1909). For a discussion of Agassiz and the Lawrence Scientific School, see Louis Menand, *The Metaphysical Club: A Story of Ideas in America* (New York: Farrar, Straus, and Giroux, 2001), 97-116; David Livingstone, *Nathaniel Southgate Shaler and the Culture of American Science* (Tuscaloosa: University of Alabama Press, 2005).

In 1891, Shaler published "The Origin and Nature of Soils" in the annual report of the U.S. Geological Survey. Up to that point in time, as he put it, there had been "no work in our or in any other language" that "will give the reader who has not had special training in the subject any connected story concerning soil problems." In writing, Shaler sought to tell just such a connected story, to demonstrate "the place of the soil in the economy of nature" in a way that accounts, not only for the "chemistry, physics, and geologic history" of soils, but also for human use of it. Shaler not only sought to describe the physical characteristics of soil, but also to persuade readers of their relationship to it, to convince them, he wrote, of "the duty which we owe to it."[21]

What was needed, he believed, was a deeper, more systematic, method for understanding soils and the care they required. Shaler acknowledged the value of the fund of vernacular knowledge about the soil that had been accumulated by farmers in their field—"[t]his body of inherited learning is doubtless of great value; it is indeed in the best sense scientific as well as practical, for it rests, as all true science does, on a series of experiments"— but this local knowledge was limited in its applicability to be widely useful. The problem, as he saw it, was that many American farmers had "no extended experience in the conditions of the soil they till." They had "but recently come upon the fields which they cultivate" and "derived from contact with the conditions of a small field." Individual farmers were only familiar with local conditions. Conservation practices improvised for Pennsylvania were not readily transposable to South Carolina. What was needed, he wrote, was "the

[21] Shaler, "The Origin and Nature of Soils," 220, 345.

enlargement of view," which comes from "a knowledge of the experience of other men in other regions who are dealing with the same class of problem." It is in this respect, he wrote, that science can best help "by presenting the results which have been gathered over a wide area of ground for the guidance of laborers in a particular field."[22]

During the nineteenth century, the study of soils was the province of the nascent field of geology. As the outermost layer of the earth's mantle, soil was natural topic of study for those concerned with the planet's geologic structure. Reflecting his geologic orientation, Shaler devoted the majority of the text to descriptions of the processes by which rock is transformed into soil. He includes detailed accounts of the processes by which soils are formed: the expansion and contraction of glaciers, weathering by rain and wind, eruption of volcanoes, and the ebb and flow of sea levels. He also includes detailed discussions of the significance of life in the soil: the worms, insects, microbes, and mammals that inhabit it. He comes to the modern conclusion that soils are not static, but part of dynamic natural systems. They are "produced," as he writes, by a complex of interactions between the earth's geology, climatic forces, and ecological associations over vast periods of time. He goes beyond older understanding of soil as a simple expression of the underlying geology of the earth. In so doing, he anticipates the contemporary conception of soil as the matrix of life on earth; a living, breathing, metabolizing organic body; an open-ended system that changes in time with the environment of which it is a part. Shaler's insights on

[22] Ibid., 220-221

the character of soils, stands with the contributions of Eugene W. Hilgard and Vasilli V. Dokuchaev, helped to lay the foundation for field of pedology, or the study of soil as a thing in itself.[23]

In a state of nature the process of soil formation is exceedingly slow. It can take centuries for an inch of top soil to accumulate under normal conditions. When undisturbed, soils are mostly stable, subject only to the processes of pedogenesis that occur in a particular place within an equilibrium defined by the composition of plant and animal species found there, the geomorphology of the landscape, short-term seasonal cycles, and longer-term changes in climate. Under natural conditions, soil is a product of natural environmental changes that take place over long spans of time, which are punctuated occasionally by sudden disruptive events, both at a large scale, like an earthquake, volcanic eruption, or a meteor striking the earth, and at smaller scales, as when, for example, a rain swollen river cuts off a bend in its channel.[24] Agricultural cultivation, by

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[23] Ibid., 230, For discussions of pedogenesis written by soil scientists see Randall J. Schaetzl and Sharon Anderson, *Soils: Genesis and Geomorphology* (New York: Cambridge University Press, 2005) and L.P. Wilding, N.E. Smeck, and G.F. Hall, eds. *Pedogenesis and Soil Taxonomy, vol. 1 Concepts and Interactions* (New York: Elsevier, 1983). Popular soil science texts include S.W. Buol, *Soils, Land, and Life* (Upper Saddle River: Pearson Prentice Hall, 2007); James B. Nardi, *Life in the Soil: A Guide for Naturalists and Gardeners* (Chicago: University of Chicago Press, 2007) Firman E. Bear, *Earth: The Stuff of Life* (Norman: University of Oklahoma Press, 1962); J. Gordon Cook, *Our Living Soil* (New York: The Dial Press, 1960; and Daniel Hillel, *Soil in the Environment: Crucible of Terrestrial Life* (New York: Elsevier, Academic Press, 2007). For discussion of the links between soils and societies see David R. Montgomery, *Dirt: The Erosion of Civilizations* (Berkeley: University of California Press, 2007); William Bryant Logan, *Dirt: The Ecstatic Skin of the Earth* (New York: W.W. Norton & Company, 2007).

[24] For a discussion of the idea that the earth's features are the product of long periods of homeostasis punctuated and the concept of catastrophism in the nineteenth century, see Aaron Sachs, *The Humboldt Current: Nineteenth-Century Exploration and the Roots of American Environmentalism* (New York: Viking Penguin, 2006), 246-251. For a discussion of how sudden environmental changes influence biological evolution, see Stephen J. Gould, *Punctuated Equilibrium* (Cambridge: Harvard University Press, 2007). For a smaller scale example of these kind of changes, see Jessica A. Zinger, Bruce L. Rhoads, James L. Best, "Extreme Sediment Pulses Generated by Bend Cutoffs along a Large Meandering River" *Nature Geoscience* 4 (October 2011), 675-678.

contrast, constitutes a dramatic disruption of this natural equilibrium. It was long understood that cropping exhausts the soil of the nutrient bases necessary for vegetative life—nitrogen (N), phosphorous (P), potassium (K), as well as trace minerals like calcium (Ca), sulphur (S), magnesium (Mg) and other micronutrients necessary for plant growth. Replenishing these nutrients had been the major concern of earlier generations of agricultural improvers.

It is important, however, to draw a distinction between soil exhaustion, a result of a combination of cropping patterns, soil characteristics, and climatic factors, and soil erosion, the translocation of soils by wind and water. Exhaustion and erosion are interrelated phenomenon; exhausted soils are prone to erosion, but they are, nevertheless, different. One is a biochemical and the other is geophysical phenomena. Soil exhaustion results from the depletion of essential nutrients from the soil as a result of regular plant growth, water leaching soluble compounds from the soil, and the heat of the sun that breaks down its molecular structure. When soils are exhausted the nutrients are lost, but the basic structure remains. In contrast, erosion, represents the physical loss of the soil matrix itself. Exhausted soils can be rehabilitated, but eroded soils can not be replaced once they are washed or blown away. This distinction between exhaustion and erosion is important because through the nineteenth and early twentieth century efforts to conserve soil were almost exclusively directed at the maintenance of soil fertility to combat exhaustion. While Shaler acknowledged the maintenance of fertility was an important issue, he looked forward to a future when fertilizers would cure exhausted soils. A more important problem then soil exhaustion, be believed, was the destruction of the soil itself by tillage. “In the state of nature all that the vegetation takes from the earth is promptly returned to it by the processes of decay.” Tillage, by contrast, he wrote, “requires that the natural coating of vegetation shall be stripped away.”[25] When this happens the inevitable result is the loss of topsoil down to the bedrock.

From his years spent leading the geological surveys of Kentucky, Shaler was intimately familiar with the processes of erosion. Visitors to the Appalachian parts of the state will “observe that the streams which drain the district where tillage prevails are charged with a burden of detritus won from the soils” that is evident in the “reddish yellow hue” of the “water flowing from the valleys where tilled lands lie.” The turbidity of these streams, he wrote, is evidence of a “less visible” but “vastly more important” phenomena, the washing away of the topsoil “to a point where it will no longer pay the cost of tillage.” [26] While exhausted soils have the potential to be rehabilitated through the addition of amendments and fertilizers, the damage caused by erosion is final. “Where subsoil as well as the truly fertile layer has been swept away the field may be regarded as lost to the uses of man, as much so, indeed, as if it had been sunk beneath the sea, for it will in most instances require thousands of years before the surface can be restored to its original estate.”[27] In the other words, when the soil is gone, it is gone for good. As soil erodes, the result over time is diminished crop yields, and the impoverishment of the communities who depend on the land for their livelihoods. While cycles of soil exploitation are

[25] Shaler, “The Origin and Nature of Soils,” 222, 330.
[26] Ibid., 333
[27] Ibid., 330-331.

common feature of all agricultural societies, land wastage has had a uniquely American expression.[28]

In 1890, the U.S. Census Bureau found that there was no longer a discernible line of frontier settlement in the United States. While there remained areas of the interior yet to be populated, by and large, the geographic colonization of the country was complete. Up to that point in time, soil was assumed to be an inexhaustible resource. When one field was worn out, there was another to replace it just over the horizon. In the century after Independence, this promise of virgin land lured settlers west across the continent from the Atlantic to the Pacific. In a continent-spanning nation founded on the promise of free land, soil was the great disposable asset; to be used for immediate individual gain regardless of the long term consequences.[29] Now with the closing of the frontier, Americans began to confront the prospect of a shortage out of arable land. Like most of his contemporaries, Shaler saw the abuse of soil that had accompanied the agricultural development of the country

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[28] For a big picture discussion on the relationship between agriculture and soil degradation across societies, see John R. McNeill and Verena Winiwarter, *Soils and Societies: Perspectives from Environmental History*, 2nd rev. ed. (Isle of Harris: White Horse Press, 2010). For histories of soil erosion and conservation in different international contexts see Martin W. Lewis, *Wagering the Land: Ritual, Capital, and Environmental Degradation in the Cordillera of Northern Luzon, 1900-1986* (Berkeley: University of California Press, 1991); Kate B. Showers, *Imperial Gullies: Soil Erosion and Conservation in Lesotho* (Athens: Ohio University Press, 2005); and Sarah T. Phillips, "Lessons from the Dust Bowl: Dryland Agriculture and Soil Erosion in the United States and South Africa, 1900-1950," *Environmental History* 4 (April 1999): 245-266.

[29] Henry Nash Smith, *Virgin Land: The American West as Symbol and Myth* (Cambridge: Harvard University Press, 1950); David E. Nye, *America As Second Creation: Technology and Narratives of New Beginnings* (Cambridge: The MIT Press, 2003); Gilbert C. Fite, *The Farmers' Frontier, 1865-1900* (Norman: University of Oklahoma Press, 1966); Gates, *The Farmer's Age: Agriculture, 1815-1860* (New York: Harper & Row, 1968), 3; Swain, *Federal Conservation Policy*, 144. Steven Stoll makes this point explicitly, writing, "[t]he entire republican project, inasmuch as it assumed that upward growth in population would force the outward geographical extent of the United States, was predicated on the waste of land," in *Larding the Lean Earth*, 35-36.

as "inevitable and not blameworthy." He reasoned that it was this abundance of soil that had enabled the country's rapid expansion. For only by "methods of tillage which taxed the earth to the utmost," he wrote, could "any profit . . . be had from farming." Yet, the time had come to reckon the losses. He estimated that erosion already had caused "the practical destruction of [the soil] coating over an area some thousands of square miles in extent." [30] Soil erosion could no longer be ignored. In a country with no more virgin land to exploit, the physical loss of soil posed an existential threat, if not materially, then psychologically, contributing to what the historian David Wrobel has called a "frontier anxiety" characterized by new perceptions of scarcity and fragility. The closing of the frontier threw the consequences of wasteful land use practices into sharp relief and stirred calls to action for the protection of the soil. [31]

Just as soils are produced by the interactions between the earth's lithosphere, atmosphere, and biosphere, Shaler understood that they are also products of the relationships between human culture, economics, and politics. Soils are not merely artifacts of natural history, they also bear the imprint of the societies that produce them, for better and worse. This idea that humans are interrelated with the natural world was given its most famous expression in the nineteenth century by George Perkins Marsh, the prophet of American conservation, in his 1864 book, *Man and Nature; Or, Physical Geography as Modified by Human Action*. "[M]an is everywhere a disturbing agent," he wrote. Marsh warned that the destruction of natural resources by human disturbance

[30] Shaler, "The Origins and Nature of Soils," 332-339.
[31] David M. Wrobel, *The End of American Exceptionalism: Frontier Anxiety from the Old West to the New Deal* (Lawrence: University of Kansas Press, 1996).

had caused the collapse of past civilizations and was a threat to future civilization. When the soil is stripped of its vegetable cover, Marsh wrote, the final outcome of the chain of environmental changes that follows is a rendering of the earth "no longer fit for the habitation of man." *Man and Nature* was extremely influential, inspiring concern for nature in a generation of conservationists.[32]

Shaler took Marsh's warnings to heart. As the Kentucky State Geologist he had reprinted long passages from *Man and Nature* in his annual report for 1877, and he echoed in his own writings Marsh's concern for the sustainability of American civilization. As he wrote for *National Geographic Magazine* in 1896, if "mankind cannot devise and enforce ways of dealing with the earth which will preserve this source of life [the soil] we must look forward to the time--remote, it may be, yet clearly discernible--when our kind, having wasted its greatest inheritance, will fade from the earth because of the ruin it has accomplished."

The fear that soil erosion will undermine American civilization is a moral theme that runs through the history of soil conservation to the present day. If humankind is a cause of the destruction of soil, than humankind has an obligation to prevent it.[33] Shaler viewed conservation of the soil as a moral obligation of the land user. "When we perceive that civilization rests on the

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[32] George Perkins Marsh, *Man and Nature; Or, Physical Geography As Modified by Human Action* (New York: Charles Scribner, 1864), 36, 216. See also David Lowenthal, *George Perkins Marsh: Prophet of Conservation* (Seattle: University of Washington Press, 2000); Stoll, *Larding the Lean Earth*, 178-184; and Clarence Glacken, *Traces on the Rhodian Shore: Nature and Culture in Western Thought from Ancient Times to the End of the Eighteenth Century* (Berkeley: University of California Press, 1967), 148-149.

[33] Shaler, "The Economic Aspects of Soil Erosion," *National Geographic Magazine* 7 (November 1896): 374. See also Stoll, *Larding the Lean Earth,* 181.

food-giving capacities of the soil, when we perceive that all the future advance of our kind depends upon the preservation and enhancement of its fertility, we are in a position to consider the duty which we owe to it." But, how could farmers be compelled to fulfill their moral obligation to the soil?

The 1890s was a moment of gathering progressive reform that would express itself over the next two decades in venues across American society. Reformers addressed themselves to a broad spectrum of issues from laudable efforts to alleviate poverty, protect workers, and cleanse corruption to more dubious crusades in the names of temperance, Christian religion, and nativism.[34] Among the progressive causes was the better management of the nation's natural resources. Shaler's worries about the fragility of soil echoed these broader concerns for the sustainability of natural resources that developed in the United States in the decades after the Civil War.[35] Land use reforms—"[t]he way in which soil may best be made to support the state, the laws by which it can most effectively secure this need, the measure of governmental interference with the ownership of the fields and forests", as Shaler put it, "were all matters of serious public debate." [36] While Shaler urged that the protection of soils not be forgotten in this debates, he resisted proposals that called for public

[34] For discussions of the "Progressive Era" see Peter G. Filene, "An Obituary for 'The Progressive Movement,'" *American Quarterly* 22 (Spring 1970): 20-34; David M. Kennedy, *Progressivism: The Critical Issues* (Boston: Little Brown, 1971); Daniel T. Rodgers, "In Search of Progressisvism" *Reviews in American History* 10 (December 1982): 113-132.
[35] For a broader discussion of the emergence of concern for the conservation of natural resources during the decades after the Civil War, see Donald Pisani, "Forests and Conservation, 1865-1890," *The Journal of American History* 72 (September 1985): 340-369; Ibid., "The Many Faces of Conservation: Natural Resources and the American State, 1900-1940," in *Taking Stock: American Government in the Twentieth Century*, eds. Morton Keller and R. Shep Melnick (New York: Cambridge University Press, 1999), 123-155.
[36] "The Origin and Nature of Soils," 219.

interventions in private land use decisions. Rather, he believed instead that the conservation of soil is the responsibility of the individual land user. As he wrote, "any legislation concerning the tenure of land should be devised in view of the fact that we need to have not less but more personal interest and sense of responsibility in the management of these problems."[37]In this he followed George Marsh, who in an address to the agricultural society of Rutland County, Vermont in 1847, stated his belief that in a democracy the only way to check "improvident waste" is through appeals to the "enlightened self-interest" of individual land users. For the state to compel conservation, he implied, would mean that we no longer lived in a democracy, where citizens can do as they please with the resources at their disposal. Shaler echoed popular views on the rigid boundaries between public and private domains that would change little over subsequent decades.[38]

Soil and the Progressive Conservation Movement

In the two decades after Nathaniel Shaler published "The Origin and Nature of Soils," concern for the soil was incorporated into the broader conservation movement. Progressive Era conservationists emphasized the efficient use of natural resources through professional, scientific management. This was the essence of the conservation idea championed by President Theodore Roosevelt and elevated to the status of a national cause during his

[37] Ibid., 345. Nathaniel Southgate Shaler and Sophia Penn Page Shaler, *The Autobiography of Nathaniel Southgate Shaler* (Boston: Houghton Mifflin Company, 1909), 87, 219.
[38] George Perkins Marsh, *Address Delivered Before the Agricultural Society of Rutland County, Sept. 30, 1847* (Rutland, Vermont, 1848).

administration. During these years it was manifested in public concern for the management of nation's forest reserves, the development of water resources for irrigation and navigation, the protection of wildlife, and the overall use of the nation's natural resources. In May 1908, Roosevelt assembled a conference of state governors and other prominent leaders from government, business, and universities to discuss the problem of conservation in the East Room of the White House. This conference represented a singular expression of Progressive Era concern for natural resources. Among the broad range of topics on the agenda to be discussed was the use of soil. A paper by Thomas Chrowder Chamberlin at these proceedings illustrates both the extent of progressive concern for the soil, and also its limits.[39]

Thomas Chrowder Chamberlin was born in 1843 to a farming family in Mattoon, Illinois. While he was young he moved with his family northward to Wisconsin. He attended Beloit College and took graduate courses in geology at the University of Michigan before returning to Beloit to join the faculty in 1873. Like Shaler, Chamberlin spent his early career leading the geological survey of his state. As the head of Wisconsin Geological Survey in 1870s, Chamberlin demonstrated that North America experienced multiple discrete episodes of glaciation during the Pleistocene period. With studies he conducted of glaciated and unglaciated soils, he was able to map the outer limits of the two most recent glacial advances in Wisconsin. He would go on to have a distinguished career, serving in turn with the U.S. Geological Survey, as President of the University

[39] For a discussion of the Governor's Conference, see Douglas Brinkley, *The Wilderness Warrior: Theodore Roosevelt and the Crusade for America* (New York: HarperCollins, 2009), 770-775. The Chamberlin speech is "Soil Wastage," 75-82.

of Wisconsin, and head of the University of Chicago Geology Department, which he organized in 1893, and where he remained until his retirement in 1918. Chamberlin also founded the *Journal of Geology* and co-authored the most widely read geology textbook published before World War II. He remained active in the field until his death in 1928. [40]

Figure 2. Photograph of Thomas Chrowder Chamberlin (University of Wisconsin Archives)

In addition to Chamberlin, there were two other speakers on the topic of soil at the Governor's Conference. Both framed soil conservation in terms of exhaustion. The industrialist James J. Hill, a famous Malthusian of his time, who sounded a warning about inevitable future revolutions emanating from the

[40] See Kirtley F. Mather, *A Source Book in Geology: 1900-1950* (Cambridge: Harvard University Press, 1967), 6; Robert H. Dott, Jr. "Rock Stars: Thomas Chrowder Chamberlin (1843-1928)," *GSA Today* 16 (October 2006): 30-31

depletion of the nation's soils—"[n]o people ever felt the want of work or the pinch of poverty for a long time without reaching out violent hands against their political institutions." In a rejoinder, the geologist Charles R. Van Hise, sought to alleviate these fears with a discussion of vast phosphate deposits recently discovered in the western United States that could be mined to enrich American agricultural fields for years to come. Both papers, by explicitly equating soil conservation with fertility, recapitulated older debates about the exhaustion of soil that, as Van Hise suggested, would lose their urgency as industrial processes made mineral and synthetic fertilizers more widely available over the next three decades. By contrast, Chamberlin's paper identified erosion as the chief threat to soil. "It must be noted," he told his audience, "that more than loss of fertility is here menaced, it is the loss of the soil-body itself, a loss almost beyond repair."[41]

Chamberlin began his speech, titled "Soil Wastage," with a cheerful thought. Contrary to the then widespread belief that the Earth was a recent creation and fated to imminent destruction, he assured his audience, that the planet, was in fact, very old and would be habitable "for ages yet to come." Such debates about the age of the planet had important implications for understanding soils. If the earth was young, on the order of thousands to millions of years old, as figures from James Ussher to Lord Kelvin suggested, then it stood to reason that soil genesis happens rapidly and that soil loss was no great problem; however, if the earth was far older, on the order of hundreds of millions of years,

[41] James J. Hill, "The Natural Wealth of the Land and Its Conservation," in *Proceedings of a Conference of Governors in the White House*, 63-75; Charles Richard Van Hise, "Conservation of Soils," ibid., 426-434.

as geologists understood it to be, that meant that the formation of soil by natural processes takes significant amounts of time; upwards of ten thousand years to accumulate a foot of topsoil, as Chamberlin estimated. If a few inches of soil could be washed from an agricultural field after only a few seasons, that meant soil erosion was “a serious menace.” While Americans need not fear plunging to “a final winter in the near future,” the time had come, he concluded, that they “give due measure of thought to the ulterior effects of [their] actions.”[42]

The key to soil conservation, as Chamberlin put it, was to “improve processes” and increase “intelligent management” on the farm.[43] In expressing concern for the soil through the better organization of farm work, Chamberlin’s prescriptions exemplify the progressive creeds of “social efficiency, systematization, and scientifically adjustment harmony” that exerted so much influence on American conservation in the early twentieth century.[44] Scientific efficiency Chamberlin told his audience would be achieved through changes in modes of managing the soil. Unlike Shaler, who did not make any firm prescriptions for the care of soil, Chamberlin articulated a detailed list of agricultural practices that can be used to combat erosion. These included combination of land use changes, the adjustment of agronomic practices, and, most importantly, the use of vegetation to cover soils whenever and wherever possible.

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[42] Chamberlin, “Soil Wastage,” 75-76, 78. For James Ussher, the sixteenth century clergyman who dated the creation of the world to 4004 BC, see Alan Ford, *James Ussher: Theology, History, and Politics in Early-Modern Ireland and England* (New York: Oxford University Press, 2007). For Lord Kelvin, the nineteenth century mathematician and physicist who calculated that the Earth was in the ballpark of twenty-million years old, see Joe D. Burchfield, *Lord Kelvin and the Age of the Earth* (Chicago: The University of Chicago Press, 1975).
[43] Ibid., 80-81.
[44] Rodgers, *In Search of Progressivism*, 118.

Together, these conservation practices, he argued, would serve to control the flow of water across the landscape with the goal, as he put of causing "the maximum of rainfall to be absorbed into the soil.". Chamberlin was optimistic in his prescriptions. Like other Progressive Era conservationists, he understood soil in terms of its interrelationships with other natural resource concerns. He held out the possibility that solving the soil conservation problem was the key to all conservation problems; a belief contained in his assertion that the "solution of the problem for the tiller of the soil essentially solves the whole train of problems running from farm to river and from crop-production to navigation." While the idea of managing nature as an interrelated whole has long appealed in theory, its realization would prove elusive in practice for the simple reason that the objectives of different resource uses inevitably conflict with one another. The conservation of soil may "be the key problem," as Chamberlin suggested, but it would prove difficult to protect these natural resources while also continuing to use them.[45]

The central question faced by soil conservationists in the early twentieth century was how to persuade farmers to adopt new techniques to care for their land. Ultimately, Chamberlin, like Shaler, placed his faith in the "enlightened self interest" of the land user to recognize the benefits of soil conservation. As he stated:

> We may fairly assume that intelligent people will be guided by the total returns of a lifetime, in lieu of beguilement by the ultra-quick returns of forced and wasteful cropping in total neglect of later results. It may be

[45] Shaler, "The Origin and Nature of Soils," 77, 80. For a discussion of the shortcoming of the Progressive idea of "multiple use," see Pisani, "A Conservation Myth: The Troubled Childhood of the Multiple-Use Idea," *Agricultural History* 76 (Spring 2002): 154-171.

> assumed that he who tills a farm from his twentieth to his sixtieth year will find more satisfaction in the summed profits of forty crops of increasing value enhanced by the higher value of his land at the end, even though the margin above cost be no greater, than in the sum of forty crops of decreasing values with a debased value of the land at the end.[46]

But, was such faith in the self-interest of American land users warranted? Could individual land users be counted on to forgo the beguilement of ultra-quick returns in lieu of the total returns of a lifetime? The answer, ultimately, was no. Even as new understandings of the soil developed, in the early twentieth century soil conservation remained dependent on older agrarian view that it is the responsibility of the individual proprietor to invest the capital, labor, and time necessary to protect the land. A responsibility honored in the breach more often than not. Outside a few exceptions, American land users had yet to show the care soil conservation demanded.

Chamberlin delivered "Soil Wastage" at the peak of the Progressive Conservation movement. At that historic moment Progressive policies created national parks, forests, and wildlife refuges and influences plans to develop the nation's rivers to prevent floods and supply water. While the conservation of soil was linked with forestry, flood control, and the development of waterways during this period, there were no parallel initiative that had conserving soil as its singular objective in the ways recommended by Shaler and Chamberlin. Progressive conservationists recognized the threat of soil erosion—"[t]he waste of soils is among the most dangerous of all wastes now in progress in the United States," Gifford Pinchot wrote in 1910—but, there was little they could do to

[46] Chamberlin, "Soil Wastage," 81-82.

directly influence private land use decision. In this way, the problem of soil illustrates the limits of Progressive Era conservation initiatives. Progressives were effective at extending scientific modes of management to resources located in the public domain, but the majority of the soils in the United States had passed from the public domain into private ownership. Unlike the creation of parks, forest reserves, or wildlife refuges, the objectives of soil conservation could not be met by government agencies changing the administrative category of land already held in the public domain, soil conservation on agricultural land required the voluntary cooperation of landowners.[47]

Nathaniel Shaler and Thomas Chamberlin are important figures in the history of soil conservation in the United States. Their careers illustrate broader shifts in American life. Born within two years of one another, Shaler and Chamberlin connect Enlightenment era natural philosophy with the emergence of modern scientific specialization. In their persons they exemplify the shift from improvised and local understandings of the world to institutional and centralized systems of knowledge. They were polymaths who authored papers that integrated a broad range of topics even as they helped to separate disparate fields of inquiry into distinct academic disciplines. In their writings they articulated for the first time a contemporary narrative of soil erosion and conservation.

[47] Pinchot also remarked how it would be impossible for any seeing man to "travel through the United States without being struck with the enormous and unnecessary loss of fertility by easily preventable soil wash" in Gifford Pinchot, *The Fight for Conservation* (New York: Doubleday, Page & Company, 1910), 9-10. The Country Life Commission reported in 1909 that "[l]oss of soil by washing is a serious menace to the fertility of the American farm in the *Report of the Country Life Commission* (Washington: GPO, 1909), 34. For discussions of the lack of action on soil erosion during the Progressive Era, see Phillips, *This Land, This Nation*, 14-15; and Rasmussen, "Never a Landlord for the Good of the Tenant," 7.

As the historian David Nye has written, Americans developed narratives to explain the process of the settlement of the country to themselves. The warnings sounded by Shaler and Chamberlin represent another iteration in this cultural process. The telling of new stories about fragility and scarcity reflect broader cultural anxieties that emerged as the old stories Americans told themselves about durability and abundance no longer described the world in which they lived. Though their warnings about soil erosion and calls for conservation were not heeded during their lifetimes, both Shaler and Chamberlin would have significant influence on subsequent generations of soil conservationists.[48]

The trouble for advocates of soil conservation during the first two decades of the twentieth century was that old narratives about the abundance of soil had an enduring power. The challenge was to mobilize the mass of American farmers to make the necessary investments to protect and improve their lands. One way to do this was for the federal government to step in and help farmers care for their lands. However, both Shaler and Chamberlin, however at direct state interventions in the name of soil conservation. In this they reflected the general consensus of the age. While there were some isolated calls for land use regulations, these never gained significant traction at the state or federal level. Progressive Era conservationists turned instead to publicly

[48] David E. Nye, *America as Second Creation: Technology and Narratives of New Beginnings* (Cambridge: The MIT Press, 2003), 337-338. For examples of Shaler's influence on others' concern for soil conservation, see Pinchot, *The Fight of Conservation*, 9-10; Harold L. Ickes, "The Social Implications of the Roosevelt Administration," *The Survey Graphic* 22 (March 1934): 57. For examples of Chamberlin's influence, see Hugh Bennett and William R. Chapline, "Soil Erosion A National Menace," U.S. Department of Agriculture, *Circular* 33 (April 1928), 21-22.

sponsored research and education initiatives as their primary method for extending care of the soil to the countryside. Knowledge of soils, they believed, would support appeals to the enlightened self interest of land users. This conventional wisdom was evident in the report of the County Life Commission issued in 1909, which cited the conservation of soil as an important national problem, but offered only education and the voluntary cooperation of landowners as solutions.[49] Beyond appeals to the enlightened self interest of individual farmers through research and education, neither Shaler or Chamberlin or their peers had an answer to the question of how to persuade a nation of private landowners to adopt conservation practices. While education was important—it provided land users with the knowledge necessary to make informed decisions—it had limits. Knowledge alone did not put food on the table or make a mortgage payment. Until soil conservation could pay its way, soil conservationists would have a hard time convincing farmers of their point of view, especially when prices were high and land remained abundant as it was in the first decade and a half of the twentieth century.

[49] For an example of a Progressive Era initiative to regulate land use in the state of Mississippi, see *Proceedings of Conservation Congress, 1912*, 52.

2. The USDA, Soils, and Land Use

> So on through all the great land divisions of the country each series of soils and the different types of the same series are suited best to some special crop, group of crops, or some particular kind of cultivation.
>
> Hugh Bennett, "Making Better Use of Our Soils" *(*1909)[50]

Conservation of the soil requires knowledge of the soil. In the eighteenth and nineteenth centuries such knowledge was accumulated from the experiences of individual farmers working in their fields; by the start of the twentieth century, responsibility for its production had shifted to public institutions committed to scientifically verifiable methods. Between 1901 and 1927, the most significant of these agencies was the Bureau of Soils of the U.S. Department of Agriculture (USDA). Established as part of the larger trend towards scientific specialization in the U.S. government, the Bureau of Soils exemplified the rationalizing spirit of the Progressive Era. Through its efforts to identify, map, and classify each of the nation's soils, it developed a system of soils knowledge that was put to use as a template for using land more productively.

This chapter traces history of soil conservation during this period in the development of a national system of soil classification and its in calls for efficient use of land that developed in the Bureau of Soils. The idea that the characteristics of a soil type should determine its use represents both an expression of the scientific optimism of the period and the intellectual

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[50] Bennett, "Making Better Use of Our Soils," *The American Review of Reviews* (September 1909), 315.

foundation for the development of modern soil conservation. During the first two decades of the twentieth century, however, interest in the conservation of soil was subordinated to the larger project of agricultural modernization led by the USDA.

The USDA and National Agricultural Improvement

The USDA has its roots in an old idea—that public support for institutions dedicated to agricultural advancement will repay the investment by contributing to the greater prosperity of the nation. George Washington called for the creation of a national agricultural board in his last annual address as President in 1796. "What object," he asked can "the public purse" be "dedicated with greater propriety?" In the 1830s and 1840s, the U.S. Patent Office and the Smithsonian Institution both carried forward the idea of public support for agricultural development as part of a broader effort to promote the internal improvement of the country. It was not until the Civil War, however, that this principle would become enshrined in law by a rump Congress committed to the causes of free land and free labor. Abraham Lincoln signed the bill creating the Department of Agriculture on May 15, 1862. The same year Congress passed the Morrill Act, named for its sponsor Senator Justin Morrill of Maine, which provided grants of land to establish agricultural and mechanical schools in each of the state and territories. Both the USDA and state land grant colleges are a legacy of the developmental imperative of the mid-nineteenth century

Republican party, which promoted national institutions, opening the western territories, and educational initiatives.[51]

During its first two decades of existence the USDA functioned mainly as a clerk and dispensary to American agriculture. It collected statistics, maintained a library, and distributed vast amounts of seeds. Beginning in the 1880s, the department began to take on an active research role, evident in the proliferation of bureaus dedicated to specialized purposes of which the Bureau of Soils is an example. The department's research program was expanded in 1887 with passage of the Hatch Act, which created a system of publicly financed agricultural experiment stations to be administered by the land grant schools in each of the states. The state experiment stations became important centers of agricultural research that focused attention and resources to local problems. In 1914, the Smith Lever Act established Extension Service, which provided a mechanism for the transfer of knowledge to individual farmers through the person of the county agent. Together they would drive agricultural innovation in the United States for five decades. It remained the organizational framework around which American agriculture was organized until the 1930s. [52]

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[51] For George Washington's recommendation a national agricultural board be established, see Gladys Baker, Wayne D. Rasmussen, Vivian Wiser, and Jane M. Porter, "Century of Service: The First 100 Years of the United States," USDA, Economic Research Service, Agricultural History Branch (1962), 3. For the historical origins of the USDA, see ibid., 1-14; and Daniel P. Carpenter, *The Forging of Bureaucratic Autonomy: Reputations, Networks, and Policy Innovation in Executive Agencies, 1862-1929* (Princeton: Princeton University Press, 2001), 179-180. For a discussion of free-soil ideology, see Eric Foner, *Free Soil, Free Labor, Free Men: The Ideology of the Republican Party Before the Civil War* (New York: Oxford University Press, 1995), 28-29. For the political platform of the nineteenth century Republican party, see Richard Franklin Bensel, *The Political Economy of American Industrialization, 1877-1900* (New York: Cambridge University Press, 2000).

[52] For the development of agricultural science in the USDA see, T. Swann Harding, *Two Blades of Grass: A History of Scientific Development in the U.S. Department of Agriculture* (Norman: University of Oklahoma Press, 1947); A. Hunter Dupree, *Science in the Federal Government: A*

While the USDA came to perform some regulatory functions—among them, meat inspection, commodity standards, food safety—that stemmed from the federal government's authority over interstate commerce, it did not intervene directly in the workings of individual farms. Instead it exerted its influence indirectly through formal and informal networks of association between its agencies, land grant colleges, state and local governments, businessmen, and the farmers themselves. The development of these networks of agricultural association exemplify what the sociologist Michael Mann called "infrastructural power," or the ability of the state to "penetrate civil society and implement policies through a given territory."[53] The benefits of these types of relationships, as the historian David Hamilton, writes is that they cut "across partisan,

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History of Policies and Activities (Cambridge: Harvard University, 1957); Margaret Rossiter, *The Emergence of Agricultural Science: Justus Liebig and the Americans, 1840-1880* (New Haven: Yale University Press, 1975); ibid., "The Organization of Agricultural Sciences," in *The Organization of Knowledge in Modern America, 1860-1920*, Alexandra Oleson and John Voss, eds. (Baltimore: The Johns Hopkins University Press, 1979), 211-236; David A. Danbom, "Publicly Sponsored Agricultural Research in the United States an Historical Perspective" in *New Directions for Agriculture and Agricultural Research: Neglected Dimensions and Emerging Alternatives*, Kenneth A. Dahlberg, ed. (Totowa, New Jersey: Rowman & Allanheld Publishers, 1986), 110-14; Louis Ferleger, "Arming American Agriculture for the Twentieth Century: How the USDA's Top Managers Promoted Agricultural Development," *Agricultural History* 74 (Spring, 2000): 211-226; Carpenter, *The Forging of Bureaucratic Autonomy*, 179-211. For histories of the Extension Service, see Alfred Charles True, "A History of Agricultural Extension Work in the United States, 1785-1923," USDA, *Miscellaneous Publication* 15 (1915); and Baker, *The County Agent* (Chicago: The University of Chicago Press, 1939); and J. Scott Peters, "'Every Farmer Should Be Awakened,'": Liberty Hyde Bailey's Vision of Agricultural Extension," *Agricultural History* 80 (Spring, 2006): 190-219. For individuals examples of the growth of specialized bureaus within the USDA in the 1880s and 1890s, see Wiser, "Weather, USDA, and the Farmer," *Agricultural History* 63 (Spring, 1989): 53-57; Richard C. Sawyer, "Monopolizing the Insect Trade: Biological Control in the USDA, 1888-1951," *Agricultural History* 64 (Spring, 1990): 271-277; and Andrew Denny Rodgers III, *Bernhard Eduard Fernow: A Story of North American Forestry* (Durham: Forest History Society, 1991), 106-252.

[53] See Michael Mann, "The Autonomous Power of the State: Its Origins, Mechanisms, and Results," in *States in History*, John A. Hall, ed. (New York: Oxford University Press, 1986), 109-136; and William J. Novak, "The Myth of the 'Weak' American State," *American Historical Review* 113 (June 2008), 754. For an overview of the growth of the American state during the end of the nineteenth century and the start of the twentieth century, see Stephen Skowronek, *Building a New American State: The Expansion of National Administrative Capacities, 1877-1920* (New York: Cambridge University Press, 1982).

community, and regional boundaries to forge institutions" dedicated to common goals "without building statist bureaucracies." To their proponents these "associative" relationships, as Hamilton calls them, "made possible a means of modernizing without centralizing, or rationalizing without coercing."

The growth of associative state provided the means by which the USDA exercised the public interest in private lands at the start of the twentieth century. Establishment of a Bureau of Soils and the initiation of its national soil survey are prototypical examples. Its professional staff collaborated with their counterparts at state geological surveys, agricultural colleges, and experiment stations, and other state and local institutions. These were mutually beneficial relationships that allowed federal and state institutions to share expertise, expenses, and the burden of field work as they began to integrate disparate knowledge of soils into a universal system of soils knowledge.[54]

The U.S. Soil Survey

The U.S. Soil Survey was formally initiated in 1899 as a cooperative effort between federal, state, and local institutions that continues to the present. Its mission, then as now, is to identify, classify, and map the diverse soils of the

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[54] David Hamilton, "Building the Associative State," *Agricultural History* 64 (Spring 1990), 215. See also Theda Skocpol and Kenneth Finegold, "State Capacity and Economic Intervention in the Early New Deal," *Political Science Quarterly* 97 (Summer 1982): 255-278; Jess Gilbert and Carolyn Howe, "Beyond 'State v. Society': Theories of the State and New Deal Agricultural Policies," *American Sociological Review* 56 (April, 1991), 204-220; Gilbert, "Low Modernism and the Agrarian New Deal: A Different Kind of State," In *Fighting for the Farm: Rural America Transformed*, Jane Adams, ed. (Philadelphia: University of Pennsylvania Press, 2003, 129-146); J. Schulman Bruce, "Governing Nature, Nurturing Government: Resource Management and the Development of the American State, 1900-1912," *Journal of Policy History* 17 (2005): 375-403. For a discussion of the cooperation relationship between the Bureau of Soils and state institutions see Roy W. Simonson, "Historical Aspects of Soil Survey and Soil Classification," *Soil Survey Horizons* 27 (1986): 3-11.

United States, its territories, and the world.[55] The first recorded soil survey was made in Albany County, New York, in 1820. The first soil survey of an entire state was completed for Massachusetts in 1837. A soil survey of the state of New York followed in 1846.[56]

By the 1850s, many states had established geological surveys to investigate the natural resources located within their boundaries. State geological surveys were the source of important insights into the character of soils during the nineteenth century. As the state geologist for Mississippi, the German émigré Eugene Hilgard laid the groundwork for modern soil science during the 1870s and 1880s. Both Nathaniel Shaler and Thomas Chamberlin led the geological surveys of their states. Their experiences in the field were fundamental to their writings on soils. Soils it was understood could not be studied in a laboratory alone, they must be surveyed in the field. State soil surveys, however, were uneven; objectives and methodologies varied from state to state; and there was no systematic attempt to survey and classify the soils of the nation as a whole. There was no way to correlate the soils of one region with those of another. Soil surveys made in different parts of the country did not add up into a larger regional or national map. Creation of a Bureau of Soils at the

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[55] During its existence, the U.S. Soil Survey has been administered by the following USDA agencies: Division of Soils, 1897-1901; Bureau of Soils, 1901-1927; Bureau of Chemistry and Soils, 1927-1938; Bureau of Plant Industry, Soils, and Agricultural Engineering, 1938-1952; Soil Conservation Service, 1952-1994; and the Natural Resources Conservation Service, since 1994.

[56] For discussion of the earliest soil surveys see Gustavus A. Weber, *The Bureau of Chemistry and Soils: Its History, Activities, and Organization*, Institute for Government Research, Service Monographs of the United States Government 52 (Baltimore: The Johns Hopkins University Press, 1928), 87-89; Gardner, *The National Cooperative Soil Survey,* 9-10; and Helms and Ralph J. McCracken, "Soil Surveys and Maps" in *The Literature of Soil Science*, Peter McDonald, ed. (Ithaca: Cornell University Press, 1994), 275-311.

USDA was an effort to solve this problem. Its mission as Milton Whitney, the man chosen to lead it, wrote, was concerned "with one project, the preparation of a soil map of the United States."[57]

Figure 3. Milton Whitney pictured at the Bureau of Soils in Washington, D.C. in front of a map showing counties mapped by the soil survey, c. 1920 (NARA, College Park, RG 16-G, Box 38).

Milton Whitney came to the Department of Agriculture from the Maryland State Experiment Station, where he had made a name for himself with studies of the soils of Maryland. Milton Whitney would direct the soils work of the USDA until 1927, first as Director of the Division of Agricultural Soils beginning as Chief of the Bureau of Soils. He is best known for his theories about the properties of soil that determine fertility. These ideas were set forth in a paper published by the Weather Bureau in 1891 titled, "The Physical

[57] Milton Whitney, "General Review Of The Work," in *Field Operations of the Bureau of Soils, 1915* (Washington: GPO, 1919), 31.

Properties of Soils in Relation to Moisture and Crop Distribution," in which Whitney argued that it is a soil's texture—the relative amount of silt, sand, and clay it contains—that is the major factor in determining soil fertility. His logic was that texture determined a soil's ability to absorb water and thus its suitability for growing crops.[58] Whitney developed his ideas about soils, in part, in response to the ideas of the German chemist Justus von Liebig, who, in the 1840s, had theorized that soil fertility has a chemical basis and predicted the transformation of agriculture through the application of synthetic fertilizer.[59] While Liebig made the case for chemical basis of soil fertility almost to the exclusion of an consideration of the physical characteristics of soil, Whitney argued the opposite that it is physical rather than the chemical characteristics of soils that determine their fertility. In 1896, the Division of Soils issued an illustrated bulletin describing different soil textures and the types of crops to which they are suited. By identify texture as the most salient characteristics of soil, this publication set the template around which the soil science at the USDA would be organized for two decades to come.

Soil surveying in the field was rugged, physically grueling work. Once an area to be investigated, usually a county, was selected, a field party of two surveyors established a headquarters in the county seat town, leaving Monday mornings and generally returning Saturday afternoons. Surveyors traveled many

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[58] Weber, *The Bureau of Chemistry and Soils*, 87-89; Helms, "Early Leaders of the Soil Survey" in *Profiles in the History of the U.S. Soil Survey*, Helms, Effland, and Durana, eds. (Ames: Iowa State University Press, 2002), 20-21.

[59] This theory was given its most famous expression in Justus von Liebig, *Chemistry in its Application to Agriculture and Physiology* (London: Taylor & Walton, 1842). For a general discussion about the significance of Liebig, see Cohen, *Notes from the Ground*, 2-3; Stoll, *Larding the Lean Earth*, 151-152.

miles a day carrying in addition to the augers, shovels, and picks they used to take soil samples, a plane table and alidade for making maps, instruments for measuring the depth of accumulated sediments, gauges to measure water levels, and, in arid regions, devices to determine soil salinity. They ranged across the countryside taking the measure of different types of soil in the agricultural landscape and.[60]Their major task as Hugh Bennett wrote in 1909 was "to delineate on a map, in different colors, each distinct type of soil."[61] Early on this work was crude and lacked detail, but it improved year by year as the Soil Survey gained experience and refined its methods. [62]

Mapping soil required the development of a standardized system of soil classification. The many vernacular names for soils used throughout the country contained a wide range of meaning and were rarely transposable from one location to another. To say that a soil is "red clay, or 'gray, pine woods sand land,' or 'gumbo,' or 'buckshot,' or 'loam' means little or nothing." "Gumbo, for example, may be soil which ranges from the highly productive, limy, black clay found in the bottoms of such streams as the lower Missouri River to the unproductive gray, salty clay occurring in low positions in the Gulf coastal plain. The term 'loam' is loosely applied to numerous soils having widely

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[60] Milton Whitney, "The Work of the Bureau of Soils," U.S. Department of Agriculture, Bureau of Soils, *Circular* 13, Revised (April 2, 1905), 2-3; Macy Lapham, *Crisscross Trails: Narrative of a Soil Surveyor* (Berkeley: Willis E. Berg, 1949), 12-16.

[61] Bennett, "Making Better Use of Our Soils," *The American Review of Reviews* 40 (November 1909): 316-323.

[62] When possible soil surveyors used U.S. Geological Survey topographic base maps, but at the turn of the twentieth century these were limited in their availability. Soil surveyors often had no suitable base maps. In these cases, they sketched their observations on blank township plat book marked off into sections. Base maps at the one inch to one mile scale used by the Soil Survey were not widely available in the 1900s and 1910s. Lapham, *Crisscross Trails*, 12-16. See also Clifford M. Nelson, "Toward a Reliable Geologic Map of the United States, 1803-1893," in *Surveying the Record: North American Scientific Exploration to 1930*, Edward C. Carter, ed. (Philadelphia: American Philosophical Society, 1999), 51-77.

varying properties, cropping values, and cultural requirements." Local names for soils "could not be relied upon to convey correct ideas." Those who held on to them "are at a distinct disadvantage, in that they are not in a position to understand the best use of the fertilizer, and the cultural and crop variety tests carried on by the experiment stations of the country." That fact was "what one soil needs or what crops are best suited to it may not correspond in the least with the requirements and adaptations of another type."[63]

Figure 4. U.S. Soil Survey field party taking a soil sample, location unknown, c. 1914 (Soil Survey Photo File, Douglas Helms Collection, National Agricultural Library).

The key to the system of classification developed by the Bureau of Soils was the soil type. Soil type was the basic unit depicted on the maps produced by

[63] Bennett, "Soil Types and How They Might be Recognized" in *Yearbook of Agriculture, 1926* (Washington, Government Printing Office, 1927), 667-671.

the soil survey. The boundaries of soil types were determined by observations of differences in soil texture, color, and mineral content from frequent borings made with augers to a depth of three feet. A individual soil type was identified by combining a description of the soil's texture (silt, sand, clay, loam) with the location where it was first described. Thus those soils similar to the sandy clay loams described in Cecil County, Maryland, in the first year of the soil survey were thereafter known as the Cecil sandy clay loam. The same formula was used to label newly identified soil types in locales across the country. Each soil type was further classified as part of a soil series comprised of all the soil types in an area formed from the same parent geologic material, but having different textures. A complete soil series would include soil types ranging in texture from coarse gravel through loam and sand to heavy clay.

A complete series included soil types with different textures, but "having the same range in color, the same character of subsoil, particularly as regards color and structure, broadly the same type of relief and drainage, and a common or similar origin." Each soil series took its name from the geographic prefix of the location where the type was first described. So that, for instance, all the Cecil soils—Cecil sand, Cecil sandy loam, Cecil loam, and Cecil clays—occupied a distinct series. Later on a third category of classification was added that divided the country into seven soil provinces lying east of the Great Plains and six soil regions including the Great Plains and the country west of them. "A soil province" was said "to be an area having the same general physiographic expression, in which the soils have been produced by the same forces or groups of forces and throughout which each rock or soil material yields to equal forces equal results."[64]

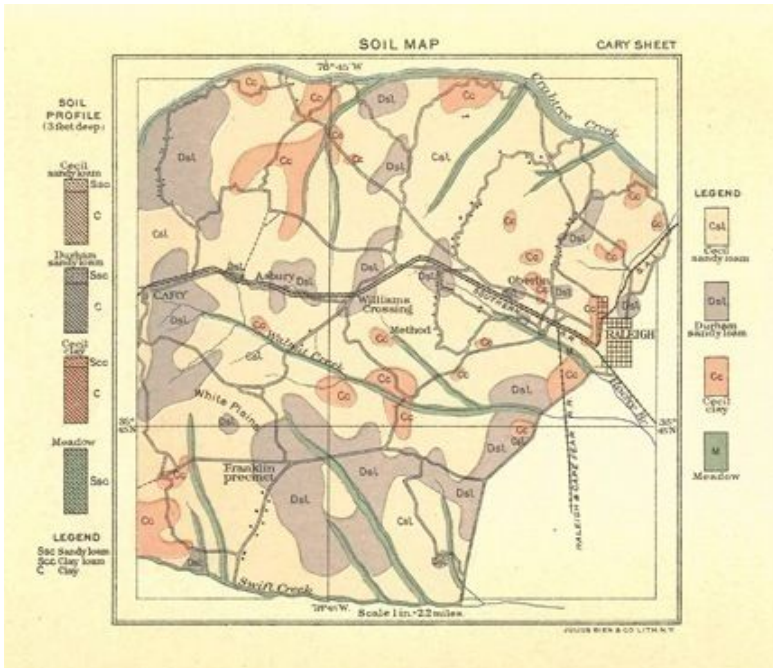

Figure 5. 1901 map showing the four principal soil types in the vicinity of Raleigh, North Carolina, from George N. Coffey and W. Edward Hearn, "Soil Survey of the Cary Area, North Carolina," *Report of the U.S. Bureau of Soils 1901* (1902), 312.

Each year the Bureau of Soils published its survey reports and accompanying maps in the *The Field Operations of the Bureau of Soils*. The information contained in these reports was meant to be used by farmers,

[64] For quotes see Curtis F. Marbut, Hugh Bennett, J.E. Lapham, and Macy Lapham, "Soils of the United States," U.S. Department of Agriculture, Bureau of Soils, *Bulletin* 96 (1913), 7-8. For a discussion of soil types, series, and provinces, see T. Lyttleton Lyon and Harry O. Buckman, *The Nature and Properties of Soils: A College Text of Edaphology* (New York: The MacMillan Company, 1922), 86; Weber, *The Bureau of Chemistry and Soils*, 91; Gardner, *U.S. Cooperative Soil Survey*, 43; Marlin G. Cline, "Soil classification in the United States," *Agronomy Mimeo* 79-12, Cornell University Department of Agronomy, Ithaca NY (1979), 2; Simonson, "Historical Aspects of Soil Survey and Soil Classification, Part I, 1889-1910," 3-11; ibid., "Evolution of Soil Series and Type Concepts in the United States," *Advances in GeoEcology* 29 (1997), 79-108; and ibid., "Soil Classification in the Past—Roots and Philosophies" in *Soil: Morphology, Genesis, and Classification*, Delvin Fanning and Mary C.B. Fanning eds. (New York: John Wiley and Sons, 1989), 139-152.

agricultural scientists, and governments to make land use planning decisions. Each soil survey report contained detailed information about "the specific crop adaptations and correct cultural method for each soil" in a given area. The accompanying soils maps showed each soil type "in a distinct color, so that any one may determine the character and crop value of a tract of land at any location by a glance at the map."[65] These early soil survey reports are an important record of early twentieth century American land use. The knowledge they contained helped to knit the country together as new states and recently settled territories were incorporated into national political and economic systems. It provided an important foundation of knowledge for the development of soil science and the nascent movement for soil conservation.[66]

Towards A Modern Conception of Soil

Mapping the soils of a continental nation is a monumental task. Between 1899 and 1909, surveyors mapped almost 124,000,000 acres or nearly 194,000 square miles across the forty-eight states.[67] Though this represented just six and a half percent of the total land area of the country, this work represented a tremendous advance in public knowledge of the distribution of soils in the

[65] Bennett, "Making Better Use of Our Soils," 316.
[66] Accounts of the early years of the U.S. Soil Survey include Macy Lapham, *Crisscross Trails: Narrative of a Soil Surveyor* (Berkeley: W.E. Berg, 1949); Roy W. Simonson, "Lessons from the First Half Century: I. Classification of Soils," *Soil Science* 74 (September 1952), 249-258; Gary W. North, "Marie Tharp: The Lady Who Showed Us the Ocean Floors," *Physics and Chemistry of the Earth* 35 (2010), 881-886; Eric C. Brevik, "George Nelson Coffey, Early Soil Surveyor" *Soil Survey Horizons* 42, 4 (2001), 122-126.
[67] I obtained these figures by combining the cumulative total area of the soil surveys performed through January 1, 1908 included in *Soils of the United States* published in 1909 with the annual totals of the soil surveys performed in 1908 and 1909 included in the *Field Operations of the Bureau of Soils* for each of those years.

United States. During this first decade of the soil survey, however, the increasing scope of the work made the task of classifying new types of soils more complex as field methods became more refined.

What had begun as an *ad hoc* system of soil classification that had developed over time to assist surveyors in mapping the boundaries of soil types as they were encountered on the ground, had grown unwieldy with the discovery of hundreds of new soil types each field season. The first season of the soil survey, field parties identified 25 distinct soil type. By 1902, the number of identified soil types had increased to 200; a year later that number doubled. In 1904, the Bureau of Soils issued a book of instructions for survey parties. In it Milton Whitney emphasized that "[i]t is very undesirable to increase the number of soil types more than is necessary, and wherever a soil can consistently be put under an established type it should be done."[68]

By 1909, the Soil Survey field guide had "outgrown the dimensions of a pocket notebook." That year the Bureau of Soils published *Soils of the United States*, a comprehensive volume containing descriptions of the 715 types of soil identified up to that point. Three years later in a revised edition described, this time, as "a very complete handbook of the soils of the United States" the number of soil types increased to 1,650.[69] The number of soil types recognized

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[68] *Field Operations of the Bureau of Soils, 1899* (Washington: GPO, 1900). The quote is from Whitney, "Instructions to Field Parties and Descriptions of Soil Types," U.S. Department of Agriculture, Bureau of Soils (1904), 15. See also Whitney, *Soil Survey Field Book, Field Season, 1906*, U.S. Department of Agriculture, Bureau of Soils (1906).

