THE LAND

TODAY AND TOMORROW

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THE LAND

TODAY AND TOMORROW

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By direction of the Secretary of the Interior the matter contained herein is published as administrative business and information.

PRE-THOUGHT

Inspired by the vision of an earth always good and always bountiful, we build upon today the bulwark of a better land tomorrow.

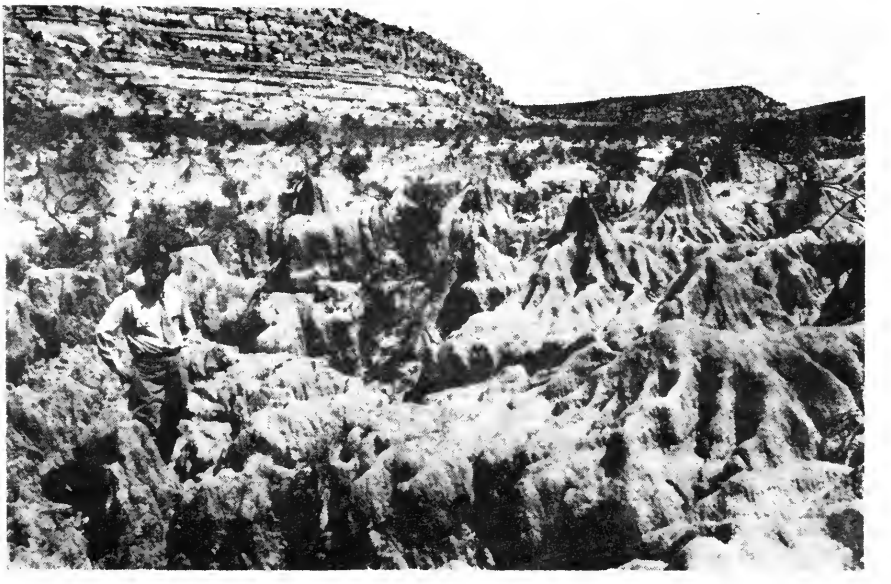
We are the vanguard in an epic stand against the elements. Something of the pioneering spirit that forever seeks a fertile land must sustain us if our common goal seems sometimes far away. Always, we must look ahead.

If *"The Land: Today and Tomorrow"* can carry forth from time to time a message of encouragement; if it can solidify our common bond; if it can crystallize the objective toward which we strive; --- then will it have fulfilled the ends to which it has been dedicated.

PROJECT WORRIES

The Navajo

Here is a good shot of the Oraibi Wash, largest of the many scourges On the Navajo reservation. Once prolific fields of corn grew along here; now the wash is about 75 to 100 feet deep, and that many miles long.



Sidewash along the Rio Puerco of the West, near Gallup. Asst. Regional Director F. D. Matthews is in the picture. This land is irrevocably ruined.

A Major Effort at Erosion Control

By H. H. Bennett
Director

Wherein are set forth our common objective and the need for real cooperation if our job is to be well done

Slightly more than a month ago, on Sept. 20th, the Soil Erosion Service passed the first anniversary of its creation. In one year it had grown with amazing speed from a nebulous plan into a well-knit organization of surprising size and scope. Now, as we enter our second year, it seems appropriate to pause for a reconsideration of our aim, a recapitulation of our accomplishments, and a look ahead.

During the latter part of 1933 the Soil Erosion Service was set up as a branch of the Department of the Interior, with an allotment of $10,000,000 from the Public Works Administration. Its purpose was to demonstrate the practical possibilities of curbing erosion and its allied evils of increasing floods and costly silting of stream channels, irrigation ditches, and reservoirs. The demonstrations were to be made within representative watersheds of the various important geographic and agricultural regions where the evils of erosion are known to constitute major problems in connection with the use of the nation's resources of land and water.

The general plan of procedure, as suggested by the President and carried out by the Soil Erosion Service, is to treat complete watersheds within which the principal regional types of soil, average topographic conditions and representative systems of agriculture are found. The individual size of these watersheds, of which 31 are now under treatment in 30 states, ranges from about 25,000 to 200,000 acres. The project on the Navajo Indian Reservation in Arizona, New Mexico and Utah involves 16,000,000 acres; the Gila River watershed project comprises something over 8,000,000 acres. Altogether, the Soil Erosion Service is now actively engaged in combating erosion and its aassociated evils on approximately 28 million acres of land.

PLAN OF PROCEDURE

The method of attack is essentially a coordinatd plan of correct land use. This plan involves not only the use of direct methods of retarding erosion (which necessarily calls for retardation of runoff by increasing absorption of the rainfall), but the use of indirect methods, such as retirement from cultivation of steep, highly erosivc areas from which accelerated runoff (resulting from incorrect land usage) descends with destructive effect upon lower-lying lands. Such critically vulnerable lands are being planted with thick-growing, soil-holding crops, such ad trees, grass, alfalfa, lespedeza, sorghum, and clover.

This initial program calls for the use of all known measures of erosion control. In some instances, however, some experimental work must be carried out in order that definite data can be obtained for application to those soil and land conditions that have not been previously studied, but which present serious erosion problems. It is the definite aim of this Service to develop efficientpractical erosion control programs for the different broad land regions and to work out a national policy of soil and water conservation based on correct methods of land use, so that the program can be extended as speedily as possible to all eroding farm lands.

Such a comprehensive setup must embody a coordination of the work of all agencies equipped to make a constructive contribution, especially the Extension Services and the Colleges of Agriculture. There must also bea purposeful, sympathetic cooperation between the farmer and the directing agency. Such a relationship is vitally essential for successful procedure in any effective program of control, which almost invariably will involve rearrangements and revisions in cropping and tillage practices, farm management and land use; and it meets fairly our traditions of property rights in land and at the same time supports the new concept that the public good calls for public participation in the tremendously difficult field of conserving our indispensable national resource, whether the land be public or private.

The moderately sloping lands which constitute the larger percentage of our cultivated farms present the most difficult job of all. Here there is always impoverishing sheet erosion wherever sloping land is devoted to the clean-tilled crops, with frequent gullying where the absorptive topsoil has been removed. Corrective methods necessarily will call for crop rotations, strip-cropping, terracing careful land use based on soil suitability, and often rather marked changes in cultural practices, such as cultivation on the contour, rather than down the slopes.

Every farm is surveyed in advance of actual work, by specialists of the local erosion staff. Soils, slopes, extent of erosion and plant cover are plotted on an accurate map. With the aid of this, the farmer and the erosion specialists go over the farmstead, study it in detail on the ground (not about an office table), and plan a course of procedure by assigning each acre or each piece of land to a particular use, in accordance with its characteristics, adaptability and appropriate place in a carefully planned, coordinated land-use program for that particular farm. The work is carried out on a strictly cooperative basis with the farmers.

Generally the farmers are enthusiastically supporting every phase of the program. On some of the projects more than 95 per cent of the farmers directly affected are going along with the program of the erosion specialists, agreeing to far reaching reorganization of their fields and farm procedures. For example, on numerous farms fences are being relocated so as to permit contour cultivation, terracing, strip-cropping, the inauguration of soil-building rotations and the planting of the more vulnerable slopes to grass, trees, etc.

Such hearty cooperation, it is believed, insures the success ofthe program. By putting through these initial educational watershed projects in a highly impressive manner, it is felt that it will then be possible to extend the work to all areas needing treatment through the activities of the Soil Erosion Service, the Extension Service, the colleges of agriculture and other pertinent organizations.

THE CHALLENGE

The call for control of erosion is not a challenge to technical men to work out methods that will permit farmers to continue any and all farm practices and land uses that they may elect to follow, from choice, tradition, or habit. Rather, it is a challenge to definite certain basic principles in practical land utilization and crop adaptation that will meet the problem and then secure, upon a

strictly cooperative basis, the farmers' acceptance of the principles and practices in his farm management program. We can not go far unless we can control land abuses. Customary farm practices are not sufficient to prevent destructive erosion. Revisions and adjustments must be made on most farms if we are to inaugurate a program that will prove adequate and effective in controlling land wastage from erosion and make possible a surer and more stabilized farm prosperity.

Such a revised plan of farm operations will embody those beneficial and proven ideas that agricultural leaders and governmental and state agencies have been urging upon the farmers for years, in their separate and detached ways. But this time these ideas are combined in a coordinated program that will rest squarely upon the fundamental physical factors of soil erosion control as determined by research and practical farm tests.

Such a program, then, must include a definite plan to be followed in all cropping and land use, in order to achieve a three-fold objective: (a) a beneficial re-cast of farm set-up and practices so as to bring about a more dependable and permanently profitable farming enterprise for the individual, (b) the control of soil erosion and land wastage in a permanent way, and (c) the minimizing of flood and water hazards and stream-channel and reservoir sedimentation with the products of erosion.

The unit area of control is the individual farm. Each land owner in the selected watershed is being urgently invited to participate in and cooperate with the general program. Participation is based on an agreement with the Government to perform certain specified essential work on his farm under direction of the local technical erosion staff, the farmer agreeing to maintain in effective and continous operation for a period of five years all installations affected under the agreement.

FIRST COORDINATED EROSION CONTROL EFFORT

Here is the first attempt in the history of the country to put through large-scale, comprehensive erosion and flood control projects, applying to complete watersheds from the very crest of the ridges down across the slopes to the banks of streams and thence to their mouths. These are not engineering projects or forestry projects or cropping projects or soils projects or extension projects, but a combination of these, with other specialized activities where needed, operated conjointly with such reorganization of farm procedure as the character of the land indicates as being necessary. This procedure is based on the best information in the possession of scientific agriculturists:--the agronomist, forester, range specialist, soil specialist, erosion specialist, agricultural engineer, economist, extension specialist, game specialist, geographer and others. It is the application of accumulated knowledge pertaining to the great multiplicity of variables affecting the three-phase process of absorption, runoff and erosion, employed not as single uncoordinated implements of attack, but collectively, according to the needs and adaptability of the land, in a combination of integrated control measures, to be supplemented where necessary by new information accruing from the experience of combat.

No such coordinated attack has ever before been made against the evil of erosion in this country. Considering the physical factors involved, it should be definitely obvious to any one that there is no other possible practical method of ever making any effective, lasting headway against this vicious problem. Even if the Government owned the land, it would still have to be used over large areas in the production of crops and for grazing, and here again precisely the same physical problems would have to be met and conquered, an eventuality that unavoidably precedes all other considerations relating to correct land use.

CONTROL OF EROSION AN UNAVOIDABLE NECESSITY

Control of erosion is the first and most essential step in the direction of

correct land utilization on something like 75 per cent of the cultivated (and cultivable) area of the nation. If the soil is permitted to wash to a condition equivalent to skeletonized land, as has already happened over something like 35 million acres formerly cultivated, there will be nothing left to save. Failure to curb this insidious process will effectively and disastrously take care of all aspects of the land problem in numerous localities, both physical and economic; and after this deluge of waste, nature, in numerous instances at any rate, can do as good a job as man toward rehabilitating these hopelessly devastated areas. But nature's is a slow process.

It seems scarcely necessary to add that whatever our inclinations may be, whatever opinions, conclusions or complexities our round-table, institute and academi discussions may lead us to, here is a physical job--the job of curbing erosion--that must be performed if the nation is to avoid early arrival at an inconceivably bad lan situation.

The Union of South Africa has reached this conclusion and is now busily engag in an attack against the devastating erosion of that country, employing a plan of pro cedure very much like that developed by the Soil Erosion Service. The Italian Govern ment is engaged in an enormous land reclamation and conservation program--the Bonific Integrale--at a cost of $500,000,000. Japan for many years has been spending many times the value of numerous critically eroding areas in order to protect indispensabl valley lands from the silt issuing from such sore spots. The United States can no more afford to neglect any further this gigantic problem of waning soil productivity than South Africa or Japzn or Italy, for the very simple reason that we are depleting our farm and grazing lands at a rate probably exceeding that taking place on any other important part of the globe.

NO OTHER WAY OUT

This job we are engaged in must be carried through to completion. The physical facts involved show conclusively that there is no other way out if the agricultural lands of the nation are to be saved.

Long ago we were warned about the evil of erosion by Washington, Jefferson, Edmund Ruffin, Shaler and others. What has been the answer? Definitely, the answer is that regardless of these warnings erosion has been permitted to continue in this country, not merely progressively, but at an accelerated rate. To be sure, valiant attempts to control the evil have been made locally; and in many areas, particularly on gently sloping land, the problem has been pretty well solved. But much of our effort--an effort pitifully small considering the nation as a whole--has come to a disastrous end. This is because we have made the mistake of trying to curb the most powerful physical agency that affects the character of the earth's surface, except sunlight, with a single implement of combat, used too frequently with little regard for adaptability, as determined by the character of the land.

Now that we have mapped as much as a hundred thousand acres of land in a single country hopelessly eroded, though every acre had been treated according to this single-track method of erosion control, it would be as unpatriotic as it would be obstinately foolish to cast aside what research and study have shown us to be the only possible road to success. We must make use of all our accumulated information, all of our implements of attack, according to need, in controlling this agency which, across the centuries, has built up approximately seven-eighths of the area of the nation through processes of tearing down, transportation and sedimentation. Of course, we are not immediately concerned with this slow geologic norm of erosion, but it is important to know that even this slow process is a prodigious tool of land sculpture.

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Some Necessary Distinctions In Land Use Problems

By W. C. Lowdermilk

VICE-DIRECTOR

In launching the service bulletin "The Land: Today and Tomorrow", I am constrained to believe that an important event has taken place. Who knows the extent of the growth of this modest internal organ of the Soil Erosion Service? Who knows how its influence on the thought of people concerned with conservation of basic resources of the soil will develop? It may become an instrumentality for furnishing the bases for policies in the management of land resources that will have far reaching influence upon the maintenance of land productivity for generations to come.

Whatever the distant future of the venture now entered upon, we can expect that "The Land: Today and Tomorrow" will contribute to the solidarity of the aims and function of the Soil Erosion Service: it will serve to keep our personnel informed of the various activities of other members of the Service. It will make each of us realize that we are working together in a program which is fundamental to the maintenance of civilization.

A civilization cannot continue to develop on the destruction of the productivity of its basic soil resources. It is necessary at this point to make such distinctions between depletion of soil productivity resulting from the consumption of plant nutrients within the soil by plants, and the destruction of the physical body of the soil. Too often a confusion exists in the evaluation of causes of reduction in crop production. Such confusion militates against sound program of land use planning. The consumption of plant foods by crops is essentially the operation of an agricultural factory. The soil and climatic temperature and moisture supply comprise the factory. This factory is, however, a delicately balanced complex of physical, chemical and biotic elements which need not be enlarged upon here. The plants are the factory machines, and the plant foods within the soil are the expendable materials employed in the production of crops. Plant foods as fertilizers may be replaced in the soil factory, and production thus becomes a venture to be managed on economic principles.

Destruction of the physical body of the soil by accelerated erosion is quite another matter: it involves wrecking the factory, often beyond repair. Accelerated, or man induced, erosion may so wreck the factory for agricultural crops that the factory site must be abandoned. From this point on our analogy begins to fall down, but it is sufficiently valid to emphasize the dangers of confusion in considering the processes involved in the reduction of land productivity.

Cropping of land may become unprofitable from a number of causes, which may be divided into two major groups, (1) economic and (2) physical. Economic factors are relative and depend upon transportation facilities, price changes, changing demands responsive to movements, and increases or decreases of population. Physical factors represent the fixtures of the country, including climate, topography, and soils. The soil is the factor subject to modification and damage by human occupation. With the soil are bound up conditions affecting absorption of rainfall, runoff, and soil erosion, and sedimentation in flood plains and in reservoirs. To

save the soil saves conditions essential to continued maximum productivity of lands and beneficial utility of waters. The first requisite, therefore, is to safeguard the physical elements of our factory of agricultural production. Having done this there is left to this and future generations the freedom of choice in the use and development of land resources With the destruction of the physical body of the soil, on the other hand, goes a loss of liberty of action in the use of a basic resource. The consequences affect not only the economics of land use but the maintenance of resident populations.

The Soil Erosion Service, therefore, has for its major function the establishment of erosion control demonstration areas representative of regions of critical soil wastage resulting from accelerated erosion, and to carry out on such areas a well-rounded, coordinated program of erosion control through suitable measures involving correct land use. To fulfill this function there are being made erosion surveys, and investigations to establish necessary information on the problems of soil erosion as it affects regional and national welfare. The needs of the land determine the measures and practices to be followed.

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DR. A. H. MEYER PASSES AWAY

Dr. A. H. Meyer, regional director of the Soil Erosion Service projects at Minden and Ruston, Louisiana, died Saturday, September 15, as the result of injuries sustain d in an automobile accident. Although apparently not seriously injured, Dr. Meyer succumbed twenty-four hours after the accident. He was buried at College Station, Baton Rouge, Louisiana, September 18.

Director Bennett's tribute is representative of the feeling of all who knew Dr. Meyer. Said Mr. Bennett: "I have known and worked with Dr. Meyer many years, as have a number of others of the Soil Erosion Service staff. We knew him as a highly capable man, a diligent worker, and a most agreeable friend. His passing means the creation of a gap in our work and lives--a gap that will be difficult indeed to cross."

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DIPLOMAS GIVEN CCC GRADS

"By this all will know John Doe served his country well as a member of the Civilian Conservation Corps and engaged valiantly in the national struggle to preserve our lands and farms, and that with all honors he completed his tour of duty at Smithville, U. S., on ---- 1934."

Appropriately designed and officially signed copies of diplomas bearing the above description are in the future to enrich the possession of all CCC workers honorably discharged from the Soil Erosion Service. Ten thousand two hundred of these diplomas were recently mailed from the office of J. G. Lindley, Supervising Engineer, to the erosion camps.

It is as a mark of appreciation of services in the battle against erosion, Lindley said, that the diplomas are tendered to men deserving them.

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In Prospect

By Charles W. Collier

SPECIAL ASSISTANT TO THE DIRECTOR

Satisfied that the Soil Erosion Service is obtaining results of lasting benefit in its fight against erosion, Secretary of the Interior Harold L. Ickes recently has made available an additional ten million dollars from the Public Works fund for the purpose of expanding the Service's frontiers of combat throughout the nation.

Announced in two five million dollar allotments, the new allocation brought to twenty million dollars the total thus far turned over to the Service for prosecution of its vital program of soil conservation.

News of the Secretary's action was the signal for an intensive effort to expand the program in accordance with his wishes. Director Bennett immediately began investigations to determine where the Service might locate new demonstration projects with benefit to the widest possible number of people.

As this issue goes to press, eight new projects have been formally set up in various sections of the country, some as independent projects, others as extensions of projects already under way. Together these new undertakings cover a total of 8,681,000 acres and have received allotments of funds aggregating $4,335,000. Other new areas are being announced as rapidly as preliminary studies requisite to judicial selection can be completed.

First to be created under the additional ten million dollar fund was the Root River project in southeastern Minnesota, just across the Mississippi from the Soil Erosion Service project on Coon Creek, Wisconsin. The area selected covers 150,000 acres of land typifying some twelve million acres of surrounding country. R. H. Davis, Regional Director at Coon Creek, who is also to direct the Root River project, was advised by Mr. Bennett on September 21 that an allotment of $300,000 had been made for the Minnesota work. He is now proceeding with the selection of personnel and other matters incident to the launching of actual work.

On September 28, with the approval of Secretary Ickes, Mr. Bennett announced the allotment of $200,000 for an extension of the North Carolina erosion control program to include 44,000 acres in the watershed of the Haw River. Work in this additional drainage area will be under the direction of Dr. J. H. Stallings, Regional Director of the Deep River project at High Point, North Carolina.

An entirely independent project, covering 115,000 acres of land in central Pennsylvania was established by Mr. Bennett on October 5, with an allotment of $200,000 from the new PWA funds. Dr. Austin L. Patrick, who has had charge of the soil erosion experimental-survey project at State College, Pennsylvania, was named Regional Director, and will set up headquarters at Indiana, Pa. The area selected for the demonstration work embraces the watershed of Crooked Creek, about 90 miles from Pittsburgh, and is representative of approximately 1,728,000 acres in the central portion of the state.

Expansion of the program in South Carolina was authorized by Mr. Bennett on October 5, when he announced the allotment of $150,000 for a demonstration project covering 50,000 acres in the watershed of Fishing Creek. The work in

this new area will be under the direction of Dr. T. S. Buie, Regional Director of the South Tiger River project at Spartanburg.

On October 7, the Director announced an allotment of $250,000, since increased to $500,000, for active prosecution of the gigantic erosion control project in the basin of the Gila River in New Mexico and Arizona. The program contemplated for this 8,200,000-acre undertaking represents one of the most comprehensive land utilization projects ever attempted, involving a complete and coordinated system of erosion control, flood prevention, forestry management and range regulation. It will be carried out in close cooperation with the United States Forest Service, the Office of Indian Affairs, and the grazing authority created under the Taylor Grazing Act.

Major B. P. Fleming, Chief Engineer of the Soil Erosion Service, has been acting Regional Director of the Gila project for some time, supervising the work being done there with CWA and CCC labor. He will continue in that capacity indefinitely, directing the organization and launching of the vast program now authorized.

An allotment of $70,000 for establishment of the first wind erosion control project ever undertaken in this country, was announced by Mr. Bennett on October 9. This unique demonstration will be located at Dalhart, Texas, in the heart of the Panhandle region which suffered so heavily during the intense drouth of last summer. Mr. H. H. Finnell, agronomist of the Oklahoma State Experiment Station, has been named Regional Director.

Another independent project was established by Mr. Bennett on October 11 with the allotment of $200,000 for a demonstration program covering 75,000 acres in northern New Jersey. The area selected is only 40 miles from New York City and forms an important source of supply for the milk and vegetable markets of the nation's great metropolis and other cities in the thickly populated sections adjacent to it. No Regional Director has yet been formallyappointed for this project. Dr. L. L. Lee, land and soils specialist of the New Jersey Collegeof Agriculture at Trenton, conducted the preliminary surveys and submitted the report upon which Mr. Bennett based his decision to go into the state.

Projects in California Maine and a number of other states are under consideration, but have not yet been announced.

Through these new projects, we carry forward our frontier in the struggle to save the land. Through them we will dramatize the situation in new regions, just as we have dramatized it with our other regions where now we are well established. Through them we will educate public opinion and lay the foundation for an effectively expanded program which must surely be set up within the not very distant future.

If our program succeeds,--- and it will,--- we will have done more towards insuring a permanently prosperous civilization in the United States than almost any other agency ever created. For every civilization is utterly dependent for existence upon the productivity of its agricultural lands.

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When Harry E. Reddick, Regional Director of the project at Santa Paula California, decidesto go over the area he does just that. Reddick is a licensed airplane pilot and owns and operates a plane.

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STRIP-CROPPING
and
ITS RELATION TO FARM TERRACING

by Ernest Carnes
Spartanburg Area

Most of us who have been working with farmers for a number of years know that it is not the best policy in most instances to recommend drastic or sudden changes in the fundamental system of farming. Therefore, it is recommended that the following outline be followed in the determination of a strip cropping program:

1. List the crops grown in area and percentage of acreage of each compared to total crop acreage.
2. Classify these crops as erosion resisting or not.
3. List other crops that are not generally grown in area, and that should be grown to develop a better cropping system, and assist in erosion control.
4. Determine which of the erosion resisting crops that are being grown, or to be grown, make their maximum growth or development concurrently with the usual maximum rainfall.

When these facts are determined the general program of strip cropping or strip-rotation may be formulated, leaving of course many details to be worked out for each individual farm.

In the South Tyger River area we find that cotton and corn are the two principal clean cultivated crops and these two crops combined represent about two-thirds of the cultivated acreage. We also find that the grain, oats, wheat, barley and rye, represent about one-fourth of the cultivated acreage, and on the remaining acreage are planted such crops as sorghum, cow peas, soy beans, alfalfa, etc.

The grain crop makes its maximum growth, or approximately so, near the time when the heaviest rain or greatest precipitation occurs, namely, in the spring months. Therefore, it is not difficult to decide that the grain crops arethe logical ones to be used as the basic or principal strip crops.

Recently a large number of objections to the narrow strips have been made by cooperators and many non-cooperators said they would not join in the program of erosion control, if narrow strips were required. The general complaints raised were that the strips were too narrow to be harvested very successfully with machinery without interfering with cultivated crops, and that the narrow strips caused "patchy farming", requiring more effort in cultivation and harvesting. Another objection was that the large number of strips resulted in more bordex rows of cotton and corn, which reduced yields.

By this time, we had studied the problem more thoroughly and had already decided to recommend a decided change beginning this fall, using the grain crop as the fundamental strip crop, supplementing this with lespedeza or sweet clover, sowing these crops on that portion of the grain crop not needed for summer hay. In addition, some semi-permanent strips of Serecia and alfalfa are being grown.

When terraces have been newly built in late fall, winter, and early spring, the strip crop program for the current summer will be to plant each

terrace ridge to some crop such as cowpeas, sorghum, sudan, or a mixture of sorghum and cow peas. This will furnish protection for the newly built terrace and permit the ridge to become well stabilized, raising the seep line before the rainy season the following winter and spring.

The above program is probably not the ideal or most efficient, but who knows what is ideal? Too, we have the promise of the farmer to adopt this system of strip rotation, beginning this fall. To a great extent, we are using the crops the farmer is already growing and knowshow to grow, but we are simply rearranging these crops in such a way as to greatly lessen erosion on his farm.

It is true we are attempting to change to some extent the cropping plans, but only in minor detail. For example, we are getting farmers to plant more oats and barley and less corn on these red hillsides. We have less failures with oats and barley compared to corn as the grain ripens in the spring when we usually have plenty of moisture. More grain planted results in less erosion. Too, we are introducing lespedeza and sweet clover as a supplementto grain as strip crops. These are new crops for this area.

There are now many discussions about strip cropping, or vegetative control and farm terracing. My personal opinion is that one is just as important as the other for this project area. Practically every farm in this area has some type of terraces on every hillside, yet erosion is aaking place at an alarming rate. Wemust state that probably 75 per cent of the existing terraces are improperly run and built. They have entirely too much fall or grade, resulting in severe erosion, especially near the outlets. Undoubtedly much valuable soil would have been saved if farmers years ago erected and maintained the best known system of terracing.

It is evident that most of the soil loss from any given slope takes place during some extraordinary condition. This condition may happen only once or probably twice or three times during a twelve months' period when a very heavy rain takes place in a very short period of time, and especially if the slopes have no vegetative protection during such a time. No system of terraces is perfect and they are likely to break at just such a time. If the field in question has bands of close-rooted crops growing or present when the terraces break, much valuable soil will be saved. It is entirely possible that the terraces would be prevented from breaking if the strips were present and all the slope *was not plowed at any given time.* Even if an efficient system of terraces are constructed, strip cropping is equivalent to a good insurance policy kept in effect.

Assume that a system of terraces will be constructed on the project areas that will hold under any condition. It is reasonable to believe that it will be some time before all the rest of the hillside farms will have such a system of terracing. It is understood that the project areas are to serve as models in erosion control for the rest of the country. Therefore, strip cropping or strip rotation should by all means be put into effect in conjunction with terracing. We could hardly justify the expenditure of public funds on project areas if it were not for the fact that these large-scale demonstrations are to show the rest of the country how best to do the job.

Therefore, until more research information is available, we believe that both terracing and strip-rotation should be practiced, especially on the project areas.

WORK GOES ON AT ALBION

This is the first of a series of articles describing the various projects and their problems. In this article by Regional Director R. L. von Trebra, an optimistic note for the future is sounded.

The Nebraska area, Soil Erosion Service, started the first actual field operations May 14. This work consisted of gully control activities and all the labor was done by CCC enrollees. By June, the signing of cooperative agreements and the agronomic work in connection therewith was getting under way in good manner. By July 15 construction work with terracing machinery was started.

In the Plum Creek project, which is composed of approximately 70,000 acres, there are in round numbers 300 individual farms. On October 1, 136 cropping systems had been planned on the same number of farms. These cropping systems covered an area of 28,931 acres. Out of a total of 136 cropping systems that had been planned, 105 cooperative agreements were signed, which included an area of 22,304 acres. In the 22,304 acres that were signed up and covered by cooperative agreements, 3,014 were taken out of cultivation for the purpose of seeding to pasture grass mixtures or alfalfa. We have, out of the signed acreage, 4,751 acres now in pasture grasses or alfalfa. We now have a combined total of 7,761 acres of the total signed acreage that will be taken completely out of cultivation or remain out of cultivation. This is approximately 35% of the total contracted acreage and represents the steeper, more seriously eroded land of the farms that have been signed up. Many fields that are now in cultivation and that contain slopes varying from 7 to 20% are being removed entirely from cultivation, and being seeded to grass or alfalfa.

In the Plum Creek area the program of erosion control that will be employed on practically all farms will embody almost all phases of erosion control activities. These various phases are gully control, tree planting, reseeding of eroded slopes and gully banks, contourcultivation, contour cropping, and permanent contour strips of grass. Almost every farm will of necessity have to have complete rearrangement of field boundaries based on contourlines or terraces.

The soil in the area is of one general type. It is a deep loess and belongs in the Marshall or Knox series. Much of the land is very rough and rolling, and is subject to severe sheet and gully erosion. The land itself is very productive, but where severe sheet erosion has taken place there is a marked reduction in yields. Farmers are following a general practice of growing corn two or three years, followed by oats and sweet clover. Regardless of the amount of surface soil that has been lost through erosion, it is not difficult to secure good stands of sweet clover on this particular soil type. When sweet clover is plowed under in the summer of the second year, a large amount of vegetative growth and plant food is turned under that has an immediate effect

on the following crop which is usually corn. For this reason it is difficult to get many farmers to realize the devastating effect that erosion causes.

There is one phase of erosion that is becoming quite serious that the farmers admit their inability to cope with, and are very willing and glad to have the services of the Soil Erosion Service in combating. This is gullying, and to drive over the area, and to note the seriousness of gully formation, it is easy to realize that thisone phase of erosion has gotten completely beyond the control of the average farmer. It has threatened the very foundation of his farm value, and in some casesgullies are threatening the complete destruction of his farm yards and buildings. When gullies form in the soil type found on the Plum Creek project, they produce deep narrow gulches with vertical sidewalls, and the gully becomes a serious menace to farm operations, pasturing of live stock and threatens the destruction of the entire farm if left uncontrolled.

Engineering principles employed on the project are the construction of interception ditches around the heads of many of the gullies, grading down the gully banks, and the construction of brush and wire dams in the bottoms of the gullies in order to stabilize them until such time as tree growth and vegetative covering tends towards a stabilized condition. On the tillable farm land level terraces are being constructed wherever terraces can satisfactorily be constructed as regards degree of slope, use of land, and the condition of the erosion taking place thereon. The terraces, besides acting as an interceptor of surface runoff, and storing a large quantity of water that falls, will also act as a guide in contour cultivation, and very often will serve as a means of using a contour field boundary on natural lines.

Since July 15, 451 terraces have been built with two elevating graders working, and have a length of 102 miles. The actual acreage protected adjacent to the terraces amounts to 3,600 acres. It is not expected to use terraces in this area as a permanent means of erosion control, but besides preventing soil losses by slowing up the runoff, a large quantity of rainfall which otherwise is lost will be stored and allowed to penetrate the subsoil. In some respects moisture conservation as well as soil conservation is a very important factor in this region, where the average rainfall is less than 26 inches, and at times is far below normal requirements during the growing season.

In the gully control operations which are done entirely by CCC labor, 1145 brush dams have been constructed up to October 1. 273 single post wire dams and 164 double post wire dams have been constructed. On both of the wire dams, straw and trash, together with large quantities of brush are used in constructing the core of the dam and the apron. Around the heads of gullies on the contracted acreage 38,343 feet of interception ditch has been built. The purpose of the interception ditches are to take the water out of the gullies and carry it around the sides and on to more gradual slopes where it can be dispersed in a thin sheet, and the cutting effect of water in a concentrated form be diminished as much as possble.

At this time we have definite plans made for 433 acres of strip cropping and 57 farms on which 559 acres will be permanently protected with permanent grass strips. We expect in addition to this to employ strip cropping on every farm possible. At the time that the cooperative agreements are signed, definite plans for rotations, strip cropping, and the like cannot be made until after the engineering phases of the erosion control program are completed. We know that it will be necessary to make rearranged fields and to even set up different rotations than those shown on the contract maps.

After the engineering features, such as gully control activities and terracing, have been placed on the farm, it will be much more satisfactory to use the contour field strips and the contour strip cropping plans because it is felt that all such phases of cultivation and erosion control operations are based primarily on contour methods that of necessity have to follow survey lines that are laid out by the engineers.

The program that is being worked out for erosion control on the Plum Creek project and the complete change in farming operations that from necessity will have to follow is such a revolutionary change from the present methods of farming that some farmers object strenuously to the idea of contour cultivation, strip cropping, and terracing. Gradually the objections are being overcome as the farmers become more familiar with the work, and the principles on which it is based. The farmers are gradually beginning to realize that erosion is a problem to which they must give more careful attention in the future, and when once they see it in such a light, their cooperation in the program is not so difficult to secure. Many of the farmers are primarily interested at this time as much or more in the conservation of moisture as they are in the conservation of soil. Fortunately the two are so closely correlated and go hand in hand, and the principles that bring about the conservation of one bring about the conservation of the other.

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CORN SURPLUSES AND SOIL EROSION

by *C. Reed Hill*
Extension Agent, Bethany

Corn surpluses are caused in large measure, by the impoverished acreages. Each agricultural community has what it considers its "cash" crop. The acreage in this crop is increased to offset decreased yields and low price. Soil building investments have been cancelled out in their net effect by erosion.

The "cash" crop for the Bethany project is corn. Our emphasis on crop rotation and the retirement of submarginal corn acreage from production is, in its final analysis, a direct attack upon the contribution of this community towards a corn surplus. The following table shows the relationship between low yields and total production:

LOW ACREAGE YIELDS INCREASE TOTAL CORN PRODUCTION

	YIELDS		
	Low	Medium	High
Yield, bushels per acre	25	40	60
Value per acre @ 45¢ per bushel	$11.25	$18.00	$27.00
Average operating cost, per acre	9.00	10.00	11.00
Net return, per acre	2.25	8.00	16.00
Acres to yield $600 net return	266.6	75.0	37.5
Total production, bushels	6666	3000	2250

The farmer who is leaving the soil of his farm get away from him and who has not systematically built up the soil fertility, is producing 6665 bushels of corn to get that $600 which we have considered as the minimum "cash" income to a farm family. Some of the more erosive slopes of his farm now in corn are not even paying operating expenses.

As the yield per acre increases in net returns the total production per farm decreases, if the demand for cash is kept reasonable. The medium-yield farm produces about 45 per cent as many bushels of corn as the low-yield farm to get that necessary $600 "cash" family income. Our problem is much more important between the low- and medium-yield farms than between the medium- and high-yield farms.

The foregoing table also brings out the relationship between selling price and soil productivity. Twenty-five-bushel land demands a 36-cent per bushel price to meet operating expense, while sixty-bushel land covers operating expenses at half this price - 18-1/3 cents.

A correlated attack of the soil erosion problems of an individual farm will do permanent good in remedying our crop surplus problem. Our activities are not in opposition to those of the United States Department of Agriculture, which is energetically wrestling with this surplus problem.

Any of our analyses which fail to get down to dollars may have a hole punched into them some day.

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COON CREEK PROJECT EXHIBITS "BEFORE AND AFTER" FARM MODEL

At the Tri-State Fair, held at La Crosse, Wisconsin, September 18-21, Chief Agronomist I. K. Landon, of the Coon Creek project, exhibited a miniature model of a farm before and after treatment by the Soil Erosion Service. On one side of the booth was shown a farm in its condition before the Soil Erosion Service undertook its reorganization, with denuded overgrazed hillsides, unprotected cornfields, and the consequent damage from sheet and gully erosion. Adjoining on the other side of the booth was a model of the same farm as laid out by the erosion specialists, with terraces, protected terrace outlets, strip-cropping, fenced and planted hillsides, protected stream banks, and food patches for wild life. To further show the effect on run-off made by the operations of our technicians, the models were from time to time sprayed with water.

This exhibit attracted so much attention among the farmers coming to the fair that Mr. Landon, who was in attendance at the booth to explain the model, reached home so hoarse every night that he couldn't talk back to his wife when scolded for being late for supper.

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DROUGHT HAMPERS TEMPLE PROJECT

The planting of erosion-resisting vegetation on the Temple, Texas project has been greatly hampered due to the fact that no rain of any consequence has fallen there since early in April. A grass multiplication nursery, consisting of fifteen acres of irrigated land has been acquired, and planted to various grasses which are obtainable only in small quantities, or that have to be transported from distant points. The principal species planted are Paspalum dilatatum (Dallis grass), both seed and sets; Paspalum distichum, sets only; Paspalum - species unknown, sets only; Lippia (species) a hardy, low-growing, rapid spreading, non-edible plant, sets only; Andropogon annulatus (Angleton grass) sets only; and others of lesser importance. Several species new to the region are being tried out to determine their adaptability. The Bureau of Plant Industry is cooperating in this work.

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BY WAY of BIOGRAPHY

H. H. BENNETT

Director

born on a North Carolina Piedmont cotton farm in 1881.....it was on this farm that he was first introduced to the problem of erosion.....at the age of nine he helped his father lay off terrace lines along the contours of slopes by digging a hole with a hoe at the lower end of an old-fashioned wooden horse..... however, it wasn't until after he had graduated from the University of North Carolina and had spent several years in the Soil Survey of the Department of Agriculture that Mr. Bennett really began to study this problem.....it was he who first developed a national plan for measuring the destructiveness of the evil under varying conditions of soil, slope and climate and for working out practical measures of control applicable to the various soils and cropping practices of the nation.....studied in great detail the soils of the United States, Alaska, Central and South America and Cuba...devoted more study to the problem of erosion than any other man in the country.....selected for the task of organizing and carrying forward the most comprehensive program of erosion control ever attempted in the history of the country.....large, affable, sincere, really beloved.....

GENERAL POLICIES OF GULLY CONTROL IN THE SALT CREEK WATERSHED

Because gullies are spectacular exhibits of the results of soil washing they often receive attention which should be directed to the much greater damage done by sheet erosion. Gullies are a serious menace but there can be little hope for reclaiming many areas that are badly gullied without tremendous cost. The justification for controlling gully erosion is the possibility of maintaining or increasing the productiveness of the land. The job should be a demonstration of *what can be done by the average farmer.* Structures must be of simple design and the cost in keeping with the benefits derived from their construction. In determining value of structures consideration should be given to their durability. Materials should be as nearly as possible confined to those which are found in the locality. In planning gully control work with structures, the future use of the land and the ultimate control methods should be kept in mind.

Gully control methods are to be employed on three different classes of land: crop land, pasture land, and land to be reforested. One of the important needs of this area is the maintenance of productive crop land. Where structures can be put in that will offer permanent protection tocrop land it is justifiable to go to considerable expense. In pasture land vegetative cover should be utilized to the fullest extent for permanent control and structures should beused only as an aid to the establishment of vegetative control. On land where trees are to be planted structures should be of the temporary type and the amount of labor and material kept to a minimum.

Where the ultimate control of the gully is to be accomplished through the use of grass, shrubs, trees or other vegetative cover, such points as rapidity with which vegetation can become established, necessity of temporary structures to establish vegetation and time necessary for structures to hold before vegetation can take its place should be considered. In addition the relationship between the cost of construction, establishment of vegetation and the benefits to be derived must be taken into account.

GENERAL TYPES OF STRUCTURES TO BE RECOMMENDED:

Crop Land. On small drainage areas where slopes are steep or on larger drainage areas with relatively flat slopes, inexpensive structures can be used to temporarily control erosion until permanent sod strips can be established. Sod bags, small wire dams, slab dams, diversion ditches, wide check devices to spread the water, brush, litter, etc., should be used in general for this type of work. Where the quantity of water on the slope will not permit such simple check devices, the more permanent types of dams built from rock or logs may bejustified.

In some cases, soil saving dams may be recommended where there is considerable pondage created above the dam and there are gullies eating back into cultivated land. In some cases the pond may be used temporarily as a stock reservoir.

Pasture Land. On small drainage areas, temporary check devices similar tothose recommended on crop land should be used. On larger drainage areas the more permanent types of structures may be used, providing the value of the land will justify them. In some cases on pasture land it may be necessary to

fence off the gullies and to depend largely on vegetative cover as the ultimate control measure supplemented by temporary dams. Often satisfactory control measures can be employed by depending upon the use of vegetation, using diversion ditches near the heads of the gullies.

Land to be Reforested. Structures are to be used only when it is felt that the trees alone cannot prevent erosion. Where the drainage area is small (less than three acres) a few temporary dams spaced at strategic points in the gully are justified to temporarily control erosion until the trees get a chance to take root. On the larger drainage areas where trees or other vegetative cover cannot control erosion effectively, it may be advisable to divert additional water into a main gully which would justify the expense of installing some type of permanent structure.

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BRANCH of ENGINEERING

OFFICIAL NOTICE

All projects are requested to note carefully a memorandum to Regional Directors concerning the policy of the Soil Erosion Service on terracing procedure and equipment. Please apply the policy to your particular conditions, taking especial care to estimate carefully the area suitable for terracing, and make requisitions for equipment accordingly.

Occasion is taken to offer a word of explanation regarding procedure in submitting gully control and terracing report forms. A number of projects have written in asking if uncompleted work should be reported. It should not, with the following exception:

If terraces are completed and terrace outlets are not, or vice versa, then either may be reported and a notation made in the column in which the uncompleted work will later be reported, to the effect that this part of the work is not yet complete. If this procedure is followed the acreage is shown only with the first report. This results in securing an accurate average cost per acre. Later work such as planting, repairs or maintenance may be included in more than one report.

These are engineering reports and only work directed by the engineering branch should be included. A note should be made if this includes planting.

Under the column *"Bank Sloping"* include all work done for bank protection of any nature whatever.

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BRANCH of AGRONOMY

The Branch of Agronomy reports that during the last three months almost two and one-half million pounds of seed have been purchased for the various soil erosion projects. These purchases cover 32 different kinds of seeds which are to be used for strip-cropping and cover crops and include over 12,000 bushels of grains. Most of this seed has or soon will be sown this fall and winter to prevent erosion during the winter and spring months. The total amount of seed purchased this year amounts to almost four million pounds and an additional million and a quarter pounds was obtained from the Federal Surplus Relief Corporation, making a grand total of five-and-a-quarter million pounds.