[69] Marbut, Bennett, Lapham, and Lapham, "Soils of the United States," 3; Whitney, "Soils of the United States," 3. A discussion of the proliferation of soil types can be found in Gardner, *The Cooperative Soil Survey of the United States*, 44-45.

by the Bureau continued to increase through the decade. As it did quality control became an important concern for the administrators of the soil survey.

As the number of soil types multiplied, the challenge for the Bureau of Soils was to ensure that field parties working in different areas at different times identified similar soil types correctly. So that a soil identified in one place as a certain type, was not, in fact, a soil of a different type described in another place. This meant, for example making sure that the soils identified as Cecil Fine Sandy Loam in Gaston County, North Carolina, in 1909 and in Louisa County, Virginia, in 1905 was substantially the same as the Cecil Fine Sandy Loam first identified in Cecil County, Maryland, in 1899.

The addition of new soil types each field season compounded the problem by requiring the Bureau to revise classification of soils previously understood to be one type after they were discovered to be a different type altogether. As Whitney explained, "the correlation of the soils is a very difficult problem, and one which can not be definitely solved from the data obtained by the survey of a limited number of widely separated areas. Each additional survey throws new light upon the subject, and sometimes necessitates changes in the soil names used in the earlier reports. The student of soils will doubtless realize that the necessity for such readjustments is an inherent feature of work of this character." Final determination of a soil type required the correlation of the results of the different soil surveys in the Washington office, using descriptions from the field and the results of laboratory analysis.

All of this amounted to quite a bit of work. At the start final determination of soil types was done by Whitney, but the proliferation of soil type descriptions made this impractical as the task of correlating the results of each season's soil surveys took up increasingly more time each year. The mounting workload caused delays in the publication of the soil surveys in *The Field Operations of the Bureau of Soils*.[70]

By 1909 the scale of the soil-mapping project had grown so large that the Bureau of Soils reorganized itself to provide greater oversight and more accurate correlations for the Soil Survey. That year Milton Whitney appointed inspectors to take charge of the work in the different regions of the country. One Inspector each for the South, North, and West was named. Additional inspectors were later appointed to handle the comparatively larger workloads in the Northern and Southern Divisions. Each Inspector oversaw the work of the field parties in their region. As part of this work they also served on what was called the Committee on the Correlation and Classification of Soils, which had the task of reconciling the soil type descriptions with one another and officially incorporating them into the Bureau's system of soil classification.[71] The process of correlation also involved the systematic cataloging of the characteristics of different soil types. The committee met in the winter months to determine the final classifications of the soils surveyed the previous field season. This was an important role because the decisions reached by the Committee determined the

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[70] Whitney, *Soil Survey Field Book*, *Field Season, 1906*, 3.
[71] Lapham, *Crisscross Trails*, 80-81.

official Department of Agriculture position on the extent and character of a soil type.

This arrangement was formalized in 1911 when Curtis Fletcher Marbut was named as the Scientist in Charge of the soil survey work and made chairman of correlation committee. Marbut, who had studied under Nathaniel Shaler at Harvard, joined the Soil Survey in May 1910 after working for fifteen years as a professor of geology at the University of Missouri. Under the direction of Marbut, the Soil Survey underwent a period of growth in the scope of its work. During his time at the soil survey until his death in 1935, Marbut would be responsible for the development a modern system of soil classification that evaluated soil types based on a variety of factors rather than simply geologic origin. In that time soil science would differentiate itself as a distinct field of scientific inquiry.[72]

After more than a decade of surveys, it was clear that there was a great deal about soils encountered in the field that did not conform to existing theories about their provenance. Whitney's system of classification was based on the premise that soils are simply products of the slow decay of the underlying geologic material. This understanding guided the classification and mapping of soils based on differences in soil texture, color, and the size of mineral particles. A major weakness of this system, though, was that not all soils could be

[72] Helms, "Early Leaders of the Soil Survey," 43; Helms and McCracken, "Soil Surveys and Maps," 282; Weber, *The Bureau of Chemistry and Soils*: *Its History, Activities, and Organization*, 91-98; Lapham, *Crisscross Trails,* 94-95.

explained in terms of their geologic origin. Whitney's classification system paid little attention to other factors that influence the creation of soils.[73]

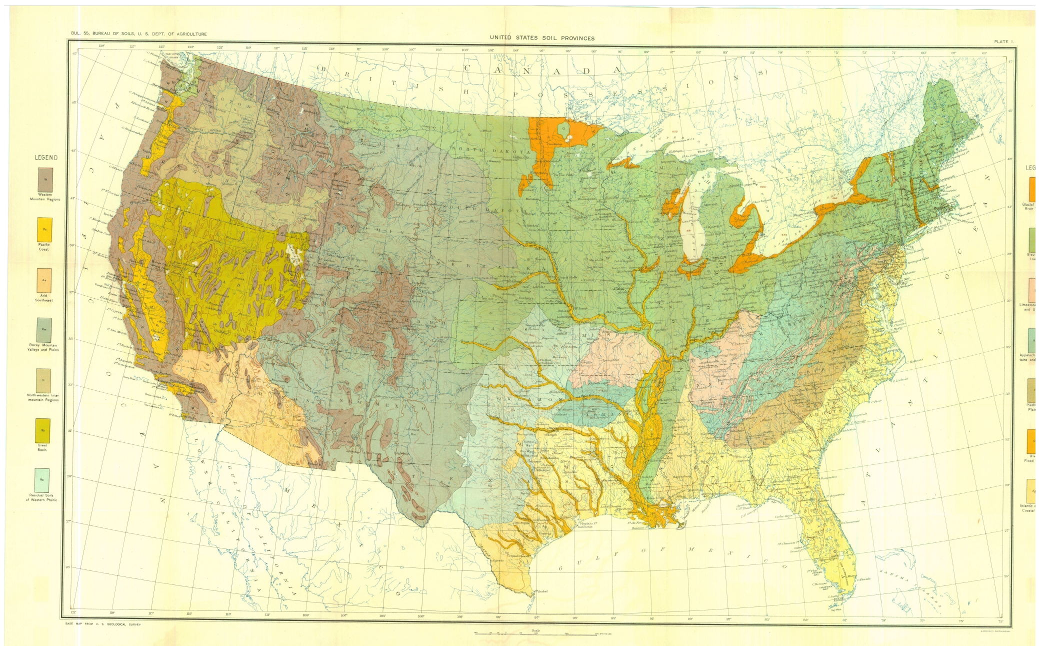

Figure 6. Map of the seven Soil Provinces and six Soil Regions identified by the Soil Survey and published in *Soils of the United States* (1909).

In 1914, the Russian soil scientist Konstantin Dmitrïevich Glinka published a book, *The Great Soil Groups of the World and Their Development*. A copy of this book reached the Department of Agriculture's library just as the First World War broke out. Over the next several years Marbut translated the text from the original German into English. Glinka wrote that soils are "independent natural bodies" formed by unique local conditions. Glinka drew from the work of V.V. Dokuchaiev, the founder of Russian soil science, who through his observation of the geographic distribution of soils in Russia

[73] Weber, *The Bureau of Chemistry and Soils*, 93

developed a multi-causal theory of soil genesis. Soils are produced, he theorized, through unique interactions between geology, climate, topography, and biology varying across time and space. The interactions between these factors could be observed in the vertical profile of the soil, which reflected the specific local conditions that produced the soil. These so-called Dokuchaiev factors provide the foundation of modern conceptions of soil science.[74]

These ideas revolutionized the study of soils in the United States. "We had been groping for a long time in the dark," Marbut wrote, "and had realized . . . that the basis of our broad grouping was naturally insufficient, but we had not yet worked out a means of improving it."[75] Dokuchaiev's insights caused the Bureau of Soils to shift its emphasis, as Marbut wrote, to "the study of the soil itself rather than on the study of the geological material beneath the soil." In other words, soils should be understood not merely the product of decomposed rock, but as unique organic body with their own natural history. The fact was, Marbut wrote, a soil is "so profoundly changed in becoming a soil that it differs in a great many respects, and to a very great extent from its parent geologic material." He continued each soil type has "characteristics of its own which have been superimposed or impressed upon it since the material out of which it has been made was a geological formation." This was Marbut's great

[74] Konstantin Dmitrïevich Glinka, *Die Typen de Bodenbildung: Ihre Klassifikation und Geographische Verbreitung* (Berlin: Gebrüder Borntraeger, 1914); Glinka, *Dokuchaiev's Ideas in the Development of Pedology and Cognate Sciences* (Leningrad: Academy of Sciences of the Union of Soviet Socialist Republics, 1927). Another significant work of Russian soil science is Emil Ramann, *The Evolution and Classification of Soils* (Cambridge: W.W. Heffer & Son's, 1928).
[75] Marbut quoted in Weber, *The Bureau of Chemistry and Soils*, 91.

contribution to American pedology; to show that soils should be studied as soils.[76]

The most immediate result of the revelations introduced by the Russians was to render the idea of the soil province obsolete."[I]t was realized," Marbut wrote, " that the soils of the Glacial and Loessial provinces were much widely different in their characteristics in different parts of this province than many soils in two entirely different provinces. Realizing this, it was forced upon our recognition that such a soil province differentiation has no scientific value."[77] After 1921, the soil province was discarded into the scientific scrap bin. In its place Marbut began to develop a natural system of soil classification that followed Glinka in considering multiple factors in soil genesis as revealed in the soil profile. As Marbut wrote, "[a]s long as the student of the soil in the field was impressed with the idea that soil differentiation depended to a great extent on the character of the geological formations from which the soil had developed, he would be inclined to study the geology of the region rather than the soils."[78] This realization provided the foundation for the development of modern soil science in the United States. "Soil science has become soil science with its own methods, its own point of view and generalizations based on its own facts, and not facts brought in from some outside, even though, closely related source."[79]

The new system of classification jettisoned the concepts of soil series and soil province and replaced it with groupings of soils into orders

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[76] Weber, The Bureau of Chemistry and Soils: Its History, Activities, and Organization, 91.
[77] Curtis Marbut quoted in Weber, *The Bureau of Chemistry and Soils,* 93.
[78] Ibid, 93-94.
[79] Ibid, 99.

differentiated by the processes that form them. The new system of soil classification, however, the soil type as its basic unit. The soil type embodied local conditions of a specific place. In time it would come to serve as a kind of shorthand for the capabilities of land. As such it would be key concept for planning land use.[80]

Figure 7. Employees of the Bureau of Soils pictured on the National Mall in Washington, D.C., circa 1922. Milton Whitney stands front and center. Hugh Bennett is pictured directly behind Whitney. (NARA, RG 16-G-2619).

Throughout the early history of the soil survey, there was a tension between its scientific mission to identify and classify the soils of the country and the economic applications of this knowledge. While the primary job of the soil survey was simply to identify, classify, and map the different types of soils

[80] An explanation of Curtis Marbut's ideas on soil classification can be found in Marbut, "Geography at the First International Congress of Soil Science," *Geographical Review* 17 (October 1927): 662-663, and "Soil Classification," in *Soils of Cuba* (Washington: Tropical Plant Research Foundation, 1928), 341-357. See also Cline, "Soil Classification in the United States," 3-7.

encountered in the field, soil surveyors often found themselves in a position to interpret their field observations to make recommendations for the best uses of different soil types. When Curtis Marbut took over the survey, he discouraged field staff from making such interpretations, asking them instead to mind the distinction between describing the characteristics of soil and prescribing their uses. The description of soils was a scientific endeavor; while prescriptions for use was an inherently interpretative exercise subject to bias, best left to others. This was a fine distinction, though, for the economic applications of this work were never far removed from the scientific aspirations of those who produced it. The early soil surveys are filled with suggestions to farmers for how to use their land.

The interpretation of soil surveys was a role that Hugh Bennett embraced in his role as Inspector for the Southern Division. Promotion of the correct use of soils based on the capabilities of soil types a the central theme of his career. Early on this knowledge was used for economic purposes. As he wrote in 1909, shortly after his promotion to the position of Inspector, each soil series contains "upwards of a dozen types of soil," each of these "differing from the other in crop adaptation and value." A central purpose of the soil survey, he wrote, was to encourage agricultural specialization based on the different characteristics of soil types. These different soil types should be used for different purposes depending on their unique qualities and agricultural potential. Knowledge about the capabilities of different soil types should provide a template for organizing its use. This was the foundational idea of modern soil conservation in the United States.

Erosion and the Soil Survey

The Bureau of Soils' official view of erosion during this period was colored by the scientific stances of the Bureau's chief. Season after season soil surveyors cataloged the extent of erosion throughout the South and the country as a whole. Through the Bureau of Soils efforts to systematically map and classify the soils of the United States, it became possible, for the first time, to construct a picture of the scope and severity of soil erosion, initially at the scale of individual counties, and eventually at the regional and national scales. Still, erodibility was just one of many characteristics of soils observed by the soil surveyors in the field, and it was relatively low on the hierarchy of concerns for the Bureau of Soils. This was due in part to the emphasis placed by the bureau chief Milton Whitney's idiosyncratic theories about the relationship between soil texture and fertility.

In 1909, Whitney infamously wrote that "soil is the one indestructible immutable asset that the nation possesses. It is the one resource that cannot be exhausted that cannot be used up."[81]According to his doctrine all soils contained all of the chemical nutrients needed for plant growth in unlimited amounts. "I have never in my experience seen a case in which one could say with any degree

[81] Milton Whitney, "Soils of the United States," U.S. Department of Agriculture, Bureau of Soils, *Bulletin* 55 (1909), 66; Bennett, "The Future of Our American Land," 7.

of certainty or even of probability that exhaustion was due to the actual removal of plant food," he testified to the U.S. Industrial Commission in 1901.[82]

For this theory to be true, Whitney had to explain obvious declines in crop yields over time. If soil texture remained constant and if all soils in their natural states contained all the nutrients they needed in unlimited amounts, then there must be some other reason why fields become exhausted. To fill this lacunae, Whitney invented what he called "soils toxins," as a sort of invisible force that must exist for his theory to be true. As he wrote in 1909, "[w]e have proved in this way, by a large amount of investigative work upon worn-out soils from all parts of the country, that infertility is often due to the presence of toxic organic bodies in the soil, either execrated by the previous crops or perhaps formed by the action of bacteria, molds, or ferments from the plant remains."[83]Decreases in crop yields over time were not a result of the gradual loss of nutrients taken up by plant growth, but an effect of toxic compounds released into the soil by continuous cropping.

Whitney's views on soil were conceived, in part, in response to the theories of the German chemist Justus von Liebig, who in 1840, with his book *Chemistry in its applications to Agriculture and Physiology* laid the foundation for modern conceptions of soil fertility as a product of chemical nutrients in the air and soil. While Liebig made a case for the chemical basis of fertility to the

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[82] "Exhaustion and Abandonment of Soils; Testimony of Milton Whitney before the Industrial Commission," U.S. Department of Agriculture, *Report* 70 (1901), 4.
[83] Whitney, Soils of the United States, 1909, 64. For Whitney's explanation of his theory of soil toxins, see Whitney and Frank K. Cameron, "The Chemistry of the Soil as Related to Crop Production," U.S. Department of Agriculture, Bureau of Soils, *Bulletin* 22 (1903). See also Brink, *Big Hugh*, 57.

exclusion of physical soil characteristics that bear on agriculture. Whitney's ideas, on the other hand, argued for the salience of the physical characteristics of soils rather than the chemical characteristics of soils that determined their fertility. [84]

Whitney's ideas were controversial at the time they were propounded. In a dispute over them, the soil scientist Eugene W. Hilgard attempted to have Whitney removed from his post as Chief of the Bureau of Soils. For the same reason, the state of Illinois refused to cooperate in the work of the U.S. Soil Survey as a result of disagreement between Whitney and Cyril Hopkins the head of the state experiment station.[85] Whitney's ideas also caused dissension within the ranks of the Bureau of Soils. His theories would eventually be proven false as more sophisticated techniques of laboratory analysis demonstrated beyond doubt the essential role of chemical nutrients in plant growth, but, until the 1920s, they exerted a distorting influence over the work of the Soil Survey, which, at best, caused surveyors to discount the significance of erosion observed in the field and, at worst, made the Bureau of Soils complicit in the destruction of millions of acres of farm land.

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[84] Simonson, "Historical Aspects of Soil Survey and Soil Classification, Part I, 1899-1910," 5-8; Helms, "Early Leaders of the Soil Survey," 22-23; and Gardner, *The National Cooperative Soil Survey of the United States*, 26-27.

[85] McCracken and Helms, "Soil Surveys and Maps," 279-280.

Figure 8. Image of severe gully erosion in the Cane Hills region of Mississippi c. 1900 from the Soil Survey of the Yazoo Area, Mississippi in the *Field Operations of the Bureau of Soils, 1901.*

That said, it should be noted, that the Bureau of Soils was not entirely indifferent to the problem of erosion. Milton Whitney had acknowledged the destruction caused by erosion and the Bureau of Soils issued several bulletins on the topics.[86] The USDA published a bulletin for farmers on the topic, titled "Washed soils: How to Prevent and Reclaim Them" in 1894.[87] And in 1913, Whitney hired W. J. McGee to run an erosion investigation unit for the Bureau of Soils. McGee was a leading light in the progressive conservation movement, who had been a principal organizer of President Theodore Roosevelt's

[86] See "Exhaustion and Abandonment of Soils; Testimony of Milton Whitney before the Industrial Commission," 29. Late in his life Whitney authored a paper titled "Dynamic Forces Underlying Soil Erosion by Moving Waters," that sought to show the extent of erosional losses in the United States. See Milton Whitney, "Notes on Soil Erosion," RG 114, Entry 21, Miscellaneous Papers of H.H. Bennett, 1926-1934, Box 5, Folder "Notes on Soil Erosion" and Woods to Whitney, July 12, 1927, RG 16, Entry 37, Correspondence of the Director of Scientific Work, Volume 7, 429.

[87] "Washed Soils: How to Prevent and Reclaim Them," U.S. Department of Agriculture, *Farmers Bulletin* 20 (1894).

Governor's Conservation Conference in 1907. That year Milton Whitney, appointed McGee "to take up the important study of erosion or wash and sedimentation which has not hitherto been fully investigated" [88]McGee died in 1912 before he could see the work to fruition. The erosion investigation unit was shuttered. [89] It would take the development of a modern conception of soil science in the 1920s before erosion would be addressed. In the meantime soil surveyors in the field continued to catalog the extent of erosional damage in the countryside. In time, one of those surveyors, Hugh Hammond Bennett, would become the leading champion of soil conservation in the United States.

Hugh Hammond Bennett and Southern Land Use

If there is to be a central character in the story of soil and water conservation in the United States, then it is Hugh Hammond Bennett. Hugh Bennett's life has its beginnings in the North Carolina piedmont where it is bound up with the history of the southeastern United States, its people, and the use of land in the decades after the Civil War. He was born the eighth of nine children to Rosa May Hammond Bennett and William Osborn Bennett in the family home on Brown Creek in the watershed of the Pee Dee River near Wadesboro in Anson County, North Carolina, on April 15, 1881.

Hugh Bennett's father, William Bennett, was the proprietor of a large plantation located in the rolling Piedmont landscape. Slaves worked the Bennett

[88] Quoted in Helms, "Early Leaders in the Soil Survey," 28.
[89] See W.J. McGee, *Soil Erosion*, U.S. Department of Agriculture, Bureau of Soils, *Bulletin* 71 (Washington: GPO, 1911); Emma R. McGee, *Life of W.J. McGee* (Cedar Rapids, Iowa: The Torch Press, 1915).

plantation before the war, and many stayed on as tenants in the decades that followed. Before the Civil War, Anson County was the leading cotton producing county in the South. Cotton remained the major cash crop in Anson county through the 1920s. Cotton provided the Bennett family a steady cash income and secured them a relative status and affluence for their time and place. The family worshipped with the rural gentry at the Episcopal Church in Wadesboro and each of the Bennett children was "sent to college solely on the proceeds of the plantation."[90]

The 1890s the decade during which came of age was a period of acute economic hardship across the United States. The Panic of 1893, triggered by the failure of over-leveraged railroads and subsequent bank runs, marked the beginning of the most severe economic crisis in American history up to that point. Hard times were particularly acute in the South. Cotton prices, which had been in a slow decline since 1880, reached all-time lows and hovered there through the decade. Bennett remembered it as a "long lean ten years."[91] With

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[90] The last quote can be found in Bennett, "Back to the Farm," c. 1932, NARA, RG 114, Entry 21, Box 2, "Sandy Bottoms," 4. Anecdotes about former slaves on the Bennett plantation can be found in Wellington Brink, *Big Hugh: The Father of Soil Conservation* (New York: The MacMillan Company, 1951), 34; Jonathan Daniels "Hugh Bennett" *The Land* 1 (Winter 1941): 5-10. Substantially the same piece was published as a chapter in Daniels, *Tar Heels: A Portrait of North Carolina* (New York: Dodd, Mead, and Company, 1941), 174-191. See also Douglas Helms, "Hugh Hammond Bennett" in *Modern American Environmentalists: A Biographical Encyclopedia* eds. George A. Cevasco and Richard P. Harmond (Baltimore: The Johns Hopkins University Press, 2009). For cotton culture in North Carolina, see Helms, "Revision and Reversion: Changing Cultural Control Practices for the Cotton Boll Weevil" *Agricultural History* 54, 1 (1980): 108-125.

[91] Quote is from Bennett, "Back to the Farm," 4. See also Daniels "Hugh Bennett" *The Land* 1 (Winter 1941), 6. See also Gilbert C Fite, "Southern Agriculture Since the Civil War: An Overview," *Agricultural History* 53 (January, 1979): 11; Richard White, *Railroaded: The Transcontinentals and the Making of Modern America* (New York: W.W. Norton & Company, 2011), 393; C. Vann Woodward, *Origins of the New South*, 1877-1913 (Baton Rouge: Louisiana State University Press, 1951); and Edward L. Ayers, *The Promise of the New South: Life After Reconstruction* (New York: Oxford University Press, 1992).

cotton prices down, the Bennett plantation turned production operations inward to meet subsistence needs. The large extended household managed the day-to-day operations of the plantation. Its fields produced corn, wheat, and vegetables for the home kitchen. Hogs, chickens, and some cattle provided meat, eggs, milk. Its blacksmith shop forged plowshares and fashioned scrap iron into nails and staples. Cotton was ginned and compressed for knitting homespun cloth and for sale, "largely on the surplus side of the farm ledger." This was a form of self-sufficient agriculture that could take advantage of the market when opportunity presented itself, but was not reliant upon it. The key to success in agriculture, he would write, is "self containment with respect to primary necessities." For the rest of his life Bennett would hold on to the self-sustaining mixed-production agriculture he remembered from his youth as an ideal to which the country should aspire. He would come to see soil conservation to re-create his vision of a nation of self-sufficient yeoman. It is an irony of history that the soil conservation he advocated would become an instrument of agricultural modernization. agriculture[92]

To the extent that the Bennett plantation remained self-sufficient, it represented an exception to the trend of greater dependence on the market by southern farmers. Since the Civil War southern farmers had become increasingly dependent on cotton. Greater reliance on cotton also came with greater levels of indebtedness as farmers borrowed money at the beginning of each season to buy the fertilizers and amendments necessary for a profitable crop. In this system of

[92] See Bennett, "Back to the Farm," 4-6; ibid., "The Hugh Bennett Lectures" (Raleigh: The Agricultural Foundation Inc., North Carolina State College, 1959). See also Swain, *Federal Conservation Policy, 1921-1933*, 146 and Wellington Brink, *Big Hugh*, 31-.

agriculture, the capacity of the soil was not as important to the planter as fresh land. Once land became unproductive it was left to return to brush or pine.

Southern planters needed to clear forest and open new lands to cultivation in order to maintain production at constant levels. They chose to employ labor, often tenant farmers, to put larger expanses into production rather than cultivate a more limited area more intensively using conservation farming techniques. This dependence on one crop agriculture locked the South into a system of debt tenancy that fed a mutually reinforcing cycle of poverty for people and soils alike. While Bennett would in time come to equate dependence on the market with abuse of the land, While Bennett would tell these stories to celebrate the virtues of economic independence, he also implicates himself in the destructive system of southern land use that he condemns.[93]

Bennett was the fifth of six sons, two of whom had left home by the mid-1890s. As he grew older much of the day-to-day work of the plantation fell on his shoulders. As a teenager he led work teams often comprised of members of his extended family and the sons of former slaves on his father's plantation, who lived as tenants on Bennett lands. Routine labor on the plantation involved the clearing of land to bring it into cultivation. Much later in his life, he recounted an episode from this time to the writer and newspaper editor Jonathan Daniels. At the age of fifteen, Bennett and the son of a tenant a few years older than himself named Watt Gaddy were sent to clear some twenty or thirty acres of

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[93] Bennett, "Back to the Farm," 4-6; ibid., "The Hugh Bennett Lectures," 11. See also Stoll, *Larding the Lean Earth*, 127-134; Steven Hahn, *The Roots of Southern Populism: Yeoman Farmers and the Transformation of Georgia's Upper Piedmont, 1850-1890*, 2nd edition (New York: Oxford University Press, 2006), 142-152; and Ted Steinberg, *Down to Earth: Nature's Role in American History* (New York: Oxford University Press, 2002), 71-73.

forested hill and bottom land. He told the story later in life, Bennett recalled how he, swinging an ax with his left hand, and Gaddy, swinging an ax with his right, raced to see who would be the first to strike his blade through the heart of the tree. Together they pushed up steep slopes, chopping timber so the hillside could be put into cotton and the wood could be sold at market. Much of this particular piece of land, like countless others in the Piedmont, had been cleared of its native mixed hardwood and pine forests decades before, cultivated for a few seasons, and then abandoned once its soils became exhausted and crop yields fell. The reforestation of such land would, in time, become a cornerstone of soil conservation, but in the 1890s land was cleared when it was needed Years later Bennett told Jonathan Daniels how he had returned to this tract as an adult to find that "terrific changes had taken place." The "magnificent oaks, hickories and forest pine" that once covered the landscape were gone, in their place were "exposures of rock in the field." Old fields were cut up by gullies and stream bottoms filled with sediment.[94]

In the Fall of 1897, Hugh Bennett entered the University of North Carolina at Chapel Hill. As a student he scored high marks in history and English in an early display of the aptitude that would manifest itself again in the prolific writings he produced throughout his career. Bennett's academic focus, however, primarily was the subjects of chemistry and geology. After a two year interruption in his studies, a result of low cotton prices, Bennett earned his

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[94] Accounts of this incident can be found in Daniels, "Hugh Bennett," 9; and Brink, *Big Hugh*, 34-38. See also Helms "Contributions of the Soil Conservation Service to Forest Science" in *Forest and Wildlife Science in America: A History*, ed. Harold K. Steen (Durham: Forest History Society, 1999), 72-74.

University degree in 1903 with a senior thesis written on the "Deportment of Zirconium with Organic Acids." During his time at North Carolina, Bennett came under the tutelage of Collier Cobb, a professor of geology on the university faculty who had studied with Nathaniel Southgate Shaler at Harvard. Cobb had begun to teach courses on soils and soil surveying at the behest of the North Carolina State Department of Agriculture. North Carolina was an early leader in the use of soil science in agriculture.

The state experiment station had begun research in 1899 on the characteristics and capabilities of the different types of soil in North Carolina; to determine the crops, fertilizers, and amendments best adapted to each of the state's soils. These were the first experiments of their kind in the United States. From Cobb, Bennett became acquainted with the formal study of soils and learned of job opportunities in soil surveying. After graduation, Bennett was offered a position at the U. S. Department of Agriculture's Bureau of Soils laboratory. He accepted but before he could travel to Washington, D.C., to take the position, he was asked to join the soil survey of Davidson County, Tennessee, scheduled for that summer. In his words that decision, "fixed my life's work in soils." What was initially a temporary assignment became a career. "Having been reared amongst cotton fields, with the amenities of plantation life, soil surveying being strictly outdoors work, was my line."[95]

[95] Last quote is from Bennett, "The Hugh Bennett Lectures," 12; Bennett, "Deportment of Zirconium with Organic Acids," Undergraduate Thesis, University of North Carolina, 1903. For the significance of the North Carolina state soil survey see, Bennett, "The Relation of the Soil Survey to the Utilization of Southern Soils," *Journal of the American Society of Agronomy* 16 (July 1924): 422-423 and C.B. Williams, "How the Soil Survey is Proving Most Valuable to North Carolina," *Journal of the American Society of Agronomy* 16 (July 1924), 447. For Collier Cobb see Helms, "Early Leaders in the Soil Survey" in *Profiles in the History of the Soil Survey*,

In early 1905, Milton Whitney, Chief of the Bureau of Soils, assigned Hugh Bennett and William E. McLendon, another young surveyor from the Southeast, to survey Louisa County, Virginia. Louisa is located in the central Virginia piedmont about half way between the tidewater region and the Blue Ridge mountains. It has a gently-rolling, naturally-forested landscape that is drained by many water courses; the largest of these, the North and and South Anna rivers flow into the Chesapeake Bay. Louisa was not dissimilar from Bennett's Anson County or McClendon's home in Lee County, South Carolina, or, for that matter many other places in the southern Piedmont. Louisa also had a reputation for poor soils. In his instructions to the survey party, as Bennett recalled, Milton Whitney asked them to ascertain the reasons why.[96]

In 1905, Louisa was indicative of a burgeoning prosperity in the American countryside. The depression of the 1890s was over and American farmers were experiencing the first few years of what would in hindsight be called a golden age of agriculture in the United States. The dramatic expansion of agricultural production that had taken place in the decades since the Civil War had slowed. At the same time, population growth continued unabated as immigrants from the countryside and foreign nations alike filled American cities with hungry mouths. The major result was to reverse the long decline of the real value of farm products as demand for them outpaced supply for the first time in

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Helms, Anne B.W. Effland, and Patricia J. Durana, eds. (Ames: Iowa State Press, 2002), 34-41 and Eric C. Brevik, "Collier Cobb and Allen D. Hole: Geologic Mentors to Early Soil scientists," *Physics and Chemistry of the Earth* 35 (June 2010): 887-894.

[96] See Bennett, "The Cost of Soil Wastage," June 15, 1932, NARA, RG 114, Entry 21, Box 1, Folder "Lectures on Soil Erosion; Its Extent and Meaning and necessary measures of control," 2. See also Brink, *Big Hugh*, 56.

decades. Gross income for the American farmer doubled and the value of the average farm tripled between 1900 and 1920. Bennett and McClendon's observations of Louisa County reflect the general trend of rising agricultural prosperity in the country. They observed a good standard of living for Louisa farmers. More than two thirds of whom owned their land free of encumbrances, and were said to "make a comfortable living, and have generally substantial homes."[97]

Louisa County had experienced the cycles of southern land use. First settled in the eighteenth century, it was an early center of Tobacco production. Continuous cultivation of tobacco— "without rotation or manuring," as Bennett and McClendon noted—led to a decline in the productiveness of county soils during the antebellum period. Like elsewhere in the South, planters in Louisa compensated for exhausted soils through an extensive mode of agriculture that relied on slave labor to bring new field into production on land often located on steep hillsides.

When virgin land became scarce, growers experimented with deep plowing to break up the sub-soil layers for cultivation, and applied "Peruvian guano" and "plaster" to add missing nutrients to their fields. In the decades after

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[97] Hugh H. Bennett and W.E. McLendon, "Soil Survey of Louisa County, Virginia" in *Field Operations of the Bureau of Soils, 1905* (Washington: GPO, 1907), 193, 209-210. For a discussion of the rising prospects of American farmers in the first two decades of the twentieth century, see David Danbom, *Born in the Country: A History of Rural America*, Second Edition (Baltimore: The Johns Hopkins University Press, 2005), 163-165. See also James H. Shideler, *Farm Crisis, 1919-1923* (Berkeley: University of California Press, 1957), 4. For a discussion of the place of agriculture in the political economy of the Gilded Age, see Richard Franklin Bensel, *The Political Economy of American Industrialization, 1877-1900* (New York: Cambridge University Press, 2000), 19-100. For a discussion of land tenure in the South, see Edward L. Ayers, *The Promise of the New South: Life After Reconstruction* (New York: Oxford University Press, 1992), 195-198. For quotations see Bennett and McClendon, *Soil Survey of Louisa County*, 196.

the Civil War, "[l]ack of capital" and the "disorganization of labor" caused the abandonment of large areas of cleared land, which subsequently had grown up in old field pine. What land left in cultivation was divided up into small holdings, averaging about a hundred acres in size. In their survey, Bennett and McClendon noted how "the soils of the county as a whole are rather less productive than the average for piedmont soils." They were known for the "extreme poverty of their organic content" and general "unhealthiness." They diagnosed the problem "a lack of labor and capital" to improve the land to its potential.

This was due, in large part, they wrote, to broad demographic shifts taking place in Louisa and across the South. As the surveyors wrote, "the tendency among young men seems to be to take up other occupations or professions rather than agriculture," and "[m]ost of the able-bodied colored labor has drifted to the cities or is employed on public works, railroad building, and in the mines." These observations reflect a changing economic reality in the South as the extensive form of agriculture practiced throughout the nineteenth century gave way to a more "intensive treatment of a relatively restricted acreage with subsequent increased crops yields."[98]

Through a close reading of the soil survey of Louisa County it is possible to discern the emergence of an understanding of another reason for the diminuition of soil productivity: namely, the loss of the soil itself through

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[98] Bennett and McClendon, "Soil Survey of Louisa County," 210-211. For an overview of tobacco agriculture in the Tidewater see Avery O. Craven, *Soil Exhaustion as a Factor in the Agricultural History of Virginia and Maryland, 1606-1860* (Champaign: University of Illinois Press, 1925; repr., Columbia: University of South Carolina Press, 2006), 30-33

erosion. Louisa lacked the gullying common elsewhere in the Southern piedmont, thanks, in part, to "extensive forested areas," along the higher elevations that "liberate the heavier rains much more gradually than otherwise would be the case." But, with this exception, Bennett and McClendon observed almost the whole train of erosion processes at work in Louisa. Converting forests to tobacco and wheat fields on sloping hillsides increased the amount of runoff from rain showers washing into the numerous streams that drain the rolling landscape.

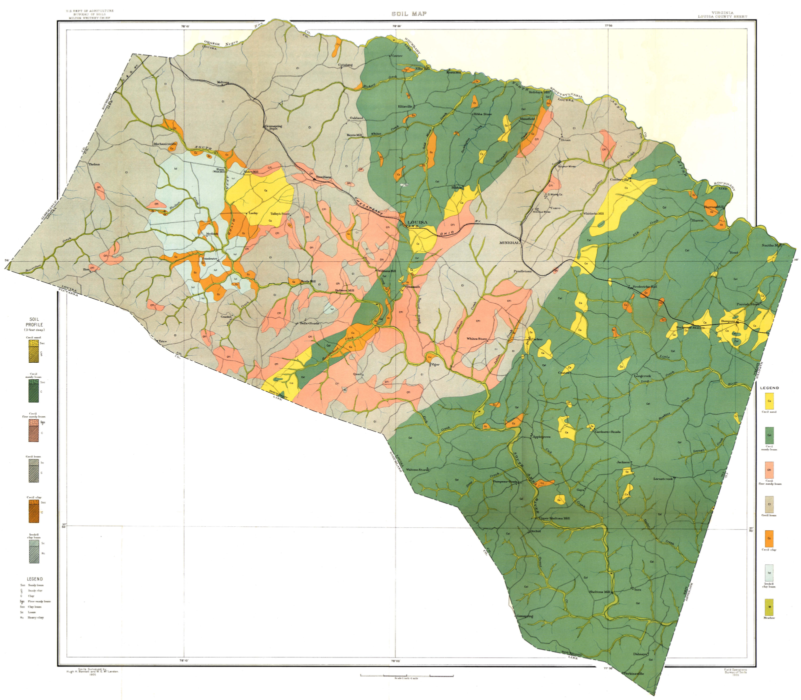

Figure 9. Soil survey map made in 1905 showing the major soils types identified in Louisa County. The soil types shown by color are *Cecil sandy loam* (green), *Cecil loam* (brown), and the *Iredell clay loam* (blue).

Over time water flowing over cleared fields carried away layers of topsoil leaving the "surface soil shallowed" and "in places removed" with "the subsoil clays exposed." The problem was particularly severe on the Iredell clay loam—where, in places, "the soil covering of slopes has been washed off"—and the Cecil loam soils, which had been cut into by the many streams that flow into the North Anna and South Anna rivers. Water courses that were "merely spring branches along the divides, deepen rapidly as they near the rivers, where the valleys are from 150 to 250 feet deep," producing "a decided disfiguration of the once more level, surface" by stream channels cutting downward to accommodate larger volumes of water during high flow events.

Soil particles washed downstream filled valley floors with sediment converting "considerable areas of former good cultivable lands" into a "marshy, untillable [sic] condition." Classified as "meadow," these lands were potentially the best corn lands in the county, but "[o]wing to a failure to keep the lower courses of many of the streams open, coupled with a neglect of the adjacent slope soils," flood plains in the county had become "forested with water loving trees and shrubs."[99]

The soil survey of Louisa County, Virginia, is a prominent episode in Hugh Bennett's career. Later in life Bennett would often claim that it was in Louisa where he first understood how erosion changes the landscape.[100] What Bennett saw was that without forests or other kinds of plant cover to hold the

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[99] Ibid., 194-95. A classic descriptions of physical processes involved in stream bed erosion is Stafford C. Happ, Gordon Rittenhouse, G.C. Dobson, "Some Principles of Accelerated Stream and Valley Sedimentation," United States Department of Agriculture, Technical Bulletin 695 (May 1940). A more modern text on the same subject is S.A. Schumm, M.D. Harvey, and C.C. Watson, *Incised Channels: Morphology, Dynamics and Control* (Littleton, Colorado: Water Resources Publications, 1984). A good primer on river sediment load dynamics is Luna B. Leopold, *A View of the River* (Cambridge: Harvard University Press, 1994), 5-10, 186-197. Another useful text is Jeffrey F. Mount, *California Rivers and Streams: The Conflict between Fluvial Process and Land Use* (Berkeley: University of California Press, 1995).

[100] The story of Hugh Bennett's epiphany about erosion in Louisa County is a central episode in the narrative of his life. See Bennett, "The Cost of Soil Wastage," June 15, 1932. See also Swain, *Federal Conservation Policy*, 146-147.

earth, a layer of topsoil was washed away with every rainfall, carried away by sheets of water flowing over clean-tilled fields.

This "soil washing" or "sheet erosion," as it would come to be known, was apparent only after the passage of time in the shallow topsoil of cultivated fields when compared with the deep soil profiles of adjacent forested areas. In Louisa, Bennett wrote, "[w]here the land had never been cleared a good depth of mellow loam or sandy loam topsoil was invariably present," but "in practically every sloping field which had been in cultivation long enough for the stumps to have disappeared neither loam nor sandy loam was found as a rule." What was left was the tell-tale sign of sheet erosion, bald spots in the fields of exposed subsoil. [101]

Bennett had observed the same phenomena, "severe erosion of sloping areas," in Hanover County, Virginia, and the year before he had noted "severe washing and gullying" in Appomattox County, Virginia. And he had seen the same process at work at his home in Anson County, North Carolina.[102]

Through these experiences, Bennett claimed to have grasped not only the cause of Louisa's reputation for poor soil, but, in time, a major reason for agricultural poverty across the South. The cause was human abuse of the land.

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[101] This quote comes from Hugh Bennett, "Lectures on Soil Erosion: Its Extent and Meaning and Necessary Measures of Control," November 4, 1932, RG 114, Entry 21, Box 1, Folder "Lectures on Soil Erosion," 2. See also Daniels, "Hugh Bennett"; Bennett, "The Future of Our American Land" *Soil Conservation* 16 (1950), 6-7; Brink, *Big Hugh*, 55-57; H.E. Waldrop, "A Tireless Worker," *Soil Conservation* 22 (1956), 112; and Bennett, "The Hugh Bennett Lectures," 12. For early references to sheet erosion, see J.A. Udden, "Loess as a Land Deposit" *Bulletin of the Geological Society of America* 9 (1898), 8. See also N.M. Fenneman, "Some Features of Erosion by Unconcentrated Wash," *Journal of Geology* 16 (November-December, 1908).
[102] See also Bennett and W.E. McClendon, "Soil Survey of Hanover County, Virginia," *Field Operations of the Bureau of Soils, 1905* (Washington: GPO, 1907), 235. Thomas A. Cain and Hugh H. Bennett, "Soil Survey of Appomattox County, Virginia" in Field Operations of the Bureau of Soils, 1904 (Washington: GPO, 1905), 152.

From this insight Bennett began to understand that these environmental changes were not merely local in extent. The culprit was a whole sequence of events--baring the soil with a plow, erosion, and sedimentation; these had transformed the upland South.

Erosion was evident to anyone who visited the rural South in the decades after the Civil War in bare fields and spectacular gullies. In 1891, Nathaniel Shaler had written that the in the hilly parts of the southern states there is scarcely a county where "the true soil has been allowed to wash away, leaving exposed to the air either bare rock or infertile subsoil" over areas several hundred acres in size.[103] The characteristics of the southern environment—its topography, climate, and soil types—made the region particularly vulnerable to erosion. The southern landscape was never glaciated, so the region did not benefit from the sheets of ice that had ground northern soils into their present state. Instead many southern soils are derived from granite, a hard rock that breaks down slowly and contributes few nutrients. In many places the topography is comprised of steep sloped hills. The warm climate bakes soils in the summer and leaves them bare of protective of snow cover—the "poor man's manure"—in winter.[104]

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[103] Shaler, "The Origin and Nature of Soils," 331-333. See also See Glenn L. Fuller, "Charting the Effects of Erosion in the Old Plantation Belt of the Southern Piedmont," *Transactions of the American Geophysical Union* 15 (1934), 495-500; Stanley W. Trimble, *Man-Induced Soil Erosion on the Southern Piedmont, 1700-1970* (Ankeny, Iowa: Soil Conservation Society of America, 1974); Arthur R. Hall, *The Story of Soil Conservation in the South Carolina Piedmont 1800-1860*, United States Department of Agriculture, *Miscellaneous Publication* 407 (1940); and R.O.E. Davis, "Soil Erosion in the South," U.S. Department of Agriculture, *Bulletin* 180 (1915).
[104] Shaler, "The Origin and Nature of Soils," 251.

More frequent and intense rains subjects southern soils to greater erosivity than other regions of the country, and the natural acidity of many southern soils types meant that farmers could not grow cover crops, like clover and Timothy grass, use to protect and improve soil. Southern soils are, in general, less suitable for intensive agricultural production than the soils in other regions of the country. The extensive system of cultivation practices in the South evolved as an adaptation to these conditions.[105]

While the natural characteristics of the southern environment were important factors in the exhaustion and erosion of southern soils, the condition of the soil did not determine the shape of the southern system of labor and land use. Acknowledging that land use in the South was an adaptation to conditions of the southern environment does not exonerate southerners from blame for exploitive land use and labor practices. After all, these practices discouraged investments in the long-term health of the land. Historians of the southern environment should not neglect the historically contingent cultural factors that have shaped land use in the region, but they should also understand the distinct characteristics of soils and climate that limited the range of uses to which southern soils could be profitably put.[106]

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[105] Helms, "Soils and Southern History," 730; John Majewski and Viken Tchakerian, "The Environmental Origins of Shifting Cultivation: Climate, Soils, and Disease in the Nineteenth-Century US South," *Agricultural History* 81 (Fall 2007), 522-549; Julius Rubin, "The Limits of Agricultural Practice in the Nineteenth-Century South," *Agricultural History* 49 (April 1975), 362-373; See also Albert Cowdrey, *This Land, This South: An Environmental History* (Lexington: The University Press of Kentucky, 1983); and Eugene Genovese, "Soil Exhaustion as a Historical Problem," in *The Political Economy of Slavery* (Middletown: Wesleyan University Press, 1989), 85-97.

[106] The role soils play in determining historically contingent outcomes is an important point of historiographical contention. To its critics, the argument that the character of southern soils determined the character of the southern land use is a sleight of hand that allows the South to

With each subsequent year in the field, soil surveyors produced more explicit observations of the damage caused by all phases of erosion. The 1910 soil survey of Lauderdale County, Mississippi, conducted in cooperation with the Mississippi Geological Survey noted severe gullying of the Orangeburg fine sandy loam soils. A soil type, with a texture similar to brown sugar that is "peculiarly susceptible to ruinous erosion under the conditions of rolling topography," resulting in "deep gorgelike gullies" that "gradually encroach upon cultivated fields" and "timbered areas." [107]

The 1910 soil survey of Fairfield County, South Carolina, found that soil erosion had severely damaged or ruined nearly half the county. This survey was one of the first attempts to measure quantitatively the extent of erosion in an area. Some 90,000 acres of the yellow clay soils in the Iredell series common in the southern Piedmont were mapped as "Rough gullied land," made "largely non-arable" by erosion "with a considerable part washed off to bed rock."

Another 46,000 acres of bottom lands, "formerly cultivated and highly productive" were mapped as "Meadow," or "essentially worthless swamp" ruined for agriculture by "the filling of the stream channels with the products of

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escape blame for exploitive labor and land use practices. This is an old criticism. In a 1936 review of Stuart Chases' *Rich Land, Poor Land*, a book that embodies the case for environmental determinism, the writer Malcolm Cowley takes Chase to task for "the neglect of social structure for what might be called an agronomic interpretation of history." See Cowley, "The Waste Land, " *The New Republic*, September 23, 1936, 187; and Chase, *Rich Land, Poor Land: A Study of Waste in the Natural Resources of America* (New York: Whittlesey House, 1936). For more recent discussions of environmental determinism and soil, see Eva-Maria Swidler, "The Social Production of Soil," 2-8; and Sutter "What Gullies Mean," 581-582.

[107] Bennett, Howard C. Smith, W.M. Spann, E.M. Jones, and A.L. Goodman, "Soil Survey of Lauderdale County, Mississippi," *Field Operations of the Bureau of Soils, 1910* (Washington: GPO, 1912), 733-784; Bennett, *The Soils and Agriculture of the Southern States* (New York: The MacMillan Company, 1921), 98; and Bennett, "The Future of Our American Land," *Soil Conservation* 16 (1950), 6.

erosion."[108]The survey of Stewart County on the coastal plain of Georgia, published in 1913, reported a similar story: 70,000 acres Susquehanna clay soils ruined, "the result mainly of erosion which has taken place since the land was cleared for cultivation," 36,000 acres were cut up with "deep gullies with steep or perpendicular sides on which no vegetation can find a footing."[109] Through a combination of very explotive land use practices and the natural vulnerability of southern soils, erosion took a similar toll across the upland South: 25,000 acres in Anson County, North Carolina; 38,000 acres in Lounds County, Alabama; 31,000 acres in Spartanburg, South Carolina. This list goes on. Every County in the Piedmont from Alabama to New Jersey encompassed areas of formerly cultivated land destroyed by erosion.[110]

Soil Type and Land Use

By the early twentieth century soil erosion was a widely understood phenomenon. But, the broader long term implications of soil erosion for agriculture were not widely appreciated by the country at large, even as erosion followed the frontier westward in the last decades of the nineteenth century and

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[108] M.E. Carr, F.S. Welsh, G.A. Crabb, R.T. Allen, and W.C. Byers, "Soil Survey of Fairfield County, South Carolina" *Field Operations of the Bureau of Soils, 1911*(Washington: GPO, 1913), 479-511. See also Bennett, "The Geographical Relation of Soil Erosion to Land Productivity," *Geographical Review* 18 (October 1928), 590; *Soil Conservation* (New York: McGraw-Hill Book Company, 1939), 74; "Development of Our National Program of Soil Conservation" *Soil Science* 64 (October 1947), 259-273; Bennett, "The Hugh Bennett Lectures," 15; and Brink, *Big Hugh*, 58.

[109] David D. Long and W.W. Burdette, "Soil Survey of Stewart County, Georgia," *Field Operations of the U.S. Bureau of Soils, 1913* (Washington: GPO, 1916). See also Bennett, "The Geographical Relation of Soil Erosion to Land Productivity," *Geographical Review* 18 (October 1928): 591. See also Sutter, "What Gullies Mean," 611-613.

[110] Bennett, "Lectures on Soil Erosion," 2-3; and ibid., "Memorandum Relating Basis for the Estimates of Erosion Loss," September 1930, RG 114, Entry 21, Box 1, Folder "Report for Congress on the Nat'l Program of Soil Erosion."

the first decades of the twentieth. When erosion was considered at all, it was considered an inevitable result of agricultural use, a cost of doing business, so to speak, and when business was good, as it was in the two decades after 1900, it was a cost that could be borne without sacrificing profits. In the meantime, erosion remained relatively low on the Bureau of Soils' hierarchy of concerns through this period, subordinated as it was to the larger priority of mapping and classifying the soils of the United States, and, increasingly, the correlation of soil characteristics with the uses to which they may be most economically put.[111]

Hugh Bennett played active part in the development of the soil survey. From the time he joined the Survey in 1903, Bennett took to the work quickly, both in the field, leading survey parties during the summer, and in Washington, during the fall and winter, when the results of the field season were reviewed and prepared for publication. During this time he demonstrated an aptitude for the analytical work required in the correlation and publication of the soil surveys. He personally authored most of the published reports of the surveys in which he participated.[112]

Increasingly, he was asked to take on other duties. In 1906, Bennett, along with other "field men of wide experience" was detailed to review all the survey reports made up to that point "to bring each soil into its proper place in the classification."[113] When Whitney reorganized the Soil Survey after the 1909

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[111] As Donald Swain has observed erosion was not specifically mentioned in the annual report of the Chief of the Bureau of Soils until 1927, well after the broader movement for soil conservation had begun. See Swain, *Federal Conservation Policy, 1921-1933*, 204.
[112] See Appendix 1 for a list of soil surveys authored or co-authored by Bennett between 1903 and 1910. These early soil surveys are available online at soils.usda.gov/survey/online_surveys/.
[113] Whitney, *Soil Survey Field Book, Field Season, 1906,* 3

field season, he promoted Bennett to the post of Inspector for the Southern Division of the Soil Survey. In this role he was responsible for overseeing the field parties deployed each season across eighteen southeastern states and integrating the results from these surveys into the national system of soil classification being developed by the Bureau of Soils. When the Bureau of Soils issued its *Soils of the United States* in 1913, Bennett authored the sections on the southern United States.[114] Through this work he developed a deep understanding of the character of capabilities of soils across the southeastern United States and in the process established himself as a leading national soils expert.[115]

The phase of Bennett's career as surveyor of southern soils is synthesized in his book *The Soils and Agriculture of the Southern States*. Published in 1921, its stated purpose was to emphasize and encourage "better use of the soils by using them more in accordance with their adaptations and requirements" as "a means of improving agricultural efficiency." To that end Bennett systematically described in technical prose the distribution and characteristics of every soil type in the South that had been identified by the Bureau of Soils up to that point.[116] Amid the minutiae of soil characteristics cataloged by Bennett is the germ of another idea. If knowledge of soil characteristics can used to determine the purposes for which soils are best adapted, then the converse is also true. Soil knowledge can be used to determine

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[114] Marbut, Bennett, Lapham, and Lapham, "Soils of the United States," 17-84, 221-380.
[115] Donald Swain downplayed Bennett's early career successes, writing, "Bennett's vigor and youthful eagerness labeled him, in the eyes of his superiors, as a promising but impetuous soil scientist. Advancement came slowly." On the contrary, I would argue that Bennett's advancement was swift. Swain, *Federal Conservation Policy, 1921-1933*, 146.
[116] Bennett, *The Soils and Agriculture of the Southern States* (New York: The MacMillan Company, 1921), vi.

purposes for which soils are *not* adapted. Some soils—like the Orangeburg sandy loam, the Susquehanna clays, or the entire the Lauderdale series—due to their physical qualities or location on steep slopes in hilly regions, are more vulnerable to soil erosion relative to other soil types. The soils should not be used at all. Instead erodible soil types should be taken out of agricultural production and instead put them into permanent timber.[117]

In July 1921, Bennett articulated these ideas in greater detail at the third annual southern forestry congress in Atlanta, Georgia. At the event, as an indication of his stature, Bennett shared the dais with Gifford Pinchot, the country's most famous forester, William Greeley, then Chief of the Forest Service, and Andrew M. Soule, President of the University of Georgia. Bennett's paper, titled "The Classification of Forest and Farm Lands in the Southern States" explicitly called for the use of soil type to classify lands better suited for forests than for agriculture. Throughout the southern states, he observed "there are here and there areas of eroded rolling lands and even of stony lands which are obviously not adapted to farming."

Such lands under prevailing systems of agriculture in the South would eventually be "completely and irreparably destroyed."[118]A prime example was the Susquehanna clay, a common soil type distributed across the coastal plain. This soil, Bennett told his audience, is unfit for agriculture. It "is difficult to till, penetration of plant roots is resisted and proper circulation of air and moisture is

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[117] Ibid., 98, 37.
[118] Bennett, "The Classification of Forest and Farm Lands in the Southern States" in *Proceedings of the Third Southern Forestry Congress, held at Atlanta, Georgia July 20-22, 1921* (New Orleans: John J. Weihing Printing Co., 1921), 74, 82.

hindered by the density of the clay, erosion works rapidly and disastrously on all unprotected slopes--in short, this is a very inferior grade of farm land." Such soil should instead by used for timber—"[p]ine trees succeed on it" and "incidentally protect the soil from washing, slowly adding humus and building up a surface soil upon which grass comes in and spreads over slopes that formerly consisted of extremely unproductive 'raw' clay." The same was true of the Lauderdale series, and the Orangeburg sandy loam, among others. These soils could be more profitably used for timber than for row crops. Agriculture should be limited to soils suited to that purpose. This idea that soil type should guide land use is the organizing principle of his professional career.[119]

Bennett's ideas about correct use of soil illustrate what are essentially the economic origins of private lands conservation, which during the first three decades of the twentieth century grew out of efforts to make American agriculture more productive by using scientific knowledge of soil type characteristics as a guide to land use planning decisions. In that time Bennett came to see a corollary to the axiom that soils should be put to the uses for which they are best suited.

That is soil types should not be used for purposes to which they are not suited. "When we know the soil types and where they occur, we are going to be in a much better position to do more good farming on good land and less bad farming on bad land."[120] In these observations is the germ of the concept of land use capability classification, which in time became the guiding principle of

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[119] Ibid., 71. See also Swain, *Federal Conservation Policy*, 1921-1933, 148 and Helms, "Land Capability Classification: The U.S. Experience," *Advances in GeoEcology* 29 (1997): 163.
[120] Bennett, "Using the Soil Correctly," *Farm Journal* 49 (December 1925): 50.

conservation planning in the United States. "Let's get the notion, even make an obsession of it," he would write, "that better soil usage—usage more nearly in accordance with the requirements of the soil type—is necessary to our present welfare and to that of our children's children."[121]

Soils Abroad and at Home

In 1907, Hugh Bennett had married Edna McCue, a young woman from Louisa County, Virginia. She died tragically two years later while giving birth to their daughter Sarah Edna Bennett. For Bennett, the day-to-day requirements of child rearing were not compatible with the peripatetic life of a soil surveyor. Young Sarah was left in Anson County to be raised on the Bennett family place by Hugh's brother Joe and sister Fannie.[122] In the wake of this personal tragedy, Bennett accepted the first of what would be a series of foreign assignments that over the next two decades would send him to locales throughout the Western Hemisphere to survey soils from the Arctic Circle to Central America and the Caribbean. The international phase of Bennett's early career is often overshadowed by the role he would later play as a key figure in the soil conservation movement in the United States, it is important, nonetheless, to consider for what his time abroad reveals about the development of ideas about soil and land use. Just as Bennett's soil surveys served to export American ideas

[121] Bennett, "The Relation of the Soil Survey to the Utilization of Southern Soils," *Journal of the American Society of Agronomy* 16 (July 1924), 428.
[122] L.H. Bailey, *RUS: A Register of the Rural Leadership in the United States and Canada* (Syracuse: Mason Printing Corporation, 1920), 42. See also Douglas Helms, "Interview with Hugh Hammond Bennett, Jr." 1997, Douglas Helms Collection, National Agricultural Library.

about agricultural modernization to the developing world, his experiences abroad would inform his ideas about the use of land in the United States.[123]

Bennett's first foreign assignment was a mission to the Panama Canal Zone in 1909. Created as an American possession by the Hay-Bunau-Varilla Treaty of 1903, the Panama Canal Zone comprised an area ten miles wide by fifty miles long stretching across the isthmus from the Caribbean to the Pacific Ocean. At the request of Colonel George W. Goethals, the U.S. Army Corps of Engineer officer in charge of the canal construction project, President William Howard Taft asked Secretary of Agriculture James Wilson to send a team of specialists to Panama to evaluate the agricultural potential of the region.[124]

Congress had recently passed legislation that allowed for the leasing of public lands in the Canal Zone and Goethals was hopeful that "with proper instruction and information lease holders should be able to secure sufficient returns to make the cultivation and settlement of the Canal Zone very attractive." Goethals was especially interested in securing a local supply of fresh vegetables to help sustain the more than 40,000 Panamanian, Chinese, and American workers engaged in the construction of the canal.[125] Goethals' initiative to develop local food production was part of a broader effort to improve living conditions for the workers in the Zone. In this connection, the

[123] Bennett's foreign sojourns have not received significant attention from scholars. Donald Swain touches on this aspect of Bennett's career, but does not explore its significance in great detail. Swain, *Federal Conservation Policy, 1921-1933*, 147.
[124] Taft to Secretary of Agriculture, July 13, 1909, RG 54, Records of the Bureau of Chemistry and Soils, General Correspondence, 1907-1927, Box 145, File 11782, Canal Zone.
[125] Goethals to Secretary of War, June 22, 1909, RG 54, Records of the Bureau of Chemistry and Soils, General Correspondence, 1907-1927, Box 145, File 11782 Canal Zone.

USDA sent Bennett and William A. Taylor, a crop specialist from the Bureau of Plant Industry, to Panama in November 1909.[126]

Bennett's task was to identify and map the soils of the Canal Zone. This was a different sort of challenge than the survey of southern soils. As he wrote to Milton Whitney, while there was "not a great variety of soils," they were "exceedingly hard to get at." There were no maps of the country available on which to base the survey and the few trails were "extremely bumpy and rough," and often impassable even on foot (never in buggy)." The survey identified only two soil types—a red clay covering three-fourths of Canal Zone and a black clay of alluvial origin. The resulting survey, along with William Taylor's report on the agricultural outlook in the region, was published as a USDA bulletin in 1911.[127]

In the course of his soil reconnaissance of the Canal Zone, Bennett made an important observation about the characteristics of some tropical soils that would shape his thinking about land use in the United States. "The strange thing to me," he wrote to Milton Whitney from Panama in November 1909, "is the very little erosion that has taken place." Even "in the patch clearings on hillsides

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[126] The classic history of the construction of the Panama Canal is David McCullough, *The Path Between the Seas: The Creation of the Panama Canal, 1870-1914* (New York: Simon and Schuster, 1977). See pages 410-427 for a discussion of the For a more critical view of the American presence in the Canal Zone, see Thomas D. Schoonover, *The United States in Central America*, *1860-1911: Episodes of Social Imperialism and Imperial Rivalry in the World System* (Durham: Duke University Press, 1991), 99-110, 135-141; and John Lindsay-Poland, *Emperors in the Jungle: The Hidden History of the U.S. in Panama* (Durham: Duke University Press, 2003).

[127] Bennett to Whitney, November 26, 1909, RG 54, Records of the Bureau of Chemistry and Soils General Correspondence, 1907-1927, File 11782, Canal Zone, Box 145; W. A. Taylor and H.H. Bennett, "The Agricultural Possibilities of the Canal Zone," U.S. Department of Agriculture, Office of the Secretary, *Report* 95, (1912).

too steep for horse travel, very little erosion has taken place."[128] Bennett would discover that the reason for such resistance to erosion was the fine and highly porous texture of these tropical soils.

Known as laterites, these soils form under the intense conditions of weathering that occur in the tropics, which thoroughly decomposes the parent rock material. A result of this extensive weathering is that individual soil particles develop, as Bennett wrote, "a state of flocculation that prevents the filling up of the soil pore space." A result, was "a most desired mellowness" and "ready passage of rain water."[129]This physical characteristic of tropical soils meant water did not run off them in the same way as it would from similarly situated soils in the United States. Instead because of the microscopic pore space between "floccules" water was instead absorbed almost completely by them. "Soils of large areas of Central America," he wrote, "are of such a character that they do not 'wash' at all like soils on the land of the same relief in the humid parts of the United States."[130] These were observation that Bennett would make over and over again throughout the Central America. In time it would form the basis for an understanding of soil erosion as a form of American exceptionalism.

During WWI, Bennett received a commission as First Lieutenant in the Army Engineering Corps. He served stateside until 1919 and continued on as an Army Reserve Captain until 1929. After the War he traveled more frequently to

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[128] Bennett to Whitney, November 26, 1909.
[129] Bennett, "Agriculture in Central America," Annals of the Association of American Geographers 16 (June 1926), 65-66; Ibid., "Some Comparison of the Properties of Humid-Topical and Humid-Temperate American Soils; With Special Reference to Indicated Relations Between Chemical Composition and Physical Properties," *Soil Science* 21 (May 1926): 349-375
[130] Bennett, "Agriculture in Central America," *Journal of the American Society of Agronomy* 17 (1925), 318.

Central America. In 1919 Bennett and Curtis Marbut were sent to survey the contested borderlands between Guatemala and Honduras to provide definitive information on the topography and economic resources of the area at the behest of the International Boundary Commission created to arbitrate the dispute.[131] Bennett returned to the region in 1923 as part of an expedition sent by the U.S. Department of Commerce to scout locations for cultivation of *Hevea brasiliensis,* the Pará rubber tree, throughout Central America.[132]

While Bennett's missions to Central America had ostensibly official purposes, some of their most important beneficiaries were large pineapple, banana, and sugar cane growers. In 1923 and 1924 Bennett made soil surveys of the United Fruit Company's pineapple plantation at Columbiana, Costa Rica, and its banana plantations in Panama. In Guatemala, he inspected a sugar cane plantation owned by the country's Secretary of Agriculture.[133] These surveys of the region were explicitly directed at bringing land into cultivation for export agriculture. It turned out that many of the same characteristics that make tropical soils resistant to erosion also make them well-adapted to agriculture. These are "rich soils in most cases, producing without fertilization of any kind good crops of corn, bananas, plantains, beans, coffee, cacao, and a large number of tropical

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[131] See Brink, *Big Hugh*, 62-64; Weber, *The Bureau of Chemistry and Soils*, 78. F.C. Fisher "The Arbitration of the Guatemalan-Honduran Boundary Dispute," *The American Journal of International Law* 27 (July 1933): 403-427; "The Guatemala-Honduras Boundary" *Geographical Review* 23 (April 1933): 306-309.

[132] Bennett, J.C. Treadwell, C.R. Hill, "Possibilities of Para Rubber Production in Northern Tropical America," U.S. Department of Commerce, Bureau for Foreign and Domestic Commerce, *Trade Promotion Series* 40 (1926); "The Government Study of Rubber Production" *Geographical Review* 17 (July 1927): 523-524. See also Mark R. Finlay, *Growing American Rubber: Strategic Plants and the Politics of National Security* (New Brunswick: Rutgers University Press, 2013).

[133] Hugh H. Bennett, "Some Geographic Aspects of Western Ecuador" *Annals of the Association of American Geographers* 15 (September 1925), 126-147; Hugh H. Bennett, "Agriculture in Central America" *Annals of the Association of American Geographers* 16 (June 1926), 63-84.

vegetables and fruits."[134] The Fullest expression of Bennett's work about would come in Cuba, where he was sent in 1926 to Cuba to survey the soils and agricultural practices in the sugar producing areas of the island.

Sugar production had been a mainstay of the Cuban economy since the eighteenth century. The island's climate is ideally suited to the growth of the sugar cane plant. Its cultivation was the most profitable industry in Cuba until the outbreak of the Cuban war for independence from Spain in 1895, a conflict that crippled Cuba's economy and caused the destruction of much of the sugar cane sector. The war ended after the American intervention in 1898. In the decades that followed, thanks to favorable political and economic conditions, American business interests came to dominate the Cuban sugar cane industry. A major result was the consolidation of sugar cane production among fewer concerns. Before the war there were some 1,100 mills on the island.

By 1914 that number had dropped to 173. Cuban sugar cane plantations or *centrals*, as they were called, were large capital-intensive, highly-mechanized modern enterprises that ran twenty-four hours a day and required constant inputs of raw cane to remain profitable. In response to a dramatic rise in the price of sugar brought on by the onset of World War I, the *centrals* expanded their geographic footprint indiscriminately across the island. During this period, Cuban sugar cane production increased from 9.5 million tons per year to in excess of 18 million tons per year through the decades of the 1920s. After the war ended in 1918, however, the price of sugar began to fall. By 1924 sugar

[134] Bennett, "Relation of Land Utilization to Erosion and the Economic Desirability and Feasibility of Preventing Erosion," July 1929, RG 114, Entry 21, Box 2, Folder "Relation of Land Utilization to Erosion," 9; Bennett, "Agriculture in Central America," 319.

cane production on the island become unprofitable. The same year mosaic disease devastated cane fields across the island. The combination of the drop in prices, falling yields, and disease caused an economic shock to the sugar industry felt across Cuba and by foreign investors abroad.[135]

Figure 10. Photo of Hugh Bennett amid young sugar cane plants in the coastal region of southern Havana Province, Cuba c. 1926. Image Bennett and Robert V. Allison, *The Soils of Cuba* (1928), 126.

As perhaps the leading expert on the agricultural potential of tropical soils, Bennett was invited to Cuba by the Tropical Plant Research Institute to survey the soils and agricultural conditions of the islands sugar plantations. The

[135] For a discussion of the environmental changes wrought by sugar cane production in Cuba see, Reinaldo Funes Monzote, *From Rainforest to Cane Field in Cuba: An Environmental History since 1492* (Chapel Hill: University of North Carolina Press, 2008); Mark Smith, "The Political Economy of Sugar Production and the Environment of Eastern Cuba" *Environmental History Review* 19 (Winter 1995), 32; and Alan Dye, *Cuban Sugar in the Age of Mass Production: Technology and the Economics of Sugar Central, 1899-1929* (Palo Alto: Stanford University Press, 1998). See also, Samuel Crowther, "Cuba Puts the Brakes on Sugar," *The Country Gentleman* 91 (December 1926): 22-23, 53.

Tropical Plant Research Foundation was established in Washington, D.C. in 1924 to promote the scientific development of agriculture in Central America and the Caribbean. The Tropical Plant Research Foundation in cooperation with the Havana-based Cuba Sugar Club, an organization comprised of planters, operated an experiment station at the Baraguá *central* in the province of Camagüey in south central Cuba. Its research focused on breeding resistance to the disease and pests affecting sugar cane in Cuba. [136]

Over the course of two field seasons, Bennett and Robert V. Allison, a soil biologist working at the Tropical Research Foundation experiment station at Baraguá, completed a soil survey of the island. They identified more than one hundred soil types, including the twenty or thirty soil types most suitable for sugar cane.[137] While Cuban soils shared the relative immunity to erosion common to many tropical soils, they varied considerably in their suitability for sugar cane production. During the run-up in cane production before 1918, many plantations expanded operations to marginally productive soils. Bennett's major recommendation to sugar cane growers was land use readjustments according to soil type. “Careful study of the soil situation in Cuba by the soil type method shows conclusively that a large increase in the average yield of cane can be brought about by better adjustment between soil and cultural methods, and by a

[136] For discussions of the Tropical Plant Research Foundation, see William Crocker, “The Tropical Plant Research Foundation,” *Science* (June 11, 1943), 527; and Stuart George McCook, *States of Nature: Science, Agriculture, and Environment in the Spanish Caribbean, 1760-1840* (Austin: University of Texas Press, 2002), 60-61

[137] Bennett and Robert V. Allison, *The Soils of Cuba* (Washington: Tropical Plant Research Foundation, 1928), 316; Bennett, “Geographical Aspects of Cuban Soils,” *Geographical Review* 18 (1928), 62-82.

reorganization of the fields for the purpose of taking certain inferior soils out of cane and turning them to pasture or timber."[138]

Soil type should serve as a guide for land use. Rather than plant indiscriminately on all types of land, focus agricultural production on only the most suitable lands. While less suitable lands could be put to less intensive use. Higher yields would compensate for fewer acres cultivated. Bennett's recommendations for Cuban sugar cane plantations echoed his recommendations to southern farmers and anticipated the basic outline of the soil conservation program he would shape in the United States.

Bennett returned to Cuba every year between 1926 and 1933, taking a leave of absence from his regular duties with the soil survey to consult with Cuban sugar producers. For his work in Cuba to "revolutionize sugar production," Bennett received the *Orden Del Mèrito Agrìcola e Industrial* from the government of Cuba. Bennett's official biographer would rank it as his second most important achievement. The soil maps made by Bennett and Allison remain important sources of information on the soils of Cuba.

Cuba provided an important laboratory for Bennett's ideas about the adjustment of land use to soil type. He had advocated for the alignment of land use with soil type capabilities for almost two decades. He was able to see his recommendations put into practice there on a large scale for the first time. "I think I can safely say," Bennett wrote, "that in no other country has the work of the soil survey been quicker adapted and applied to field conditions than in

[138] Ibid., 313.

Cuba."[139] These recommendation echoed the conclusion reached by Bennett for the southeastern United States and anticipated his prescription for a national soil conservation program in the coming years and decades. As he wrote, "the tremendous possibilities of correct land usage in Cuba are sharply etched upon my brain. At this moment that Island is ahead of the United States in regard to recognition of the necessity for stepping out of marginal land cultivation; also, it is far ahead of us in the matter of actually revising their practice with respect to farm lands."[140] Here was a lesson for the United States, for as he wrote, "no other modern nation of the Western Hemisphere, north of the equator, is wasting its agricultural lands as rapidly as the United States."[141].

[139] Bennett to A.R. Whitson, June 30, 1930, RG 114, Entry 18, Correspondence of the Director of the Soil Erosion and Moisture Conservation Investigation, 1928-34, Box 4, Folder "W 1930-1931."
[140] Bennett to Paxton, "Bennett to Paxton," September 27, 1931, Hugh Hammond Bennett Papers, Papers and Presentations, Denver Public Library, 2.
[141] Bennett, "Lectures on Soil Erosion," November 4, 1932, RG 114, Entry 21, Miscellaneous Papers of H.H. Bennett, 1926-34, Box 1, Folder "Lectures on Soil Erosion," 3.

3. Erosion and the Crusade for Soil Conservation

> The most thing important to do at present . . . is to howl out from every housetop against erosion.
>
> — Hugh Bennett, "The Real Reason for 'Worn-Out' Soils" (1926)[142]

As the preceding pages illustrate, there is a longstanding history of concern for the soil in the United States. Such concern, however, did not always translate into action for its protection. Outside the work of the Bureau of Soils, and the initiatives of county agents and progressive farmers, little work had been done to promote soil conservation. This changed by the middle 1920s as soil erosion gained a higher profile as a national problem. This happened, in part, as a result of changing cultural and economic factors, including the agricultural depression that settled across the countryside after the wartime boom years and the broader processes of agricultural modernization. Attention was also focused on the problem of erosion during this time by a concerted campaign launched by the USDA and led by Hugh Bennett to promote soil conservation. This crusade for soil conservation served to raise the profile of soil erosion as a nationwide issue, and succeeded in encouraging educational campaigns in several states, in particular Texas and Oklahoma, but, nonetheless, progress at the local level was limited. The biggest barrier to the success of this national campaign at the community level was the inability of farmers themselves to accept that fighting soil erosion was in their immediate self interest.

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[142] Bennett, "The Real Reason for 'Worn-Out'" Soil," *The Farm Journal* 50 (April 1926): 46.

Emergence of Erosion as a National Concern

Hugh Bennett returned from Cuba to the United States in June 1926.[143] After more than two decades of surveying soils across the American South and throughout the western hemisphere, he had come to see erosion as the chief land use problem in the United States. While he continued to write and speak on other topics, by 1926 his attention was turned increasingly to the problem of erosion and its prevention through land use readjustments and conservation practices.[144] That spring he published what would be the first of many public pronouncements on the problem of soil erosion.[145]It was the beginning of what would be a self-conscious crusade for soil conservation. “I am undertaking to start a campaign in opposition to the evils of soil erosion,” he wrote. “The more I look into the problem the larger it looms.”[146]

Bennett’s voluminous writings, speeches, and correspondence from this period chronicle this work, which, by 1929 had succeeded in winning broad private and public support for the cause of soil conservation. In these texts, it is possible to discern the development of the case for soil conservation as it took shape during the critical period of the late 1920s.[147] This case contained two major arguments. One was an economic argument: that soil erosion represents a

[143] “News of the Personnel of the Government Departments,” The Washington Post, June 20, 1926, A2.
[144] The question of when exactly Bennett became focused on the issue of soil erosion is open for debate. It is clear he saw it as a problem before 1926, but it was not until that year that it became an exclusive focus of his attention. For discussion of this point, see Swain, *Federal Conservation Policy, 1921-1933*, 146.
[145] Bennett, “The Real Reason for ‘Worn Out’ Soil,” *Farm Journal* 50 (April 1926): 10, 46.
[146] Bennett to Washington, January 12, 1927, RG 114, Entry 21, Miscellaneous Papers of H.H. Bennett, 1926-34, Box 7, “Records about the initiation of soil erosion research, 1927-28.”
[147] The most significant trove of such materials from this period is the Miscellaneous Papers of H.H. Bennett, 1926-34 held at the National Archives in College Park, Maryland in Record Group 114, Entry 21.

cost, both direct and indirect, to American farmers and, by extension, to the nation as a whole; and by eliminating these costs, soil conservation represents a profitable investment both for the individual and for society. The other was a moral argument: that soil erosion represents a threat to the thus nation, thus the country is obligated to prevent it through conservation. Failure to act was to risk economic ruin and the future sustainability of American civilization itself. By merging these arguments, Bennett made the case that soil erosion is a "costly farm evil" that deserves national attention.[148]

Figure 11. Rill erosion near Temple, Texas, May 4, 1934 (NARA, RG 114p, Soil Erosion Experiment Station photographs, Box 15).

Observations from his speeches, writings, and correspondence from this period provide a virtual tour of the damage done by erosion to agricultural lands across the United States. Erosion had long been understood as a southern

[148] Bennett, "Soil Erosion A Costly Farm Evil," January 31, 1933, RG 114, Entry 21, Miscellaneous Papers of H.H. Bennett, 1926-34, Box 3, Folder "Soil Erosion a Costly Farm Evil,"

phenomena, but by the middle 1920s it had become a nationwide problem. As Bennett wrote in 1927, “I have just completed a trip from Provincetown on Cape Cod to Laredo, Texas. The only time that gullies and washed slopes were out of view was at night and in some occasional grass-covered areas and level-prairies. There were gullies even on Cape Cod.”[149] In Switzerland County, Indiana, a quarter of the land was classified as “crop failure” or “idle land,” conditions “fundamentally due to soil erosion.”[150] Across the Upper Mississippi Valley, erosion was carving deep gullies in the regions fine loessial soils formed by wind deposits. In Wisconsin, “dairy farms which ten years ago or less were valued at $15,000 to $30,000 have been practically ruined or entirely destroyed by branching gullies, some of which have rapidly cut to depths of more than fifty feet.”[151] In Iowa one and a half million acres of crop land were reported destroyed.[152] In northeastern Kansas almost three fourths of the area known as the Kansas corn belt was severely eroded.[153] Doniphan County in northeastern Kansas provided a startling example. On lands first settled in the 1860s and 1870s, an average of six inches of topsoil had been lost from upland fields.[154]“This sort of thing,” he wrote, “is taking place in varying degrees up

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[149] Bennett to Davenport, January 7, 1927, RG 114, Entry 21, Miscellaneous Papers of H.H. Bennett, 1926-34, Box 7, “Records about the initiation of soil erosion research, 1927-28.” See also, Bennett, “Soil Erosion A Costly Farm Evil,” January 31, 1933, RG 114, Entry 21, Box 3, Folder "Soil Erosion a Costly Farm Evil,”4-7.

[150] Hendrickson to Bennett, September 30, 1926, RG 114, Entry 21, Box 7, Folder "Records about the Initiation of soil erosion research, 1925-26."

[151] Bennett, “Federal Land Bank Rates Topsoil as Farmer's Principal Capital," c. 1931, RG 114, Entry 21, Box 2, Folder "Federal Land Bank Rates Topsoil as Farmers Principal Capital,” 5.

[152] See “Save Iowa Soils” and “Better Iowa, Iowa Soil Saving Campaign Edition," March 24, 1929, RG 114, Entry 21, Box 6, Folder "Erosion Program."

[153] Frank L. Duley, "Hanging on to Your Farm,” *Farm Journal* 49 (March 1925): 11.

[154] Knobel to Bennett, January 5, 1927, RG 114, Entry 21, Box 7, Folder “Records about the initiation of soil erosion research, 1927-28.” See also Bennett and William R. Chapline, “Soil Erosion A National Menace,” U.S. Department of Agriculture, *Circular* 33 (April 1928), 9; and

and down the Missouri River and its tributaries, and along many other streams of the central West."[155]

Bennett recounted stories similar stories of erosion in the West. Soils in Texas and Oklahoma--where level ground, un-tilled land, and the absence of the boll weevil had spurred a cotton boom between 1900 and 1920-- had "undergone terrific erosion during the past generation," On "thousands of farms throughout the Red Plains," a vast area of 36 million acres," he wrote, "There are areas where from every open slope or ridge crest one sees to the north, east, south and west gullied fields and exposed clay subsoil."[156] In the Pecos River Valley in New Mexico, he found "splendidly grassed valleys" that had been "cut to pieces" by gullies.[157] The same was true along California's coastal range, where clearing steep hillsides resulted in severe erosion.[158] Through his broad experiences, Bennett had come to see soil erosion as the greatest land use problem facing the United States. "The problem has now become a national menace," he wrote in 1927. "We must do very much more than we have been

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Bennett, "The Geographical Relation of Soil Erosion to Land Productivity," *Geographical Review* 18 (October 1928): 595-596. For description of the Loess hills of northeast Kansas, see Robert W. Eikleberry, "Farming that Fits the Land in the Loess-Drift Hills of Northeastern Kansas," U.S. Department of Agriculture, Soil Conservation Service, PA-35 (September 1947). For a detailed discussion of the causes and consequences of erosion in the Upper Mississippi River Valley, see Stanley Trimble, *Historical Agriculture and Soil Erosion in the Upper Mississippi Valley Hill Country* (Boca Raton: CRC Press, 2013).

155 "Soil Erosion A National Menace," 10

156 Bennett, Federal Land Bank Rates Topsoil as Farmer's Principal Capital," c. 1931, RG 114, Entry 21, Box 2, Folder "Federal Land Bank Rates Topsoil as Farmers Principal Capital," 7.

157 Bennett to Floyd, August 14, 1927, RG 114, Entry 21, Box 7, Folder "Records about the initiation of soil erosion research, 1927-28."

158 For descriptions by Bennett of erosion in the western United States during the later 1920s, see "Erosion Notes," c. 1928, RG 114, Entry 21, Box 6, "Erosion Notes,"2; "Federal Land Bank Rates Topsoil as Farmer's Principal Capital," 7; and "Bennett to Twenhofel," April 19, 1928, RG 114, Entry 1001, Correspondence of Hugh H. Bennett, 1924-1947, Box 1, Folder "Material on Investigations 1928-1935," 3.

doing to save our farming and grazing lands. There is immediate necessity for a tremendous awakening to action."[159]

Figure 12. A forty-acre field in Harrison County, Missouri, abandoned because of severe sheet erosion and gullying. Image scanned from Russell E. Uhland, "Soil Erosion in the Corn Belt Region," 1931, RG 114, Entry 21, Miscellaneous Papers of H.H. Bennett, 1926-34, Box 5, Folder "Soil Erosion in the Corn Belt Region."

Concern for the effects of soil erosion was not new. More than three decades of reports, bulletins, and surveys published between 1890 and 1920 attest to a long-standing concern about erosion among a community of soils specialists at the USDA, universities, and experiment stations across the country.[160] While these works contributed to a base of knowledge about erosion,

[159] H.H. Bennett, "Soil Erosion Takes $200,000,000 Yearly from U.S. Farmers," 592.
[160] For instance, see Shaler, "Origin and Nature of Soils"; J.A. Bonsteel, "Worn Out Soils" in *State of New York Department of Agriculture, Bureau of Farmers' Institutes and Normal Institutes Report for the Year 1904* (Albany: Brandow Printing Company, 1905), 99-114; Chamberlin, "Soil Wastage" (1909); E.N. Lowe, "Our Waste Lands: A Preliminary Study of Erosion in Mississippi," Mississippi Geological Survey (1910); McGee, *Soil Erosion*; E.E. Free, "The Movement of Material by the Wind," U.S. Department of Agriculture, Bureau of Soils, *Bulletin* 68 (1911); R.O.E. Davis, "Economic Wastes of Soil Erosion" in *Yearbook of Agriculture, 1913* (Washington: GPO, 1913), 207-220; F.R. Baker, "The Prevention and Control

by the middle twenties, little progress had been made towards its prevention. Why was this case?

One reason for a relative lack of action, was that erosion had long been subordinated to broader concerns about soil fertility. Since the appearance of the first agricultural improvement tracts in the American colonies in the seventeenth century, agricultural improvers were more concerned with the maintenance of the nutrients in the soil, rather than with its loss through erosion. This focus persisted at the USDA in the first decades of the twentieth century. In 1910, William J. Spillman, the leading farm management expert of the day, authored a USDA bulletin titled "Soil Conservation" that consisted entirely of recommendations for using complex crop rotations and manures to improve soils without a single reference to erosion..[161]This was a point Bennett was always quick to make in his speeches and writings. "Our agronomists have devoted their attention almost entirely to ways and means of checking plant food wastage by crops removed and by leaching, or to restoring this loss in the form of fertilizer or manure. They have overlooked erosion almost completely, except in a few localities."[162]

After World War One, changed as soil erosion became a focus of greater concern. One reason was the development of synthetic fertilizers. The

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of Erosion in North Carolina, with Special Reference to Terraces," North Carolina Agricultural Experiment Station, *Bulletin* 236 (1916); J.G. Mosier and A.F. Gustafson, "Washing of Soils and Methods of Prevention," University of Illinois Agricultural Experiment Station, *Bulletin* 217 (1918).

[161] W.J. Spillman, "Soil Conservation," U.S. Department of Agriculture, *Farmers Bulletin* 406 (1910). The emphasis on fertility over erosion is also evident in the literature on the history of soils. For example, see Rossiter, *The Emergence of Agricultural Science*; Stoll, *Larding the Lean Earth Erosion*; and Cohen, *Notes from the Ground*.

[162] Bennett, "Soil Conservation First Consideration," 1926, RG 114, Entry 21, Box 8, Folder "Soil Conservation (First Consideration)," 7.

commercialization of the Haber-Bosch process for making nitrogenous fertilizers in the United States made it seem that the problem of soil fertility had been solved.[163] Suddenly it appeared the centuries-old concern for soil exhaustion was a problem no more. New technology had the potential to make real the promise of guaranteed soil fertility through chemistry. It is no coincidence that Avery Craven's book *Soil Exhaustion as a Factor in the Agricultural History of Virginia and Maryland, 1606-1860* appeared at this time. Soil exhaustion was, in a sense, history. The "loss of materials by plant growth," Craven wrote in 1925, "is no longer considered the absolute factor which it was at one time supposed to be." A more serious factor than exhaustion was "the damage done by rainfall," he told his readers. "The loss comes not only from the actual carrying away of soil particles in suspension [erosion] but also by the removal of materials in solution [leaching]. The danger is greatest on hilly lands but any soil under cultivation is subject to more or less loss."[164]

Synthetic fertilizers would not be widely adopted in the United States until after the Second World War, but already, by the middle twenties they held out the promise of giving agriculture something it did not have before—a reliable, economic way of restoring the nutrients taken by crops from the soil each season. This was true to varying extents for the entire country, but it held

[163] Rossiter, *The Emergence of Agricultural Science*, 127-128; Vaclav Smil, *Enriching the Earth: Fritz Haber, Carl Bosch, and the Transformation of World Food Production* (Cambridge: The MIT Press, 2001); McNeil, *Something New Under the Sun*, 24-26; Giovanni Federico, *Feeding the World: An Economic History of Agriculture, 1800-2000* (Princeton: Princeton University Press, 2005), 89.
[164] Brackets around "leaching" and "erosion" are in the original text. Avery O. Craven, *Soil Erosion as a Factor in the Agricultural History of Virginia and Maryland, 1606-1860* (Columbia: University of South Carolina Press, 2006), 16; For discussion of Craven, See Jack Kirby, *Poquosin: A Study of Rural Landscape and Society* (Chapel Hill: The University of North Carolina Press), 116-117.

particular promise for the South where the USDA had established a fixed nitrogen research laboratory in 1913 and where a fertilizer plant was installed at Muscle Shoals on the Tennessee River in 1918. By the 1920s trade groups like the National Fertilizer Association, publications like the *The Fertilizer Review*; private firms like the Synthetic Nitrogen Products Corporation and the Federated Farmers' Fertilizer Corporation, and business celebrities like Henry Ford promoted a united front of artificial fertilizer use.[165] With the fertility problem seemingly solved erosion took on a greater salience for agricultural improvers as a factor that handicapped American agriculture.

Another reason for a lack action was the view that soil erosion was a cost of doing business for American agriculture. As the agricultural economist Lewis Gray observed in 1913, "it is not necessarily true that the method of utilization which results in conservation is the method which results in maximum profits."[166] Farmers were not blind. They observed the muddy wash flowing from fields after a heavy rain. They noticed when a gully doubled in size overnight after a strong storm. They understood that the sediments that clogged stream channels came from fields planted on surrounding hillsides. Yet season

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[165] Robert Stewart, "Nitrogen and Muscle Shoals," *The Farm Journal* 49 (July 1925), 11, 26; Chester H. Gray, "Nitrogen at Muscle Shoals," *Annals of the American Academy of Political and Social Science* (January 1928): 166-171; R.O.E. Davis, "Muscle Shoals, Nitrogen and Farm Fertilizers," *Annals of the American Academy of Political and Social Science* 135 (January 1928): 157-165. See also McNeil, *Something New Under the Sun*, 25; and Greg Grandin, *Fordlandia: The Rise and Fall of Henry Ford's Forgotten Jungle City* (New York: Metropolitan Books, 2009).

[166] L.C. Gray, "The Economic Possibilities of Conservation" *The Quarterly Journal of Economics* 27 (1913), 502-503. Gray was influential in the development of USDA land use policies in the 1920s and 1930s. For sources on his career, see Philippe J. Crabbe, "The Contribution of L.C. Gray to the Economic Theory of Exhaustible Natural Resources and Its Roots in the History of Economic Thought," *Journal of Environmental Economics and Management* 10 (September 1983): 195-220; and Richard S. Kirkendall, "L.C. Gray and the Supply of Agricultural Land," *Agricultural History* 37 (October 1963): 206-214.

after season soils were allowed to erode from unprotected fields. The reason was that agriculture in the United States was governed by a narrowly economic logic that privileged short-term profits over the long term care of the land. Farming in ways that builds and conserves soil is expensive in terms of the necessary labor, fertilizer, and the other amendments required.

Too often it was simply more profitable to mine the land for what could be gotten for as long as possible, without care for replacing nutrients taken by crops or protecting the soil from erosion. The costs of the conservation were simply higher than the benefits. A combination of the abundance of inexpensive land and high interest rates on borrowed money through the nineteenth century incentivized exploitive land use practices. After 1900, rising crop prices exasperated these factors as farmers expanded crop production on vulnerable soils to take advantage of favorable markets.[167]

By the middle-1920s, the moment was ripe for a champion of soil conservation to emerge. Hugh Bennett was, in a sense, the right person in the right place at the right time. His personal qualities, his experience, and his position at the USDA all made him an ideal candidate for the job. In 1926, he was forty-five years old. Professionally, he was at the top of his field as a recognized expert on the soils of the Southeastern United States, Central America, and Cuba. In his personal life he had become more settled, having remarried five years earlier to Betty Virginia Brown, a young woman from

[167] For the political economy of nineteenth century agriculture, see Bensel, "The Political Economy of American Industrialization, 1877-1900," 20, 43-47. For the geographical expansion of agricultural production between 1900 and 1920, see Walter Nugent, *Into the West: The Story of Its People* (New York: Vintage Books, 1999), 131-170.

Salem, Virginia, whom he had met when she was volunteering in Washington during the First World War. They had a son together, Hugh Hammond Bennett, Jr., and lived in the Mount Pleasant neighborhood in northwest Washington, D.C., before moving across the Potomac to the Virginia suburbs.

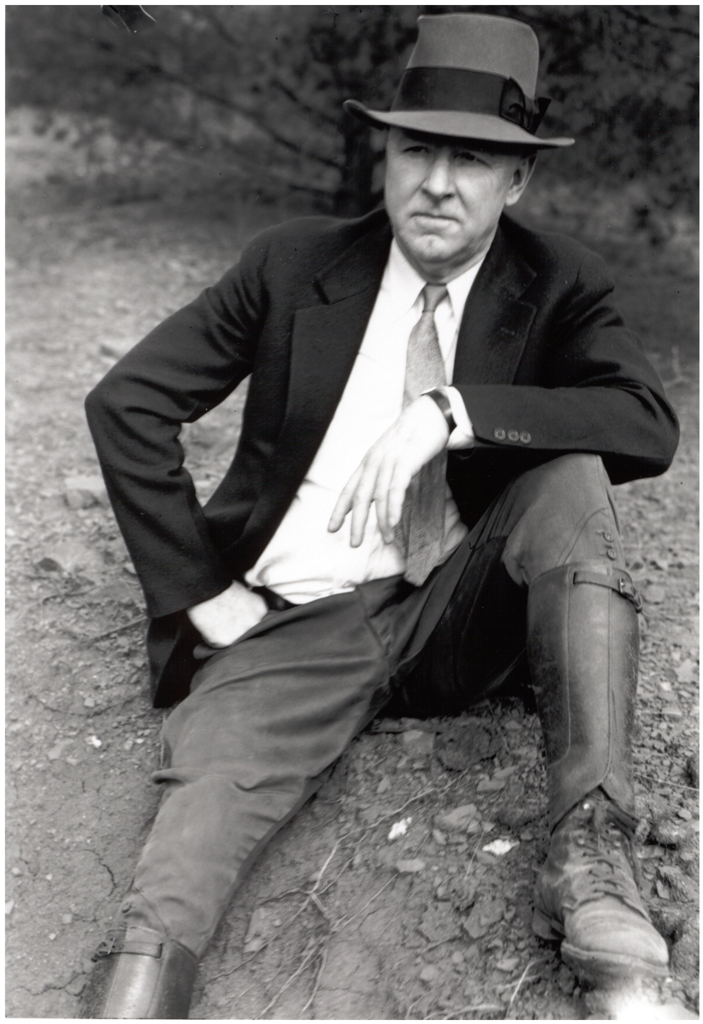

Figure 13. Hugh Hammond Bennett pictured c. 1927. NARA, RG 114-G, Image No. 90002.

Bennett was an imposing figure, over six-feet tall and seasoned from time in the field, He cultivated a disheveled appearance that belied a sharp mind and prodigious work ethic. It has been said that he was slow to take to the task of public speaking. If this true, he quickly warmed to the challenge, becoming a world class raconteur. Preserved audio recordings capture in his voice a genteel southern lilt, rising and falling in musical cadences as it carried the message of soil conservation to the ears of a nation. With new leadership at the Bureau of Chemistry and Soils, Bennett's days as a soil surveyor in the field were largely behind him. The campaign against soil erosion marked a new phase of his career.[168]

The campaign for soil conservations found a natural home in the Department of Agriculture. By the 1920s the USDA was the largest and fastest growing department in the federal government. It had a staff of 20,000 employees, an annual budget of $47,000,000, and a diverse array of bureaus conducting cutting-edge research in agriculture and social sciences.[169] In 1926 a reorganization of the department under the new Secretary of Agriculture William M. Jardine separated the regulatory functions of the Department from its purely research activities. The Bureau of Soils was combined with the Bureau of Chemistry and the Department's Fixed Nitrogen Laboratory to form the Bureau of Chemistry and Soils in July 1927.[170] The combined bureau was placed under the leadership of Henry G. Knight, a veteran chemist in the department. Milton Whitney retired that year, ceding the field of soil science to the younger generation. He was replaced by Arthur G. McCall. McCall was an

[168] For personal and biographical information about Bennett, see Helms, "Oral History Interview with Hugh Hammond Bennett Jr.," 1-2; Austin Patrick, "Hugh Hammond Bennett," *The Geographical Review* 51 (January 1961), 121; Swain, *Federal Conservation Policy*, 148.
[169] See James H. Shideler, *Farm Crisis, 1919-1923* (Berkeley: University of California Press, 1957), 36; Fitzgerald, *Every Farm a Factory*, 30-32.
[170] See Weber, *The Bureau of Chemistry and Soils*, 79; A.F. Woods, "The Development of Agricultural Research and Education Under the Federal Government," *The Scientific Monthly* 36 (January 1933): 5-34.

experienced soil scientist and professor of soils and geology, who began his career at the Bureau of Soils in 1901 before leaving the government in 1904 for academic posts at Ohio State and later at Maryland, where he led of the state's soil survey investigations.[171] Curtis Marbut remained in charge of the Soil Survey.

In the fall of 1926, Bennett met with Alfred F. Woods, the USDA's Director of Scientific Research, to discuss the problem of soil erosion. Albert Woods received the attention he deserves for the role he played in raising the profile of soil erosion as a national issue. Woods was a botanist by training who had joined the USDA's Bureau of Plant Industry in 1893. He left the Department in 1909 to become the Agriculture and Forestry Dean at the University of Minnesota, where he also directed the Experiment Station. He became president of the Maryland State Agricultural College in 1917, a post he held until in 1926 when that institution broadened its pedagogical emphasis and changed its name to the University of Maryland. In September of that year Woods returned to the USDA as Scientific Director, his job was to coordinate the research agenda for the Department of Agriculture.[172]

At the meeting Bennett proposed that the Bureau of Chemistry and Soils should begin extensive soil erosion experiments to measure the relationship

[171] For biographical information on McCall see L.H. Bailey, *RUS: A Register of the Rural Leadership in the United States and Canada* (Ithaca, NY, 1930), 41,
[172] Woods to Horton, April 22, 1927, RG 16, Entry 37, Letters Sent by Director of Scientific Work, Volume 7. For a discussion of Director of Scientific Research position see, Baker, et al, "Century of Service," 224; For Wood's role in the conception of the USDA's soil conservation campaign see Swain, *Federal Conservation Policy*, 149.

between erosion and soil type.[173] Establishment of erosion experiment stations, however, would take congressional action. In the meantime, Woods suggested to Bennett that he undertake to educate the public about soil erosion. Bennett would credit Woods' interest in soil erosion for launching what in a matter of years would become a nationwide campaign for soil conservation.

As Bennett explained later, Woods told him to "tell the people about it, write about it, talk to everyone who will listen, educate the nation as to the gravity of this evil of erosion." Woods gave Bennett the support of the office of the Secretary of Agriculture. This meant that soil conservation would have the institutional backing of the Department of Agriculture.[174] For his part, Woods' interest in soil erosion was sincere. He arranged to have a course of soil erosion and methods of its control included in the curriculum of the USDA's Graduate School. He also personally made the case for soil conservation to the public. At the First International Congress of Soil Science held in Washington, D.C., in June 1927, Woods declared in a speech that the "problem of controlling erosion, both slow and rapid types, is, I believe, the most vital soil problem we have, and on which we are doing the least work."[175] He put it more baldly later; "we are planning to attack [erosion] with all the force we can turn against it."[176]

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[173] Bennett, "A Major Project for Soil Erosion Investigations by the Bureau of Chemistry and Soils," December 1926, RG 114, Entry 21, Box 7, Folder "Major Project for Soil Erosion Investigations." See also Swain, *Federal Conservation Policy*, 1921-1933, 149.

[174] Bennett wrote in 1929, "This education program was undertaken about two years ago at the suggestion of Dr. A.F. Woods, Director of Research Work, who understood this process of soil depreciation so well that he said in effect: 'Tell the people about it, write about it, talk it to everyone who will listen, educate the nation as to the gravity of this evil of erosion.'" Bennett to Gapen, March 27, 1929, RG 114, Entry 21, Box 6, Folder "Erosion Program."

[175] "Scientist Declares Soil Erosion Menace," *The Washington Post*, June 16, 1927, 2.

[176] Woods to Shuler, c. 1929, RG 114, Entry 21, Miscellaneous Papers of Hugh Bennett, 1926-34, Box 6, Folder "Erosion Program."

After 1926, the USDA launched what was essentially a public relations campaign to publicize the problem of soil erosion. Hugh Bennett became its public face. The USDA closely coordinated these efforts with state agricultural officials. Its objectives were to encourage farmers to adopt soil erosion practices, but also to galvanize public support for national and state funded conservation initiatives. Bennett was always a prolific writer. He had already begun to publish articles in the popular press on the connection between land use and soil erosion, and with the support of the USDA's press office, Bennett's articles on the problem of erosion appeared more frequently in department publications and popular periodicals.[177]

Bennett also appeared regularly on USDA radio broadcasts. Radio would broadcast the message of soil conservation to farm households across the country.[178] He also traveled extensively on trips that allowed him to speak to diverse audiences and cultivate a large extended network of contacts, as well as to gather first hand information on the extent of erosion in the countryside and what was being done to stop it. With the support of the USDA and the Bureau of Chemistry and Soils, Hugh Bennett's full time job increasingly was to make the case for soil conservation in whatever venue he could. As he wrote in early

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177 See Bennett, "Using the Soil Correctly," *Farm Journal* 49 (December 1925): 10, 50; ibid., "Judging the Value of Land," *Farm Journal* 50 (February 1926), 34, 76; "The Real Reason for Worn Out Soils," 46-47.

178 Radio played a significant part in the soil conservation campaign that took shape after 1926. A folder of Bennett's radio messages can be found in RG 114, Entry 21, Box 6, Folder "Farm Flashes." For a general discussion of the development of radio broadcasts for rural audiences see Hugh R. Slotten, "Radio's Hidden Voice: Noncommercial Broadcasting, Extension Education, and State Universities during the 1920s," *Technology and Culture* 49 (Jan., 2008): 4-5; and Reynold M. Wik, "The USDA and Development of Radio in Rural America," *Agricultural History* 62 (Spring, 1998): 177-188.

1926, the "most important thing to do at present is to howl out from every housetop against erosion."[179]

For Bennett, the role of public advocate represented a departure from the job of soil surveyor, which he had held for more than two decades. While soil surveyors dutifully marked eroded areas on the maps they made and chronicled the extent of "rough gullied land," "meadow," and other types of landscapes altered by erosion in the surveys they published the threat of erosion was not a top priority. Erodibility was just one of many soil characteristics considered by field surveyors in their investigations of the characteristics and distribution of different soil types. The soil survey considered this work to be empirical science. By identifying, mapping, and classifying soils, and making this information available to the public, soil surveyors saw their job as having been completed. Certainly the USDA hoped that the expert information about soils and other topics produced by its staff of specialists would be used by the public to make informed decisions—indeed, to distribute its knowledge the Department developed an extensive outreach apparatus to communicate with the public—but, there was a line that the soil survey was careful not to cross. As neutral observers in the service of government, soil surveyors could do little to alter the land use practices that caused soils to erode. While soil surveyors made recommendations for optimal land uses on different soil types, they had no

[179] Quote is from Bennett, "The Real Reason for 'Worn Out' Soil," 47. For a discussion of the role of public relations campaigns in the history of conservation and environmentalism in the United States, see Stephen Ponder, "'Publicity in the Interest of the People' Theodore Roosevelt's Conservation Crusade," *Presidential Studies Quarterly* 20 (Summer, 1990): 547-555; ibid., "Gifford Pinchot Press Agent for Forestry," *Journal of Forest History* 31 (Jan., 1987): 26-35; and Mark Neuzil and William Kovarik, *Mass Media and Environmental Conflict: America's Green Crusades* (Thousand Oaks, CA: Sage Publications, 1996).

power to compel land users to take any particular action. The system of optimal land use promoted by the USDA depended entirely on the enlightened self-interest of the individual land user to obtain the information they needed and to act accordingly.

First and foremost, Bennett's campaign for soil conservation was an effort to challenge this traditional approach. Stopping erosion was a different sort of problem than the one encountered by the soil surveyor in the field. While the physical process of erosion can be empirically measured--such things as how much soil erodes from x amount of rainfall on soil type y with slope z, or the optimal width for terraces built on slopes with different grades--the production of such data, as important as it was, it was not sufficient in itself to inspire public action. For the cause of soil erosion at its root is human. Erosion is a product of culturally contingent factors in the use of land. The conservation of soils requires not only an awareness of the particular qualities of a landscape and the methods best suited for its management, but also an understanding of human behavior. Because soil surveyors treated erosion as purely a natural phenomenon, they could not address the ultimate cause of erosion.

The Economic Case for Soil Conservation

The economic case for soil conservation rested on the premise that soil erosion represents a direct and indirect financial cost to farmers, individual states, and the nation as a whole. This was a cost that stole from the immediate bottom line and the long term security of the land as an investment. By reducing or eliminating these costs soil conservation promised increased profits from the land. The costs of erosion and the benefits of conservation were important themes in Hugh Bennett's case for conservation as well as state-level soil conservation initiatives that began during the 1920s.

Calculating the cost of erosion first required figuring out the amount of soil washed from fields each year. Estimates varied considerably. In his 1908 speech at the governor's conservation conference, Thomas Chamberlin, the University of Chicago geologist, speculated that "1,000,000,000 or more tons of richest soil-matter" is carried out to sea annually. [180] This was a rough estimate. At that point in time very little field work had been to measure actual sediment loads at the mouths of the nation's rivers. The first research of this kind was performed by two hydrologists working for the U.S. Geological Survey, Richard Bryant Dole and Herman Stabler. From their measurements published in 1909, Dole and Stabler calculated that a total of 513 million tons of soil matter washed out to sea annually. Charles Van Hise repeated this figure in his influential textbook on natural resources conservation in the United States published in 1918.[181] In addition to visible soil matter William H. Twenhofel, a pioneer in the field of sedimentary geology, estimated in the early twenties that an additional 270 million tons of dissolved soil material is carried to tidewater each year.[182]

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[180] Chamberlin, "Soil Wastage," 78.
[181] Richard B. Dole and Herman Stabler, "Denudation," U.S. Department of the Interior, *Water Supply Paper* 234 (February 1909). For Dole and Stabler, see also, Kirtley F. Mather, *A Source Book in Geology, 1900-1950* (Cambridge: Harvard University Press, 1967), 148-149. Charles Richard Van Hise, *The Conservation of Natural Resources in the United States* (New York: Macmillan Company, 1918), 307-308.
[182] See Bennett, "Soil Conservation First Consideration," 1; Bennett to Twenhofel, April 19, 1928, RG 114, Entry 1001, Correspondence of Hugh H. Bennett, 1924-1947, Box 1, Folder

Together these estimates put the amount of sediment washed from dry land out to sea each year at between 750 million and 1 billion tons.[183]

In 1926 when Bennett began to quantify the extent of erosion in the United States, he saw that previous estimates of soil loss had not accounted for the amount of eroded soil that is deposited as alluvial sediment. "A very obvious thing to any one who has seriously studied erosional processes in the field," he wrote, "is that far more material is washed out of fields and pastures than is carried directly to the sea." This figure, the amount of soil deposited "as overwash upon lower slopes and valley lands, and as alluvial sediments over flood plains and in the beds of streams vastly exceeds the amount actually entering the oceans." Bennett conceded that was impossible to calculate the exact amount of such soil loss. "The amount of the material thus stranded we do not know. It may be a hundred times as great, or even more." Whatever this number was, he confidently estimated that the total amount of soil material washed out to sea annually amounts to at least 1.5 billion tons.[184] This figure was important because it had direct bearing on the cost of erosion. The higher the aggregate figure of soil loss, the higher the costs of erosion.

One category of these costs was the value of the fertilizers and amendments washed from fields each year. Bennett estimated that 126 billion

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"Material on Investigations, 1928-1935." See also William H. Twenhofel, *Treatise on Sedimentation* 2nd ed. (Baltimore: The Williams & Wilkins Company, 1932).

[183] A summary of the state of knowledge on suspended sediment loads in the 1920s can be found in Frank L. Duley and Merritt F. Miller, "Erosion and Surface Runoff Under Different Soil Conditions," University of Missouri Agricultural Experiment Station, *Research Bulletin* 63 (December 1923), 7.

[184] H.H. Bennett, "Some Aspects of Soil Erosion as a National Problem," n.d., RG 114, Entry 21, Box 3, "Some Aspects of Soil Erosion as a National Problem," 2-3; Bennett, "Soil Conservation, First Consideration," 1-2.

pounds of the nutrients essential to plant growth (nitrogen, potassium, phosphate, calcium and magnesium) were lost annually through erosion. By comparison the National Industrial Conference Board, a business think tank founded in 1916, estimated that crop production in the United States took only around 6 billions pounds of plant nutrients from the soil each year.[185] The amount of nutrients washed away with eroded soils, Bennett calculated, was more than twenty times the quantity used up by cropping. "The loss of plant food by crops removed dwindles almost to the point of insignificance in comparison with that removed by running water."[186] Using cost data, as he put it, from "the cheapest form of fertilizer constituents" available, Bennett estimated that the aggregate value of the nutrients washed from fields was more than two billion dollars annually. Of this he estimated, that the loss to farmers was in the range of two hundred million dollars every year.[187]

American farmers understood soil in terms of fertility. By placing a monetary value on cost of soil nutrients carried away by erosion, Bennett illustrated the costs of erosion in a way that most farmers could comprehend. Yet while the cost of fertilizers lost in a solution of rainwater flowing from fields was significant, Bennett was far more concerned with the erosion of the soil itself. "This removal of 126 billion pounds of plant food each year by erosion is but a fraction of the damage wrought," he wrote. "The real scourge of erosion can be appraised only when it is realized that rushing rainwater takes not

[185] "Soil Conservation. First Consideration," 2-3.
[186] Bennett to Washington, January 12, 1927, RG 114, Entry 21, Box 7, "Records about the Initiation of soil erosion research, 1927-28."
[187] "Soil Conservation First Consideration," 1; Bennett, "Soil Erosion Takes $200,000,000 Yearly from U.S. Farmers," 591-593.

merely the plant food but the whole soil, plant food and everything else, and that from the top part, the richest of the fields."[188] The "crops take only the plant food, which can be replaced in fertilizers, while erosion takes the plant food and the soil in addition, and this can not be replaced except through the slow geological process of rock decay."[189]

The loss of plant nutrients was, in truth, only the beginning of the cost of erosion to the farmer, which did not stop with losses of the soil or plant nutrients. Erosion had other costs that were more difficult to quantify. "In addition to this enormous waste," Bennett wrote in the 1927 *Yearbook of Agriculture*, "other things should be taken into consideration—the expensive cumulative effect of the increasing difficulty of cultivation occasioned by the removal of the mellow top soil, the richest part of the fields, the need for more and more fertilizer material to enrich the exposed raw subsoil material, and the taxes paid on land which has been abandoned because of soil poverty brought about by this master thief, erosion."