Of the seeds purchased this fall, Hairy Vetch leads in quantity with almost one-half million pounds, and Austin Winter Peas is second with one-quarter million pounds. Two hundred thousand pounds of Timothy, 132 thousand pounds of alfalfa, and 126 thousand pounds of Red Clover have been purchased during the last three months. Over four thousand bushels of barley, three thousand bushels of rye, and oats, and a thousand bushels of wheat are also among the fall purchases.

The Bureau of Agricultural Economics reports that there is a real shortage of some seeds and short crops of nearly all of the important field seeds. For instance, the crop of Timothy is just one-fifth of last year's small crop, Alfalfa 25% smaller, Sweet Clover 15% to 25% smaller, and Red Clover 40% smaller than last year. This situation has caused a rapid rise in prices. Prices between July 1st and October 1st have risen as follows:

Timothy	*.11 to .21*
Alfalfa	*.16 to .22½*
Orchard Grass	*.09 to .17*
Sweet Clover	*.05 to .08*
Red Clover	*.15 to .24½*

In years of short crops the supply of seeds of high quality is always limited and it is advisable to purchase needed supplies early before all of the better lots are sold. Seeds which are to be purchased for use next spring should be ordered as soon as possible.

Arnold S. Dahl,
Associate Agronomist.

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Glenn L. Fuller, Chief Soil Expert, was confined to his home with a severe illness for a week this month. Dr. W. C. Lowdermilk, Vice-Director, pinch-hit for Mr. Fuller in aiding to wind up the National Resources report.

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TRAINEES ON THE NAVAJO

by John O. Wood,
Agronomist, Navajo Project

To attain the general objective of the Soil Erosion Service on the Navajo project it is not only necessary to demonstrate the possibility and methods of erosion control, but Navajos must also be trained to carry on the work in the future. To that end, the following procedure is used:

Young Navajos who speak English have been assigned to field men in the various divisions of the Soil Erosion Service as trainees. These young men have been selected rather carefully and in most cases have a high school education. Generally all of the trainees are above the average in native ability and were selected for the places they fill because they appeared to be adapted to take up the particular phase of work to which they were assigned.

The trainee is very valuable to the field man since he is always available as an interpreter. It is possible to get a great deal more of the kind of information sought by having a native who knows something about your work to interpret and ask questions pertaining to the specific problem. Many contacts are also made with non-English speaking Navajos through the trainee which would otherwise be impossible. In field work where laborers are being used who do not speak your language, the trainee is able to explain details, which is decidedly to your advantage.

In return for his services the trainee is paid a fair wage and in addition to this he is being taught all that is possible about the particular line of work in which he is engaged. For example, the trainees in the Agronomy Division are being taught the value of vegetation in erosion control which includes the selection of proper kinds of grasses, shrubs or trees to meet different conditions and the adaptation of different plants to various soil and climatic conditions.

Instruction is also given in soil preparations, selecting crops best adapted to the particular kind of soil, rate, time and method of planting the various crops and improved tillage methods. Particular emphasis is being given to the training of these men in greater and more efficient use of flood water or crop production. They are also getting a great deal of training in actual revegetation of their land with native grasses, shrubs and trees which they help to collect and re-seed or transplant.

Trainees in other divisions of the Soil Erosion Service are getting comparable training in their respective lines of work. One very valuable feature of the training is that it is being given under actual field conditions where actual practice is dominant rather than theory, which makes any kind of instruction more effective. The training period has been too short for us to make very definite predictions at this time; however, we are expecting some worth while accomplishments as a result of the training being given these fine young men.

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To assure our success, each superior must be a teacher to his subordinates. The seemingly impossible demands of our new and difficult work will then disappear like fog in a warm air current. *And the teacher will be taught.*

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Continued from Page Four

We may turn aside from the plan of attack outlined above, but eventually we shall have to come back to it, and when we come back the job will be larger and more difficult and more costly.

If we should leave out of consideration, for example, the lesson taught by nature--the fact that vegetation is the most powerful agency of erosion and flood control--we would be as guilty of neglect as the physician who would refuse to administer an anaesthetic where the life of a patient depended absolutely upon such administration. Let's not forget that over the 50 million acres of the great Piedmont area, extending from New York City into east-central Alabama, there was not so much as one acre of erosion-exposed clay, or one single erosional gully when these lands were taken over from the Indians. Now we have between 15 and 20 million acres of erosion produced relatively stiff clays and clay loams in the place of the original mellow, humus-charged loams, sandy loams and clay loams, and probably not less than 20 million gullies that were formed after the removal of the cover of vegetation. Let's not forget that stand of virgin timber by commercial forest-destroyers who have skimmed the cream of the regional resources and left to the people of these sections, in many instances, not so much as a dollar's worth in the way of improvement, but rather millions of dollars of outright loss in wrecked forests and devastated land, the result of erosion which such wreckage fosters.

WORKING TOGETHER

It should be obvious to any one that in order to make any headway along permanent lines of erosion control it is going to be vitally necessary for the Soil Erosion Service to make the best possible use of its pooled resources of brains and technical information. Its specialists and all others must work together in a coordinated plan of land protection and soil and water conservation.

Failure to do this would result in weakening the chain in its vital link, with resultant failure. Seeing this obvious necessity, it should be perfectly clear to every man on the job that he or she has a duty to perform, a piece of work to accomplish successfully, if this most basic resource of the nation--the land--is to be conserved for our present use and for the use of those who are to come after us. It should also be obvious that not only must each individual perform his or her duty, but that it is an obligation upon each one to help his co-laborers wherever and whenever circumstances call for such assistance. Likewise it should be perfectly clear that success calls for perseverance and unwavering loyalty to the nation through the organization of the Soil Erosion Service. It is clearly the moral and patriotic obligation of every member of the organization to work according to these precepts of imperative individual responsibility, or else to move into some other field of activity where he or she can work according to the rules.

And finally, let's remember that civilizations have disappeared because of erosion--that magnificent temples are being dug from beneath the products of erosion in regions where the land is all desert or rock or incredibly poor soil. On the other hand, let's remember that the descendants of the Incas, who were cultivating the steep slopes of the Andean Mountains when the Conquistidores scaled the ramparts of Pacific South America 400 years ago, are still being cul-

tivated with methods of land use that were in operation before the time of Christ.

The above general statements outline the procedure which is essential to success in this great erosion program undertaken by the Soil Erosion Service. If we fail in carrying out these things, then the program fails.

But we shall not fail; we shall move ahead, constantly improving our methods, weeding out dead timber as soon as signs of decay are revealed, ever pushing forward along lines of proven correct procedure, cooperating closely with those who can help us. We must all recognize that we are not fighting for ourselves but for the lands of a great nation. We are not merely crusaders, but soldiers on the firing line defending the vital substance of our homeland.

Let me urge with deepest earnestness that each of us, regardless of any circumstance except bodily disability, contribute his ultimate best to this cause. This, let me assure you, will mean success, and in success we shall all be happy. It will not be forgotten that we were the shock troops.

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OHIO CAMP GIVEN HONOR RATING

Company 1527, Camp SES-2A, at Sonora, Ohio, one of the CCC camps now engaged in erosion control work on the Zanesville project, has been designated as an "honor" camp for the month of July, according to word just received by Regional Director J. S. Cutler.

As pointed out by J. G. Lindley, Supervising Engineer of the ECW camps under the Soil Erosion Service, such a distinction is quite an honor inasmuch as only one "honor camp" is selected in each district.

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DISTINGUISHED BRITISH SCIENTIST VISITS COON CREEK

Recently the Coon Creek project was host to Dr. R. Maclagan Gorrie, of the British Forest Service. Dr. Gorrie has worked for a number of years in Punjab, India, with headquarters at Lahore. He is now in this country on a Leverhulme grant to study erosion and grazing in relation to foresrry and watershed protection. He is accompanied by Mrs. Gorrie.

The Coon Creekers were so delighted with the Scotch brogue and charming personality of this couple that they almost lost sight of the fact that theyhad in their midst a scientist of distinction.

Dr. Gorrie also spent several days at the Washington office, and will visit a number of other projects this fall and winter.

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WHAT IS A SOIL SURVEY?

What is a soil survey? Here's how William DeYoung, Soils Expert on the Bethany, Mo., project, answers that question.

"A soil survey is essentially an inventory of the soil resources of any particular area. It is a fundamental investigation of our soil resources on which all systems of agriculture must be based. It corresponds to the work of the Geological Survey which investigates the mineral and oil resources. The

aim or purpose of the Soil Survey is to determine the character and extent of the various kinds of soil, knowledge of which will enable the Soil Erosion Service to point the way toward a better utilization of the land."

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THE ADDRESS OF BIG CHIEF GULLY

It is the sad duty of the Committee of Gullies to report that since the last annual meeting of the Gullies, Chief Big Gully has passed on. This loss is a severe blow to our organization at this time when we have a new enemy, the S.E.S., to combat.

The Committee urges each individual gully to make every effort to establish a progress record for the year. By united efforts we may be able to discourage this new enemy. A new "Chief" will be elected at the next annual meeting.

By order of the Committee of Gullies:

Fellow Gullies! It is with a heavy heart that I bring you this message. I have deeply appreciated the honor that you have bestowed upon me for the past decade. Some of our young members who are quite good sized today have been born during my time of office. I realize that I am aged; that my efforts have become more feeble with each of the passing years. My sides are heavily grown with brush and grass, my lower limbs are desecrated with trees and even my head and upper limbs are now becoming clogged with small brush and grass. I know my life is nearly run. I do not wish sympathy or pity. My life has been full. I have ruined 4 acres of land; I have killed 2 horses and 4 cows. Is there one among you who has done asmuch? But I have made my misaakes and it is of these I wish to speak. I will speak briefly of our allies and at length of our enemies. I hope especially that our younger members will heed some of the warnings that I will give.

It is proper that first I should classify our enemies and allies. Our first ally is runoff. Any method of cultivating land which will increase runoff is therefore an ally. Our enemies are all types of vegetation, contour cultivation, terraces, strip cropping, or anything that will reduce runoff or cover the soil so that it washes less readily. Now we have the activities of man as both an ally and an enemy. Wemust, however, class man as an ally. The history of our race shows that we follow man and his activities. We have never gained a strong grip on any country without man. Thus we must classify him as our ally.

A special type of man has been visiting us recently. He is from the S. E. S. The Soil Erosion Service, fellow members, is an organization of trained men that would introduce, to his brother and our ally, means of cultivation and cropping practices that would wipe us from the face of the earth. Our only hope is that men who have been our allies for generations will not desert us now. If they do, I see the doom of our race. Do not become too alarmed at this new menace. There are doings of man that we will never understand. Although man, our ally, and man, our enemy are brothers they often act as enemies. Man our ally is distrustful of man ourenemy. Therein lies the hope of our posterity.

So much for man. Now let me warn you against the neglect of cancerous growths of grass, shrubs, trees, yes, and even weeds. They may seem unimportant at the time but if let alone they will grow on you until they begin to catch soil that you are trying to throw away. As they catch soil they catch seeds and before long your system will become clogged. I know that often our ally, a big

heavy rain will come to your assistance and put you back in good condition again. But, don't depend upon it. I did, and three times it repaired the damage dueto my negligence, but the heavy rain did not come the fourth time until it was too late. That was five years ago, but my death started then, and was due to my carelessness. I should have caved off those clumps of grass and small brushes. I didn't though. I laughed at them; I wanted them to get a little larger before I destroyed them. I even forgot them for a period and when I again remembered it was too late. But even in my death struggles it is with pride I view my torturous length and great depth. I will die knowing that what I have destroyed will never be tillable again.

Enough of warnings. In closing let me say I am proud of our record in this community. The tabulated record of the year's program is not at hand but within my memory we have ruined 1,000 acres of good land, killed 37 head of livestock, and generally depreciated the value of all the farms on which we live. It is a record of which to be proud. Thank you!

-- Harvey G. Bobst
Asst. Agr. Engr
Nebraska project.

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THE TECHNIQUE OF OBSERVING AERIAL PHOTOGRAPHS

by Charles W. Collier

Many users of aerial photographs, even those of long experience, frequently have difficulty in clearly reading aerial photographs because of the fact that the valleys have a tendency to appear as ridges and ridges toappear as valleys. This optical illusion is caused by the fact that the photographs are taken from such a high altitude that all effect of perspective is lost and also because the average person is not fully familiar with the appearance of the earth from the air. Another element which aids in creating this optical illusion is that our eyes have become conditioned to shadows cast by light originating in the sky, or, in any event, from above our heads. For this reason, for example, a projection from a wall which casts a shadow below it, has the appearance of a projection rather than a depression. If the shadow were cast upwards, the tendency would be to interpret the projection as a depression, particularly if one were to look at it through one eye so as to eliminate stereoscopic vision.

In the same way, if a photograph is held so that the shadows of elevations are cast towards the observer, such elevations will generally appear to be elevations. If, on the other hand, the photograph is turned around so that the shadows of elevations are cast away from the observer, or cast upwards if the photograph is being held in a vertical position, elevations will frequently appear to be depressions and streams will seem to be running on top of ridges.

The moral of the above analysis is obvious: when examining aerial photographs, hold them so that the shadows cast by trees or houses or land elevations are thrown towards the observer, or, if the photograph is held vertically so that they are thrown downwards as though cast by a light originating in the sky.

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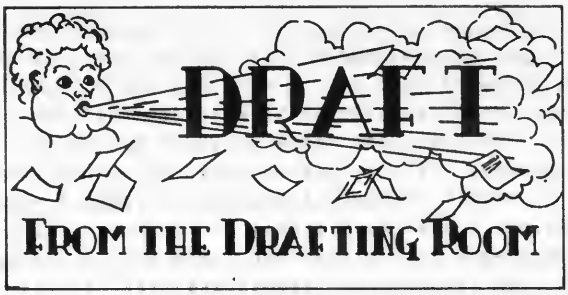

The drafting department, of which little is heard, occupies quite an important niche in the Soil Erosion Service. Under the direction of W. F. Beamon, Chief Draftsman, a great many activities are carried on. Chief of these are the preparation of area, state and national maps, for varied purposes connected with the activities of the Service; charts and drawings for illustrated pamphlets and other publications; design of emblems and insignia and assembling and filing various map data and aerial photos of regional areas. At the present time, the drafting department is temporarily employing a force of approximately 40 men in preparation of a national erosion map. After this map is completed it is expect that additional men will be added to the regular staff of five to prepare a more comprehensibe national map delineating in addition to erosion, soil types, vegetive cover and slope range.

EDITOR'S NOTE: In connection with the drafting room department, it is quite apropos to pay tribute to the cover design artist, Miss Elizabeth Osgood.

Miss Osgood

In addition to the cover work, Miss Osgood has spent quite a few hours with speedball and art gum in the preparation of designs, headings, and other work essential in the planning and promulgation of this magazine. Also we acknowledge work of Mrs. Danforth, who is responsible for the caricatures which appear on this page and others that will be reproduced in subsequent issues.

The drafting room believes that coordination of work and inter-employee harmony can be expedited by congenial enjoyment after office hours. Accordingly on Tuesday night, October 2, the personnel of the National Resources division of the Soil Erosion Service drafting department staged a party at one of Washington's night clubs --- in celebration of their first pay day. Here we have an eye witness report:

It was pay day at the office
And the draftsmen all were there
Awaiting their checks for salaries,
Oh 'their patience was worn bare.

For many weeks they'd waited,
And Beamon loaned them dough.
To keep them all from starving
Their cash was worse than low.

Now rose "Sus" Pence among us,
He said, "We'll celebrate.
We'll have a little party,
We'll dine and dance 'til late.

.....

And now they're all arriving
By two and three and four,
Until there were assembled
Full thirty odd or more.

The gang was now assembled—
Each seated in his place.
When up arose our Beamon,
A smile upon his face.

We toasted them unto his health
Also his wife, so fair
We toasted loud, we toasted long—
They are a splendid pair.

Then up 'rise Cousin Clarence,
And grabbed himself a girl,
He took her on the dance floor,
And there began a whirl.

Of course there was Boss Beamon,
And Beamon's boss was there.
And seated close upon their left
"Zack", I do declare.

Ann was there, and so was "HooksA,
Miss Yaler, also Wright....
Pence danced in with Margaret,
It was a merry sight.

Smith came early, brought a girl,
"Little Sticks" was there,
Armstrong danced with Campbell,
And Dorris danced with Meagher.

And there was "Arizona"
Norcross, Easter too,
You say we had a good time?
Well, I'll agree with you.

Levi, Woodson, and Osgood,
Jehler, also Sagg,
Olson and Muldowney...
bet some gal got a hug...

And thus we dined and danced
Good fellowship did reign,
And everyone enjoyed the night,
....Next day was a pain.

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THE DISINTERESTED OBSERVER

The Press and the Public speaks it's mind about the S.E.S.

Mr. Frank Bohn, in TODAY of October 6:

"It was the enthusiasm of the men in the field that led me to search out the commandant at Washington. His name is H. H. Bennett, and his vigor, enthusiasm, and industry account, I believe, for much of the activity of his forces on the job.

"To early training, education and experience, Mr. Bennett adds the fire of a missionary's zeal in his cause."

Mr. Owen P. White, in COLLIER'S of September 29:

"...And if the energy and enthusiasm with which the Soil Erosion Service has tackled its job can be made to count for all it should, we are not going to do anything like that.

"As a rule, government services are slow to take their feet off their desks and when they do, as a general thing, they move reluctantly about. The men in the Soil Erosion Service, however, who are now at work in twenty-four different stations in the country educating farmers are not like that. On the contrary they constitute about the liveliest gang I ever met, which I think can be accounted for by the fact that Mr. H. H. Bennett, the director of the service, has instilled into every one of his young men the idea that the job he is on is of even more importance to the future welfare of this country than that of a congressman."

Editorial in the LA CROSSE TRIBUNE AND LEADER-PRESS, La Crosse, Wisconsin, September 22:

"Few men in charge of federal projects in the series that has come and gone under the present administration have displayed such enveloping interest in their work as have these soil erosion technicians. They have fused their knowledge with the problems of the farmer in such a way that co-operation with the plan has been more spontaneous than had been hoped for in the beginning."

Editorial in the FORT WORTH STAR TELEGRAM, Fort Worth, Texas, September 12:

"In the development of the program to prevent soil erosion, which is one of the most constructive projects of the Administration at Washington and is winning widespeead farmer cooperation....."

Editorial in the BOSTON TRANSCRIPT, Boston, Sept. 10:

"There is one PWA project that deserves from every American the most resolute and far-reaching support. With$10,000,000 alloted from the Public Works fund, the Department of the Interior is fighting to save millions of acres of this nation's arable land from destruction.

"No such effort can be too great, if under the supervision of competent specialists.....Upon the outcome of this campaign there depends the whole future, and to a far greater extent than most people realize, the present welfare of American civilization."

Editorial in the SAN ANTONIO EXPRESS, San Antonio, Texas, August 30:

"As the soil is one of the most valuable assets which the country possesses, no phase of President Roosevelt's 'national economy' program is more important than planned use of the land."

Editorial in the ATLANTA JOURNAL, Atlanta, Georgia, August 29:

"A service more essential to America's fundamental industry can scarcely be imagined....But at last this all-important work has begun in earnest and effectively. It means a new day of security and prosperity in the country at large..."

Letter from Mr. J. E. NOLL, Bethany, Mo., October 10:

"The citizens of North Missouri appreciate the splendid soil erosion and flood control work being done by the U. S. Department of Interior, through the Soil Erosion Service in the Big Creek demonstration area.

"There is no question in my mind, but that agriculture will derive more lasting benefit from this work than from all other methods and plans being undertaken by the Government...

"I am handling 69 farms in Harrison County, Missouri, containing 15,092 acres, 6 farms in Kansas containing 3800 acres, and without question the greatest problem that confronts me in handling this land is how to operate at a profit and at the same time not lose the top fertile soil."

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TEXANS STUDY EFFECT OF EROSION ON COTTON

All cotton ginned at twelve of the gins within the Temple, Texas watershed is being classed and graded by a specialist from the Bureau of Agricultural Economics. The project staff is thus enabled to make a study of the effect of erosion and erosion control methods on grade and staple of cotton.

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CONTRACT RAMBLINGS

A humorous outline explaining the necessary steps in putting a contract through the mill. Itwas written by Shane MacCarthy, Contract Clerk, who we suspect had afew impatient Chief Clerks in mind.

A special research bureau has been working steadilysince the advent of the Soil Erosion Service, diving into the annals of antiquity trying to unearth the Goddess of Contracts. From unpublished information we have just learned by rumor that her habitat is the planet "Impatience", and her name is Adbico, which her father, the god named "Rush" gave her, deriving said cognomen from the first two letters of each of the words Advertisements, Bids, and Contracts.

Under the ever watchful eye of Adbico, the Advertisement is born, and grows through the "bidding" years of puberty until it is married by the contracting officer to "Award" and under the married name "Contract" lives through its allotted span of life. Could an advertisement talk, we might hear this conversation:-

Chief Clerk: "I think you are now ready to leave on life's journey."

Advertisement: "Listen, dumb egg, please put on my 'Compliance-paper' vest before I venture out."

Chief Clerk: "There you are. Thank heaven I won't see you for 10 days. Goodbye."

Advertisement: "Youthink you're clever, eh! Bet you don't even know my component parts."

The Advertisement goes to the bidder:

Bidder: "Who on earth fixed you up this way?"

Advertisement: "That sap, the Chief Cluck, and his assistants."

Bidder: "You don't look so bad to me so I guess I'll tattoo you a little with figures."

Advertisement: "O. K., but you have not yet signed my Compliance."

Bidder: "All these darn Compliances give me a code-in-the nose. Do you get it? Now you're like a mature individual. SIeep in this envelope for a few days until your Chief Clerk friend opens you and smiles graciously at the marks I put on you."

Advertisement sleeps placidly for a few days, until the shrouds are ripped and he is face to face with the Chief Clerk.

Advertisement: "Hello, here I am, a mature individual. Now look me over."

Chief Clerk: "You look horrible. I must see some of your incoming companions."

The Chief Clerk looks at the others and in disgusted fashion comes back to poor Advertisement, looks at him, writes a letter to Washington and like an old-fashioned match-maker recommends the marriage of Advertisement to Award. Advertisement, along with the other eligible suitors, is shipped to Washington. The Contract Section in Washington sees them and notes that the Chief Clerk has said "Please Rush". So Advertisement and companions are relayed to the Purchasing Office. In the Purchasing Office the eligibility of the various suitors is fully tested. During this period the eligibility of checked while the "Rushers" in the field are sending letters, telegrams, etc., asking for the marriage date. Eventually, Advertisement is hooked up with Award. The union is unique in that a new name is adopted -- "Contract", and the result is many necessary items are born to supply the needs of our workers.

Just another contractucal marriage. The Goddess Adbico smiles on.

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DROUGHT WORKS BOTH WAYS IN KANSAS

by F. L. Duley
Regional Director

The drought in this region during the past summer was the most severe on record. This has worked both to the advantage and disadvantage of operations on this project. There has been so little rain that we have had few opportunities to demonstrate the value of the different phases of our program. Some rains have fallen recently which have shown very forcibly the value of contour planting of row crops even though the crop itself had made very little growth. The contoured fields showed water standing during the rains along each row, the soil absorbing the water, with little or no runoff taking place. Some of the brush dams and other types of dams have had no chance until recently to catch sediment, but have proven very satisfactory in practically all cases so far. In some instances considerable fills have been made. Trees planted during the spring started in good shape, but the prolonged drought and intense heat killed most of them although some have come through in a fairly satisfactory manner. The dry weather has also prevented the seeding of erosion control crops such as grass, alfalfa and sweet clover. The readjustment of our cropping systems will, therefore, really not begin until the spring of 1935.

On the other hand, we have been able to take advantage of the dry weather and the AAA program, due to the fact that there has been unused land available all summer on which we could work. We moved onto the contracted acreage to do terracing after the farmers planted much of their land to corn. In June it was evident that the small grain crop had failed and many farmers permitted us to go through their wheat and oats fields because their crops were not worth saving. Following this, the complete corn failure enabled us to go into corn fields and build terraces and other structures in July and thereafter, whereas, if a good corn crop had been produced, it would have delayed our work until October or later.

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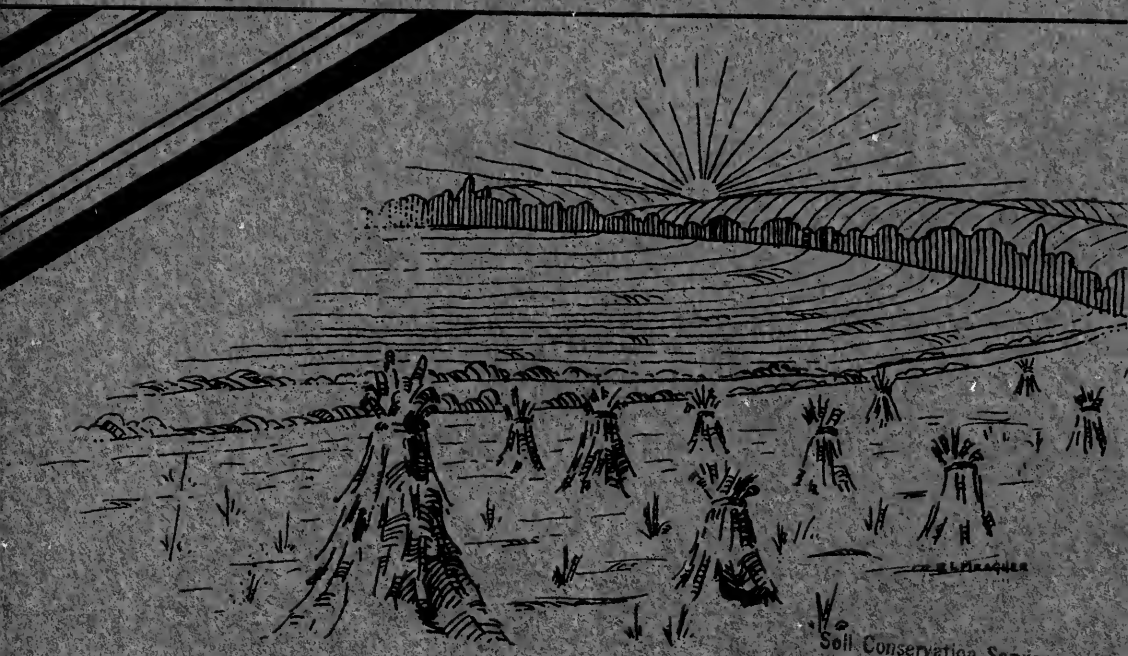
Soil Conservation Service
Region 4
Division of Information and Education

1-2

NOVEMBER
1934

THE LAND

TODAY AND TOMORROW



Soil Conservation Service
Region 4
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OFFICIAL
BULLETIN

SOIL EROSION SERVICE
U.S. Department of the Interior

VOL. 1 NO. 2

THE LAND
TODAY AND TOMORROW

Issued Monthly by the
U. S. SOIL EROSION SERVICE
Department of the Interior

Harold L. Ickes
SECRETARY OF THE INTERIOR

H. H. Bennett
DIRECTOR, SOIL EROSION SERVICE

AN IMPORTANT STATEMENT FROM THE DIRECTOR

My attention has lately been directed to an apparent misunderstanding on the part of other agricultural agencies in certain sections of the country regarding the aims and purposes of the Soil Erosion Service.

Since its inception, the Soil Erosion Service has sought continuously the active cooperation of every farm organization, whether federal, state, or private in character. In most sections, as a result, the most harmonious relations now exist between the Service and kindred agencies.

Any program of operation or expansion which did not have as a basic factor this indispensible element of cooperation with other forces working for the betterment of farmers and their land, would merit not a moment's consideration by the Soil Erosion Service.

It is the sole purpose of the Service to develop a national program of expansion in which it will work hand in hand with the Extension Service, the State Colleges of Agriculture, the State Experiment Stations, and all other organizations which can in any way contribute to the continuing welfare of the land and those who till it.

H. H. Bennett

PROJECT WORRIES

Athens, Georgia

View from Hix Gully, showing laterals due to improper terrace outlets.

This land was formerly cultivated. Erosion in 25 years has left barren wastes.

Sodded Terrace Outlets

By I. K. Landon

CHIEF AGRONOMIST WISCONSIN AREA

Flat bottomed waterways prove that terrace outlets may be economical and still do the job.

Approximately 8% of the area covered by the cooperative agreements on the Coon Creek project in Wisconsin is to be terraced. To workers on other staffs this may seem to be a very small percentage for terracing, but there are several reasons for this condition. Among these reasons are the facts that more than half of the area is occupied by steep woods and permanent pastures, and that the terraceable land lies on a plateau with a 400 to 500 foot vertical drop to the main valley floor.

The limiting factor on many fields is the difficulty in finding or preparing adequately protected outlets for the terraces. We have built outlet structures of rubble masonry, of logs, and rock filled log cribs, but find that the cost per acre protected is too high to make these outlets feasible for farmers outside of the demonstration area who do not have labor and materials furnished by the government. Then too, the psychological effect of elaborate structures in a field is not good.

In working out an inexpensive and yet adequate protection for our terrace outlets we have put in quite a few of the type shown in SES-1-241. These waterways are flat-bottomed to insure an even distribution of the water and are built with a cross section large enough to handle the maximum runoff without having the water more than 3 inches deep in the outlet channel. As more terraces are emptied into them they are widened and the water is emptied into a grassy draw or well protected woods.

The logical way to construct such an outlet would be to shape and grade the channel and seed it. Then after a few years, during which the sod had time to become well

established, the terraces should be constructed and emptied into it.

The necessity of completing our program by June 30, 1935, precludes this method of construction and necessitates the grading of the outlet channels at or after the time the terraces are built, and the immediate protection of them by transplanting sod. This is more expensive than seeding but less expensive than structures have been on our project and has the destined advantage of appearing reasonable and practical to the farmers.

One of the requisites of this type of outlet is an adequate supply of good sod within reasonable distance. Beginning with the conditions as left by the terracing crew as shown in SES-1-202, a crew of seven CCC boys, with a half-ton pickup, and under the direction of an SES foreman, shaped the ditch by hand, cut, hauled, and laid the sod at the rate of 1 square yard per man hour of labor.

The sod is cut in strips approximately one foot wide and as long as the width of the outlet ditch including the sloping side banks. The sod strips are cut loose

SES-1/202. Field north of home showing terrace outlet channel after terraces have been built but before any work has been done on the outlet channel. Sept. 24, 1934.

with an axe or shovel and are moved by slipping 1" x 12" boards under them and hauling them on these boards to the outlet where they are laid directly in place, laying the strips across the channel. These strips are then fastened down with large staples made of No. 9 wire, extending 6 to 8 inches into the ground. The sod is then tamped to insure close contact with the soil and is watered if necessary.

If it is necessary to construct the outlet with a gradient greater than 12 or 15 percent, level spreaders of masonry or creosoted lumber are placed every 10 to 20 feet as a precaution against the concentration of the water in one portion of the outlet ditch. Such outlets likewise prove quite satisfactory. Water from large tracts may be safely carried down rather steep slopes with safety.

SES-1/241. Sodded terrace outlet on E. H. Johnson farm, Vernon County, Wisconsin. This is a repeat photograph of the same land in the previous picture. Oct. 15, 1934.

Harmful Effects of Erosional Waste

By Henry M. Eakin

SPECIALIST IN SEDIMENTATION STUDIES

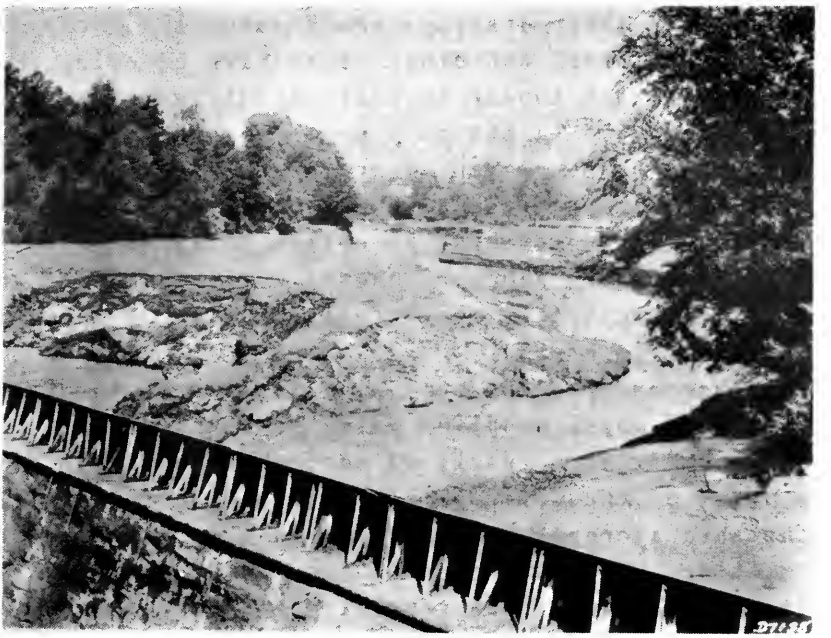
Accelerated erosion naturally entails accelerated production of erosional waste. An extra burden of soil, sand and rock waste is thus thrust upon the streams that flow out of abnormally eroding areas. This they must carry away and redistribute at lower elevations -- in valley reservoirs or in delta areas at mouths of streams

The effects of this extra burden of debris are generally harmful. The affected streams tend progressively to shoal their original channels, to flood their valleys more frequently and to higher levels, and to build up steeper slopes by aggrading banks and bottom lands. Rich bottom land soils are thus buried under new deposits of inferior soil, generally lean, sandy, poorly drained and given over to natural brush and timber growth or seasonal pasture. The steepening of grades increases the volume and the coarseness of grain of load delivered downstream, whether into a reservoir or into a succeeding stream of the river system. Valuable reservoirs in the course of such debris trains are filled up with unfortunate rapidity. In the absence of reservoirs the influence of overload in headwater streams extends with time toward the trunk streams of even the largest river systems, and eventually induces in them some measure of shoaling, steepening and aggravation of floods, according to the prevalence and intensity of accelerated erosion in their watersheds.

Manifestations of these harmful effects of abnormal output of wastes are apparent in all regions of accelerated erosion. In the South, thousands upon thousands of acres of rich bottom lands have been replaced with so-called "meadow" soils which support little besides natural wilderness. In the West in similar fashion, the once

best grass-lands of valley bottoms have been extensively replaced by barren, ridged and channeled wastes of sand and gravel.

In both South and West rapid silting of reservoirs is in force. In the Southern Piedmont Region broadly representative rates of silting in excess of 60 acre feet a year per 100 square miles of drainage area have been determined. In the same region some 13 major reservoirs have been completely filled within an average period of less than 30 years, all of them with first-class concrete or masonry dams hundreds of feet wide, and ranging up to 50 feet in height.



Topsoil, carried from the drained farm land by the Pacolet River in North Carolina, has silted this dam almost to its top

In the Black Land regions of Texas, which are notedly erosive, the rate of fill determined for one small but significant headwater reservoir is 568 acre feet a year per hundred square miles of drainage area, or nearly 20 tons a year for each acre draining into the lake. In other regions of Texas, with less erosive soils but where erosion has been accelerated by agriculture and overgrazing, as at Lake Waco, Lake Worth and Lake Penick, some what less but still high rates of silt accumulation are in evidence.

In the semi-arid Southwest, where overgrazing is mainly responsible for accelerated erosion, very material rates of silting are generally affecting the large reservoirs of important irrigation projects. Previous surveys made under other auspices have shown the Elephant Butte reservoir in New Mexico to have accumulated 231,500 acre feet of sediment in the ten year period of 1915 to 1925, which gives a rate of 72 acre feet per acre per hundred square miles of drainage. Comparative rates for the Zuni Reservoir at Black Rock, New Mexico, and Roosevelt Dam on Salt River in Arizona, are shown to be 90 and 116 acre feet a year per hundred square miles of drainage, respectively.

In California, most reservoirs are high in the mountains and have their drainage areas naturally protected with chapparal brush and other vegetative covering. Generally they do not appear to silt rapidly under natural erosional conditions, but only under accelerated erosion following the burning over of drainage areas. A case in point is the Harding Reservoir which silted but little until its basin was overrun by a fire in 1927. Heavy rains the following February caused a great deal of erosion and the practically complete filling up of the reservoir in a single month.

Another case of the same kind is that of the Gibraltar Reservoir which supplies water to Santa Barbara, California. Here, as a result of successive burns in different parts of the drainage basin from year to year, a very notable increase has occurred in the rate of reservoir silting, which has created the prospect of a serious shortening of life of the remaining storage capacity of the reservoir. Due to 7 burns within 11 years, from 1922 to 1933, the rate of silting of 80 acre feet a year per 100 square miles up to 1925, was followed by increased rates of 125 acre feet up to 1931, and 300 acre feet a year per 100 square miles of drainage up to 1934.

The foregoing bare outline of effects of abnormal erosional waste shows the general nature of the harm it does to valley lands, to flood control, to navigability of rivers and to water supply for municipal, irrigation and water power uses. Further investigations appear eminently in line with public interest to show the full picture of inroads already made upon developed resources

and the menace to longevity of other projects now building or contemplated for the early future. It is already clear, however, that these inroads have been serious and that the menacing, man-induced processes are destined to continue -- and at increasing rates -- unless corrected through man's ingenuity and enterprise.

The inherent relation of excessive sedimentation to abnormal erosion points directly to erosion control -- control of sources of sediment -- as the major means to bring these adverse processes within economic bounds.

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FECHNER INSPECTS SALT CREEK AREA

Tour of inspection of the Salt Creek project, Ohio, was made November 3 by Robert T. Fechner, National Director of Emergency Conservation Work. He was accompanied by Wm. A. F. Stephenson, Chief of Operations of the Soil Erosion Service, and J. G. Lindley, Supervising Engineer of Emergency Conservation Work for the Soil Erosion Service. The tour included the Salt Creek watershed as well as work done by the CCC camps in Southeastern Ohio.

A field day of officials and enrollees of CCC units for the district was arranged, Mr. Fechner addressing an audience of over 1,000. This was the first opportunity which had been taken by Mr. Fechner to inspect the work of the Soil Erosion Service and attend a field meet of these proportions.

In the evening a banquet arranged in his honor by the Soil Erosion Service and the Zanesville Chamber of Commerce was attended by over two hundred persons representing the various cooperating agencies in the CCC work.

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MAJORITY OF TEXAS FARMS CULTIVATED

About ninety percent of the land in the Temple, Texas project is in cultivation, and more than sixty-five percent is farmed by tenants. Majority of the farmers in this region do their work with mules, only a few owning tractors.

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A Rookie Looks At Soil Erosion

By Ewing Jones

Who marvels at the utter desolation resulting from erosion, the prevalent apathy, and how easily the soil wastage may be curbed.

I can remember soil erosion from my boyhood days in Oklahoma. We used to have pictures of it in our geography. Occasionally we would play out near the levee north of Pauls Valley, and romp up and down the gullies. "That's erosion", we would comment, and promptly forget it.

Nowadays, since I have become inured to the atmosphere of erosion control and inoculated with the entrancing fever which seems to grab one who makes a study of this engrossing problem, the same apathy towards erosion is even more noticeable in the lay mind. Sure, we have erosion, is the general consensus, and straightway, it is forgotten.

"What do you do?" I am asked.

"Soil Erosion Service," I always say with a show of pride, "working to control erosion over the country."

"Oh, yes," is the inevitable answer, "terracing."

Then I very carefully explain that it isn't just terracing, that our work also includes strip-cropping, revegetation, rededication, and the many ramifications in the coordinated program.

This hasn't happened two or three times -- but at least a dozen. It is positively amazing to note the scarcity of knowledge about just what erosion is and what is being done about it over the country.

But I must admit I had the same idea until I was initiated. We started out in the Tennessee Valley Gus

Lentz took us down a steep ravine, about 20 feet deep, I guess it was, and half a mile long. That gully had been started on purpose! It was kept alive on purpose! The owner of the farm had driven his plowshare down the center of his field two or three times to start a gully so that he wouldn't have to put up a fence to separate his fields. He got his gully -- and he is getting more every year, and apparently does not care.

No laughter emanates from this farm home. It has been abandoned, the fields riddled with erosion.

Another good old T. V. pioneer followed the archaic but quite popular method of running his furrows up and down the hill, and letting the land lie fallow each winter.

"Here, man", we pointed out in a burst of outraged dignity, "don't you realize that during the winter every rain carries off a sizeable layer of your top soil?"

His eyes gleamed. "Sure, that gives me fresh soil to till each year. See?" That's downright pathetic.

The hills down there are plenty steep, and many should have been left in timber. Why, Mr. Batten, a small town real

Erosion control as practiced in Wisconsin. Strip-cropping holds this soil, and the land pays dividends.

estate man and a dead ringer for Eugene Pallette, told us that pencil companies had bought up the old cedar rail fences down there, sometimes paying more for the fences than the farms themselves would bring!

Across to Oklahoma. Charlie Hollopeter took us out over the Stillwater area. I asked him why it was that the grass strips bordering the fields were 7 to 10 inches higher than the fields themselves.

"Come here," he beckoned, and led me out to the field. What looked like cultivable ground from the highway was really nothing but harsh red subsoil. Even sunflowers wouldn't grow on that. Sheet erosion had robbed the field of its entire topsoil -- but the grass held the shoulders in their virgin profile.

We went on down to Texas, just in the wake of a 3 inch rain. In the rich black belt, on a half-acre experimental plot, Geib showed us where tons and tons of fine top soil had been swept from a fallowed field by that one rain, while on an adjacent field, strip-cropped with oats and cotton, the runoff was negligible; a third plot, covered with grass representing permanent pasture, showed no runoff! Yet the farmers in that vicinity protested to the state highway commission because it was using bermuda grass to hold the shoulders along the highways.

We talked to a farmer who had seen his neighbor's contour furrowed field hold his soil during that heavy rain, while his own field was badly rilled and gullied. Yes sir, he wanted to come into the project program now. Encouragement!