From his analysis of the soil surveys, Bennett estimated that in total "[n]ot less than 10,000,000 acres of formerly cultivated lands have been permanently destroyed by erosion in this country" and an additional "3,000,000 acres of rich bottom lands have been irreparably damaged or ruined by the deposition of sand and gravel, and by increased swampiness due to the choking of drainage ways by erosional debris."[190] These aggregate numbers, Bennett was careful to emphasize, masked considerable variability in the rates of erosion on

188 "Soil Conservation First Consideration," 2.
189 Bennett to Washington, January 12, 1927.
190 "Soil Erosion Takes $200,000,000 Yearly from U.S. Farmers," 591-593.

different soil types put to different uses. “From time to time it is announced that erosion removed so many inches of soil from the surface of the United States in so many centuries. These averages mean nothing, and are dangerous in that they serve to breed complacency.” He emphasized that it “must not be lost sight of that all soils do no erode alike, and that closely grazed pastures wash more than forested land.”[191]

Bennett began to publish his estimates of the cost of erosion in the fall of 1926. These figures—10,000,000 acres suffering from erosion, 3,000,000 acres buried in sediment, 1,500,000,000 tons of soil and 26,000,000 pounds of plant food lost each year at a minimum total annual cost to American farmers of $200,000,000—comprised the quantitative backbone of the economic case for soil erosion. They would be a mainstay of Bennett’s case for soil conservation, repeated in the popular press, speeches, and radio programs over the next seven years.[192] These numbers, however, were not entirely reliable. Curtis Marbut chief of the Soil Survey, acknowledged as much in his correspondence, “Bennett has accumulated some figures,” he wrote, “but we all realize that it has been roughly done, and may be greatly changed in the future.”[193] Bennett recognized the limits of his calculations. He saw these figures as minimum estimates of the cost of erosion, noting in a lecture to the USDA graduate school in January

[191] “Soil Conservation First Consideration,” 2.
[192] The earliest examples include “Soil Erosion Causes $200,000,000 Loss to Farmers Each Year,” *Engineering and Contracting* 65 (November 1926): 243; Bennett, “Soil Conservation” (March 1927): 304; Ibid., “Neglect Causes Two Hundred Million Dollars Yearly Loss by Soil Erosion,” *Scientific American* 136 (April 1927): 237-239.
[193] Marbut to Lipman, May 8, 1929, RG 114, Entry 18, Correspondence of the Director of the Soil Erosion & Moisture Conservation Investigations, 1928-34, Box 2, Folder "L 1927."

1928, "my estimates of erosional wastage undoubtedly are much to small."[194]

The ambiguity of Bennett's calculations also served a rhetorical purpose. While his figures put a floor on the cost of erosion, he could imply that the true costs were much higher. "The damage that has been done and continues to be done can not be precisely calculated. We have not the fundamental data for making the calculation. We know the wastage is enormous; there are reasons to believe it is much more serious than indicated by the estimates given above." These assertions allowed him to conclude that "[c]ertainly the problem is the most important one of the whole lists of conservation problems."[195]

Bennett's economic case for soil conservation was an explicit refutation of the short-term calculus—that the abuse of land is profitable and its conservation costly—that had governed American land use since the formation of the Republic. He made this point explicitly. In 1929, he wrote: "A prominent business man was quoted recently as saying: 'Progress is not how long you can keep a thing, but how quick you can economically scrap it.'" While conceding that perhaps "this statement is true in its application to machines employed in the speedy processes of modern-day mass production," in the case of soil "the scrapping of that resource on any large scale can not in any sense contribute toward national economic permanency." When "this machine, the land, is scrapped it can not be replaced and most of it can not be economically

194 Bennett, "Soil Erosion and Flood Control," January 30, 1928, RG 114, Entry 21, Box 7, Folder "Lectures," 19.
195 Bennett, "Soil Conservation First Consideration," 6.

restored."[196] For Bennett these facts meant that, "land impoverishment by excessive washing is a business problem which must be met today, not something which may be left for another generation to solve." [197]

The Moral Case for Soil Conservation

Beyond dollars and cents, Hugh Bennett also employed a moral argument in his case for soil conservation. Its crux is that soil is something that can not be replaced— once washed or blown away, it is gone for good—and unless something is done to protect it, its loss will lead inexorably from the ruin of the farmer to the decline of the nation. In this frame, soil conservation is tantamount to the safeguarding of civilization itself; a moral obligation to protect the resources on which we depend, or risk, not only their destruction, but the destruction of ourselves.[198] While the economic case for conservation employed quantifiable facts, like the amount of soil lost from an agricultural field, to make objective claims about the benefits of preventing erosion, the moral case rested on subjective value judgments about what constitutes ethical use of the land. In tone and theme, they echoed religious jeremiads, equating conservation with the restoration of a fallen world. This was a message that

[196] H.H. Bennett, "Some Aspects of Soil Erosion as a National Problem," c. 1929 RG 114, Entry 21, Box 6, "Some Aspects of Soil Erosion as a National Problem," 1. This document is a draft manuscript of an article published as "The Increased Cost of Erosion" in March 1929 in which the phrase "A prominent business man" was replaced with the word "Someone." Hugh Hammond Bennett, "The Increased Cost of Erosion," Annals of the American Academy of Political and Social Science 142 (Mar., 1929), 170.
[197] Hugh Hammond Bennett, "Federal Land Bank Rates Topsoil as Farmer's Principal Capital," c. 1931, RG 114, Entry 21, Box 2
[198] For broader discussions of soil conservation in moral terms, see George Dykhuizen, "Soil Conservation: A Philosopher's Viewpoint," Vermont Agricultural Extension Service (1938); Angus McDonald, "Farmer-Preachers" *The New Republic* 116 (April 21, 1947), 35; Walter A. Forred, "Religion and Conservation," *Soil Conservation* 19 (July, 1954): 280-282; Eric Freyfogle, *Why Conservation is Failing and How It Can Regain Ground*, 47-51.

Bennett would deliver with a evangelical fervor in publications, radio broadcasts, and countless speeches given across the country after 1926, and in doing so sought to recruit the nation to his cause.[199]

The idea that erosion represents an existential threat to American civilization is a persistent theme in the history of soil conservation. It can be traced from the writings of George Perkins Marsh through the exhortations of Nathaniel Shaler and Thomas Chamberlin to the work of authors writing to the present day.[200] Historians have suggested that nineteenth century fears about the limits of natural resources faded with the rise of the progressive conservation movement and its emphasis on rational planning for efficient use.[201] The moral concern for the destruction of soil had been subordinated to the Bureau of Soils' efforts to identify and classify the nation's soil types during the first decades of

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[199] For examples of Bennett's soil conservation jeremiads, see Bennett, "The Real Reason for 'Worn-Out Soil"; ibid, "Soil Conservation," *The American Review of Reviews* 75 (March, 1927): 303-306; ibid., "The Wasting Heritage of the Nation," *The Scientific Monthly* 27 (August, 1928): 97; ibid, "Soil Erosion A Costly Farm Evil"; ibid., "The Unseen Menace of Erosion," *The Country Gentleman* 93 (October 1928): 12-13, 151; ibid, "Erosion," *ibid.,* 101 (May, 1931): 10-11, 100-101. For discussions of this literature see, Swain, *Federal Conservation Policy*, 150-152; Held and Clawson, *Soil Conservation in Perspective*, 58; Beeman and Pritchard, *A Green and Permanent Land*, 11-13; and Sutter, "What Gullies Mean," 591. For a discussion from a philosophical point of view about the way objective facts are used to make subjective arguments, see Hilary Putnam, *The Collapse of the Fact/Value Dichotomy and Other Essays* (Cambridge: Harvard University Press, 2002), 28-45.

[200] See George Perkins Marsh, *Man and Nature, or Physical Geography as Modified by Human Action*, 4-5, 416; Shaler, "The Origin and Nature of Soils," 332; and Chamberlin, "Soil Wastage," 77. See also Walter Lowdermilk, "Man's Moral Obligation to the Earth," (1935), See also Paul Sears, *Deserts on the March* (Norman: University of Oklahoma Press, 1935); Stuart Chase, *Rich Land, Poor Land: A Study of Waste in the Natural Resources of America* (New York: Whittlesey House, McGraw Hill, 1936); Robert O. Whyte and Graham V. Jacks, *Vanishing Lands: A World Survey of Soil Erosion* (New York: Doubleday, Doran, and Company, 1939); Ward Shepard, *Food or Famine: The Challenge of Erosion* (New York: MacMillan, 1945); Tom Dale and Vernon Gill Carter, *Top Soil and Civilization* (Norman: University of Oklahoma Press, 1955); Joe Paddock, Nancy Paddock, and Carol Bly, *Soil and Survival: Land Stewardship and the Future of American Agriculture* (San Francisco: Sierra Club Books, 1986); Montgomery, *Dirt: The Erosion of Civilization*, 49-82.

[201] Hays, Conservation and the Gospel of Efficiency, 122-46; Pisani, "Forests and Conservation," 357-358.

the century. By the 1920s it had reemerged as a topic of primary concern.[202] The trope of national decline was a central theme of Bennett's moral case for soil conservation. "It is incontestably true," he wrote, "that land impoverishment, chiefly by erosion, has caused the downfall of nations and probably the disappearance of some civilizations." From the Mediterranean, where "every vestige of soil has been swept from numerous areas," to China, where the record of erosion was "told in terms of destroyed land, famines and millions stricken with dire poverty," he invoked the decline of ancient cultures as parables of the American future.

The force of these narratives derives from the threat they contain. If the country does not protect the soil on which it defends then it risks a similar fate: the fall of its own civilization. What made this argument persuasive was that Americans did not have to look very far to witness the damage done by erosion and its consequences. Bennett was all too happy to emphasize these facts. As he wrote, travelers who had brought stories from ancient lands "where the soil has been planed down to sterile bed rock, or vast slopes gullied to worthlessness, need only range through our own land to find going on at a rapid rate the very processes which have wrought this devastation in the older countries."[203]

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[202] For examples of the persistence of moral concern about soil erosion during the 1910s, see R.O.E. Davis, "Economic Wastes of Soil Erosion," in *Yearbook of Agriculture 1913* (Washington: GPO, 1914), 207-220.

[203] For quotes, see Bennett, "Our Vanishing Farm Lands," 170-171; ibid., "Soil Conservation, First Consideration," 8; ibid, "The Unseen Menace of Erosion," 151. See also ibid., "Soil Conservation," 304; and ibid., "The Wasting Heritage of the Nation," 101; ibid., "Uncle Sam Takes Thought of Soil Productivity," July 1929, RG 114, Entry 21, Box 4, Folder "Uncle Sam Takes Thought of Soil Productivity"; Ibid., "The Importance of Soil Conservation," August 1931, RG 114, Entry 21, Box 3, Folder "The Importance of Soil Conservation."

Already, Bennett observed, soil erosion had contributed to rural poverty in the United States. "With tens of thousands of farmers the burden of erosion is not a threat of the future, but a present evil. Today many thousands of farmers are eking out the barest living on land from which the fertile surface soil has been washed away."[204] On his extensive surveys of the American countryside, he had seen families living in crippling poverty on eroded lands. While on a reconnaissance of East Texas, he observed, "cotton fields on deep sand so gullied that the land had been thrown out of cultivation." On these trips he encountered, as he wrote, "some of the poorest people I have ever seen," not excluding, he took care to emphasize, "isolated jungle families of Tropical America." On one such farm in Texas he found "one single-room dwelling a sick mother lay upon a decrepid [sic] bed beneath a single quilt; two babies, one and two years old, played upon a dirty floor, there was a single wooden stool, a rusty stove and not a vestage [sic] of anything else but despair in that house." [205] Across the country, he wrote, the "human tragedies these devastated areas and severely impoverished fields could tell will be remembered in many instances only by the monuments of gullies and ravines and wastes of weeds and brush left to mar the landscape."[206] His conclusion was that "of all the nations of the world. . . the United States has been the most wasteful of its agricultural lands."[207]

[204] Bennett, "Federal Land Bank Rates Topsoil as Farmer's Principal Capital," c. 1931, RG 114, Entry 21, Box 2, Folder "Federal Land Bank Rates Topsoil as Farmers Principal Capital," 13-14.
[205] Bennett to Davenport, January 7, 1927, RG 114, Entry 21, Box 7, Folder "Records about the initiation of soil erosion research, 1927-28."
[206] Bennett.,"Soil Erosion Takes $200,000,000 Yearly from U.S. Farmers," 592.
[207] Bennett, Uncle Sam Takes Thought of Soil Productivity, 4

In making these observations, Bennett cast explicit blame on farmers themselves for the destruction caused by erosion. It was farmers, he wrote, who had "considered it to their advantage, under pressure for immediate returns, to cultivate rapidly eroding land, regardless of the accumulating evil consequence in the form of rapid land exhaustion."[208] American farmers were complicit in not only the destruction of soil, but also their own eventual destitution. Farmers had raided nature's storehouse "without thought of the future and without consciousness of any present material depletion of the stores contained therein."[209] This was an explicit indictment of farmers, who, he wrote, in "most localities are doing little or nothing to stop the washing and much to speed it up."[210]

The conservation of soil, then, represented a struggle with farmers to change the way they used the land. In this regard, the case for soil conservation differed from the terms of traditional conservation narratives. Rather than a virtuous struggle between the "people" and the "interests," as conservationists cast prior efforts to protect public lands from development, those responsible for the destruction of natural resources on farms and ranchers were not distant corporations, but the land users themselves.[211]

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[208] Ibid., "Some Aspects of Soil Erosion as a National Problem," 1.
[209] Ibid., "The Problem of Soil Erosion in Relation to Flood Control," 1927, RG 114, Entry 21, Miscellaneous Papers of H.H. Bennett 1926-34, Box 8, Folder "The Problem of Soil Erosion in Relation to Flood Control," 4
[210] "Erosion Notes," c. 1928, RG 114, Entry 21, Box 6, "Erosion Notes,"2.
[211] For a discussion of older progressive narratives about the conservation movement, see Hays, *Conservation and the Gospel of Efficiency*, 2. For examples, see J. Leonard Bates, "Fulfilling American Democracy: The Conservation Movement, 1907 to 1921," *The Mississippi Valley Historical Review* 44 (June, 1957): 29-57.

In holding a mirror up to the destruction caused by traditional agricultural practices in the United States, Bennett sought to compel land users to action. If erosion was an evil menace that threatened the present and future of the nation, then the logical conclusion was to take defensive measures against it. “There is immediate necessity for a tremendous awakening to action,” he wrote in 1927. “We must do very much more than we have been doing to save our farming and grazing lands.”[212]

Bennett framed these calls to action in martial language. “To stop [erosion], even to slow it down in a far-reaching way,” he wrote, “is going to be a hard prolonged fight.”[213] A fight he viewed as the responsibility of the entire country. It was both a duty of the individual to society, and also, as he increasingly saw it, a responsibility of society to assist the individual to fulfill their obligation to the land. “Let every thinking citizen appoint himself or herself an agent in this campaign,” he wrote[214] “We have our national associations for the preservation of wild flowers, for the popularization of the national playgrounds, for the preservation and propagation of wild life, and for practically everything else except the soil.” The time had come for individual and collective action to protect the soil. It represented nothing less than a patriotic duty. [215]

[212] Ibid., “Soil Erosion Takes $200,000,000 Yearly from U.S. Farmers,” 592.
[213] Ibid., “Soil Erosion: Address to the 2nd SW Soil and Water Conservation Conference," June 1930, RG 114, Entry 21, Box 3, Folder “Soil Erosion,” 13, 15.
[214] Ibid., “Soil Erosion Means Wasted Lands and Increased Floods," c. 1927, RG 114, Entry 21, Miscellaneous Papers of H.H. Bennett, Box 8, Folder “Soil Erosion Means Wasted Lands and Increased Floods, 1
[215] Ibid, “Soil Conservation,” 304-305; ibid, The Importance of Soil Conservation,” 9.

The ultimate objective of the moral case for soil conservation was the restoration of a prosperous and virtuous agrarian order. Where wise soil conservation practices are employed, "one finds better farm conditions more painted houses, better towns and schools and roads," Bennett believed. With such statements he drew on older agrarian ethic that saw the improvement of soil as synonymous with the improvement of society.[216] Such observations also represent Bennett's own romantic agrarianism, which idealized the self-sufficient mixed-husbandry mode of production that he remembered from his youth in Anson County, North Carolina. For Bennett soil conservation not only promised to prevent erosion, but also it came increasingly to represent a remedy to the problems facing rural America. Bennett believed soil conservation to be the foundation for an agricultural system that would allow American society to sustain itself in perpetuity. This was a message that resonated with rural audiences, many of whom had begun to feel the effects prevailing low crop prices in the agricultural depression setting in around the country.

This utopian vision of a "permanent agriculture" would become a driving force in the development of a national program of soil and water conservation with Hugh Bennett as one of its chief apostles. Bennett captured the imagination of audiences receptive to message that promised prosperity through the

[216] ibid., "Uncle Sam Takes Thought of Soil Productivity," 9. For a discussion of moral concern for the improvement of soil in the nineteenth century, see Stoll, *Larding the Lean Earth*, 169; Cohen, *Notes from the Ground*, 37; ibid., "The Moral Basis for Soil Science and Geology: What Antebellum Farmers Knew and Why Anyone Cared," *Physics and Chemistry of the Earth* 35 (2010): 15-18.

restoration of the land, and helped to propel soil conservation the forefront of national concern.[217]

While Bennett's case for conservation resonated with sympathetic audiences, it also attracted criticism from those who did not share his views. Some in the old guard of soil scientists believed Bennett's pronouncements on erosion were exaggerated, and the focus on erosion was a distraction from the serious business of soil science. Other critics called his rhetoric overwrought and charged with hyperbole. Elsewhere, he was called an alarmist. An editorial in the magazine *Popular Science Monthly* denied that soil erosion was any cause for concern. Opining, that the "rapidity with which soil is renewed by natural processes. . . is still scientifically debatable." Referring obliquely to Bennett, it continued, "[l]ike most propagandists, professional viewers with alarm over the so-called menace of soil erosion are weakening their case by overstatement."[218]

This was a perception that would follow Bennett for the rest of his life. Upon his death, *Time* magazine called Bennett "a folksy Cassandra," a prophet of disaster whose warnings went unheeded like the mythical daughter of the Trojan King.[219] In their mid-century analysis of U.S. soil conservation programs R. Burnell Held and Marion Clawson echoed this view, writing that Bennett "brought to soil conservation a religious conviction and fervor—and also, some

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[217] For Bennett's views on , Bennett, Hugh, "Back to the Farm," c. 1932, RG 114, Entry 21, Box 2, Folder "Sandy Bottoms"; ibid, "Sandy Bottoms," c. 1932, ibid. For a discussion of Bennett and the idea of a permanent agriculture, see Beeman and Pritchard, *A Green and Permanent Land*, 7-86. See also, David Danbom "Romantic Agrarianism in Twentieth-Century America," *Agricultural History* 65 (Autumn 1991): 1-12.
[218] A transcription of this editorial can be found in "Soil Erosion Alarmists," November 1929, RG 114, Entry Entry 21, Box 3, Folder "Soil Erosion Alarmists." The editorial originally appeared in *Popular Science Monthly* 115 (December, 1929).
[219] "Died Hugh Hammond Bennett," *Time*, July 18, 1960, 66.

would say a religious intolerance." For his part, Bennett was self conscious of his use of charged language—a mode of discourse, he referred to as "wailing" and "howling mournfully."[220] While economic arguments appealed the rational minds of his audiences, Bennett understood that changing the behavior of the nation's farmers required moral rhetoric designed to appeal to their emotional hearts.[221]

Hugh Bennett presented his moral and economic cases for soil conservation as two sides of the same argument—"an economic necessity and a . . . moral obligation," as he put it. In doing so, however, he elided the differences between the two.[222] While the economic case for soil conservation rested on the presumption that the prevention of erosion is a sound business practice, the moral case was predicated on the view that the protection of soil represents a moral good regardless of the costs or benefits to the individual. What is good for the land and what is profitable for the farmer, however, are not always the same thing. This is the central conflict in the history of soil conservation in the United States. The reality was the problem of soil erosion was too great for individuals acting alone. Increasingly, it was clear that only collective public action could address the problem at the scale necessary to solve it, that society must play a role to extend soil conservation to the countryside. For as Bennett wrote sometime in late 1926 erosion "is entirely too big a

[220] For instances of this expression, see Bennett to Whitson, August 14, 1927, Entry 21, Box 7, Miscellaneous Papers of H.H. Bennett, 1926-34, Folder "Records about the initiation of soil erosion research, 1927-28," 1; and Bennett to Lowdermilk, April 8, 1929, RG 114, Entry 18, Correspondence of the Director of the Soil Erosin & Moisture Conservation Investigations, 1928-34, Box 1, Folder "A 1929-1931," 2.
[221] See also Swain, Federal Conservation Policy, 1921-33, 155; Held and Clawson, Soil Conservation in Perspective, 57.
[222] Bennett, "The Importance of Soil Conservation," 9.

problem for the farmer to handle alone . . . it seems no more than a national duty that all of us should interest ourselves in fighting this greatest enemy of cultivated land."[223]

The Floods of 1927 and the Case for Soil Conservation

The urgency of the case for soil conservation was underscored in the spring of 1927 when severe floods inundated much of the United States from the Plains to New England. Flooding caused destruction and human suffering across the country, but the damage was most severe along the lower Mississippi River. 1926 was a wet year. Consistent rains through the summer and fall saturated soils throughout the Mississippi river valley from the Alleghenies to the Rocky Mountains. The rain continued through the winter and early spring of 1927. By March tributaries of the Mississippi from Tennessee to Kansas had reached flood stage. On April 15, 1927, the famous Good Friday storm dumped between six and fifteen inches of rain on the south central United States. The resulting flood crest caused the river to break out of the levees built to contain it in 145 locations. The result was widespread devastation.

At its maximum extent, the great flood of 1927 inundated 26,000 square miles across seven states. This included over 16 million acres of farmland flooded and the destruction of 41,000 buildings and 162,000 homes. This amounted to $236 million in direct property loss, $200 million in indirect property loss. This does not include the human cost of the floods. An estimated 250 to 500 people died, and an estimated 700,000 people became refugees in the

[223] "Bennett, "Soil Conservation First Consideration," 7

months after the flood. Up to that point it was the most destructive flood disaster in the history of the country. The floods of 1927 provided Bennett with broader justification for his campaign against soil erosion.[224]

In 1927, the question of a national flood control policy was an old issue. It had long been clear that individual landowners and communities did not have the wherewithal to implement measures on their own capable of preventing flood damage. That was something that only the federal government had the means to accomplish. In 1927 the long-held consensus, however, was that while the Constitution granted the federal government the authority to regulate the navigability of rivers as part of its broader powers under the Commerce Clause, it prohibited federal spending on projects that had purely local benefits, which, in theory, precluded federal support for flood control projects.

As the historian Karen O'Neill has written, the boundary between what was constitutional and what was not was contested through the nineteenth century. In the nineteenth century, while Congress was understood to have power ensure the navigability of rivers, it did not have the authority to provide for flood control. So using navigability as their justification, local interests in the lower Mississippi Valley succeeded in securing federal support for the construction of a massive levee system. This plan for flood control on the Mississippi was conceived and implemented primarily by the Army Corps of

[224] An excellent narrative history of the 1927 Mississippi River floods is John M. Barry, *Rising Tide: The Great Mississippi Flood of 1927 and How It Changed America* (New York: Simon and Schuster, 1998), 14-15. See also Christopher Morris, *The Big Muddy: An Environmental History of the Mississippi and its Peoples* (New York: Oxford University Press, 2012). For a contemporary account of the flood, see F. H. Newell, "Mississippi River Floods" *The American Review of Reviews* 75 (June 1927), 592.

Engineers, and consisted of one approach, the construction of levees to confine the river within its banks and increase its flow to speed as much water as fast as possible downstream during high water events.[225]

In the aftermath of the 1927 disaster along the Mississippi River, flood control became a hot topic of public debate. The Army Corps of Engineers' was singled out, in particular, for its adherence to the levees-only policy. At a national flood control conference held in Chicago in June, Gifford Pinchot declared, "[t]he complete futility of depending on levees." "No one whose judgement is worth considering any longer believes that the greatest river in the world in length, if not in volume, draining an area of a million and a quarter square miles, is to be controlled by one single method in one restricted portion of its bed." Criticism of the Corps and levees opened the door for alternative ideas for effective flood control that had been waiting in the wings.

The most prominent up these was idea of upstream flood control, which held that flood causing rains should be stopped where they hit the ground through a comprehensive approach that included a combination of reforestation, improved agricultural practices, and upstream reservoirs. As Pinchot suggested, "the cause of the trouble is not single but multiple, not one but many, so must the remedy be multiple also." The idea that forests and ground cover reduces flooding by regulating the flow of streams —the so-called "stream flow hypothesis"— can be traced to the European antecedents of American

[225] Karen O'Neill, *Rivers by Design: State Power and the Origins of U.S. Flood Control* (Durham: Duke University Press, 2006). See also Martin Reuss, "The Army Corps of Engineers and Flood-Control Politics on the Lower Mississippi," *Louisiana History: the Journal of the Louisiana Historical Association* 23 (Spring 1982): 131-148. For a discussion of the physical effects of levees on the flow of rivers, see Barry, *Rising Tide*, 40-45.

conservation. Likewise, the civil engineer, Charles Ellett had advocated upstream reservoirs as an alternative to levees on the Ohio and Mississippi rivers as early as the 1860s. Advocacy of this multi-faceted approach to conservation were not new, but they had yet to be implemented on a large scale.[226]

In April, as floodwaters spilled out over the Mississippi valley, USDA issued an official statement that authored by Hugh Bennett. "The thousands of press despatches [sic] relating to the great flood now racing down the Mississippi have carried numerous diverse opinions about floods and flood control," he wrote, "but not one of these has emphasized [a] major cause of increased floods in the Mississippi Valley area — that is, unrestrained soil erosion."[227] The same practices that caused erosion of soil, he argued, also contributed to increased severity of floods. "If the soil material is kept in the fields and on the ranges where it belongs (and most of it can be kept there), we will do much to reduce the menace of floods, for the protected slopes will not

[226] The text of Pinchot's speech can be found in RG 114, Entry 21, Miscellaneous Papers of H.H. Bennett, Box 7, Folder "Records about the initiation of soil erosion research, 1927-28," 2-3. See also "Can Floods Be Prevented," The New Republic 50 (May 18, 1927), 344; F. H. Newell, "Mississippi River Floods," *The American Review of Reviews* 75 (June 1927): 592; and Matthew T. Pearcy, "After the Flood: A History of the 1928 Flood Control Act," *Journal of the Illinois State Historical Society* 95 (Summer, 2002): 175-177. For a discussion of the history of the idea of upstream flood control and its implementation in European and American contexts, see Tamara L. Whited, *Forests and Peasant Politics in Modern France* (New Haven: Yale University Press, 2000), 53-56; Gordon B. Dodds, "The Stream-Flow Controversy: A Conservation Turning Point," *The Journal of American History* 56 (June, 1969): 59-69; and Pisani, "Water Planning in the Progressive Era: The Inland Waterways Commission Reconsidered," *The Journal of Policy History* 18 (October 2006), 389-418. Two of the most famous examples of upstream flood control are the projects in the Muskingum valley in Ohio and the Wichita valley in Texas. For these, see Bryce C. Browning, "Watershed Management in the Muskingum Watershed Conservancy District," *Journal of Forestry* 58 (April, 1960): 296-298; Hal Jenkins, *A Valley Renewed: The History of the Muskingum Watershed Conservancy District* (Kent: Kent State University Press, 1976); and Jahue Anderson, "The Wichita Valley Irrigation Project: Joseph Kemp, Boosterism, and Conservation in Northwest Texas, 1886-1939," *Agricultural History* 85 (Fall, 2011), 493-519.

[227] "A Statement Relating to Soil Conservation and Flood Control by H.H. Bennett" c. April 1927, RG 114, Entry 21, Box 8, Folder "A Statement Relating to Soil Conservation and Flood Control," 1-4.

only hold back soil material but will store more water in the subsoil for summer use of tilled crops and range grasses."[228] Increased absorption of rainfall in the soil would, in turn, decrease the amount of water rushing downstream. "The disastrous results of the 1927 flood in the Mississippi Valley came from the last few feet of the rising waters, Bennett reasoned. "So it is with all floods. If a part of the water is held back, that part will cut down on the dangerous last few feet."[229] Soil conservation, he argued, was also flood control.[230]

This was the case Bennett made for soil conservation at a regional flood control convention held at Tulsa, Oklahoma, in July 1927. Tulsa was a prime example of the new American cities sited on upstream tributaries of the Mississippi, which included Omaha, Kansas City, and Wichita, among others, that developed in the decades after the Civil War and suffered periodically from floods. While public spending on Corps levee projects helped to protect rich agricultural lands on the lower Mississippi and along the Sacramento River in California, there was no comparable public assistance for flood protection for other parts of the country. The general prohibition on public spending on flood control measures, however, did not lessen the need for them. During the 1910s and 1920s, upstream interests in states that did not directly benefit from the federal levee projects began to call for a more equitable distribution of public flood investments. Groups like the Mississippi Valley Association organized to

[228] Bennett, "Soil Erosion Takes $200,000,000 yearly from U.S. Farmers," 593.
[229] "Soil Erosion Means Wasted Lands and Increased Floods," 14.
[230] See also Bennett, "Some Aspects of Erosion as a National Problem," 19; ibid., "Soil Conservation and Floods," *Annals of the American Academy of Political and Social Science* 281 (May, 1952): 181-188; ibid., "Drama of Wrathful Waters," *American Forests and Forest Life* (June 1927): 323-327.

advocate for upstream flood control projects. The Tulsa conference held in July 1927 was held as part of these broader efforts.[231]

In his flood control conference speech Bennett appealed to this sentiment to win support for soil conservation. The flood damage did not end with the losses to the people of the lower Mississippi valley. Rather, he told the audience, they "reached far up the tributaries and subtributaries [sic] that finger out over the hillsides and plains of the entire valley area." The source of the flood waters was not "crystal-clear springs and trickles from picturesque glens," but "sheets of rain that have gone plowing and scouring down every slope, tearing away the soil material from the surface of the ground, the richest part of the fields and pastures." What was needed, Bennett suggested, echoing the sentiments of the broader conservation community, was a comprehensive flood control solution that treated the Mississippi River as a single unit from its mouth to the headwaters of its many tributaries, and such approach should include soil conservation as an integral part. "[A]nything we may do to prevent erosion or to lessen its evil effects," as Bennett wrote, "will help materially to diminish the seriousness of floods." In particular, Bennett recommended the "[t]erracing of

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[231] For sources on national upstream flood control advocacy groups see "To the Members, Friends and Supporters of the Mississippi Valley Association," August 18, 1927, RG 16, Entry 17, General Correspondence of the Office of Secretary, 1906-1970, Box 1274, Folder "Floods July 1 to"; "Report of the Special Committee of Oklahoma City Chamber of Commerce on Mississippi Flood Control, c. 1928, ibid.; "The Pending Fight for Flood Control," c. 1927, ibid.; "Flood Prevention: Why 'Levees Only' Have Failed in Every Great Flood," c. 1927, ibid. For the Tulsa flood control convention see "May Propose Plan to Harness Rivers," *Tulsa Daily World*, July 10, 1927, 6; "Southwest Flood Control Meeting Under Way Today," *Tulsa Daily World*, July 14, 1927, 1; "Government Aid Pledged to Curb Ravaging Floods," July 15, 1927, *Tulsa Daily World*, 1. For other sources on upstream flood control in Oklahoma see E.E. Blake Papers, 1925-1941, Oklahoma Historical Society Research Division, Oklahoma Historical Society, Oklahoma City, Oklahoma; and the Kerr-McBride Collection, 1923-1977, Series 1: General, Box 4, Folder Flood Control, 1923-1929, Special Collections & University Archives, Oklahoma State University, Stillwater, Oklahoma.

fields and the growing of trees and grass on idle lands and areas too steep for cultivation and upon soils that are highly susceptible to washing." Such a comprehensive program of soil conservation, he assured those listening, would speedily create "a situation that will not only serve as a mighty prop to effectiveness of flood control by levees and reservoirs, but one that will lessen the economic ills of countless farmers." Soil conservation "should be one of the major foundation stones in any long-continuing system of flood control." In other words the prevention of erosion also meant the control of floods.[232]

In making these arguments Bennett echoed the sentiments of the broader conservation community. An article in the pages of the *The New Republic* echoed Bennett's diagnosis of the problem that the "lesson of the most recent Mississippi flood is not bigger and better levees," but fixing "the faulty system of agriculture in the Mississippi drainage basin" that "does not permit the soils to hold the rainfall as of yore, but lets the soil slip slowly away to the sea." This work also had the support of Gifford Pinchot, who publicly called for soil conservation as part of a comprehensive upstream flood control program, and advocacy groups that included the National Reclamation Association, American Forestry Association, American Society of Agronomy, and the Association of American Geographers, all of which endorsed soil conservation as a method of flood control. The reclamation booster George Maxwell wrote to Bennett

[232] Bennett, "The Problem of Soil Erosion in Relation to Flood Control," 2-3, 5. See also Bennett to Woods, July 17, 1927, 2, 9.

expressing his support for the conservation campaign. "Nothing will save this country but your work." [233]

Despite the broad base of support for soil conservation as a method of flood control, as critics of the idea pointed out, there was no conclusive evidence that linked conservation upstream with reduced flood heights downstream. There was only conventional wisdom, accumulated since the nineteenth century, that this was the case. While some research was being done on this topic by the Forest Service on its experimental watersheds, the fact was that the relative influence of different kinds of land use on rates of runoff rates over an areas as large as the watersheds that comprise the Mississippi River valley and its major tributaries was unknown.[234] While Bennett admitted as much—"[i]nadequacy of measurements makes it entirely impossible to estimate the full relationship of soil erosion to flood control" —it did not stop him from touting flood control as a benefit of soil conservation. The connection between erosion and floods would become an integral part of his case for soil conservation.[235]

To Bennett, the floods of 1927 underscored the case for soil conservation. Floods were natural calamities that made worse by the wasteful

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[233] Pinchot, "Untitled," 4. Swain, Federal Conservation Policy, 1921-1933, 155; Robert Stewart, "Soil Waste and the Flood Menace," The New Republic 53 (December 7, 1927): 64-67; Maxwell to Bennett, August 24, 1929, RG 114, Entry 1001, Correspondence of Hugh H. Bennett, 1924-1947, Box 1, Folder Material on Investigations, 1928-1935.
[234] For criticisms of claims made by advocates of upstream flood control see, Ashley L. Schiff, Fire and Water: Scientific Heresy in the Forest Service (Cambridge: Harvard University Press, 1962), 117-118; Hays, Conservation and the Gospel of Efficiency, 209. For the Forest Service's watershed research projects, see Raphael Zon, "Forests in Relation to Soil and Water," *Proceedings of the American Philsophical Society* 89 (July, 1945): 399-402; Norman J. Schmaltz, "Raphael Zon: Forest Researcher," *Journal of Forest History* 24 (January 1980), 24-39; and Stephen P. Glasser, "History of Watershed Management in the U.S. Forest Service, 1897-2005," *Journal of Forestry* 103 (July-August, 2005): 255-258.
[235] Bennett, "The Geographical Relation of Soil Erosion to Land Productivity" *Geographical Reviews* 18 (October 1928): 602

land use practices of Americans. “There are convincing indications,” he wrote, “that the near future will show that it took precisely this terrible thing to bring the people of the United States to see their moral and economic duty toward a stricken part of the country. . . .”[236] The major obstacle to implementing a comprehensive program of upstream flood control, however, was the same one faced by advocates of soil conservation, that is the difficulty coordinating the land use practices of tens of thousands of private land owners. How could advocates of soil conservation convince private landowners to adopt the practices they recommended?

While Bennett saw soil conservation as a “moral and economic duty,” he also understood that some impetus would be required to convince farmers and ranchers to adopt the recommended conservation practices. What was needed as he wrote to Albert Woods from Tulsa, is “a great national agency for education of the people about these problems of conservation and flood control.”[237] In 1927, no national agency existed. Such an impetus had to be channeled through the state land grant complex. During the 1920s, several states, mainly in the southeastern United States launched soil conservation campaigns through the state Extension Services. Of these more successful was the one launched by Texas.

[236] Bennett, “Soil Erosion Means Wasted Land and Increased Floods,” 1.
[237] Bennett to Woods, July 17, 1927, 2.

Soil Conservation and the States

The soil conservation campaign launched in 1926 by the USDA and led by Hugh Bennett was an effort to raise public awareness about soil erosion by creating publicity about the problem. From his post in Washington, D.C. and frequent travels throughout the country, Bennett made his case with speeches, radio broadcasts, and articles written for popular periodicals and government publications. These were as Bennett wrote to A.R. Whitson, head of the University of Wisconsin's Soils Department, in August 1927, "the only instruments at hand for the moment."[238] The USDA and Bennett supported local conservation initiatives and sought to mobilize them as part a larger national campaign, however, the responsibility for the implementation of soil conservation practices belonged to state agencies—namely, land-grant colleges and extensions services—and private-sector interests—such as banks and chambers of commerce. The most prominent of these of these efforts was in Texas, where the Houston Land Bank and the Texas A&M Extension Service coordinated a state-wide initiative to encourage farmers to terrace their land.

The Texas soil conservation campaign was an expression of the public-private model of cooperative agricultural extension that developed in the United States after the First World War. Texas was an early leader in extension work. The first demonstration farm in the country was established in the state in 1903 by the extension pioneer Seaman A. Knapp to showcase practices for combating

[238] Bennett to Whitson, 2.

the Boll Weevil.[239] These efforts were expanded in 1914 when Congress passed the Smith-Lever Act, which provided federal support for the creation of a national system of cooperative extension services operated by each state's land-grant school. State extension services placed agents in each county. Their job was was to work with farmers and ranchers to adopt improved agricultural techniques. After 1914 county agents in Texas and in other states began to promote soil conservation as part of their duties. "There are no more cheap lands in Texas," wrote T.O. Walton, the state extension service director in 1919. "More attention must be given to the conservation of the soil as well as soil rebuilding, if the people of today and their descendants are to be prosperous tillers." [240]

Soil conservation in Texas, however, remained limited until the House Land Bank became involved. The Houston Land Bank—one of the twelve district land banks established across the United States by the Federal Farm Loan Act of 1916, passed to increase access to credit in rural areas—came to see soil conservation as part of its fiduciary duty to guarantee the security of the mortgages it held.[241] Like other the land banks around the country, the Houston

[239] Alfred C. True, "A History of Agricultural Extension Work in the United States, 1785-1923," U.S. Department of Agriculture, *Miscellaneous Publication* 15 (1928), 59-60; Gladys Baker, *The County Agent* (Chicago: The University of Chicago Press, 1939), 26-30.

[240] T.O. Walton, "Terracing in Texas," Texas Agricultural and Mechanical College Extension Service, *Bulletin* B-51 (June 1919), 3; C.E. Ramser, "The Prevention of the Erosion of Farm Lands By Terracing," *Journal of the American Society of Agronomy* 21 (October 1929): 430-432. For a discussion of Extension Service conservation initiatives during the nineteens and -twenties, see Charles Hardin, *The Politics of Agriculture: Soil Conservation and the Struggle for Power in Rural America* (Glencoe, IL: The Free Press, 1952), 21-23.

[241] Congress passed the Federal Farm Loan Act in 1916, establishing the nationwide Farm Credit System—a network of credit cooperatives—to be a reliable source of funding for farmers, ranchers and aquatic producers. The legislation set up 12 district banks across the country to provide funds to local mortgage lending cooperatives. One of these banks, the Federal Land

Land Bank obtained the funds it lent out to farmers from the sale of bonds to investors. Payment on these bonds was secured by mortgages on farm lands. In the words of A.K. Short, who its conservation and terracing agent, the security of these bonds was “a sacred trust.”[242]

In 1918, the Houston Land Bank had included language in its loan agreements that required borrowers to build terraces if the bank found their land was deteriorating from erosion; if not, the bank would call loan to be paid. Though the terracing clause, “may seem arbitrary,” as Short put it, “it not only guarantees the security to the bond holders, it saves the thoughtless farmer from himself.”[243] According to Short, there was little effort to enforce the provisions of the terracing clause until 1927.[244] In July of that year, partially in response to the soil conservation campaign initiated by Bennett and the USDA and also in recognition of financial losses sustained by bad loans in worsening economic conditions, the Houston Land Bank created a department of soil conservation and terracing to educate farmers about the importance of erosion prevention. “We are all coming more and more to the realization that the solution to all problems, including the farm problem, is information or education,” Short wrote. “The Bank chose the educational route, using the terrace clause to stimulate interest.”[245] In July 1927 the Houston Land Bank in cooperation with

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Bank of Houston, was designated to serve the Tenth Farm Credit District and later would become the Farm Credit Bank of Texas.

[242] A.K. Short, “Statewide Soil Conservation Campaign in Texas,” c. 1928, RG 114, Entry 21, Box 5, Folder “Synopsis of the Results of Run-Off Water and Soil Erosion Experiments,” 1.

[243] Ibid.

[244] A copy of the Deed of Trust used by the Houston Land Bank that contains this language can be found in RG 114, Entry 21, Box 5, Folder “Synopsis of the Results of Run-Off Water and Soil Erosion Experiments.”

[245] Short, “Statewide Soil Conservation Campaign,” 2.

the Texas A&M Extension Service launched a state-wide campaign to promote soil conservation.

At this time, the chief soil conservation technique was the hillside terrace, which individual farmers had used to hold soil in hilly areas across the southeast since the nineteenth century. The first terracing demonstration in the state was at Tyler in 1910. After 1914 county agents began to encourage the practice more widely. Texas farmers were slow to adopt terraces as a method of soil conservation. One reason cited was a resistance to new methods among farmers who saw terraces as unnecessary, impractical, and . . . an example of the folly of book learning."[246] Another reason was the limited ability of county agents to assist every farmer that needed terraces. As A.K. Short noted, "there were only 165 County Agents in Texas," and "[i]t is hardly probable that these county agents can average more than 50 farms per year. At this rate, it would take more than 35 years for the farms of Texas to be terraced." The Houston Land Bank's idea was that to "get more farms terraced there must be more people trained in the fundamentals of terracing." By holding classes to teach "men and boys to run terrace lines under the county agent's or vocational teacher's supervision, then the agent's efficiency can be increased many hundred times."[247]

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[246] "Texas Arrests Soil Erosion," c. 1931, RG 114, Entry 21, Box 8, "Soil Erosion (General)," 2.
[247] "Statewide Terrace Campaign and Program of Work,"1-2.

Figure 14. Demonstration of terrace construction in Temple, Texas, c. 1930. (RG 114p, Soil Erosion Experiment Station Photographs, Box 15, National Archives, College Park, MD).

In July 1927, A.K. Short and M.R. Bentley, an Extension farm engineer, began an educational tour of Texas that took them to every section of the state to lead day-long terracing classes to both "impress upon farmers and business men the importance of soil and plant food conservation" and to demonstrate methods for "building adequate terraces." To reach farmers the Houston Land Bank sent notifications to all of its borrowers in a community where a terracing demonstration was to be held. The county agent as well as local chapters of the National Farm Loan Association, of which all land bank borrowers were members, were responsible for further publicizing the event. The support of business interests was also important to the success of the terracing schools. As A.K. Short wrote, "[w]e have noticed that there are larger and more enthusiastic crowds in those communities where the business men are interested."

Businessmen were a particularly important constituency because they were relied upon to help defray the costs of the terracing demonstration and the installation of actual terraces. Support from business was asked for and given in a variety of ways, from the provision of sandwich lunches to participants in the schools to the actual purchase of the farm levels necessary for terrace construction. [248] Terrace schools were also touted also as business opportunity. Banks lent money to farmers to finance the installation of terraces. A state representative of the Martin Ditcher Company attended each session to demonstrate the use of the company's equipment in terrace construction. The Ford Motor Company and the International Harvester Company also sent representatives to these events, though with the caveat that "only machinery being used for [terracing demonstration] should be displayed."[249] The founder of the Coriscana Grader Company wrote a song to the tune of "Casey Jones" celebrating the financial benefits terraces brought both to farmers and his company's bottom line:

> Come all you farmers if you want to hear
> A lecture by a civil engineer
> You may look for the Governor but its nothing of the sort
> For its R.M. Bentley and A.K. Short.
>
> Terraced land will make more cotton,
> Terraced land will make more hay,
> Terraced land will make more goobers
> To sit around the fire and eat on a rainy day.
>
> They will set up the level and adjust the screws

[248] Short to Gentry, c. 1928, RG 114, Entry 21, Box 5, "Synopsis of the Results of Run-Off Water and Soil Erosion Experiments."; Short to Christian, Ibid.; McDonald to the Bankers of Texas, June 11, 1931, RG 114, Entry 1001, Correspondence of Hugh H. Bennett, 1924-1947, Box 1, Folder "Material on Investigations, 1928-1935."
[249] "Statewide Terrace Campaign and Program of Work," 4.

For that is what they are teaching in these terracing schools
They will take you to the field and run you a line.
If you want to buy a grader I wish you'd buy mine.

Now Mr. Farmer I will see you later
If you'll only give me an order for a Corsicana grader
For the Federal Land Bank says the time's at hand
When you'd better get busy and terrace your land.[250]

Texas' soil conservation program served as a model for the country. In their first year and a half, Short and Bentley, conducted 182 terracing classes in 31 counties to a total audience of 19,782 people.[251] By 1929, almost three million acres of land had been terraced in the state, and the work was proceeding at a rate of one million acres terraced a year.[252] A similar terracing campaign was begun around 1926 in Oklahoma. Oklahoma's terracing program, however, lacked the coordinating force provided by the Houston Land Bank in Texas. The extent of terracing varied from county to county; carried out in one place by a progressive farmer, in another by vocational classes at the local high school, and somewhere else by an active county agent.[253]

The overall message of state terracing initiatives begun in Texas, Oklahoma, and elsewhere during the twenties was simple: soil conservation not only protect the soil from further loss, but they also bring higher yields and

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[250] "Terracing Song," c. 1929, RG 114, Entry 21, Box 8, "Soil Erosion (General)."
[251] "Other States Are Watching Texas System," *The Daily Oklahoman*, February 3, 1929, 64.
[252] Conner to Bennett, April 15, 1929, RG 114, Entry 21, Box 6, "Erosion Program." See also Conner to Woods, RG 16, Entry 17, Correspondence of Secretary of Agriculture, Box 1412, "Erosion File 1929"; "Texas Has 2,808,251 Acres Terraced Land, Northeast and Smith County Leading," *The Dallas Morning News*, April 3, 1929, 24;"Texas Benefited by Terraced Lands," *The Wall Street Journal*, April 11, 1929, 15.
[253] "Pruning of Trees Urged by Donart," *The Daily Oklahoman*, October 19, 1919, 4; "Terracing Value Demonstrated by Test at Edmond," *The Daily Oklahoman*, July 11, 1920, 17. "Farm Level Bought For Community Use, *The Daily Oklahoman*, February 22, 1925, 53; "Boys Terrace Big Acreage," *The Daily Oklahoman*, September 5, 1926, 52; "Canadian County Agent Begins His Tenth Year, *The Daily Oklahoman*, March 21, 1927, 9.

increased land values. “Terracing land pays its own way many times over in the increased yields resulting from conserved soil and water.”[254] By 1931 Bennett could put an exact dollar on this value added by terraces. Extension agents in Texas and Oklahoma calculated that terracing raised the value of an acre of land by $8.26. Multiply that figure by the millions of acres terraced in Texas, “and you will have some idea of the value of this contribution of county extension agents to the prosperity of the Texas farmer.”[255] This was the essence of the economic argument for the protection of topsoil, conservation promised to lower costs and raise profits.

The relative success of the soil conservation campaigns begun at the USDA and in the different states, however, also illustrates the limits of the educational, cooperative, voluntary approach by which they were carried out. In 1930 a survey of the state of Oklahoma found that 13 million out of a total of 16 million acres suffered from erosion, of which only 226,000 acres had been terraced.[256] In Texas, the state with the most advanced soil conservation program in the country, after five years of concerted efforts to terrace the countryside, only a fifth, about 5.6 million of the 26.5 million acres, of the farm land in the state that needed terracing had been terraced.[257]

Both Oklahoma and Texas recognized the severity of the problem and the limits of private initiative to solve it. In 1929 the Oklahoma state legislature

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[254] Bennett, "Soil Erosion Means Wasted Lands and Increased Floods,” c. 1927, RG 114, Entry 21, Miscellaneous Papers of H.H. Bennett, Box 8, Folder “Soil Erosion Means Wasted Lands and Increased Floods.”

[255] “Texas Arrests Soil Erosion,” c. 1931, RG 114, Entry 21, Box 5, Folder "Synopsis of the Results of Run-Off Water and Soil Erosion Experiments,”1.

[256] “Oklahoma Soil Erosion,” *The Wall Street Journal*, July 21, 1930, 2.

[257] “Texas Passes High Mark in Terracing,” c. 1932, RG 114, Entry 21, Box 8, “Soil Erosion (General).”

passed a $20,000 appropriation to support the erosion survey of the state. The same year Oklahoma Governor William J. Holloway appointed a state soil conservation committee.[258] In 1929, the states of Texas, Oklahoma, New Mexico, Colorado, Kansas, Louisiana, Arkansas, and Missouri agreed to interstate compact to cooperate on the development of soil conservation protocols. In November 1929 representatives from these eight states met in College Station, Texas, for the first Southwest Conference on Soil and Water Conservation. The first meeting of its kinds to focus specifically on the problem of soil erosion. Bennett likened the significance of this conference to the governors conference on conservation convened by President Theodore Roosevelt in 1908. [259] While these were welcome developments, they were also implicit admission that greater public involvement would be required to extend conservation measures to where they were needed.

Concern for soil erosion did not appear overnight in 1926. The causes and consequences of erosion, as well as the general practices for preventing it had been known for some time. What changed was the receptiveness of American public to the message of soil conservation. The threat of erosion, evident in obvious damage to agricultural landscapes in the form of gullies, fields bared of topsoil, water courses clogged with sediment, and destructive floods, resonated with other national anxieties about technological change, rural poverty, and the deepening agricultural recession, and served to focus attention on erosion as a critical national problem.

[258] Trent to Bennett, November 29, 1929, RG 114, Entry 21, Box 6, Folder "Erosion Program."
[259] Bennett, “Uncle Sam Takes Thought of Soil Productivity,” 3.

Likewise, Hugh Bennett was not the first to notice the problem of erosion, nor was he personally responsible for developing the practices for its prevention. His significance during this period lies in the role he played as an impresario for soil conservation through his intellectual efforts to synthesize extant knowledge of soil erosion and conservation into a coherent narrative calling for action and his organizational efforts to coordinate at the local and state levels into a national campaign for soil conservation. By virtue of his position, he emerged as a leader in a national movement. In doing so he followed in the steps of the previous generation of conservationists who had observed soil erosion and warned of its potential dangers. Men like Nathaniel Southgate Shaler and Thomas Chrowder Chamberlin among others, whose warnings Bennett consciously echoed, however, Bennett's case for soil conservation represented a marked departure from previous generation of those concerned for the soil. Where his predecessors believed state intervention in private land use decisions was out of bounds, Bennett would come to see it as the solution to the problem. For all these reason, as historian Douglas Helms has observed, Bennett, "succeeded in arousing national attention where others had failed."[260]

[260] Helms, "Hugh Hammond Bennett and the Creation of the Soil Erosion Service," 68A-74A.

4. The Technology and Culture of Soil Conservation

> Information greatly needed in connection with the problem of erosion should be made available through experimentation and research work as speedily as possible.
>
> — Hugh Bennett, "Soil Erosion A National Menace (1928) [261]

Concern for the problem of soil erosion did not develop parallel to the knowledge necessary for its prevention. While a consensus had formed by the middle twenties that soil erosion was a serious problem, what, exactly to do about it remained an open question. There existed a general understanding of erosion as a physical process and some ideas about methods that could be used to control it. There remained, however, many unanswered questions. How does erosion vary across different soil types? What conservation practices are most effective at preventing erosion in different environmental contexts? How can soil conservation practices be best incorporated into existing regimes of agricultural production? What should be done with land unsuitable for agriculture? The primary objective of the soil conservation campaign launched by the USDA and led by Hugh Bennett had been to secure public support for a systematic investigation into these questions.

This chapter examines the appropriation of funds for soil conservation research on ten agricultural experiments stations located in representative regions around the country between 1928 and 1933. It follows the development of two competing visions of how best to conserve soil: one led by agricultural engineers who advocated terraces and the other championed by Hugh Bennett

[261] Bennett and William R. Chapline, "Soil Erosion A National Menace," U.S. Department of Agriculture, Circular 33 (Washington: GPO, 1928).

and his staff, which emphasized agronomic approach that kept soils covered in vegetation. By the end of this period, the ideas about soil conservation developed from this work would be at the center of proposals for a national land use policy.

Soil Erosion A National Menace

A common refrain in the campaign for soil conservation was the need for more research into its causes and solutions. This case was made most famously with the publication of USDA *Circular* number 33 "Soil Erosion A National Menace" in April 1928.[262] This publication was issued as part of an effort by Secretary of Agriculture William Jardine to secure funds from Congress to pay for research into erosion research at agricultural experiment stations. It consisted of two essays, one written by Hugh Bennett and the other by William Ridgely Chapline, a Forest Service grazing effort. Chapline wrote on the problem of erosion on western range lands.[263]

Erosion on grazing land was an important aspect of the broader soil conservation problem that had not received as much as attention as the loss of on agricultural lands in the eastern half of the United States. By bringing attention

[262] Bennett used variations of the title "Soil Erosion A National Menace" for several different essays and articles he wrote between 1927 and 1933. While different versions of the title contained a comma or colon, the version published as the title to USDA *Circular* 33 contains no punctuation. See also Bennett, "Soil Erosion—A National Menace," *Journal of Forestry* 26 (April, 1928): 520-527; and ibid., "Soil Erosion, A National Menace," June 4, 1931, RG 114, Entry 21, Box 3, Folder "Soil Erosion, A National Menace."
[263] William Hurst, "William Ridgely Chapline: A Pioneer in Range Research," *Rangelands* 9 (June 1987), 134-135. For the development of the discipline of range management more generally, see William D. Rowley, "Historical Consideration in the Development of Range Science" in *Forest and Wildlife Science in America*, Harold K. Steen, ed. (Durham: Forest History Society, 1999), 230-260.

to it, Chapline widened the scope of soil conservation concern. It was Bennett's essay, however, "Some Aspects of the Wastage Caused by Soil Erosion," which neatly summarized the case for soil conservation that he had been making since 1926, for which the publication is best remembered.[264]

Through well-chosen words, Bennett took readers on a virtual tour of soil erosion in the United States, detailing the type, extent, and kind of damage most common in each region of the country. He pared his descriptions of erosion with lurid images of giant gullies, washed fields, trampled rangelands, and valleys buried in sediment. His central point was that soil erosion was not just an individual, local, or a state problem, it was a national problem—"a national menace" as he framed it—that would require national action to solve. "Erosion is a very big problem," he concluded. "It is doubtful if the farmer can handle it alone." But, what was to done? The only methods the USDA and the state agricultural authorities had at their disposal to influence land use were research initiatives and the education of individual farmers—persuasion through science. In 1928, it was to these legal channels that the department turned to further the cause of soil conservation.