Westward we continued to the Navajo. Here were encountered two remarkable "before and after" scenes in real life. One was down in a sand swept region near Jeddito, in the Keams Canyon district. Sand dunes had almost covered a "hogan", or Navajo dwelling, and were gradually creeping farther. The Navajo grinned as we gaped at the impending danger. "Pretty soon hafta build 'em higher," he commented tersely. A mile farther, we ran into quite an enterprising man by the name of Wilma Roberts. A big gully was cutting through his land -- he ut a stop to that with cottonwoods and willows. Sand dunes were creeping toward his home. He promptly put up simple fences, and the dunes were halted.

Another vivid scene was where a fence divided an

area. On one side was a fine stand of native grasses -- on the other, erosion pavement: harsh, pebbly, interspersed with a few dead tufts of sagebrush. Overgrazing had taken its toll.

We had seen photographs of bench terraces with which the Incas in the Colca Valley of Peru had controlled erosion on steep hilly lands and still cultivated them. In California we found a few duplicates, in rich citrus orchards. Some of them have been in use for several years, others were just being built, and again it was encouraging to note that someone was realizing that immediate steps were necessary if the land was to survive.

The Palouse region in Washington and Idaho is a billowy land, quite resembling ocean waves. The practice of summer fallowing these fine wheat lands was taking its toll -- but where the farmers kept their steepest slopes in native grasses, or alternated their wheat with clover or peas, all was quiet on the western front and on the eastern front too, and these were income-producing crops.

Although little has been said, much was noted over the country of the works, the *varied, coordinated* works, which were being applied to these problems. And as the rookie ended his initiation, three things stuck in his craw: the large areas destroyed by erosion and the utter desolation which can result therefrom, the ignorance of the majority on this major national problem, and with what small effort erosion can be avoided.

The rookie had his initiation -- and it ended with the warm feeling that the days are on the wane when gully control means tossing a worn out auto body into the ditch. Uncle Sam has substituted a coordinated attack which has stuff on the ball.

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AIN'T IT SO

by Wm. Fentress
ASST. AGRICULTURAL AIDE

I been lookin' 'bout th' farm
'N hit durn nigh makes me sick,
T' see th' dirt a-washin'
Frum th' pints down to th' crick.

It haint been so long ago
Since that thar knob wuz green,
With lotsa them thar big white oak
'N walnuts in 'atween.

But Pap tho't he wuz short o' dirt
Just after I wuz born,
So he jist ups an' cuts 'er off
'N put 'er all in corn.

But if ole Pap wuz livin' still
He shore would see his folly
Cuz all 'at's left on that thar hill
Ain't nuthin' much, by golly.

THE DISINTERESTED OBSERVER

The Press and the Public
speak their minds about the S.E.S.

Editorial in the Washington, D. C. DAILY NEWS:

"In view of the staggering losses of America's soil wealth from erosion, there can be only one criticism of Secretary Ickes' transfer of $5,000,000 of PWA funds to the Soil Erosion Service. It is not enough.

"H. H. Bennett, Director of the Service, estimates....

"This is not the alarm of a disaster-monger; it is the calm conclusion of a responsible scientist...In view of these past and future losses the $10,000,000 we have spent is a pittance. Yet it is a tribute to this Administration that it is the first in 150 years to sense the danger and try to do something about it." (Nov. 6).

Editorial in the High Point, N. C. ENTERPRISE:

"Revealed as one of the major employers in the local scene is the Soil Erosion Service, which ....is distributing some $425,000 annually to the several hundred employes....in this community...

"Helpful as is that payroll to the commerce of the community, the greater benefits of it rest in what is being accomplished as a direct result of that expenditure....The program...is an insurance that farming will continue to prosper and protect its base -- the land -- for the prosperity of future generations." (Nov. 2).

Drew Pearson & Robert S. Allen in nationally syndicated column, "Washington Merry-Go-Round":

"Determination of the Soil Erosion Service to hire 1,000 additional college boys is not mere lip service to shrines of learning.

"Behind it is experience which the service has already had...tapping...intellectual curiosity...." (Oct. 30).

Editorial in the Columbia, S. C. STATE:

"Our present administration, through its Soil Erosion Service of the Department of the Interior, is trying to arouse people to realize that 'merely because our forefathers ruined millions of acres of good farm land is no reason why we should gold-brick our posterity by handing them a country they can't live on'". (Oct. 30).

Editorial in the Nashville, Tenn. TENNESSEAN:

"The Soil Erosion Service of the United States Department of the Interior...has...decided to train a limited number of graduates of agricultural colleges for the work...The program should suggest an opportunity for agricultural schools to extend their activity into a field for which, until now, there has been no great demand, but for which there is likely to be a great demand in the future..." (Oct. 29).

Editorial in the Atlanta, Ga. CONSTITUTION:

"America has no greater problem affecting its natural resources than the annual loss from erosion. We have been inexcusably blind to these losses in the past, and the task of checking them is thus made more difficult. It will require the development of highly trained and intelligent leaders in every state. To this end the new employment-instruction system can prove of invaluable aid." (Oct. 26).

C.A.F., Government news columnist, in Washington, D. C. DAILY NEWS:

"The idea of a 'school' to train Government employes for bigger and better places in the public service seems to be getting somewhere. The Soil Erosion Service of the Interior Department today became the second agency

within a month to take up the idea...

"...the plan, if carried on at this rate, will undoubtedly completely revise federal employment....Soil Erosion, of course, is not under civil service, but it probably will become a permanent organization." (Oct. 24).

Letter from Joe R. Jones, County Engineer, Kingfisher, Oklahoma:

"I was really impressed with the work they are doing at Stillwater. No doubt the Soil Erosion Service is doing great things..." (Oct. 16).

Editorial in the LaCrosse, Wis. TRIBUNE AND LEADER-PRESS:

"...As these projects have been launched, one after another, and as the benefits derived by farmers have become more and more apparent, there has been a growing demand on the part of land owners for continued and increased participation by the government in this work. The skepticism which met early efforts by the government has subsided almost entirely, and in its place has grown a more complete understanding with the result that more and more farmers are welcoming the erosion experts to their farms." (Oct. 19).

Editorial in the Dallas, Texas MORNING NEWS:

"The new federal project in the Panhandle, which has for its purpose the stopping of soil erosion by wind, is not contemplated as a giant Government enterprise involving large expenditures. It will lead the way by experimentation and example and thus help the farmers to help themselves.....The experiment near Dalhart may mark the beginning of a new era in PanHandle farming." (Oct.14).

Editorial in the Portland, Ore. OREGONIAN:

"There no longer exists any doubt that erosion is taking annually a menacing toll from the wheat lands of the two states (Washington and Oregon)...Any program looking toward the checking of this annual loss should be hailed with enthusiasm..." (Sept. 30).

Overgrazing – A Popular Fallacy

By Lyman Carrier

CHIEF OF THE BRANCH OF AGRONOMY

If a person has a headache it is a good plan to locate the source of the ailment. It may be caused by eyestrain requiring the services of an optician or it may be caused by indigestion needing an entirely different treatment. Likewise there are many different causes for low yields of farm products. This is generally recognized in the production of crops. A striking exception must be noted, however, for grazing deficiencies. So common has become the habit of attributing poor pastures to "overgrazing" that few agricultural writers appear to realize that there might be some other factors involved.

The fact that uncontrolled overgrazing has brought ruin to much of the dry Western range country is no reason for thinking that close grazing is equally as harmful in the humid regions. In one case the best grazing plants are annuals which must mature seed to reproduce themselves, in the other the best plants are sod forming perennials which do not need to produce seed to multiply. In fact they make much better turf if prevented from going to seed.

Most of the agricultural literature of this country dealing with pasture management is unscientific, that is, conclusions are drawn which are not based on or justified by facts. One type of article common in farm papers would be amusing were it not doing so much harm. These articles start with a dissertation on the evils of overgrazing, how the pastures of a whole neighborhood have been devastated by this nefarious practice. Then the hero is introduced. He is the one farmer in that locality who does not overgraze. His pastures are like the lawns of a city park. Incidentally, before the article closes it comes out that the pastures on this farm are carrying two to several times as many grazing animals as the same acreage on the neighboring farms. It seems never to occur to these writers that the increased number of

animals might have some bearing on the creation of the lawn-like turf.

Most poor pastures in the humid regions are poor because the soils are not fertile. The fields may have been cropped to death before turning into pastures. The topsoil may have been washed away. They may have been grazed for generations without any manure or fertilizers being applied. If any of these reasons are the cause of the poor conditions, reducing the number of grazing animals is not going to bring about the desired improvement.

The road to pasture improvement where turf forming grasses and legumes are involved is as well defined as the Lincoln Highway. First, lime to the need of the soil. Second, give a good heavy application of stable manure or commercial fertilizer. Third, keep the vegetation grazed down to two inches. Fourth, if the grass grows faster than the animals can graze to two inches, get more animals or clip with a mowing machine. The farmer who follows these directions will go down in history as one who does not overgraze.

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Pasture Management and Erosion Control

By Harold Tower

AGRONOMIST NEBRASKA PROJECT

Note: The Plum Creek project in Nebraska is on the border line between the annual bunch grass type of grazing lands of the western ranges and the turf forming grasses and legumes of the more humid Eastern areas. The observation that blue-grass and buffalo grass thrived under heavy grazing is especially interesting. The question: is it best to plan pastures to withstand a repetition of the extreme drought conditions of 1934 or for best results under normal rainfall should be given careful study. Lyman Carrier, Chief of the Branch of Agronomy.

The drouth which occurred throughout the Middle West this past year has resulted in considerable damage to native grass pastures. The exact extent to which the different grasses have been killed or the plants weakened so

that growth will be slight for the next few years is yet unknown, but it is certain that material and lasting ill effects will be noticed. However, not all pastures in the Plum Creek area were injured to the same degree. Striking differences in the appearance of native pastures are beginning to show since the grasses have had a chance to resume growth this fall. Pastures which have been properly handled in the past show little ill effects of the drouth while pastures, which have been continuously overgrazed for several years for the most part are in very poor condition.

These overgrazed pastures do not now contain to the original native species in the same proportions that once made up the prairie vegetation. Big and little blue stem, needle grass, side oat gramma, western wheat grass and others have decreased considerably in amount. In their place is found Kentucky blue grass which, because of its aggressiveness in early spring, was able to establish itself and spread rapidly under heavy grazing conditions. Also, blue gramma and buffalo grass, both native grasses, have increased under overgrazing practices. However, this year Kentucky blue grass was killed to a large extent. Other grasses have succumbed to a much less degree. Therefore, the drouth, although responsible for the damage this year, would not have been so damaging had not overgrazing preceded it.

Overgrazing not only reduces the amount of pasturage produced, but it also affects erosion. In this area the pastures occupy for the most part the roughest lands on the farm. The slopes are often quite long and steep with "cat-step" formations along the sides. When the vegetation is grazed closely it offers little resistance to runoff flowing down over the "cat-steps" and gullies are thus often started. Likewise, excessive runoff congregating in a main drainage channel causes gullying where the slope is above a silting grade. A good growth of grass on the hillsides would greatly reduce the amount of runoff that occurs during heavy rains and lessen the chance for gully formation. This water saved would in turn increase the production of the pasture. Good grazing practices are of great importance both from the standpoint of increasing pasture production and decreasing erosion.

On the Plum Creek project there is need for addition-

al pasture acreage. Pasture is the cheapest feed the farmer can produce and is essential to profitable livestock production. The Soil Erosion Service is doing much to increase the pasture acreage on cooperating farms in this area. In the majority of cases seed of permanent grasses is being furnished for seeding down the roughest and most eroded land areas. However, if these seedings are to be successful from the standpoint of producing pasturage and controlling erosion, they must be managed properly. Deferred and rotation systems of grazing will be encouraged where the pasture acreages are large enough to justify dividing the fields. The use of temporary pastures such as rye, sudan grass, and sweet clover to supplement grazing of permanent pastures will also be encouraged. A good pasture program diligently followed together with the fencing off and stabilizing of present gullies with engineering structures and plantings of trees, shrubs and grasses should do much to eliminate the pasture erosion problem in the future.

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NORTH CAROLINA GRANGE APPROVES WORK

Statewide approval of the work of the Soil Erosion Service in North Carolina was shown by members of the State Grange in a resolution recently adopted at a meeting in Lumberton.

The resolution commends the government in its effort to arrest soil erosion in North Carolina and other states, and recommends that increasing attention be given to soil conservation as a permanent national policy and that a reasonable share of money be expended to strengthen the erosion control program of the Department of the Interior.

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LIONS CLUBS TOUR GEORGIA AREA

Royston and Lavonia Lions' clubs, under the direction of W. T. Ray, District Governor of Georgia Lions clubs, recently sponsored a tour of the Athens, Georgia, area.

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DATA RELEASED BY LINDALE PROJECT NOTEWORTHY

Data assembled from the first 25 cooperative agreements signed by the Lindale, Texas project and cooperating farmers reveal interesting changes being made in farm organization.

The objectives sought are control of erosion, flood reduction, and better land use, Regional Director Louis P. Merrill has pointed out, in releasing the following data:

Total acreage	2,751.6
Acres to be retired from cultivation	184.0
Acres to be rededicated to pasture	163.3
Acres to be rededicated to forest	20.7
Acres to remain in cultivation	1,431.0
Acres to be contoured, strip-cropped and terraced	1,131.8
Acres to be contoured and terraced	5.3
Acres to be contoured and strip-cropped	231.4
Acres to be contoured	1.1
Acres to be in crop rotation	1,369.0
Acres to be in pasture	696.5
Acres pasture to be contour furrowed	696.5
Acres pasture to be seeded	629.2
Acres to be in timber	501.8
Acres to be planted to timber	40.8
Acres to receive gully control	1,282.0
Acres to receive rodent control	2,751.6
Number fields under old form plan	515.0
Number fields under new form plan	263.0

Staff education, farmer education, careful farm planning, plus some salesmanship are responsible for the improved practices as outlined, Merrill stated.

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WASHINGTON STAFF HEADS TRAVEL

The middle of November found many of the Washington staff in the field. Dr. W. C. Lowdermilk, Vice-Director, left on an extended field trip to the West. B. P. Fleming, Chief Engineer, left November 13 for the Southwest to launch the Gila project. Director H. H. Bennett and Technical Secretary R. A. Winston were both in the South.

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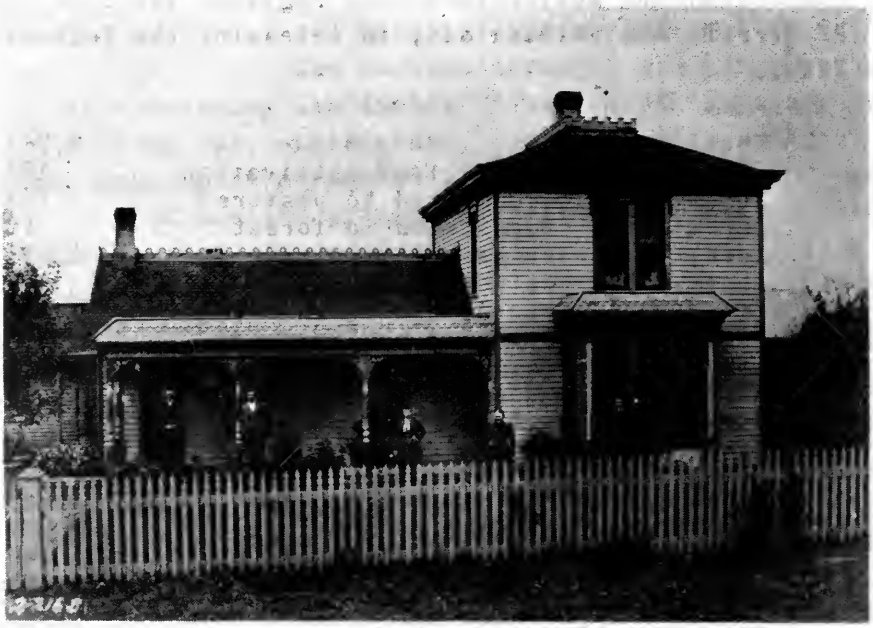
The Teale Farm — Then



That soil erosion can end in abandonment, not only of the land but of human hopes, is graphically illustrated by a set of pictures recently displayed by the Bethany Mo., project, as an example of the gullying which is rapidly encroaching upon the rich bluegrass pastures of that area.

This particular farm was obtained from the Government in 1853, the Teale family assuming possession in 1881. The house, then considered one of the most beautiful homes of the community, was sold by the family in 1900.

There were no gullies on this farm when it was owned by them, according to Mr. Teale -- in fact, there were hardly any in the community. Present condition of the farm was caused by force-farming since the World War. Today the house stands abandonded, dejected, the farm stripped by gullies which are still eating back.

----------and Now

Above: the house as it stands today. Below, Mr. Teale(who is at the extreme left in the photograph on the opposite page), is shown as he revisits the old homestead. The background shows quite well why the house has been abandoned.

Mapping at Stillwater Creek

by Charles A. Hollopeter

SOIL SPECIALIST OKLAHOMA PROJECT

Mapping, as a source of basic information on the Stillwater Creek project in Oklahoma, is one of the most important phases of the soil erosion project. Preliminary mapping includes a detailed soil survey, the land utilization, slope conditions, severity and extent of erosion and as much history of the cropping methods as can be obtained as a basis for the development of a satisfactory erosion control and soil building program.

These maps are made in the field by the use of a plane table at a scale of one inch to 500 feet. This gives a map of slightly over 10½ inches to the mile, which shows the complete detail of every farm unit, including fences, trees, houses, and in fact everything that goes into a complete farm map. These maps after having been constructed in pencil are inked in with six different colors, each color symbolizing some definite object.

When the plane table map is complete it is turned over to the draftsman who constructs a tracing. With careful labeling, he is able to show the farm divisions, fences and size of fields, taking all of the legend off the base map except the technical soil notes.

By using this base tracing, innumerable prints can then be made by using the ordinary sun frame and a black line printing paper. This print then comes out in black lines on a white background The cost of these prints is comparatively negligible.

On these printed maps as a base, the Soil Specialist, the Agronomist, the Engineer and the Erosion Specialist are able to complete the contract map for controlling erosion on the farm. The foreman of each field crew is then able to determine what is to be done by each department of the organization.

A complete bookkeeping system is maintained separate from the contract file to show what each contract calls for. These are kept in book form available to the technical

staff. Another set is maintained to show what has been accomplished toward filling the soil erosion contract.

The aerial pictures of this project area have proven quite helpful in determining the timbered areas and the size and extent of the gullies, but the primary object in showing field boundaries, fences, soil and vegetative conditions has proven misleading in many cases. By using the aerial picture, one man can accomplish the mapping in much less time than when working without it.

The present utilization and condition of each field as found and recorded on these plane table maps offer an extensive clue as to the best methods and the routine of procedure to follow for the greatest advantage to the farmer.

To outline the best method of procedure in bringing about a better program of soil utilization calls for the close cooperation of the Engineer, the Agronomist, and the Soil Specialist before the program is presented to the farmer. Often it has been found that with this basic information available, the soil erosion staff knows more about the soils and crops problems of the farm than the farmer himself.

The Soil Experts are not only charged with making soil surveys but are also responsible for the collection of soil samples to test their need for lime and fertilizer. Upon the basis of these tests recommendations can then be made for their correction. The problems of economic application of fertilizers and planting soil building crops are worked out with the Agronomist to fit the need for each farm. This information is placed upon the printed maps at the time the contract is written.

Special soil problems in the Stillwater Creek basin have necessitated close supervision of terrace-fill construction. These fills, as ordinarily made by the farmer, are composed of materials taken from barren white places within the fields, which are "alkali" spots. These "alkali" spots have proven objectionable as a source of fill material and for that reason it is necessary that the farmer be warned of these facts in advance of his terracing program.

The Soils Department is closely related to every other department. Our aim is to secure a complete inventory of soil conditions upon which a five-year soil conservation and soil building program can be developed for each farm.

BY WAY of BIOGRAPHY

THOMAS S. BUIE

Regional Director, South Carolina

local boy who made good....born February 5, 1896, in Marlboro County, South Carolina...started as clerk in a general country store....at odd times was a rural letter carrier...studied at Clemson College, taking a B.S. in soils in 1917.....at Rothamsted Experiment Station, Harpenden, England, studying soils...an M.S. and Ph. D. from Iowa State College, Field Crops division..... was in the army from 1917 to 1919 and has been working with soils and field crops since...at South Carolina Experiment Station, Georgia Experiment Station....taught agronomy at Clemson College, and became Head Agronomist... aligned for awhile with the Superphosphate Institute, where he edited the Phosphorus Digest..... did great deal of experimentation on soil erosion and control many years before the advent of the Soil Erosion Service....is author of many bulletins along this line..... knows farmers as well as he knows his work...very well, indeed.....energetic, alert...with a southern brogue.....

Coordination Stressed at North Carolina

By J. H. Stallings

REGIONAL DIRECTOR

SECOND IN A SERIES OF ARTICLES ON PROGRESS OF THE PROJECTS

The North Carolina Soil Erosion project area is divided into two units: the Deep River area, consisting of approximately 140,000 acres, and the Brown Creek area of about 60,000 acres. The former has headquarters in High Point, and comprises portions of Forsyth, Guilford, and Randolph Counties; the latter has headquarters in Wadesboro, and comprises portions of Anson and Union Counties, North Carolina, and Chesterfield County, South Carolina.

The office in High Point was opened early in March, 1934, and the one in Wadesboro about three months later.

The ground work for the program in both areas was laid during a series of educational meetings held at strategic points throughout the areas. Prior to these meetings, however, each area was divided into distinct communities were definite farmer organizations were set up. At the first meeting the organization was perfected by electing officers, consisting of President, Vice-President, and Secretary. The President was then authorized to select from five to seven additional key farmers strategically located geographically throughout the community to serve with the duly elected officers as a steering committee for their respective communities. Members of our Extension Department then cooperated closely with these steering committees, emphasizing all the while the necessity of this group taking the initiative and assuming a major share of responsibility for the success of the program.

Additional meetings were held only at the request of the presidents of the various organizations. Numerous repeat meets were requested in each community, however.

First field work was done in the Deep River area the last week in June and the first cooperative agreement signed July 2. Field work was started in the Brown Creek

area about the middle of June, but the first cooperative agreement was not signed until August 21. At the close of business November 3, exactly 437 cooperative agreements had been signed, representing a total of 46,577 acres.

Inasmuch as about 70 percent of the total area is in forest and the farms are small, averaging only about 70 acres in the Deep River area, it has not been possible to remove a large acreage from cultivation. Only 1571 acres have been retired from cultivation thus far.

PROPERLY BALANCED PROGRAM

We are endeavoring to properly balance our program; that is, engineering and vegetative control measures are being given their proper emphasis in a complete land use program. All engineering work is of the highest type and the cost held to a minimum. The quality of the work is well attested by an incident of some three or four weeks ago, at which time we witnessed the heaviest 36 hour rainfall recorded since the establishment of the local weather bureau some ten years previously. At the time of this downpour more than 100 miles of terraces, and over 900 terrace outlets and gully control structures had been completed. Not a break occurred in a completed terrace, nor was a single terrace outlet or gully control structure damaged.

Proper engineering structures are essential to the success of the program, but even at that they are only a small part of the solution. The importance of the proper use of vegetative covers is stressed all along the line. Our terraces, terrace outlets, gully control structures, and terrace outlet ditches are all well supported by proper plantings immediately upon being completed.

Records show that about 85 percent of the erosion occurs during June, July and August. It so happens that soil and climatic conditions are such that we experience no serious difficulty in establishing suitable supporting plantings and covers for all of our engineering structures, not only during this season, but the year around.

Importance of vegetative covers is constantly emphasized and used. Reforestation, seeding to pasture, strip-cropping, cover crops, crop rotation and other practices are constantly kept to the fore.

Thus far, 1571 acres have been retired from cultiva-

tion, 2152 acres have been strip-cropped or agreed to be strip-cropped, 13,663 acres agreed to be terraced, 1300 acres terraced, 609 acres planted to erosion resisting crops; more than 250 miles of terraces have been built, and 3000 terrace outlets and gully control structures completed. 51,465 acres have been mapped by the soils men, 15,497 acres agreed to be contour tilled.

Realizing the difficulty of properly coordinating the efforts of the various departments and individual specialists into a smooth running, well balanced, coordinated unit, a member of the staff was assigned the duties of coordinator for the entire program. For the basis of this portion of the program, a tracing of the aerial photographic map, reduced to a suitable scale, with the boundary lines of each farm in the area accurately located, is used. The map is re-subdivided into the respective communities to conform to the original plan previously explained, each farm being given a number according to a definite system.

Invitations from the farmers are accurately recorded on this map by red pins as they are received. This shows the progress and distribution of interest in the program, and serves as a basis for other operations. As this picture unfolds, the coordinator is able, by the use of different colored pins, and appropriate symbols, to direct the efforts of the various departments along the channels where the greatest amount of good can be obtained with the minimum effort. The activities of the various departments clear through the coordinator, so that some one person is in direct contact with all activities at all times.

No effort has been spared to get our program across to the general public. We established the policy from the beginning to carry our message to all groups sufficiently interested to the extent of issuing an invitation to us to appear before them. Thus far, our staff members have made over 100 public appearances before civic clubs, school bodies, press associations, radios, and others. In addition, approximately 300 items have been prepared and released to the press.

As a result of this extension work, practically every county in the Piedmont section of the state has made, or is making an active effort to get the program extended.

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Some Precautions in Photography

By C. J. Whitfield

FIELD SCIENTIST

Charles J. Whitfield, Field Scientist who has been engaged with E. A. Nieschmidt of the Albion staff in a reconnaissance of the Great Plains, has had unusual success in photographing conditions in the Middle West. Vice-Director Lowdermilk asked Whitfield to delineate his methods of photography. This is his answer.

Focusing:

When a general view of the foreground, midground and background together is desired the camera is focused slightly below the center of the scene.

When details of either foreground, midground or background are desired the focus is set on that particular section without regard to the others.

If a particular object is to be photographed the camera is set up to make the object stand out as clearly as possible from the surrounding area.

Aperture and Shutter Speed:

An exposuremeter is used and one of the suggested combinations of aperture and shutter speeds is employed, keeping in mind that the smaller the lens opening the sharper the picture.

When light values are changing rapidly the reading of the exposuremeter is obtained immediately before the picture is taken.

When the recommended aperture and shutter speeds are not found on the camera the aperture is approximated, but the shutter speed is set on the nearest value to the one indicated and corresponding to the aperture.

General: Film Pack, Camera, etc..

Lens are cleaned before each series of photographs are taken and whenever necessary between photographs.

Film pack adapter is always held by the top and bottom parts of the frame; care is taken never to handle the ends or the broad sides of the pack, as pressure applied at these points permits the entrance of light.

The black cloth is used only for focusing. It is not used to cover the film pack when the latter is in the camera.

The shutter is always tested before a picture is taken.

The tripod is firmly braced before the film pack is inserted.

When focusing against the sun the lens is shaded from the top or side.

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BRANCH of AGRONOMY

The Division of Plant Exploration and Introduction of the Bureau of Plant Industry, U.S.D.A., is cooperating with the Soil Erosion Service through their erosion control nurseries. This cooperation consists in obtaining and testing seeds and plants of those species which are not commercially available. Many of the native grasses of the Great Plains will be made available to the Soil Erosion Service for use in the projects of that area.

Collection of seeds in quantity have been made during the late summer and fall. Several collecting crews have been busy in the field and have collected quantities of seeds for our use.. The drouth cut down seed production in many localities but from the information at hand it is apparent that there will be some seed available of all of the important species of native grasses and other plants having erosion control possibilities. Seed of more than 75 species has been collected.

In the erosion control nurseries, grass nurseries have been set up to conduct experiments with each of the native grassed. Studies will be made of the time of planting, growth habits, root development, ability to withstand drouth, hardiness, seeding habits, adaptability to cultivation, and erosion control possibilities. Physiological studies will be made of the processes in the establishment and reproduction of the plants. These will involve studies of the various factors affecting germination of seeds; the rest period of the seeds and the means of breaking it; longevity; ability of the plants to reproduce vegetatively either by roots or rhizomes; the resistance of plants to extremely low temperatures and drouth, and other characteristics necessary to a plant in order to survive. *Arnold S. Dahl, Associate Agronomist.*

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WILD-LIFE WORK ON COON CREEK PROJECT

Until the appointment of Lawrence E. Hicks last June to the Ohio project and the assignment of Ross O. Stevens to North Carolina on September 1, wild-life work in the Soil Erosion Service was limited to the Wisconsin project. The work was initiated with the appointment of Ernest G. Holt, as Conservation Biologist, on December 1, 1933, and as erosion control operations got underway, environmental manipulations for the benefit of wild-life were made an integral part of the revegetational work. Practically without any fanfare of publicity, this effort towards the management of wild-life as a farm crop has come to attract many specialists in this field of activity.

From its inception, Aldo Leopold, Game Specialist at the University of Wisconsin, has manifested keen interest in the Coon Creek work and has given freely of his time and advice in its advancement. Waldo L. McAtee, of the U. S. Biological Survey, has twice visited the project, and has recently been followed by Clarence Cottom, In Charge, Food Habits Research, and J. Paul Miller, who has been doing research for several years on ruffed grouse in New Hampshire. Ralph T. King, Game Specialist at the University of Minnesota, has twice visited the project, and has expressed the desire to have his entire class look over the work that is being done.

The project has also been visited by Paul L. Errington, in charge of Wild-Life Research, Iowa State College, and by Wallace B. Grange, co-author with Mr. McAtee of the publication of the Department of Agriculture, "Improving the Farm Environment for Wild-Life" (Farmers, Bulletin No. 1719). And in October Gardiner Bump, Superintendent of the Bureau of Game, New York Conservation Department, brought three members of his staff to inspect the Coon Creek work.

Messrs. Holt, Chase, and the other fellows responsible for the Coon Creek development are beginning to feel that some return visits might be in order. They would like to know what these far-flung specialists are doing in their own bailiwicks.

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BIRD PROTECTION IS CROP AID

In many sections the practically complete destruction of a promising top crop of cotton by leaf worms which suddenly appeared in mid-October has again served to emphasize the need of more birds to control insect ravages. The cotton leaf worm has over forty known bird enemies, according to authorities on bird life. Had any one or two species of birds which devour this insect been present in numbers when the leaf worm appeared this fall, the top crop which meant so much to farmers would have been permitted to grow to maturity.

It is not hunters' guns, as important as they are, which chiefly limit the number of birds in an area. It is the absence of adequate cover to provide nesting places and protection from enemies, and the destruction of bird food through the clearing out of berry and seed-bearing undergrowth which are chiefly responsible for the diminishing number of birds.

Protection of birds, which are the farmers' best friends in controlling insects such as leaf worm, boll weevil and others, was one object in view when the Soil Erosion Service set up as part of its program the re-establishment of forests on a portion of the land in the Duck Creek watershed near Lindale, Texas. Knowing, too, that ground birds will not utilize forests where there is no undergrowth for nesting or food, the Service is asking that cooperating farmers not overgraze their woodlands. The primary purpose of this is to protect newly-planted forest trees and prevent erosion, but it also has as an incidental purpose the protection of birds and small animal life.

Strip crops of sorghum, lespedeza sericea, cowpeas and oats, and the plantings of trees in deep gullies, which are also part of the Erosion Control program, will afford nesting places for doves and other low-nesting birds which are so helpful in eating weed seeds. Such seeds from crops as happen to fall on the ground in the harvesting process will serve as food for birds in the fall and winter when food would otherwise be scarce. While these crops are growing, they will afford opportunity for quick escape from enemies and thus encourage them to range over the whole field, where they will destroy uncounted millions of weed seeds and insect pests.

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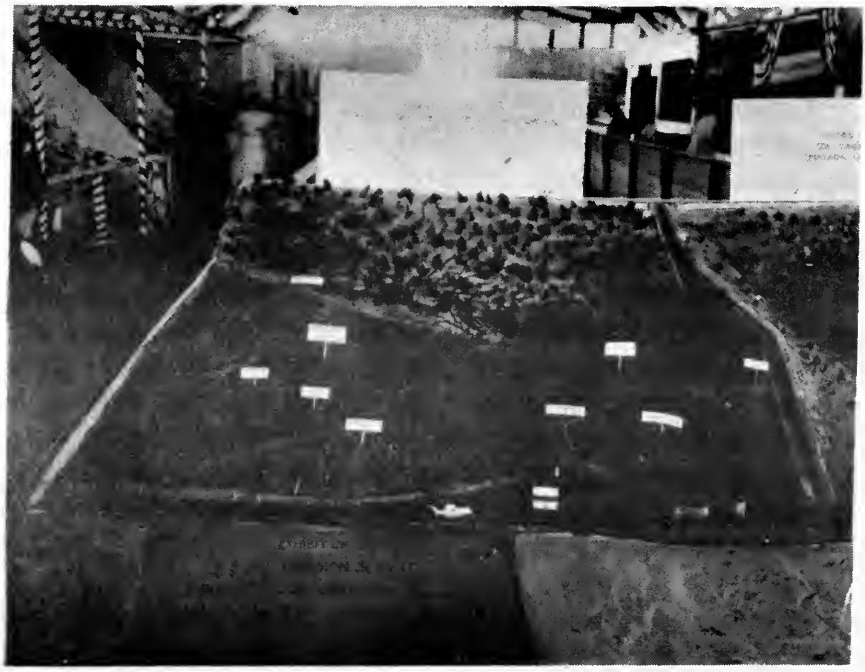
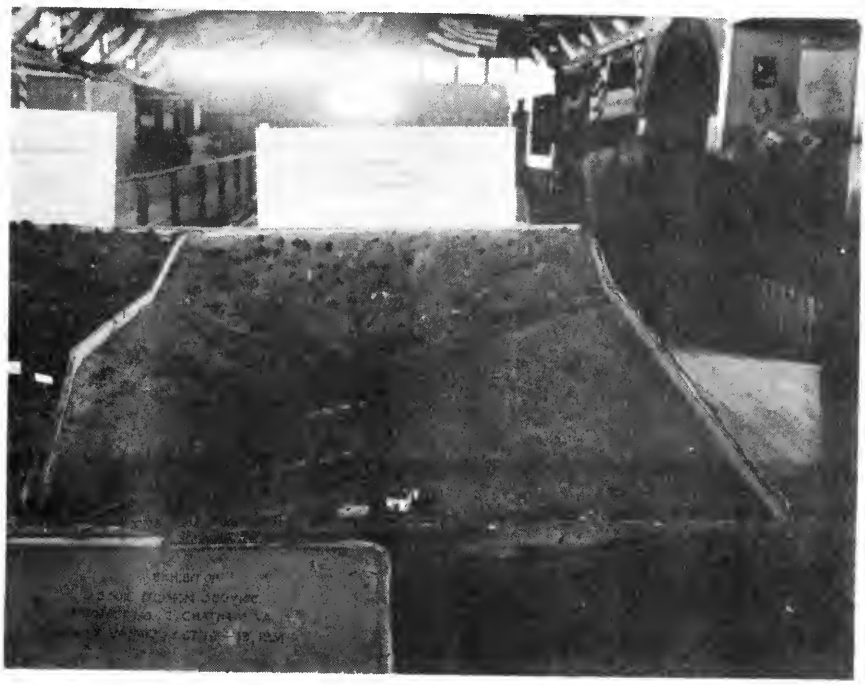
We Show Our Wares at



"FARMED ACCORDING TO U. S. SOIL EROSION SERVICE RECOMMENDATIONS - EROSION CONTROLLED", says the legend above the table.

Mr. Keil and cohorts at Chatham sent this mighty lesson in miniature to Danville's fair. Virginians by the thousand paused to ponder the graphic story of good farming and bad farming.

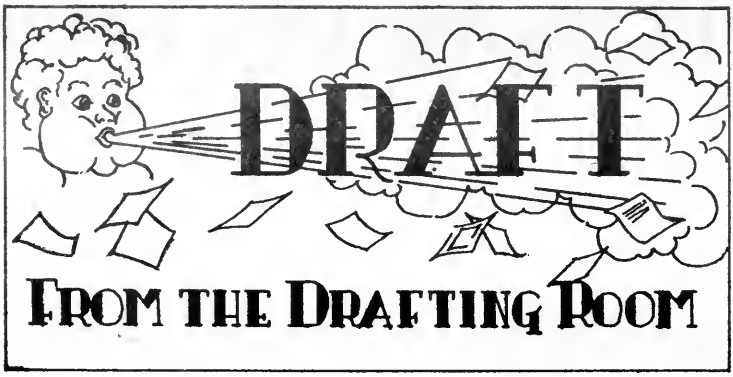
Old Dominion Fairs



"FARMED WITHOUT A SOIL SAVING PROGRAM - EROSION UNCONTROLLED", the legend reads.

Greatly pleased, and rightly so, Mr. Keil moved on to Pichmond where other thousands of Virginians, gathered for the State Fair, saw and profited thereby.

(This is the first in a series of fair exhibit pictures. Displays prepared by other projects will be reproduced each month in subsequent issues of "The Land".



It is with a great deal of pride and satisfaction that the Drafting Department is able to announce that it was successful in completing within the time limit set, its portion of the National Reconnaissance Survey report for the National Resources Board.

This of course, was made possible only by the hard work and enthusiastic personal cooperation of every man in the Drafting Department, which involved a willingness to do a great deal of night and overtime work. We also wish to thank all other branches of the Soil Erosion Service for their cooperation in furnishing supplies and data, and for other assistance in this work.

"Zack"
Planimeter boss

* * * * *

A Hallowe'en party for the drafting room was given by Miss Barbara Norcross. Noteworthy was that anyone who mentioned work was fined a quarter, contributors being Beamon, Wade, Johns, Zackrison, and Pence.

* * * * *

Meigher

The editor thanks: R. L. Meigher, whose clever cover design adorns the November issue; also who drew a good many headings for this magazine; Miss Elizabeth Osgood, whose clever pen turned out the bulk of the art labors; Mrs. Danforth, who is responsible once more for the funny faces on this page; Thomas F. Muldowney, for miscellaneous art work.

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George Spann, copyist draftsman, was married to Miss Edith H. Lanns, Nov. 3.

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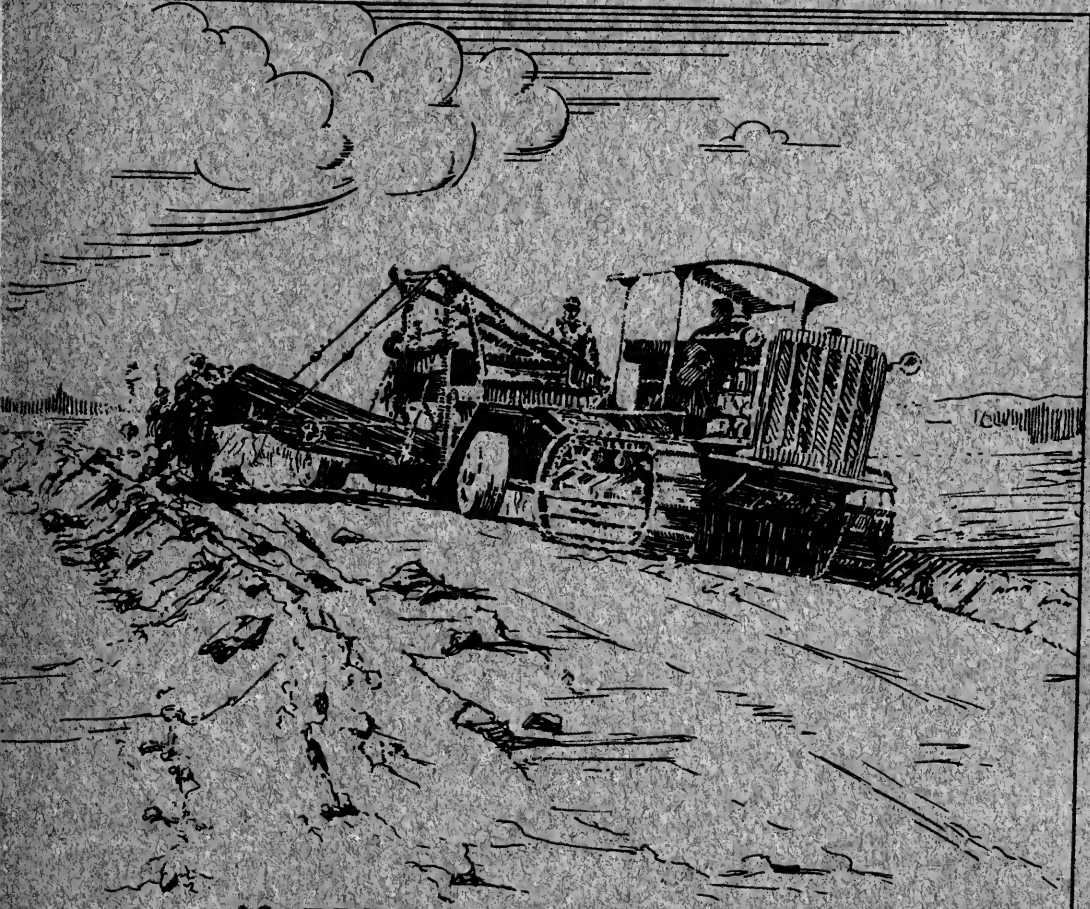
THE LAND

TODAY AND TOMORROW



IS TERRACING ENOUGH?