What was needed more than anything, Bennett argued in "Soil Erosion A National Menace," was more research into the problem and its solutions. "In this country," he wrote, "only a limited amount of information has been acquired concerning the rates of erosion on different soil types." Likewise, there was a

[264] For an account of the circumstances in which "Soil Erosion A National Menace" was commissioned and published, see Helms, "Oral History Interview of William R. Chapline," August 23, 1982, Douglas Helms Collection, Oral Histories, National Agricultural Library, Beltsville, Maryland, 32-42. See also Swain, *Federal Conservation Policy*, *1921-1933*, 149.

need to study the effectiveness of different conservation practices under varying conditions such "as the holding effect of terraces of different build or the possibility of reinforcing [sic] them with various stabilizers such, perhaps, as grass, shrubs, or vines." What research of this kind that had been done, at experiment stations in Missouri, Texas, and North Carolina, as Bennett observed, was limited to "[o]nly three or four soil types of the many involved."[265]

Any conclusions drawn from this data could not be applied to soils of others type. To be of any value, erosion research must be conducted on the basis of soil type. "The kind of information that is most needed about erosion is that which will apply to definite kinds of land—to soil types that vary from place to place, not only in their crop adaptations and requisite methods of cultivation, but in their resistance to erosion and needs for checking the washing. "Any other method of procedure in studying the problem he wrote, would be "wasted effort, as methods that may apply to one soil may injure a soil of different character."[266]

Bennett had drawn up an ambitious research agenda on soil erosion and presented it to the USDA director of scientific work, Albert Woods, as early as the fall of 1926. From that time forward, securing an appropriation to for soil erosion research became part of the Department's agenda on Capitol Hill. [267]

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[265] "Soil Erosion a National Menace," 18-22.
[266] Ibid., 19-20. See also Bennett, "Soil Conservation First Consideration," 7.
[267] For these preliminary plans for the soil erosion experiment work, see Bennett, "A Major Project for Soil Erosion Investigations by the Bureau of Chemistry and Soils," December, 1926, RG 114, Entry 21, Box 7, "Major Project for Soil Erosion Investigations by the Bureau of Chemistry and Soils"; and Ibid., "Soil Conservation First Consideration," 10. See also ibid., "The Technique of the Quantitative Study of Erosion and Some Early Results of This Study,"

Bennett was generally supportive of state-level soil conservation initiatives that had developed during the twenties, but he was adamant that any future erosion control programs should be national in scope and coordinated by the USDA. "If the states all get into the game there will be a lot of disconnected work," he wrote to Arthur G. McCall, the director of the department's soils work in 1927. "We should jump into this problem actively at the first opportunity, and I trust you are going to see to it that we get a real opportunity."[268]

In the spring of 1928, U.S. Senator Morris Sheppard, Democrat from Texas, introduced a bill to authorize the Secretary of Agriculture to research methods to control erosion, conserve soil fertility, and minimize silt deposits in reservoirs. While this proposal passed the Senate, it died in the House Committee on Agriculture.[269] Recognizing the need to win support in the House of Representatives for soil conservation, Bennett conspired with Arthur B. Conner, the Director of the Texas Agricultural Experiment station, to lobby. Congressman James P. Buchanan, a Democrat who represented southeast Texas' tenth district, to support an amendment to the annual agricultural appropriation bill to fund erosion control research. As a member of the House Appropriations Committee Subcommittee on Agriculture, Buchanan played an influential role in determining the USDA's budget. Influenced by Conner and Bennett, Buchanan

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December 28, 1932, RG 114, Entry 21, Box 4, "The Technique of the Quantitative Study of Erosion," 3.

[268] Bennett to McCall, October 2, 1927, RG 16, Entry 17, General Correspondence of the Office of Secretary, 1906-1970, Box 1412, Folder "Erosion."

[269] S. 3484, 70th Cong., 1st Sess.; "Hearings before a Subcommittee of the Committee on Agriculture and Forestry on S. 3484," May 3, 1928, 70th Cong., 1st Sess. (Washington: GPO, 1928), 6-18; See also Bennett, "Memorandum for the Secretary of Agriculture in Regard to Senate Bill 3484," April 16, 1928, RG 114, Entry 21, Box 7, Miscellaneous Papers of H.H. Bennett, 1926-34, Box 7, Folder "Records about the initiation of soil erosion research, 1927-28." See also, Morgan, *Governing Soil Conservation,* 5-6.

came to see the benefits of stopping erosion both for Texas farms and his own political fortunes. From 1929 until his death in 1937, he would be a leading champion of soil conservation in Congress.[270] The legislative text of the amendment itself was drafted by the Bureau of Chemistry and Soils, which requested $150,000 to fund the program. Buchanan subsequently added it to the Agricultural Appropriations Act for fiscal year 1930. Hearings were held in late November 1928. It was approved by the House of Representatives on December 18, 1928, and became law as part of USDA's budget in February 1929. The final legislative text authorized the USDA for the first time to make investigations into:

> . . . the causes of soil erosion and possibility of increasing the absorption of rainfall by the soil in the United States and to devise means to be employed in the preservation of soil, the prevention or control of destructive erosion and the conservation of rainfall by terracing or other means, independently or in cooperation with other branches of the Government, State agencies, counties, farm organizations, associations of business men, or individuals. . . .[271]

The final bill added an additional $10,000 to the Department's initial request, bringing the total funds appropriated for erosion control research to $160,000. Forty thousand dollars was made immediately available, with balance released

[270] For secondary accounts of this episode see Hugh Bennett, *Soil Conservation*, vii-viii; Wellington Brink, *Big Hugh: The Father of Soil Conservation*, 74-78; and Swain, *Federal Conservation Policy, 1921-1933*, 151. See also Arthur B. Conner Papers, Texas A&M University Archives, Vertical Files, Center for American History, University of Texas at Austin. For an example of statement by Buchanan on need for soil conservation, see *Congressional Record*, 70 Cong., 2nd Sess., House, February 25, 1929: 4261-4262. See also James Paul Buchanan Papers, 1896-1954, Center for American History, The University of Texas at Austin.
[271] "Department of Agriculture Appropriations, Fiscal Year 1930," *U.S. Statutes at Large* 45 (Washington: GPO, 1929), 1207-1208.

at the start of the new fiscal year on July 1, 1929.[272] Appropriation of these funds marked a significant moment in the history of the soil conservation in the United States. For the first time federal dollars were to be dedicated to solving the problem of erosion. As Bennett saw it, passage of the Buchanan Amendment, represented "the first important step the nation has taken toward a far-reaching attempt to protect our agricultural lands from the unrestrained ravages of soil erosion." It was the beginning of a national public commitment to the conservation of soils. [273]

Establishment of Erosion Experiment Stations

In February of 1929, Albert F. Woods, the USDA's director of scientific research, appointed a committee on soil erosion to develop a research agenda for the soil and water conservation experiments now authorized by Congress. The soil erosion committee was chaired by Arthur G. McCall, Chief of Soil Investigations at the Bureau of Chemistry and Soils; and included Samuel H. McCrory, Chief of the Division of Agricultural Engineering in the Bureau of Public Roads; E.H. Clapp of the Forest Service; and two representatives from state experiments stations, Jacob G. Lipman from New Jersey and Arthur B. Conner from Texas.

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[272] H.R. 12481, 70th Cong., 2d Sess.; "Hearings before a Subcommittee of the House Committee Appropriations on the Agricultural Appropriation Bill for 1930," November 21, 1928, 70th Cong., 2nd Sess. (Washington, GPO, 1928), 310-330; *Congressional Record*, 70th Cong., 2nd Sess., House, December 18, 1928: 835.
[273] Bennett, "Uncle Sam Takes Thought of Soil Productivity," 1.

The USDA soil erosion committee met in Washington, D.C. on March 12, 1929.[274] The most important outcome of this meeting was the articulation of a formal plan of work. Issued in late March 1929, the research agenda for the soil erosion and moisture conservation investigations closely followed proposals for erosion research first drafted by Hugh Bennett in late 1926.[275] It called for a comprehensive program of research on the physical process of soil erosion and methods for its control.

The first priority was the collection of data on the process of soil erosion. This meant both the collation of existing knowledge and the initiation of new experiments to determine the specific rates of soil and water loss for a broad range of soil types and land uses under different climatic and topographic conditions. Secondly the research stations would investigate the effectiveness of different measures for conserving soil. This involved two general lines of inquiry. One was experiments on engineering measures such as terraces and small dams. The other involved agronomic practices such as the use of cover crops and crop rotations adapted to conserve soil.

Another important decision made was how responsibility for the administration of this work would be divided. While the funds were included in the appropriation for the Bureau of Chemistry and Soils, the legislative text stipulated that the work should be carried out cooperatively within the USDA

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[274] "A Program for Soil Erosion Moisture Conservation and Stream Regulation Research," March 25, 1929, RG 114, Entry 21, Box 1, Folder "Report for Congress on the Nat'l Program." See also Selman Abraham Waksman, *Jacob G. Lipman: Agricultural Scientist, Humanitarian* (New Brunswick: Rutgers University Press, 1966), 54-58.
[275] See Bennett, "Major Project for Soil Erosion Investigations by the Bureau of Chemistry and Soils"; Ibid., "Soil Conservation First Consideration," 10-11.

and with the states. Thirty thousand dollars of the funds appropriated by the Buchanan amendment were allocated to the Forest Service and $65,000 went each to the Division of Agricultural Engineering in the Bureau of Public Roads and the Bureau of Chemistry and Soils. Each agency brought its own institutional viewpoint to solving the problem of soil erosion.

The Forest Service used the money to continue its ongoing research on the relationship between forest cover and runoff.[276] The Division of Agricultural Engineering focused predominantly on the development of engineering practices—namely terraces and check dams—for the control of water flowing across agricultural fields and by extension the prevention of erosion. The Bureau of Chemistry and Soils, in keeping with its traditional focus on the capabilities of soils, emphasized study of the relationship between soil type, land use, and erosion. The division of authority over the research would have important implications for the development of soil and water conservation program at the Department of Agriculture. While it allowed for simultaneous inquiry into different aspects of the erosion problem, over the next four years it also led to disputes over the most effective conservation methods and institutional rivalries within the USDA for control of the soil conservation program.

One important decision left unmade by the committee was the politically sensitive question of where the erosion research stations would be located. The committee report issued in March 1929 recommended only that the research be

[276] For an overview of the Forest Service research program on watersheds, streamflow, and erosion see Glasser, "History of Watershed Management in the U.S. Forest Service, 1897-2005," 255-258; Zon, "Forests in Relation to Soil and Water," 399-402; Schiff, *Fire and Water: Scientific Heresy in the Forest Service*, 116-163; and Dodds, "The Stream-Flow Controversy: A Conservation Turning Point," *The Journal of American History* 56 (June 1969): 66-67.

located in seven of the most severely eroded regions of the country. These were the red lands of Oklahoma and Texas; the grey lands of northern Missouri and southern Iowa; the black lands of central Texas; the light-colored sandy lands of southwest Arkansas, northwestern Louisiana and east central Texas; the southern Piedmont of Virginia, North Carolina, South Carolina and Georgia; and the northern Piedmont lands of New Jersey and Pennsylvania.[277] These regions had been identified by a reconnaissance survey of country conducted by Hugh Bennett over the previous two years. From these observations, Bennett compiled a map of the country on which he had identified eighteen regions with distinct erosion problem. While Bennett described the map as “rather hastily gotten-up,” it was the first soil erosion map of the United States.[278]

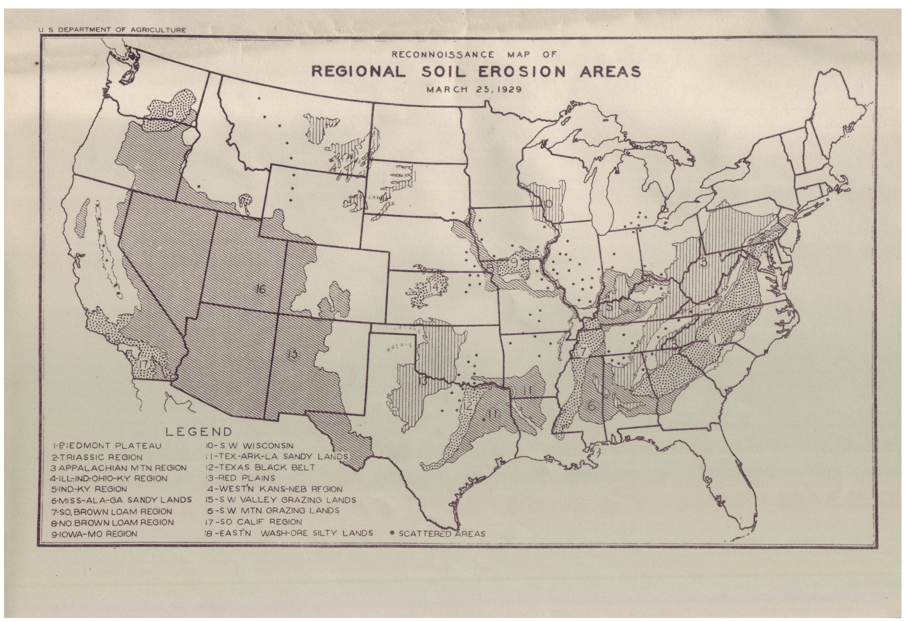

Figure 15. Map of Regional Soil Erosion Areas compiled by Hugh Bennett, March 1929 (RG 114, Entry 21, Miscellaneous Papers of H.H. Bennett, 1926-34, Box 1, Folder “Report for Congress”).

[277] “A Program for Soil Erosion Moisture Conservation and Stream Regulation Research,” 9.
[278] Bennett to Lauman, June 5, 1929, RG 114, Entry 18, Correspondence of the Director of Experiment Stations, Box 2, Folder “L 1929.”

Where exactly each of the erosion research stations would be located was left to the individual agencies to determine. While the Forest Service used its funds to support its watershed research on national forest lands, the Division of Engineering and the Bureau of Chemistry and Soils had to find lands on to which to conduct their erosion investigations.[279] For this purpose the ideal location was an improved farm about 240 acres in size, with good soil, varied topography, at least one field on which terraces half a mile long could be built, and access to a paved road.[280]

There was considerable demand for these experiment stations, as members of Congress, chambers of commerce, and local boosters from all over the country contacted the USDA to request that this research be conducted in their locale. Nevertheless, finding appropriate sites took time. It was a "new line of work," as Arthur McCall wrote to Arkansas Senator Thaddeus H. Caraway, who had sought an erosion experiment station for the southwestern part of his state. "We are feeling our way slowly with it."[281] In making these decisions, preference was given to places where local and state interests provided the resources to purchase the land on which the experiments would be conducted. They were also influenced by existing relationships develop Bennett, who was placed in charge of the work for the Bureau of Chemistry and Soils, and Lewis

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[279] For discussion of the Forest Service's use of funds made available by the Buchanan Act, see McCall to Woods, March 19, 1929, RG 16, Entry 17, General Correspondence of the Office of the Secretary, 1906-70, Box 1412, Folder "Erosion"; Lowdermilk to Bennett, April 1, 1929, RG 114, Entry 18, Correspondence of the Director of the Soil Erosion & Moisture Conservation Investigations, 1928-34, Box 2, "L 1929."
[280] J.E. Noll, "The First Erosion Experiment Farm," *The Lan*d 1 (Winter 1941): 24.
[281] McCall to Caraway, October 8, 1929, RG 114, Entry 18, Correspondence of the Director of the Soil Erosion & Moisture Conservation Investigations, 1928-34, Box 1, Folder "C 1929."

A. Jones, who led the research for the Division of Engineering, with the staffs of the state agricultural colleges and experiment stations. The locations eventually chosen for the first experiment farms were in states that had demonstrated the most interest in soil conservation up to that point in time.[282]

The establishment of soil erosion experiment stations is part of the broader history of publicly sponsored agricultural experimentation and education initiatives in the United States in the early twentieth century. First established with by the Hatch Act in 1887, which created the legal mechanism through which the federal government funded agricultural research, state experiment stations conducted research that helped to drive the scientific revolution that transformed American agriculture in the late nineteenth and early twentieth centuries. After 1914, with passage of the Smith-Lever Act, which helped to establish state extension services, the scientific knowledge developed at the experiment station was extended to the countryside by county agents. The USDA-Land Grant School-Experiment Station-Extension Service nexus was the organizational center of scientific agriculture in the United States. This system for the development and spread of agricultural knowledge relied on the voluntary cooperation of land users to adopt expert knowledge recommended to them. [283]

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[282] For an discussion by Bennett of the factors that led to selection of sites for the soil erosion experiment stations, see Bennett to Secrest, March 27, 1931, RG 114, Entry 1001, Correspondence of Dr. Hugh H. Bennett., Chief, 1924-1946, Box 1, Folder "Material on Investigations, 1928-1935," 1-2.

[283] See Baker, Rasmussen, Wiser, and Porter, *Century of Service*, 24-25; A.C. True and V.A. Clark, "The Agricultural Experiment Stations in the United States," U.S. Department of Agriculture, Office of Experiment Stations, *Bulletin* 80 (1900); Norwood Allen Kerr, The Legacy: *A Centennial History of the State Agricultural Experiment Stations, 1887-1987* (Columbia: Missouri Agricultural Experiment Station, 1987); Charles E. Rosenberg, "Science,

In this way it is also represented an expression of the faith in enlightened self-interest—that as Bennett put it, "[w]hen the farmers know what to do they will act"—that had defined public policy on land use from the nineteenth century to the Republican administrations of the 1920s.[284] This was the institutional model with which USDA launched its soil and water conservation program in 1929. While the work done on the these experiment stations would not in itself serve to extend soil conservation practices to the countryside, it provided a foundation of knowledge that would[285]

The site chosen for the first soil erosion experiment station was at Guthrie, Oklahoma. The Red Plains Soil Conservation Experiment Station, as it was called, was established through a cooperative initiative of the Guthrie Chamber of Commerce, Oklahoma A&M Experiment Station, and the USDA. Within a year and a half erosion control research began under similar arrangements at Hays, Kansas; Temple, Texas; Statesville, North Carolina; Bethany, Missouri; and Pullman, Washington. Subsequent appropriations made possible additional erosion research stations at Clarinda, Iowa, and LaCrosse, Wisconsin, in 1931, and in Zanesville, Ohio, in 1932. Erosion research begun in 1926 by the state experiment station in Spur, Texas was incorporated into the

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Technology and Economic Growth: The Case of the Agricultural Experiment Station Scientists, 1875-1914," *Agricultural History* 45 (January 1971): 153-72; Rosenberg, "The Adams Act: Politics and the Cause of Scientific Research," *Agricultural History* 45 (January 1971): 1-20; Gary E. Moore, "The Involvement of Experiment Stations in Secondary Agricultural Education, 1887-1917," *Agricultural History* 62 (Spring 1988): 164-176; Joel P. Kunze, "The Purnell Act and Agricultural Economics," *Agricultural History* 62 (Spring 1988): 131-149. See also Dupree, *Science in the Federal Government*; Harding, *Two Blades of Grass*; Margaret W. Rossiter, "The Organization of the Agricultural Sciences," 211-236.

[284] For a discussion of the role of voluntary cooperative action in the conservation initiatives of the 1920s, see Kendrick Clements, *Hoover, Conservation, and Consumerism: Engineering the Good Life* (Lawrence: University of Kansas Press, 2000), 30-31.

[285] Bennett, "The Wasting Heritage of the Nation," *The Scientific Monthly* 27 (August 1928): 121-122.

federal program after 1929.[286] The experiments done on these experiment stations and others subsequently established over the next decade provided the foundation for a modern understanding of erosion as a physical process and the means for its control. The story of this research provides important insights into the origins of soil and water conservation as a technical practice in the United States; an endeavor that Arthur McCall correctly predicted in 1929 was "destined to develop into one of the largest projects ever undertaken by the Department."[287]

Measuring Erosion

The first modern experiments to study soil erosion were begun in May 1917 by Frank L. Duley and Merritt F. Miller at the University of Missouri agricultural experiment station.[288] For this research, Miller and Duley constructed a series of nine runoff plots on which they simulated common cropping conditions found on Missouri Farms. From these plots, they could measure and compare the amounts of water and soil lost after each rainfall. Their results, first published in 1923, demonstrated beyond a category of doubt

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[286] See Appendix 2 for a table listing the location, date established, and director of each erosion experiment farm.
[287] McCall to Burlison, May 20, 1929, RG 114, Entry 18, Correspondence of the Director of the Soil Erosion & Moisture Conservation Investigations, 1928-34, Box 1, Folder "B 1929-1931." For sources on the establishment of the ten erosion experiment stations see "Departmental Plans for the Development of the Soil Erosion Program," January 12, 1931, RG 114, Entry 21, Box 7, Folder "Programs"; Bennett and Lewis A. Jones, "The National Program of Soil and Water Conservation," March 18, 1932, RG 114, Entry 21, Box 2, Folder "The National Program of Soil and Water Conservation"; and Brink, *Big Hugh*, 78.
[288] Starting in 1912 the U.S. Forest Service had begun research into the relationship between ground cover, runoff, and erosion on grazing lands in the high country of Colorado, Utah, and Arizona. While this research provided an important foundation for understanding soil erosion, it had little bearing on the problem of soil erosion on working farm lands. For a summary of this early research on erosion see, "A Program for Soil Erosion Moisture Conservation and Stream Regulation Research: First Report of the Committee on Soil Erosion," 3-5.

that not only was significant soil erosion taking place, but also the extent to which typical farming practices contributed to the problem. They showed that an inch of topsoil a year will erode from sloping land sown continually to corn, while practically no soil loss occurs on land kept in continuous vegetative cover.[289] Similar research was begun by state agricultural experiment stations at Raleigh, North Carolina in 1924 and Spur, Texas in 1926.[290]These experiments yielded important early erosion data that provided a quantitative basis for claims about the costs of erosion. They also provided the research template that the federal erosion experiment farms would follow in the coming years.

While these early run-off experiments yielded important insights into the relationship between land use and soil loss, they also had significant limitations. Namely, they were conducted on only a small number of soil types—a point Bennett was quick to make in his case for erosion research: "[a]s yet we have measured the rate of washing on but three important types of farm soil of the hundreds of types in the country."[291] This fact meant that conclusions reached from the experiments in Missouri, Texas, and North Carolina about how to best conserve soil could not be applied to in other places. For different soil types varied in their susceptibility to erosion "Why, for example," as Bennett

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[289] Frank L. Duley, "Hanging on to Your Farm," *Farm Journal* 49 (March 1925): 11, 90; Duley and Merritt F. Miller, "Erosion and Surface Runoff Under Different Soil Conditions," University of Missouri Agricultural Experiment Station, *Research Bulletin* 63 (December 1923); Duley, "Controlling Surface Erosion of Farm Lands," University of Missouri College of Agriculture Agricultural Experiment Station, *Bulletin* 211 (April 1924).

[290] For discussion of the erosion research done at the Raleigh and Spur experiment stations, see Bennett, "Soil Conservation," *The American Review of Reviews* (March 1927): 304; ibid., *Soil Conservation*, vii; R.E. Dickson, "The Results and Significance of the Spur (Texas) Run-off and Erosion Experiments," *Journal of the American Society of Agronomy* 21 (October, 1929): 415-422; "Erosion Notes," RG 114, Entry 21, Box 6, Folder "Erosion Notes"; and "Texas Arrests Soil Erosion," c. 1931, RG 114, Entry 21, Box 8, "Soil Erosion (General)," 2.

[291] Bennett, "The Wasting Heritage of the Nation," *The Scientific Monthly* 27 (August 1928): 122.

wrote in 1929, "did 27 inches of rainfall in west Texas remove 40.7 tons of soil per acre from a 2-per cent slope of fallow ground, when 35.6 inches of rain removed only 25 tons per acre from a 9 per cent slope of fallow ground in the Piedmont of North Carolina?"[292]

Determining the relationship between soil type, land use, and erosion was the central objective of the USDA's runoff experiments. This research was important because it would provide the basic information necessary for the development of conservation practices tailored to agricultural conditions in different regions of the country. This emphasis on determining the correlations between soil type, erosivity, and optimally conservation practices in the erosion research echoed of the central theme of Bennett's career: different soil types have different characteristics and that these characteristics should serve as a guide to their use.

Each of the ten soil erosion experiment stations built a set of run-off plots of different lengths and gradients. At the start of these investigations, a measurement was taken of the depth of the soil profile to establish a baseline against which soil loss could be measured. Each plot of the plots received a different treatment; usually either bare soil; corn only; wheat only; a three-year rotation of corn, wheat, and a cover crop; a continuous cover crop, or no cultivation at all. Additionally, different methods of tillage—such as subsoiling, scarification of the soil surface, and modifications of the soil texture from rough clods to a finely pulverized condition—were tested. At the base of each plot, a

[292] Bennett, "Relation of Land Utilization to Erosion and the Economic Desirability and Feasibility of Preventing Erosion," July 1929, RG 114, Entry 21, Box 2, Folder "Relation of Land Utilization to Erosion," 5.

large tank was installed to measure the amounts of water and soil that ran off after each rain.

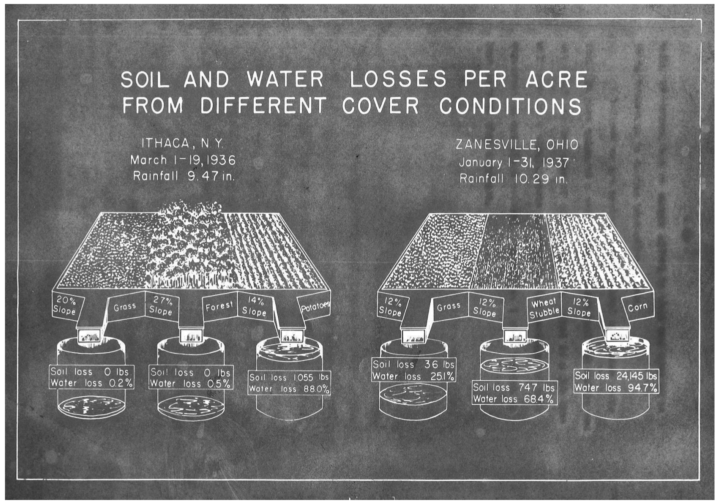

Figure 16. This 1937 illustration shows the basic principles of the run-off investigations conducted on the erosion experiment stations. See Figure 1 in Bennett, "Relation of Soil Conservation to Control of Floods and Silting," April 26, 1937, Douglas Helms Collection, Speeches of Hugh Hammond Bennett, National Agricultural Library, Beltsville, Maryland.

The results of these studies confirmed the results of the earlier experiments, showed in quantitative terms what was known intuitively. That is soils kept in vegetative cover are less susceptible to erosion and absorb more water from rainfall than soils that are continuously cropped season after season. They also showed that crop rotations are almost as effective as permanent vegetative cover at preventing erosion. Beyond that they indicated that anything that could be done to increase the amount of organic matter in the soil—from cover cropping to leaving stubble in the field after harvest—helped to stop erosion and increase the soil's water holding capacity. An important conclusion from these results as Frank Duley had observed in 1926 was that "[b]y properly arranging the crops in the rotation, it is possible to keep the land protected by a growing crop nearly all of the time."[293]

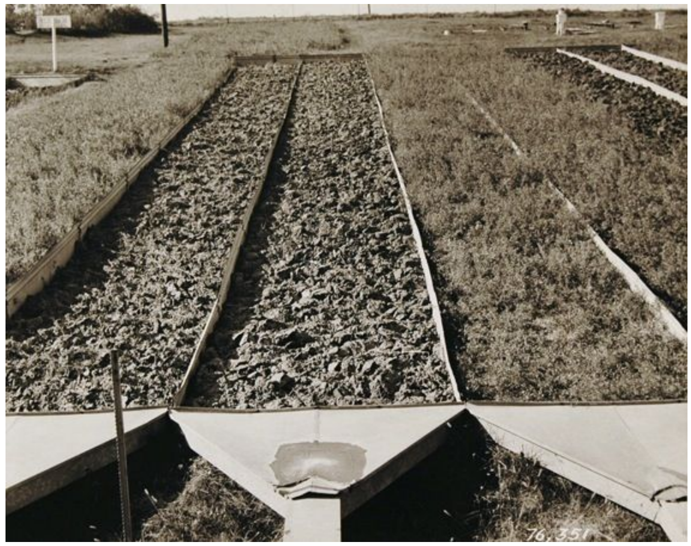

Figure 17. Photograph of run-off plots at the Upper Mississippi Valley Experiment Station at LaCrosse, Wisconsin, c. 1937 (RG 114-H, Prints: Photographs of Soil and Natural Resource Conservation Activities and Personnel, 1936-1988, Box 44, National Archives, College Park, MD).

While the conclusions reached from these run-off experiments were basic, they had several important implications. Producing detailed measurements of the erosivity of different soil types under a variety of common agricultural conditions, allowed USDA researchers to measure the effectiveness of different conservation practices for both preventing erosion and the rehabilitation of eroded land. Thanks to state-led initiatives like those in Texas and Oklahoma,

[293] Duley, "Hanging on To Your Farm," 90. For the results of runoff experiments see, Henry V. Geib, "Soil Erosion and Moisture Conservation Investigations, Temple, Texas," December 1932, RG 114, Entry 21, Box 1, Folder "Report on Soil Erosion Investigations Prepared for Dr. Connor's Annual Report for 1932"; Samuel W. Phillips, "The Red Plains Erosion Station," July 1932, RG 114, Entry 21, Box 5, Folder "The Red Plains Erosion Station"; Bennett, "Statement for Soil Erosion Part of the Annual Report of the Chief of the Bureau of Chemistry and Soils," July 13, 1932, RG 114, Entry 21, Miscellaneous Papers of H.H. Bennett, Box 1, Folder "Statement for Soil Erosion: Material Prepared for Dr. Knight's Annual Report"; Ibid, "Soil Erosion Problem Under Investigation in National Control Program" in *Yearbook of Agriculture, 1932*, (Washington: GPO, 1932), 344-351; ibid., "The Quantitative Study of Erosion Technique and Some Preliminary Results," *Geographical Review* 23 (July, 1933): 423-432. See also Swain, *Federal Conservation Policy, 1921-1933*, 154.

when the erosion experiments began in 1929, the most common method for the control of erosion was the construction of terraces. The insight that keeping soil covered with vegetation is the most effective method of soil conservation challenged the prevailing terraces-only paradigm.

This created a schism between advocates of terraces to control erosion and those who took the insights gleaned from the results of the run-off experiments to advocate for a comprehensive approach to soil conservation tailored to the specific characteristics of local environments. This conflict was expressed in institutional rivalry within the USDA between agricultural engineers, on one hand, and agronomists and soils specialists, on the other, over control of the department's soil conservation work. Its outcome would have significant consequences for the national program of soil conservation that would developed during the 1930s.

Engineering Conservation

Throughout human history, solutions for the control of erosion on sloping lands have converged on some form of the hillside terrace. Terraces flatten sloping terrain land to allow the cultivation of crops. The earliest known examples date to 2000 B.C.E. They can be found on every inhabited continent and islands throughout the oceans. Few agricultural practices are as common globally as the terrace.[294] The United States is no exception, but while the practice was generally known during the colonial period and in the early

[294] John R. McNeill and Verena Winiwarter, "Breaking the Sod: Humankind, History, and Soil," *Science* 304 (June 2004): 1628.

republic, it did not come into widespread use until after the Civil War. Terrace construction is a technical endeavor that requires significant amounts labor and engineering expertise to complete. For this reason, large numbers of American farmers began to adopt terraces only after the era of abundant land that made possible the extensive of agriculture came to close in the decades that followed the Civil War.[295]

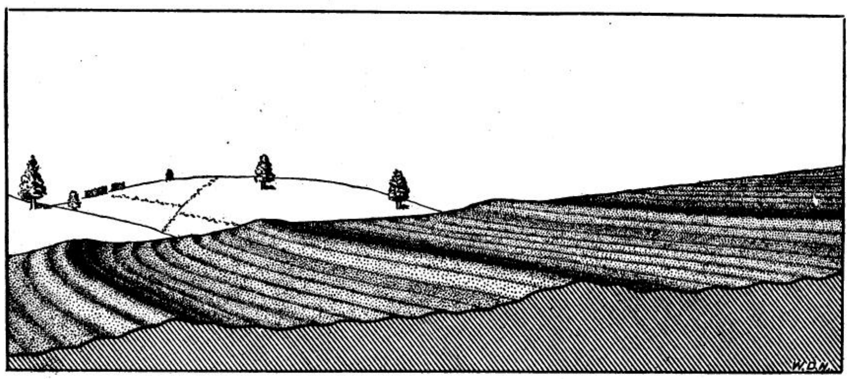

Figure 18. Illustration of broad based terraces taken from Charles E. Ramser, "Terracing of Farmlands," U.S. Department of Agriculture, *Farmers' Bulletin* 1386 (1924), 6.

In the nineteenth and early twentieth centuries, terraces were tried to greatest advantage in the South, where the combination of rolling terrain, soil type, climate, and predominant mode of row-crop agriculture made soil erosion a more pressing problem than other agricultural regions. It is no coincidence then that the South, which yielded the most spectacular examples of erosion, was also a source of conservation innovation. There were a number of variations in terrace design. Perhaps the most recognizable kind of terrace is the so-called

[295] See also Hall, "Early Erosion-Control Practices in Virginia," 15-21; ibid., "The Story of Soil Conservation in the South Carolina Piedmont," 23-27; Ibid., "Terracing in the Southern Piedmont," 96-109. See also Angus McDonald, "Early American Soil Conservationists," 8-10, 58; and Helms, "Soil and Soil Conservation" in *The New Encyclopedia of Southern Culture*, vol. 8, ed. Martin Melosi (Chapel Hill: The University of North Carolina Press, 2007), 146.

"bench" terrace which resemble steps carved into a hillside. This style is perhaps most closely associated with steeply tiered fields in the Andes or Southeast Asia. While examples of bench terraces in the United States could be found, by the end of the nineteenth century the most common type of terrace in the country was the "falling" terrace, which was developed by a North Carolina farmer Priestley Mangum on his farm near Wake Forest around 1885.

In contrast to the bench terrace, the so-called Mangum terrace was built with a slope from one end of the terrace to the other. The terrace's fall—a lateral drop of about one inch for every ten feet from side to side, and from one to two feet from the front to the back—allowed it to collect runoff and channel it from fields into adjacent outlet ditches, which typically drained into a stream. Constructed from eight to ten feet wide, each individual terrace resembled a long broad mound. A field of them was said to look like a series of a graded roadbeds running across the side of a hill. An important feature of this design was that farmers could plow over each terrace, in contrast to bench terraces that must be cultivated separately because of the sharp drop between each level. By 1900, the falling terrace were in use across the Southeast.[296]

The USDA and state agricultural colleges began to formally research the problem of terrace construction around 1914. Over the years, a number of

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[296] For a discussion of the two different types of terrace common in the United States during the early twentieth century, see F.R. Baker, "The Prevention and Control of Erosion in North Carolina, with Special Referencing to Terracing," North Carolina Agricultural Experiment Station, Bulletin 236 (February 1916). See also, E.W. Lehmann and Frank L. Duley, "The Mangum Terrace," University of Missouri Agricultural Experiment Station, *Circular* 98 (September 1920), 2; J.G. Mosier and A.F. Gustafson, "Washing of Soils and Methods of Prevention," University of Illinois Agricultural Experiment Station, *Bulletin* 207 (April 1918), 535-536; Hall, "Terracing in the Southern Piedmont," 97; and Davis, "Economic Wastes of Soil Erosion," 281-219.

variations on the terrace were developed. There was, for example, the Nichols terrace, an invention of the Alabama College of Agriculture, which represented an improvement on the falling terrace by including a defined channel to conduct runoff safely away from cultivated land. And there was a "syrup-pan" terrace, invented at the Spur, Texas, agricultural experiment station, which was broad and flat, an adaptation to the semi-arid Plains environment, to better hold rainfall where it fell and increase the absorption of water in the soil. Of all the innovations in terrace design to emerge from state and federal agricultural research, the most significant, however, was the variable-grade terrace developed by Charles E. Ramser.[297]

Born in 1885, Charles Ramser was raised on a livestock and hay farm near Montezuma, Iowa. He graduated with a degree in civil engineering from the University of Illinois in 1909, and joined the USDA in 1913 as an Assistant Drainage Engineer. His first assignment for the department was to study the relationship between floods and capacity of drainage channels in the lower Mississippi Valley.

From these studies, he showed how floods could be reduced by increasing the capacity of these channels. This work had direct bearing on his subsequent research into terrace construction. In 1915, Ramser was assigned to survey terraces in the Carolinas, Georgia, Alabama, and Mississippi. From these

[297] R.E. Dickson "The Results and Significance of the Spur (Texas) Run-off and Erosion Experiments," *Journal of the American Society of Agronomy* 21 (October 1929): 415-422; "Texas Benefitted by Terraced Lands" *Wall Street Journal*, April 11, 1929, 15; T.O. Walton, "Terracing in Texas," Texas Agricultural and Mechanical College Extension Service, *Bulletin* B-51 (June 1919); J.T. Copeland, "Terracing in Mississippi," Mississippi Agricultural and Mechanical College, *Extension Bulletin* 34, (1926); and Jerome J. Henry and Melvin L. Nichols, "The Nichols Terrace: An Improved Channel-Type Terrace for the Southeast," U. S. Department of Agriculture, *Farmers' Bulletin* 1790 (1937), 4-5.

observations, he made what he called the “the first attempt for a scientific and systematic approach to the problem of terracing.”[298]

Figure 19. Terraces built on the Chapman farm near Temple Texas, February 1933. (RG 114p, Soil Erosion Experiment Station Photographs, Box 15, National Archives, College Park, MD).

Ramser’s major insight was that a terrace’s grade should increase in proportion to its length. This design provided additional capacity to accommodate the increased amount of runoff that results from longer terraces without having to increase the width of the terrace itself. The USDA published Ramser’s plans for this variable-grade terrace in USDA *Bulletin* 512, “Prevention of the Erosion of Farm Lands by Terracing” in 1917. More than 150,000 copies of this publication were issued. Ramser also published

[298] For biographical information on Ramser, See “Charles Ernest Ramser,” Douglas Helms Collection, Biographical Files, National Agricultural Library, Beltsville, Md. See also, Charles E. Ramser, “Resume of Outstanding Research Contributions made during the last Twenty-Five Years,” c. 1940, Douglas Helms Collection, Misc. Papers, National Agricultural Library, Beltsville, Md.

pioneering studies in the early 1920s on the use of check dams to control gullies through the accumulation of debris behind the dams, which gradually halts cutting and fills in the gully. These publications, and their subsequent editions, would become the standards texts on these subjects. They firmly established Ramser as the leading expert on engineering practices for soil conservation in the country. For this reason, it was he who was chosen in 1929 to lead the engineering research at the soil erosion experiment stations established by the Buchanan Amendment.[299]

Figure 20. Photo of a check dam made from logs on the soil erosion experiment station at Tyler, Texas, July 21, 1930 (RG 114p, Soil Erosion Experiment Station Photographs, Box 15, National Archives, College Park, MD).

By the later 1920s, the terrace was synonymous with soil conservation, and the construction of terraces was understood to be the job of agricultural

[299] Ramser, "Prevention of the Erosion of Farm Lands by Terracing," U.S. Department of Agriculture, *Bulletin* 512 (1917); Ibid., Terracing Farm Lands," U.S. Department of Agriculture, *Farmers' Bulleti*n 1386 (1924); Ibid., "The Prevention of the Erosion of Farm Lands by Terracing," *Journal of the American Society of Agronomy* 21 (October 1929): 430-432; Ibid., "Gullies How to Reclaim and Prevent Them" *Farmers Bulletin* 1234 (1922).

engineers. Agricultural engineering had only emerged as a distinct discipline around 1910. State land grant colleges began to grant degrees in the field around this time, and it became distinctive function of the USDA when a division of agricultural engineers was created in what would become the Bureau of Public Roads in 1915. The USDA's division of agricultural engineers remained in the Bureau of Public Roads until 1931 when in that year an independent Bureau of Agricultural Engineering (BAE) was created.

As the source of institutional knowledge on terrace construction the BAE was given joint responsibility with the Bureau of Chemistry and Soils for conducting research at the soil erosion experiment stations. As the historian Deborah Fitzgerald has written, the rise of the agricultural engineer corresponds with a larger process of modernization taking place across American society during the first decades of the twentieth century. Just as engineers sought to apply principles of scientific problem-solving to the streamlining of American industry, they sought to rationalize agriculture by encouraging farmers to adopt best business practices, new technologies, and greater efficiencies of scale in the name of productivity and profitability.[300] The application of engineering principles to soil conservation can be seen as an extension of these broader efforts.

While engineers contributed to a technological revolution in American life, they also had blind spots in their worldviews. As scholars have noted, engineers often neglected social, cultural, political, and economic aspects of the

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[300] Deborah Fitzgerald, *Every Farm a Factory: The Industrial Ideal in American Agriculture*, 108. For a summary of the institutional history of agricultural engineering in the USDA, see Baker, Rasmussen, Wiser, and Porter, *Century of Service*, 109.

problems they attempted to solve. This was true, as well, for agricultural engineers, who in the case of the soil conservation, often ignored the natural capabilities of the landscape in their designs for a one-size-fits-all solutions for the problem of erosion.[301]

Charles Ramser directed the engineering research at the ten erosion experiment stations from his headquarters at the Red Plains experiment station outside of Guthrie, Oklahoma. These investigations measured the rates of runoff from terraces on different slopes, soil types, and with different grades and spacing between terraces. They also tested the effectiveness of different types of materials used to build check dams used to heal gullies. From this research, USDA agricultural engineers developed coefficients for formulas to determine the optimal design of drainage channels, check dams, and terraces in a broad range of environmental conditions.

In Ramser's view, and in the view of agricultural engineers at the USDA, the results of these experiments confirmed that terraces and other engineering practices should be given top priority in conservation planning. By insisting on the primary of terraces, agricultural engineers stood on one side of a conflict with advocates of a more comprehensive approach to soil conservation, which incorporated engineering measures where appropriate, but also employed a

[301] For further discussions of the implications of the rise of the engineering profession in American life, see David F. Noble, *America by Design: Science Technology, and the Rise of Corporate Capitalism* (New York: Oxford University Press, 1977); Edwin T. Layton, *The Revolt of the Engineers* (Cleveland: Press of Case Western Reserve University, 1971).

range of alternatives approaches to the prevention of erosion. First among these, was the use of vegetation wherever possible to hold the soil in place.[302]

Towards A Comprehensive Conservation

Hugh Bennett had long recognized the importance of terraces. As a boy he had helped his father build a variation of the Mangum terrace on the family plantation in Anson County, North Carolina, and he had promoted terracing throughout his career. As early as 1916, he organized a terracing demonstration in South Carolina.[303] In his writings spanning more than two decades Bennett consistently described terraces as a key soil conservation practice. As he wrote in "Soil Erosion A National Menace," a terrace "properly laid out and built is a highly efficient instrument for protecting vast areas of land now wasting . . . on unprotected slopes."[304] As the results from the erosion experiments came in, limitations of terraces as a one-size-fits-all conservation practice became apparent. After 1929, Bennett and his staff from the Bureau of Chemistry and Soils increasingly saw the use of vegetation as an important compliment, if not outright alternative, to engineering practices in conservation planning. New

[302] For discussion of the engineering research at the experiment stations, see Bennett and Jones, "The National Program of Soil and Water Conservation," 22-35; Ramser, "The Prevention of the Erosion of Farm Lands by Terracing," 432; and for a contemporary newspaper article describing Ramser's role in the erosion research work at the Red Plains Experiment Station in Guthrie, Oklahoma, see "Get Rid of the Deep Gullies! Stop Your Soil from Washing," *The Daily Oklahoman,* March 2, 1930, 50.

[303] An account of Bennett's recollection of building terraces as a young man, can be found in Brink, *Big Hugh*, 28. For a reference to Bennett's organizing of a South Carolina terrace demonstration project in 1916, see Swain, *Federal Conservation Policy, 1921-1933*, 147, 204.

[304] Bennett, "Soil Erosion A National Menace" 19. For other instances of Bennett's advocacy of terraces in his writings and speeches during the 1920s, see ibid., *Soils and Agriculture of the Southern States*, 64, 98, 139, 141, 221; ibid., "The Unseen Menace of Erosion," 150; ibid, "The Problem of Soil Erosion in Relation to Flood Control," 9, 12; and ibid, "The Wasting Heritage of the Nation," 121; ibid., "Terraces Close the Bunghole," *Farm and Ranch* 51 (July 1, 1932): 15.

methods of cover-cropping, crop rotations, and the retirement of land to permanent vegetation that were developed at the ten erosion research stations represented important innovations in the prevention of erosion.

The first and foremost limitation of engineering practices like terraces is the time, skill, and labor necessary to construct and maintain them. For most farmers, building terraces properly required the assistance of trained engineers to survey the field and lay out the contour lines for their construction. When such expertise was not used the results if a terrace failed could be worse than if it had not been built in the first place. Furthermore, terraces are also not appropriate for all types of soil, terrain, or agricultural uses. For instance they are difficult to build on sandy, loessial, or otherwise thin soils, like those that occur extensively on sloping lands along the Missouri and Mississippi rivers from South Dakota and Wisconsin to Louisiana.

Terraces are also difficult to build in orchards, vineyards, or on extensively irrigated fields. Finally, the use of terraces was highly localized in the southeastern and south central United States. Terraces were not widely employed outside of these regions of the country. As Bennett often noted in his writings, [t]here probably is not so much as one acre of terrace land in a hundred thousands acres north of the Oklahoma line and the Ohio River." Because the topography is flatter and the climate less erosive, farmers outside the South, as Bennett wrote, "know nothing" of terracing, "many of them have not even heard of it." As soil conservation moved beyond the South, the need for conservation practices adapted to other regions became apparent.[305]

When work began at the ten erosion experiment stations in 1929, terraces were seen as the primary method for controlling erosion. Results of the erosion research at the experiment stations, however, showed that vegetative cover is the most effective method for preventing erosion and absorbing rainfall. Bennett and the staff working under him at the Bureau of Chemistry and Soils began to adapt this insight to the development of conservation practices that relied on vegetative means of erosion control.[306] While Bennett continued to acknowledge the importance of terraces as a method of stopping erosion on cultivated fields, increasingly he saw the practice as only one of many that can be used to conserve soils. "Although mechanical means of control"—read terraces and check dams—"can and will be successfully employed over large areas adapted to the use of such measures," he wrote in 1932, "it is realized now that no other method will give so nearly complete and permanent control as that to be obtained with vegetation correctly worked into practical cropping schemes."

The facts spoke for themselves. Ground kept in permanent vegetative cover did not erode at all, and when cover crops were worked into crop rotations, erosion was reduced significantly. This was the central insight of the comprehensive conservation Bennett would come to advocate over the coming

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[305] For discussions of the need for professional expertise in the construction of terraces, see Bennett, *The Soils and Agriculture of the Southern States*, 198; and Hall, "Terracing in the Southern Piedmont," 108-109. For quotes about the rarity of terrace outside of the South, see Bennett, "The Problem of Soil Erosion in Relation to Flood Control," 9; ibid., "The Wasting Heritage of the Nation," 121. See also ibid, "The Unseen Menace of Erosion," 150.
[306] Ibid., "The Technique of the Quantitative Study of Erosion and Some Early Results of this Study," 14.

years. Innovation in the use of vegetation to control erosion was, as he Bennett put, a “discovery of a revolutionary nature.”[307]

For Bennett, the major conclusions reached from the results of the research conducted at the erosion experiment stations was that single-practices, like terracing alone, are not sufficient to conserve soil in all circumstances. Critics viewed the engineering approach to conservation as more rigid and top-down. It reduced the problem of erosion to sets of formulas, which, once the correct variables were input, would provide measurements for terraces that would, in theory, allow any piece of land to be put into cultivation. It addressed only one component of the larger problem, namely the control of water as it flows across fields, and neglecting important factors of soil, climate, and topography that influenced the agricultural productivity of the land. By contrast, the vegetative conservation measures represented a more flexible, bottom-up approach to protecting the soil. While Bennett and his staff recognized a place for engineering in conservation planning—indeed, for moderately sloping fields the variable grade terrace would remain a standard practice—they also came to view terraces as just one of many conservation practices that can be used to protect soil. This distinction would define the institutional rivalry between advocates of engineering and vegetative conservation within the USDA over control of the department’s soil conservation program.

While no one disputed that permanent vegetative cover was the most effective method of preventing erosion, the fact was agricultural production

[307] Quotes are from ibid, “Saving Soil with Vegetation,” c. 1932, RG 114, Entry 21, Box 2, Folder “Soaking Up the Rainfall,” 2.

required that large expanses of soil be bared for cultivation every season. The question faced by erosion researchers was how to keep the soil covered in vegetation and produce crops from it at the same time. The major breakthrough came with the development of the practice of strip-cropping. Strip-cropping was simply the alternating strips of clean-till crops like cotton, wheat, and corn with strips of cover crops such as alfalfa, clovers, or grasses laid out along the contour of the landscape. These strips of vegetation would serve to intercept water and eroded soil running off the strips of land planted to cash crops between. Like most conservation practices, the general principle of strip-cropping had long been understood. Thomas Chamberlin had suggested in 1909 had suggested alternating "strips of grass-land, or shrub-land, or wood-land" with "zones of plowland" on steeper slopes. A Purdue University agricultural circular recommended "strip farming" in 1919 as an effective way to control soil washing. But, by late 1920s, like other practices, with the exception of parts of Wisconsin, particularly around the area of Madison, and in the Pennsylvania Dutch country, it was not widely implemented, nor had systematic experiments been conducted to test its use in different agricultural contexts.[308]

Bennett began to consistently champion the practice of strip cropping after 1930. That year he attended a demonstration of its effectiveness on the Hooks Farms, a 7,500 acre commercial operation near Itasca, Texas, in the black belt region of the state. Around 1925, the superintendent of the Hooks Farms, a

[308] Chamberlin, "Soil Wastage," 81-82. Fisher, "The Washed Lands of Indiana: A Preliminary Study," 2, 14-16. For early examples of strip-cropping, see Lynne Heasley, *A Thousand Pieces of Paradise*, 26-27; Bennett, "Saving Soil with Vegetation," 3. A discussion of the rarity of strip-cropping in the nineteenth century can be found in Hall, "Terracing in the Southern Piedmont," 100; and ibid., "The Story of Soil Conservation in the South Carolina Piedmont," 9.

man named Fred C. Newport, who had been the county agent in Hill County where farm was located, developed a system of strip-cropping that alternated strips of sweet-clover with strips of small-grains like sorghum with strips of clean-till crops over six thousands acres of plow land. Strips put into vegetative cover would the be rotated into clean-till strips, and vice versa, in following years. Like much of the Texas hill country, the soils on the Hooks Farms had been subject to years severe erosion from clean-till cultivation of cotton, corn, and grains. Newport's strip-cropping program succeeded in halting and reversing this damage. [309] Bennett was enthusiastic about what he had seen. In correspondence, he celebrated Newport for his innovation. "I haven't any doubt whatever," he was sure, "that this idea is going over in a large way," it is "too sensible and too practical and too cheap not to go over."[310]

After his visit to the Hooks Farms, Bennett directed each of the erosion experiment stations to begin small-plot and field scale tests of strip-cropping. Strip-cropping was initially seen as a supplement to terracing, but the research conducted on its effectiveness suggested that it could be used as an alternative to terraces altogether. An experiment at the erosion farm outside Bethany, Missouri, compared three plots: one farmed with no conservation practices; one using strip-cropping; and another using strip-cropping plus terracing. The results showed that there was little difference in the amount of soil saved by terraces

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[309] For discussion of the influence of the Hooks Farm strip-cropping demonstration on Bennett, see Bennett, "Saving Soil with Vegetation," 3; and Bennett to Hearn, August 27, 1931, RG 114, Entry 18, Correspondence of the Director of the Soil Erosion & Moisture Conservation Investigations, 1928-34, Box 2, Folder "H 1931"; Bennett, "Saving Soil with Vegetation," 3-4.
[310] Quote is from Bennett to Newport, August 16, 1932, RG 114, Entry 18, Correspondence of the Director of the Soil Erosion & Moisture Conservation Investigations, 1928-34, Box 1, Folder "A 1929-1931," 1.

used in combination with strip cropping than by the soil saved by strip cropping alone. Results were similar at the Red Plains Experiment Station in Oklahoma, where strip cropping "almost completely stopped soil losses and very largely diminished runoff," demonstrating "its efficiency and practicability." At Tyler, Texas, "The results," superintendent B.H. Hendrickson wrote, were "almost unbelievable." The strips of vegetative cover "not only stop soil washing on moderate slopes but slow it down to a large extent on steep land," causing "increased amounts of rain to sink into the ground where it falls." Similar conclusions were reached from research conducted at the other erosion experiment stations across the country.[311]

Never one to forego hyperbole if it favored his cause, Bennett declared that innovation in vegetative erosion control, "probably is going to mean as much to the nation in the long run as many of the many major discoveries that have altered the course of mankind." While perhaps overstated, the popularization of strip-cropping as a result of the research conducted during the early 1930s was a real step forward for soil conservation. Used in combination with crop rotations, tillage practices like listing and sub-soiling, and the retirement of marginal lands, it represented a cost-effective solution to the problem of soil erosion. [312]

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[311] For results discussion of the strip-cropping experiments, see Bennett, "Saving Soil with Vegetation, 6; S.W. Phillips, "The Red Plains Erosion Station," 5; Hendrickson, "Tyler, Texas Soil Erosion Experiment Station, Summary of Work Accomplished to October 31, 1930," October 31, 1930, RG 114, Entry 1, Miscellaneous Papers of H.H. Bennett, 1926-34, Box 1, Folder "Report for Congress on the Nat'l Program of Soil Erosion." Bennett quote is from, "Saving Soil with Vegetation," 3.