By T. B. Chambers

OFFICIAL BULLETIN

U.S. SOIL EROSION SERVICE
DEPARTMENT OF THE INTERIOR

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1934

THE LAND
TODAY AND TOMORROW

Issued Monthly by the
U. S. SOIL EROSION SERVICE
DEPARTMENT OF THE INTERIOR

Harold L. Ickes
SECRETARY OF THE INTERIOR

H. H. Bennett
DIRECTOR, SOIL EROSION SERVICE

Editors
G. A. Barnes Ewing Jones

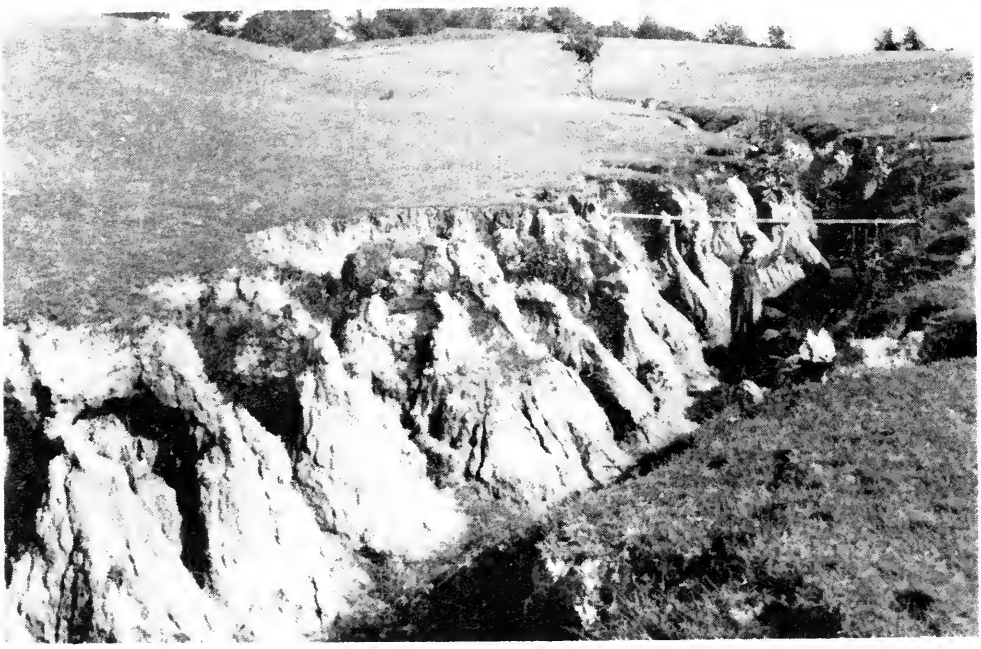
The Contents

Cover Design by Miss Elizabeth Osgood, Drafting Section

PROJECT WORRIES

Urbana, Illinois

Cowpaths rapidly become gulches in the deep soils of Illinois.



Waterfall erosion is whittling wide and deep into the heart of Illinois fertile soils. Gullies practically have ruined this field.

Is Terracing Enough?

By T. B. Chambers

ASSISTANT TO CHIEF ENGINEER

The Soil Erosion Service says no —and here Mr. Chambers points out why. Terracing, he explains, is a vital factor in erosion control—but not the sole solution.

In view of a rapidly expanding interest in measures of erosion control, it is timely to present a statement on the subject of terracing and define the construction, functions and values of terraces as one of the implements of combat against severe land wastage.

If terraces are properly laid out, and properly constructed and maintained on selected lands adapted to their use, they are very effective in the control of gullying and reduction of sheet erosion, as well as useful in encouraging contour cultivation and strip cropping. They must be considered a very helpful, practical approach to the problem of soil erosion control. But on the other hand, they must not be regarded as the sole effective measure of prevention. They are, barring exceptional circumstances, only one factor in a properly coordinated control program.

The purpose of a terrace, stated simply, is to help prevent erosion by: (a) intercepting runoff from rainfall in its course down a cultivated slope, and (b) conducting excess water away from the field at a velocity that produces a minimum of erosion. However, there are supplementary purposes which assume more or less importance under varying conditions of climate and land use. For instance, in regions of dry farming it is customary to construct level terraces, or level terraces closed at the ends, to assist in conserving moisture. In most instances, conservation of the soil is the principal purpose, but on certain very gently sloping or level lands in the sub-humid region, conservation of rainfall may be the primary aim.

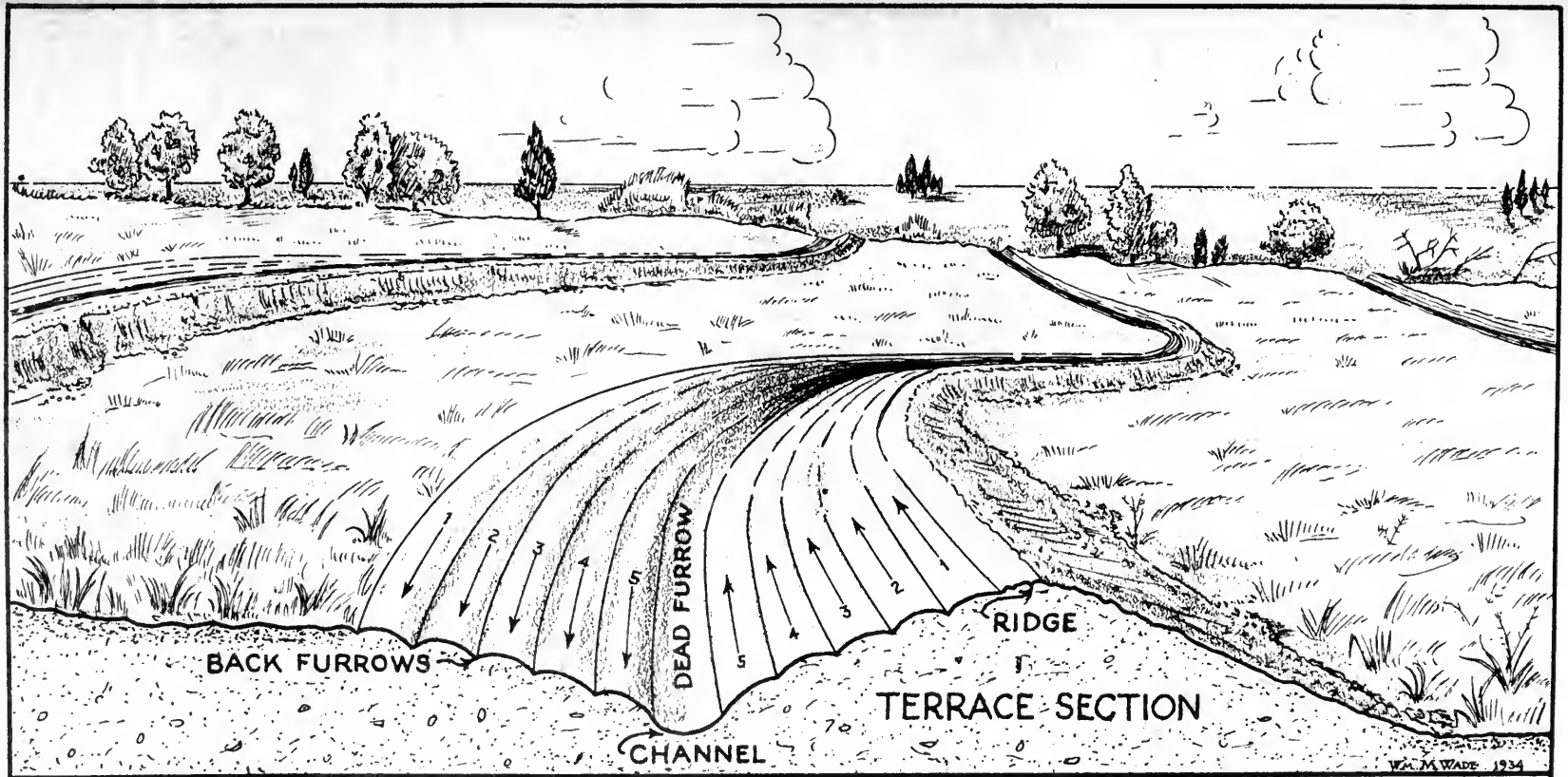
Many fallacious views have arisen with regard to the functions of a terrace and the results to be expected from its use. It has been stated that terracing, as a perfect method of controlling erosion, is self sufficient. Results from the ten Soil Erosion Experiment Stations located on as many different soil types in the principal farming regions of the United States show that soil loss from terraced areas is reduced in an important degree as compared with unterraced areas. This is an obvious fact, as is also the fact that efficient terracing is a practical measure for minimizing erosion. Some of the measurements referred to might easily be misleading, however, owing to the method by which they have been made. The soil removed from the slope is measured at the outlet end of the terrace. No accompanying figures are available to show how much additional soil is removed from the area between terraces, intercepted by the lower terrace and dropped into the channel, where it is allowed to remain until the channel is dangerously choked, and later, by a process of maintenance, removed to the top of the ridge, where the same process is repeated.

It is true, of course, that soil movement is retarded by the terrace system. Instead of a great quantity of topsoil being swept away directly as the result of a heavy downpour as frequently happens in unterraced fields, a much smaller amount is carried immediately out of the field. Generally a considerably larger quantity is intercepted, at least for a while, by the terrace embankment. The result then is not a perfect system of erosion control, but a foundation on which a better system may be erected, as will be pointed out below.

KINDS OF TERRACES

Only the broad-base terrace is being constructed by the Soil Erosion Service. This type is adaptable to cultivation on slopes that are not too steep, since it does not have the steep side-slopes of the narrow-ridge terrace.

Several types of broad-base terraces are in general use, all of which are a modification of the Mangum Terrace (devised on the farm of Mr. Priestly Mangum, some forty years ago, near Wake Forest, N.C.) The old type Mangum Terrace, constructed by moving equal amounts of soil from the upper and lower sides of the ridge, has generally been abandoned due to the small water channel formed on the upper side. A modification of this type, composed of a broad, flat water channel above the terrace ridge, is now most generally used. From 75 to 100 percent of the material generally is moved from the upper side, the amount increasing with the steepness of the slope. The broad, flat channel is of sufficient capacity to care for the runoff from ordinary storms, and the ridge is a safety factor for unusual rains.



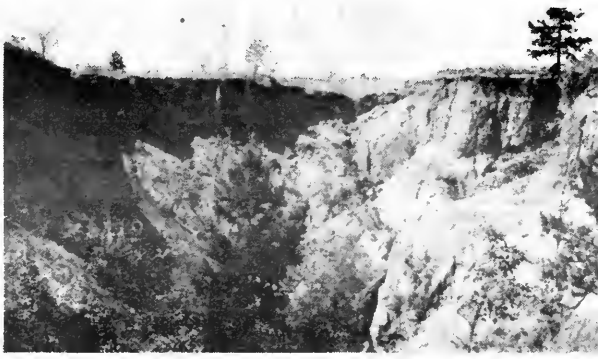
METHOD OF MAINTAINING TERRACES BY PLOWING

ARROWS INDICATE THE DIRECTION IN WHICH FURROWS ARE MADE

L-88a

The narrow-ridge type, sometimes locally referred to as one-row terraces, which formerly was so common in the South, is rapidly giving way to the modified Mangum Terrace. The narrow-ridge type is susceptible to damage by percolation when carrying its full capacity of water. To overcome this danger, such terraces must be constructe with an excessive grade, such as induces scouring, otherwise the ridge must be stabilized with permanent vegetation. It is generally impossible to cultivate across the steep, narrow ridges without destroying them, but the practice of cultivating over the broad-base terrace is quite common.

Terraces must be designed to meet local conditions. Such factors as slope, climate, soil and cultural practices must be considered. In the more humid regions, the terrace channel must be constructed for maximum capacity, and on comparatively gentle, non-erosive gradients. In establishing a balance between channel capacity and quantity of runoff it is necessary to place the terraces at closer intervals. Consequently, as the land slope increases, the interval between terrace decreases. Soil characteristics, particularly erosivity and permeability, must influence the design of the terrace system. The abilit of soil to absorb water should not generally influence the design to any great extent, since a condition sometimes arises where the surface soil is saturated at the beginning of a heavy rainfall, so that runoff is approximately equivalent to that from an impervious soil.



Gully caused by washing in improperly protected terrace outlet.

Under conditions of low rainfall, it is often imperative to conserve as much moisture as possible, and to this end the terrace should be constructed on the level and at greater horizontal intervals.

Terrace gradings fall under three general classifications, namely: level, uniform and variable. The level terrace is most commonly used in the drier regions, where its primary function is water conservation. A terrace channel of uniform gradient produces maximu discharge in a comparatively short time after precipitation begins, and has other objectionable features. A terrace channel of variable grading begins with the flatter gradients (or with no slope at all)

at the upper end and increases with units of length toward the outlet. This effects a more gradual and favorable discharge rate, and it is the type most generally used by the Soil Erosion Service.

In the past, most farmers using terraces have done their own work. The amount of equipment was necessarily limited, generally to a plow, Martin ditcher or home-made drag, all horse-drawn. The expenditure of time and labor was excessive and quite often resulted in the work being discontinued before adequate cross-section of ridges and water channel had been attained. Frequently, the gradients were imperfect, often too steep.

Machinery consisting of tractor-operated terracing blade graders, that makes terrace construction much more economical, has been developed in recent years, and is in general use on cooperative projects. Realizing the necessity of economical construction, this heavy equipment is being extensively used by the Soil Erosion Service. Heavy elevating graders have proven economical under conditions of long uniform flat slopes.

Since the projects of the Soil Erosion Service are demonstrational, a number of the horse-drawn machines are furnished each project and their use taught to individual cooperators.

DANGERS OF TERRACING

Improper terracing involves dangers which should be carefully considered. Too often we see fields ruined by gullies which have been caused directly by improperly constructed terraces or terrace outlets with inadequate protection. In numerous instances, the failure can be traced directly to faulty construction. In other instances, failure has come about because the designer did not properly evaluate all the conditions influencing the successful operation of the complete system, such as excessively steep slopes, shallow surface soil over impervious clay, and highly erosive soil. The chief faults of improper construction are: (a) inadequate size of channel and ridge, such as induce overtopping and consequent cutting of the ridge, with resultant scouring and gullying; excessive gradients that produce erosion in the

A terraced field

Continued on Page 24

Fifty Years Finished the Mayans

A flourishing civilization perished in half a century — choked with the products of its own erosion. Could such a disaster overtake the United States?

By P. H. Walser

EXTENSION AGENT LINDALE PROJECT

What mysterious cause brought about the fall of the Mayan empire which flourished for about twelve centuries in Central America in what are now the tropical jungles of Guatamala?

The Mayans, numbering about 14 million persons, are not known to have been wiped out by the superior strength of an invading enemy. They were probably unconquerable in their day. Their temples and public buildings had been in ruins for nine centuries before the conquering Spaniards under Cortez wiped out most of the few records concerning them which then remained. There is no evidence that their civilization was destroyed by an earthquake, tidal wave, storm, or by fire. But we do know that in the fifty years between 580 and 630 A.D. this marvelous civilization suddenly disappeared, leaving no reminder but a few ruins. The very site of their great empire was deserted by their survivors and descendants.

Scientists have since dug into their ruins, examined their descendants, studied their language, and patiently pieced together their history in the effort to solve the baffling mystery of their disappearance. All solutions advanced, however, were no more than mere guesswork until an American geologist, Dr. C. Wythe Cooke, hit upon the reason for the fall of their empire and gathered the necessary data to support his conclusions.

Dr. Cooke found the secret in the swamps or bogs which constitute about forty per cent of their territory at present. He made a close study of the soil formation in these bogs and on the lofty hills which surround them. From this examination he came to the conclusion

that what are now bogs and flat, muddy plains were immense, clear lakes in the days of Mayan civilization. The eroded hills now covered with mahogany and chicle trees, were fertile farms of rich black soil. On these farms they produced their bountiful crops, and carrying them down the hills on their backs -- they did not use beasts of burden and had never discovered the principle of the wheel -- they put their products on boats and exchanged goods with each other across their lakes. With rich soil to draw on, with lakes as a means of transportation, and with their ingenious minds directing, they built up a civilization unaided, for they did not have the history of all previous civilizations to draw on.

Life flowed smoothly for them until their farmers, spurred on by the demand for more agricultural goods caused by an increasing population, cleared more and more of the uplands for cultivation and thereby exposed increasing amounts of the black soil to the torrential rains which fall in that climate six months out of the year. Erosion set in, and as the Mayans knew no way to stop it, the inevitable happened. The rich soil was carried down hill in torrents, baring the farms to the subsoil. After a time it was no longer possible to feed the millions of people in the valleys below or even to support the farm families. The soil which left the hills silted up the lakes below, interfered with and in time stopped the interchange of goods on these lakes.

Says Dr. E. E. Free, in his *"Week's Science"* (New York):

"The Maya civilization choked itself to death, Dr. Cooke believes, with mud washed from its own hillside corn patches. The former Maya country is marked today, Dr. Cooke reports, by small, flat plains of sticky clay soil, almost impassable in wet weather. Each of these plains, he believes, once was a small lake, these lakes being connected by streams or by short portages forming a system of water highways as the lakes of North America once did for the canoes of the Indians. The Maya cities, he believes, were built near these lake highways, and maintained by this easy form of transportation. On nearby hillsides, the theory continues, the Maya farmers grew the corn, which was their chief food. In so doing they cut or burned the natural hillside vegetation. The result was that every violent rainstorm washed a part of the hillside soil down into the lakes. Slowly the lakes filled up and the hillsides grew bare. The filling of the lakes blocked the waterways, while erosion of the hillside soils ruined the farms and lowered the nation's supply of food."

Soil gone and commerce gone, the people were reduced to a state of poverty. But, as Dr. Cooke has pointed out, something else is

necessary to explain the almost complete wiping out of the population, which is known to have occurred within the short space of fifty years. That something was disease -- malaria and yellow fever -- which arose and spread as soon as the lakes and lowlands were converted into mosquito breeding bogs Not knowing how to control either disease, there was nothing for the Mayans to do but flee the country. A few thousands of their survivors may yet be found in Yucatan, Guatemala, Honduras, and other parts of Central America.

Could such a thing as this happen to the United States? Instinctively, we say no. The idea is too repulsive for us to want to consider it. But sober reflection will show that just that is happening in the United States now. Hills wholly or partly stripped of their fertile top soil have become too commonplace to provoke comment. The steady sanding over of rich meadows with soil from above is a sight almost as common. The silting up of lakes which cities build to provide themselves with water goes on so rapidly that the lakes are filled almost before the bonds issued for their construction have been retired.

The United States has already lost through soil erosion not less than 35 million acres of good farm land, according to Director H. H. Bennett, who further estimates that 100,000 acres of land are being abandoned each year as no longer worth cultivating. Ahead of us looms the possible complete loss of 125 million acres of land and the partial destruction of a much greater amount.

We must not permit the same calamity to overtake us which overtook the Mayans. We shall have only ourselves to blame if we do. We know how to control soil erosion; the Mayans did not. We know more of the science of engineering than they. We presume they did not even know of terraces, since they left none. We know more of the science of agriculture. It is not probable that they ever conceived the idea of a cover crop or a strip crop, or of land slopes too steep for safe cultivation. Surely, they had no soil erosion experiment stations, nor a far-seeing Government to stage large-scale erosion control demonstrations from which they could learn methods of controlling soil losses.

In fifty years soil erosion caused the Mayan civilization to decline from its greatest height to the point of actual extinction. It has taken the American people just about that long to reduce some of the richest farm lands in the world to the point of being worthless. Destruction of some of our farms is complete. On many more erosion has progress to the point where the soil will no longer yield a profit on its cultivation. Isn't it time to apply what we know?

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Permanent Strip Cropping in California

By Harry F. Reddick

REGIONAL DIRECTOR VENTURA PROJECT

California rich citrus orchards being protected by bench terraces developed from permanent strips — adapting an idea from the ancients

In spite of the indisputable marvels of the ancients in constructing their elaborate systems of terracing, California has developed a method of successfully farming steep slopes that has all their good points and lacks many of their bad ones.

The successful and continuous farming of steep hillsides has always been a major problem to the agriculturist. Steep slopes, ranging from twenty to fifty per cent in grade, have been utilized for crop production since long before the white race first practiced systematic cultivation of the land, but the methods of adapting the hillsides to production invariably called for an expenditure of labor that would be prohibitive to the modern American farmer.

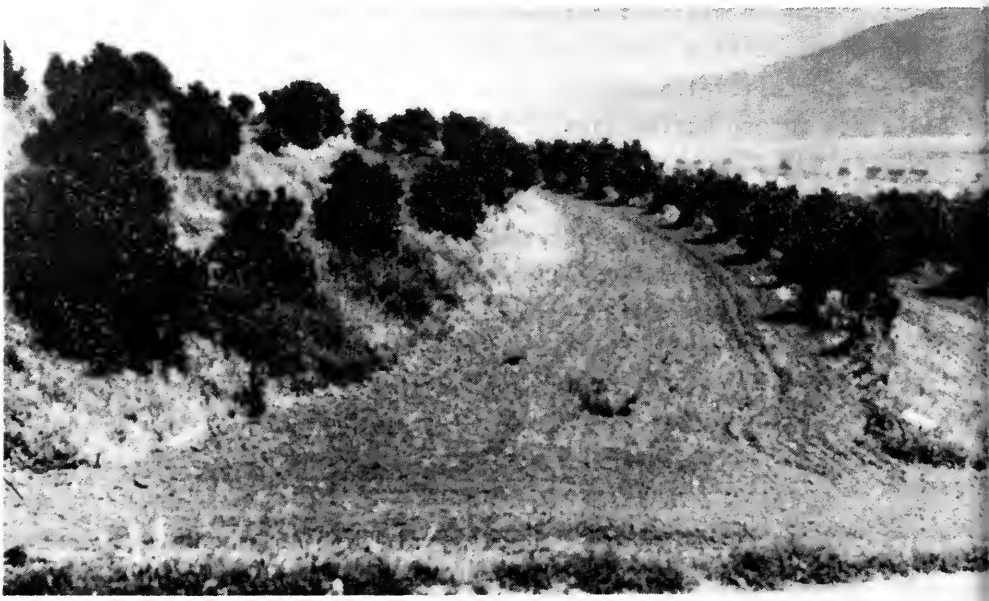
The Germans, in the fertile valley of the Rhine, terraced the banks up slopes so steep that the retaining walls of the plots often had more area than was made available for the growing of their grapes. The Chinese have long grown rice upon the stair step hillsides that sweep upward from the rivers. The ancient Incas of Peru (likely one of the most highly advanced agricultural people this planet has ever known) carried on their farming with a fervor that bordered on fanaticism, and built one of the most elaborate and most lasting systems of terraces of which history has any record. So succesful and so foresighted were these inspired builders of land that even today, after four thousand years of continuous cropping, the same plots are supporting their descendants.

Such grand methods of land usage were not without their cost.

Walls of perfectly joined masonry, six to twelve feet in thickness, and eight to twenty feet in height, were constructed by man power alone, in order to retain an area seldom exceeding a fraction of an acre. Single stones 36 by 24 feet in area and six feet thick are to be found in the walls constructed by that ancient race who had only man power, a keen appreciation of the power of leverage, and boundless energy to assist them. It is said that good rich earth was packed seven hundred miles on the backs of spindly legged llamas to carpet those precious mountain side plots which were often so small that only two rows of potatoes could be planted in their entire width.

Obviously no such methods can be used by the American farmer today, but the need of terracing on the steeper slopes is just as acute, and just as essential, if they are to be successfully cropped throughout a number of years. In California the ranchers (all farmers are known as ranchers in the West) long ago discovered that the steep slopes were often the best adapted to growing of citrus fruits, avocados, and many deciduous fruits. The hillsides were preferable, because of the deeper and richer topsoil, because they were warmer in the winter and less subject to killing frosts, and were usually freer from diseases and pests.

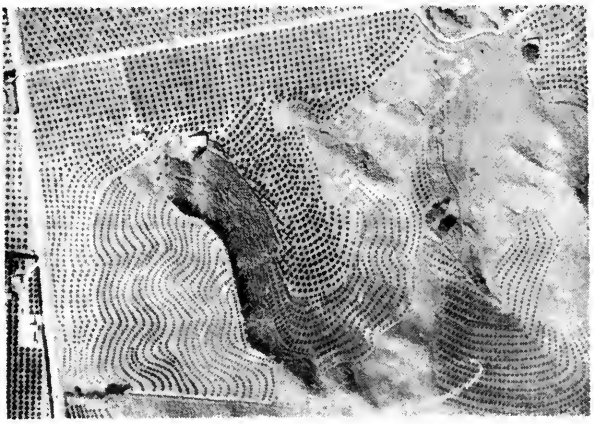
The question of planting orchards on steep slopes was aggravated by two primary necessities: the soil must not be carried away by erosion, and there must be sufficient grade for irrigation. It was these conditions that proved the need of an engineer specializing in



Bench terrace that has developed due to permanent strip cropping and cultural practices in an irrigated orange orchard. Note the heavy growth of vegetation on the steep bank.

agricultural problems, and such has been the author's work for the sixteen years prior to entering the Soil Erosion Service.

The first step taken by the agricultural engineer in designing a hillside orchard lay-out is the making of a topographic map having a scale of 1" equal to 100', with contour intervals of from 0.5' to 2', depending on the terrain. Such contour maps are usually obtained in the fall of the year after the annual crops have been harvested. Following the completion of the map a paper layout is made of the proposed orchard, showing the tree rows laid out on suitable grades to give the water a uniform distribution. Due to the fact that conditions vary from field to field, the grades of the irrigation contours range from 1% to 4%. On this map there is also indicated the irrigation lines, drainage lines, roads for future use in hauling fruit, and all other necessary features that will aid in efficiently farming the land.



Irrigated contour citrus orchard in California where bench terraces developed from permanent strip cropping.

The following spring, from February to May, the paper lay-out is staked out on the site of the orchard, and when the job is complete there is a stake for each and every tree, pipe line, irrigation head, gate valve, overflow, catch basin, and outlet. The construction work is then started and the trees planted.

Before the completion of laying out an orchard the writer always advised the rancher to cultivate only on the contour, and never do any cross cultivation under any consideration. He was further advised to leave the strip of grass cover crop and weeds in the tree row intact. If the weeds became too tall he was advised to cut them with a scythe, but let the litter remain where it fell. This practice has been adopted by a large number of ranches throughout California, and the results have proven very satisfactory.

In a few years the shape of the hill changes gradually from that of a uniform slope to one composed of a series of "falling terraces." It has been found that there is a definite movement of the soil down hill toward the tree row regardless of whether the old-fashioned side hill

plow is used or the cultivating is done with tractors and heavy double disc harrows. Each succeeding cultivation tends to steepen the slope or "riser" between the terraces, and after ten years of such practice there has been formed the definite bench terrace.

The advantages of bench terraces are several. It provides the rancher with a terrace which has a flat cross slope plus the desired irrigation grade. There he can place his irrigation furrows, from four to six to a space, and he can use wagons for hauling his fruit out of the orchard instead of sleds. An additional advantage of such cultural practice is that he can plant his winter cover crop on the terrace and by irrigation have it up before the winter rains set in, thereby preventing any erosion that the storms would ordinarily cause. These cover crops furnish excellent green manure when disced under the following spring.

The leaving of the grass in the tree rows is nothing more or less than establishing a permanent strip crop to prevent runoff and soil erosion. Records and measurements of eroded material have been kept on a five-acre contour lemon orchard for several years, and in spite of the fact that during that time two storms of near cloudburst proportions have occurred, the average soil loss has been less than fifty pounds per acre per annum. The runoff, although not measured, was equally small.

It is interesting to note that while the original cross slope of the tract referred to above was from 25% to 40% there has never been a rill, rivulet, or gully come down its slopes. This is in no sense an isolated case as can be testified to by hundreds of ranchers in California who have plotted and tilled their orchards by the method herein described.

Erosion control as practiced by the Ancient Peruvians. Detail of bench terraces in the Colca Valley.

Thus it is that the modern California rancher obtains all of the advantages of the terraces built by the ancients plus many that they did not have, and he does it at a cost within reason, and without the use of tens of thousands of toiling slaves that fenced their soil with huge blocks of stone.

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Before Villa's Firing Squad

By G. A. Barnes

SPECIAL ASSISTANT TO THE DIRECTOR

A little known chapter from the life of J.G.Lindley, who escaped, of course, to become Supervising Engineer for the E.C.W. Camps of the Service....

Behind me, the door marked "Supervising Engineer ECW Camps" swung shut with a faint click, and Lindley looked up from a pile of papers in front of him. He smiled, and I felt a little better about interrupting a busy man at the end of a busy day. I told him what was on my mind.

"Well", he said, "if yuh really want that story I guess I'm hooked. But you sure must be hard up for copy this month."

He started off with biographical detail, and I took it all down very dutifully, though it wasn't what I'd come for. He was born, Lindley said, in Moberly, Missouri, in 1888. That made him only 46, and I was surprised because he looks about 40 to me. I wasn't surprised, a moment later, though, when he sketched an outline of his 46 years...University of Oregon, University of Arizona...surveyor, chemist, metallurgist engineer, superintendent of mining camps in the Southwest and Mexico...the Chemical Warfare Service in the War years.. a construction job with peons and Indians in tropical Sinaloa. I started to ask how he managed it all in 46 years, but he was getting to the story I wanted so I didn't interrupt.

He tipped his swivel chair back as far as it would go, locked his hands behind his head, and grinned reminiscently. I was set to hear a chronological account of the incident that interested me, but Lindley began to ruminate.

"Under the circumstances", he said, meditatively, "the traditional devil-may-care attitude was something of a strain. Leaning against that adobe wall, I pretended extravagant indifference toward death, because extravagant indifference seemed to be the formula for such situations. Also, there was a certain satisfaction in irritating the pompous gentleman who had things undeniably in hand. We all tried to maintain the customary Yankee coolness, but the sight of those eight highly efficient cut-throats, hand picked for our execution, was

just a trifle disconcerting. Even a Villista firing squad is apt to quite accurate at ten paces, you know."

I didn't know, but I could imagine. Lindley stopped and swung around to look at me.

"I'm putting the cart before the horse, though. Suppose I start at the beginning and let you in on the events leading up to the tragedy, or rather, that almost led up to the tragedy."

I nodded agreement.

"Mexico in 1914 and 1915 was a pretty hectic place", he went on, "what with an elusive Villa and an exasperated Carranza letting blood all over the country-side. I was engineer and assayer for the National Mines Company in Durango, and I was very young. I had little on my mind but hair, and not much more of that than I have now.

"Villa had been defeated at Agua Prieta, and the United States Government had permitted Carrancista troops to go in bond across American territory to help repulse him. It made Villa regard all Americans as enemies. After he was beaten, he broke his army up into raiding bands of 60 to 70 men, placed them in the command of generals, colonels, and assorted other officers, and sent them south with blanket orders to tear up railroads and kill off "gringoes".

"William Jennings Bryan was Secretary of State in those days, and realizing that Villa meant business, he ordered all American mine employees out of Mexico. Anyone with half a care for his skin would have obeyed, and most of our fellow-workers did. But I was very young; I guess you might say I was just a trifle foolhardy. Anyway, I agreed with four other youngsters to stick around and take my chances.

"We spent the next several days and nights ducking into hiding and out again. Every rumor about Villistas on the raid -- and there were rumors a-plenty, believe me -- sent us scurrying for cover in th mine. We were ninety miles by stage coach from the nearest railroad, and we were five peace-loving Yankees against an army of blood-thirst villains.

"For a while, we were lucky. Then, one day, a roving band took us by surprise, in broad daylight. We weren't even hiding. They descended upon the camp suddenly and corraled us very neatly, indeed.

"The five of us were hauled at once before a pompous, pseudo-military gentleman who turned out to be General Pedro Bracomontes, on of Villa's trusted henchmen. We were searched and relieved of the fe valuables we had, even down to hats and boots. In stockinged feet, w stood there while the General delivered himself of varied thoughts about America and Americans. He was, I think, the greatest master of invective I have ever met. He approached the matter of insulting us

with a care and delicacy hardly short of the artistic. His vocabulary was colossal and, for some fifteen minutes, he let us have it with both barrels. Calmly, then, he sentenced us to be shot."

Lindley grinned -- that quizzical grin -- and continued.

"Eight genial blackguards formed a squad about us. At a command they marched us away, down through the terrified town and across a long mesa to an old *almacen*, or warehouse. There, against the old adobe wall, we lined up, the five of us, side by side. It was hard to appear nonchalant and casual; one wanted to yell in protest. But the tradition was strong. We tried to look indifferent, even if we didn't feel that way. With the business end of eight Army rifles staring coldly at you across ten feet of ground, it's only natural to be concerned.

"Then, suddenly, the pompous colonel in command of the squad approached us with his proposition. He realized the international consequences likely to follow our execution, he said importantly, and he was anxious to avoid them. Naturally, it was his duty to carry out the order of General Bracomontes. But a tangible consideration, he suggested, might persuade him that our lives should be spared in the interest of international harmony.

"Greedily, we began to negotiate. One thousand silver pesos? we suggested. The colonel scoffed. Fifteen hundred? we countered. Again he scoffed. Two thousand -- virtually all we had between us in the world? Well, he would consider. He wrangled for another two hours and finally agreed. For two thousand pesos he would turn us free. We scraped it up from our savings back at the mine, and handed it to him. The firing squad lowered its rifles, formed, and marched away, our friendly colonel leading a pack mule laden with the monetary fruits of our many months' labor in the mines of Durango.

"Just as I can't describe the sensation that came over me when I found death staring me in the face, so am I unable to describe my feelings when the colonel and his men departed. I say frankly that I was scared stiff. What I needed, I decided was a drink. My companions agreed lustily. We dashed for the nearest *cantina*, and you can be certain I never enjoyed a stiff slug of mescal as much as I did that day."

Lindley halted with an inflection that meant he had finished, but I was not yet satisfied. What became of Bracomontes, I asked. He was killed shortly afterward in a battle near Durango City, Lindley replied; and I could detect no sympathy in his voice.

Which, I reflected, was hardly odd.

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THE DISINTERESTED OBSERVER

The Press and the Public
speak their minds about the S.E.S.

EXCERPT from address of Louis J. Taber, Master, National Grange, opening annual convention, Hartford, Conn.:

"There is no better way to use funds if they are wisely and economically expended, than in demonstrating to the American farmer practices and methods that will enable him to operate his farm and prevent, as largely as possible, the loss from erosion by runoff water. This program of the government is but a drop in the bucket. Six million farm homes must become centers from which radiate sound information on the preservation of our soil and its fertility...This fertility does not belong to those alone who hold the deed to the farm. It is not the wealth of this generation; it is the property that belongs in part to those who will live in the centuries to come." (Nov. 14).

ARTICLE in Baltimore, Md. SUN:

"Probably the most important conservation program that has been sponsored by the Roosevelt Administration is now being carried forward in most of the states by the Soil Erosion Service of the Department of the Interior." (Nov. 25).

ARTICLE in BARRON'S, The National Financial Weekly:

"Gloomy, indeed, would be the outlook for the nation if erosion could not be controlled, but it can be if the people are disposed to do it...The condition will go progressively worse until the nation awakens to the fact that its existence depends upon effective means taken to control the erosion and preserve that 7 inches of soil that stand between it and ruin." (Nov. 12).

EDITORIAL in the WALL STREET JOURNAL:

"The question of erosion is beyond the discussion stage...It affects the means of human existence. To permit it to go on unchecked is to trifle with a national menace."

EDITORIAL in the NEW REPUBLIC:

"One of the most hopeful projects of the PWA is the Soil Erosion Service. It has only a $10,000,000 fund to combat a process that is costing American farms something in the neighborhood of $400,000,000 a year, but it is a determined step in the right direction and it sets a precedent that may in the future become a normal, nationwide service." (Nov. 14).

LETTER from Walter R. Humphrey, Editor, Temple, Texas DAILY TELEGRAM:

"Through the work which has been done in this section of the state under the able direction of H. V. Geib, the farmers of Central Texas have been given a new vision and a new hope, which is going to reflect untold improvement on farm values and farm revenues. The farmer of Temple, Texas, swears by the Soil Erosion. Never before has the Government come to him with such valuable assistance. I think the value of the work already done will be a lasting monument to the New Deal, to the President, to you, and to your associates."

EXCERPT from address of Edward A. O'Neal, President of the American Farm Bureau Federation:

"We must formulate and apply a national program of land use to correct the unsound policies of the past and protect our greatest natural resource -- land." (Dec. 10).

EDITORIAL in the Minneapolis, Minn. STAR:

"A large erosion control project has been instituted near Winona...and thus moves in the Governmental program to improve agricultural conditions through conscious application of scientific means.

"Erosion control is a big factor in Agriculture...America has reached the point where her agricultural resources must be protected and rehabilitated; waste must be replaced with conservation." (Oct. 20).

ARTICLE in the Silver City, N. M. Enterprise:

"...the work being done by the Soil Erosion Service in Arizona and New Mexico will undoubtedly result in the restoration of many thousands of acres to their former fertility and grazing value.

"One of the principal benefits to result from the control of erosion will be the decreasing of the amount of silt carried down by the Gila River to lodge behind the Coolidge dam."

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Many Special Problems in Texas Blacklands

By H.V. Geib

REGIONAL DIRECTOR TEMPLE PROJECT

THIRD IN A SERIES OF ARTICLES
ON PROGRESS OF THE PROJECTS

Central Texas Erosion Control project is located in the Elm Creek Watershed with headquarters at Temple. The size of this area is approximately 200,000 acres and lies partly in four counties.

The Texas Blacklands comprise an area of approximately 11 million acres, and occupy a relatively narrow strip extending in a general north and south direction almost completely across the state. The topography varies from gently undulating to broadly rolling and hilly. The average slopes range from 3 to 6 percent, but there are considerable areas where the range is from 10 to 15 or 18 percent. The Elm Creek watershed is quite typical of the entire Blacklands

The soils of this watershed are all clays, derived from limestone, and are highly calcareous. Many of the samples analyzed show a calcium carbonate content of as high as 65 percent, and some of them have well over 50 percent in the colloidal fraction.

The rainfall of the area averages around 36 inches per year, but it is usually very unevenly distributed.

The ElmCreek project was set up in December, 1933, but very little actual field work was accomplished until the latter part of the winter, due chiefly to bad weather conditions. The character of the soil makes it impossible to do any kind of field work for a considerable period after heavy rains.

Greater part of the area was originally a treeless prairie and at the present time approximately 90 percent of the land is in cultivation. The average size of the farms is approximately 110 acres. The majority of the farms in this region have been cropped for from 65 to 75 years and in this comparatively short period of time erosion has made tremendous inroads on the fertility of the land.

TYPES OF WORK BEING DONE

While an effort is being made to put into effect all practicable methods of erosion control, it has been necessary to take into consideration quite a number of important factors and conditions which are not common in other parts of the state. These conditions tend to make

the Texas Blacklands unique in the methods of erosion control which are effective and practical to put into operation.

The effect of vegetation on erosion control has been amply demonstrated, and this fact has not been overlooked in our program. In our gully-control work, vegetation is used wherever possible. Bermuda grass has been found to be the most satisfactory plant in this respect. A great many farmers object to its use in their cultivated fields, as it is so very agressive and so difficult to control that it is likely to become a menace on cultivated land. There is usually no objection to its use, however, in gullies in pastured areas, or in the creation of new pastures on badly eroded hillside areas.

There are a few other grasses which give promise of being effective in erosion control, but a sufficient quantity of these cannot be found in this locality to utilize to any great extent. A 15 acre nursery has been established where we are propagating Dallis grass (paspalum dilatatum), and a few other grasses which we think may be successful. This nursery is irrigated.

Cotton is by far the most important crop in the region. It is better able to withstand the long summer drouth than any other cash crop and it can be readily sold at any time during the year. The principal other crops have been corn and oats, with some sorghum, cane, grain sorghum, sudan grass, and a very little wheat. From the standpoint of erosion control this is about the poorest possible cropping system. It means that from 75 to 90 percent of the crop land has been in row crops year after year, which has resulted in a depletion of the supply of organic matter and a tremendous loss of the surface soil. The general practice has been to run crop rows down the slope, and this of course has been responsible for great soil losses, as well as loss of much needed rainwater. In this region a sufficient supply of moisture is the most important factor in crop production. We have many instances where simply contouring the rows has more than doubled the yield of cotton and corn. This has been due not only to the saving of rainfall, but also to the saving of nitrates which are carried off so readily with the runoff rainwater.

Whenever practical, strip-cropping is being recommended. There are, however, quite a number of factors which tend to discourage this practice. On account of a fungus disease commonly known as cotton root rot, which is prevalent in most of the black soils, and which attacks practically all leguminous crops, it is usually not practical to recommend the planting of any legumes except those which make their growth in the winter months. At this period of the year the root-rot disease is not active. Small grains are therefore practically the only crops which can safely used as the erosion-resisting crop.

During the long summer drouth large cracks commonly occur in our heavy clay soil. When rains come they follow these cracks through strips of thick growing crops and even through well-established pastures and, where this condition occurs, gullies form rapidly regardless of the type of vegetation on the land. Long seasons of drouth render ineffective, from the standpoint of erosion control, practically all types of vegetative growths. During such seasons pastures become grazed down so that the ground is almost bare, and when heavy rains occur there is not enough vegetation to offer much resistance to the flow of water. We believe that strip-cropping will be most effective in this region when combined with an adequate system of terracing. Terracing alone does not give sufficient protection on the steeper slopes, but when combined with strip-cropping, is the most effective of all methods applicable to this region.

We like to lay off the strips, both when strip-cropping is carried on alone and in combination with terraces, in such a way that the irregularities of the field are taken care of by the strips so that there are no short rows in the cultivated crop. This removes one of the greatest objections most farmers have to terracing or contouring.

We are not recommending contour farming without the reinforcement of terraces or strip-crops, except on land having a slope of less than one percent, as in this region there is grave danger of serious gullying if such a practice is followed.

FARMERS DO TERRACING WORK THEMSELVES

On this project all of the terracing work is done by the farmers themselves, with the Service furnishing light terrace graders and fresnoes. We fell that in this way the farmers will have a thorough appreciation of the terraces, and will feel a greater responsibility in maintaining them. Furthermore, it not only teaches the farmers how to do the work, but it also demonstrates to those in the surrounding areas that they can do this terracing work at almost no expense to themselves -- an important factor in this region. This also means that the greater part of the S.E.S. funds will be paid out for labor, rather than for heavy equipment. At the present time the project has about 560 men on its payroll, besides approximately 500 World War veterans in the two ECW camps.

Old pastures are being terraced where the land is exceedingly steep, and contour-furrowed where the slopes are not excessive. This contour furrowing usually consists of plowing back-furrows on the contours at intervals of from 10 to 20 feet, depending upon conditions.

Terrace outlet control is largely taken care of by the two ECW camps under our supervision. These camps are building mostly permanent structures, chiefly of concrete, since suitable rock is scarce here.

These camps have to date completed in the neighborhood of 1600 permanent dams. The cost of these is not as high as is generally presumed. Considering that the farm land is worth at this time from $75 to $150 per acre, the cost of this much needed protection is not at all out of proportion to the benefit derived therefrom.

In a great many cases we have been able to empty our terraces upon pastures which are already established, or on areas where we are now planting pastures. A great deal of care has to be exercised in this practice because where the water is concentrated it takes a heavy stand of grass to keep the soil from washing badly. Where several terraces dump into the same outlet ditch it is usually necessary to build permanent structures since it is almost impossible to get vegetation to hold satisfactorily under conditions common to this area.

Up to December 8, 610 cooperative agreements have been signed, which cover a total area of about 67,000 acres. Work has been started on approximately 400 farms. To date more than 1700 miles of terrace lines have been run, and about 700 miles of terraces completed.

When work on this project was inaugurated, not over 1 percent of the area had any means of erosion control. Most of the farmers were backward about subscribing to our program. It was therefore necessary to put forward a great deal of educational work, the response to which has been exceedingly gratifying. In one section of the watershed more than 95 percent of the farmers have signed agreements. A great many who at first had no interest at all in the work, and who vowed that they would never cooperate in such a program, are now voluntarily coming to the office and asking that the service be extended to include their land.

This general attitude seems to be sweeping the entire state. More and more interest in erosion control is continually being evidenced from all quarters. Inquiries are received almost every day from various parts of the state asking in what way their region might obtain assistance in working out their erosion control problems. One watershed has submitted a petition carrying more than a thousand signatures, pledging approximately 95 percent of the land in the watershed. The unanimous expression is for continuance of the work.

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A series of soil terms, with their meanings, is being carried in each issue of the *Navajo Project News*. It has been compiled by A. T. Strahorn, Chief Soil Expert of that project.

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BY WAY of BIOGRAPHY

Walter C. Lowdermilk

Vice - Director

a real old-time scientist...a young man...world authority on erosion and runoff problems...born in North Carolina, July 1, 1888...studied in Park College...then University of Arizona...became an Oxford scholar....later studied in the University of California where he took his Ph.D...a forester with many years experience...used to sleep out in the open range and still likes plenty of fresh air...had practical training in the state forests of Germany and France...in charge of timber acquisition in the A.E.F...member of special commission in Paris to assist the American Peace Commission ...selected by the University of Nanking to study conditions in China ...his observations and discoveries gained widespread recognition... narrowly escaped death in Nanking when attacked by communistic element... member of numerous professional societies...delights in and is proficient in coining new soil erosion phrases...writes often and technically...loves his work and is intensely interested in the West...married, two young children ...sometimes gruff, sometimes abrupt, yet somehow, always courteous...

Farm Management in the Erosion Control Program

By E. H. Reed

AGRONOMIST OHIO PROJECT

The Soil Erosion Service must be so devised as to increase farm incomes as well as save soil and water. The farmer is usually more interested in immediate financial returns than he is in saving soil for posterity. If we are to continue to receive his support and cooperation, we must be able to prove that the program is practical and profitable from the immediate as well as long time viewpoint.

In working out the program for the individual farm, careful attention should be given in putting each field to its most practical and profitable use from the standpoint of farm management as well as from that of soil and water conservation. The farm program must fit the farmer's needs and give him the proper combination of enterprises for the greatest profit. This, therefore, places a grave responsibility on those in charge to see that a logical program is worked out for each individual farm. If this is done, there is little doubt but that the farm may be made to afford a larger income at the same time that soil and moisture is being conserved.

The next step is to be able to prove whether or not the program is profitable. In the Salt Creek Area, an attempt is being made to do this. A farm management survey is being taken on each farm at the time work is started. This survey shows the farm management plan and the labor income before the program was begun. A large percentage of the cooperating farmers have agreed to keep general farm account records in cooperation with the Soil Erosion Service. At the end of each year, these records will be analyzed to show whether or not progress is being made and whether the income has been maintained or improved. Methods used and results obtained on the more profitable farms will be compared with those on the less profitable to determine why some farms pay better than others. This information then will be used in educational work with the farmers.

Incomes will be correlated with soiltype and degree of erosion in order to show the effect of erosion on labor incomes. This information will be used to show the farmers the importance and desirability of erosion control.

A research project is also being planned in which a historical study will be made to determine causes of erosion as effected by man, and the resultant economic and sociological effects.

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(Continued from Page 5)

channel; (b) insufficient gradients which cause the choking of the channel in places; (c) excessive distance between terraces, with consequent increased soil loss from the inter-terrace; and (d) improper construction such as results in excessively high places in the channel or low places in the ridge.

Terrace outlets that are improperly protected may cause serious erosion and result finally in gullying. Numerous big gullies in terraced areas can be traced to concentrated discharge from the terrace system on unprotected slopes, or into channels that were not adequately protected. Once a gully is started in the outlet channel, an overfall is created for the water entering from the terrace, and this will result in a progressive gully extending up the line of the terrace.

To overcome the dangers of improperly constructed terraces and terrace outlets, the Soil Erosion Service is attempting to make each terrace as nearly perfect as possible. The inherent dangers are anticipated and provided for as fully as may be possible. Points of danger resulting from improper construction are carefully checked and the defects corrected before the system is pronounced complete. Prepared terrace outlet channels are protected with vegetation or structures or a combination of both. Wherever possible, safe natural outlets are used, with the discharge onto pasture sod, thick-growing timber lands or into natural swales or depressions that can be protected with a permanent sod.

Terraces require some maintenance, and cooperators are taught the necessary procedure. Maintenance is ordinarily performed by plowing out the channels so that the furrows are turned to the ridge with the water or dead furrow falling in the lowest part of the channel. This process deepens the channel three or four inches and is necessary for the first few years, or longer, after the terrace is completed. The process is adequately shown in the illustration.

Other maintenance measures include filling breaks that may be caused by overtopping, or by low places resulting from settlement; removing silt from channels either by plowing, as illustrated, or by use of slip scrapers or blades.

COORDINATION WITH OTHER CONTROL METHODS

Terracing must be coordinated with other control measures. It is only in this manner that maximum control from cultivated areas can be achieved. Records of experiments show that terraces perform a ser-

viceable function in prevention of erosion on certain adaptable lands. The records also show that the soil loss from heavily vegetated land is reduced to a mere fraction of a ton per acre. The introduction of close growing vegetation in connection with terraces is advocated by the Soil Erosion Service as the only effective method of reducing erosion losses to a minimum. The vegetation may be placed in the form of strips to be located between or on the terrace ridges; in rotations that utilize an erosion preventive crop at least one year of the rotation period; or seeding slopes to permanent pasture. Improved cultural practices that tend to keep the soil in a high state of absorptive capacity is also a highly valuable part of soil conservation.

In designing the terrace system other factors than runoff and carrying capacity of the terraces must be considered. For instance, soil characteristics, land use and cultural practices should influence the terrace design. Gully control work also will often influence the design or vice versa, since the terrace system frequently can be used to divert water from a gully and thus materially reduce the cost of its control. Occasionally a convenient gully can be used as an outlet making construction of the terrace system less expensive.

CHANGING ATTITUDE TOWARD TERRACING

The practice of terracing agricultural lands was for a great many years the only widespread effort made towards controlling erosion. This resulted in a fallacious assumption on the part of many people that the construction of terraces was the only control method necessary. With the acquisition of new knowledge about erosion control, gleaned from scientific experimentation and study, however, this idea is rapidly undergoing a change. We have learned that vegetative measures of control are highly effective and that terraces can only be one factor in a properly coordinated program of control. The practical application of this new concept of terracing can be seen in recent activities on the part of Federal and state agencies, individuals, and cooperative organizations.

PART TERRACING PLAYS IN SES PROGRAM

Construction of terraces and terrace outlets is one of the activities of the Soil Erosion Service. Equipment adapted to varying conditions found on the several projects is being used. The Temple, Texas project uses light horse-drawn or farm tractor propelled blade graders satisfactorily. In the South, Southeast and Central West, the tractor operated blade grader with 8 to 10 foot blade has proven economical and is being used almost exclusively. In Kansas and Nebraska, the elevating grader and heavy tractor give better results. A

small supply of light horse-drawn blade terracers and terrace drags is available on all projects for use of cooperators in building their own terraces and in performing their share of the work to be done.

It should be understood that the Soil Erosion Service does not propose to terrace all the lands of any cooperator in one season. The terracing program provides that the work be extended over three or four years, which necessitates restricting the yearly service for a cooperator to about 25% of the total acreage to be terraced. This arrangement guarantees service to a maximum number of farmers. The cooperator is required to perform a certain proportional part of the work incidental to terrace construction. His work will vary on different projects but generally, he is required to fill all low places on the terrace ridge, open the ends of channels, harrow and smooth down the terraces and plant the ridges to close-growing, erosion-resisting crops. On other projects, he may be required to perform a specified minimum of work with the light equipment before the Soil Erosion Service begins operations with heavier equipment. In addition, the cooperator is also required to adopt other measures which will further reduce erosion, such as contour cultivation, strip-cropping and the rotation of crops to include close-growing, soil holding legumes or grasses.

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SOIL EROSION ASSOCIATION FORMED IN LOUISIANA

Believed to be the first of its kind in the nation, a Soil Erosion Association has been formed in Claiborne Parish, Louisiana.

It is the avowed intention of the association to go after a soil erosion project for that parish. A petition is being circulated throughout the parish, and latest reports are that a huge number of names have been attached thereto.

As reported by the "Brushy-Cooley-Cypress Creek News, the service bulletin of the Minden project, officers of the Claiborne Association are keeping in close touch with the work on Project No. 15. They state that the more they see of the work, the more determined they are to expend every possible effort to secure such work for their own parish.

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J. G. Lindley, Supervising Engineer of ECW work for the Soil Erosion Service, left Washington Dec. 15 for an extended inspection trip of all CCC camps under direction of the Service.

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Wind Erosion Endangering Colorado Vegetation

By C. J. Whitfield

CHIEF OF RANGE MANAGEMENT GILA PROJECT

Throughout eastern Colorado striking vegetative changes are taking place in the native grass land as a result of wind erosion. At present the sod grasses, gramma grass, *Bouteloua gracilis*, and buffalo grass, *Buchloe dactyloides*, are the principal range species.

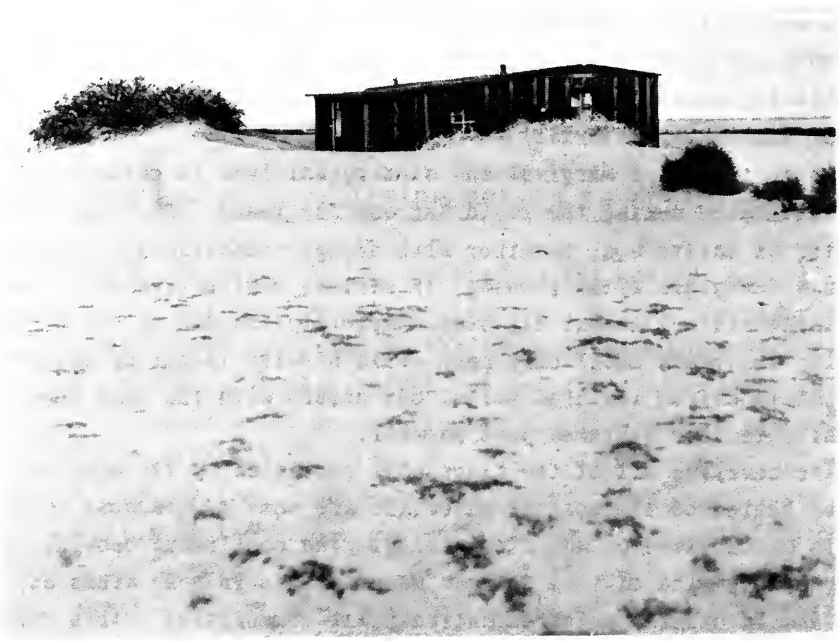
There has been a decrease in density and height of the present native vegetative cover as a result of recurring droughts and serious overgrazing. In some areas dead plants of grama grass were observed, death undoubtedly being due to the drought. Density has been so reduced in many areas that the various textured soils have begun to blow. It is not uncommon on range lands to see the soil set in motion by gusts of wind and trampling of stock. Regions have been observed where native sod has been entirely blown out of the soil. On the sandy and sandy loam soils that predominate over eastern Colorado, soil blowing exposes roots and smothers entire plants by the deposition of wind-blown material.

Large tracts of marginal and submarginal land in eastern Colorado were cultivated during the World War and the years following. The breaking of native sod, together with drought conditions, resulted, within a few years after plowing, in serious destructive wind erosion. Over large areas the soil has been completely denuded of the A-horizon, exposing the heavy adobe clay pan. This blowing is not by any means confined to coarse textured soils, but occurs with the same degree of intensity in fine textured ones as well.

The carrying off of the finer soil particles by the wind and the leaving behind of the coarser materials are some of the most serious results of cultivation and overgrazing. The continuous blowing and piling by the wind of this coarser material has in some areas exposed roots and in others smothered entire plant communities. This exposure and covering of native vegetation is becoming of serious importance in eastern Colorado.

The windblown material is deposited against existing barriers -- houses, fences, barns, windbreaks and the like. One of the most common barriers is the Russian thistle plant. It has spread from cultivated and abandoned fields in all directions, and become lodged on range land and along fences.

The first effect of the deposit of windblown material is the decrease in density of the cover. Buffalo grass with its surface runners is damaged more than grama grass with its underground parts. As the depth of the deposit increases, native grasses are damaged until only a few remnants appear. Finally a large area of range land is covered, and Russian thistle dominates what was formerly a short grass plain. In some sections the area has been desolated, with windblown material covering range land, fences, and partially covering barns and houses. In sandier areas bur-nut, *Tribulus terrestris,* replaces Russian thistle, and in some sandy loam areas purslane, *Portulaca oleracea,* predominates. Near Las Animas, almost the entire native grass cover, consisting primarily of grama grass, has been smothered out and only huge hummocks of *Yucca* remain. In another section nearby, sands have been set in motion, active dunes are formed and even now are moving over and destroying large areas of native vegetation and endangering buildings and cultivated areas.



Windblown material has almost covered this farmhouse in Eastern Colorado. Salix on the left has been buried to a height of seven feet.

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DRAFTING SECTION

Since the dawn of civilization men have dreamed, planned and completed works to extend and make secure that civilization. The earliest dreamers had to proceed by trial and error until a body of knowledge and experience was built up from which others could drae to plan their works with greater assurance of success and less waste of time and material.

Men still dream and plan. But today they can crystallize and translate these dreams and plans into a medium which others can read, understand, and augment from their own knowledge. At the side of the planner -- his translator into reality -- stands the draftsman.

From time immemorial, pictorial representation of ideas has been the easiest method of assimilation, and the draftsman, its exponent, is an invaluable and integral part of any organization entering anew undertaking which requires the coordination and cooperation of many people.

The Drafting Section of the S.E.S. has sought to present an accurate, forceful representation of the composite best thought and experience of the personnel of the Service. It is at present engaged in the compilation of various types of data gathered from all available sources for use in both field and office. As the field forces gather further and more exact information in our comparatively new line of endeavor, the department will be the instrument of correlation. The best available known methods of combating erosion are being worked up into standards to be adapted in the field to each individual case. Slides have been prepared for lecture purposes, to present clearly the need for erosion control. We are acting as a clearing house for aerial survey prints and as preceptors in their uses. Countless charts and miscellaneous maps have been worked up, and standardization of drafting methods in both field and office is being effected. All the art and poster work incidental to such a program as ours is being handled by this department. Reconnaissance Erosion Survey maps of every state have been recpared, and tabulations made of all types of erosion in each state.

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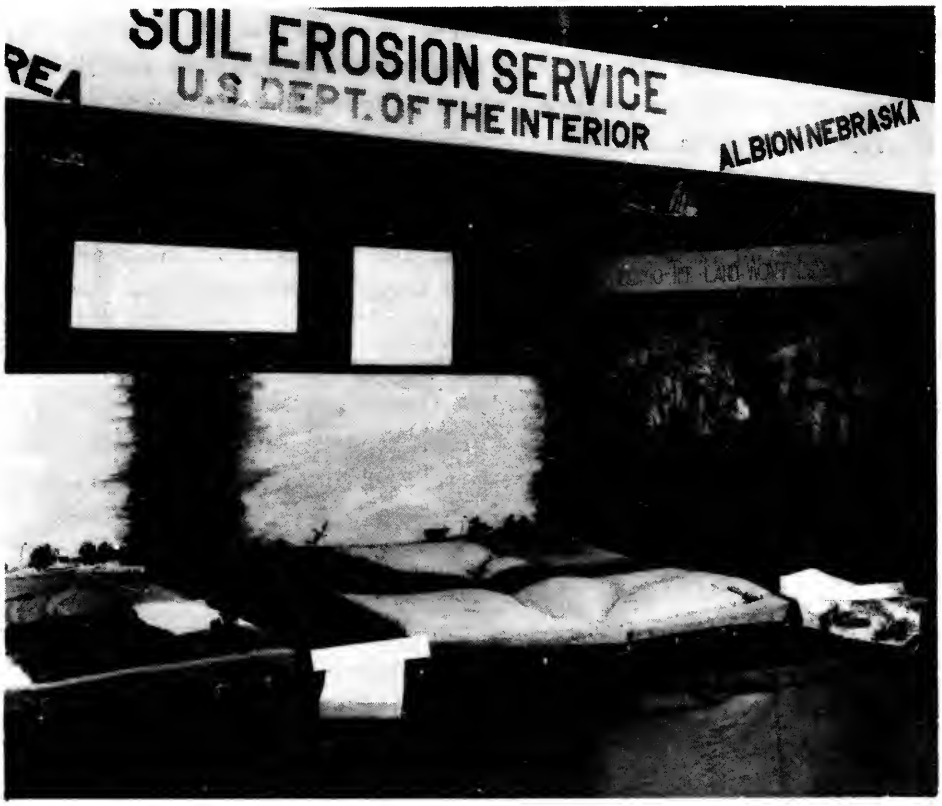
In the Land of Cotton

Continuing our series of exhibits displayed by Soil Erosion Service projects this fall, we show here what the visitors to the Louisiana State Fair saw. It was prepared by the Minden project under direction of Mr. Mims.

And Out Where the Tall Corn Grows



And here is the exhibit prepared by the ingenious force at Albion, Nebraska, where R. L. von Trebra is Regional Director. "A deed to the land won't save the soil," the legend warns.

A Symposium on Pastures

By Lyman Carrier

CHIEF OF THE BRANCH OF AGRONOMY

Two full days of papers and discussions at the annual meeting of the American Society of Agronomy held in Washington, D. C. November 23-24 were devoted to a symposium on pastures. It was a splendid and worthwhile program from start to finish. Never before has there been so much interest evidenced in the grazing problems by the American Agronomists. Experimental work is under way at a dozen or more experiment stations. Some of these experiments have not progressed beyond the lawn-mower clipping stage. Several states, however, notably Connecticut, New York, Pennsylvania, New Jersey, Ohio and Missouri have comprehensive pasture investigations under way where actual grazing by animals is being studied.

A marked advance in grazing thought could be noted at these meetings. Instead of impassioned tirades on the sins of overgrazing there was a general recognition of the necessity of close, even, grazing to keep pasture plants in a vegetative condition for best results.

Many chemical analyses have been made of pasture grasses in various stages of growth which show that a greater production of protein per acre is realized when the grass is harvested at the most palatable stage for animals, that is, two to four inches in height, than when left to mature for hay, although the hay yield is much larger in pounds of dry matter per acre.

One speaker emphasized the need of using the best soils for pastures. That, to be sure, is a new idea for this country. Fertilizer experiments with pasture sward give the same contradictory results that they show with other crops. Phosphorus gives the best results under practically all conditions. Potash with phosphorus is helpful in promoting the growth of legumes. Nitrogen was the bad boy of the experimental school. In some experiments, notably those under way in Pennsylvania, applications of nitrogenous fertilizers gave marked increases in production. Other experimenters reported actual depressed yields for the total season's growth from the use of nitrogen. Lime alone in most cases is not very effective but used with phosphorus and potash may be beneficial. A number of experiments noted that herbage from fertilized areas was more palatable and richer in essential food constituents than that from unfertilized soils.

Some confusion of results was due to the fact that the experimenters were dealing with diverse conditions. The best procedure for the production of a permanent bluegrass-white clover sward might not give the most profitable results with a rotation pasture of only a few years' lay.

It is hoped that the A. S. A. will publish all of these papers and devote another session to this very important subject three or four years from now.

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This formerly fine bluegrass pasture near Bethany, Missouri, is being cut to ribbons by gullies.

SOIL SURVEY GROUP INVITES MEMBERS

The American Soil Survey Association has for its purpose the exchange of ideas, discussion of problems, and the creation of interest in the study of soils as a natural body.

Since this is necessarily the basis of erosion control recommendations, the representatives of the Soil Erosion Service have been invited to become members. Meetings are held annually, and the proceedings, including papers presented, are published and distributed to the members. Applications for membership, together with remittance for two dollars annual dues may be sent to the Secretary-Treasurer, Dr. Austin L. Patrick, Department of Agriculture, State College, Pennsylvania.

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EROSION REVEALS ANCIENT POTTERY

While examining a shallow wash in a sloping field west of Lindale, Texas recently, one of the CCC workers noticed an unusual appearing formation on the ground at his feet. He kicked it with the result that it was partially dislodged and broken. Closer examination revealed that the object was an Indian pottery vessel, one of several which had been uncovered by the action of water removing the soil from the slope.

It was the custom of the Indians who inhabited East Texas before the coming of the white man, to bury with their dead, pottery vessels of food and water, which were to sustain the deceased on his journey to the Happy Hunting Ground. Such burials were of varying depth, according to the hardness of the soil, but most of them were three or feet or more below the surface. Most, if not all of them would have remained undisturbed for centuries to come had it not been for the clearing and cultivating of the land, and the consequent washing away of the soil which covered them.

Aside from the tragedy of the destroyed grave, it is interesting to consider the loss of soil which had occurred in exposing the burial. Even if the burial had been only two feet deep, which is certainly a minimum estimate, then two feet of topsoil, the most fertile and productive part of the soil, had been washed away and lost.

The owner of the farm upon which the burial was found is a cooperator with the Lindale project of the Soil Erosion Service.

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Soil Conservation Service
Region 4
Division of Information and Education

HE LAND
DAY AND TOMORROW

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EROSION SERVICE
DEPARTMENT OF THE INTERIOR

THE LAND
TODAY AND TOMORROW

Issued Monthly by the
U. S. SOIL EROSION SERVICE
DEPARTMENT OF THE INTERIOR

Harold L. Ickes
SECRETARY OF THE INTERIOR

H. H. Bennett
DIRECTOR, SOIL EROSION SERVICE

Editors
G. A. Barnes Ewing Jones

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Looking Ahead

By H.H. Bennett
Director

The Director stresses the need for cooperation with other agencies as the Soil Erosion Service swings into a new and vital year_____

As we close the old year, with its well-worn paths of faithful effort and its record of useful accomplishments, and enter the New Year with its challenging tide of opportunities for an expanded service, I wish to express my deep appreciation to all my co-laborers for their loyalty and unflagging zeal in the important work that has been entrusted to the Soil Erosion Service; and I wish to pledge anew my continuing efforts in the administration of our Service organization on a basis of sound and fair procedure.

It seems appropriate at this time, to extend to the State Colleges of Agriculture, State Experiment Stations, the Extension Service and other State and Federal agencies, the very great appreciation of the Soil Erosion Service for the invaluable assistance given by these organizations in the inauguration of an extensive demonstfational-educational program of erosion prevention and control.

It is our feeling that the directing specialists of the organizations that have been so helpful must have realized the complexity of difficulties involved with the launching of such a far-reaching program. Without their timely and consistent help, we could not have accomplished the impressive progress that has been made. They have been particularly generous in making available for our Service some of their best trained personnel. Our difficulties would have been almost insurmountable if this spirit of helpful cooperation had not been accorded us, and we are deeply grateful.

We recognize the principle of cooperation as a fundamental part of our program. We greatly desire to render helpful service wherever we can, and we know that the degree of successful accomplishment in our field operations will reflect the quality and character of our cooperative relationships. We must have the confidence, sympathy, and

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active support not only of the farmer on whose lands we actually work, but of all purposeful individuals, organizations, and associations interested in the preservation and wise maintenance of our indispensable farm land.

Looking ahead, the enormousness of the problem of land erosion with its far-flung economic and social ramifications, is a clear challenge to the combined abilities of all of us. There must be a loyal, willing cooperation on the part of all agencies that can make a useful contribution to the development of a nation-wide coordinated plan of land protection, which must be set up if we ever expect to curb the evil effects of destructive erosion and so save our remaining indispensable agricultural soils.

There is work for us all, plenty of it -- far more than can be done in any short period of time; but we can organize our combined resources of effort to the greatest possible advantage in bringing to the job all of those practical measures of erosion control that have been worked out by the Experiment Stations, the Colleges of Agriculture, the Federal Department of Agriculture, the Soil Erosion Service, and individuals, and apply them under a program of workable cooperation in accordance with the needs and adaptabilities of the many different kinds of land that make up this complex country.

Thus far the Soil Erosion Service has undertaken to achieve within the limits of its regional projects, the best possible job by employing all known practical erosion control measures regardless of their origin. Being supported by emergency funds, we have provided as much employment as could be advantageously used, and we have proceeded as rapidly as possible in getting our comprehensive program under way. Our life has been brief, but we feel that we have moved forward effectively, and the comments that have come to us from many parts of the country expressing commendation and approval, have emheartened and encouraged us.

It has been a great personal regret that I have not been able to get into the field more often. There simply has not been time to do so nor has there been time to carry on a great deal of correspondence with those institutions that have contributed and must continue to contribute unceasingly to this national program in order that it may be of greatest benefit to the country.

Looking ahead, I want to express what is clearly the desire of everyone in the Soil Erosion Service: that nothing be left undone in effecting a closer relationship and a clearer understanding with each of the organizations and institutions referred to above. Recently, circular letters were sent to our regional directors urging the adoption of

plans for bringing about this closer and better association of ideas and efforts. It is my feeling that the earnest, capable men concerned will not fail in that highly desirable undertaking.

In addition, I would urge that these institutions and organizations give careful scrutiny to the work that has been done by our Service, and offer to us their helpful criticisms and constructive suggestions that we may incorporate them in our future planning. It is not an easy thing offhand to write out the precise details by which erosion-control work should be extended to all land needing treatment; nevertheless, precisely this must be done, and it is our hope that all of us will give serious thought to this very important matter, to the end that we may work out very definitely the best possible methods for accomplishing those essential things in the field of soil conservation that can not be omitted regardless of the position or inclination of any of us. The physical facts involved make it clearly obvious that we shall never get very far unless we make use of a coordinated program of land treatment, employing many different methods, separately or combined, according to their applicability. There is no need for arguing this point; it was settled when the world was created.

In the Soil Erosion Service, we have exerted every effort to train our specialists to think beyond and above their individual interests; to conceive themselves as parts of an integrated machine functioning to the limits of human capacity to protect the needs of the agricultural lands of the nation. In the hearts of our field laborers, we are striving to build the concept that every stroke of work performed in this gigantic undertaking, adds value to the land that represents our country's most indispensable resource. We are teaching these men, specialists and field laborers, to try to build into the hearts of every farmer with whom they come in contact a greater love for the land and a clearer understanding that this substance we call the soil is the primary source of life's necessities and comforts, and it is the most basic and essential of all of our God-given assets.

The course the Nation must pursue over its major areas, if this is to be a permanently productive agricultural country, is clearly marked out. If we refuse to conserve our agricultural lands, obstinately continuing with old methods that have failed, then we may as well confess that we have consciously chosen to head in the direction of disaster. Since posterity can not meet the task and since many farmers are utterly unable to handle all phases of the work that must be done, the responsibility of the Government and of the states is obvious. Aside from this responsibility, the Government has a definite and inseparable interest in the continuing welfare of its remaining

areas of good agricultural land.

It should not be overlooked that the physical facts involved show, also, that we can not have any large measure of permanency in our flood control operations and in our efforts to reduce the hazards of silting of stream channels and reservoirs until the problem of erosion, which is a problem of accelerated runoff of rain-water, is controlled on the watersheds all the way from the crest of ridges down to stream channels. Here again it is perfectly clear that there must be cooperation: programs of erosion control tied in with building levees, spillways and reservoirs, as well as with programs of farm management and wise land use.

And finally, why should there not be cooperation? Is there any physical obstacle in the way that can not be overcome? Or is there any organization objection that can not be smoothed out? I think not. The needs are too acute and the demands too urgent to invite any delay, or even possible defeat, through a lack of cooperative helpfulness on the part of the agencies concerned.

I want to go squarely and definitely on record for the Soil Erosion Service, that we believe in the fundamental principle of cooperation; that we will continue to offer and accept cooperative service; that we have no intention of usurping any field of operative effort; that we need all the help we can get in carrying through the gigantic job entrusted to us; that our minds are not closed to constructive suggestions; and that we are determined to do those things that are necessary to save the nation's remaining areas of good farm land.

It is felt that the Soil Erosion Service has something very pertinent to contribute to the problem of soil conservation, flood control, reduction of the problem of silting, and better land use; and, if others have anything of this same conception, it is our desire to dedicate our best efforts to the interests of the nation. Our work is on the land; it is under way and open to the visual inspection of everyone. We invite such inspection at all times; and we invite the criticisms, suggestions and cooperation of every thinking, patriotic citizen.

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REGIONAL DIRECTOR HEADS SCIENCE GROUP

W. A. Rockie, Regional Director of the Soil Erosion Service demonstration area near Pullman, Washington and Moscow, Idaho, has been elected president of the Northwest Scientific Association.

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Land Use and Erosion In the West

When pioneer cattlemen reached the Palouse, the bunchgrass was stirrup-high. Today, little remains in many sections except miles of sand and rock and sage... The famed "Johnson pasture" is an impressive relict of pioneer vegetation. This article is a tribute to the foresight of the original owner--and a warning to others.

By A. L. Hafenrichter

CHIEF AGRONOMIST PULLMAN PROJECT

Extensive areas of dismal sage and drifting sand on the range lands of the Pacific Northwest are a sharp contrast to the vast seas of luxuriant bunchgrass which greeted the early pioneers on their arrival in this great intermountain grazing region. This valued heritage of millions of acres of excellent range land has been destroyed by those who need it most. Some of it yielded to the plow; the remainder succumbed to the effects of overgrazing.

Pioneer cattlemen concur in the fact that when they emigrated to the unbroken ranges, the bunchgrass seldom failed to reach the saddle stirrup. Today, in its stead, mile after mile of sage, sand, and rock present a gloomy picture of practically valueless eroding land. Erosion by water has removed a large part of the surface soil. Gullies, dry stream beds, and empty water holes are common. Wind erosion has scattered the soil from millions of acres since the grass cover was destroyed.

Few vestiges of the climax bunchgrass association of the western states remain. Sagebrush has crept over the land once carpeted with the "Palouse Prairie". The exact extent of this prairie has not been definitely determined. However, by a study of relicts, it is possible to picture it as originally extensive. With this picture comes one of complete control of erosion processes. Would that the lessons these relicts teach could be impressed on all who are concerned with the land!

In the heart of the reliable wheat belt of eastern Washington is

a 1600 acre remnant of climax bunchgrass prairie. Around it on three sides stretches the wheat land of the Palouse, scarred and marred by wind and water erosion. It alone remains intact and in complete command of the soil in which it is rooted and which it helped to form. To the westward and beyond the Palouse lie millions of acres of range land on which little valuable cover remains. It forms the link between the land of the pioneer, the land of today, and the land of tomorrow.

An orthodox "cow-man" owned this remnant of Palouse prairie. When those around him plowed and tilled, Charles Johnson kept his grassland intact. He nurtured and protected it with the skill of a frugal pioneer. His repeated admonition to his wheat-farming neighbors was, "You may handle more money when you are farming but you make a greater net profit from bunchgrass." His grassland was never overgrazed. For over forty years it furnished seven months' pasture for 250 to 300 cattle yearly. His steers were never "finished off" with grain, but always "topped" the market as prime two- or three-year-olds direct from the range.

So well has the original grass stand been maintained that Dr. F. E. Clements characterized it as the best example of the climax Palouse prairie in the West today.

Figure 1 shows a portion of the Johnson Estate range as it is today. The density and luxuriousness of the grass and the absence of ruderal vegetation and sage are striking. The picture shows the absence of accelerated erosion. For contrast Figure 2 is shown. This was once a dense stand of bunchgrass; now only sage and the erosional

Fig. 1. Portion of the Johnson pasture. The tips of the trees in an original timber claim plantation can barely be seen in the valley.

debris of a dry stream bed remain. Figure 4 shows an immense gully in range land, the result of unchecked erosion. There is no reason why this land could not support a grass stand like that shown in Figure 1 had it been treated in the same constructive manner.

Grass can be maintained on the ranges in the West. Grass will return a profit when grazing is carefully regulated. Overgrazing has allowed the land to be ruined by erosion and has destroyed the cover on which its value rested. To the West this is a hazard of first magnitude. With the depletion of the cover have come "drought years". One of the old-time herders in Oregon put it this way, "We have had 'dry years' before but none have had effects like this last one."

Fig. 2. Dismal sage, dry streams, and eroded soil have supplanted valuable bunchgrass stands on millions of acres.

The Johnson Estate grassland is free from erosion scars except near the water holes. Its topography still bears the unaltered mold of geological erosion. There is no accelerated runoff. On every side is land tilled for fifty years to raise wheat -- acre after acre

Fig. 3. Contrast this slope of summer-fallowed wheat land with the Johnson pasture in Fig. 1. This is the result of a single rain.

of none but wheatland. Wheat stubble and summer-fallow are all that occupy the land. No grass on these farms -- one is told it doesn't "pay". Sharp ridges, gullies, soil slips, subsoil outcrops, and muddy inundations disfigure a once graceful topography.

The summer-fallowed fields of the wheatlands in the Northwest lie unprotected against water and wind, a prey to erosion during each critical period. Steep slopes are farmed without deference to the inevitable toll run-off and soil losses are taking. (See Figure 3). There is no forage. There are no livestock on most of these farms.

The ranges of the Northwest are depleted of their cover. Grazing is becoming less profitable. The productivity of the wheatlands in the Northwest is decreasing. Erosion is taking its toll on both. It is still possible to save most of the grazing land and the wheat land by instituting and maintaining stringent erosion control methods. Action cannot be delayed. The day of rational land use must come, and soon. Without it, grazing and wheat farming cannot remain as profitable industries.

If the overstocked ranges could be relieved by introducing permanent forage on marginal acres on every wheat farm, the solution would be well-nigh automatic. These acres could be grazed just prior to shading-up in the spring and to finish stock when it comes off the range in the fall. Such a plan could be made to "pay". The Johnson Estate grassland is a symbol of what might and must be if the land of the pioneer remains as the land of tomorrow.

Fig. 4. Denuded range lands soon lose their surface soil and are destroyed by gullies. Excessive runoff explained part of the scourge of drouth years.

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Fundamental Concepts of Erosion

By W. C. Lowdermilk
VICE DIRECTOR

Erosion as a geologic process is as old as the first rain storm; it is older than sedimentary rocks. It is therefore necessary for clarity of thinking, in considering problems of soil-erosion and its control, to differentiate between geologic normal erosion and accelerated or man-induced erosion.

Normal erosion, which I term "geologic norms of erosion" has, throughout geological time, carved out with master hand the wonders of the Grand Canyon of the Colorado and Bryce and Zion Canyons with the leisure of moving glaciers. It has worn through uplifted plains; it has provided material to fill rich alluvial valleys, it has rounded off hills and sculptured landscapes. The benefits have been many because this geologic erosion did not proceed faster than nature formed new soils and a protective cover of vegetation. Thus we may use this geologic norm of erosion responsive to local conditions as a basis for the measurement of what we may call accelerated erosion or soil-erosion. Experimental studies have served to measure the degree of acceleration for varied soils, climates, and natural vegetative cover.

The alarming problem confronting thinking people today is that the agricultural occupation of our land has broken the balance of nature and has produced what I term "accelerated or induced erosion", which means that the soils are washing away faster than new soils are being formed.

What is this balance of nature and what has man done to destroy it? When the first settlers came to this continent about three hundred years ago, they found the largest and richest tract of land in a state of pristine fecundity ever discovered by any people. The vast resources of oil and forests and rich fertile lands were millions of years in the making. It was not a gift for the exploitation solely by that generation or our generation, but it is a heritage to be used, not misused; to be conserved, not exploited, for it must be the basis for the sustenance of our American civilization for this generation, for 1,000 years, for 10,000 years,- but why limit our occupation of

this land. What has happened? We have been here a short time, in the life of a civilization, yet in these few years, we have all combined in one continuous frenzy of exploitation, each generation grasping for all that it could get of the rich contributions of nature, with apparently little realization that we are in danger of making this wonderful land of promise a future land of poverty and impoverishment for the increasing populations of the years to come, whereas we might use those resources wisely and leave them in continued productivity for this and future generations.

The important feature of normal geologic erosion, is that it generally proceeds no faster than soil formation. In other words, nature was able to build up soils and a protective vegetation cover at an equal rate with the normal rate of erosion. Development of soil and vegetation has progressed dependently through time, measured in geologic terms. Vegetation has built up and protected the nourishing soils of varying depths, which were the products of intricate processes of soil formation during thousands of years. Thus this coverage of vegetation and its layer of ground litter under pristine conditions, rendered surface-wash of soil negligible. It also supplied nutrients for myriads of soil micro-flora and fauna, and for burrowing animals. All this favored the percolation and retention of rain water and moisture rendering maximum control of flood flows and at the same time protected the surface from the erosive action of wind and flowing water. Thus the soils were maintained despite the geologic process of erosion. General soil profile development or differentiation into topsoils and subsoils is the evidence of this fundamental fact.

The same processes which have laid waste and barren much of the lands of Asia Minor and China where civilizations have long inhabited the earth, are rapidly destroying our lands in the United States. We can often trace the rise and fall of civilizations by the way they have used and misused their soils. The same processes of the destruction of soils which have brought impoverishment and low economic standards to China, will also bring them to us unless we awaken to the menace of this octopus of erosion, which is reaching its myriad tentacles into fields of our best lands and tearing away the rich, productive soils, carrying them out to the ocean or depositing them to silt up stream beds and our expensive reservoirs and irrigation systems, leaving our lands sterile from cancerous gully systems, or reduced in productivity despite all efforts made in improved crop strains, and application of fertilizers.

Of course man must till the good earth for the production of food and textiles and cut the trees of the forests for homes and comforts.

Such necessary use of soils and forests can be done in a manner which will keep them in a continuous condition of productivity, or, man can in a short period so destroy the soils of the mountains and valleys that they are of little use for any kind of production.

We came to this continent as exploiters. There was an abundance of land. We cleared off nature's protective cover. We exposed the rich soils to wind and rains. We destructively cut off or burned off our watersheds without thought of maintaining continuous productivity We overgrazed our hill lands until there was insufficient vegetation to hold back the soils. On mountain and hill, we broke up the balance of nature for the control of erosion. Farmers tilled the slopes and plowed their fields so that each furrow might become a potential gully. The rich topsoils washed off and left subsoils exposed. Little rivulets rapidly grew into gullies. Gullies have devoured the farms over great areas. Soils were deprived of their natural mantles of protection, and few or no measures to safeguard them from accelerated erosion were taken. Thus the geologic norm of erosion was accelerated at a menacing and dangerous rate for national stability.

This process of land destruction, or suicidal agriculture has gone on without much attention, because there were always new lands to the west to clear and cultivate. Our frontier of new lands was pushed westward until it dissolved in the waters of the Pacific Ocean and has reappeared under foot. Our new frontier is the conservation of the lands which we now occupy. The President's executive order of November 26, 1934, withdrawing the remainder of the Public Domain from homestead entry, brought to a close an era in American history, an era of land exploitation. Essentially all of our good tillable lands are now occupied, their sustained and safe usage become our frontiers of a new era of conservation in land use.

The lands of the earth are now occupied; there are no new continents to be discovered and colonized. We as a people must consider the making of this continent the home of this civilization. Our methods of use of the soil will determine the well-being of the present and future standards of living in this land. We may condemn future generations to poverty and low economic standards, or we may assure the present and future generations of sustained soil productivity.

In the final analysis all things are purchased with food. No civilization can endure when the productivity of the land is wasted away. Farming subsoils when productivity has been washed away will produce sub-citizens, whereas productive lands mean continued prosperity and high standards of living.

It is becoming evident to the thoughtful people of the nation that this prodigal wastage of our soils cannot continue if we are to sustain

the American standard of civilization. The time has come to determine what is the safe usage of land for crops, grazing and forests. We must check erosion by artificial means when necessary and remove from cultivation slopes better fitted for controlled grazing or forests and allow nature to come to our aid with a vegetative cover and protection and save what lands we now have as a heritage for our people.

The country is tardily becoming conscious of the menace of soil erosion. On all side we are urged to extend measured of erosion control which are now being employed on the demonstration projects of the Soil Erosion Service. The growth of interest is marvelous. It is the clarion of hope to tens of thousands of hopeless and distressed farmers. Erosion control will need to be a vital part of long time planning of land use, if our nation is to escape the poverty and low economic standards which have befallen older nations through wastage of soils from the destructive acceleration of erosion above the normal geologic rates of erosion.

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Where does soil washed from farms go? Here is one answer. In this reservoir near Columbus, Ohio, 30 inches of silt -- normally under 20 feet of water, have been collected in ten years.

Soil Profiles Show Alarming Loss in Topsoil

The devastation and havoc caused by sheet erosion is illustrated in the accompanying picture of two profiles of the Kirkland soils, extensively developed in Oklahoma. These profiles were prepared by Chas. A. Hollopeter, Soils Specialist of the Stillwater Creek watershed project.

These profiles show the comparative loss of soil on identical slopes, the first showing the Kirkland silt loam uneroded, as it was before man broke the luxuriant bluestem sod. In the second profile, taken in a field just 25 feet away, more than 12 inches of soil has been removed through sheet erosion, exposing the heavy clay subsoils. The texture has been changed from a silt loam, highly productive, to an unproductive clay which will support only a meager growth of wire grass.