[312] For the Bennett quote on the significance of strip-cropping, see ibid, 2. For positive discussions of strip-cropping, see also Bennett, "The Cost of Soil Erosion," 31; ibid., "Statement for Soil Erosion Part of the Annual Report of the Chief of the Bureau of Chemistry and Soils,"

Figure 21. A photo of a strip-cropping on the Hooks Farm near Itasca, Texas, October 3, 1933. The center row is grain stubble between strips of cotton on the left and right. (RG 114p, Soil Erosion Experiment Station Photographs, Box 15, National Archives, College Park, MD)

While Bennett did not often use the word "ecology," in his approach to conservation he drew on ecological ideas about relationships in nature.[313] Our modern ecological view of the world has its roots in the eighteenth century. A central insight of an ecological view of the world is that human societies are integral parts of nature, and that human actions are capable of causing far-reaching changes to natural systems. The application of ecological ideas to agriculture dates to early decades of the twentieth century. Over the next three decades ecological thinking would be applied to the conservation of natural

July 13, 1932, RG 114, Entry 21, Box 1, Folder "Statement for Soil Erosion: Material Prepared for Dr. Knight's Annual Report," 3; B.H. Hendrickson, "Experimental Work at the Federal Soil Erosion Experiment Station No. 4," July 1932, RG 114, Entry 21, Box 5, Folder "Articles, Papers, Radio Talks by B.H. Hendrickson," 7; Geib, "The Significance of Strip Cropping," 1932, RG 114, Entry 21, Box 5, Folder "Papers of Field Men Sent in for Approval"; and Geib, "Strip Cropping to Prevent Erosion" *Farm and Ranch* (April 1, 1932): 24.

[313] In my research, I found only one instance of Bennett's use of a form of the word ecology. In his paper at the Third Southern Forestry Congress in 1921, he noted that the use of soil type to determine lands to be reforested is one the "promising fields for useful and interesting ecological investigations." Bennett, "The Classification of Forest and Farm Lands in the Southern States," 72.

resources, most notably in the fields of forestry and wildlife management. The development of soil conservation during the 1920s and 1930s can be seen as part of this broader trend in the evolution of ecological thought in the management of natural resources.[314]

Soil erosion is a prime example of the unintended consequences caused by human changes to the natural environment. It is a result, as Bennett wrote, of "doing away with nature's stabilizers--the trees and grass and shrubs that were sown across the face of the earth to hold the soil in place." The solution to the problem of protecting the soil then, as he came to see it, was to simulate natural conditions wherever possible. This was the conclusion reached from the results of erosion experiments conducted by the Bureau of Chemistry and Soils. And this was the purpose of strip-cropping and other vegetative conservation practices they developed, which sought to imitate nature by using "thick-growing, water-retarding, soil-saving" plants to prevent erosion.

This was a key difference from terraces, which worked by engineering the landscape to convey water more efficiently from sloping fields into adjacent waterways. Vegetative practices in contrast hold the rain where it falls. They did

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[314] For discussion of the origins of ecological ideas, see Donald Worster, *Nature's Economy: A History of Ecological Ideas*, 2nd ed. (New York: Cambridge University Press, 1994). For the application of ecology to agriculture in the 1910s and 1920s, see Mark D. Hersey, "'What we need is a crop ecologist': Ecology and Agricultural Science in Progressive-Era America," *Agricultural History* 85 (Summer 2011), 297-321. For the application of ecology to the management of wildlife, see Susan Flader, "A Biographical Study of Aldo Leopold: Thinking Like a Mountain" *Forest History* 17 (April 1973), 14-28; Thomas Dunlap, "Values for Varmints: Predator Control and Environmental Ideas, 1920-1939," *Pacific Historical Review* 53 (May 1984), 141-161. See also Char Miller, "The Greening of Gifford Pinchot," *Environmental History Review* 16 (Autumn 1992): 1-20. For a broader discussion of the influence of ecological ideas on the development of soil conservation, see Beeman and Pritchard, *A Green and Permanent Land: Ecology and Agriculture in the Twentieth Century* (Lawrence: University of Kansas Press, 2001). My interpretation, however, differs from theirs by placing the point of influence of ecological ideas on soil conservation earlier in time. Ecological approaches to the care of soil were not solely a product of the New Deal.

not require the same level of expertise to install as terraces did. Nor did they necessitate downstream protections from flooding and stream bank erosion caused by the concentrated runoff flowing from terraced fields. For these reasons vegetative practices gained a reputation as a “simple and cheap” alternative to terraces. Vegetative conservation practices also had the added advantage of rebuilding depleted topsoil. By incorporating nitrogen-fixing cover crops like legumes in the conservation farming rotations and leaving the stubble of small grains in the field, those practices enhanced both the fertility and tilth of the soil, contributing to more productive harvests. These practices also improved habitat for wildlife in agricultural areas. Over the coming years, vegetative erosion control practices would become the cornerstones of an approach to soil conservation that viewed nature as an integrated whole. This did not mean simply terracing fields, but instead the use of a coordinated suite of conservation practices tailored to the specific features of agricultural landscapes.[315]

The development of the comprehensive approach to soil conservation echoed the central theme of Hugh Bennett’s career. That is land should be put to the uses for which it is best suited to be determined by, as he wrote, its “individual fitness for crop production . . . susceptibility to improvement and feasibility of protection against wasteful washing.” This meant that some types of land are best suited for pastures, that others can be cropped, and that some land should not be used at all. As Bennett observed in 1927, “[m]any millions of

[315] Quotes respectively are from Bennett, “Soil Loss Through Erosion Challenges ‘Our Most Basic Asset,” *The New York Times*, June 17, 1934, sec. 8, p. 3; and Bennett to Smith, August 18, 1933, RG 114, Entry 1001, Correspondence of Hugh H. Bennett, 1924-1947, Box 1, Folder “Material on Investigations,” 1.

acres that are being farmed really represent forest lands and should be used for growing timber and grass only."[316] The removal of marginal lands—those already too eroded, too wet, too dry, or too steep—from agricultural production eliminates a significant cause of soil erosion. Used in conjunction with modern erosion control practices in the fields, the retirement of marginal lands would become a key part of conservation planning. As the grip of the Depression tightened, these techniques of land use planning came to be seen not only as a way to conserve soil, but also as a pathway to renewed prosperity for a country in the grip of the Great Depression.

Land Utilization and the Great Depression

In hindsight, the years between 1900 and 1914 were a golden age for American agriculture as demand outpaced the supply of farm goods. Prosperous times continued as the start of World War I ensured foreign markets for American crops. These years would be wistfully remembered, according to James Shideler, as a picture of "stability, balance, satisfaction, and economic justice."

It was a period of economic security for American agriculture that came to an end with the conclusion of the First World War. By 1920, Americans farmers received payments two-thirds less for their crops than they had gotten six years earlier. Prices stayed low through the rest of the decade with prevailing conditions of high supply and low demand for farm commodities. A decade of deflating agricultural commodity prices and mounting debts caused a significant

[316] Bennett, "Soil Erosion Takes $200,000,000 Yearly from U.S. Farmers," 592-593.

reduction in the purchasing power of rural Americans. At a time when between forty and fifty percent of the workforce was engaged in agriculture, the slump caused a significant drag in the overall economy. During the otherwise booming 1920s, low prices for farm crops were seen as an economic benefit for urban centers, but after the stock market crash in October 1929, they contributed to the broader economic downturn, as the depression that had affected rural America since the early part of the decade spread to the nation's factories and cities.[317]

By the early 1931, a consensus had formed that a national policy of land utilization represented a solution to the agricultural economic crisis. The progressive economist Richard T. Ely had outlined what such a policy should like in 1922. "A national policy for land utilization," he wrote, "means planning for desired ends with respect to the use of land. It signifies that we ascertain what kinds of land we have and that we put each kind to its best use."[318] If the overproduction of agricultural commodities was a cause of the economic crisis affecting rural areas, then reducing agricultural production through land use reforms, the thinking went, was a solution not only to hard times in the countryside, but perhaps also an avenue toward economic recovery for the rest of the country. One of the most important of these necessary reforms was the removal of marginal lands from agricultural production. At national conference on land utilization held at Chicago in November 1931 to discuss the future of

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[317] Quote is from James H. Shideler, *Farm Crisis, 1919-1923* (Berkeley: University of California Press, 1957), 6. For discussions of the agricultural depression of the 1920s, see ibid.; and Danbom, *Born in the Country*, 186-197.
[318] Richard T. Ely, "A National Policy for Land Utilization" in *Report of the National Agricultural Conference, January 23-27, 1922,* 67th Cong., 2nd Sess., House, *Document* 195 (Washington: GPO, 1922), 115.

American land use policy, Henry G. Knight, Chief of the Bureau of Chemistry and Soils, estimated that 200,000,000 of the 650,000,000 acres, or one-fourth to one-third, of the land in agricultural production in the United States was "of marginal or sub-marginal character and should not be used for cultivated crops." Knight repeated what had become conventional wisdom, cultivation of marginal lands was "seriously disturbing the balance between supply and demand of agricultural commodities." The problem with farming marginal lands was that "[I]n favorable years, these lands create surpluses which are disastrous to the whole agricultural structure, while in years of drought or other unfavorable conditions they create serious hardships for those working on them." Removing these lands from production, he argued, would alleviate these problems. More intensive production on better suited lands would more than compensate for the lost acreage. "[W]ith the practical application of the scientific knowledge we now possess," Knight was confident, "we can make the more favorable areas produce almost at will to meet the needs of our expanding population for many years to come, provided we give due protection to the erosive areas of these better lands." [319]

Support for efficient land utilization had long been a part of official USDA policy. As its scientific director, Albert Woods, observed, for years the department had "been making soil surveys and soil studies" that did much

[319] Henry G. Knight, "Soil Conservation A Major Problem of Agricultural Readjustment," Proceedings of the National Conference on Land Utilization, Held at, Chicago, Illinois, November 19-21, 1931, U.S. Department of Agriculture (Washington: GPO, 1932), 160-61. See also Carl O. Sauer, "The Problem of Land Classification," *Annals of the Association of American Geographers* 11 (1921): 3-16; and G.M. Peterson and J.K. Galbraith, "The Concept of Marginal Land," *Journal of Farm Economics* 14 (April 1932): 295-310.

"towards pointing out areas and soil types that should be devoted to state and national forests and those adapted to staple crops." The vast amount of information produced by the Soil Survey of the Students and department's soil scientists, Woods suggested provide a strong foundation on which to establish a national land utilization program. It all begins with the soil. "If the soil is good and adapted to the crops grown we have the foundation of good agriculture. If the soil is not good or not adapted to crops grown we have the beginning of the failure." The problem in his judgement was that American farmers had not adequately used the information available to them. As he wrote in early 1933,

> We have cut down the forest and plowed up the prairie and put the land into corn, wheat and cotton, cattle, pigs and poultry, with no regard to soil or market requirements or competing areas. We have built up one community only to have it pushed to the verge of bankruptcy by developing new areas. Millions of acres of land adapted only for forests or range have been sold for general farming purposes. There is no present need for these lands in general crop production, but there is a real need for them in forest or pasture, in which they will give good economic return in the production of wood and other needed forest products or in the production of grass.

In making this argument, Woods echoed a growing refrain. Inappropriate land use was a source of the country's economic ills, and enacting a national land utilization policy Woods should the first step in any effort to address them.[320]

Such calls for a national policy of land utilization echoed the arguments that Hugh Bennett was making for soil conservation. Enactment of a national land use policy represented the logical conclusion of the case for appropriate land use he had made throughout his career. For Bennett, land utilization and soil conservation were synonymous. If soil erosion was a land use problem; a

[320] Quotes are from Woods, "The Development of Agricultural Research and Education Under the Federal Government," 20-24.

symptom of the inappropriate use of soils, then soil conservation represented a tool to accomplish objectives of land utilization. "Cultivation of marginal land, whether it be eroded land or land that is too wet or too dry for safe farming, is not, of course, the sole cause of surpluses," he wrote, "but it is a contributing cause of major importance." By taking these marginal lands out of production and planting them to trees on an extensive scale, Bennett argued, the country would take a "long step . . . toward farm relief." Soil conservation represented both a solution to the problem of erosion, and also an antidote to the Depression. The major obstacle remained in the question of how to extend conservation planning to the countryside. [321]

Taking marginal lands out of production and installing soil conservation practices are commonsense ideas, but they had radical implications, clear to anyone who considered them. For such land use reforms meant direct government intervention in the private use of land. This was considered, with few exceptions, considered beyond the political pale in the United States up to that point. The fact was, as Henry Knight noted at the 1931 that "if a landowner desired to destroy a piece of agricultural land for no good reason whatsoever by covering it, say, with 6 feet of granite bowlders [sic], it would be recognized as within his right to do so without interference by any authority or agency," and throughout American history, "figuratively . . . just such action has happened time and again." Despite this, Knight continued:

> While we do recognize in principle that one may not harbor a nuisance or a menace to public welfare, such as an insect pest or a disease, and we further recognize State and national authority in dealing with such

[321] Bennett, "Our Vanishing Farm Lands," 175.

> matters even to the extent of supervision of agricultural practices, still we have not as yet reached the stage where the State or Federal agencies may control the use or abuse of lands in private hands [sic].

On the question of whether or not it was time to expand state or federal authority over private land use, Knight repeated the traditional view that "any land-conservation policy can not, and probably should not, be developed and put into effect by taking advantage of the regulatory power of the States and Nation [sic]." Instead, he suggested the "problem should be handled through a process of education." This was an expression of the popular consensus of the time, which recognized the problems of private land use, but demonstrated a continued reluctance to take direct public action to address the problem, preferring instead to rely on the traditional channels of research and education to deliver appeals to the enlightened self interest of farmers and ranchers.[322]

By the early 1930s, however, the limits of voluntary cooperative action were apparent. The soil erosion experiment stations made important inroads on the problem of soil conservation, but the practices and techniques they developed were still not widely adopted. Lack of action by individual farmers was a core problem. Research and education could broaden an individual's ability to make independent, informed decisions, but they proved insufficient to compel farmers to adopt the necessary land use changes of their own volition, especially in difficult economic times.

There were also deeper structural issues in the systems of American land tenure and the agricultural economy that presented obstacles to the implementation of comprehensive national land use reforms. For instance, in

[322] Knight, "Soil Conservation A Major Problem of Agricultural Readjustment," 160.

many places, local property taxes regimes incentivized destructive land use practices by causing farmers to wring crops out of depleted soils in order to pay their tax bills. Furthermore, the fragmented character of land ownership in the country made it difficult to implement larger scale conservation planning, extending beyond the property lines of individual farms, that would be necessary to stop erosion in a meaningful way. In other words, enlightened self-interest in an of itself was insufficient to convince farmers to adopt soil conservation practices. What was needed was some form of public intervention to address these individual and structural challenges to the adoption of conservation practices. As the depression deepened, the notion that government should take greater action to protect the public interest in private lands gained broader support. This was the view that Bennett came to hold. "Only the Federal and State Governments [sic]," he wrote in 1929 "can undertake a program of this kind on a sufficiently large scale to have a real effect" on the land use situation.[323]

The period between 1929 and 1933 was an important phase in the history of soil conservation. The experimentation work carried out on the ten soil erosion experiment stations established by the Buchanan Amendment laid a foundation for developing a modern understanding of soil conservation practices. These experiment station functioned as important laboratories for soil conservation. They conducted the first research on erosion as a physical process

[323] For quote, see Bennett, "Our Vanishing Farm Lands," and ibid., "The Menacing Aspects of Erosion," 176. For a discussion of the problem of property taxes and agricultural land use, see Bennett, "Our Vanishing Farm Lands," 175-176; and Arthur M. Hyde, "Developing A National Policy of Land Utilization" in *Proceedings of the National Conference on Land Utilization* (Washington: GPO, 1931), 33.

on different types of soil, topography, and land use practices. This research helped to refine conservation methods and helped to disseminate that knowledge to farmers nationwide.

The question of how best to conserve soil prompted competing visions of soil conservation: one that rested on the application of engineering principles to reshaping the environment, and the other that sought imitate nature with a more comprehensive approach to conservation that replied on the use of vegetation and the retirement of marginal lands to stop erosion. This institutional rivalry would play itself out by 1935. In the meantime, there was no mechanism to extend the fruits of the erosion research to the countryside. Soil conservation remained dependent on the enlightened self-interest of individual landowners, which by the early 1930s had proved incapable of stemming the flow of soil washing off the country's agricultural fields. This would change with the coming of the New Deal, which would make soil conservation a primary vehicle of its policies to conserve natural resources, create jobs and restart the national economy.

5. The New Deal Soil and Public Assistance for Soil Conservation

> Since posterity can not meet the task, and since many farmers are unable to handle all phases of the work that must be done, the responsibility of the Government is obvious. Aside from this responsibility, the Government has a very inseparable interest in the continuing welfare of its remaining areas of good agricultural land.
>
> Hugh Bennett, "The Menacing Aspects of Erosion," c. 1934[324]

The history of soil conservation is closely identified with the New Deal. There is a good reason for this. For it was during the first two terms of the Roosevelt administration that pieces of the modern soil conservation state were put into place. While this period is rightly viewed as a dramatic break from the traditional operation of the American government, it can also be seen as a culmination of longer term trends and the result of the application of ideas that had been in the air, so to speak, for some time. This was the case with soil conservation, as it was for public works, industrial regulation, social security, housing policy, labor protections, and other signature New Deal initiatives that drew inspiration from the concerns of previous generations.

With those concerns as with soil conservation, what changed after March 1933, however, was a new willingness to brush aside old orthodoxies about the role of the federal government in national life. With a mandate of recovery from the economic emergency, the new administration was willing to experiment with untried ideas and commit public resources to implement them at a large scale.

[324] Bennett, "The Menacing Aspects of Erosion," RG 114, Entry 21, Box 3, Folder "The Menacing Aspects of Soil Erosion," 24.

The severity and scope of crisis provided the political impetus for public interventions in private land use; not just research and education, but what would become a complete program of publicly-led planning and financing of soil conservation practices on American farms.

In this way, the New Deal provided a channel through which accumulated conservation wisdom could be put into action, not just on land owned by the federal government, but on all land, as part of a national program of soil conservation. Naturally, there were obstacles to the achievement of this vision: Most prominently the decades-old unwillingness to extend public assistance to private landowners for the conservation of soil. Negotiating the boundary between the public private use of land required new thinking on every front. This chapter examines the development of the mechanism by which this was accomplished—namely, the creation of public agencies dedicated to the conservation of soil, establishment of permanent programs of technical and financial assistance, and the organization of locally-led conservation districts through which to administer them. These essential innovations of New Deal created the mechanisms, gears of government to apply soil conservation practices to every farm and ranch in the country. The remain the cornerstones of soil conservation in the United States today.[325]

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[325] For discussion of the place of soil conservation in the New Deal agenda, see Sarah T. Phillips, *This Land, This Nation: Conservation, Rural America, and the New Deal* (Cambridge: Cambridge University Press, 2007); see also, Theodore Saloutos, "New Deal Agricultural Policy: An Evaluation," *The Journal of American History* 61 (September 1974), 416; Saloutos, *The American Farmer and the New Deal* (Ames: Iowa State University Press, 1982). For discussions of continuities and changes between the New Deal and its antecedents, see Richard S. Kirkendall, "The New Deal as Watershed: The Recent Literature" *The Journal of American History* 54 (March 1968): 839-852; Otis Graham, *Encore for Reform: The Old Progressives and the New Deal* (New York: Oxford University Press, 1967); Theda Skocpol and Kenneth

NIRA and the Creation of the Soil Erosion Service

On the eve of the New Deal, the question for soil conservationists was how to extend the comprehensive conservation practices, developed at the experiment stations, to individual farms throughout the country. By 1933, soil conservation had gained greater public support. There was broad agreement within the new Roosevelt administration and among the general public that soil conservation was rightfully a public enterprise that required coordination and action across all levels of government. It was also understood that the application of conservation measures sufficient to address the problem of soil erosion was beyond the capability of most individual farmers and small communities. There was a consensus that soil conservation should be included in the recovery legislation being considered by Congress that spring.

President Franklin Roosevelt himself played a significant role in the development of soil conservation during his administration. Like uncle Theodore, Roosevelt took a great personal interest in the details of conservation policy. He had a long history of concern for the conservation of natural resources from his experience growing up in rural Hyde Park, New York to efforts as an adult to apply forestry principles on his family estate. While his natural interest in resource management predisposed him to support soil conservation, Roosevelt was also persuaded by the case made by advocates of a national policy of land utilization to remove marginal lands from production and

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Finegold, "State Capacity and Economic Intervention in the Early New Deal," *Political Science Quarterly* 97 (Summer 1982): 255-278; Skocpol, *Protecting Soldiers and Mothers: The Political Origins of Social Policy in the United States* (Cambridge: The Belknap Press of Harvard University Press, 1992); Daniel T. Rodgers, *Atlantic Crossings: Social Politics in a Progressive Age* (Cambridge: The Belknap Press of Harvard University Press, 1998), 415-416.

rehabilitate them. As Governor of New York, he had established a state program to pay for the purchase and reforestation of cut-over lands. Advocacy of national land use planning was a plank in his campaign for President. As a candidate for President he gave a major speech on agriculture policy at Topeka, Kansas, in which he voiced support for a national policy of land utilization based on "an economic soil survey," directed towards the "mapping and classification of lands of all kinds, to determine which lands are best suited for agricultural production, which lands are marginal and which lands are suited only to growing tree crops."

The idea of rational land utilization would serve as an organizing principle for New Deal agricultural and conservation policies. Within weeks of taking office Roosevelt would approve a broad swath of initiatives, from the restructuring of American agriculture via the Agricultural Adjustment Act, the creation of the Civilian Conservation Corps, and the public acquisition of cut-over lands in the Southeast by the National Forest system, all guided by the principle of efficient land utilization.[326]

[326] For a discussion of Roosevelt's background of interest in conservation, see Schlesinger, *The Coming of the New Deal* (Boston: Houghton Mifflin Company, 1958), 335-341; Stephen Fox, *The American Conservation Movement: John Muir and His Legac*y (Madison: The University of Wisconsin Press, 1981), 183-188; David B. Woolner and Henry L. Henderson, *FDR and the Environment* (New York: Palgrave Macmillan, 2005); Maher, *Nature's New Deal*, 19; Phillips, *This Land, This Nation*, 24-25. For Roosevelt's comments on the need for a national land use policy, see Franklin D. Roosevelt, "Campaign Address in Topeka, Kansas on the Farm Problem," September 14, 1932, The American Presidency Project, http://www.presidency.ucsb.edu/ws/print.php?pid=88396.

Figure 22. President Franklin D. Roosevelt having lunch at mess table in Camp Fechner, a Civilian Conservation Corps camp at Big Meadows, Virginia. Seated around the President [l to r] are General Paul B. Malone; Colonel Louis Howe; Secretary of the Interior, Harold Ickes; Director of the Civilian Conservation Corps, Robert Fechner; Secretary of Agriculture, Henry A. Wallace; and Assistant Secretary of Agriculture Rexford Tugwell, August 12, 1933 (Library of Congress, Prints and Photographs Reading Room, Reproduction Number LC-USZ62-93597).

Congressional support for soil conservation came in the first hundred days of the New Deal with passage of the National Industrial Recovery Act (NIRA), on June 6, 1933. The NIRA was the early New Deal's most significant economic reform and unemployment relief measure. Along with the farm programs passed as part of the Agricultural Adjustment Act (AAA) in May 1933, the NIRA's attempt to regulate business and its spending on public works comprised the heart of the early New Deal's economic program. The NIRA was written in two parts. Title I dealt with creation of the National Recovery

Administration (NRA) the regulation of industry, while title II established the authority for a vast program of public works spending. It appropriated 3,300,000,000 for this purpose. Harold L. Ickes, the man chosen by Roosevelt to administer the new agency created by the bill, called it the "greatest sum of money ever appropriated by any government for such a purpose in the history of the world." Over the next decade this public wealth would be used to develop the physical infrastructure of the country. [327]

Among the explicit purposes listed in NIRA for which public funds could be spent was the prevention of erosion. Language in the bill specifically authorized projects for the "conservation and development of natural resources, including . . . prevention of soil or coastal erosion." This language was vague but its implication was clear. Public money could be spent on the prevention of soil erosion. Congress, however, did not give specific instructions for how the funds it appropriated should be spent. It only provided guidance on the general categories of work that this money could support. To make these decisions and to administer the program it created Federal Emergency Administration of Public Works, otherwise known as the Public Works Administration (PWA). In early July 1933, President Roosevelt appointed Ickes, who was also his Secretary of Interior, to administer the PWA. Ickes was a native of Chicago who made his name as an attorney and an operative in Theodore Roosevelt's Progressive Party in 1912. By 1933 he was an old Washington hand. In Ickes

[327] For quote, see Harold L. Ickes, "The Social Implications of the Roosevelt Administration," *Survey Graphic* 23 (March 1934), 113. For discussion of NIRA public spending, see Leuchtenburg, *Franklin D. Roosevelt and the New Deal, 1932-1940* (New York: Harper Torchbooks, 1963), 55-58; David M. Kennedy, *Freedom from Fear,* 150-153.

was vested almost total power over administering the public works program. He could establish agencies, cooperate with the states and other federal entities, and hire employees at his discretion. Only the President had veto power over Ickes' authority.[328]

On July 17, Harold Ickes allotted $5,000,000 from the PWA for work on erosion prevention. This was a considerable sum of money. It dwarfed the amount spent up to that point for the USDA's soil erosion and moisture control experiments. In fact, it was more than was appropriated for the USDA's entire experiment station budget, which amounted to $4,300,000, for all of fiscal year 1933.[329] Still, many questions remained unanswered. Just what the PWA soil conservation program would look like in practice remained unclear. Could these funds be spent on private lands? If so what portion of the cost of conservation would the government cover? Could cooperators be paid for participation in the program? What would a national soil conservation program look like in practice? Who would administer it? These were questions without answers in the summer of 1933.

In the months leading up the inauguration of President Roosevelt, USDA officials anticipated passage of some kind of bill providing funds for erosion control. Bills along these lines had been unsuccessfully proposed in the lame duck session of the 71st Congress.[330] Aware of these developments, the Bureau

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[328] For language in NIRA authorizing prevention of erosion, see *Statutes at Large* 48 (March 1933 to June 1934), 201. For discussion of Ickes and the PWA, see Clarke, *Roosevelt's Warrior*, 59-70; Graham, *Encore for Reform*, 116, 214. Helms, "Hugh Hammond Bennett and the Creation of the Soil Erosion Service," 69A.
[329] Woods, "The Development of Agricultural Research and Education Under the Federal Government," 13.
[330] H.R. 16909, 71st Cong., 2nd Sess.

of Agricultural Engineering (BAE) prepared a proposal for a nationwide farm-terracing program in February 1933 in an effort to take advantage of the opportunity. Lewis Jones who directed the BAE's erosion experiments, wrote up a plan that called for agricultural engineers to be sent into every section of the country and, in cooperation with state authorities, provide the technical assistance necessary for farmers to terrace their fields. Under this plan the federal government would share the cost of paying the engineers and furnishing the necessary materials, machinery with the states, and equipment for laying out terraces. The farmer would be expected to cover half the costs and maintain the terraces after they were installed.[331]

After the Roosevelt administration took office on March 4, the BAE submitted its terracing proposal to the new Secretary of Agriculture, Henry A. Wallace. Wallace discussed the matter with the President, who, Wallace said, was "very much interested in the general problem of erosion."[332] After passage of NIRA in June, Assistant Secretary of Agriculture Rexford Tugwell forwarded the BAE's proposal to Harold Ickes.[333] When Ickes allotted the PWA funds for soil erosion the middle of July it seemed a sure thing that the engineers would be given control over the soil erosion money. On July 25, the USDA's *Daily Digest* reported that the PWA erosion control plan would provide "for the practice of terracing, which agricultural engineers have found to be the most effective

[331] "Memorandum in Regard to Soil Erosion Control," February 17, 1933, RG 8, Records of S.H. McCrory, Box 503, Folder "Correspondence—Public Works."
[332] Wallace to McCrory, May 30, 1933, RG 8, General Correspondence 1931-39, Box 312, Folder "3-20-C Soil Conservation."
[333] Tugwell to Federal Emergency Administration of Public Works, June 9, 1933, RG 8, Records of S.H. McCrory, Box 503, Folder "Correspondence--Public Works."

means of controlling erosion."[334] Lewis Jones, director of the BAE's terracing program, wrote to Charles Ramser, "it appears that $5,000,000 will be allotted to us." [335]A national terracing program to be administered by agricultural engineers seemed a *fait accompli*. The BAE began making arrangements with the state officials to manage the work. It seemed only a matter of waiting for the requisite authorities to wend their way through the necessary bureaucratic channels. In late July, the PWA's Board of Public Works forwarded the BAE's terracing proposal to the White House for the President's final approval.

In the summer of 1933, the question of who would administer the PWA erosion funds caused the long simmering dispute between the Bureau of Chemistry and Soils and the BAE to grow into a full fledged conflict over control of the USDA's soil erosion work. Within the USDA, well-defined skirmish lines had formed between advocates of an engineering, terrace-centric approach to erosion control and those that favored agronomic methods, which employed vegetation as part of a more comprehensive approach to conservation. On the one side was the BAE and its leadership. On the other was Hugh Bennett and his allies in the Bureau of Chemistry and Soils. To Bennett, the terraces-only approach was emblematic of a view of erosion as simply an engineering problem, rather than the more complex land use problem that it is. Bennett cited as an example the severe erosion on the Navajo Reservation in New Mexico and Arizona, which he had surveyed in the spring and summer of 1933 at the request

[334] Quoted in Helms, "Hugh Hammond Bennett and the Creation of the Soil Erosion Service," 72A.
[335] Jones to Ramser, July 20, 1933, RG 8, General Correspondence 1931-39, Box 312, Folder "3-20-C Soil Conservation."

of John Collier, Roosevelt's Commissioner of Indian Affairs. On the Navajo reservation, erosion had nothing to do with farming sloping fields; it was a result of overgrazing by herds of sheep. Terraces were simply not an appropriate solution in the Navajo context. The same was true in other parts of the country for different reasons, on existing orchards, or extensively irrigated land for instance. Terraces alone were too rigid of a solution to control soil erosion in all of its manifestations. What was needed instead, Bennett argued, was the application of a suite of conservation practices tailored to the needs of the landscape used in combination with land use adjustments, including the retirement of marginal land, as part of a comprehensive strategy to stop erosion, reduce floods, and protect soil.[336]

Hearing of the apparent decision to grant the BAE the PWA erosion funds, Bennett confronted Assistant Secretary of Agriculture Rexford Tugwell about the matter sometime in mid-July 1933. Tugwell was an economist by training. He had been a student of Scott Nearing and earned his Ph.D. from the University of Pennsylvania with a dissertation on "The Economic Basis of Public Interest." Its core argument was that private activities that are harmful to the public good should be regulated by government. From his professional perch in the Economics Department at Columbia University he was a high profile advocate of the "rights of the public in private business" through the 1920s. He had been a member of FDR's informal group of advisors known as

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[336] For discussion of the federal soil conservation project on the Navajo reservation, see Helms, "Hugh Hammond Bennett and the Creation of the Soil Erosion Service," 69A-72A; Parman, *The Navajos and the New Deal*, (New Haven: Yale University Press, 1976), 37-38, 42; and Marsha Weisiger, *Dreaming of Sheep in Navajo Country* (Seattle: University of Washington Press, 2009).

the "brain trust" and would play a prominent role in the New Deal as an architect and administrator of national land use policy. He would later serve as governor of Puerto Rico during the Second World War.

For Tugwell, the problem of soil erosion clearly fell into this category of private activity to be regulated is in the public interest. He was familiar with Bennett and had quoted extensively from his estimates about the costs of soil erosion in an economics textbook he published in 1930. Tugwell shared Bennett's concern about the costs of erosion, but he was not up-to-speed on advances in its control made over the previous five years. After passage of the NIRA, he had simply forwarded the BAE's terracing plan on to Harold Ickes, writing "[t]he most effective method of controlling erosion is by the practice of terracing as developed by the agricultural engineer." Now a little more than a month later, Hugh Bennett was in Tugwell's office in high dudgeon demanding a rethink of the department's plan for the PWA funds. Rather than terraces only, Bennett told Tugwell the money should be spent on the comprehensive approach to soil conservation. As the USDA's representative to the PWA councils and a personal advisor to the President, Tugwell would exercise decisive influence on determining the shape the national erosion program. Persuaded by Bennett's arguments, he promised to see what could be done about redirecting the PWA funds.[337]

[337] Discussions of this episode cane be found in Helms, "Hugh Bennett and the Creation of the Soil Erosion Service," 9; Brink, Big Hugh, 83-84; Rexford G. Tugwell *Roosevelt's Revolution: The First Year--A Personal Perspective* (New York: Macmillan Publishing Co., 1973), 246-248. For sources on Tugwell and soil conservation, see Tugwell, *The Economic Basis of Public Interest* (Menasha, Wisconsin: The Collegiate Press, 1922), v; ibid., "The Place of Government in a National Land Program," *Journal of Farm Economics* 16 (January 1934): 55-69; ibid., *Roosevelt's Revolution*, 246; Beeman and Pritchard, *A Green and Permanent Land: Ecology and*

In the meantime, Bennett authored a memorandum to Harold Ickes laying out his case for comprehensive conservation. "Through the activities of our erosion experts," Bennett wrote, "many basic facts have been obtained" and "measures of combatting erosion have been developed for many of the differing regions in which the problems of erosion is of major importance." Now, the time had come, he wrote, that "these facts and measures of control" were put into action, "marshaled and applied to the problem of slowing down the evil." Such a program, Bennett emphasized, should make the most of vegetative means of soil conservation. "Thick-growing vegetation, as trees, grass and clovers, is the most powerful agency of erosion control," he wrote. Vegetation "is adaptable in one way or another to all conditions of soil, slope, rainfall and agricultural practice, where there is enough moisture for efficient plant growth." Cropped land in the country, he wrote, he continued, should be treated with "cover crops, incorporation of vegetable matter with the soil, crop rotations, hole-digging machines, strip-cropping and mulching." Engineering structures, such "as terraces and soil-saving dams" would be used "where applicable." Marginal lands not suitable for agriculture would be taken out of production together. Here in a nutshell was the argument for comprehensive soil conservation that Bennett had been making since 1930, which echoed the central strains of his career as a soil surveyor. All soil conservation work, he assured Ickes, carried out "under the National Industrial Recovery Act" would "be carried out on a

Agriculture in the Twentieth Century, 23-28. For citations of Bennett's soil erosion figures in Tugwell's textbook, see Tugwell, Thomas Munro, and Roy Emerson Stryker, *American Economic Life: And the Means of Its Improvement* (New York: Harcourt Brace and Company, 1930), 232-233. Quoted correspondence is Tugwell to Federal Emergency Administration of Public Works, June 9, 1933, 1.

soil-selective basis" so as to obtain "the most effective and permanent results." The capability of the land would serve to guide to conservation planning. Bennett proposed that the PWA erosion control funds should be spent to set-up demonstration projects to show the effectiveness of comprehensive conservation planning on whole farms. As he wrote, "[a] reasonable acreage of the more erosive lands of the nation should be treated in this way, the acres being so distributed as to serve as a wholesome, far-reaching demonstration of good land-use practice."[338]

At the end of July, word came from the White House that the President wanted the USDA to revise the terracing plan it had submitted to the PWA on June 9. Roosevelt desired that the soil conservation work be planned on large areas encompassing all the land within whole watersheds rather than individual farms. Watersheds represented units, it was reasoned, within larger interstate hydrologic systems, and could thus be managed by the federal government under authorities given to it by the Commerce Clause of the Constitution. At a meeting held on July 24, Rexford Tugwell directed changes to the plan for the PWA erosion funds that reflected both the administration's wishes and Bennett's influence. The new plan called for the comprehensive conservation of whole watersheds in different regions throughout country. Each of these projects would apply, [t]erracing, strip-cropping and seeding to pastures" as "principal control measures." Tugwell also recommended that Ickes used his authority as the administrator of the PWA to create an independent erosion control agency to

[338] Bennett to Ickes, July 25, 1933, Douglas Helms Collection, National Agricultural Library, Beltsville, Maryland, 2-4, 5.

implement these plans. Tugwell believed such an agency, created as a temporary special unit of the government, would exist only long enough to administer the emergency appropriation for soil conservation before dissolving. He saw this proposal as Solomonic solution to the rivalry between the different USDA agencies for control of the soil conservation program. It also appealed to him as a way to circumvent the political structure of American agriculture embodied in the land grant college-extension service-county agent complex, which he saw as an obstacle to direct federal influence.[339]

Ickes took this advice, but rather than set up the erosion control service in the PWA, he established it as an agency of the Department of the Interior. On August 25, 1933, Ickes in his capacity as the Administrator of Public Works wrote a letter to himself in which he transferred control of the $5,000,000 from the PWA to the Department of the Interior. Four days later he had the minutes of the July 17 meeting of the Board of Public Works retroactively "corrected" to substitute "Department of the Interior" for "Department of Agriculture" as the federal agency to which the funds were allocated. This decision was influenced in part by Ickes' personal designs to remake the Department of the Interior as a department of conservation. He hoped to consolidate control of all the public lands in the Department of the Interior. As part of this longer game, he envisioned being able to trade the erosion control agency, along with the Reclamation Service and the Subsistence Homesteads agency in Interior for the

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[339] For sources on the shift in emphasis in plans for the NIRA soil erosion funds, see Boyd to McAlister, July 26, 1933, RG 8, General Correspondence 1931-39, Box 312, Folder "3-20-C Soil Conservation." See also, Christiana McFayden Campbell. *The Farm Bureau of the New Deal: A Study of National Farm Policy, 1933-40*, (Urbana: University of Illinois Press, 1962), 174; Helms, "Hugh Hammond Bennett and the Creation of the Soil Erosion Service," 73A.

Forest Service, Bureau of Public Roads, and the Biological Survey from Agriculture. While this scheme did not work out as Ickes imagined it might, his decision to create the soil erosion service as an Interior agency would have important implications for the development of the national program of soil and water conservation after 1933. As the political scientist Robert Morgan observed, the Department of Agriculture would eventually have "to accept a program of erosion control which it did not originate, along with an organization which it did not create, to serve its objectives."[340]

To lead the new soil conservation agency, Tugwell initially suggested the University of Chicago geographer Harlan Barrows. Barrows declined. As a second choice Ickes settled on Hugh Bennett. It was agreed that Bennett should take leave without pay from his post at USDA while in the employment of Interior. When the work was completed, it was understood that he would return to Agriculture. Similar arrangements were made for Bennett's top field lieutenants in the Bureau of Chemistry and Soils. He requested the immediate transfer of Henry V. Geib and George W. Musgrave in Iowa, W.A. Rockie in Washington state, R.E. Uhland in Missouri, and Raymond Davis in Wisconsin. "These are the best trained men of the country for taking over direction of our big field projects," Bennett wrote. In their new positions, they would direct work on the conservation demonstration project while also continuing to oversee the work at the erosion experiment stations. It did not hurt that in recruiting his staff,

[340] For discussion of Ickes' creation of the Soil Erosion Service and his designs on a Department of Conservation, see Morgan, *Governing Soil Conservation*, 10-11; Clarke, *Roosevelt's Warrio*r, 111-112; Brink, *Big Hugh*, 83-84; Richard Polenberg, "The Great Conservation Contest," *Forest History* 10 (January 1967): 13-23; Ickes, *The Secret Diary of Harold L. Ickes: The First Thousand Days, 1933-1936* (New York: Simon and Schuster, 1953), 223, 250, 324, 326, 343-44.

he offered men coming to SES more money than they had made in their old jobs at the USDA. Nevertheless, Bennett emphasize the importance of continued cooperation with Agriculture, as he wrote in a letter to Rexford Tugwell, "[w]e must at all times maintain the very closest cooperation with the Department of Agriculture, not only in work, but in spirit and everything else concerned." With these assurances, the Soil Erosion Service (SES), as the new agency would be called, was officially established in the Department of the Interior with Hugh Bennett as its director on September 19, 1933.[341]

At Tugwell's suggestion, Bennett chose Walter Lowdermilk as SES's assistant director. Like Bennett, Lowdermilk was born in North Carolina, but from a young age he was raised near Wilcox, Arizona. He was an internationalist: a Rhodes Scholar, who had gone on to make his name during the 1920s with studies of erosion in the Yellow River valley of China under the aegis of the University of Nanking. After returning to the United States in 1927, he completed a doctorate in forestry at the University of California and took charge of research at the Forest Service's experimental watershed at San Dimas, California. Through this work Lowdermilk studied the problem of erosion on chaparral forest covered watersheds of Southern California. In doing so he became acquainted with Bennett. The two men had corresponded about the problem of soil conservation since at least 1928 when Lowdermilk appeared at

[341] For discussion of the creation of SES, see Helms, "Hugh Hammond Bennett and the Creation of the Soil Erosion Service," 73A. See also "U.S. Inaugurates New Soil Bureau," *The Washington Post*, September 20, 1933, 2. For sources on the transfer of USDA employees to Interior, see, Ickes to Bennett, February 6, 1934, Harold L. Ickes Papers, Secretary of the Interior File, 1928-1946, Box 266, Folder "Soil Erosion 1", Library of Congress, Manuscript Division, Washington; and Bennett, "Memorandum to Dr. R.G. Tugwell, September 20, 1933, RG 16, Entry 17, General Correspondence of the Office of the Secretary, 1906-70, Folder "Erosion"; Wallace to Ickes, September 12, 1933, ibid., and Bennett to Tugwell, September 20, 1933, ibid.

symposium on soil erosion arranged by Bennett at the annual meeting of the American Society of Agronomy. As Vice-director of SES, Lowdermilk was placed in charge of soil erosion research for the agency. He would also play large roles in overseeing the SES's operations in the western United States as well as matters related to the Civilian Conservation Corps. By the end of September it was clear that the scale of SES's conservation work was going to be larger than previously imagined or thought possible. As Bennett wrote to Lowdermilk, "I think we are heading into something that is going to be much bigger than we had supposed."[342]

Watershed Demonstrations and Technical Assistance for Conservation

By October 1933, SES had finalized plans to use the public works funds to establish between ten and twelve soil conservation demonstration projects in various parts of the country. The basic idea was that SES would apply the principles of comprehensive conservation to all the farms within a watershed area. In many ways the SES watershed demonstration projects resembled the farm demonstrations set-up by county agents, experiment stations, and agricultural colleges since the 1880s. They drew on a long tradition of voluntary

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[342] Quotes is from Bennett to Lowdermilk, September 30, 1933, RG 114, Entry 1, Central Files, September 1933-October 1935, Box 1, Folder "Administration and Organization, November 1931-December 1933," 1. For sources on Lowdermilk's background and his role in the history of soil conservation, Lowdermilk and J. Russell Smith, "Notes on the Problem of Field Erosion," *Geographical Review* 17 (April, 1927), 226-235; Lowdermilk, "Erosion in the Orient as Related to Soil Conservation in America," *Journal of the American Society of Agronomy* 21 (April, 1929), 404-414 Lowdermilk and Chall, "Walter Clay Lowdermilk: Soil, Forest, and Water Conservation and Reclamation in China, Israel, Africa, and the United States," 1969, Regional Oral History Office, Bancroft Library, Berkeley, California, 133-134. Douglas Helms, "Walter Lowdermilk's Journey: Forester to Land Conservationist," *Environmental Review* 8 (Summer 1984): 132-145; and David R. Montgomery, *Dirt: The Erosion of Civilizations* (Berkeley: University of California Press, 2007), 44-46.

cooperative relationships between the USDA, state and local governments, private business interests, and the individual farmer. In each case the objective was to demonstrate best management practices on model farms as a part of a broader community effort toward agricultural improvement. SES's watershed demonstration projects, however, also represented a significant departure from the past in several important ways; in their legal authority, geographic scale, and the objectives for which they were conceived.

Up to that point in time, soil conservation had been part of the traditional structure of American agriculture. Now as an agency of the Department of the Interior, SES operated outside of the USDA and the land grant colleges. At the same time, as a New Deal "action agency" SES drew on unprecedented funding levels and political support to carry out its projects. Legal opinions from Agriculture and Interior that Congress could have had no other intention when it appropriated funds to the PWA for soil erosion control then that the money would be spent on privately owned lands, both for the necessary materials and also the compensation of landowners for participation in the project, gave the SES the authority to work directly with farmers. Where earlier demonstrations relied on the enlightened self interest of the individual to incorporate new practices into their farming operations, the SES demonstration constituted a direct government intervention into the operation of the farm itself. SES went beyond simply demonstrating techniques to farmers, to actually planning the use of farmers' land and directing the installation of conservation practices for them. Though modest in number, these projects represented the first units of a national system of land use planning that would grow over the next two decades to encompass the entire nation.[343]

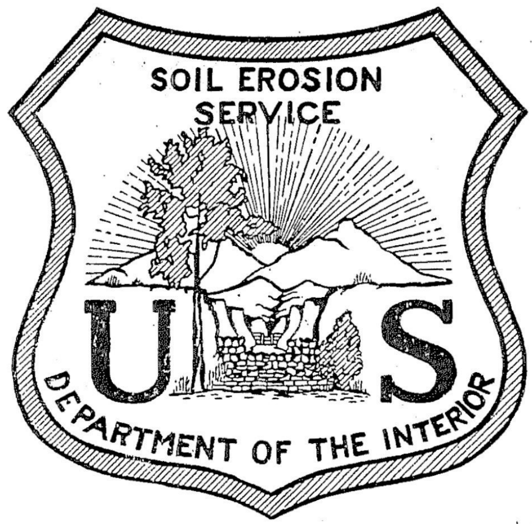

Figure 23. The official logo of the Soil Erosion Service between 1933 and 1935. This image of the SES logo reproduced here was scanned from the newsletter of a demonstration project in Mississippi, see "The Okatibbee Creek Watershed, Project No. 21," October 5, 1934, RG 114, Miscellaneous Papers of H.H. Bennett, 1926-34, Box 8, Folder "Soil Erosion Service."

The major innovation of SES's demonstration projects was that individual farms would be incorporated into a comprehensive conservation plan that encompassed entire watersheds. All the land within complete drainage areas, ranging in size from 25,000 to 200,000 acres, from ridge line to stream bed, would be treated with the conservation practices adapted to the characteristics of the landscape. As Hugh Bennett wrote of the demonstration

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[343] For the development of SES's plans for watershed demonstration projects, see Bennett, "Memorandum for the Secretary of Agriculture," October 9, 1933, RG 16, Entry 17, General Correspondence of the Office of the Secretary, 1906-70, Box 1790, Folder "Erosion 1933." For legal opinions on SES's authority to spend funds and perform work on private lands, see Thomas to McCrory, July 17, 1933, RG 8, General Correspondence 1931-39, Box 312, Folder "3-20-C Soil Conservation"; "M.H. Siegel, "Memorandum for Dr. H.H. Bennett, Director of the Soil Erosion Service," November 1, 1933, RG 48, Central Classified Files, Folder "File 1-275"; and Fahy to Ickes, May 16, 1934, Harold L. Ickes Papers, Secretary of the Interior File, 1928-1946, Box 266, Folder "Soil Erosion 2", Library of Congress, Manuscript Division, Washington,

projects, "Here is the first attempt in the history of the country to put through large-scale comprehensive erosion and flood control projects, such as will apply to complete watersheds from the very crest of the ridges down across the slopes where floods originate, and on to the mouths of the streams."[344]

Until 1933, Hugh Bennett had not explicitly discussed soil conservation in terms of watersheds, though in his earlier writings on land use, flood control, and conservation practices, it is possible to detect glimmers of the watershed thinking that after 1933 would provide a unifying conceptual framework for soil and water conservation in the United States. Conservation planning at the watershed scale is an idea that dates to at least the nineteenth century in the United States. The word "watershed" came into use as a topographic term to describe the line that divides adjacent drainage basins, but by the second half of the nineteenth century the word's meaning had broadened to define the entire drainage area encompassed by that line. It meant seeing the geographic area drained by a stream as a distinct unit comprised of the totality of the hydrologic, geologic, and biologic systems that it contains. Seeing the watershed as an integrated whole was an important intellectual breakthrough for understanding nature in terms of the interconnected relationships between its component parts.[345] The concept of the watershed was influential in the development of

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[344] Bennett, "The Cost of Erosion,"12.

[345] For sources on the influence of watershed thinking on nineteenth century and Progressive Era conservationists see Marsh, *Man and Nature*, 329; Caroline Crane Marsh, *Life and Letters of George Perkins Marsh* (New York: Charles Scribner's Sons, 1888), 7; Donald Worster, "Watershed Democracy: Recovering the Lost Vision of John Wesley Powell," in *Water: Histories, Cultures, Ecologies*, eds. Marnie Leybourne and Andrea Gaynor (Crawley: University of Western Australia Press, 2006), 3-14; Dodds, "The Stream-Flow Controversy: A Conservation Turning Point," 67. For influence of the watershed idea on contemporary environmental thinking, see Peter Warshall, "Streaming Wisdom," *The CoEvolution Quarterly*

public lands management, and, in particular, forestry, but for the reason that watershed boundaries don't correspond with property lines, watershed planning had not been applied in any significant way to private land use in the United States. This changed after 1933 as watershed planning dovetailed with the broader New Deal agenda to join multiple social, economic, and environmental objectives in large-scale comprehensive planning. The funds and authorities provided by the New Deal administration to SES made it possible for the first time to apply watershed planning principles to American agriculture.[346]

SES set up the first demonstration project in November 1933 in the Coon Creek watershed near LaCrosse in southwest Wisconsin. Within a year nine additional projects had been established, and by April 1935, the number of watershed demonstration projects would number forty. Between 1933 and 1935, demonstration projects were established in a line running through the southern Piedmont from Louisiana to New Jersey. Projects dotted the tributaries of the Ohio, Mississippi, and Missouri rivers. They were established in the rutted hills of Oklahoma and Texas. West Coast projects were organized in the Palouse

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12 (Winter 1976-1977): 4-11; Bob Doppelt, Mary Scurlock, Chris Frissell and James Karr, eds., *Entering the Watershed: A New Approach to Save America's River Ecosystems* (Washington: Island Press, 1993); Paul A. Sabatier, Will Focht, Mark Lubell, Zev Trachtenberg, Arnold Vedlitz, and Marty Matlock, eds. *Swimming Upstream: Collaborative Approaches to Watershed Management* (Cambridge: The MIT Press, 2005).

[346] According the Historical Thesaurus of the Oxford English Dictionary, the word "watershed" entered the English language in 1803. Watershed is a calque, or a word translated literally from one language into another. In this case, the English word was borrowed from the German term *wasserscheid*e, which is a compound of the nouns *wasser*, for water, and *scheide*, which means border or sheath; and is sometimes as a euphemism for vagina. Scheide's English cognate, shed also has dual meanings. Derived from the Anglo-Saxon verb sceadan, which means both "to separate or divide" and "to shade or shelter," shed means "to pour forth or cast off" and it also connotes a sheltered place. Watershed's multilingual, compound character gives it a multivalent meaning. This characteristic accounts for the word's influence and continuing resonance in thinking about the environment. For etymology of the word see Christian Kay, Jane Roberts, Michael Samuels, and Irené Wotherspoon, *Historical Thesaurus of the Oxford English Dictionary*, Vol. 1 (New York: Oxford University Press, 2009), 10.

region of Washington state and in California along the Pacific Coast and in the foothills of the Sierra Nevada. Surveys were made of New York and Pennsylvania to begin to assess the need for soil conservation in the northeast, the region of the country where the soil erosion problem had been studied the least.

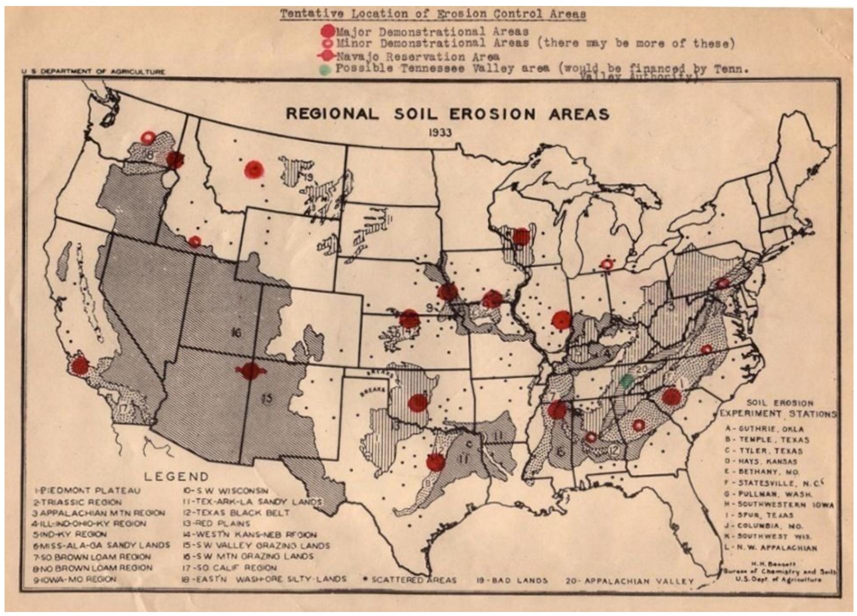

Figure 24. Annotated map showing regional soil erosion areas, locations of the soil erosion experiment stations, and the tentative sites for watershed demonstration projects marked with red dots, c. 1934. (NARA, RG 114, Entry 1, Central Files, Sept. 1933-Oct. 1935, Box 1).

During this time SES also administered large soil erosion control projects on the Navajo Reservation and in the watersheds of the Gila and Rio Grande rivers. It was also carried out a reconnaissance of every county in the country to create a national erosion map and made a topographic survey of the floor of the Boulder Dam reservoir to help measure future sedimentation.[347]

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[347] See Appendix 3 for a complete list of the watershed demonstration projects established by the Soil Erosion Service between September 1933 and April 1935. For further discussion of the establishment of SES watershed demonstration projects see Helms, "Hugh Hammond Bennett and the Creation of the Soil Conservation Service," *Journal of Soil and Water Conservation* 65

The first demonstration projects were located in close proximity to the erosion experiment stations. In many cases, the director of the experiment station took a temporary post with the SES to run the demonstration project and effectively administered both. Relatively quickly, though, watershed demonstration projects expanded beyond the experiment stations' original geographic footprint. To accommodate the growth of the program, SES divided the country into eleven regions. Each of which was placed in the charge of a Regional Director, who reported to Bennett and the headquarters staff in Washington. Each region employed an interdisciplinary group of conservation specialists in diverse fields from soils, agronomy, range management engineering, economics, forestry, and biology, among others to set conservation practice standards for the region. Likewise each demonstration project was staffed with professional conservationists who planned and oversaw the work at each location. To build its staff SES recruited from the agricultural colleges and provided training programs for new employees who chose to stay after regular hours to attend lectures on soil conservation as a way to gain career advancement within the organization. Many of the individuals employed on the watershed demonstration during this period would in time form the core leadership cadre in the soil and water conservation movement as it grew over the next twenty years.