This sheet eroded field has been abandoned, as have thousands of others in Oklahoma. First the individual field, then the whole farm, becomes submarginal.

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THE DISINTERESTED OBSERVER

The Press and the Public speak their minds about the S.E.S.

President Franklin D. Roosevelt, in opening message to Congress:

"This work will cover a wide field including.....an intensified program to prevent soil erosion and to reclaim blighted areas..." (Jan. 4).

Editorial in the ATLANTA JOURNAL:

"...the greatest land-saving and land-building activity ever known in Georgia...The good results of the Sandy Creek project are not confined to that district. The demonstrations are drawing visitors from other parts of the state and are enlisting the keen interest of bankers, merchants and other men of affairs as well as of farmers and owners of land. For it is evident that if the washing away of soil is checked and controlled, as undoubtedly it can be, the commonwealth will be saved tremendous losses.

"A leaven is at work which means the saving and the making of millions, eventually billions of dollars for Georgia." (Dec. 30).

Editorial in NEW ORLEANS TIMES-PICAYUNE:

"Mr. Bennett makes the point that long has been realized in the lower Mississippi Valley, and which this section has fought hard to impress upon the rest of the nation: that until scientific means are adopted to halt erosion and runoff of rainwater from the surface of the soil... efforts to curb such waters by building levees, new channels or more reservoirs are simply leading in an endless and costly circle"... (Dec. 16).

Editorial in ELIZABETH, N. J. JOURNAL:

"It cannot be stressed too strongly that erosion is a most vital issue..." (Dec.)

Editorial in LOS ANGELES TIMES:

"If the 1934 drouth has succeeded in waking up the country to the danger of soil erosion and the necessity of locking the barn door before all the horses are gone, it may eventually prove to have been a blessing in disguise, despite the appalling losses it has caused...The problem is one that must be faced and solved. The alternative is a continent that will resemble the Sahara Desert."

Editorial in the WASHINGTON DAILY NEWS:

"The American record of land misuse is almost unparalleled', Secretary Wallace reports. 'Perhaps only the Chinese can match it. But they have been on the job longer than we have.'

"We can still save America from China's fate."

Editorial in WALLA WALLA, Washington, BULLETIN:

"The study of erosion to be started in the vicinity of Adams in Umatilla County will naturally be of interest in and around Walla Walla. Further losses can be largely prevented and it is to determine the best ways of doing this that the work will be undertaken in our neighboring county."

Excerpt from Report of Special Committee on Land Policy, Chamber of Commerce of the United States:

"Recently a vigorous program of soil conservation... was inaugurated...headed up in the newly established Soil Erosion Service in the Department of the Interior. The program calls for control of erosion, reduction of the flood hazard, protection of rich bottom lands from worthless sand and gravel washed out of the hills, prevention of silting of stream channels and reservoirs, and readjustment of land-use practices...Every practicable method of control is being used, according to the character of the land. Reforestation and reseeding to grass of the steeper slopes, soil-conserving cropping systems, strip and contour farming, terracing and other erosion control engineering works, and control of grazing constitute the more common of these methods...

"Such activities as these are deserving of public support, not only through appropriations for their continuance, but particularly through local cooperation by farmers and others...

"The Committee recommends further cooperation between Federal and state governments and private owners in soil erosion work; also that this work be continued and developed along sound economic lines."

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Gully Control Work Withstands Torrential Downpours

By Harold G. Anthony

EXTENSION AGENT MINDEN PROJECT

A terrific rain and hail storm visited the Minden area Tuesday afternoon, November 20, 1934. The rainfall totaled six inches in some parts of the area and in no section was it less than three inches. An inspection of the entire area the day following the downpour showed that only negligible damage had been done to terraces, except where fills had not been made and outlets opened. The gully control structures stood the test.

The accompanying photographs show how the dams in gullies held the water and kept it from rushing off too rapidly and washing. The particular gully in the pictures shown here is located on the Holley & Brewer farm south of Minden. It is one of the longest and widest gullies in the North Louisiana area, records show. The dams were constructed several months ago, but had not before been put to a test since there had been practically no rain in this area. The large dams at the head of the gully are constructed of poles, chinked with straw and back-filled with dirt. Aprons were constructed of small pine poles, held in place with wire. The smaller dams, in the lower end of the gully, are constructed of wire with brush aprons and a back-fill of straw. After the water had subsided in the gully it was found that several inches of silt had been collected, not only directly behind the dams, but also over the bed of the gully.

Legumes Hold Soil in the Cornbelt

By F. A. Fisher

REGIONAL DIRECTOR ILLINOIS PROJECT

Corn has been King in Illinois since the state was settled, but legumes are commanding a large share of the honors under the program of the Soil Erosion Service in the Illinois area. Where there was very little clover or alfalfa two years ago, about 25 percent of the cultivated acreage now is being sown to these crops each year.

Our field men have helped farmers establish improved crop rotations on 62,000 acres in the area. In most cases sweet clover or red clover is included in the rotation. In addition, cooperators have agreed to sow 15,000 acres to legumes every year for the next four years.

Alfalfa is one of the most valuable crops that can be grown in Illinois. Its value is three-fold. The first factor of its value is its resistance to erosion on sloping land. Its dense cover and extensive root system reduce soil washing to a minimum. Secondly, alfalfa is one of the best crops for enriching the soil because of the nitrogen and organic matter it adds. In the third place it is rated as the highest profit crop in this state even though corn holds the spotlight.

We had some difficulty in getting started with alfalfa. All of last spring's seedings in this area failed almost completely. The main reasons for this failure were lack of rainfall and the inability to pack the seedbed under the conditions of extremely dry weather. The seed was sown with a heavy drill which ran too deep in the loose soil. If the seed ever germinated, the sprouted plants dried out and perished before they reached the surface.

The fall seeding, on the other hand, was a 100 percent success. This success was attributed to method of seedbed preparation mainly, and suitable climatic conditions. The ground was disked several times instead of being plowed. Plowing would have turned under the limestone which was applied in the spring and would have made it of little benefit to the present crop. In some instances it was necessary to disk the ground six or seven times to kill all the heavy growth of weeds but it was worth all the effort in the final results. Following the disking the ground was packed with a heavy corrugated roller.

The seed was sown broadcast and covered lightly with a harrow run across the roller ridges. This placed the seed at the proper depth in a well-packed seedbed. A wonderful stand of alfalfa was obtained on the entire 3000 acres sown this fall. The chief reason that it has been nearly forgotten in the past is that it would not grow on most of Illinois' soils without liming and farmers hesitated to go to that expense. Knowing the value of alfalfa in saving the soil, its properties of enriching the soil and its value as a cash crop, many farmers now feel that they cannot afford to be without it.

Results obtained at various erosion experiment stations over the country reveal that alfalfa closely rivals bluegrass as a soil-saver. This fact in itself is sufficient recommendation for alfalfa on sloping lands, not only in the cornbelt but in other sections of the country as well. It grows abundantly on sweet soil in Illinois.

Lespedeza is another legume which proved worthy of a great deal of consideration in this area last summer. Despite the drought, it produced a good stand and lived through the summer remarkably well. Lespedeza will grow on sour soil but does better on soil sweetened with limestone. It serves best as a pasture crop and is excellent in controlling sheet erosion.

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EXCLOSURES VALUABLE IN GREAT PLAINS STUDY

By C. J. Whitfield

During the summer and fall of 1934 an erosion-vegetative reconnaissance of the Great Plains was conducted over a distance of approximately 24,000 miles in the ten states comprising this territory.

One interesting result noted was the presence of sufficient relics in graveyards, fenced areas and other protected spots to lend further support to the theory that the present sod grass type of vegetation, composed chiefly of grama grass, *Bouteloua gracilis*, and buffalo grass, *Bulbilis dactyloides*, is a subclimas type, the area originally being covered by a combination of sod grasses and bunch grasses. The latter were composed chiefly of western wheat-grass, *Agropyron smithii*, and western needle-grass, *Stipa comata*.

Change from the climax mixed prairie vegetative type to the subclimax "short grass plain community" is a result of disturbance (overgrazing, trampling, etc.) and drought.

Exclosures in various types have further proven the soundness of this view and are of value in connection with grazing districts, reconversion of dry-land farms, shelter-belts, and the like.

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Erosion Control in the Navajo Reservation

By Hugh G. Calkins

REGIONAL DIRECTOR NAVAJO PROJECT

The history of the Navajo Indians and their evolution during the past few centuries, from a warlike and marauding tribe to a more or less nomadic nation of peaceful herdsmen and farmers, is yet to be written. It is known, though, that when, after a few unpleasant years of exile as prisoners of war at Fort Sumner, they were returned to their own lands in 1868, they had been reduced to a population of something like 8,000, and that a forgiving Government had started each family in the sheep-raising industry with a small nucleus of a herd. From that rebirth, the population has grown to between 45,000 and 50,000 and their herds have increased to a total of over a million head of sheep and goats, not to mention numbers of cattle and horses.

As human and stock population grew and as blanket-weaving and wool marketing assumed the proportions of a sizeable industry, encouraged by white advisors with abounding faith in the unfailing productivity of the land, grass grew shorter and sparser, especially around the too infrequent water-holes and springs, and gullies began to form. Once started, the erosion process continued at a rapid rate. The Oraibi wash, for example, which once was a mild intermittent stream course confined to a narrow channel between shallow, innocent-looking banks, lined with small but productive cornfields, has become a sinister, twisting gully for its entire length of eighty miles, varying from 20 to 80 feet deep in rich alluvial soil that caves off by the hundreds of tons with every summer freshet. All of its tributaries are in like condition, contributing to the destruction of small farms and helping to carry enormous quantities of silt into the Colorado river where it is a pure detriment.

Just as it has been shown that the painted deserts and many of the picturesque features of the Navajo country are the products of natural processes extending through geologic eras, it has been amply proven that accelerated and destructive erosion of the Oraibi Wash variety is directly attributable to that almost universal enemy of the Southwestern States -- overgrazing. Too many grazing animals, either concentrated in a small space or spread over a large area, reduce the normal stand of grass, weeds, and shrubs and allow the unrestricted flow of rainwater over the hillsides. Broad grassy swales become networks of tiny gullies eating out cancer-like in every direction and combining, in their downward paths, to form giant straight-banked ravines, sapping

Exposed roots of Yellow Pine on rock slope. Presence of roots shows that once this slope had soil on it. Mexican Springs area.

the water formerly available for plant growth and destroying the power of even the richest soil to produce worthwhile vegetation growth.

The Navajo country, comprising some 25,000 square miles -- as big as the state of Pennsylvania -- and stretching from the Grand Canyon of Arizona far into New Mexico, is too often and too carelessly described as a desert. True, its lower fringes, in regions of extremely sparse rainfall, is naturally endowed with desert-like features, but in the main it is only a desert to the extent that men -- white men with an often sincere but mistaken desire to help the Indians -- have made it so.

Picture this country as the Spaniards, who brought in the first domestic four-footed animals, found it; ranges of wooded mountains and hills alternating with broad valleys filled to great depths with rich, humus-bearing soils, covered with an abundance of palatable grasses, herbs, and valuable browse plants. Wild hay was there for the cutting and the succulent chemise or shad-scale, that choicest of sheep and cattle feeds, abounded in the moister bottom lands. The hills were clothed with a less luxuriant stand of grass but with a greater variety of valuable shrubs with great forests of pinon, juniper, and pine in all stages of growth. Streams, whether their flow

was on the surface or underground, were lined with willows, cottonwoods, and other trees, of direct use to man and of indirect use in controlling runoff. The inhabitants of the region were pleasure-loving, relatively prosperous people whose economic life was bound up with the simple problems of bartering the simple products of their handiwork and hunting prowess.

Contrast that picture with the situation that prevails today. Once-productive valleys are cut to pieces by ugly gullies; corn fields and squash-patches formerly irrigated by the simple methods of flood-water farming are rendered valueless because the water-courses, large and small, have become wild and uncontrollable; slopes and valleys that produced abundant forage are given over to worthless weeds or bare ground because, deprived of the vegetative mat that once held back the water and filtered it into the soil, they now act as roofs over which the water flows in sheets to the gullies. Because of overstocking and an undue proportion of goats, the browse cover has been nearly destroyed. The pinon, that valuable nut-bearer whose great crops have been one of the Navajos income-producers, is gradually disappearing because the goats destroy the seedlings and the mature trees are being consumed for fuel. The recurrent drouths which once held no terror for the Navajo now deprive him of income and hasten the depletion of the land.

Where antelope, deer, and wild turkey were once abundant, overhunting and overgrazing have made them non-existent.

Examples of erosion caused by water after vegetation has been destroyed.

Such was the situation recognized by forward-looking officials of the Indian Service and brought to a focus last year by John Collier, Commissioner of Indian Affairs, who sought the advice and help of H. H. Bennett, Director of the newly-created Soil Erosion Service. As a part of the great program, the Soil Erosion Service established the Navajo Project on January 1, 1934.

The problem was not a simple one of gully-plugging. Its solution demanded a combined effort of governmental agencies toward the economic and social rehabilitation of a great Indian nation, involving the right kind of education, the upbuilding of arts and crafts, and the

re-establishment of agriculture and grazing on an enduring basis. The Navajo people must be convinced that the situation was serious and that they must make a sacrifice to save their lands. The government must immediately start the process of restoration and furnish work to produce wages as an offset to the loss in income from livestock.

Indians at work on a head erosion control structure.

The task of the Soil Erosion Service was, among other things, to determine the carrying capacity of the Reservation for livestock, the best methods of range management, and the possibilities of restoring eroded and depleted land to a productive state for farming and grazing. In short, a complete and workable plan for land restoration and land management must be formulated and put into effect. In order to carry out this program the Soil Erosion Service has employed a technical staff, established a land-use experiment station at Mexican Springs, on the Reservation, started comprehensive range and soil surveys, and selected a series of demonstration areas, ranging from 5,000 to 40,000 acres, on which the actual work of erosion control has been started. These areas cover the Reservation from Kayenta to Klag-e-toh, from the Cove to Mariano Lake, and more of them will be added so that all representative types of range and erosion will be included and the entire population will have access to examples of what can be done toward restoring their lands. Each area is fenced and all stock excluded, to be partially brought back when proper numbers and methods of management can be worked out.

Removal of topsoil by the action of wind and water has exposed the roots of the juniper in Red Rock Valley.

The whole-hearted response of the people to the request that they

give up their grazing grounds, and the keen interest shown by them in the work, has infected the Soil Erosion staff with corresponding enthusiasm and energy. Sice the work of restoration must be carried to a conclusion by the Navajos themselves, the partnership now being formed between the people and the agencies of government is a hopeful sign that the project will ultimately accomplish its objectives.

First and most important step in the program is the reduction of livestock to the carrying capacity over a period of three or four years. To this, spurred by efforts of the Indian Service and the Navajo Tribal Council, the Indians have agreed. Already they have made an initial cut in sheep and have removed half of the goat population.

Once the herds have been reduced, the control work can -- funds permitting -- proceed rapidly. Aside from restoring natural vegetation through range management it is and will be the aim of the Soil Erosion men to revegetate the ranges by such artificial aids as will detain the greatest practicable amount of water where it falls. For this purpose they are diverting water out of gullies, around gullyheads, and spreading it over flat and gently-sloping ground to augment the natural growth of grass and other plants. Gullies that are too big for such treatment are planted to quick-growing cottonwoods, willows and tamarisks and, as rapidly as stock can be produced, with food-bearing trees such as wild plum, walnut, and honey-locust. Denuded spots are being planted or sown to a great variety of native plants that can be easily propagated, and are valuable for forage as well as for holding the soil. Water diverted from gullies is being made available to the Indians to the greatest possible extent for flood irrigation. Where necessary, check-dams, wire and brush dams, and jetties are being built.

Three fundamentals are stressed: first, all efforts must be directed toward aiding vegetation, the only cure for erosion; second, artificial structures must be simple ones; and third, that all white men must know the Navajo and his wants, teach him the basic facts of land management, and inspire him to help himself along the right road.

The Navajo is endowed with a high degree of native intelligence and integrity. Show him the logic of a situation and he will go all the way with you. He has never surrendered his independence but he was -- economically at least -- on the verge of doing so. Working in cooperation with the Indian Service and tribal representatives, the S.E.S. is attempting to do its part to make the Navajo nation a self-sustaining, self-respecting, and truly free people. It is too early to predict that this great experiment in human rehabilitation and land-restoration will succeed. Nevertheless, the equally favorable response, to date, of both people and soil is most encouraging.

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By Ewing Jones
TECHNICAL SECRETARY

A scant ten years ago, this nation was just beginning to suffer an epidemic of nascent radio stations. Commercial programs, with the exception of a few local "plugs" and sporadic Whoosit Mercantile Company broadcasts, were unknown. Radio "bugs" hunched before three-tube sets at radio parties -- instead of bridge or cocktail parties -- and alternated using cumbersome headsets. Static crackled in staccato blasts and whistles blighted the dubious entertainment.

Of course, the radio was thrilling, but for entertainment the victrola was the accepted thing. It was great sport to wire the broadcasting station that "program is coming in fine", and listen with abated breath for your name to be read over the radio. And it usually was.

At this same time, the future of soil erosion control was not particularly heartening. Once in a blue moon a short article or technical bulletin would appear on the subject. A few men had already seen the light and were becoming energetic in the study of this problem. A chunky fellow named H. H. Bennett was Inspector in the Soil Survey under the Bureau of Chemistry and Soils.

The future of radio in education was uncertain in 1925. In 1935 its authority is not questioned. Thus education of the masses in the important matter of erosion control via the airwaves is not only timely but advisable, and practically every project of the Soil Erosion Service has been alert to take advantage of its possibilities.

It is but natural that H. H. Bennett, as Director of the country's most comprehensive attack upon soil erosion, should assume the lead in this matter. His appearances on the air have not been volunteered --

since 1932, he has been drafted no less than a dozen times by the coast-to-coast Farm and Home Hour. Director Bennett has likewise gone on the air locally in connection with the delivery of technical papers at scientific meetings.

The Athens, Georgia project has been allotted one 15-minute program each week over WTFI. Although the station is a small one, it is estimated that 300,000 people reside within its coverage. The last census showed 200 radios in the Sandy Creek demonstrational area. It is interesting to note in this connection, too, that radio dealers in Athens sold 1,000 battery-operated sets during November, 1934, 90% of which went to rural residents. A two-fold objective,- to make the programs both interesting and instructive,- is kept in mind by Regional Director Loy E. Rast.

Out in the Palouse wheat belt, the Pullman, Washington project has been filling the air for a good many months. Series of talks was given over the Western Farm and Home hour hook-up, followed by releases through Idaho Farm Flashes over KFPK, Spokane, and a series of two papers given over a Northwest hook-up of eight stations. Good will programs were then started, with lots of variety and fun as well as instruction. The latest stunt has been to organize an orchestra of SES members under the name "Bunchgrassers", this title typifying the original vegetative cover of the region.

A. F. Ruff, Assistant Regional Director at Rock Hill, S. C., has just completed arrangements for weekly broadcasts over WBT, Charlotte, N. C., a 50,000 watt station. He was offered unlimited time on the air at mid-day in addition to his scheduled 15-minute talks at night. With Dr. T. S. Buie, the Spartanburg Regional Director, Mr. Ruff intends to present an ingenious "Soil Erosion Game", devised by the former, over the air. Details of this game are being withheld temporarily. Dr. Buie has held quite an extensive schedule, with several programs over WSPA and WBT, from which he received excellent comment, and is now running a series of 15 talks over WFBC. Most of these talks have been strictly informational, but Dr. Buie plans to develop the dialogue type of broadcast.

The California project under Harry E. Reddick has not made extensive use of the radio until recently, having confined its air extension work to intermittent news and announcements through the Farm and Home hour. Starting this month, however, regular monthly use of radio service is planned. The coverage for California is excellent with the Farm and Home Hour, which has from seven to ten stations.

Radio broadcasts by the Nebraska area have been arranged over two stations. WJAG features a weekly appearance of some member of the Soil Erosion Service staff of Regional Director R. L. von Trebra. The aud-

ience of this station, estimated conservatively at from 40,000 to 50,000, is largely rural. On alternate weeks programs are given over WGBZ, a 500 watt station with a wide coverage. These broadcasts emphasize activities of the Service. Importance of erosion from a national standpoint, physical, economic, and social, is likewise stressed.

Members of the Mankato, Kansas project have been fortunate in securing the active cooperation of the extension department of Kansas State College. Under the guidance of Regional Director F. L. Duley, the S.E.S. staff prepares articles on various phases of soil erosion work. These are broadcast not only over KSAC each week, but over eight other cooperating radio stations to which the material is sent. These talks are occasionally broadcast by staff members themselves, but generally the material is read by some other member of the radio force. The same material is then rewritten for newspapers.

Project No. 15, Minden, Louisiana, considers itself fortunate in being granted time for a weekly broadcast over KTBS of Shreveport. The station is owned by the Shreveport Times, which incidently has almost daily carried news stories of the North Louisiana project, and is sold on the erosion control objectives. The station is an NBC outlet and a popular one among listeners in the Arkansas-Louisiana-East Texas-territory.

The Louisiana broadcasts, which follow immediately after the National Farm and Home hour, have thus far been given by Harold G. Anthony, Extension Agent. The first two were of a general nature on the work and its need. Subsequent talks are more specific, with a few minutes' time at the end of each broadcast being allotted to answer questions which come in following each appearance on the air.

Radiocasting is a new departure for the Chatham, Virginia area but, like other projects, its reaction is favorable. Weekly talks are given over WBTM at Danville during the Farm Bulletin Hour.

Regional Director L. P. Merrill, Lindale, Texas, has been running occasional talks, and is now engaged in a series of 16, with the assistance of his extension agent, P. H. Walser. At Zanesville, Ohio, Director J. C. Cutler has frequently taken the air, the Ohio State University station WOSU at Columbus being one of the outlets.

The Cornell University station at Ithaca, N. Y., WESG, has been invaluable to Dr. F. B. Howe, the regional director there. Dr. Howe recently sponsored a series of talks in which most of his staff and advisory council took a hand.

Success has greeted the radio educational work of the Soil Erosion Service. Responses have been overwhelming. Hordes of requests for more information are coming in. The work has sold itself.

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Role of Forest Litter Shown by Studies

By E. V. Jotter
CHIEF FORESTER

Destruction of the forest with loss of valuable stands of timber is a cost of forest fires which is readily apparent. A less dramatic and less immediate cost than the burning of mature trees, but one which is of even more serious economic consequence, is the greatly increased danger of soil erosion which is the inevitable aftermath of forest fire.

The function of trees as soil-builders has generally been recognized. The importance of forest cover in preserving the stability of the soil, and in absorbing and conserving rainfall has been conclusively established by experiment and research. On a slope stripped of its vegetative protection the runoff of water is unimpeded, and the soil is exposed to the destructive force of erosion.

In California, for example, and in other regions where water is paramount in determining land use, this capacity of the forest cover to conserve rainfall is of especial importance. For much of our understanding of this function of the forest we are indebted to the researches of Dr. W. C. Lowdermilk.

The start of a forest fire in Southern California.

The so-called "sponge effect", the capacity of forest litter to absorb water, was known and generally recognized, when Dr. Lowdermilk's researches in China first made known the further function of the litter in keeping water clear, and in preventing the sealing of the earth's surface. Results of other of his studies, conducted in California, show that the amount of water running off of forest plots that had been burned over is much greater than for similar unburned plots. During one major rain storm, the runoff was 35 times greater from the burned area than from the unburned.

In the eastern hardwoods region where there has been a great lowering of water tables, the research of Dr. John T. Auten of the Central

States Forest Experiment Station is particularly significant, and should be of interest not only to those concerned with soil and forest conservation, but also to the farmers of the region, many of whom have been forced by the decreasing water supply to haul water for stock.

Dr. Auten's studies showed that the failure of springs and streams, the lowering of water tables and the failure of wells are closely related to decreased forest lands and to the poor condition of remaining woods. His experiments indicate that undisturbed woods (those in which there has been neither forest fires nor grazing) take up from three to nine times as much water as those which have been burned.

This devastated forest scene shows direct forest damage but does not show subsequent losses to soil and its capacity to absorb water.

These two examples of research are representative of many other studies which show the importance of the forest cover in preserving the soil and in conserving rainfall.

Another result of a forest fire. Burned over slopes could not hold back the onrush of mud and boulders following a torrential rain.

Making A Reconnaissance Erosion Survey Map

By W. F. Beamon
CHIEF DRAFTSMAN

Realizing the need for a well defined plan of operation if its program was to prove successful, the Soil Erosion Service undertook, shortly after its organization, to obtain data and prepare maps showing present erosion conditions in the United States. The assembling of such information, it was felt, was essential to the proper determination of future policies and careful planning of future work.

On August 18, 1934, it was decided to make a reconnaissance erosion survey of the United States and the drafting division was notified to prepare for the task of translating the results of the survey into maps of the entire country and of each state. As the work was to be completed and copies of the national map ready by October 30, the assignment called for exceptional speed on the part of the Drafting Section.

It was first necessary for the drafting room to obtain all available base maps in the United States for use by the field men in making their field surveys. In the selection of these base maps, first preference was soil maps wherever they were available, for inasmuch as the same soils tend to erode in the same manner and degree under the same conditions, the soil outlines and the erosion areas could be plotted in detail with a high degree of accuracy.

Second preference in the selection of base maps was given to Geological Survey topographic maps and Army topographic maps because the land slope and contour indicated on these maps permitted a better visualization of the most probable and natural divisions of erosion. Third preference was given Post Office maps because of their general accuracy in showing drainage and road locations. When maps of these types were not available, any base map which would serve the purpose at hand was secured.

Placing these maps in the hands of the field survey men, the Drafting Department turned itself immediately to the matter of obtaining necessary equipment and of securing and training a competent personnel to handle the projected work as fast as the base maps were returned from the field.

As the drafting force consisted of only three persons it was necessary to contact and interview approximately 175 draftsmen and to select therefrom a force of 45 whose experience was flexible enough so that they could be quickly trained for the special work to be handled. While the personnel was being obtained and given advance training the

town was being scoured for drafting equipment. Even after every available drawing table that could be bought or borrowed was secured it was still necessary for some of the draftsmen to work on everything except the floor. During this period of preparation various standards for carrying out the actual work had to be set up, and it was also necessary to select and prepare the best available base maps on which the final work was to be presented.

By this time the soils men in the field were sending back their plotted surveys. These were checked in, given a file number, and turned over to Dr. Mark Baldwin, who from his vast experience with the general soils conditions in the United States, could exercise the responsibility of making a thorough inspection and check of these maps before they were turned over to the draftsmen. Where necessary, maps were returned to the field for any corrections or changes to bring them within the accepted standards. After being passed by Dr. Baldwin the maps were turned over to the individual draftsman, who transferred the data which was on various scale maps to the individual state maps on a scale of 1 to 500,000. The plotting of the draftsmen was then thoroughly checked for accuracy and workmanship, as well as against adjoining states and counties so that when maps were laid edge to edge they would be in perfect agreement. Although most of our field work was sent in in very good shape, there were some instances where it was necessary to return maps to the field again so that the field men could reconcile differences which appeared on adjoining maps made by other surveyors.

When the detailed individual state maps were completed the poor old draftsman's worries were just begun. He had then to planimeter and determine the actual area of the various erosion classes both by county and watershed, and to prepare therefrom final tabulations which were made by the draftsmen under the direction and supervision of our statistical division. To insure accuracy in this work each area was planimetered twice, and checked, both by the original planimetering and against the total county area, until they agreed within ½ of 1%, the allowance we made for expansion and contraction of the paper due to weather conditions. The map was then turned over to the copyist to be inked in, lettered and each erosion class colored to conform with a set of predetermined standard symbols to identify the various erosion classes.

From the above state maps it was necessary to make a map of the United States showing the same distribution of erosion as on the state maps, but on a more convenient size. The draftsman was again called upon to reduce the state maps to a United Stated map on a scale of 1 to 5,000,000 showing the various classes of erosion in as much detail

as consistent on a map of this scale. After all data was transferred from the state maps to the United States map, several hand-colored copies were made to be presented with the National Resources Board report, as our time limit was too short in which to have this map published.

After this map had been accepted as satisfactory, preparations were made to have it reproduced in quantities. This reproduction requires: first, the preparation of a base map for the lithographer's use, showing the state outlines and names; second, a base map for the river lines, lakes, etc., and their names; third, base maps showing the outline and number symbols of the various erosion areas; fourth, color charts and legend for the various colors to be shown on the finished map. After the contract had been placed with the lithographer, he made a plate for each base map and each color. As fast as the plates were made a proof was taken from each plate and checked and corrected by the drafting room. After the plate had been corrected by the lithographer, a second proof was made and checked again by the draftsmen. It was also necessary to make checks on each color plate, one for accuracy of detail and a second for accuracy of color and register. Then a final check was made with the composite colors on the map to determine any final discrepancies and to check the color shades before allowing the lithographer to make his final printing of the finished map.

In making up these maps 39 separate color symbols were used. These will act as a basic set for all future erosion maps. This required the lithographer on this particular job to make up 17 plates including the necessary base plates.

This gives an outline of the difficulties encountered in making a map of the United States showing the distribution of erosion. The Drafting Department of the Soil Erosion Service, however, has completed its share of this work, and the map is now in the hands of the lithographer. Moreover, plans are being laid and estimates prepared to have copies of each of the state maps reproduced in color. The drafting department is already at work on the base for these state maps, which will show the degree and classes of soil erosion in much greater detail than does the United States reconnaissance erosion survey map.

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BIBLIOGRAPHY ON SOIL EROSION SERVICE COMPILED

A bibliography on the Soil Erosion Service and its works has recently been compiled by James T. Rubey, Acting Librarian of the U. S. Geological Survey Library. It will be revised frequently.

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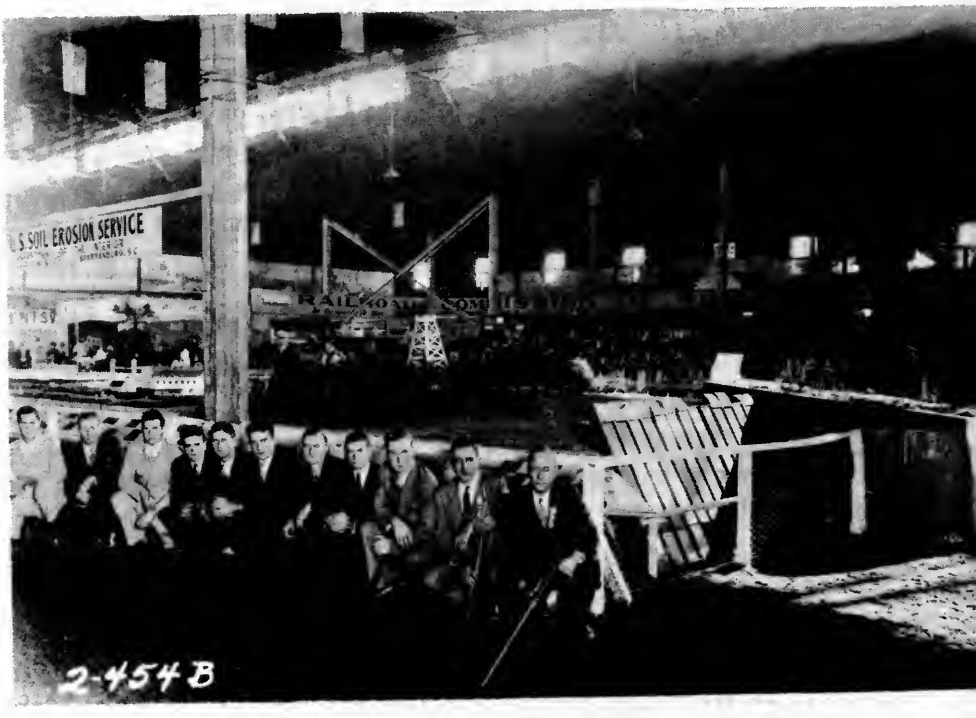
Miniatures



Dr. Buie's boys -- see photo -- put their South Tyger River project in their pocket, so to speak, and took it to the fair.

— with a mighty Meaning

South Carolina farmers marveled at a Lilliputian lesson -- and made up their minds to mend their ways.

Coordinated Attack on Enemy Essential to Campaign

By T. S. Buie

REGIONAL DIRECTOR SPARTANBURG PROJECT

Can we conceive of the frantic preparations for attack which would be made had a foreign foe landed troops on our shores and laid waste to a territory approximately twice the size of South Carolina? Actually an enemy -- an enemy as real as any our troops ever have faced in battle -- has conquered an area 35,000,000 acres in extent, laid waste to what once were fertile fields and almost unchallenged continues his relentless march of destruction across other fields wherever the slope of the land is sufficient for water to flow.

The fact that this area of land, the value of which has been effectively destroyed by unchecked erosion, does not lie in one body but is distributed throughout the entire country, prevents the public from realizing fully its significance.

Let us for a moment consider what would be our plan of action were we facing an armed foe instead of an agency of nature, and note the similarity between such a plan of attack and the coordinated program of the Soil Erosion Service to combat this menace to agriculture.

First, we would learn everything possible of the enemy -- his relative strength at various points, thereby determining the most vulnerable positions. In order to acquire such information we would employ air craft of all kinds, supplemented by military intelligence and information from any other source which would be of value. Having such information, it would be possible to plan an attack with hope of ultimate success.

In like manner the program of the Soil Erosion Service involves making plans for treatment of each area in accordance with the best known methods of control. A definite procedure is indicated for each separate condition. After such a plan of action has been agreed upon it is put into execution in much the same manner as a military plan of action is initiated.

In a military attack artillery preparation is essential and it is particularly necessary that such fire be directed where it will be most effective and not dissipated throughout a large area. Just so with the terracing program in an effective plan of erosion control. Terracing is one of the most valuable measures of control, but

just as the fire of artillery should be coordinated with other arms of the military service in an attack, terracing should be coordinated with other measures of erosion control, and employed where it will be most effective.

In modern warfare, tanks -- supplemented by machine guns and auxiliary arms -- play a most important part. While such implements of warfare are very helpful in an attack, they do not permit of final occupation of the position and consolidation of gains. The use of such arms of the military service in warfare may be directly compared to the building of check dams in gullies, the construction of terrace outlets, the preparation of controlled waterways, and the like, in the fight against erosion. While very important in each case, they are but a means to an end.

Finally, as in the military engagement, the ultimate victory is dependent upon the aggressiveness of the infantry consolidating the gains made possible by the coordinated attack by all arms; the effective control of erosion is dependent upon vegetative cover. In the program of the Soil Erosion Service main reliance is placed upon vegetative methods of control -- nature's method of protecting steep slopes.

Contour cultivation, strip cropping, strip rotations, substitution of close-growing crops for clean-culture crops, placing slopes in pasture and reforestation of steep slopes, are considered as most effective methods of control. Terracing, construction of terrace

Gully encroaching upon a South Carolina corn field.

outlets and controlled waterways and gully control work in general are very important phases of the erosion control program, but in the last analysis are but a means to an end in that revegetation of many slopes is the only answer.

In an attack on an armed foe Americans would not be satisfied with one method of approach alone. They would consider the throwing of a few shells into the enemy's camp at intervals ineffective. Some good would be accomplished, it is true, but we would not limit our activities to such nominal preparations for we would realize that we could not hope to stay the progress of the enemy, much less drive him from our shores, by such an ineffective method of attack. Rather we would employ every means at hand -- every device which the ingenuity of our inventors and experimenters could develop. Just so it is in our attack on the greatest foe of present day agriculture -- erosion. It is absolutely necessary that in attempting to combat this menace we attack all along the line using all the implements and methods at our disposal, just as would be done in the case of an attack on the armed force of the enemy. This is the program of the Soil Erosion Service.

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The start of a gully in a South Carolina cotton patch. Unless checked, it can soon reach proportions similar to those shown on the previous page.

BY WAY of BIOGRAPHY

R. E. Uhland

Regional Director, Bethany Project

in charge of Missouri project, it is quite natural that he should have resided there "almost all my life"...which dates from April 10, 1896. schooling at the University of Missouri...an M. A. degree in Soils and Crops in 1924...graduate assistant and research instructor while pursuing work toward a Ph.D...enlisted in the Navy during the war...took up dirt farming, operating a general farm of 240 acres and a 70-acre orchard...accepted position with the Forage Crops office, Bureau of Plant Industry, making general study of the Mississippi Delta...instrumental in starting a number of experiments... which are still in progress...went with Bureau of Chemistry and Soils in 1930, later becoming superintendent of the Soil Erosion Experiment station at Bethany... there until October 10, 1933, whenhe joined the Soil Erosion Service... like most regional directors, is a fluent and technical writer...invented a divisor flume for taking aliquots of runoff...has had a heavy load as director of two joint areas...but that hasn't even slowed him up...short, stocky...bristly, greying hair...ultra-friendly...would stare if you called him "Russell", but that's his name...

Should Erosion Control Be Dramatized ?

By Chas. D. Jarrett
VENTURA PROJECT

Yes, and the reason is this. Soil erosion, of the man-induced type, is the greatest menace this country, or any other country depending on its agriculture for its prosperity, has ever known. We can do little more than guess regarding its influence upon the fall of those nations that prospered and passed only to leave crumbling ruins in the deserts we know today, but there is a growing belief that the sinister and greedy hand of erosion played a far greater part than has heretofore been suspected. Soil erosion must be controlled. Soil erosion can not be controlled without the cooperation and education of the men who actually manipulate the soil for their living. We have our conclusions, experimental data, and our proven corrective methods, but they are like jewels locked in a vault until they are delivered to and used by the men who in the end must decide the value of the Soil Erosion Service. Ours, particularly in the Extension Department, is very much a problem of delivery, and there has been no cart or carriage devised to date that will deliver information to the masses as efficiently and as effectively as drama.

How can we dramatize soil erosion control? We know that soil erosion has already cost this country ten billion dollars, and we tell the people that -- but it doesn't register, because not one in a thousand of our listeners or readers ever saw as much as fifty thousand dollars. We tell them that soil erosion has taken a value out of this country equal to fifty 30-car freight trains loaded with silver dollars, and that draws a picture. A freight car loaded with silver dollars leaving this country on a one way schedule would be dramatic to the man who has to work two hours for a single silver dollar.

We speak of sheet erosion that gradually washes away the topsoil, but it doesn't draw a very exciting picture to the man who has lived all of his life on the land. We speak of sheet erosion -- the sneak thief, who robs farmers while they sleep, and who creeps on to the land in the guise of a friendly rain, and then we draw a picture that immediately stiffens the hair on his neck. No man likes to think that his possessions are being systematically plundered while he sleeps.

We say that improper tillage is destructive to the topsoil, but

while it is unquestionably true, it fails to bang the average farmer hard enough to make him sit up and think. We say, "Good men have robbed their children, and they will immediately bristle, because they are good men and would never knowingly rob anyone. The implication arouses them, or if printed, catches their eye, and they read on while you prove your point.

We say that the problem is to keep the moisture in the soil, and the average farmer will yawn and reply, "Sure, I've known that since I was a boy." We say, "It is purely a problem of making running water walk," and we have not only drawn a picture, but presented a challenge as well.

We tell a group of farmers that a gully is destructive, and they will all agree, because they have known that for years. It's an old and familiar story to them. We tell them, "There's a gully over here on the Jones place that has moved more dirt off of his farm than Jones and his hired man could have removed with a Ford truck, if they had spent fifteen days out of every thirty hauling the farm down to the river and dumping it in." That is true about the gully on Jones' farm, and it's dramatic when we compare the ability of the gully as a dirt mover to that of himself and his hired man.

Drama in presentation is the most effective tool that any speaker, teacher, or salesman can use in reaching the thinking processes of the uninformed. Soil erosion control is a vital problem that concerns every living man, woman, and child, and because it is so important that they know, it is imperative that we employ every ethical means to impress them with the peril of continued indifference. The decay of a nation's agriculture is drama to those whose happiness and prosperity is at stake, and any movement to avert such an end is, and must be, essentially dramatic. Count the number of farmers you know who pay to hear a farm lecture, and then, after watching them at the ticket booth of a movie show, draw your own conclusions.

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A sloping field,
A surface bare,
A heavy rain
And the soil ain't there.

A sloping field,
A clover cover,
The rain soaks in,
Somehow or other.

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Nebraska County Aids In Gully Control

By E. R. Kinnear

CHIEF ENGINEER NEBRASKA PROJECT

One worthwhile phase of erosion control has been worked out on the Albion project which exemplifies a fine degree of interest and cooperation.

Within the area in the two counties of Boone and Nance are many inadequate drainage structures along the county roads. In more than twenty cases, both wooden bridges and culverts are so installed that severe gully erosion continues to destroy adjacent farmland. In many cases the bridges are replaced by larger ones every year or two, and the culverts and road fills are often completely washed out in normally heavy rains, hence, in addition to loss in land values through erosion, the maintenance cost to the county is excessively high.

A specific case is given here. Across one major gully a 35-foot timber bridge had become virtually unsafe, due to the gully eroding to a depth of 30 feet below the bridge deck. This gully has already cut 500 feet through the farm on the south, and was cutting into the farm to the north with a 22-foot head. The bridge would have to be replaced within six months at a cost of about $1,500.00. The Soil Erosion Service has corrected this situation by installing a drop culvert at a cost of $450.00.

The field to the north draining into this gully has been terraced with level terraces, and will be farmed on the contour, the bottom terrace being a bench terrace. This cuts down the drainage area so that an 18-inch Armco pipe culvert has now replaced a 35-foot wooden bridge.

To accomplish this job cooperation of the landowner, the County, and the FERA was obtained. The landowner supplied the culvert pipe and materials; the County supplied the machinery for grading; the FERA supplied relief labor and teams; and the Soil Erosion Service supplied supervision and design.

The result is that the gully erosion has been permanently stopped, the County is relieved from further maintenance cost of renewing the bridge several times, and the relief labor has performed a valuable work. There are seven other projects of this nature now in the process of negotiation with the landowners and the County Commissioners.

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Appraising the Soil Resources on the Salt Creek Watershed

By A. H. Paschall

CHIEF SOIL EXPERT OHIO PROJECT

The primary responsibility of the Soils Division is to prepare maps which will give an adequate evaluation of the present conditions of the area. They are the appraisers who examine the assets and liabilities of the land for the Soil Erosion Service. They map the soil type, cover, slope, and erosion of the area. The soil experts inventory the "Today" of the land within the project area. It is upon their work that the "Tomorrow" of the land is based.