(March-April 2010): 37A-47A; Heasley, *A Thousand Pieces of Paradise: Landscape and Property in the Kickapoo Valley*, 36-37; Chris Rasmussen, "'Never a Landlord for the Good of the Land': Farm Tenancy, Soil Conservation, and the New Deal in Iowa," 70-95; Neil Maher, "'Crazy Quilt Farming on Round Land': The Great Depression, the Soil Conservation Service, and the Politics of Landscape Change on the Great Plains during the New Deal Era," 319-339; Parman, *The Navajos and the New Deal*; and Weisiger, *Dreaming of Sheep in Navajo Country*.

The multidisciplinary approach to conservation was the key feature of the SES program. "In this regard," Bennett wrote in the annual report of the Soil Erosion Service in 1934, soil conservation on the watershed demonstration projects "differs from any other ever undertaken in this country. The plan of procedure is not one of employing single and unsupported implements of attack, but it is definitely one wherein all practical measures of erosion control (which involves control of run-off by increasing absorption of the rainfall) are utilized in a coordinated, correct land-use program." His central point as he repeated often was that soil conservation was "not an agronomic program or a soils, forestry, or engineering program, but a program employing all of these measures in accordance with the needs and adaptability of every acre of land requiring treatment, so coordinated that the integrated activities will support one another to effect complete control of the erosion, flood, and silting problems of entire watersheds." The over-all objective was a reorganization of land use in each watershed to achieve a balanced agriculture that protected the soil and provided for the people who lived on it.[348]

While the general principles SES's comprehensive conservation planning were laid out from Washington, it was left to the regional directors and demonstration project staffs to translate them into action. Once the location for a demonstration project was selected, a thorough survey was performed. Using

[348] Bennett, "Soil Erosion Service," in *Annual Report of the Secretary of the Interior for the Fiscal Year Ended June 30, 1934* (Washington: GPO, 1934), 355; Lowdermilk, "Coordinated Uses of Land on Erosion Control Demonstration Projects," April 30, 1934, Walter Clay Lowdermilk Collection, Correspondence and Papers, 1914-1961, Articles A-Z, Container 1, Coordinated Uses of Land on Erosion Control Demonstration Projects, Bancroft Library, Berkeley, California; Helms "Land Capability Classification: The U.S. Experience." *Advances in GeoEcology* 29 (1997): 165-167.

aerial photographs commissioned for this purpose, SES made highly detailed maps of the projects. Soils surveyors classified all the farm land in the project according to soil type, slope, and predominant land uses, and the condition of the land. The technical staff on the demonstration project then used this information to develop detailed conservation plans for each individual farms. Steep land and fragile soils would be taken out of production altogether and put into grass or trees; cultivated land would be treated with conservation practices to reduce erosion; contour lines would be laid out, gullies would be checked with soil-saving dams; fences were put up to manage grazing, terraces would be built where necessary, and areas conducive to game, timber, or recreation would be identified and developed. The exact mix of practices varied from place to place depending on local conditions and preferences.[349]

In Directing SES's demonstration projects, Bennett continued to emphasize the importance of vegetative control measures. When the regional director in the southern states wrote to Bennett suggesting that a Terrace-centric approach was more appropriate for the Piedmont region in which his demonstration projects were located, Bennett responded in lecturing fashion in a letter that was circulated to the Regional Directors and passed by them on to other employees of the agency. Bennett cited the success SES had on the Gila project near Safford in southeastern Arizona in using willows, tamarisks, and cottonwoods to stabilize eroded stream banks and support dams. "If we can do this in the arid region, with an annual rainfall of around 10 inches, I am

[349] For a discussion of the planning procedures, see *Soil Erosion A Critical Problem in American Agriculture, Part V of the Supplementary Report of the Land Planning Committee to the National Resources Board* (Washington: GPO, 1935), 32, 36.

distressed that it is necessary for any of us to say that we must have terraces to control erosion in the humid region."[350] With the emphasis on the use of vegetation in the conservation work, each demonstration project experimented with different types of plant materials to test their effectiveness not only for erosion control, but also soil building, wildlife habitat, and fodder for livestock, among others side benefits. A separate PWA appropriation established seven regional federal nurseries under the auspices of the Bureau of Plant Industry, which supplied SES with these necessary plant materials.[351]

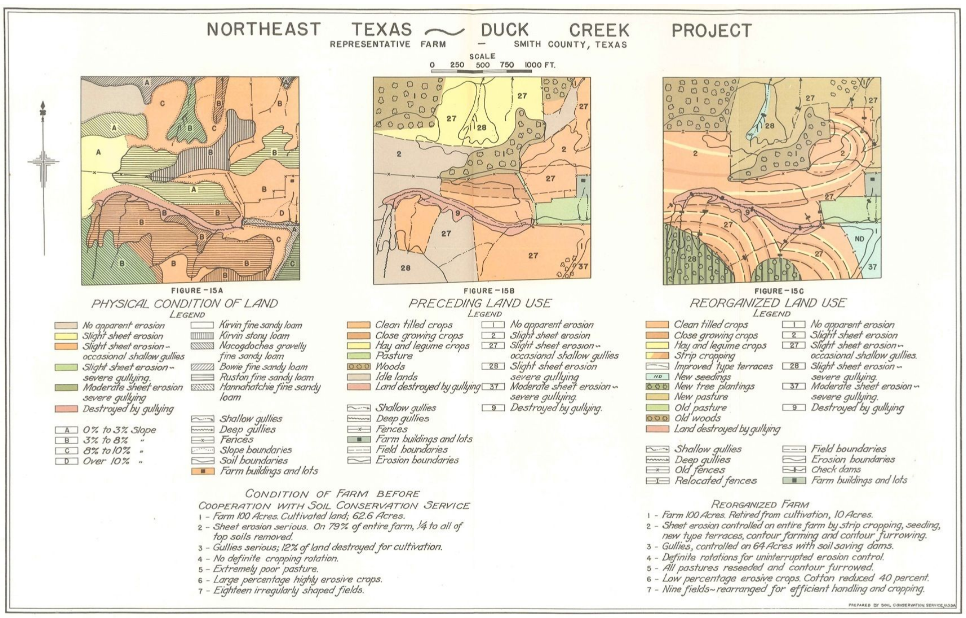

Figure 25. This figure illustrates conservation planning and land use adjustments on a farm in the Duck Creek watershed project in Smith County, Texas. (Soil Erosion: A Critical Problem in American Agriculture, Part V of the Supplementary Report of the Land Planning Committee to the National Resources Board. Washington: GPO, 1935, Figure 15.)

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[350] Bennett to All Regional Directors, September 13, 1934, NARA, San Bruno, RG 114, Pacific Southwest Region (Reg. 10) Santa Paula Regional Office, General Records, 1935-39, Box 1, Folder "101 Administrative Gen. Reg. F.Y. 1935."

[351] For discussion of the establishment of federal nurseries to produce plant materials for conservation, see Helms, "Plant Materials Briefing" in *He Loved to Carry the Message: The Collected Writings of Douglas Helms*, ed., Sam Stalcup (Raleigh, NC: Lulu.com, 2012), 304-305.

In California, SES staff pioneered the use of native species in land rehabilitation with the efforts of staff there "to work out the whole vegetative control problem with species already adapted to the area." As regional director Harry Reddick, explained, "[o]ur program has been to hold to nature as closely as possible, and we feel that native plants will give much more satisfactory results than exotic shrubs that might be introduced. We are always on the lookout for new plants, but these will be tried out in a small way, at no great expense, until they are proven adaptable." In other places SES provided seedlings for mass plantings of trees. At Okatibbee Creek in Mississippi, SES distributed trees and shrubs for controlling erosion, and decoration, in farmers' yards. While SES drew on and was influenced by the nascent field of ecology in its advocacy of vegetative erosion control, not all of the practices it employed were ecologically benign. The most famous example is kudzu, but there are others including honeysuckle and honey locusts, which soil conservationists recommended throughout the 1930s and 1940s for their fast-growing properties to stabilize badly eroded fields and control gullies. These species may have helped to stop erosion, but they but they also turned out to be extremely invasive in their new environments.[352]

[352] For quotes on the use of plant materials on SES's California projects, see "Annual Report to June 30th, 1934, Santa Paula, California," July 1934, RG 114, Entry 1176, Project Plans and Reports, 1930-1944, Box 69, Folder "Annual Report to June 30th, 1934," 44. See also, "The Okatibbee Creek Watershed, Soil Erosion Service Chain," February 1935, RG 114, Entry 21, Box 8, Folder "Soil Erosion Service," 6."The Okatibbee Watershed Project No. 21," c. 1934, RG 114, Entry 21, Box 7, Folder "Lectures," 5. See also H.H. Meginnis, "Using Soil-Binding Plants to Reclaim Gullies in the South," U.S. Department of Agriculture, *Farmers' Bulletin* 1697 (January, 1933). For the use of kudzu for soil conservation, see also C.V. Piper, "Kudzu," U.S. Department of Agriculture, *Circular* 89 (1920); J.O. Rutherford, *Kudzu: The Great Pasture Hay Plant and Soil Enricher* (Atlanta: Rock Glen Farm, 1931); R.Y. Bailey, "Kudzu for Erosion Control in the Southeast," U.S. Department of Agriculture, *Farmers' Bulletin* 1840 (1939); and

Figure 26. Kudzu used to completely envelop a gully in Greenwood County, South Carolina. The photo's caption reads, "[t]he kudzu has spread over adjacent acres and has proven to be an excellent soil improver." (RG 114P, General Photographic File, 1933-1977, Box 59).

Once the location for a watershed demonstration project was selected all the landowners in the project area were contacted and recruited to participate. Participation was entirely voluntary, but it was highly encouraged. SES engaged in a variety of public outreach activities to educate farmers and the general public about the benefits of cooperation with the soil conservation program. These ranged from tours of the demonstration area, public lectures, to the publication of monthly newsletters. Such outreach was important. SES sought to forge relationships with important stakeholders in the communities in which they operated, as well as with other state and federal agencies in support of the conservation projects. SES understood that outreach initiatives helped to win

Roland McKee and J.L. Stephens, "Kudzu as a Farm Crop," U.S. Department of Agriculture, Farmers' Bulletin 1923 (October, 1943).

public support and convinced farmers to sign on to the demonstration project plan. "The success of our program depends," read a newsletter from Okatibbee Creek watershed project, "upon the extent to which we can sell the latest plan of erosion control to all agricultural leaders, the farmers, and the public generally."[353]

Farmers who agreed to participate signed legally binding agreements with the government that obligated the landowner to carry out SES's conservation plan for five years and to cover a portion of the costs. In return SES provided the technical expertise and supplied a portion of the necessary labor, equipment, and materials to carry out the program. SES also provided a direct financial payment to farmers to compensate them for their participation in the program. It was up the director of each region to determine the exact pay schedules to be used. These varied from place to place and fluctuated over the life of each project, but their existence marks the first use of payments to farmers as incentives to adopt conservation practices. Conservation payments represented a dramatic departure from past custom defined by reliance on the enlightened self-interest of the individual. Financial assistance for conservation was a significant innovation of the watershed demonstration projects that proved a significant catalyst for cooperation. As Harry Reddick reported from California, where there was resistance to the SES program it was "based on belief that any erosion control measures agreed upon might cost the individual money," but when these concerns were allayed with explanation "in the form of

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[353] "The Okatibbee Creek Watershed, Project No. 21," October 5, 1934, RG 114, Entry 1176, Miscellaneous Papers of H.H. Bennett, 1926-34, Box 8, Folder "Soil Erosion Service," 4.

letters to cooperators, tours for those who had been doubtful when first approached, and time given for better acquaintance with the idea, the recommendations were usually accepted with more enthusiasm."[354]

Figure 27. Aerial Photo of Conservation Practices applied to a whole farm near on Arroyo Grande Project, near San Luis Obispo, California, June 18, 1937 (NARA, San Bruno, RG 114, Photographs of the Arroyo Grande Watershed Demonstration Project, CAL 3980).

Early on SES made some effort to establish demonstration projects in areas where they could provide the most assistance to struggling farmers. In an example from southern California, SES gave preference to a location near Arroyo Grande in San Luis Obispo County over another site near El Toro in Orange County because land near Arroyo Grande was "in small ownerships, which will average between forty and sixty acres" while the Orange County location was controlled by three large owners. In this choice SES showed a clear

[354] "Annual Report to June 30th, 1934, Santa Paula, California," 1934, RG 114, Entry 1176, Project Plans and Reports, 1935-1942, Box 69, Folder "Annual Report to June 30th, 1934,"

preference for the small holders who were “having a tough time of it both with erosion and marketing conditions.”[355] When tenants occupied lands in a demonstration project, SES favored making payments to the tenant rather than the landlord. As Henry Geib wrote Harry Reddick, “I believe that where a tenant occupies the land, he should do most of the work in connection with our experiments and demonstration and that he should be the one who received the compensation, or most of it at least.” In many other cases, however, the tenant landlord split the payment.[356]

At the outset of the work Bennett estimated that a twenty-five percent rate of farmer participation would be a success. Within a year he reported ninety-five percent participation in many of the demonstration areas.[357] “[T]his cooperation on the part of farmers is the crux of the government's effort to preserve fertility and promote proper use of land,” Bennett wrote in a press release.[358] Public support was critical to the long term success of the conservation program. Bennett and his staff understood that while the government could provide technical and financial assistance for conservation, without real acceptance of a conservation ethos by farmers, extending conservation practices beyond the demonstration projects would not be possible.

Another critical component of SES’s demonstration projects was the public labor force provided through the New Deal’s emergency jobs programs.

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355 Lowdermilk to Reddick, June 18, 1934, RG 114, Entry 1, Central Files, Sept. 1933-Oct. 1935, Box 94, Folder "232 General”; Reddick to Lowdermilk, June 27, 1934, Ibid.

356 Geib to Reddick," November 21, 1933, Ibid.

357 “Memorandum for the Press," August 14, 1934, RG 114, Entry 21, Box 8, Folder "Soil Erosion Service."

358 “Memorandum for the Press,” September 10, 1934, RG 114, Entry 21, Miscellaneous Papers of H.H. Bennett, Box 8, Folder “Soil Erosion Service.”

A principal objective of the PWA when it was created was to employ dislocated workers as a relief measure. Soil erosion control was especially conducive to these objectives. “No other public work promises such immediate and permanent benefits as erosion control” the USDA recognized in 1933. The work of conservation is physically demanding. It requires significant amounts of labor to contour hillsides, list fields, build terraces, construct dams, and plant trees. These were arduous tasks that could absorb tens of thousands of workers. The USDA estimated that in the first year alone, a national soil erosion program would put 30,000 men within a year.[359]

The Emergency Conservation Works legislation of March 31, 1933, which created the CCC, mentioned prevention of soil erosion as an explicit purpose of public employment. [360] In the summer of 1933 one of the first actions of the incipient Emergency Conservation Work program was to assign CCC camps to the Forest Service for the control of gullies on national forest land. One of the first priorities for Bennett after the creation of the Soil Erosion Service was to secure CCC labor for the watershed demonstration projects. To put the land use changes envisioned by SES into practice required significant amounts of labor, beyond what the individual farm owners could furnish individually. Obtaining CCC workers for soil conservation, had the potential to

[359] “Soil Erosion Control As An Unemployment Relief Measure,” c. 1933, RG 8, Entry Records of S.H. McCrory, Box 504, Folder “Correspondence--Public Works.”
[360] “Relief of Unemployment through Performance of Useful Public Works,” *U.S. Statutes at Large* 48, 22.

dramatically augment the capacity of SES to put its watershed plans into action.[361]

Early in his first term, Roosevelt was reluctant to allow emergency conservation work on private lands. The ECW program was initially conceived for public lands projects in the National Forests, National Parks, Indian lands, and on state property. Almost from the start, however, pressure was applied to the administration to put the CCC and other public employment programs to work on private lands projects. While there were lingering questions about the legality of such a step, revolving around legal objections to the perception of the spending of public funds for private benefit, attorneys for both the Interior department and the USDA issued opinions in support of the private lands work. Concluding, in essence, that in the state objectives of the legislation creating CCC and SES, Congress could have had no other intent than to allow work on private lands. Otherwise, the legislation would not be able to achieve the intended results.

At the same time there was also pressure being brought to bear on the administration from representatives of the Midwest and plains states to allow public labor on private lands These "treeless states," such Kansas, Nebraska, North Dakota, Iowa, Missouri, and Texas, had much smaller public domains than the states in the West or Southeast where most CCC camps had been assigned in the first year of the program. Allowing CCC, labor to conserve

[361] For general discussion of the CCC, see Maher, *Nature's New Deal*; Gorham, "The Ambiguous Practices of the Civilian Conservation Corps: *Social History* 17 (May 1992): 229-249. For SES's desire for CCC camps, see Helms, "Hugh Bennett and the Creation of the Soil Conservation Service," 38A

eroded farmland would allow states like these to participate in the public works program. These factors helped to influence Roosevelt's decision in early 1934 to allow the CCC to work on erosion control projects.[362] The first CCC workers were assigned to SES in April 1934, when 22 camps were transferred from the Forest Service to SES. Within a year SES would direct a total of 51 CCC camps. These camps typically consisted of 200 or so workers from which small teams would be dispatched to work areas located within a twenty-five or thirty miles radius. During this time, SES also employed public labor through the Civil Works Administration (CWA), predominantly at its Navajo and Gila river projects, before the CWA was ended on March 31, 1934, as well as workers provided by the Works Progress Administration (WPA). By the spring of 1935, SES was utilizing 11,000 workers from the CCC, CWA, and WPA combined, and another 5,000 men were employed from local relief rolls. This public workforce would provide the muscle behind soil conservation in the 1930s. [363]

By early 1935 it was clear that SES had grown beyond the limited and temporary role originally imagined for it. Its forty demonstration projects encompassed an area 4,000,000 acres in size, and it had agreements with

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[362] For discussions about the use of public labor on soil conservation projects, see "Soil Erosion Control An An Unemployment Relief Measure," 3. Legal opinions on the question of spending public funds on private lands are cited above. For discussion of the initial reluctance of Roosevelt administration to extend public works programs to private lands, see Bennett to Burlew, October 24, 1934, Harold L. Ickes Papers, Secretary of the Interior File, 1928-1946, Box 266, Folder "Soil Erosion 2", Library of Congress, Manuscript Division, Washington; and Helms, "Hugh Hammond Bennett and the Creation of the Soil Erosion Service," 40A; and ibid, "The Civilian Conservation Corps: Demonstrating the Value of Conservation." *Journal of Soil and Water Conservation* 40 (March-April 1985): 185. For an example of pressure from "treeless" states, see Ickes to Bennett, February 22, 1935, Harold L. Ickes Papers, Secretary of the Interior File, 1928-1946, Box 266, Folder "Soil Erosion 1", Library of Congress, Manuscript Division, Washington.

[363] For summaries of CCC contributions to soil conservation work, Maher, *Nature's New Deal*, 60-69.

farmers to retire more than 220,000 acres from production, to apply agronomic and engineering conservation practices on another 900,000 acres, and to plant some 400,000 acres in soil-saving crop rotations.[364] As a centerpiece of the New Deal's rural recovery program, the watershed demonstration projects had high public visibility. While these projects had their critics, they were generally well received by participating farmers and the general public alike. As a result there was a continuing demand, from the states and from Congress, for the expansion of the existing projects' boundaries and for the establishment of new projects in different areas of the country.

The growth of the SES program, however, faced several important obstacles. One was funding. Up to that point in time the PWA had allocated $20,000,000 to fund SES's first forty projects and its other activities, but the legal authorities in the NIRA that supported the public works spending were set to come under review in June 1935, making SES's budgetary future uncertain. Another obstacle was shortages of both the qualified personnel to make conservation plans and the necessary labor to carry them out. In February 1935, the Department of the Interior requested that 500 CCC camps be assigned to SES, to average five camps for a total of 100 planned demonstration projects. Due to lingering concerns about the legality of applying public labor to improve private lands, SES did not receive any increase in the number of camps assigned to it for 1935. It was also forbidden for spending money on small things like fences, which could be construed as benefiting the individual at government

[364] *Hearings before a Subcommittee of the Committee on the Public Lands*, March 20, 21, 22, 25, 1935, 74th Cong., 1st Sess. (Washington: GPO, 1935), 4-5.

expense. Finally, a rival soil conservation initiative funded by the Federal Emergency Relief Administration (FERA) threatened to undermine SES's authority in the countryside.

A combination of these circumstances brought SES future status into question. To address these uncertainties, SES, in collaboration with the Interior department and allies in Congress, began to formulate proposals legislation cementing SES's status as a permanent federal. Bennett was confident, "that the time has arrived when the function of the Soil Erosion Service as a major agency to be responsible for erosion control on agricultural lands should be recognized."[365]

A Permanent Policy of Soil and Water Conservation

In the Spring of 1935, decisions about the future of soil conservation policy in the United States were taking place against the backdrop of gathering dust storms on the western plains. Drought, or drouth, as people called it, began in parts of the region in 1929, and had become a basic fact of life by 1933. Its effects were most severe in the part of the southern plains where the states of Kansas, Colorado, New Mexico, Oklahoma, and Texas meet, though by the end of the decade dust storms were common up and down the Great Plains. Farms in

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[365] Quote is from Hugh Bennett, "Memorandum to the Secretary," February 23, 1935 in Nixon, ed., *Franklin D. Roosevelt and Conservation, 1911-1945*, vol. 1 (Hyde Park: New York: Franklin D. Roosevelt Library, 1957), 357-358. For the prohibition on fencing, see Ickes to Bennett, October 25, 1934, Harold L. Ickes Papers, Secretary of the Interior File, 1928-1946, Box 266, Folder "Soil Erosion 2", Library of Congress, Manuscript Division, Washington; and Bennett, "Memorandum for the Secretary of the Interior," November 3, 1934, ibid. For concerns about the FERA soil conservation program, see Ickes to Hopkins, January 28, 1935, ibid. For the start of discussions about the preparation of legislative proposals for making SES a permanent soil conservation agency, see Bennett, "Memorandum to the Secretary of the Interior," October 11, 1934, ibis.; and Margold to Ickes, October 19, 1934, ibid.

this region represented the western edge of continuous frontier settlement. Many fields in the region had only been plowed for the first time ten or twenty years before when farmers replaced the native grasses with expansive stands of monocultured wheat stretching from horizon to horizon. High prices and demand during WWI encouraged farmers to plow up the plains almost to the front range of the Rocky Mountains. A conversion that had paid off with bonanza crops in the wet years between 1914 and 1929, but failed disastrously when the rain stopped falling in the early thirties. Many parts of the region went from receiving annual precipitation averaging consistently from fifteen to twenty-five inches a year to five to fifteen inches. By April 1935, three successive wheat crops had failed in the geographic region by then known as the Dust Bowl. [366] The combination of drought and crop failure left the soil exposed to the high winds common on the plains. Shallow roots of annual crops like wheat could not hold the soil when the wind began to blow. The sandy soil types of the region were the most vulnerable. The wind swept particles of soil into the atmosphere where they collected into massive, roiling clouds of dirt. These dust storms grew in size and frequency through the 1930s, further intensifying in a positive feedback cycle of land degradation. [367]

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[366] The famous sentence by the journalist Robert Geiger that coined the term "dust bowl" appeared as an *Associated Press* release in the April 15, 1935 issue of the *Washington Evening Star.* See R. Douglas Hurt, *The Dust Bowl: An Agricultural and Social History* (Chicago: Nelson-Hall, 1981), 3; Dust Storms Menace Midwest Wheat Crop," March 21, 1935, *The Washington Post*, 1; "Dust Storms Push Grains Up," March 21, 1935, *The Washington Post*, 22.
[367] For discussions of contributing causes to the Dust Bowl, see Donald Worster, *Dust Bowl: The Southern Plains in the 1930s* (New York: Oxford University Press, 1979); Hurt, *The Dust Bowl: An Agricultural and Social History*; Paul Bonnifield, *The Dust Bowl: Men, Dirt, and Depression* (Albuquerque: University of New Mexico Press, 1979); Geoff Cunfer, *On the Great Plains: Agriculture and Environment* (College Station: Texas A&M University Press, 2005), 143-163; and Benjamin I. Cook, Ron Miller, and Richard Seager, "Amplication of the North American

When Hugh Bennett began his soil conservation campaign, soil erosion by wind, while recognized as an important phenomenon, was not a focus of primary concern.[368] Rather, the focus was almost entirely on water erosion. "Soil Erosion a National Menace," the publication that launched public action for soil conservation mentioned the wind as an agent of erosion only in passing; it was explicitly concerned instead with "soil removal by the rains" as the most destructive form of erosion.[369] This had all changed by 1933 as the worsening situation on the plains drew attention to the problem of wind erosion. That summer the Bureau of Chemistry and Soils dispatched Horace V. Geib, the director of the Blacklands Soil Erosion Experiment station in Temple, Texas, to survey areas of wind erosion on the southern plains for the new administration.[370] The following year, in September 1934, SES established a wind erosion demonstration project 126,000 acres in size at Dalhart, Texas, under the direction of Henry Howard Finnell. [371]Additional wind erosion demonstration projects were established in eastern Colorado and central South Dakota by the summer of 1935. In total thirteen demonstration projects were established to mitigate wind erosion.

'Dust Bowl' Drought Through Human-Induced Land Degradation" *Proceedings of the National Academy of Sciences* 106 (March 2009): 4997-5001.

[368] For an early USDA publication on wind erosion see E.E. Free, "The Movement of Soil Material By the Wind," U.S. Department of Agriculture, Bureau of Soils, *Bulletin* 68 (June 15, 1911).

[369] Bennett, "Soil Erosion A National Menace," 1.

[370] Geib, "Report of Wind Erosion Survey Oklahoma Panhandle and Adjacent Territory," September 1933, RG 16, Entry 17, General Correspondence of the Office of the Secretary, 1906-70, Box 1787, Folder "Drought (Misc.)," 37. See also Geib to Bennett, August 22, 1933, RG 114, Entry 1, Central Files, September 1933-October 1935, Box 73, Folder "210 Wind Erosion Control."

[371] "Annual Report, Dalhart Area Project, 1934-35," June 1935, RG 114, Entry 1176, Project Plans and Reports, 1930-1944, Box 74, Folder "Annual Report, Dalhart Area Project, 1934-35."

Conservation plans on these projects called for farmers to employ the practice of listing by plowing deep furrows and piling up soil in adjacent row at a right angle to the prevailing direction of the wind. The resulting ridged furrows served to catch blowing soil. SES also discouraged the use of the one-way disk harrow, which long been used to plow wheat fields, but left the soil vulnerable to blowing.[372] As the projects expanded in scope, SES worked with farmers to build broad terraces on the contour in the style first developed at Spur, Texas.

Strip-cropping rotations were also encouraged, as well as new methods of conservation tillage that left stubble from the previous year's crop in the field to help hold the soil in place, as well as the use of implements to scarify the soil. Shelter belt plantings of trees, once established, were also used to slow down high winds. Combined these measures served to increase the absorption of what rain that did fall into the soil, reduce the effects of wind, and promote the growth of vegetation. [373] Much of the land in the dust bowl, however, was unsuitable for cropping, should never have been plowed up in the first place, and would ultimately be retired into permanent grass cover.[374]

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[372] Ben Hibbs, "Reaping the Wind," *The Country Gentleman* 104 (May 1934): 15, 45-48; "Midwest Seeking to Conquer Dust," *The New York Times*, March 31, 1935, E6.

[373] Charles E. Kellogg, "Soil Blowing and Dust Storms," U.S. Department of Agriculture, *Miscellaneous Publication* 221 (March 1935); For an account of conservation planning on the Dalhart, Texas demonstration project, see Helen M. Strong, "The Soil Conservation Service and Its Work," *The Journal of Geography* 36 (October 1937): 257; Helms, "Hugh Hammond Bennett and the Creation of the Soil Conservation Service," 41A. See also J.F. Brandon and Alvin Kezer, "Soil Blowing and Its Control in Colorado," Colorado State College Experiment Station, *Bulletin* 419 (January 1936).

[374] For retirement of agricultural land on the Plains, see Hurt, "The National Grasslands: Origin and Development in the Dust Bowl" *Agricultural History* 59 (April 1985): 246-259; and Cunfer "The New Deal's Land Utilization Program in the Great Plains," *Great Plains Quarterly* 21 (Summer 2001): 193-210.

Figure 28. Land protected by deep furrows ten miles south of Springfield, Colorado, in the heart of the Dust Bowl, c. September 1933. (“Report of Wind Erosion Survey Oklahoma Panhandle and Adjacent Territory," September 1933, RG 16, Entry 17, General Correspondence of the Office of the Secretary, 1906-70, Box 1787, Folder "Drought (Misc.),” 23.)

Although the region known as the Dust Bowl comprised a comparatively limited area relative to the total amount of agricultural land in the United States, the continent spanning dust storms it spawned occupied a disproportionate size in the popular imagination. Images of black clouds of soil darkening the sky retain the capacity to shock to the present day. They represent at a glance the consequences of a failure to account for the environmental limits in the use of natural resources. By the middle the 1930s, dust storms blowing off the plains helped elevated the cause of soil conservation to a high national concern. No longer was erosion a creeping affliction. It had become an imminent natural disaster that threatened to render a whole section of the country uninhabitable.

The crisis was underscored on May 11, 1934, when for the first time a dust storm passed over the eastern seaboard. Inhabitants of the Atlantic states reported “a distinct sensation of grittiness to the teeth.” In “Washington the sun was obscured by mid-day.” Ships out at sea accumulated a layer of dust on their decks. In a quote that appeared in *The New York Times*; Hugh Bennett warned that the “[r]ecent dust storms were due to soil erosion, and frequent and worse storms will follow if it is not checked.”[375] Less than a year later, on Wednesday March 6, 1935, a dust storm swept over the East Coast for the second time in less than a year. It reached 8,000 feet into the atmosphere and dropped “tons of Kansas, Colorado, Texas, and Oklahoma top soil” on eastern cities.[376]

In an editorial published in *The Washington Post* the following Sunday, Bennett reminded readers of his prediction the previous year. “With the arrival of the second great dust cloud over Washington last week, this prophecy came true.” And “unless immediate steps are taken” to stop soil from blowing more storms would come. “Control of wind erosion is possible,” Bennett averred. The demonstration projects had shown as much. All that was needed was to put the SES’s “balanced control program” into effect at a greater scale.[377]

On March 11, 1935, Bennett was called to the White House. Accompanying him was SES vice-director Walter Lowdermilk. They with Donald R. Richberg, Executive Director of the National Emergency Council, who had been tasked with coordination of the various agencies charged with implementation of the NIRA. As Bennett understood it, the reason for the

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[375] “Dust Storms Due to Soil Erosion,” The New York Times, May 14, 1934. 5; W.A. Mattice, “Dust Storms, November 1933 to May 1934,” *Monthly Weather Review* 63 (February 1935), 53.
[376] “Dust Storm Descends Like Dusk Upon City,” *The Washington Post*, March 7, 1935, 1; “Capital’s Face Washed by Showers Sans Soap,” *The Washington Post*, March 8, 1935, 5.
[377] Bennett, “Capital, Caught by Dust Storm, Turns to West's Topsoil Problem,” *The Washington Post,* March 10, 1935), B9

meeting was to discuss SES's plans for expansion of the demonstration projects and its pending request for five hundred CCC camps. After discussing matters these matters with Richberg, Bennett was the called into the Oval Office to speak privately with the President. The question on Roosevelt's mind was whether SES should remain in Interior or be transferred to the Agriculture department. The temporary authorities under which SES operated were set to expire in the middle of June.

The time had come to decide the future status of soil conservation in the federal government. The President used the meeting to ask Bennett where he thought soil conservation should reside. Bennett's response was equivocal—"I know nothing of the ethics in matters pertaining to conversations with the President," he reported to Ickes—but, it did not take an ethicist to know that the political wind was blowing in Agriculture's direction. As Bennett recounted the episode immediately after returning to his office at the Department of the Interior. Roosevelt had told him "that from almost every conceivable angle requests were being made for the Soil Erosion Service to be transferred to the Department of Agriculture."[378]

Indeed, there was a consensus in the countryside that soil conservation was the proper function of the Agriculture department. Iowa Governor Clyde Herring relayed this common sentiment in a petition he forwarded to Roosevelt

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[378] Roosevelt requested the meeting on March 9. It took place on Monday March 11, 1935. *Franklin D. Roosevelt and Conservation, 1911-1945*, Vol. 1, 357-358. For Bennett's account of his meeting with FDR, see Bennett, "Memorandum for the Secretary of the Interior," March 11, 1935, Harold L. Ickes Papers, Secretary of the Interior File, 1928-1946, Box 266, Folder "Soil Erosion 2", Library of Congress, Manuscript Division, Washington. See also Helms, "Hugh Hammond Bennett and the Creation of the Soil Conservation Service," 43A-44A.

in January 1934. The “soil erosion problem is dovetailed practically 100% with other agricultural problems. It is very difficult to separate this work from crop rotation, fertilizing the soil, and other agricultural activities”[379] Secretary of Agriculture Henry A. Wallace echoed this opinion in a note to the President in March “[t]he work of the Soil Erosion Service is excellent but it is largely agricultural work and done in cooperation with the Agricultural Experiment Stations and Extension Service on individual farms.”

If SES remained in Interior, Wallace warned there was “likely to be serious trouble” between these different interests.[380] With all this as background, it appears that Roosevelt had already come close to making a final decision by the time of his meeting with Bennett. At the end of February, he had asked Donald Richberg to outline the procedure necessary for giving SES permanent status in the USDA. What was needed, Richberg concluded, was an Executive order for the transfer and legislation from Congress to consolidate all erosion control work in one agency.[381] By the Spring of 1935 almost the only people that believed SES should remain in Interior were Harold Ickes and his allies in Congress. SES was in Interior in the first place because in 1933 Ickes thought it useful in 1933 to use` the NIRA erosion control money to create an agency that would bolster his claims for consolidating the federal government’s public lands programs under his authority in Interior. He hoped to obtain the Biological

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[379] “Some Suggestions Why the Soil Erosion Work Should Remain Under the Direction of the United States Department of Agriculture,” January 10, 1935, Franklin D. Roosevelt Papers as President, Official File 732, Franklin D. Roosevelt Library, Hyde Park, New York.
[380] Wallace to Roosevelt, March 7, 1935 in *Franklin D. Roosevelt and Conservation, 1911-1945*, vol. 1, 361-362.
[381] Richberg to Roosevelt, February 28, 1935 in *Franklin D. Roosevelt and Conservation 1911-1945*, vol. 1, 358-359.

Survey and the Forest Service from the USDA. The Biological Survey was eventually transferred to the Interior in 1939, becoming the Fish and Wildlife Service in 1940, but the Forest Service stayed in Agriculture where it remains to the present.[382] At the time, Ickes designs were common knowledge. As Henry Wallace indicated, "I have the feeling that Secretary Ickes has no illusions whatever as to the character of the functions of the Soil Erosion Service and where it belongs but he is holding on to it because he thinks it is good trading stock."[383]

By the middle of March, Roosevelt had made up his mind on the subject. "I have definitely concluded," he wrote to Ickes on March 20, that as a matter of function, the Soil Erosion Service should be transferred to the jurisdiction of the Department of Agriculture." To avoid controversy, the President waited until Ickes was out of Washington to Act. Ickes was in Florida scouting potential locations for the Everglades National Park when Roosevelt's decision reached the Department of the Interior. Since SES was a creation of NIRA, Roosevelt requested Ickes to convene a special meeting of the PWA board to pass a resolution allowing the transfer of SES to USDA. When Ickes sought to delay the move from Florida, Roosevelt himself ordered the PWA to pass the resolution immediately on March 22.

The next day, after Ickes returned to Washington, he was obligated, in his capacity as the administrator of the PWA, to sign the order transferring the

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[382] For the institutional history of the USDA's Biological Survey, see *Century of Service*, 518; and Lawrence S. Mastroni, "The Conflicted Mission of the United States Bureau of Biological Survey 1885-1940: Wildlife, Uncertainty am Ambivalence" (Ph.D. diss., University of Oklahoma, 2012).
[383] Wallace to Roosevelt, March 7, 1935.

funds, personnel, property and equipment of the Soil Erosion Service from the Department of the Interior to the Department of Agriculture. For what he believed to be betrayal of trust by the President, Ickes held a grudge on this matter for the rest of his life. For Roosevelt the maneuver was simply a matter of expedience. As he explained, "from the point of view of common sense administrative lay-out and charting . . . there is no question that Soil Erosion has more to do with Agriculture activities than with Interior Activities." Still, the President insisted he would have waited to make the decision had not "a very difficult situation . . . come to a head on the Hill."[384]

SES was now an agency of the USDA, but its future status as an independent agency remained uncertain. By late March 1934 a number of bills to establish soil conservation as a permanent function of the federal government had begun to move through Congress. Texas Congressman Marvin Jones, who chaired the House Agriculture Committee introduced the first of these on March 11. Within weeks five other proposals along similar lines had been introduced in the House and Senate.[385] The House Public Lands Committee, which had authority over Interior business, scheduled hearings to reconcile these bills to begin on March 20, the same day that President Roosevelt had made his decision

[384] Quotes are from Roosevelt to Ickes, March 20, 1935 in *Franklin D. Roosevelt and Conservation, 1911-1945*, vol. 1, 338; and Roosevelt to Ickes, March 22, 1935, Harold L. Ickes Papers, Secretary of the Interior File, 1928-1946, Box 266, Folder "Soil Erosion 2," Library of Congress, Manuscript Division, Washington. See also Ickes to Roosevelt, March 21, 1935, ibid; "Secretary Chapman Called the Secretary at West Palm Beach, 12:20 Noon, March 22, 1935," c. March 1935, ibid. For Ickes' grudge on the issue of soil conservation, see Ickes, *The Secret Diary of Harold L. Ickes: The First Thousand Days, 1933-1936* (New York: Simon and Schuster, 1953), 324-325; and Ickes to Brink, December 28, 1950, Douglas Helms Collection, National Agricultural Library, Beltsville, Md. See also Helms, "Hugh Hammond Bennett and the Creation of the Soil Conservation Service," 43A-44A

[385] H.R. 6011, H.R. 6432, H.R. 6439, H.R.6440, and S. 2149, 74th Cong., 1st Sess.

to transfer SES to USDA. Bennett was on hand to testify on the first day of the hearings. His statement repeated chapter and verse on the costs of erosion. He recounted the progress made by SES over the past year and half on its watershed demonstration projects, explaining the benefits of the comprehensive approach to soil and water conservation. The demonstration projects, Bennett told the congressmen, represented the foundation of a "permanent national erosion-control program of adequate scope to meet the acute land crisis created by wasteful methods of land utilization." SES had shown that soil erosion can be stopped, what was needed he urged the committee was public support to extend the program nationwide.[386]

As the first day of hearings on soil conservation ended, news reached Washington that a large dust storm was moving east across the Plains. SES field staff sent telegrams to Washington. "WORST DUST STORM IN THIS SECTION NOW IN PROGRESS STOP," read one telegram from Kansas.[387] A cloud of dust stretching from the Gulf of Mexico to the Great Lakes and reaching to an altitude of 11,000 feet in height moved eastward at thirty miles an hour. By late afternoon on March 21, the dust storm moved over Washington, and for the third time in less than year, shrouded the nation's capital. "A clay-

[386] *Hearings before a Subcommittee of the Committee on the Public Lands*, March 20, 21, 22, 25, 1935, 4.

[387] "Chambers to Bennett," March 20, 1935, RG 114, Entry 1, Central Files, Sept. 1933-Oct. 1935, Box 15, Folder "107.2 "; "Black Dust Storm Chokes Midwest," March 21, 1935, *The New York Times*, 25; "Many States Hit by Dust Storms," March 21, 1935, *The Washington Evening Star*, A9.

colored veil hung before the Washington Monument, the Lincoln Memorial, the Capitol, and the Library of Congress," reported *The Washington Post.* [388]

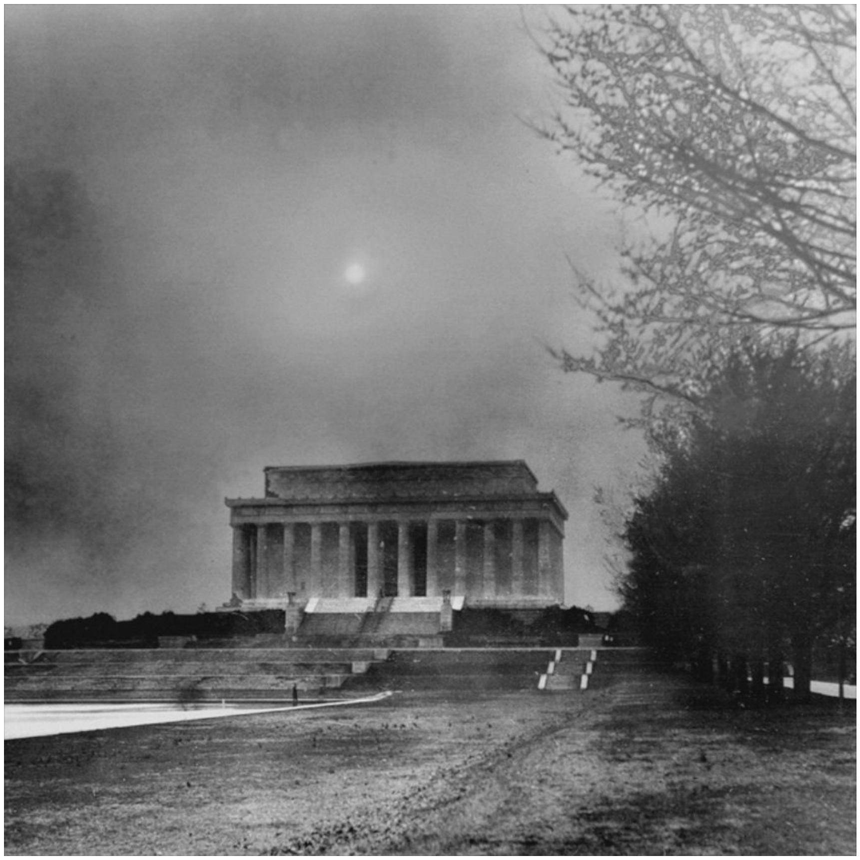

Figure 29. Dust Cloud over Lincoln Memorial. This photo was most likely taken on March 6 or March 21, 1935 when dust clouds blew over Washington. It was taken by Science Service Photographer John Hugh O'Neill and appeared on the March 30, 1935 cover of *Science News Letter.* It was later accessioned by the National Archives. (NARA, College Park, RG 114G-c-6001a).

When the dust storm appeared outside the committee room, where the second day of hearings on the creation of a permanent soil conservation agency were taking place, it is said that the proceedings were paused as people gathered

[388] "D.C. Invaded by Dust Storm from Midwest," *The Washington Post*, March 22, 1935, 1; "Dust Fight Begun by 7 U.S. Agencies," *The Washington Evening Star*, March 22, 1935, A2.

at the windows to gaze at the dust outside.[389] Events moved quickly thereafter. The chairman of the House Public Lands Committee, John J. Dempsey of New Mexico, introduced House Resolution 7054 on March 27. H.R. 7054 passed the House on April 1 and an amended version passed the Senate on April 15. After reconciliation a final version was passed without a dissenting vote in either chamber. It was signed into law by the President on April 27, 1935.

Public Law 74-46, sometimes informally known as the Soil Conservation Act—its official title was "An Act to Provide for the Protection of Land Resources Against Soil Erosion and for Other Purposes." Its preamble contained official federal recognition of soil erosion as a matter of federal concern:

> That it is hereby recognized that the wastage of soil and moisture resources on farm, grazing, and forest lands of the Nation, resulting from soil erosion, is a menace to the national welfare and that it is hereby declared to be the policy of Congress to provide permanently for the control and prevention of soil erosion and thereby to preserve natural resources, control floods, prevent impairment of reservoirs, and maintain the navigability of rivers and harbors, protect public health, public lands and relieve unemployment. . . .[390]

P.L. 74-46 established for the first time a permanent national policy of soil conservation. The law vested in the Secretary of Agriculture the power to coordinate and direct all activities in relation to soil conservation in the federal government, and it explicitly instructed the Secretary to "establish an agency to

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[389] The story of the arrival of a dust storm in Washington as Hugh Bennett was testifying to the congressional committees is an often repeated anecdote in histories of soil conservation. For a discussion of this event, see Helms, "Hugh Hammond Bennett and the Creation of the Soil Conservation Service," 44A-45A; 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.

[390] "An Act to Provide for the Protection of Land Resources Against Soil Erosion and for Other Purposes," April 27, 1935 *U.S. Statutes at Large* 49, 163-164

be known as the 'Soil Conservation Service,' to exercise the powers conferred on him by this Act." The law gave new legal validation to the existing research and demonstration programs, which had been the primary vehicles of publicly sponsored soil conservation up that point.

More importantly, language in the legislation significantly expanded the ability of the USDA, and by extension the Soil Conservation Service (SCS), to cooperate directly with private landowners, with the authority to to "furnish financial or other aid" to "any agency, governmental or otherwise, or any person" for the purpose of soil conservation. Such assistance could be provided on both on public lands and "[o]n any other lands," with the caveat that "proper consent or necessary rights or interests in such lands" be obtained. The law also gave USDA broader authority [t]o acquire lands, or rights or interests" in land "by purchase, gift, condemnation, or otherwise" for the purposes of soil conservation. Finally, to safeguard the new public investment in soil conservation, P.L. 74-46 reserved the right of the Secretary of Agriculture to require the enactment of local and state laws to enforce compliance with soil conservation agreements before any federal benefits were extended to private lands. This broad expansion of powers was justified under the general welfare clause of the constitution, which provides for the national government's ability to defend the nation against threats. By declaring soil erosion a menace to the national welfare, Congress invoked its power to defend the nation through soil conservation.

In summary, with passage of P.L. 74-46 Congress established a permanent policy of soil conservation in the federal government. The most immediate effect of the law was that it allowed SES to continue as SCS in the Department of Agriculture. It also paved the way for expansion of the demonstration program. With uncertainty over the status of the soil conservation program resolved, SCS received 533 CCC camps for the enrollment period beginning in April 1935. At its peak SCS would administer 90,000 CCC workers a year on its demonstration projects which would eventually number 147 in total.

The new authorities granted to SCS after 1935, however, also contained the seeds of change for soil conservation policy in the United States, change from a demonstration model to a reliance on direct public assistance. For the first time USDA was explicitly sanctioned to provide technical and financial assistance directly to private landowners. In providing this assistance, USDA was empowered to cooperate with state agencies, such as the land grant college and extension service, but it was not strictly required to do so. By allowing the Secretary to require localities and states to enact separate legal mechanisms to guarantee USDA's investments in soil conservation before cooperation would be given, the law set the stage for the creation of soil conservation districts, which after 1940 would become the central units of conservation planning on private lands in the United States. Additionally, the land purchase authorities in P.L. 74-46 provided a basis for the USDA's Land Utilization program of the later 1930s, which eventually converted tens of thousands of acres of eroded farmlands into national forests and grasslands. And also, by explicitly mentioning flood control as a purpose of soil conservation, the law would allow SCS to lay claim to a role as a water resources development agency in the coming decades.

For Bennett, these were happy outcomes. Passage of the soil conservation law embodied everything he had ever sought to achieve in his professional life. He had spent his career at the USDA. Now, he returned as the head of a unified national soil conservation agency. On March 27, Secretary of Agriculture Henry A. Wallace consolidated within SES, soon to be SCS, control over the soil erosion experiment stations previously operated by the Bureau of Chemistry and Soils and the Bureau of Agricultural Engineering, the plant materials nurseries run by the Bureau of Plant Industry, along with the CCC erosion camps administered by the Forest Service. After passed of P.L. 74-46, Wallace established SCS as a full-fledged Bureau of the USDA, and appointed a committee on soil conservation to study how best to incorporate the new agency into the department's regular operations. In the meantime, SCS's operations would continue to be funded by emergency public works appropriations and its demonstration projects continued apace.

ACP and Financial Assistance for Conservation

At the top of the list of challenges facing the Roosevelt administration when it took office in 1933 was the crisis in rural America. The collapse in farm prices over the previous decade had exposed serious weaknesses in the

American agricultural system that were manifested during the depression in large agricultural surpluses and low crop prices. To address this problem, New Deal planners conceived of a policy to raise prices by reducing the amount of land used for the production of the major farm commodities--cotton, wheat, corn, rice, tobacco, hogs, and milk. Such a program of “domestic allotment” was at the heart of the Agricultural Adjustment Act, the legislation passed during Roosevelt’s first hundred days to address the farm crisis. The Agricultural Adjustment Act created the Agricultural Adjustment Administration (AAA) in the USDA to administer the commodity program. It would be carried out in local communities by AAA county committees, who would determine acreage reduction levels. The economic objective of the AAA program was to increase the purchasing power of farmers. Raising farm income it was hoped would in turn stimulate demand for the products and services of city workers, and, in turn, contribute to the broader economic recovery.[391]

The AAA domestic allotment program dovetailed nicely with soil conservation. Bennett had long seen the retirement of marginal lands from crop production as the most important conservation practice. Soil conservation had been a central feature of land utilization policy proposal since the late 1920s. SES sought to coordinate conservation planning on its watershed demonstration projects with AAA’s acreage reduction quotas. As Bennett requested of Henry Wallace in October 1933, where AAA allotment contracts “will withdraw from surplus crop production,” it “would be highly advantageous to the erosion

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[391] William E. Leuchtenberg, *Franklin D. Roosevelt and the New Deal, 1932-1940* (New York: Harper Torchbooks, Harper & Row, 1963), 48-49.

control program to arrange for an exchange of less productive, erosive acres for the contracted acreage representing the more productive, non erosive land on a basis of proportionate reduction."[392] Where possible this sort of arrangement was carried out, demonstrating the co-benefits of unified planning for commodity production and soil-conservation. SES also encouraged the AAA to approve the application of conservation practices on land retired through its programs.[393] When SCS was transferred to the Department of Agriculture in April 1935, it continued to coordinate its activities with the AAA. There was a widespread consensus that, as the historian Richard Kirkendall has written, acreage reductions along with "the adoption of soil conservation methods throughout the country would bring production in line with existing markets."[394]

To accomplish its domestic allotment objectives, the AAA had made cash payments to farmers to limit the number of acres they used to grow any of the basic commodity crops. These incentive payments were funded through a tax levied on the processors of agricultural products (for example, the millers, canners, and packers who turned farmed goods into marketable food products).

While the processing tax that funded the AAA domestic allotment program was politically popular among American farmers who held old grudges against "middle men," its legality was questionable, and was challenged almost immediately after it went into effect. In December 1935, the Supreme Court

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[392] "Memorandum for the Secretary of Agriculture," Oct 9, 1933, 2.

[393] "Practices Approved by the Agricultural Adjustment Administration for Contracted Acre from Wheat Production in Connection with the Wheat Allotment Contract," September 1933, RG 114, Entry 21, Box 1, Folder "Agricultural Adjustment Administration."

[394] Richard S. Kirkendall, "Howard Tolley and Agricultural Planning in the 1930s," *Agricultural History* 39 (January 1965): 29.

heard arguments brought by the Hoosac Cotton Mill of Massachusetts, which was a subsidiary of the Armour meatpacking company. When the federal government sought to claim unpaid processing taxes, one of the Hoosac receivers, a man named William A. Butler, sued in federal court to block collection. This was to be a test case against the constitutionality of the AAA.

United States v. Butler, was argued in December of 1935 and a decision was issued January 6, 1936. The Court ruled 6-3 that the processing taxes used to fund the domestic allotment programs of the Agricultural Adjustment Act were unconstitutional. The majority opinion ruled that Congress could not regulate the agricultural economy under its Constitutional authority to tax. In his opinion Justice Owen Roberts wrote that the AAA represented "a statutory plan to regulate and control agricultural production, a matter beyond the powers delegated to the federal government."

At issue was the processing tax, which Roberts opined amounted to "the expropriation of money from one group for the benefit of another." The "tax, the appropriation of the funds raised, and the direction for their disbursement," he wrote, were "means to an unconstitutional end."[395] Eight months before the Supreme Court had ruled in *Schechter Poultry Corporation v. The United States* that the National Recovery Administration was also unconstitutional. These decisions were part of a broader political reaction to the New Deal that sought to

[395] U.S. v. Butler, 297 U.S. 1 (1936)

circumscribe its scope, and forced the Roosevelt administration on the defensive.[396]

In the winter of 1936, USDA scrambled to draft legislation to salvage the commodity programs before the spring planting season commenced. The department's office of the solicitor drafted a bill that drew on the authorities granted to the Secretary by the P.L. 74-46, the soil conservation act. Among these was the authority to enter into agreements and furnish assistance, financial or otherwise, for the purpose of soil conservation. The Supreme Court had ruled specifically that it was the use of a processing tax to fund payments to farmers that was unconstitutional, rather than the payments to farmers themselves. The Court had upheld the legality of such payments, citing the power of the government to spend money for purposes that it considers to be in the general welfare. USDA attorneys sought to use this angle to their advantage. In crafting the replacement legislation, the commodity program was designed as a soil conservation program. Rather than pay farmers to reduce acres planted in commodity crops, farmers would be paid for adopting soil conservation measures.

Under the new plan, farmers would be compensated for taking land out of "soil depleting crops," defined by the USDA as the commodity crops it sought to limit, and putting those acres instead into "soil conserving crops" or

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[396] For a discussion of conservative reaction to the New Deal farm programs, see Jean Choate, *Disputed Ground: Farm Groups That Opposed the New Deal Agricultural Program* (Jefferson, NC: McFarland & Company, 2002), 140-145; and Peter Irons, *A People's History of the Supreme Court*, rev. ed. (New York: Penguin Books, 2006), 301-306. See also James T. Patterson, "A Conservative Coalition Forms in Congress, 1933-1939," *The Journal of American History* (March 1966): 757-772.

"soil improving" crops such as grass, clover, or trees and other species of permanent vegetative cover. This was, in effect, a backdoor way of using the department's soil conservation authorities to meet the same agricultural adjustment objectives as the first AAA domestic allotment program. The USDA solicitor's office crafted amendments to P.L. 74-46 to accomplish these objectives. It was introduced in the Senate on January 22, 1936 as the Soil Conservation and Domestic Allotment Act, passed both houses within a week, and was signed into law on leap day, February 29, 1936. President Roosevelt's signing statement famously included the remark that "[t]he history of every nation is eventually written in the way in which it cares for the soil."[397]

In the history of soil and water conservation, passage of the Soil Conservation and Domestic Allotment Act marked an important milestone. It provided the legislative machinery to would fund the public subsidy of soil conservation practices on private lands. Within months farmers across the country would begin to receive cash payments for applying soil conservation practices to their farms. Even if the ACP's ostensible objective was commodity production control, its creation represented an unprecedented public investment in soil conservation. In 1936 the ACP would provide payments to farmers for soil improving practices totaling $470,000,000. For 1937 the amount allotted for

[397] "Soil Conservation and Domestic Allotment Act," February 29, 1936, *U.S. Statutes at Large* 49 (Washington: GPO, 1936) 1148-1152. Roosevelt, "Statement on signing the Soil Conservation and Domestic Allotment Act," March 1, 1936. Online by Gerhard Peters and John T. Woolley, *The American Presidency Project*, http://www.presidency.ucsb.edu/ws/?pid-15254.

soil improvement was reduced to $296,000,000, as President Roosevelt sought to economize the federal budget.[398]

The public spending on soil conservation made possible through the Soil Conservation and Domestic Allotment represented a dramatic break from past practice. When the first watershed demonstration projects were initiated in 1933 this type of public assistance on private lands was a radical idea. While SES had helped to finance conservation practices on its demonstration projects and also paid farmers a token amount for their participation, this activity was limited by SES/SCS's relatively minuscule budget and the limited geographic extent of its projects. Now USDA would pay farmers directly, based on formula determined by the AAA, for putting land into soil conservation crops, and it would also share a portion of the costs for installing approved soil conservation measures. In this program is the origins of the modern system of public financial assistance for conservation on private lands in the United States.

Because the Soil Conservation and Domestic Allotment Act was passed to replace the stricken provisions of the Agricultural Adjustment Act, the new financial assistance program for soil conservation that it created was administered by the AAA, rather than the SCS. To provide the payments to farmers to cover the cost of adopting conservation practices, the AAA created what it called the Agricultural Conservation Program (ACP). The ACP would have the same general administrative structure as the original domestic allotment

[398] "National Soil Conservation Plan is Announced by Wallace," March 21, 1936, RG 16, Entry 112, Records Concerning the Soil Conservation and Domestic Allotment Act, 1936 and 1937, Box 3, Folder "SC-7"; "$296,000,000 Paid for Soil Improvement," May 20, Ibid., Folder "SC-9." For discussion of the effects of federal budget cuts in 1937, see Alan Brinkley, *The End of Reform: New Deal Liberalism in Recession and War* (New York: Vintage Books, 1996), 23-28.

program. AAA's county committees, under the oversight of a state ACP committee, would administer the program at the local level.[399]

Naturally there were questions about how payments for soil conservation would be determined. Representative Karl Stefan of Nebraska raised an important issue, in a letter to Henry Wallace, on behalf of hay growers in the Elkhorn Valley, who believed that they should receive benefit payments for maintaining pastures in native grass. "In my opinion, these hay lands are soil-conserving crops," Stefan wrote. "They are not plowed up and they do not blow away." In other words, Stefan believed his constituents should be compensated for maintaining land in a natural state. "Tame hay and wild hay . . . should be called soil-conserving crops under the Act and by neutralizing them I feel that a discrimination is being made against these particular farmers."[400]

Wallace was adamant in his response, however, that farmers' would only be compensated for undertaking "soil conservation practices on their farms that they would not otherwise undertake."[401] The purpose of the financial assistance for conservation was not to reward farmers for appropriate land use, but to provide incentives to alter existing land use. As Howard R. Tolley, administrator of the AAA, explained, "no payment will be made on any farm unless there has been positive action which results in additional soil building or soil conservation

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[399] On April 10, 1936, Howard R. Tolley wrote a memo stating: "[e]ffective immediately, Agricultural Conservation Program shall be used in all printed material and all references to any proposal by name which involve the sections of the Soil Conservation and Domestic Allotment Act to be administered by the Agricultural Adjustment Administration." Tolley to Byrd, April 10, 1936, RG 16, Entry 112, Records Concerning the Soil Conservation and Domestic Allotment Act, 1936 and 1937, Box 1, Folder "SC-3."
[400] Stefan to Wallace, May 31, 1936, RG 16, Entry 112, Records Concerning the Soil Conservation and Domestic Allotment Act, 1936 and 1937," Box 3, Folder "SC-7."
[401] Wallace to Stefan, June 20, 1936, Ibid.

on that farm." Such a policy, Tolley continued, would serve to guarantee, it was hoped, the other objective of the ACP, to prevent the "return of burdensome surpluses and protect farm income."[402]

During the first year of the new program low yields consequent from continuing drought conditions obscured fact that the actual number of acres planted in the basic commodity crops had increased during 1936. With the return of more favorable conditions over the next two growing seasons, USDA was faced with bumper crops in 1937 and 1938. It was clear that the ACP alone was insufficient to meet the AAA's acreage reduction targets. Continuing forecasts of crop surpluses and price declines caused the USDA to begin to revise it program plans. The Soil Conservation and Domestic Allotment Act was a stop-gap measure precipitated by the Supreme Court's decision and improvised on the soil conservation authorities granted to the Secretary by P.L. 74-46. Almost from time the first Agricultural Adjustment Act was struck down in 1936, USDA went to work on ways to fix it.

The second Agricultural Adjustment Act was enacted nearly on February 16, 1938. It augmented acreage allotments with price supports, surplus marketing, non-recourse loans, and the first crop insurance programs. The law retained the ACP, and strengthened it by stating its intent more explicitly. USDA could pay farmers for "soil restoration, soil conservation, or the prevention of erosion," as well as "changes in the use of their land. . . ."[403]

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[402] "National Soil Conservation Plan is Announced by Wallace," 3-4.
[403] "Agricultural Adjustment Act of 1938," February 16, 1938, *U.S. Statutes at Large* 52 (Washington: GPO, 1938), 31; Saloutos, "New Deal Agricultural Policy: An Evaluation," *The Journal of American History* 61 (September 1974): 396-398; Douglas E. Bowers, Wayne D.

After 1938, different legal mechanisms would be found to manage the USDA's commodity programs, though ACP would remain on the books, becoming over time USDA's primary financial assistance program for soil conservation. ACP's "cost share payments" would become the bread and butter of public assistance for conservation on private lands. Between 1936 and 1996, American farmers and ranchers received ACP payments of fourteen billion dollars not adjusted for inflation.[404] Over time, the purposes for which these funds could be used expanded to include a broad range of conservation practices, from seeding land in permanent pastures or reforestation to engineering measures such as terraces, check dams, and farm ponds, as well as drainage and irrigation projects, among a host of other approved practices. The steady trickle of ACP funds that flowed into every county of the country through the twentieth century helped to finance the production of conservation landscapes at a national scale.[405] As Hugh Bennett predicted in a statement issued in March 1936, the ACP represented a new "national economic policy designed to make possible a fundamental change, farm by farm, and for

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Rasmussen and Gladys L. Baker, "History of Agricultural Price-Support and Adjustment Programs, 1933-84," U.S. Department of Agriculture, Economics Research Service, *Bulletin* 485 (December 1984), 12-15.

[404] For a general discussion of the evolution of USDA commodity programs, see Douglas E. Bowers, Wayne D. Rasmussen, and Gladys L. Baker, "History of Agricultural Price-Support and Adjustment Programs, 1933-84," U.S. Department of Agriculture, Economic Research Service, *Bulletin* 485 (December 1984). For the total amount of dollars spent by ACP between 1936 and 1996, see George A. Pavelis, Douglas Helms and Sam Stalcup, "Soil and Water Conservation Expenditures by USDA Agencies, 1935-2010," U.S. Department of Agriculture, Natural Resources Conservation Service, *Historical Insights* 10 (May 2011).

[405] For an exhaustive breakdown of the practices funded by ACP, see "Agricultural Conservation Program: 45-Year Statistical Summary 1936 through 1980," U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service (May 1981).

agriculture as a whole, from an exploitive type of farming to a conservation type."[406]

Beyond the new funding for soil conservation, another important long term implication of the Soil Conservation and Domestic Allotment Act was the separation of financial assistance from technical assistance for soil conservation.[407] Under the system that evolved after 1936, financial assistance programs would be administered by the AAA and its successor agencies. While SCS was officially responsible for supplying the technical assistance. This was a position Bennett staked out immediately after the AAA soil conservation program was announced. While AAA and SCS "are working toward a common goal," he emphasized, "each has its own well defined field"—"The Soil Conservation Service is a research and demonstration agency."[408] Inevitably, this state of affairs, characterized by one USDA agency holding the purse strings for soil conservation and another responsible for issuing the technical standards to carry it out, created tensions between AAA and SCS. SCS's largest concern was that the AAA did not engage in the comprehensive conservation planning it thought to be necessary. In time, SCS would be given responsibility for overseeing the technical aspects of conservation planning under the ACP. But, in 1937, how SCS would be able to extend its own comprehensive approach to

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[406] "Statement by H.H. Bennett," March 1, 1936, RG 114, San Bruno, Entry Pacific Southwest Region (Reg. 10) Santa Paula Regional Office, General Records, 1935-39, Box 1, Folder "115.2 Agri. Adj. Admin. Reg. F.Y. 1936."
[407] The AAA was renamed the Production and Marketing Administration (PMA) in 1945, Agricultural Stabilization and Conservation Service (ASCS) in 1961, and Farm Service Agency (FSA) in 1994.
[408] "Statement by H.H. Bennett,"1.

soil conservation beyond its demonstration projects was an important question that remained to be answered.[409]

Soil Conservation Districts and the End of the New Deal

By 1937, the key question for the Soil Conservation Service was what form its comprehensive conservation planning would take in the future. It was understood that the watershed demonstration projects and the CCC labor were temporary expedients. While the demonstration and employment projects were significant steps towards a national soil conservation program, they had limitations as long term vehicles for extending public conservation initiatives to private lands. Likewise, the ACP provided welcome resources for soil conservation, but, at least at first, SCS had only a perfunctory influence on the AAA county committees charged with allocating those resources.

To extend SCS's conservation planning capacity there were some within the USDA, and others outside of it, who advocated for the establishment of a system of centralized land use regulations to be administered by USDA through SCS. In the files of Arizona Senator Carl Hayden there is a specific proposal calling for the creation of "federal conservancy regions" in which SCS would direct "all land use planning activities." This was a common sentiment among advocates of soil conservation in the middle 1930s. What developed instead, however, was a decentralized system of autonomous locally-organized soil

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[409] Wallace to Bennett, December 22, 1939, RG 16, Entry 17, General Correspondence of the Office of the Secretary, 1906-1970, Box 3091, Folder "Soil (Conservation)." For a discussion of the SCS role in administering the ACP, see Pavelis, et al, "Soil and Water Conservation Expenditures by USDA Agencies, 1935-2010," 1-3.

conservation districts, which merged the older tradition of voluntary cooperation between the landowner and the USDA with newer modes of public assistance to subsidize the cost of conservation planning and the installation of conservation practices.[410]

Soil conservation districts have many precedents in United States history. American farmers have long organized themselves into drainage, irrigation and levee districts, sometimes with state sanction, sometimes without, to manage natural resources at a scale impossible for an individual to accomplish alone.[411] Such districts provided a natural model for carrying out soil conservation work. By 1935, some states had already established special districts for soil conservation as a way facilitate cooperation with federal authorities dispensing relief measures. In Iowa, the state legislature required farmers to form local conservation districts before they could cooperate with the

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410 For documents calling for centralized soil conservation program, see "Outline for Federal Legislation," c. 1936, Carl T. Hayden Papers, 606, Folder "2", Arizona State University, Tempe, Arizona. For discussion of advocacy for a centralized national soil conservation program, see Morgan, *Governing Soil Conservation,* 45. The failure to enact a centralized system of land use regulations is often interpreted as a shortcoming of New Deal era agriculture and conservation policies. For example see Donald Worster, *Dust Bowl*, 229-30; Richard Lowitt, "Agricultural Policy and Soil Conservation: Comment," *Agricultural History* 52 (April 1985): 320; Rasmussen, "'Never a Landlord for the Good of the Land': Farm Tenancy, Soil Conservation, and the New Deal," 93; Lehman, *Public Values, Private Lands: Farmland Preservation Policy, 1933-1985*. I would argue that these interpretations have downplayed the significance of the system of soil conservation districts that developed after 1937.

411 For discussion of the role of special districts in natural management, see Mary R. McCorvie and Christopher L. Lant, "Drainage District Formation and the Loss of Midwestern Wetlands, 1850-1930," *Agricultural History* 67 (Autumn 1993), 13-39; Ann Vileisis, *Discovering the Unknown Landscape: A History of America's Wetlands* (Washington: Island Press, 1997). 79, 125-128; Mark Fiege, *Irrigated Eden: The Making of an Agricultural Landscape in the American West* (Seattle: University of Washington Press, 1999); Donald J. Pisani, *To Reclaim A Divided West: Water, Law, and Public Policy, 1848-1902* (Albuquerque: University of New Mexico Press, 1992), 102-104; ibid., *Water and American Government: The Reclamation Bureau, National Water Policy, and The West, 1902-1935* (Berkeley: University of California Press, 2002), 133-135; Joseph J. Arnold, *The Evolution of the 1936 Flood Control Act* (Fort Belvoir, VA: U.S. Army Corps of Engineers, 1988), 6-7; and Steven Phillips, "The Limits of Federal Policy Making: The Soil Conservation Service and Levee Repair," *Agricultural History* 70 (Spring 1996), 351-376.

CCC. In the Dust Bowl area around Amarillo, Texas, farmers organized into wind erosion control districts to implement conservation measures financed by the Farm Credit Administration. The SES and SCS watershed demonstration projects also represented a form of special conservation district, though organized by the a federal agency rather than a state or local authority. These conservation districts provided the legal intermediary through which the federal government could cooperate with individual landowners. When SES published a long range agenda in the fall 1934, it anticipated a future, after the demonstration work had been completed, in which soil conservation planning would take place "on large watersheds in the agricultural regions of the United States" in cooperation with "local conservancy districts" and "erosion-control associations." Likewise, the 1935 legislation creating SCS included provisions that explicitly called for the agency to work through special soil conservation districts. This approach to extending public assistance to private lands was endorsed at the USDA, but just what it would mean in practice at a national scale was unclear.[412]

After SCS was transferred to the USDA in the summer of 1935, Assistant Secretary of Agriculture, Milburn L. Wilson began to work with an attorney in the solicitor's office, Philip M. Glick, to create a legal mechanism to establish soil conservation districts in the states. Wilson had replaced Rexford Tugwell as Assistant Secretary in 1934, and would go on to direct the Extension

[412] Herring to FDR, January 10, 1935, Franklin D. Roosevelt Papers as President, Official File 732, Franklin D. Roosevelt Library, Hyde Park, New York; Wilson to Stewart, May 31, 1936, RG 16, Entry 112, Records Concerning the Soil Conservation and Domestic Allotment Act, 1936 and 1937, Box 1, Folder "SC-5-5"; and "Soil Erosion: A Critical Problem in American Agriculture," 54.

Service after 1940. He had made his name as an agricultural economist with the Montana State Extension Service, and later as a manager of the Fairway Farms, an experiment in industrial scale wheat growing in eastern Montana. Along with another economist Moredcai Ezekiel, Wilson had helped to design the original AAA domestic allotment program. In planning the AAA program, Wilson emphasized the importance of locally-led decision making processes. Wilson had written that economic planning "must be developed democratically and be brought about by the will of the people."

The county committees created to administer the AAA domestic allotment program were an example of this philosophy. At its core was the idea that while the federal government has a large role to play in managing the agricultural economy, no plan will be successful without the support of the people with whom it will be carried out. National planning schemes can not be superimposed from Washington, D.C., Wilson believed, but developed only through cooperative democratic processes with local people at the lead. Wilson also understood, however, that democratic cooperative did not just happen on its own. It required, as historian Jess Gilbert has written "continuous learning, personal growth, cultural adjustment, and civic discussion" to succeed. Providing the framework for this cooperation to take place, Wilson believed, was the role of the federal government.[413]

[413] For discussion of M.L. Wilson's background, see Fitzgerald, Every Farm a Factory, 57-74. Rowley, *M.L. Wilson and the Campaign for Domestic Allotment* (Lincoln: University of Nebraska Press, 1970). Wilson, "Economic Planning as Applied to Agriculture" *Proceedings of the Western Farm Economics Association* 6 (August 1932): 76-79. Gilbert, "Low Modernism and the Agrarian New Deal: A Different Kind of State" in *Fighting for the Farm: Rural America Transformed*, ed. Jane Adams (Philadelphia: University of Pennsylvania Press, 2003), 134; Phillips, *This Land, This Nation* 54-56.

In the summer of 1935, Wilson sought to apply the principles of participatory democracy to the creation of a national system of soil conservation districts. He recognized the benefits of SCS's program of comprehensive conservation planning on whole watersheds, but he also saw the limits of SCS's demonstration projects for extending conservation planning to the whole country, which was namely the age-old problem of relying on enlightened self interest to achieve conservation objectives. While some individuals farmers would adopt practices from the demonstrations, many would not. The challenge was to organize all farmers to cooperate voluntarily with conservation planning. The solution, as Wilson saw it, was to empower farmers to take charge of soil conservation. Soil conservation districts can be seen as expressions of the associative state that had organized American agriculture since the end of the nineteenth century, yet they also varied in important ways. While the associative state represented networks of relationships between public and private institutions, like the USDA, land grant colleges, and corporations, Wilson's ideas of democratic planning relied on the development of direct relationship between the federal government and the farmers themselves. Soil conservation districts represented the legal medium through which this relationship would be facilitated.

With the assistance of an Philip M. Glick, an attorney in the USDA's solicitor's office, Wilson prepared a piece of model legislation, the Standard State Soil Conservation Act, to accomplish this objective. Their idea was that each legislature would pass a version of this sample legislation that would recognize soil conservation districts as units of state government and allow them to cooperate with SCS. The Standard State Law also included provisions to give districts a broad range of discretionary powers that included the ownership of property, the right to sue and be sued, the operation of demonstration projects, conduction of research, and imposition of land use regulations to enforce minimum erosion control standards on landowners in the district. Districts would be organized by a referendum of land owners. After passage of organic legislation in the states, districts would be established through a referendum of the land owners within its proposed boundaries and governed by locally elected boards of directors and a state conservation committee. Each district would then enter into its own individual agreement with the USDA to receive the technical and financial assistance for conservation planning authorized under the terms of P.L. 74-46.[414]

Soil conservation districts represented new units of American government, equipped with unique, autonomous powers conferred on them by state law and by virtue of their special with to the federal government. They represented a constitutional vehicle through which the USDA could implement a national program of land utilization. In February, President Roosevelt addressed a letter to the forty-eight states governors in which he enclosed a copy of the Standard State Soil Conservation Act and urged its passage in each of their legislatures. “The nub of the whole question,” President Roosevelt wrote to

[414] For a first-hand account of the circumstances surrounding the drafting of the Standard State Soil Conservation District Law, see Helms, “The Preparation of the Standard State Soil Conservation Districts Law: An Interview with Philip M. Glick,” February 1990, Douglas Helms Collection, Oral Histories, National Agricultural Library, Beltsville, Maryland, 40-46.

Henry Wallace in 1937, "is this: if a farmer in up-State New York or Georgia or Nebraska or Oregon, through bad use of his land, allows his land to erode, does he have the inalienable right as owner to do this, or has the community, i.e., some form of governmental agency, the right to stop him?" As creations of state law, soil conservation districts provided the legal medium through which the public interest could exercise that right.[415]

With the support of the administration it was clear that districts represented the future of soil conservation. By 1939, USDA policy was assistance for soil conservation would be provided only through conservation districts. While Hugh Bennett had initially sought to limit SCS's commitment to serving conservation districts— he had set a goal for the agency to establish three hundred and fifty demonstration projects by 1944 and viewed working with districts as a distraction from this effort—but, he would come around in time to champion the district partnership. While the number of watershed demonstration projects never exceeded one hundred and eighty two, the growth of conservation districts was rapid. Arkansas adopted the first conservation district law on March 3, 1937. Within a month thirteen states had passed district legislation, within a year that number had doubled, and by 1945 every state in the country, with the exception of Connecticut, had passed some form of district law, encompassing some seventy-four percent of American farms within conservation district boundaries. By April 1946, 1,500 districts had been

[415] Quoted in Schlesinger, The Coming of the New Deal, 343. Morgan, *Governing Soil Conservation*; Philip M. Glick, "The Soil and the Law: I," *Journal of Farm Economics* 20 (May 1938), 430-47; ibid., "The Soil and the Law: II," *Journal of Farm Economics* 20 (August 1938), 616-640; Hardin, *The Politics of Agriculture: Soil Conservation and the Struggle for Power in Rural America*, 70-75.

organized under the state laws, covering some 3,725,000 of the nation's 6,000,000 farms. Support for districts was earliest and strongest in the south-central and southeastern United States as well on the Great Plains. The first districts tended to be located in areas where SCS had existing relationships with farmers through its experiment stations or demonstration projects. Other parts of the country, however, were slower to join the program.[416]

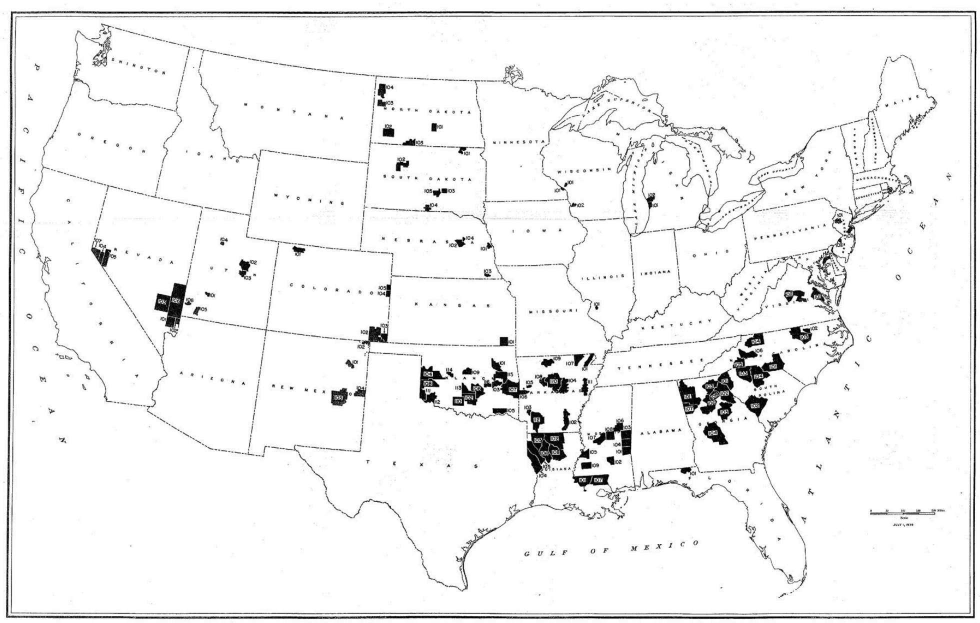

Figure 30. Map depicting locations of first conservation districts, c 1938. "Soil Conservation Service: Directory," 1939, Douglas Helms Collection, National Agricultural Library, Beltsville, Maryland.

Among the central objections to conservation districts were provisions in the standard state law that granted districts the power to impose land use regulations. For instance, in 1937, D.A. Bandeen, manager of the West Texas Chamber of Commerce, criticized provisions of act that would allow any

[416] Morgan, *Governing Soil Conservation*, 84, 88; Douglas Helms, "Oral History Interview with J.C. Dykes, Douglas Helms Collection, Oral Histories, National Agricultural Library, Beltsville, Maryland. See also Brink, "New Patterns of Land Use," *Soil Conservation* 4 (June 1939): 277-278.

twenty-five “land ‘occupants’” to organize into a soil conservation district. Twenty-five people, he protested, “could call an election, vote a debt on the land and vote the use to which the land they could set up in a district should be put.” With a consequence, as he put, that “if a landowner fails to follow their edicts he is subject to arrest for a misdemeanor and subject to fine.” Texas farmers did not want any such law he concluded. The specter of “regulation” remained a motivating force behind opposition to conservation districts in locales throughout the country and contributed to a hesitation in many states to pass district laws.

Despite a consensus that the use of land is a public rather than a private matter, that land use regulations in conservation districts represented no more than zoning ordinances, which many cities had adopted and had been held constitutional, and that, as advocates for soil conservation districts in Texas argued, individual farmers “have the right to prevent other owners from ruining adjacent land as well as their own,” objections to land use regulations influenced the district legislation passed in the states. At the end of the debate in every state, as same Texas commenter continued, the desire for the “state make it possible for the farmers to cooperate with the federal government and get the benefits of the government bounty” overruled objections to the creation of conservation districts.[417]

The details of the conservation district legislation passed by each of the states, however, varied considerable. While some states gave conservation

[417] Quotes are a typewritten copy of an article from the *San Angelo Morning Times*, August 14, 1937, NARA, Ft. Worth, RG 114, Confidential Records of the Regional Conservator H.H. Finnell, 1936-1942.

districts strong powers to enact land use regulations, most did not, and others forbade them altogether. Some states hewed closely to the language of the Standard State Act, while others changed a great deal. Over the coming years, SCS would have to adjust its program of comprehensive soil conservation to the patchwork character of the state conservation districts laws.[418]

Apart from farmers themselves, the major obstacle to the growth of soil conservation districts was the opposition of the Extension Service and the state land grant complex. The creation of a separate but parallel mechanism for federal assistance to the states through conservation districts threatened to undermine the authority of state extension services and the county agents. This was, in part, by design. By 1938, New Deal planners in the USDA saw state extension services in many places as part of the problem that their reforms were meant to address. By working directly with soil conservation districts, SCS could implement its vision of comprehensive conservation planning independently of the Extension Service. By the latter part of the 1930s, this fact had stimulated a bitter feud between Extension and SCS that would play out

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[418] Only two states—Colorado and California—allowed conservation districts to tax landowners. Sixteen states—Arizona, California, Connecticut, Delaware, Idaho, Indiana, Iowa, Maine, Massachusetts, Michigan, Missouri, New Hampshire, New York, Ohio, Pennsylvania, and Rhode Island forbade the imposition of land use regulations. For discussion of differences in the state conservation district laws, see Herman Walker, Jr. and W. Robert Parks, "Soil Conservation Districts: Local Democracy in a National Program," *The Journal of Politics* 8 (November 1946), 546; "Land Use Regulation in Soil Conservation Districts," U.S. Department of Agriculture, Soil Conservation Service, MP-29 (January 1947); Edwin E. Ferguson, "Nation-Wide Erosion Control: Soil Conservation Districts and the Power of Land-Use Regulation," *Iowa Law Review* 34 (January 1949): 165-186; Parks, *Conservation Districts in Action* (Ames: The Iowa State College Press, 1952), 15, 27-28; Stanley W. Voelker, "Land-Use Ordinances of Soil Conservation Districts in Colorado," Colorado Agricultural Experiment Station, *Technical Bulletin* 45 (March 1952); Sampson, R. Neil Sampson, *For Love of the Land: A History of the National Association of Conservation Districts* (League City, Texas: National Association of Conservation Districts, 1985), 30-32; and Helms, "Soil Conservation Districts: Getting to the Roots" in *He Loved to Carry the Message: The Collected Writings of Douglas Helms*, 281-291.

over the next decade. Citing, the “1914 Agreement,” which provided for all USDA “extension work” to be carried out through the state extension services and not independently, national extension director Clyde W. Warburton, wrote to assistant agriculture secretary M.L. Wilson in 1939, complaining that the work being done by SCS “is in large part extension, and it is without question extension so far as efforts are made to get farmers outside these areas to adopt the practices that followed thereon.” SCS also antagonized the Extension Service by seeking to organize conservation districts along watershed lines, which in most places crossed county lines, the traditional political boundary in American agriculture. This was a direct threat to Extension, which provided its assistance to farmers strictly on a county by county basis. For these reasons, state extension services and the traditional agricultural power centers they represented viewed soil conservation districts with hostility, and in some places—most notable, Oregon, Pennsylvania, and Missouri—actively fought their growth. Conflict between SCS and the state extension complex culminated in 1947 when congressional allies of the state extension services introduced bills to end SCS and merge its function into the Extension Service. These failed, ironically, in no small part thanks to the grassroots support for SCS from soil conservation districts. [419]

[419] Warburton is quoted in Morgan, *Governing Soil Conservation*, 26. For discussion of the turf battle between SCS and the Extension Service, see Ibid., 24-27; Hardin, *The Politics of Agriculture*, 54-84; Sampson, *For Love of the Land*, 27-28; Phillips, *This Land, This Nation*, 204-205. For the effort to terminate SCS in 1947, see “The SCS Fights for Life,” *The Macon Telegraph*, October 16, 1947, 6.

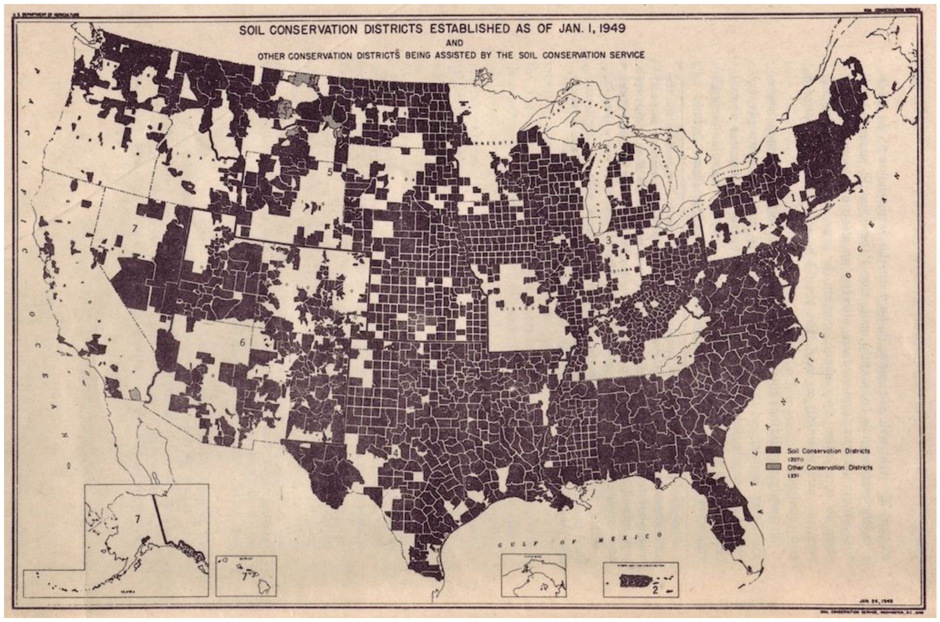

Figure 31. Map of soil conservation districts organized as of 1949. (Map from Douglas Helms Collection, National Agricultural Library, Beltsville, Maryland).

The hybrid character of soil conservation districts provided many benefits to SCS. Most immediately, they created the geographic template with which it would carry out a national program of comprehensive conservation planning. Once USDA signed an agreement with a conservation district, SCS sent a professional conservationist, the so-called district conservationist, to develop a five-year conservation plan for all the farms in the district. Carrying out these plans was the responsibility of SCS "work units" comprised of trained professionals who led the work of installing conservation practices. SCS provided a limited amount of funds as well as the necessary materials such as seedlings of soil conservation plants to carry out these plans. It also provided CCC and WPA labor and money for district projects until 1942 when these programs were phased out.

After World War II, some of this labor was replaced by surplus machinery given by the government to the districts. Over time, however, it was the financial assistance provided by ACP, and through other conservation programs created over subsequent years, that would pay for the large bulk of the soil conservation projects carried out in the districts. As independent entities of state government, conservation districts could also do things that SCS could not. Through the different powers granted to them under state law, conservation districts could compel compliance with conservation plans. While these varied from state-to-state, these powers have come to represent important tools in conservation planning. As conservation districts gained more autonomy after 1940, they began to hire their own staff and developed their own conservation plains.

Ultimately, empowering farmers through conservation districts had important consequences. Collectively they would enlist tens of thousands of farmers into the movement for soil and water conservation over the coming decades. Soil conservation districts would become an influential national interest group. In 1946, the formation of a National Association of Conservation Districts (NACD) created a powerful lobbying organization on behalf of soil conservation program and an important ally of SCS. This support helped to ensure that SCS would live beyond the New Deal.[420]

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[420] For discussion of the influence of the National Association of Conservation Districts see Sampson, *For Love of the Land*, 33-34; ibid., *With One Voice: The National Association of Conservation Districts* (Tucson: Wheatmark, 2009). See also Robert S. McClelland, *Many Hundred Strong. . . . Still Serving: A History of the Association of Past Presidents of State Associations of Conservation Districts* (League City, TX: National Association of Conservation Districts, 1974); Otis Tossett, *Land, Water, and People: A History* (Saint Paul, MN: Webb Publishing Company, 1961).

By 1940, the swashbuckling period of the soil conservation crusading and experimentation was giving way to the more streamlined, bureaucratic institutions created by the New Deal. The CCC was disbanded on June 30, 1942. The demonstration projects were discontinued after June 30, 1944, though many had been idled long before. The focus of SCS's work narrowed to the provision of technical assistance to soil conservation districts. At the same time soil conservationists could point to real results. In the pages of *The New York Times*, Hugh Bennett claimed that soil conservation had renewed life in the Dust Bowl, the practice of strip-cropping, almost unheard of before 1933, had become an icon of conservation planning, and perhaps most importantly the drive for soil conservation had helped to change the way Americans viewed the land.[421]

While there still remained conflicts over the direction of the program, namely the duplication of the mission of different agencies within the USDA and the state, which would play themselves out over the next fifteen years, by 1940, the central pieces of modern system of soil conservation in the United States were in place, namely the establishment of new public agencies dedicated to the cause, permanent programs of technical and financial assistance, and new units of state government to administer them. These innovations are the lasting legacy of the New Deal for soil conservation.

[421] Bennett, "Life Renewed in the Dust Bowl," June 25, 1939, *The New York Times*, p. E7.

Conclusion: Soil Conservation Beyond the New Deal

In researching and writing this project, my central question has been: In the United States how have we sought to conserve soil located on privately owned lands? In a democracy founded, in part, on the principle of private property rights, how have Americans sought to exercise the public interest in the private use of land? The sheer size of the continental United States masked the problem of soil wastage for more than a century after the Revolution. When land became eroded, farmers could simply move on to new fields over the horizon, but as the era of frontier settlement came to a close, this was no longer possible as virgin land became scarce.

There had long been concern for the soil among small communities of agricultural improvers, but new perceptions of soil as a finite resource stimulated fresh calls for its conservation during the Progressive Era. Men like Nathaniel Shaler and Thomas Chamberlin among others called on the country to care for the soil or risk the fall of American civilization. While observers in the late nineteenth and early twentieth centuries anticipated modern concern for the soil and methods for its control, they were limited in their ability to persuade millions of individual farmers and ranchers to change the way they used the land. The realization of their case for soil conservation relied exclusively on appeals to the enlightened self interest of individual land users to align their short term economic interest in the use of the land with the long term interests of soil and society.

The history of soil and water conservation in the United States can be read in large part as a response to the inadequacy of voluntarism to prevent erosion. Time and experience would show that the enlightened self interest of individuals was not sufficient on its own to protect the soil. This is one of my main arguments. Soil conservation at the scale necessary to adequately address the problem would require state action.

Another of my main arguments is that the modern system of soil conservation did not emerge out of nowhere in 1933. Concern for the soil was not new when Franklin D. Roosevelt was elected. The case for its care rests on economic and moral arguments that can be traced from the agricultural improvers of the early Republic through Progressive Era conservationists and New Deal land use planners all the way to our present day focus on sustainability. Likewise, the innovations of the 1930s rested on a body of scientific knowledge that was accumulated over decades by the systematic efforts of the Bureau of Soils to survey and classify the soil types of the United Sates and foreign nations. They also drew on the technology of conservation that was developed and refined at the agricultural experiments stations and on the watershed demonstration projects funded by the state and federal governments.

Finally, all this required a shift in popular perceptions about the role of government in American life. At the start of this period the place of government, where it was seen to have a place at all, was to research problems of land use and to educate the public in their solutions. By its close government had come to play an immediate role in planning the use of land and compensating farmers and ranchers for the adoption of conservation practices. Each of these represented a necessary prerequisite for the creation of the national program of soil conservation during the New Deal. The development of the ideas, technology, and institutions that shaped these changes in the five decades after 1890 is the story I have sought to tell.

This narrative is intertwined with the figure of Hugh Hammond Bennett. Emergence of the concern for soil conservation in the first four decades of the twentieth is reflected in the arc of Bennett's life and career, and he himself would become the leading champion of soil conservation in the United States. By any measure, Bennett was spectacularly successful, in promoting soil conservation as a national concern. As a son of the plantation South, he was familiar with the conditions of the southern environment and southern mode of agriculture that made the region famous for erosion and contributed to the widespread poverty there. As a soil surveyor in the United States and abroad, Bennett also helped to develop a modern understanding of soils as distinct types each having different characteristics. This understanding was at the foundation of the program of soil conservation he would come to champion.

Its central thesis was that land should be put to the uses for which it is best suited, and, conversely, that land should be removed from purposes for which it is not adapted. This idea that can be read in Bennett's soil survey recommendations to farmers for choosing which crops to plant in different types of soil; it is present in his recommendations for the reforestation of steep, rolling lands in the South and land use adjustment according to soil type on Cuban tobacco plantations during the 1920s; and it is the basic message of the soil conservation crusade he spearheaded after 1926. If erosion was a symptom of the inappropriate use of land, he would argue, then conservation was a lever of land use change.

Emphasis on the appropriate use of land was the foundation of the system of comprehensive conservation planning developed on the experiment farms, which combined the retirement of marginal lands with a suite of conservation practices, emphasizing vegetative cover wherever possible, to hold the soil. The program had as its central object the use of every acre of land according to its capabilities as determined by the characteristics of the land. With the coming of the New Deal, it would become the basis of the national system of land use planning initially implemented on watershed demonstration projects and then through conservation districts under the authorities established by Congress. During this time, the Soil Conservation Service would become a brand name in farm households and Hugh Bennett would become a national icon. Even as his day-to-day involvement in running the agency diminished as the national soil conservation program grew in complexity, Bennett, who turned 64 years old in 1945, remained Chief of the SCS until 1951, when he reached the mandatory retirement age of 70. He remained at the department for another year as a special advisor to the Secretary of Agriculture and officially retired from the USDA in 1952. During this time, and until his death from lung cancer in 1960, he remained active as a leader in the cause of soil conservation.

After World War II, the integration of soil conservation into the structure of American government went hand-in-hand with broader changes taking place in agriculture and across society. Critics of the modern system of soil conservation that emerged after 1940 have leveled a number of criticisms at the modern system of soil conservation in the United States. They have taken SCS to task for becoming an instrument of the rationalization of agriculture into a more efficient and productive enterprise, implicating the technical assistance provided by SCS and the tens of millions of dollars of financial assistance spent on conservation through ACP and other conservation programs in the rationalization of the American countryside that saw one third fewer farmers in the year 2000 than in 1900 produce seven times the amount of agricultural products.

USDA soil conservation programs have also been called criticized for being redundant, duplicative of the functions of other government agencies; wasteful for providing assistance to farmers for improving land in production while other USDA agencies put production quotas on land in production; inefficient for not distributing resources where they would be most effective; discriminatory towards minority farmers at home and tools of colonialism abroad; and that they are destructive to the natural environment. While these are important critiques, which deserve more attention from scholars, they also downplay the extent to which soil conservation initiatives reflect the broader society of which they are a part.[422]

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[422] A good example of the critique of soil conservation as instrument of the rationalization of agriculture can be found in Phillips, *This Land, This Nation*, 18. For discussion of the

The fact is soil erosion represented a significant problem in the United States during the early decades of the twentieth century. Solving it required solutions that negotiated the tangle of interests inherent in the American system of federal government. The solutions worked out in the 1920s, 1930s, and 1940s may not have been ideal, but they represented real steps forward in addressing the problem of erosion. They combined older forms of voluntary cooperation with newer programs of technical and financial assistance implemented through a process of democratic planning. In this way, the narrow case of soil conservation provides broader lessons, which are applicable to a range of collective action problems in the United States. We conserve soil on privately owned farm and ranch lands through tax-payer funded support for direct public assistance to protect private lands. In a democratic republic, such public support for conservation is a way for society as a whole to shoulder the costs of the

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rationalization and consolidation of American agriculture in the decades after World War II, see Douglas R. Hurt, *Problems of Plenty: The American Farmer in the Twentieth Century* (Chicago: Ivan R. Dee, 2002), 116-118, 146-148, 156-157; Bruce L. Gardner, *American Agriculture in the Twentieth Century: How It Flourished and What it Cost* (Cambridge: Harvard University Press, 2002); and Danbom, *Born in the Country,* 234-257. For discussion of redundancy and inefficiency in soil conservation programs, see Held and Clawson, *Soil Conservation in Perspective*; and Hardin, *The Politics of Agriculture*. For criticism of USDA for unequal treatment of minorities, see Helms, "Eroding the Color Line: The Soil Conservation Service and the Civil Rights Act of 1964," *Agricultural History* 65 (Spring 1991): 35-53; Olen Cole, Jr. The African-American Experience in the Civilian Conservation Corps. Gainesville: University of Florida Press, 1999, 15-17; Jeannie M. Whayne, "Black Farmers and the Agricultural Cooperative Extension Service: The Alabama Experience, 1945-1965," *Agricultural History* 72 (Summer 1998): 523-551. For critiques of soil conservation abroad, see Karl S. Zimmerer, "Soil Erosion and Social (Dis)Courses in Cochabamba, Bolivia: Perceiving the Nature of Environmental Degradation," *Economic Geography* 69 (July 1993): 312-327; Lawrence S. Grossman, "Soil Conservation, Political Ecology, and Technological Change on Saint Vincent," *Geographical Review* 87 (July 1997): 353-374; Phillips, "Lessons from the Dust Bowl: Dryland Agriculture and Soil Erosion in the United States and South Africa, 1900-1950," *Environmental History* 4 (April 1999): 245-266; and Showers, *Imperial Gullies: Soil Erosion and Conservation in Lesotho* (Athens: Ohio University Press, 2005). For critiques of soil conservation as ecological unsustainable, see Robert Gillette, "Stream Channelization: Conflict between Ditchers, Conservationists," *Science* 176 (May 26, 1972), 890-894; and John McPhee, "Profiles: Travels in Georgia," *The New Yorker* 49 (April 29, 1973), 44-103.

environmental degradation caused by the agricultural production on which it depends. Despite its shortcomings, the modern system of soil conservation that emerged by 1940 represents a real achievement of governance that endures to the present.

While the basic system of technical and financial assistance, and cooperation through conservation districts developed by the USDA in the first four decades of the twentieth century remains in place, over time, the objectives of private lands conservation programs have broadened to address a spectrum of natural resources issues, ranging from the traditional focus on the conservation of soil to a host of more modern concerns from the protection of wildlife habitat and the preservation of prime farm lands to the reduction of non-point source pollution, the promotion of energy efficiency, and the sequestration of carbon, among others. In 1994, the Soil Conservation Service became the Natural Resources Conservation Service (NRCS), a name change that reflect the agency's broad mission to protect agricultural environments. As of the 2008 Farm Bill, USDA has an annual budget of some four billion dollars for conservation programs, many of them administered by NRCS, that are directed towards protecting privately owned lands in every county of every state and territory in the nation. These programs are carried out in cooperation with a network of "partners" that includes the individual landowner, locally-organized conservation districts, state land-grant universities, private businesses, and a broad spectrum of issue advocacy groups and other stakeholders in conservation outcomes. This is significant work even if its diffuse character—its range of objectives, the number of actors involved, and its extensive geographic scope—defies easy understanding or synthesis. These topics deserve further exploration by historians and other scholars.

Two-thirds of the land area in the United States is managed by private owners. How we manage the public interest in the use of this land is a critical question. In our age of global change, it is important to understand how our public institutions have managed that interest in the past, as we will call on them to do more to protect it in the future.[423]

[423] For discussion of cumulative expenditures on USDA conservation programs, see Pavelis, et al, "Soil and Water Conservation Expenditures by USDA Agencies, 1935-2010," 1-14; and Helms,"The Evolution of Conservation Payments to Farmers," in *Compensating Landowners for Conserving Agricultural Land: Papers from a California Conference*, eds. Nora de Cuir, Alvin D. Sokolow and Jeff Woled (Davis, CA: Community Studies Extension, Department of Human and Community Development, University of California, Davis, 2003), 123-132. For a discussion of soil erosion as a continuing national and global problem, see Erik P. Eckholm, *Losing Ground: Environmental Stress and World Food Prospects* (New York: W.W. Norton, 1976); M. Gordon Wolman, "Soil Erosion and Crop Productivity," eds R.F. Follett and B.A. Stewart (Madison, WI: American Society of Agronoy, Inc., Crop Science Society of American, Inc., Soil Science Society of American, Inc., 1985), 9-47; and Rattan Lal, Terry M. Sobecki, Thomas Iivari and John M. Kimble, *Soil Degradation in the United States: Extent, Severity, and Trends* (Boca Raton: Lewis Publishers, 2004).

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Appendix 1. List of Soil Surveys Authored or Co-authored by Hugh Bennett, 1903-1910

William G. Smith and Hugh Hammond Bennett, "Soil Survey of Davidson County, Tennessee," Field Operations of the Bureau of Soils, 1903 (1904), 605-618.

J.E. Lapham and Hugh H. Bennett, "Soil Survey of the Auburn Area, New York," Field Operations of the Bureau of Soils, 1904 (1905), 95-118.

Thomas A. Caine and Hugh H. Bennett, "Soil Survey of Appomattox County, Virginia" Field Operations of the Bureau of Soils Reports, 1904 (1905), 151-168.

Henry J. Wilder and Hugh H. Bennett, "Soil Survey of Macon County, Alabama," Field Operations of the Bureau of Soils, 1904 (1905), 291-316.

Hugh H. Bennett and W. E. McLendon, "Soil Survey of Louisa County, Virginia" Field Operations of the Bureau of Soils, 1905 (1907), 191-212.

Hugh H. Bennett and W. E. McClendon, "Soil Survey of Hanover County, Virginia" Field Operations of the Bureau of Soils, 1905 (1907), 213-246

E.P. Carr, W. Edward Hearn, Hugh H. Bennett, and R.T. Avon Burke, "Soil Survey of Dallas County, Alabama," Field Operations of the Bureau of Soils, 1905 (1907), 453-472

Hugh Hammond Bennett and Lewis A. Hurst, "Soil Survey of the Blue Earth County, Minnesota," Field Operations of the Bureau of Soils, 1906 (1908); 813-864

Hugh H. Bennett, W.E. Tharp, W.S. Lyman, and H.L. Westover, "Soil Survey of the Easton Area, Maryland," Field Operations of the Bureau of Soils Reports, 1907 (1909), 121-164

Hugh H. Bennett and Charles F. Shaw, "Soil Survey of Robertson County, Texas," Field Operations of the Bureau of Soils, 1907 (1909), 591-640.

Charles N. Mooney, Charles F. Shaw, Lawrence A. Kolbe, Hugh H. Bennett, and Risden T. Allen, "Soil Survey of Center County, Pennsylvania," Field Operations of the Bureau of Soils Reports, 1908 (1911), 245-292.

Hugh H. Bennett and Party, "Soil Survey of Grady County, Georgia," Field Operations of the Bureau of Soils, 1908 (1911), 341-394

Hugh H. Bennett and Charles J. Mann, "Soil Survey of Thomas County, Georgia," Field Operations of the Bureau of Soils, 1908 (1911), 395-454.

Hugh H. Bennett, Howard C. Smith, W.M. Spann, E.M. Jones, and A.L. Goodman, "Soil Survey of Lauderdale County Mississippi," Field Operations of the Bureau of Soils Reports, 1910 (1910), 733-784.

Appendix 2. Soil Erosion and Moisture Conservation Investigations[424]

Location	Director	Date Research Begun
1. Guthrie, OK	Henry G. Lewis	January 1929
2. Hays, KS	Raymond H. Davis	July 1929
3.Temple, TX	George Musgrave	November 1929
4. Bethany, MO	Russell E. Uhland	April 1930
5. Statesville, NC	J.M. Snyder	June 1930
6. Pullman, WA	W.A. Rockie	September 1930
7. Tyler, TX	B.H. Hendrickson	March 1930
8. Clarinda, Iowa	George Musgrave	March 1931
9. LaCrosse, Wisconsin	Raymond H. Davis	October 1931
10. Zanesville, Ohio	Samuel Phillips	June 1932
11.* Spur, Texas	Ray E. Dickson	c. 1926

* Erosion research at Spur, Texas was initially begun under the auspices of the Texas A&M state agricultural experiment station, but was later incorporated into the federal program of soil erosion research.

[424] "Departmental Plans for the Development of the Soil Erosion Program," January 12, 1931, RG 114, Entry 21 Box 7, Folder "Programs,"

Appendix 3. Watershed Demonstration Projects established by the Soil Erosion Service, October 1933 to April 1935[425]

Watershed	Headquarters	Director	Date	Size (acres)
1. Coon Creek	La Crosse, WI	R. H. Davis	Nov. 1933	93,000
Gilmore Creek*	La Crosse, WI	R. H. Davis	Oct. 1934	6,500
2. Big Creek,	Bethany, MO	R. E. Uhland	Nov. 1933	186,000
W. Tarkio River	Bethany, MO	R. E. Uhland	Jan. 1934	106,000
3. Sangamon River	Urbana, Ill.	F. A. Fisher	Dec. 1933	133,000
4. Elm Creek,	Temple, TX	H. V. Geib,	Nov. 1933	207,000
5. S. Tyger River	Spartanburg, SC	T. S. Buie	Nov. 1933	111,000
6. S. Palouse River	Pullman, WA	W. A. Rockie	Nov. 1933	98,000
Wildhorse Creek	Pullman, WA	W. A. Rockie	Jan. 1934	32,000
7. Arroyo Las Posas	Santa Paula, CA	H. E. Reddick	Dec. 1933	45,000
Arroyo Grande	Santa Paula, CA	H. E. Reddick	Jun. 1934	10,000
8. Tennessee Valley Soil Erosion Project			Apr.1934**	
9. Stillwater Creek	Stillwater, OK	N. E. Winters	Nov. 1933	177,000
10. Navajo	Albuquerque, NM	H. G. Calkins	Nov. 1933	16,000,000
11. Limestone Creek	Mankato, KS	F. L. Duley	Dec. 1933	114,000
12. Deep River	High Point, NC	J. H. Stallings	Mar. 1934	139,000
Brown Creek	High Point, NC	J. H. Stallings	Mar. 1934	60,000
13. Reedy Creek	Spencer, WV	L.H. Carrier	Feb. 1934	87,000
14. Salt Creek	Zanesville, OH	J.S. Cutler	Mar. 1934	93,000

[425] Information used to compile this list of demonstration projects was obtained from the *Supplementary Report of the Land Planning Committee to the National Resources Board, part 5, Soil Erosion: A Critical Problem in American Agriculture* (Washington: GPO, 1935), 35

15. Cooley Creeks	Minden, LA	A.H. Meyer	Mar. 1934	55,000
Cypress Creek	Minden, LA	A.H. Meyer	Mar. 1934	45,000
16. Plum Creek	Albion, NE	R.L. von Trebra	Mar. 1934	70,000
17. E. Cadron Creek	Conway, AR	F.C. Newport	Mar. 1934	116,000
18. Buck & Sandy Crs.	Dadeville, AL	R.Y. Bailey	Apr. 1934	116,000
19. Sandy Creek	Athens, GA	L.E. Rast	Mar. 1934	107,000
20. Duck Creek	Lindale, TX	L.P. Merrill	Apr. 1934	25,000
21. Okatibbee Creek	Meridian, MI	C.B. Anders	Apr. 1934	144,000
22. Banister River	Chatham, VA	P.F. Keil	Apr. 1934	146,000
Sandy River	Chatham, VA	P.F. Keil	Apr. 1934	29,000
23. Erosion Survey	State College, PA	A.L. Patrick	April 1934	NA
24. Erosion Survey	Ithaca, NY	F.B. Howe	April 1934	NA
25. Gila River	Safford, AZ	B.P. Fleming	Aug. 1934	11,520,000
26. Deer & Bear Crs.	La Crosse, WI	R.H. Davis	Sept. 1934	151,000
Beaver Creek	La Crosse, WI	R.H. Davis	Sept. 1934	34,000
27. Dalhart Area	Dalhart, TX	H.H. Finnell	Sept. 1934	126,000
28. Reedy Fork	Greensboro, NC	J.H. Stallings	Sept. 1934	48,000
29. Crooked Creek	Indiana, PA	A.L. Patrick	Oct. 1934	135,000
30. Fishing Creek	Rock Hill, SC	T.S. Buie	Oct. 1934	52,000
31. Corralitos Creek	Watsonville, CA	H.E. Reddick	Oct. 1934	68,000
32. Neshanic River	New Brunswick, NJ	L.L. Lee	Jan. 1935	37,000
33. Shue Creek	Huron, SD	H.J. Clemmer	Feb. 1935	144,000
Wolsey Area	Huron, SD	H.J. Clemmer	Feb. 1935	45,000

34. Rio Grande	Albuquerque, NM	H.G. Calkins	Feb. 1935	11,500,000
35. Crowley's Ridge	Forrest City, AR	F.C. Newport	Feb. 1935	32,000
36. Cohocton River	Ithaca, NY	F.B. Howe	Feb. 1935	150,000
37. Muckalee Creek	Americus, GA	L.E. Rast	Feb. 1935	25,000
38. Pecan Creek	Muscogee, OK	N.E. Winters	Feb. 1935	37,000
39. Black Squirrel Cr.	Co. Springs, CO	A.E. McClymonds	Feb.1935	159,000
Smoky Hill River,	Co. Springs, CO	A.E. McClymonds	Feb. 1935	169,000
40. Massac Creek	Paducah, KY	H.W. Alberts,	Mar. 1935	27,000

* Projects with multiple locations listed indicate areas subsequently added to original projects.

**The Tennessee Valley Erosion Control project was conducted in cooperation with the Tennessee Valley Authority