In the Salt Creek watershed the soils present a complex problem. They are residual, being derived from interbedded sandstone, shale, clay shale, and limestone. Consequently the soils are very much mixed and present a wide variety of characteristics. It is not enough to classify the soils and types according to the system of classification of the Bureau of Chemistry and Soils, but they must be grouped according to certain characteristics. Two groups suffice for this project. The first group includes soils derived from sandstone and shale rocks. They are usually of silt loam texture and have acid reaction. The second group of soils are those which have some limestone or calcareous shale in the parent material. They are usually silty clay loam and have alkaline to neutral or nearly neutral reaction. The characteristics of these groups affect the erosibility of the soils either directly or indirectly. It follows that the group of soils with the least erosivity (Group 2) has a wider range of adaptability for land use, especially as regards the steepness of the land that may be used for any given purpose.

The slope classes are those established by the Washington office. These classes are: "A" slopes for cultivated crops; "B" slopes for cultivated crops where some form of erosion control is practiced; "C" slopes can be maintained as permanent pastures without serious erosion; and "D" slopes must be maintained in woodlot to prevent erosion. On the Salt Creek project the limits for the two groups are given in the table below:

	Slope Class			
Soil Group	A	B*	C	D
Sandstone and shale	0 - 5%	5 - 20%	20 - 30%	30% or more
Some limestone material	0 - 5%	5 - 25%	25 - 40%	40% or more

*The "B" class is subdivided into B and BB classes with the limits being 5 - 12% for the B subclass; and 12 - 20% and 12 - 25% for the BB subclass.

The kind and condition of the present crop is essential information in planning cropping systems especially in a region where a crop rotation is followed. Annual crops vary each year, hence it is not so necessary to have a rating of their quality. It is sufficient to know the type of crop, whether it is corn, wheat, or some other annual crop. However, perennial crops as pastures, meadow, and woodlots carry over many years and a quality rating aids materially in planning the immediate treatment and erosion control measures. Each pasture is given a rating which shows whether it is a good, fair or poor blue grass pasture, or whether it is poverty grass, or is weedy and worthless. These ratings can be translated into the measures necessary to control erosion. The meadow classification is worked out to show the type and condition of the crop. It also indicates whether the meadow should be reseeded or will improve with treatment. The woods classification indicates the type and age of the woodlot, also whether or not it is open and pastured. For example, the symbol F_3 on a woodlot indicates that it has all sizes of trees from young to mature. It will be possible to harvest a few trees from this woodlot every few years and still maintain a good cover. F_{4y} on a woodlot indicates that the trees are all old and mature, also that there are not enough trees to cover the area. Woods of this type will require considerable underplanting to prevent erosion.

The amount of erosion is indicated on the map after the system established by the Washington office for the various projects. In addition it has been necessary to add a class (Class 6) to indicate slips and landslides.

All work is indicated by symbols on aerial photographs. The amount of detail shown is determined by one question -- is this information valuable and essential in planning the reorganization of the farm to control erosion? If the answer is "yes", the point in question is indicated on the field map; if "no" the point is omitted.

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That erosion control is a tangible farm asset to be included in the list of improvements is fast becoming recognized. Recently a Central Illinois newspaper advertised a farm for sale. Included in the list of improvements noted by the paper was the fact that soil erosion control had been signed for. The clipping was sent in by G. M. Flint, Camp Superintendent of one of the CCC camps near Galva, Illinois.

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THE LAND
TODAY AND TOMORROW

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HAROLD L. ICKES
Secretary of the Interior

H. H. BENNETT
Director, Soil Erosion Service

G. A. BARNES · EWING JONES · EDITORS

The Contents

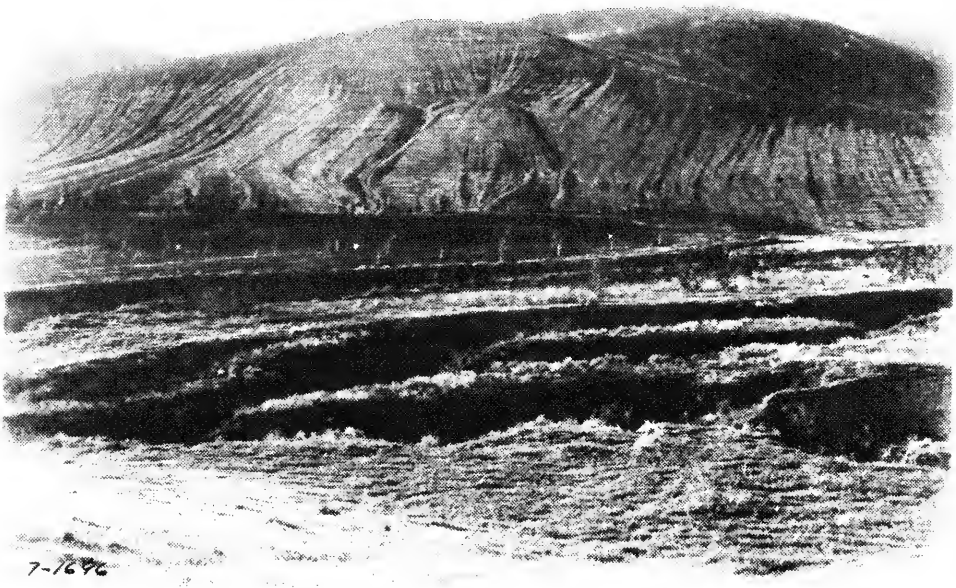
The Cover

"Permanent bench terraces in the Colca Valley of Peru"

Drawn by Rudolf Modley
from an aerial photograph

PROJECT WORRIES

Santa Paula, California.



Sheet erosion on side hills that had been clean cultivated for growing lima beans. Deep gullies or barrancas in foreground cut through the valley floor in rich irrigated lima bean, citrus, and walnut land. Storm of January 4, 1935.

Apple orchard in Corralitos project following storm of November 18, 1934.

Plant Problems in California Gullies

Vegetation of all types is proving invaluable in halting barranca erosion in the West.

By A. E. McClymonds

CHIEF AGRONOMIST CALIFORNIA PROJECT

The California gully, or "barranca", as it is more commonly known, presents problems of control that demand not only special methods of treatment, but a complete harmony of attack by the engineer and the agronomist. To appreciate properly the handicaps imposed upon the plantsman it should be remembered that Southern California would be little more than a desert were it not for irrigation. It is a country where rain seldom falls in the eight months from March to December, during which time all but the major watercourses are dry and barren wastes. Due to the extremely high mountains, with their sparsely vegetated and steep pitching watersheds, the winter storms sweep down with terrific force, taxing to the very limit all attempts to retard or control the erosive effects of the water.

Check dams, when unassisted by vegetative methods of control, have a high percentage of failures. In one case, out of 900 check-dams built by private landowners in one watershed, only one survived a recent storm. This was in the Montrose area during the storm of December 31, 1933. Such experiences have definitely pointed to the necessity of a planting program along with the use of dams. The agronomist is thus forced to overcome the handicap of arid, or semi-arid, climatic conditions if he expects to succeed.

The dimensions of the barrancas being controlled often approach those of gorges, with perpendicular walls fifty to seventy feet high and widths of as much as three hundred feet or more. In one area of forty-seven square miles there are twelve barrancas of major size, taking from cultivation more than one hundred thousand dollars worth of tillable land. One of these barrancas has carried away on an average more than nineteen cubic yards of soil every day of its life for forty-one years, and that is not allowing for the fact that there are eight months of every year when it is completely dry.

Plants, when once established, not only insure the efficiency of check dams long beyond their normal life but continue to grow in value

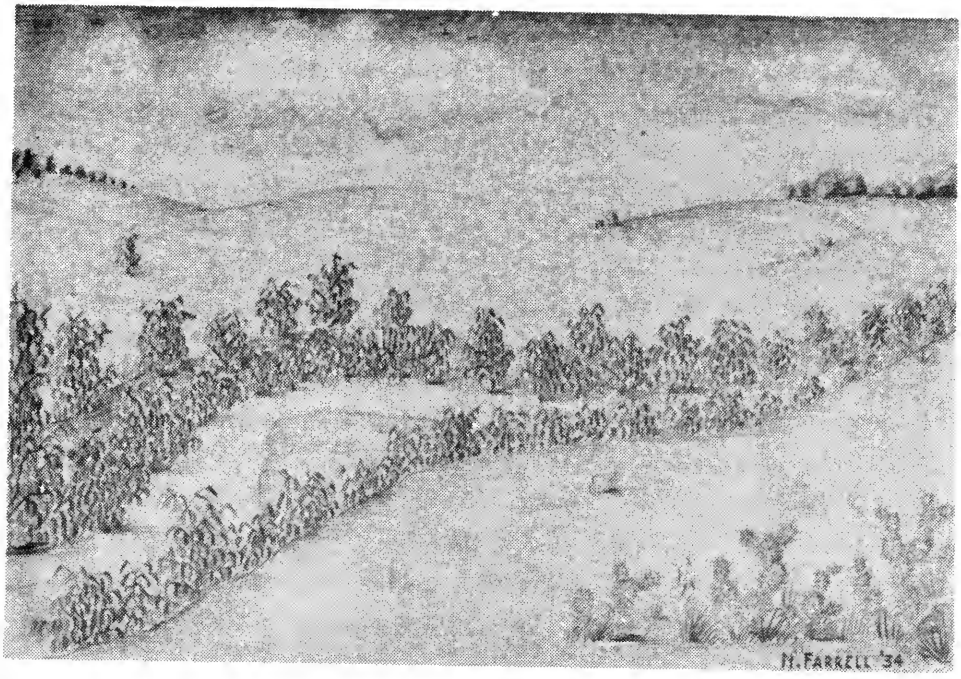
as soil holding agents, and as absorptive measures in retarding the run-off. The ideal plant in arid and semi-arid regions must, of course, depend upon its ability to survive the long periods without rain, and should be of a type that seeds heavily with an inherited means of scattering its seed -- either by action of the wind or by mechanical propulsion. In California it must grow rapidly, have a large soil-holding root system, and not only be able to stand prolonged periods of drouth, but severe conditions of heat and cold as well.

The willow (*salix* species) is not only proving of excellent value as a means of insuring the permanency of check dams, but, when once established, continues to grow under conditions hardly favorable to most water loving plants. It is planted by inserting cuttings along the sides of the stream beds during wet periods, with care being taken not to place them in the direct path of the overfall. Giant lyme grass (*Elymus condensatus*), a native type of vegetation in this region is also proving an excellent preventive of side cutting, when used along the borders of the silting basins.

After silting has occurred behind a check dam the need is for a plant that will resist the cutting action of the running water. Bermuda grass would be ideal for this purpose were it not considered a noxious weed in the state. Generally grasses of this type with stolens, or running root stocks, are proving effective. Kikuyu grass (*Pennisetum clandestinum*), an importation from Africa, is proving very effective as a silt anchoring means and also as a covering for the apron below the dam. Australian Salt bush (*Atriplex semibaccata*) has been found satisfactory for the steeper banks of the check dams.

Where prevention of side cutting in deep barrancas is the problem, the planting is always done along the banks, leaving the center unobstructed as a water course. When further silting of the water course is desired vegetative jetties are slanted down stream from each bank, and the plants used in forming these barriers are selected for their tenacious root systems, plus their tendency to bend over and form a mat of protective vegetation when the high water comes. Water Motie (*Baccharis glutinosa*) has been found to possess the desiredqualities and to withstand the varied climatic conditions it is subjected to in this state.

Where the gully or barranca makes an abrupt turn, with a resultant eating into the bank on one side, it has been found effective to plant willows in a mass formation on the eroding or outer side of the turn, with a straight line of willows on the inside to protect that bank, should the stream ever attempt to swing back. It has been found advisable in a number of cases to dig a new channel for the water

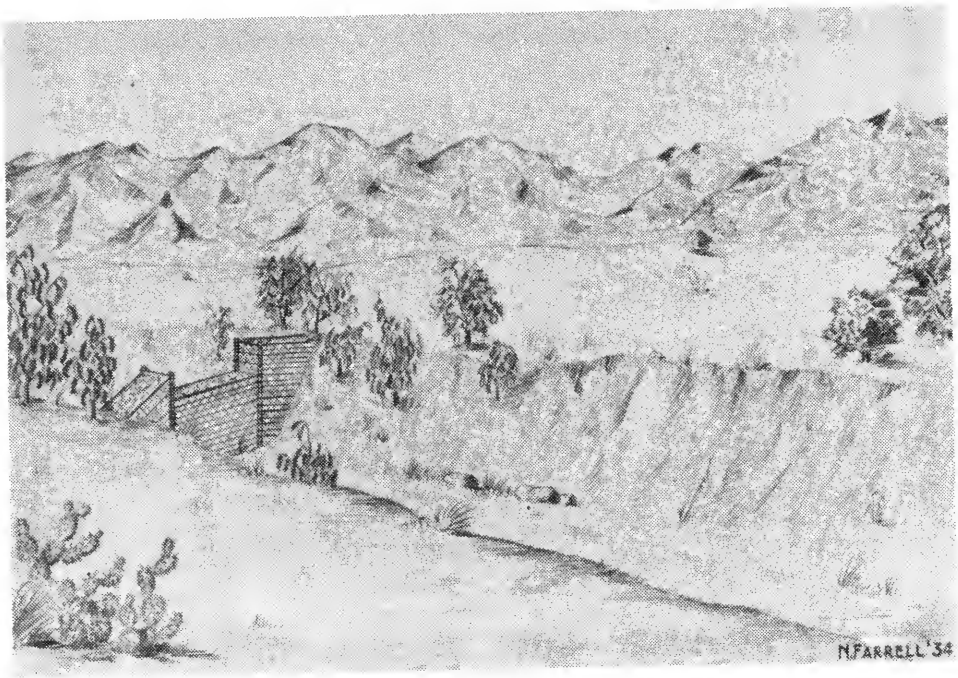


along the course desired in order to protect the plantings until they are of sufficient size to withstand the floods. As these plantings grow older they will require trimming in order to prevent their plugging of the water course and spreading of the winter floods against the banks. This method has already been the means of saving valuable walnut acreage in California.

While it is all but impossible to grow any plant upon the towering vertical walls of the larger barrancas, it is believed that proper proper protection for the base of the walls, plus vegetative control along their upper edges, will serve to stabilize them for indefinite periods of time.

For holding the sides of the smaller gullies, where check dams have been installed, Giant lyme grass is being used quite successfully. Kikuyu grass is also being planted along the side walls and across the tops of the silted basins. The above mentioned, in conjunction with native plants and shrubs, such as Wild tobacco bush (*Nicotiana glauca*), Saltbush (*Atriplex breweni*), Sagebrush (*Artemesia Californica*), and Bush sunflower (*Encelia Californica*), will unquestionably stabilize the smaller watercourses when proper head control measures are provided.

In considering plants best suited for the arid conditions found in California, willows undoubtedly deserve to be ranked among the highest. They have but two faults, their lack of drouth resistance, and their susceptibility to extermination from overgrazing. Overgraz-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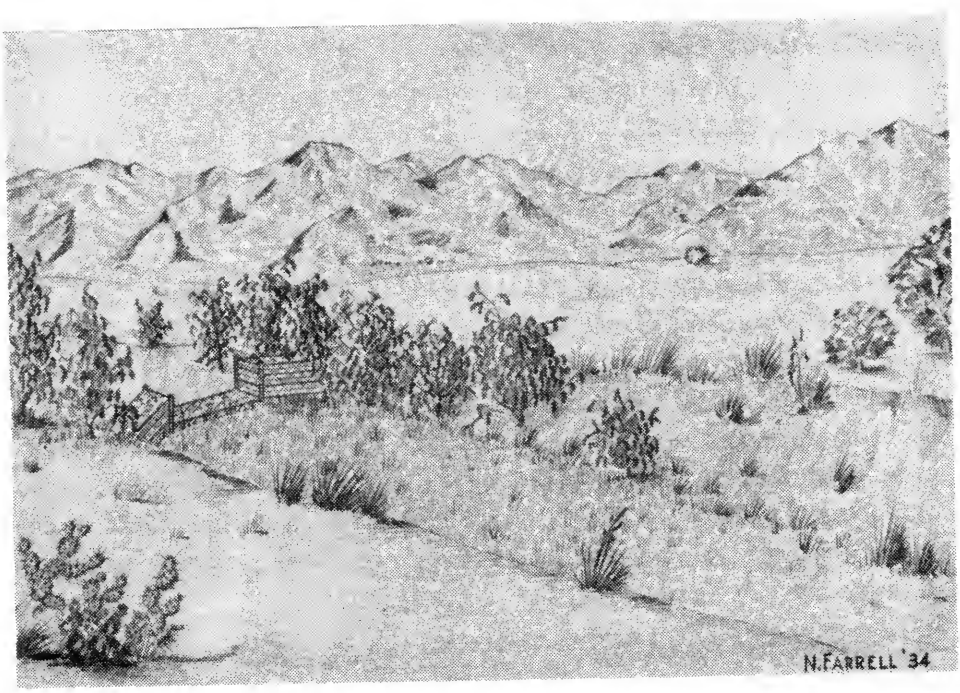
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ing undoubtedly accounts for their complete elimination along many water courses in the state where they were formerly a natural protection. Planted willows in California will grow and spread by root sprouts in soils too dry to permit their increasing by natural seeding.

Eucalyptus (commonly known on the Pacific Coast as "Gum" trees) were originally brought in from Australia. They are fast growing; attain a great height; have excellent soil holding root systems; and are very drouth resistant. The gray gums are the best suited for extremely dry regions, with the red and blue varieties following.

Water motie, commonly mistaken for willows by many people, has an excellent root system, plus the tendency to bend before the winter floods, forming a protective mat of vegetation on the stream bed.

Giant lyme grass, known locally as cane grass, seeds heavily under favorable conditions; has excellent forage qualities; and possesses a very tenacious root system. No other grass has been found equal to it for use on check dams in California.

Australian salt bush, a low lying plant that forms a mat over the ground, besides being drouth resistant has the unique quality of being fire resistant. The great value of a fire resistant plant, in gully control, cannot be realized unless one considers the thousands of square miles of precious watershed coverings that have been destroyed by constantly recurring fires during the rainless seasons. Unfortunately, this plant has a tap root and is not as valuable as a soil holder as those possessing root systems.

Elephant, or Napier grass (*Pennisetum purpureum*), is a coarse perennial that reaches a height of 8 to 12 feet when mature. It is moderately drouth resistant, and has a very dense fibrous root system. It has much the same habits of growth as sugar cane, and grows in clumps containing from twenty to two hundred canes, of about one inch in thickness.

While this article does not pretend to cover completely the place of plants in gully control, it has outlined the recommended methods of procedure with the plants of proven value as used in California. It is believed that the results of our work here on the Pacific Coast may be of interest to others, particularly those West of the Mississippi River, and it is with that thought in mind that this paper has been written.

Editor's Note: Mr. McClymonds, author of this article, has recently been appointed Regional Director of the newly established Soil Erosion Service projects in Eastern Colorado.

Soil Conservation Service
Region 4
Division of Information and Education

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Importance of Developing Native Grasses

By C. R. Enlow

SENIOR AGRONOMIST, BUREAU OF PLANT INDUSTRY
U.S. DEPARTMENT OF AGRICULTURE

In traveling the broad expanse of our country after one has become erosion conscious, the enormity of any nation wide erosion control program becomes increasingly evident. From the eroded slopes and fields of the Dakotas to the gullies of the Piedmont, erosion is evident in a multiplicity of forms and in varying degrees.

Any program of erosion control that does not take into consideration the fundamental principles of land use must certainly come to an early and inglorious end. Not only that, it will prove a distinct handicap to any future work and delay, rather than hasten the fulfillment of a general program of erosion control. For this reason, among others, the program should be very carefully planned, and all costly methods and temporary devices should be discarded. The really sound and economical policy, particularly at this time of low land values, must be built around the use of vegetation.

It is natural that the first extensive projects in erosion control should be started in the more intensely farmed areas where erosion is severe. In general, these regions have considerable rainfall with many dashing rains that make it difficult to plant large fields to corn, cotton, other row crops, and even small grains or grass without much erosion damage. It seems evident, in order to secure immediate results and thus obtain further support for an expanded program, there has been a tendency to overemphasize mechanical devices. The building of terraces generally forces the farmer into contour farming. In many cases, certainly, where terraces have been constructed, strip farming alone would suffice. Terraces cost money, and in addition to increasing the price of the land add to the difficulties of farming practice. Undoubtedly terraces do have a distinct place in the erosion control program, but certainly should not be constructed if other

and cheaper control is possible. It is unfortunate that such an important program as erosion control should of necessity, due to short time appropriations, be pushed so rapidly toward completion. A more leisurely and less expensive program, looking toward cropping methods to prevent erosion largely through the employment of strip and contour farming, crop rotation, and wherever possible with erosion slopes in permanent vegetation, seems more sound, economical and far reaching.

The problems connected with the establishment of close growing vegetation, such as grasses, alfalfa, lespedezas, clovers and others in the humid regions, while frequently difficult, are much less so than in the more arid regions. Any program of erosion control in the dry regions of the western states must of necessity be done very economically as the land is low in price and expensive methods are not justifiable.

In the west, millions of acres of range land, formerly well covered with vegetation, are now almost devoid of vegetation and eroding rapidly. Each year the situation becomes worse. Floods are proving more of a menace, irrigation reservoirs are filling rapidly with sediment and sources of water for the cities are an ever increasing problem.

Apparently the solution of these enormous problems lies in the improvement of vegetation on the dry ranges, and reestablishing grass and other plants in formerly cultivated or severely grazed land where it has disappeared. Regulated grazing by livestock will no doubt help materially, but any program of control will be greatly accelerated by seeding grasses adapted to the region. The problem here is finding plants that can be seeded successfully.

It has always been taken for granted that our native western grasses, the Andropogons, Agropyrons, Boutelouas, Stipas, Festucas and others are such poor seeders that to commercialize these plants for use in recovering the land they formerly occupied is impossible. Preliminary work, however, by the Division of Plant Exploration and Introduction, Bureau of Plant Industry, U. S. Department of Agriculture, in gathering, threshing and testing the seed of many species, makes it appear possible to develop many of the grasses and other plants for wide use. Naturally the final answer lies in the results obtained from plantings of the seed, which have been and are to be made in many places, but it is not difficult to anticipate a degree of success. The problem involves the development of machinery for harvesting, threshing, cleaning and sowing the seed, selection of strains of the grasses that are outstanding for erosion control and seed production, and studies involving the method, time and rates of seeding. Tests have been

made on the percentage of seed found in the glumes, and also on germination. Further studies are under way on delayed germination and loss of viability. This work must also be carried on for several years, as it has been noted there is a great variation in seed production from year to year, depending on climatic conditions.

While many grasses occur in large areas at present, and can be harvested directly from the ranges, many others are found in scattered stands and in limited quantities. It is possible some of the less common ones can be developed readily and will be cultivated for seed production. Many of our farmers have realized considerable income from the production of seed of introduced grasses, legumes and other plants in the past, and no doubt will in the future from many of our native plants now growing wild on our range land.

It is hoped that the Soil Erosion Service will give this program all possible encouragement. It must be understood that it is impossible to make large quantities of seed immediately available, and that experimental studies are necessary before large scale production can be expected. The work is being pushed forward as rapidly as possible and will continue to be within the limit of the funds available.

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GOPHERS MENACE TERRACES IN TEXAS

Complete eradication of gophers or salamanders in the Duck Creek watershed is the object of a poisoning and trapping campaign now under way by the Soil Erosion Service at Lindale, Texas, in cooperation with the U. S. Biological Survey of the Department of Agriculture and the A. & M. College of Texas.

The poisoning work is being done on the farms by employees of the Service at the request of the farmers concerned and is entirely without cost to the farmers. To date, more than 140 farmers have requested the Soil Erosion Service to send men on their lands to do this work.

When the number of gophers has been so reduced that it is no longer profitable to poison them, traps will be set for the stragglers.

It is highly important to the farmer that gophers be eradicated or at least greatly reduced in numbers. No terrace is too wide for a gopher to burrow through it at the base, thereby permitting water to run under and wash out the terrace. Gophers are also quite destructive to contour furrows in pastures and to the pastures themselves, as well as doing great damage to practically every crop grown in East Texas.

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—And So We Grow

The Soil Erosion Service expands with eight more sturdy blows at the Farmer's nemesis.

By Leland Barrows

SPECIAL ASSISTANT TO THE DIRECTOR

Extent of the Soil Erosion Service program has been increased by more than one-fourth since the January issue of "The Land: Today and Tomorrow" went to press. Eight new erosion control projects comprising a total area of more than 12,000,000 acres in eight states have been established by the Service within the past month. Work on twelve separate watershed areas has been initiated under allotments totaling $1,110,000.

The largest of the new projects comprises more than 11,500,000 acres in the watershed of the Rio Grande River in New Mexico. On February 4, $200,000 was allotted to inaugurate a comprehensive erosion control program in this important and seriously affected area. On private lands, which constitute roughly half of the region, and on the 1,375,000 acres of Indian lands, demonstration areas will be set up. Badly wasted areas will be revegetated, and throughout the watershed land use practices to prevent overgrazing and to conserve soil and rainfall will be initiated.

"Every important type of erosion characteristic of the Southwest is prevalent in this watershed", a report on the area by Hugh G. Calkins, Regional Director of the Navajo project, states. "Silt is being produced in large quantities by sheet erosion, headward gully cutting, and the vertical and lateral carving of stream channel banks. The same processes destroy irrigated farms, irrigation and drainage ditches, and pasture land, and add enormously to the construction and maintenance costs of highways and railways".

Two new projects expanding the efforts of the Service to combat wind erosion were included among seven projects announced on January 16. South Dakota was added to the list of states on which projects are situated when two areas in Beadle County were selected for demonstration purposes. The larger area comprises approximately 142,000 acres on Shue Creek near the city of Huron. The smaller covers 38,000 acres adjacent to the town of Wolsey. Both are in representative,

highly developed farm land where farm abandonment is rapidly increasing as a result of uncontrolled wind erosion. Mr. Harry J. Clemmer of Kansas, a graduate of Oklahoma A. & M. College, has been selected as Regional Director. He is long accustomed to dealing with problems of wind erosion in his work at Agricultural Experiment Stations at Dalhart, Texas; Woodward, Oklahoma; and Garden City, Kansas. The new project has been allotted $125,000.

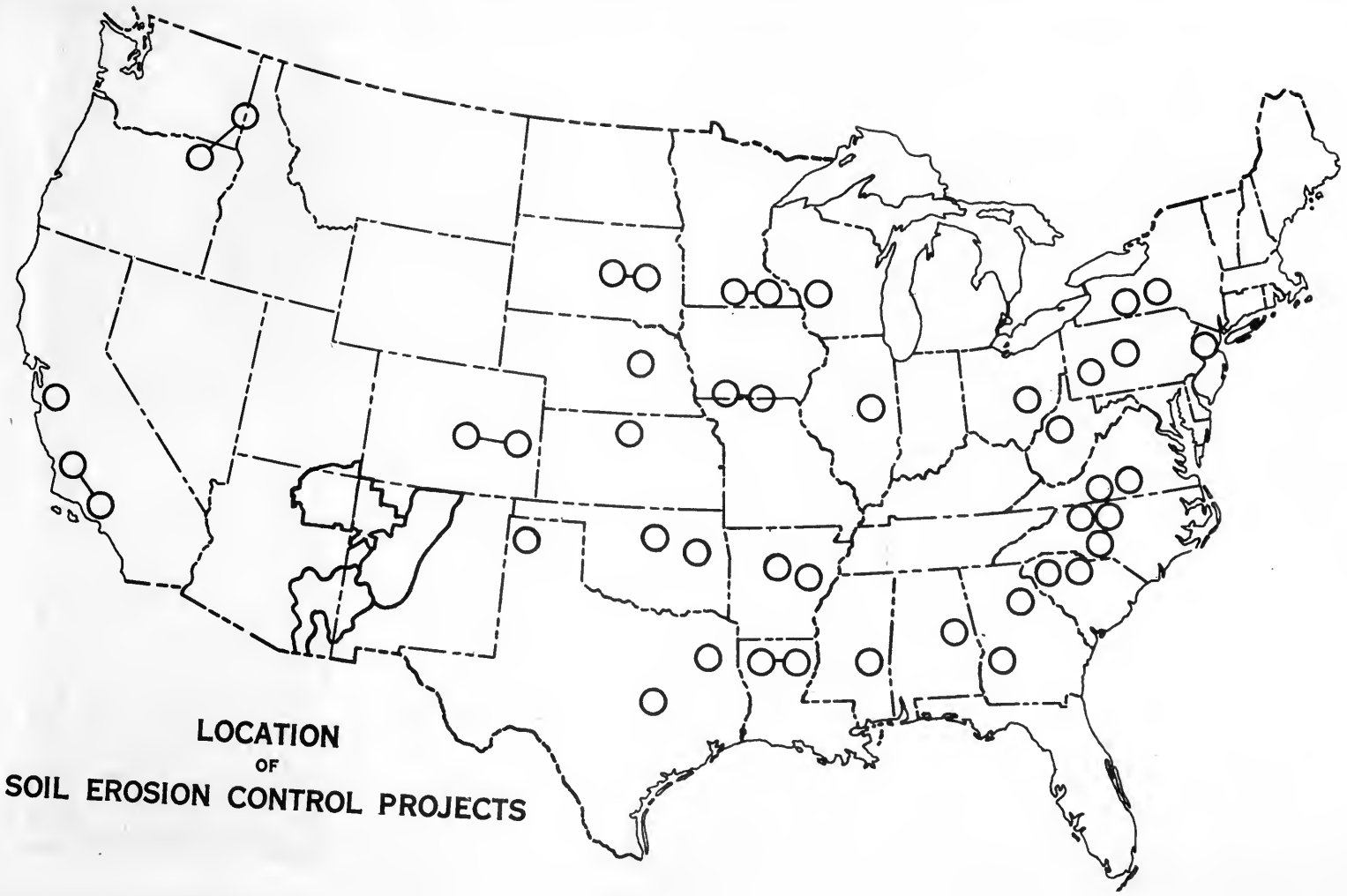
Two areas aggregating 250,000 acres constitute a new project which has been established in Colorado. In the larger of these, approximately 120,000 acres in the watershed of the Smoky Hill River in Cheyenne County near the Kansas-Colorado line, wind erosion is a principal problem. About 30,000 acres in the demonstration area is now in cultivation, and the entire tract is bordering on the submarginal because of unchecked erosion.

The upper watershed of Black Squirrel Creek in El Paso County near Colorado Springs is the site of the smaller section of the Colorado project. Approximately 100,000 acres has been selected because of its severe problems of wind and water erosion representative of the general agricultural region just east of the Rocky Mountains. Between ten and fifteen percent of the area is in cultivation. Most of the remainder is composed of fertile grazing lands which are threatened by encroaching sand dunes and deep gullies. The initial allotment for the joint Colorado project totals $125,000.

The first demonstration area to be established in New York State was included among the projects announced on January 16. An area of 150,000 acres on the upper watershed of the Cohocton River in Steuben and Livingston counties was selected because of its severely eroded condition and its representative character. The area, a large part of which is under cultivation, is one of rich rolling uplands intersected by deep valleys, and is especially susceptible to sheet erosion. Potato raising and dairying are the principal agricultural activities. An allotment of $135,000 has been assigned to the project, and Dr. F. B. Howe, Regional Director of the Soil Erosion Survey at Ithaca, New York, has been selected to direct the work.

Two small but critically eroded drainage areas in Pittsylvania and Henry Counties near Danville, Virginia, have been chosen for demonstrational purposes in the Virginia Piedmont. Tracts totaling approximately 25,000 acres will be treated, under an allotment of $125,000. The new area will be administered as a sub-project of the existing demonstration project on the Bannister River near Chatham, and under the supervision of P. F. Keil, its Regional Director.

The intensively cultivated coastal plains region of Georgia has been selected as the site of the second erosion control project to be



LOCATION
OF
SOIL EROSION CONTROL PROJECTS

established in that state by the Service. The new project comprises an area of 36,000 acres in Marion and Schley Counties on the upper watershed of the Big Muckalee Creek, and a contiguous tract of 22,000 acres on the Little Muckalee Creek in Schley and Sumpter Counties. A project office has been located at the southern end of the area in the city of Americus. Work at the project will be in charge of Loy E. Rast, Regional Director of the Athens project. An allotment of $150,000 has been granted for the new area.

The remaining two of the new projects were established in the Southwest, in Arkansas and Oklahoma. The Arkansas project comprises approximately 125,000 acres on Crawley's Ridge in the eastern part of the state, between Jonesboro and Forest City, in a region of peculiar loessial soils which are highly erodible. Erosion has already become a serious problem. The initial allotment for the area is $125,000. Fred C. Newport, Regional Director of the East Cadron Creek project will direct work on the new project from his present headquarters at Conway. A project office may later be established near the new area.

Oklahoma, regarded as one of the most severely eroded states in the Union, is receiving its second erosion control project with the establishment of a demonstration area of 40,000 acres on Pecan Creek near Muskogee. This is in a region of valuable farm land which was broken for cultivation in 1907, yet is already seriously impoverished by sheet-washing. An allotment of $150,000 has been granted for the work, which will be directed by N. E. Winters, Regional Director at Stillwater.

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Erosion control: Strip cropping in the Texas blacklands.

Natural Terraces for the West Virginia Hills

By M. M. Hoover

REGIONAL DIRECTOR, SPENCER PROJECT

The antiquity of man has long been recognized but we are ever eager to add to that growing store of information which uncovers details of life that existed in past ages.

Project No. 13, which is located in central West Virginia, has many natural terraces that have resulted from unequal weathering of the parent rock strata. These natural terraces follow the contour and it is here that man first learned to concentrate his agricultural efforts.

At present, we find that much of the farming is confined to these relatively narrow contour benches. Erosion which ordinarily would be ruinous on soils of such topography has been practically eliminated by the rock outcrops between benches which for the most part have a good covering of vegetation, shrubs or trees.

In planning the reorganization for the farms within the project area, the agronomists and foresters have recognized the value of these natural terraces in their programs. For example, the agronomist, in working out his rotation plan, would treat the level benches as fields occupying definite places in a regular rotation plan. Thus, one will find corn, small grain and meadow occupying contour bench strips at different levels in the same field. The border of each bench strip being a rock outcrop and permanently covered with vegetation, the amount of runoff is confined to a relatively small width of bench.

The forester has also taken advantage of these natural contour terraces and encouraged the planting of trees on the steep and rocky intervals between the benches. This has reached its maximum development in pasture areas that have been cleared of their timber to make way for pasture development. Many of these pasture fields have as many as four or five distinct natural terraces that may not be wide enough to permit agricultural development but do make excellent grazing areas.

When this plan of reforestation has become established we find as many as four or five bands of trees planted on the contour and between these trees will be as many strips of relatively flat benches which will support a good stand of grass. Thus, the pasture slope will not be one continuous grazing area but broken by alternate bands of trees.

Recent studies made on the relation of certain tree species to kind and density of pasture grasses indicate that grass species ac-

companying walnut and locust stands are actually superior as to density and desirability of species, especially Kentucky bluegrass as compared to those grass species found outside of this shade relationship.

Many pasture areas in recent years have been severely damaged by severe slips that have occurred on the steeper slopes. These slips have become more severe and numerous since the grass cover has been depleted as the result of decreasing fertility and heavy grazing. Bands of trees planted on the steep intervals of a given slope will provide protection against slips as well as check runoff.

Here natural benches are farmed. Steep slopes are permitted to grow a natural protective cover. Soy beans on top, meadow between and pasture below.

The narrow benches are protected from above by woods, browse and grass on 30% to 50% slopes. Here water is retarded and soil is built up. The field below is not gullied nor buried in debris. From top to lower right: corn, trees, meadow, native grass, corn, browse, meadow - soybeans; pasture at the bottom.

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Overgrazing — A Reality

By Robt. V. Boyle

CHIEF OF RANGE MANAGEMENT, NAVAJO PROJECT

NOTE: The Navajo Project personnel took particular note of the article "Overgrazing - A Popular Fallacy" in the November issue of "The Land: Today and Tomorrow". Those of us who have spent the greater part of our lives in combating the overgrazing evil considered the article as a challenge. The challenge is being accepted, all the more readily because it is a bout within the family. The following criticism is meant as a friendly rebuke and is inspired by the belief that, since "silence is consent", something should be said. H. G. Calkins, Regional Director.

To a "grazing man" the statement that overgrazing is a popular fallacy is as a red flag to a bull even when the assertion is followed up with exceptions and localizations. So long have we been preaching the gospel of conservative use of the forage that it seems almost sacrilegious for any one concerned with the preservation of our natural resources to even *whisper* anything that could be construed as encouraging that awful scourge - overgrazing. Let us hope that no Western rancher ever hears that in our official publication there was an article that not only intimated by emphasized the belief that "overgrazing" was an over-worked word. Half our battle would be lost.

We resent the statement that in the West "the best grazing plants are annuals." It is true that in Southern Arizona, and in the San Joaquin Valley and the Mojave Desert of California the spring growth of annuals contributes largely to the range carrying capacity; also, in the Northwest, cheetgrass, an annual, is considered by some stockmen as an asset. However, there is considerable evidence pointing toward the fact that these annuals have largely replaced the original perennial vegetation - because of overgrazing. Annual grasses because of their ephemeral characteristics and their absolute dependence upon favorable climatic conditions are not as valuable either as forage or cover as perennials. Space does not permit the mentioning of more than a few of our valuable perennial grasses: grama (several species), curly mesquite, wheat grass, buffalo grass, Texas timothy, drop seed, fescue, muhlenbergia, galleta, brome and the poas, including Kentucky blue grass. It will be noted that at least five of these are sod or turf-forming grasses.

Study and observation have revealed that in many places the utilization of bunch grasses has resulted in replacement by sod grasses. Throughout the West there are great areas of grama, curly mesquite and buffalo grasses where once bunch grasses were predominant. These invaders are superior as forage because of their greater palatability to livestock and because they will withstand heavier grazing than the bunch grasses. Whether, under these conditions, they are as effective in holding soil and water in place as the climax vegetation has not been definitely determined.

By the laws of plant physiology there is a degree of utilization that can be considered proper for every plant. This percentage of allowable utilization will vary greatly by species and habitat but in no case can the use be 100 percent if the plant is to thrive and reproduce either by seed or vegetatively. Whenever sod-grass ranges are grazed consistently beyond a certain point, during the growing season, it is certain that disaster will result. Whenever a pasture continues, year after year, to "hold up" and to support a given number of livestock regardless of how great the number may be, it is equally as certain that the pasture is *not* overgrazed. The man in a humid region who does not allow his Kentucky blue grass pasture to be grazed shorter than two inches is a conservative and far-sighted individual. Two inches of blue grass leafage is in all probability ample to allow for manufacture of plant food. But let him double the number of his stock and observe whether or not overgrazing is a popular fallacy!

It is wondered if the recommended use of Kentucky blue grass to within two inches of the ground is based on scientific research or if it is merely empirical. There has been a great deal of very scientific research on pasture management under all conditions. Some very noteworthy and detailed work was done in the humid regions of England. C. M. Harrison, of the National Research Council, University of Arizona, determined by exhaustive study that when Kentucky blue grass was clipped beyond a certain point it ceased tillering.

Another important factor that enters into what constitutes proper use of forage is the height or volume growth required to effectively retard runoff. In other words when there is a torrential rain, especially on sloping ground, there should be sufficient aerial growth to act as a mechanical barrier in holding velocity of water to a safe medium.

It is well recognized that there are many ecological factors that enter into the making of a good or poor pasture. When eliminating the biotic factors, the environment has everything to do with what grows on a given site and with what luxuriance it grows. If abuse has made a poor pasture out of a good one the chances are that the environment

has been changed through lowering of the water-table, erosion, depletion of fertility, etc. In the West it does not pay to put fertilizer on grazing land. In the humid regions it is doubtful if the farmer could be induced to fertilize his depleted pastures unless he had absolute proof that he would get quick returns on his investment. That being the case it would seem wise to graze denuded pasture very conservatively, allowing some vegetation to decay each year and thus gradually increase the organic content of the soil in the age-old manner.

It is readily agreed that overgrazing is not a universal practice. Usually in every locality there is at least one man who points with pride to his good range or pasture and who attributes conservative stocking to its excellence. In many cases he *does* graze more animals per a given area than his neighbors but this is usually because he has maintained the productivity of his land through judicious use while others have exploited their resources without regard for the future. Even assuming that his land was originally the best in the locality, had he not taken care of it, it would not now be a source of pride.

Recently there was released an authentic technicolor moving picture showing interesting features of Switzerland. It was interesting indeed to note that, in that country where the grazing of domestic livestock has been practiced not for hundreds of years but for a thousand years at least, the milk goats were grazing over the sloping mountain pastures up to their *knees* in luxuriant forage!

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Gullies ripping through a Missouri pasture.

Relation of E.C.W. Camps to Soil Erosion Service

By J. G. Lindley

E.C.W. SUPERVISING ENGINEER

For a number of years men engaged in agricultural pursuits, the dirt farmer, the government expert, the engineer, the extension agent, have had their attention irrevocably directed toward the growing menace of accelerated soil erosion. Exceptional farmers and cattlemen recognized the existence of the problem and tried to solve it by varied expedients. Conditions were acknowledged to be bad; but, on the whole, little or nothing was done about it.

The few people who would not be quiet about it, and who insisted that corrective measures had to be applied and existing causes removed, were regarded as cranks or publicity seekers, and had a hard time making themselves heard amidst noise and confusion of a prosperous nation going about its business. With the depression, and the consequent paralysis of a good portion of that business many men had more time to listen to cranks, time to ponder, and time to awaken.

After long years of travail, there was instituted in the Department of the Interior, the Soil Erosion Service, clothed with the proper authority and vested with sufficient funds to set up in strategically located areas important and impressive demonstrational erosion control projects.

The C.W.A. with its need for work projects acted as the starting lever on many of these areas. Bearing in mind the necessarily temporary character of C.W.A. employment, those directing the affairs of the new Service turned to the Emergency Conservation Work, the great new venture in social relief inaugurated in the Spring of 1932.

Allocation of twenty-two ECW camps to the Soil Erosion Service for the third camp period, April 1, 1934 - September 30, 1934, has been of great value in forwarding this work. The camps were located on fourteen of the project areas, assignment being made of one or more camps to an area as conditions warranted. Twelve of the 172 new 200-man camps established in the drought stricken area of the country during the Summer of 1934 were allocated to this Service. At the end of the third period, the work accomplished in the camps was used as a justification of their continuance during the fourth camp period. This request met with the approval of the Director, Mr. Robert Fechner, who also approved the assignment of seventeen additional camps to this Ser-

vice for the winter period, so that at the present writing there are, in all, 51 camps being operated by the Soil Erosion Service.

The work of these camps is largely restricted to gully control. Gullies occur in every state and outlying possession of this Union. They are caused, obviously, by water flowing at a velocity sufficient to move and carry away soil particles. They are often started by artificial means, - plow furrows, paths and trails, wheel ruts, and almost invariably by the farm yard runoff. The longer the stream the greater the capacity for erosion. Nature's own methods of checking some of her own processes are the ones that man has to make use of. First comes the establishment of a new and less sloping grade for the stream bed, thereby lessening the velocity and to a large degree the cutting and carrying power of the stream. Second is the fixing of the surface of this new grade line by means of a vegetative cover, with its surface litter and obstructions to flow and its sub-surface network of roots.

This new grade line can be obtained by a combination of check dams, pits, mounds, ditches, contour furrows, dikes, application of natural physical and structural landscape features, planting, withdrawal from cultivation of certain lands and innumerable related objects and undertakings. Probably check dams of varying sizes will be used more than any other structures.

With the necessity of putting men to work as quickly as possible on C.W.A. and related projects the actual work often got ahead of the program. Engineering, of necessity, has lagged a little behind accomplishment. This is exactly the reverse of the ideal condition and an effort is now being made to correlate the various engineering features that have been used in the construction of check dams and to make the work in camps easier for foreman and men by establishing certain standards for the varying types of structures that come under the head of check dams.

There are included in the work projects a wide range of soils, agricultural belts, geographical locations and topographical conditions; the Piedmont regions of the Southeast, the overgrazed alluvial valleys of the Southwest, the Wheat Belt of the Northwest, the glaciated soils of the upper Mississippi Valley, the Black Belt of Texas and the windblown soils of the Middle West. A variety of control measures are being applied, combining engineering, forestry, cropping and land-planning practices, based on the variations of soil, topography, rainfall, types of agriculture and related conditions.

In using the CCC men on private land bear in mind that the work is not to be done for the benefit of the owner of that land but for

the benefit of the community. The men are not to be used even on gully control on the land of a single individual unless the gullies on that land form a menace to the community.

In addition to the work which a landowner can do on his own land there is a large amount of work that should be done that he is unable to do,-that he is usually not competent to line up. It is work of this nature, and there is plenty of it in a properly coordinated program, that will enable our staff and camp engineers to keep busy laying out work for the enrollees.

I wish to commend as especially helpful the handbooks of erosion control issued severally by the Illinois project and the Ohio project. It is hoped that other areas will emulate these examples, and from the data so assembled there may be worked out a handbook of erosion control that will be of general application.

Five steps in gully control are shown in the group of photographs on the opposite page. The photographs, taken on the Illinois area, are:

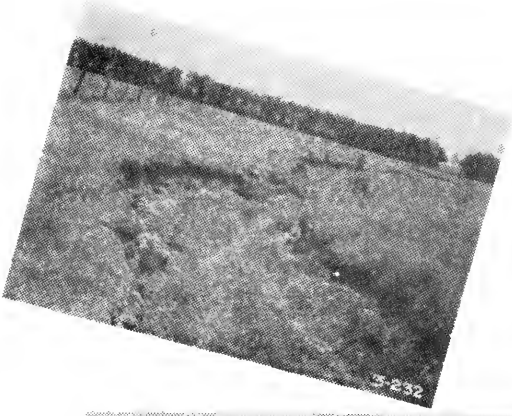
3-232. A typical gully cutting through the heart of Illinois' best dirt.

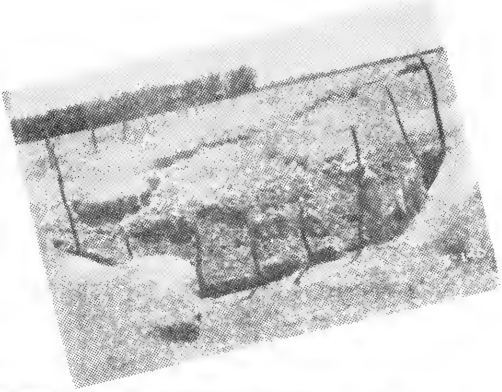
3-140. Same gully, showing the starting of the building of a wire check dam.

3-147. The dam, completed with sod bank apron on the front.

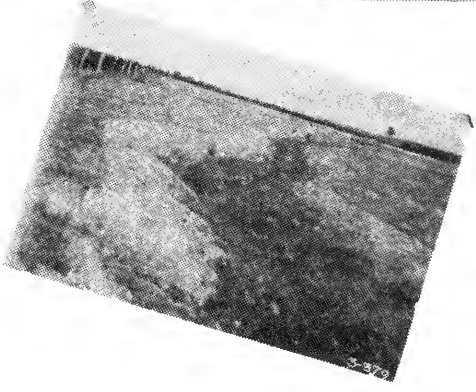
3-379. Same gully, after the banks were worked off, seeded and vegetation starting. The wire check is in the very front. The hedge in the back of picture 3-232 was trimmed to use the posts and brush for gully structures.

3-132. This shows a multiple post dam built at the head of the gully. This type of dam has proven very satisfactory for placement in smaller gullies to check head erosion. The hedge in the rear was trimmed to use for structures.


S-232




S-147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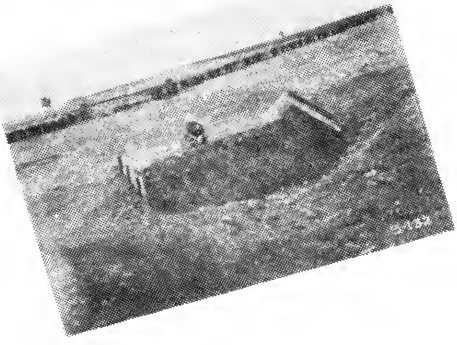

Floods Show Need for Erosion Control

By Dr. N.E.Winters

REGIONAL DIRECTOR OKLAHOMA PROJECTS

Oklahoma streams which remain dry several months each year and surge with flood waters when heavy rains fall show definitely the importance of obtaining a more even water runoff from cultivated fields, pastures and woodlands by means of erosion control measures.

The devastating drought of 1934 which placed thousands of farmers on the relief rolls is another forceful reminder of the need for a well rounded soil conservation and water control program. It is a well known fact that droughts and floods, as a general rule, are companion foes. Rainfall must be controlled where it falls, if these pestilences are to be obliterated.

Results of the field experiments on the Soil Erosion Experiment Station at Guthrie during the last five years show some startling results as to the effects of crop and soil management upon conservation of soil and the control of water runoff. Consider the following results:

AVERAGE ANNUAL SOIL AND WATER LOSS

	Percentage runoff	*Soil Loss tons per acre*
Continuous clean cultivated cotton with rows up and down the slope	15.68	28.68
Continuous cotton where surface soil is gone	29.53	34.22
Rotation (cotton, wheat, sweet clover)	12.21	5.9
A good vegetative grass cover	1.37	.038

Burning up all vegetation once each year on grass and woodland has multiplied the runoff by 38 and made the soil losses 13 times greater.

From one heavy rain in 1934 a runoff of over 20% and a soil loss of 3.25 tons per acre was suffered from a poor farming system, whereas from a good farming system with cotton planted on the contour with erosion resistant strips of alfalfa, the runoff was 1.37% and the soil loss .028 of one ton.

The results from terracing cultivated fields with an annual rainfall exceeding 30 inches show a loss of water varying from 16% to 20% of the rainfall in the discharge from the ends of terraces, and a soil loss in tons per acre varying from 1 to 15 tons per acre annual-

ly, depending upon the type of the terrace, the cropping system used, and the intensity of rainfall. In central and eastern Oklahoma, terraces alone do not conserve much water, but they delay the runoff which is a big factor in flood control.

In the plains section on the deep permiable Chernozem soils with gentle slopes and an annual rainfall varying from 15 to 25 inches, the soils generally have an absorptive capacity for about 40 inches of rainfall annually. Under these conditions, strip cropping, contour farming and level terraces may be used for conserving practically all of the water that falls on the fields.

The very nature of erosion control makes it a primary step in flood control. The erosion control program as practiced in Oklahoma includes ten salient points, namely: (1) crop rotation, (2) strip cropping, (3) contour farming, (4) terracing, (5) prevention of fire and overgrazing, (6) contour furrowing of pasture lands, (7) planting trees and grass on badly eroded lands, (8) use of winter cover crops, (9) control of gullies, and (10) construction of farm reservoirs. Each of these erosion control practices is obviously a means of flood prevention.

Water that is kept on fields, where it falls, to be used for plant production cannot cause floods; nor can excess water from cultivated fields, pastures, woodlands, or badly gullied fields become destructive when it is directed to farm reservoirs. These reservoirs supply water for livestock and act as silting basins to keep practically all the soil out of creeks and rivers and let the excess water go off as clear water, delayed in its runoff in protection against damaging floods.

Floods cannot be successfully controlled by construction of reservoirs unless the entire watershed above the reservoir is protected from erosion. Out of 56 major reservoirs in the United States, 13 have been completely filled with sediment in less than 30 years.

If we are to get anywhere in the direction of permanent flood control in this country, it is a physically determined fact that erosion must be controlled from the very crest of the ridges down across the watersheds where floods originate and where silt loads are picked up, to the banks of the streams and thence to their mouths.

There is no reason or object in continuing flood control work upon the "piece-meal" basis by which we have attacked the problem in the past, especially since we find that after 50 years of work and the enormous expenditure of billions of dollars, we are now more seriously menaced by floods than ever before.

Erosion control, as a necessary and primary step in flood control, combined with the impounding of water for large lakes to furnish water

for cities, recreational centers, power and irrigation, will give our nation a soil and water conservation program which will at the same time conserve our agriculture as the basis of material prosperity to our entire population.

(All figures quoted in this article were used through the courtesy of the Bureau of Chemistry and Soils, U. S. Department of Agriculture).

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WASHINGTON PRACTICED EROSION CONTROL

George Washington may not have been the first to practice erosion control, but he was among the first in America to acknowledge the ravages of erosion and to attempt to maintain his rich farm lands in their fertile state. His foresight as a scientific farmer is evidenced by letters on display in the Library of Congress.

On December 10, 1799 -- four days before his death, the first President wrote final instructions to his farm overseer, Mr. Anderson, listing erosion control as a major item in the plan of operations.

Washington had three farms, and on each soil losses presented a problem. To Anderson he wrote, concerning his Muddy Hole farm:

"The washed and gullied parts of it ought to be levelled and smoothed, and as far as it can be accomplished, covered with litter, straw, weeds, corn stalks, or any other kind of vegitable rubbish, to bind together, and to prevent the earth from gullying."

Not only did Washington realize the necessity of keeping a cover of vegetation -- he termed it "vegitable rubbish" -- on the ground, but he practiced crop rotation and other methods of sound land use, such as keeping eroded lands out of cultivation. The latter practice, along with crop rotation, is among the methods advanced by the Soil Erosion Service in its watershed demonstration areas.

Similar instructions were outlined by Mr. Washington for his "River farm." And field No. 2, on his "Union farm", an "indifferent field, washed in some places, gullied in others, and rich in none", was to be "prevented from getting worse, and becoming such eye sores as they now are."

Washington's erosion control measures, while not exactly in line with the most modern methods developed and urged by the Soil Erosion Service, were fundamentally correct, according to Director Bennett.

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H. A. Flueck, Erosion Specialist, who planned this farm layout, standing on the corn strip terrace, and Elmer Manske, cooperator, standing on the next lower terrace which is seeded to oats and alfalfa.

Eliminating Point Rows

By

I. K. Landon
CHIEF AGRONOMIST

G. E. Ryerson
CHIEF ENGINEER

COON CREEK PROJECT

Consensus of opinion among erosion-minded people is that terraced land should be farmed on the contour or parallel to, rather than across from, the terraces. However, it is frequently difficult to persuade some farm operator who is not yet fully erosion-conscious to agree to this method of farming.

There are many farmers who realize the benefits to be derived from having their farms terraced, but who feel that the problem of point rows presents an insurmountable difficulty. This seems to be the stock argument against terracing since we insist that all cultivation must be done parallel to the terraces that the Soil Erosion Service builds on the Coon Creek project.

It is true that unless the terraces are parallel, or very nearly so, there are bound to be point rows if the entire area between terraces is planted to row crops. But, is it necessary to plant a row crop from one terrace to the other? What other crops are to be grown in the rotation? Cannot these crops be interspersed with the row crops? The usual answer is: "Sure, we grow other crops between other terraces, but you still have point rows between any pair of terraces."

It cannot be denied that there will be point rows between non-parallel terraces, but why not have these point rows in a hay or small

grain crop. Cutting a strip of irregular width with a mower is not nearly so inconvenient as turning a cultivator in the middle of a corn field.

In many cases the area above the upper terrace is so irregular in shape that it is almost impossible to completely contour it. When this area is in corn one possibility is to plant as many full length rows of corn as possible on the crest of the ridge and to utilize the remaining irregularly shaped areas for potatoes or other truck which will not cause so much inconvenience.

Imagine a field of irregular slope on which terraces A, B, and C have been built with an average horizontal spacing of 70 feet. Because of the unevenness of the slope this 70 foot average will include some 50 and some 100 foot spacings. In a case like this we advocate plowing a strip 35 feet each side of terrace A and planting a strip of 20 rows of corn, 10 above and 10 below the terrace.

The second year do the same on terrace B and plant oats and clover on the corn strip of the previous year, but continue this planting until it reaches the corn strip on terrace B. In those places where the terraces are less than 70 feet apart there will be areas that will not grow any corn at all but will grow oats and two years of hay.

The third year a 70 foot strip, centered on terrace C, will be planted to corn and the previous year's corn land seeded to oats and clover down to the corn. The strip on terrace A will be in hay this year. The fourth year it will be planted to corn again leaving any irregularities in width in hay for the second year.

This system of combining terracing and strip cropping has proven to be quite satisfactory on the Coon Creek project and we feel that both phases of the work are materially strengthened by the combination. The terraces make a permanent contour marker for the center of the strips and the strips assure contour cultivation for terrace maintenance.

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EXHIBIT PREPARED BY OHIO PROJECT

Part of the "Soil and Water Conservation Exhibition" held at the Clarendon Hotel in Zanesville during January and February was an exhibit prepared by the Soil Erosion Service showing an average hill farm before and after erosion control.

During the month of January this exhibit was visited by over 3500 people residing in Southeastern Ohio and surrounding regions.

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Photography and Soil Erosion

By R. F. Copple

AGRONOMIST SPENCER PROJECT

The Soil Erosion Service since its beginning has attempted to make use of every available implement which might aid in awakening the American farmer to the problem of erosion and enlist him voluntarily in a national program to conserve the soil.

Not the least important of the implements at hand was photography and the Service has constantly stressed the potency of the photograph in emphasizing the acute need for action to combat erosion. Where the printed word is drab and uninteresting, the Service realized, pictures tell a grapoic and absorbing story -- a story readable at a glance by everyone. But there are photographs and photographs, just as there are fiddlers and violinists. Behind each photograph should be a reason for its existence. It should not, like Topsy. "just grow up".

Before a photograph is taken, definite plans should be made in order to save both time and motion. Even with careful planning however, there are a number of situations which lead a photographer almost to despair. One is the weather, but even that obstacle can sometimes be overcome by proper knowledge of photographic technique.

In the pasture survey work in West Virginia and in the New England States, for instance, the best turf photographs were made during cloudy weather or by shading the area to be photographed. Vertical photographs made in bright sunlight usually show too many shadows and occasionally some loss in detail. Wind usually causes the most "headaches", especially during cloudy weather. The best results for turf photographs under these conditions were had by using a four foot strip of grass rug about 20 feet long which was curled around the quadrat which protects the vegetation from wind movement as well as from shadows.

Close-ups of soil profiles have usually been best during sunshine by digging the pits to be photographed in such position which naturally shades the soil cut. If the profile is in the sunshine, it is advisable to shade the area by the photographer or some other means. The ideal day for turf and soil profiles is when the sun is obscured by high, thin clouds. Topographic views are usually best during sunshine in order to make use of shadows, especially where contours are shown. In order to take advantage of contour shadows, a definite time of day is necessary for the best results. Here the kind of exposure determines the time of day for the photograph.

Panoramic views are desirable to show topography over a large area. Where strip cropping is involved, frequently more than one photograph is desired. First, the camera should be level. Light pencil marks may be made on the back of the metal bar above the lens which permits sighting across the camera, thus indicating the distance it is necessary to swing the camera from right to left in order to make the photographs "jibe".

Usually the best results are had by using a small aperture or diaphragm, 16 to 32 or smaller. This of course usually necessitates a time exposure. Approximately 95% of our photographs have been taken under these conditions. The exposuremeter should not be considered as just another impediment hanging around your neck, but an essential part of photography. The photographic record is likewise very essential and should be complete. It should be especially marked for location so that it will aid in securing repeat photographs, which after all will prove a pictorial barometer of the success of our work.

Finally, the purpose of the photograph -- the story it has to tell -- should be kept constantly in mind while the picture is being taken. A good photograph requires time and patience, but it is worth it.

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Road Ripper Added at Mankato

By C.C. Martin

AGRICULTURAL ENGINEER, KANSAS PROJECT

Ripper loosening compacted soil in terrace channel. Earth will be removed with a rotary fresno to build up a low place in the terrace ridge.

A "road ripper" has been added to the construction equipment of the Soil Erosion Service in its Limestone Creek area at Mankato, Kansas.

This machine is a tool developed for the primary purpose of tearing loose compacted soils or surfaces so that loose earth moving machinery or tools may handle the earth more rapidly and economically. The use of the road ripper in this country is an innovation in terrace construction.

This tool is an adaptation of the chisel cultivator in that it is built heavier and has a greater penetrating depth in breaking loose the soil. The power required to pull the road ripper and do effective work is a 50 horse-power tractor. It would be possible to approach or attain the same results with a chisel cultivator on areas where the large type tractors are not available.

The ripper has been used on the Limestone area in breaking loose the earth in the channels of outlets and interception ditches before blading out the channels, and in building the levees to retain the water in the finished channel.

In the construction of terraces the ripper has proven to be a valuable tool. It is a tool that permits a terrace design that will approach a desirable terrace from the standpoint of contour farming and

cropping of the land. It aids the design of terraces that to a great extent permit the straightening of terrace lines and the easement of curves around the points of the hills and across the irregularities of the field contours. Cuts and fills in the terrace lines are made more easily with the ripper, as it leaves the earth in the terrace channels in such condition that it is easily moved with a fresno to the point of the fill. It also eliminates any necessity of disturbing any of the terraced area to obtain earth for fills except in the area of the terrace channel. As a result of such operation of terracing, there is no disturbance of the topsoil between the terrace lines.

The ripper can be used to a distinct advantage where terraces are built with a blade, particularly on the steeper slopes, where it is necessary to move a considerable amount of earth into the terrace ridge to provide ample terrace height, channel depth, and adequate slope on the lower side of the terrace. This will permit farming operations to continue unhampered by steep slopes on the lower side of the terrace.

Compacted earth in terrace channel torn up with road ripper.

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MARK TWAIN GETS AN ANSWER AT LAST

Mark Twain once said everybody talks about the weather but nobody does anything about it. But now the government is doing something about it. And it plans to do more. The weather -- with its rains, winds, storms -- is rapidly reducing the fertility of the soil. The government is studying the problem and intends to do something.

--- *Spokane Daily Chronicle.*

BY WAY of BIOGRAPHY

Wm. A. F. Stephenson

Chief of Operations

trained in political science and public administration at the University of Chicago and Vanderbilt University...left the former without completing his Ph.D....has made public administration his avocation as well as his life's work...born in Chicago, September 3, 1904, which gives him a total of thirty years resting on his broad shoulders...after leaving school in 1927 Stephenson worked up the scale,

with the business end of the Chicago Tribune, broker, then Assistant Chief of the Social Science Division of "A Century of Progress", later Supervisor of Exhibits...raised the funds for the division's buildings and exhibits... in 1933, went to the Agricultural Adjustment Administration as Commodity Chief...sponsored by such men as Dr. Luther Gulick, Dr. C. E. Merriam, Louis Brownlow, Donald Slesinger, and Leonard D. White... came to the Soil Erosion Service in January, 1934, where he has handled the business end...tall, energetic, vitriolic, popular...

THE DISINTERESTED OBSERVER

The Press and the Public speak their minds about the S.E.S.

Editorial in the CHARLOTTE, N. C. NEWS:

"Every fifth acre...This report from the Federal Soil Erosion Service is astounding and would be no less alarming were it not that the same agency which brings the bad news also intends to supply the remedy..." (Jan. 17).

Editorial in the INDIANA, PA. EVENING GAZETTE:

"At this time the experts from the Federal Government are going into their work actively in their attempt to interest the farmers in the object lesson in erosion prevention in this country...

"These hillside lands have been eroded so slowly and so gradually that the farmers have not noticed the departure of their soils at any one time, and probably some of them think those soils have not gone, and that their lands are now about as they always were...

"If each farmer will follow the instructions of these erosion experts, and improve their lands as they direct, these washed-out farms will soon be as fertile as they were when the white man took them off the hands of nature and turned forests into fields. But the farmer must act." (Feb. 13).

Editorial in the CHAMPAIGN-URBANA, Ill., NEWS GAZETTE:

"...we must, as President Roosevelt says, take notice of the losses that unrestrained exploitation has caused...of the cutting of our last stands of virgin timber; of the increasing floods; of the washing away of millions of acres of our top soils...in short, the evils that we have brought upon ourselves today and the even greater evils that will attend our children unless we act...

"We had everything a land could desire...millions of acres of fertile soil. We have built upon that foundation. It ought to be obvious that if we dissipate these resources...and permit our farm lands to deteriorate, we are simply knocking out the foundation on which the whole structure rests.

"After we have done whatever is possible to beat the depression, we shall still be under the necessity of preserving this foundation..." (Feb 8).

Editorial in the SOUTHERN AGRICULTURIST:

"The old saying that what is everybody's business is nobody's business has never found better illustration than in the matter of soil erosion. For many years farm leaders have been protesting that the washing away of the soil was a tragedy; but while some heeded their warnings, terracing their lands, rotating their crops and following other approved practices, there were many who went on in the old way...

"The Mississippi Valley Committee estimates that a twenty-year Federal erosion program, calling for joint action with states, counties, land districts and individual owners, would cost the national government $20,000,000 a year. That, the committe adds, 'is but a minute fraction of the cost of erosion,' probably about 5 per cent.

"Congress should provide the funds for carrying this program forward. Such an expenditure is as true economy as is the expenditure of a little money from time to time on lubrication to prevent a car from burning out its bearings." (February, 1935).

Letter from COOPERATOR S. J. Towler, Chatham, Va., Project:

"I noticed in your monthly bulletin that you would like to know what the farmers think of the Soil Erosion. I, speaking for myself, cannot express in words how I appreciate what they have done for me on my farm. The only regret that I have is that I could not have had this work twenty-five years ago...I feel as if we shouldn't let our farms go down because our days are about spent; but we should look forward for the next generation.

"Today I would not take one thousand dollars for the terracing alone. I have had all of my farm terraced and we have had some rains to test the value of the terraces. Of them all I had only one terrace to break. I want to congratulate each group of men that worked on my farm for knowing their work so well.

"I would like to thank our president, Mr. F. D. Roosevelt, one of the greatest presidents to the laboring class that has ever been, for giving us poor farmers this work. It is worth so much more to give it this way than to have given it in money for there would have been little land improved. I think if we farmers will only cooperate with our government and the erosion groups we will have the garden spot of the world some day." (Feb. 6).

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Soil erosion in the Tennessee basin contributes to a low standard of living, Edward C. Richards, TVA forester, asserted in a recent session of United States District Court at Birmingham, Alabama, the Associated Press reports. Where early settlers made a fortune from the land, the grandsons barely eked a living, another witness said.

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Commencement Speech in 1887 Warned of Soil Erosion

By Harold G. Anthony

EXTENSION AGENT MINDEN PROJECT

It was fifty-seven years ago that the people of the area located in Project 15 of the Soil Erosion Service received their first warning of the evils of uncontrolled erosion, according to an interesting story recently printed in the Minden (La.) Signal-Tribune.

It was 'way back in 1877 that Daniel Webster Stewart, now a venerable citizen, and then a 17-year-old youth searching for a suitable subject for his "commencement speech" at the old Homer Male Academy, saw the devastation caused by uncontrolled runoff of rain water and pointed out the facts to his elders.

"You Soil Erosion Service folks are doing a great work", Mr. Stewart said to Acting Regional Director M. M. Mims, "but I was 'way ahead of you and I wish you had been fifty years earlier." So saying, Mr. Stewart produced his essay written as a youth back in 1877.

The essay, entitled "What Will Become of the World", reads in part as follows:

"...The chemists will tell you that water is the most wonderful of all fluids and displays more evidence of Divine wisdom and goodness than any other known substance; while viewed as a physical agent it is equally wonderful and performs many wonderful works io the economy of nature. We see its effects all around us, for it is heaving to the bottom of the sea the surface of this old world of ours, and every year is hastening on its destructive work. Our lands are being carried off by every shower and our own town seems, sometimes, to be floating away on the sandy waves. The mountains and the hills are being chiseled away on every side and swept down to the valley below..."

"Every brook and rivulet is ladened with the soil which it carries to the rivers from whence it is swept on into the broad ocean. This work is going on day after day and year after year with increasing force...

"While this is the condition of affairs at present, the rate is all the time increasing by the act of man. More of this territory is being put in cultivation every year, the timber is being taken off, it is loosened up by the plow, and the waters bear it off more rapidly."

Daniel Webster Stewart had a vision 60 years ago of the wastefulness that was taking place in our nation. The Soil Erosion Service has accepted the challenge. At last we have sought to meet the problem with the weapons of energy, advanced thinking, and coordinated effort.

Erosion in Relation to Trail Construction

By Hugh G. Calkins

REGIONAL DIRECTOR NAVAJO PROJECT

Although improper farming practices are usually thought of as the most serious causes of accelerated erosion, it should be remembered that any disturbance of the vegetative cover of the soil is a potential source of washing. The opening of roads and trails and the establishment of farm lanes and barn-lots, raise problems of erosion control which those responsible for their creation must solve.

When it is realized that the silt deposited by runoff from a given amount of rain falling on bare ground may be from 10 to 100 times as great as that from a vegetated surface, it will be seen that the relatively small area of soil exposed by construction of a road or trail may be of great importance from an erosion standpoint. Cattle trails are a common source of gullying in pastures, particularly where there is serious overgrazing. Man-made roads and trails, if care is not taken to provide adequate erosion-protection, are no less sources of danger to the integrity of the soil.

Experience has shown certain definite practices in connection with road and truck-trail construction which are common causes of excessive erosion. Some of these result from improper planning and location of roads. Roads are sometimes cleared to unnecessary widths, with consequent unnecessary disturbance of protective soil covering. Deep cuts and high fills, with banks not properly back-sloped to prevent sloughing and to permit revegetation, are common causes of erosion. Valuable vegetative shelter such as trees or clumps of shrubbery are sometimes cleared away when different planning of the road or trail would have preserved them.

The most common causes of erosion in connection with roads and trails, however, arise out of faulty drainage practices. Permitting undue concentration of drainage by failure to intercept water running in the road itself, by failure to provide an adequate number of lead-off ditches along the road on sustained grades, or by bringing several natural drainage channels to a common culvert or dip whose outlet is not properly safeguarded against erosion, is a common source of danger. Another source is drainage which involves faulty diversion, such as giving drainage ditches excessive grade, or diverting them into existing gullies.

All of these factors, especially if they are aided by overgrazing, tend to increase gully erosion and add to the difficulty of con-

Soil Conservation Service
Region 4
Division of Information and Education

trol. Old roads and trails, if their drainage maintenance is neglected, often become large gullies themselves, losing their usefulness as roads and forming a major source of gully erosion in the area they traverse. Yet, if these dangers are recognized in making construction plans, roads may be changed from a menace to an aid to erosion control. Trail drainage may be designed and maintained in such a way as to afford positive erosion protection.

Erosion control begins with the laying-out of the trail. In order to avoid unnecessary soil disturbance, trails should be limited, within the maximum provided, to such width as will actually serve the purpose. In timbered country the forester as well as the construction man should be consulted. Where trees are scarce, locations which necessitate cutting should be avoided. In any case, trail lines should be located in such a manner as to avoid large trees and dense clumps. Clearing should be limited to trees which are an actual obstacle to construction and maintenance, and wider clearance for sunlight should be avoided except where it is absolutely necessary. The removal of shrubbery should follow these same principles. It should be remembered that in grazed country wide clearance is both a direct and an indirect cause of soil disturbance, for wide clearings are an invitation to stock to concentrate along the roadway.

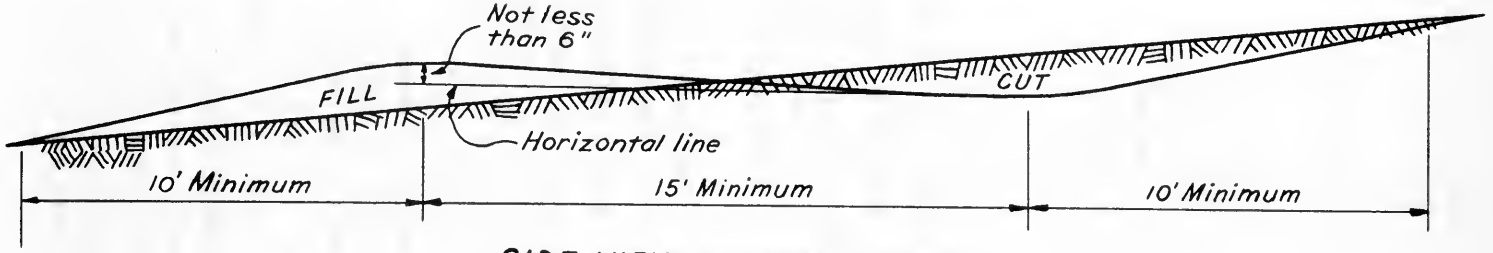
Once the road or trail is established, the greatest aid to erosion control will come through proper drainage devices and practices. In general the aim should be to avoid diverting water to, or releasing it in, places which are likely to erode, and to avoid undue concentration of water. To that end, here are certain specific recommendations:

Outslope. Where material will permit, side hill sections should be built on an outslope of ¼" to ½" per foot of width, in order to avoid concentration of water. Insloping and cross-drains should be resorted to where the soil is slippery or to prevent erosion of fills.

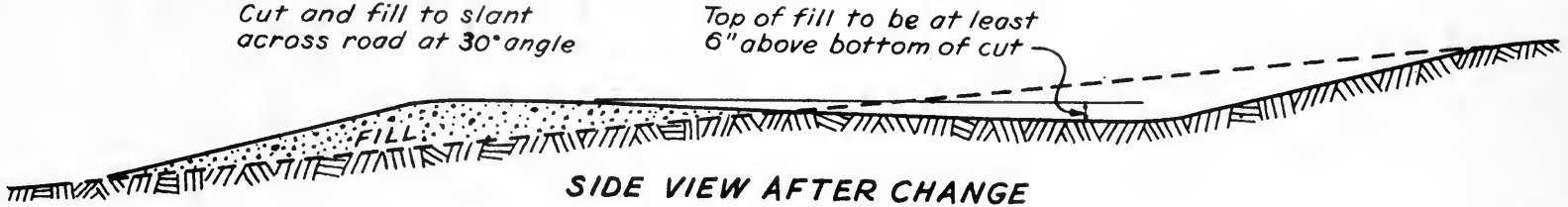
Natural Drainage. Breaks in grade and variations in alignment are desirable in order to take advantage of natural dips and to keep water from concentrating in or along roadway.

Parallel Ditches. Parallel ditches should be avoided. Where they are necessary for any considerable distance, frequent lead-off ditches should be built on a grade not exceeding ½ of 1% and led to relatively flat, well-vegetated spots. In no case should a ditch be turned loose into an existing gully or where it may start a new gully.

Interception Dips. These devices take care of both surface drainage and water collected from the sides. Their general adoption will be very effective in minimizing erosion as well as in reducing maintenance costs. They should be constructed with extreme care (in accordance with plan shown in accompanying illustration) at intervals of from 200 to 500 feet, de-



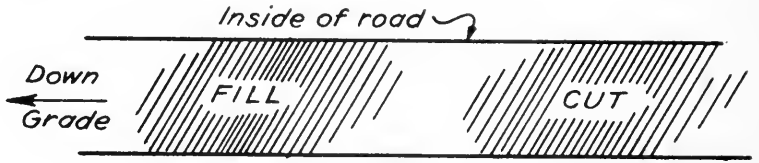
SIDE VIEW BEFORE CHANGE



SIDE VIEW AFTER CHANGE

INTERCEPTING DIP

Courtesy of
U.S. FOREST SERVICE



Detail showing Cut and Fill slanting across road at an angle of 30°

pending on the grade of the road. If properly built, preferably with a rock core in the water bar, they cause little inconvenience to the driver. Painstaking instruction of foremen is essential to insure satisfactory results.

Interception Ditches. Where these are necessary to keep water out of roads they should be of ample size to carry run-off and on gentle grades, usually not exceeding 1%.

Culverts. Generally speaking, culverts are more likely to induce erosion than are dips. Where it is necessary to install them, however, they should have suitable head structures, and, in addition, aprons of rock or other available material to insure an even spill, and such devices as may be necessary to permit spreading of the water. Dips crossing natural channels should be provided with cut-off walls to protect the road, and with aprons to prevent scouring.

The principle should be accepted and followed that it is the trail builder's responsibility to check any erosion that might be caused or increased by his work. For example, necessary steps should be taken to guard against formation of arroyos. If necessary, check dams above and below the trail should be built. Head structures below grades should be constructed to stop headward erosion, and simple rock checks placed where needed to prevent deepening of drainage ditches.

Where cuts are necessary, cut banks should be back-sloped to an angle of repose which will permit revegetation. Cuts on steep sidehills requiring long back-slopes should be avoided as much as possible by the locator. In fact, it should be his duty to avoid, as far as practicable, routes which make control measures difficult or expensive.

Roads and trails which have been located and built in accordance with sound erosion control practices will demand a minimum of maintenance work, but some attention is, of course, necessary. Drainage structures must be kept io repair and should be subject to regular inspection. Old roadd whose drainage is long neglected often become gullies, adding materially to the erosion problem. For that reason this warning should be remembered: Whenever an old road is abandoned or relocated, it must be the duty of the trail-building agency to plug adequately all abandoned sections. If the old trail is needed for travel, interception dips and other devices should be installed to control drainage. The repair of an old road not only aids erosion control, but in many cases it saves money by removing the need of new construction.

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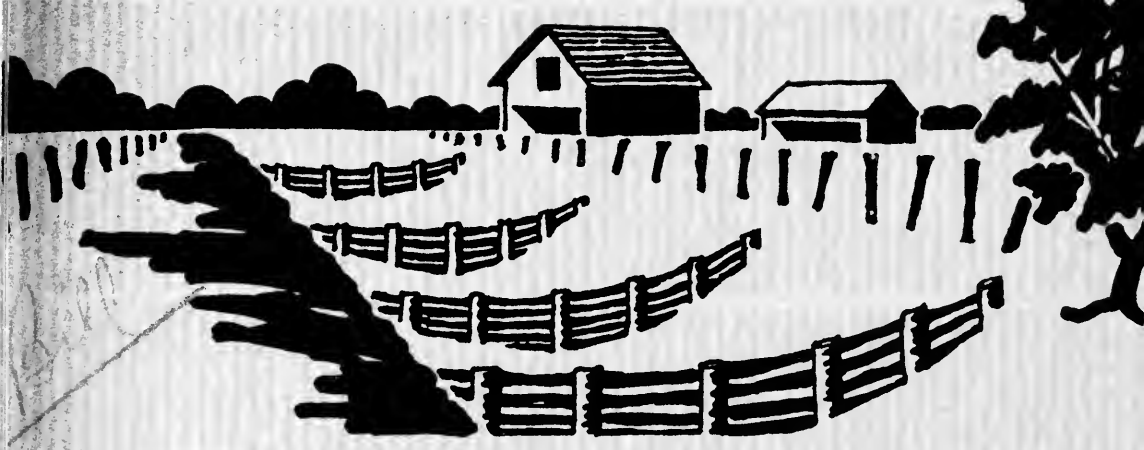

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TODAY AND TOMORROW

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HAROLD L. ICKES
Secretary of the Interior

H. H. BENNETT
Director, Soil Erosion Service

G. A. BARNES · EWING JONES · EDITORS

The Contents

Cover by the Pictorial Statistics Project of the Works Division, E R B, New York

WORK OF THE SOIL EROSION SERVICE

Gully Control in Louisiana

A deep, narrow gully cutting through a corn field near Heflin, Louisiana.

The same gully, effectively checked with an inexpensive log dam.

Nursery at Nakai Bito

a harbinger of tomorrow

By M.E.Musgrave

CHIEF OF RANGE STUDIES NAVAJO PROJECT

The old Navajo from Coyote Springs rose to address the chapter meeting. He raised his wrinkled face with its blind eyes and spread his arms dramatically. His voice quavered slightly as he spoke.

"Our land was once very beautiful," he said. "There were tall trees, many places. There was water in the streams where deer and other game came to drink. And there was grass, much tall, green grass waving in the wind. It was ni-zon-ih, very pretty."

He paused, while several of the older hearers nodded. Slowly he continued:

"Now, they tell me, all these things are gone. I can no longer see, but I know they speak the truth. The wind is hot and dry, and it is filled with sand. There is little grass left for the ponies. I can feel their ribs through the skin. It is very bad."

All were silent. None could voice a denial.

"It may be that we have caused these things, ourselves. We are told that we have too many ponies and too many sheep and goats. This means many hungry mouths eating on the grass and other plants. Very soon they're all gone."

Again a silence.

"But now," he continued more firmly, "it is going to be all right. These white men are going to help us. They will plant things and make them grow. Pretty soon, there will be much grass and many trees. It is good!"

As he seated himself, I thought upon his concise summary -- past, present, and future as we hoped it to be. How tremendous was this task which we had set ourselves, and how vitally necessary was its success! The future existence of the Navajos depended upon the rehabilitation of their ravaged lands, and time was of the utmost importance.

It was late in December, 1933, when the Navajo project was set up in a preliminary way. It then had been necessary to recruit trained men for the staff, and they, in turn, had to familiarize themselves with at least a part of the sixteen millions of acres of the Navajo project. It required time to attain these preparations and it was,

therefore, late in the spring of 1934 before any actual work was started. A lath awning, shading about one acre of ground, was erected at Nakai Bito to protect plantings of pinon *(Pinus edulis)*, winter fat *(Eurotia spp.)*, and other native stock. In addition, a few thousand willows and cottonwoods were planted up and down the Mexican Springs Wash. Due to the advanced season, only a relatively small amount of plant work was attempted. A total of perhaps 250,000 or 300,000 plants were set out last year.

Much planning and preparatory work was accomplished. A five-acre nursery site was terraced, leveled, bordered and planted. Nearly all of these plants were natives of the Southwest, and most were adapted

Variety? The Nakai Bito nursery included these plants -- a nucleus of the vegetative battle against erosion.

Yucca baileyii	*Yucca macrocarpa*
Penzia incana	*Euryops multifida*
Eragrostis curvula	*Oryzopsis milliaceae*
Quercus emoryii	*Ampelopsis quinquefolia*
Peach	*Blue plums*
Rhamnus	*Juglans nigra*
Atriplex confertifolia	*Crataegus erythropods*
Jujubus sp.	*Atriplex collina*
Sarcobatus vermiculatus	*Eriogonum sp.-Bush buckwheat*
Celtis reticulatus	*Cercocarpus intricatus*
Cercocarpus argenteus	*Acer sp.*
Rhus glabra	*Lygodesmia juncea*
Chilopsis linearis	*Cupressus arizonica*
Cowania stansburiana	*Elaeagnus angustifolia*
Eurotia lanata	*Fallugia paradoxa*
Fendlera rupicola	*Forestiera neomexicana*
Fraxinus cuspidata	*Gleditsia triacanthos*
Juglans major	*Odostemon fremontii*
Pinus edulis	*Pinus ponderosa*
Prunus americana	*Purshia tridentata*
Rhus trilobata	*Sambucus sp.*

to erosion control work in this semi-arid region.

In making plans for our revegetation work, we kept in mind the necessity for selecting plants which would not only serve as soil-binders and -builders, but which would provide food for man or beast, or both, for the problem of supporting more than 40,000 Navajos on 16,000,000 acres of badly depleted land necessitated increasing the human carrying capacity of the range.

Some of the most outstanding food-producing plants are the native peaches, plums, and berry bushes. The black walnut serves not only a dual but a quadruple purpose: providing firewood, building material, dye in the nut husks, and food. Pinon nuts and Emory oak

acorns are sold in the markets of the Southwest. Honey locust pods, yucca pods, sumach berries *(Rhus)*, and hawthorn berries form a part of the native diet, while other portions of the plants are used for various domestic purposes. For example, ash and oak wood are fashioned into the hard, glossy sticks used in rug weaving; and soap is made from the root of the yucca. Although the diet of these people is simple, their needs are, nevertheless, urgent; and we have, therefore, placed the emphasis on these food supplying plants both in the field and in nursery stock.

In addition to the nursery, prepared for seed planting, we selected an area with a favorable southern exposure, where will will handle plants that are brought in from various parts of the Southwest. The soil is a light sandy loam, especially adapted for this particular use, with enough natural moisture to obviate the necessity of artificial irrigation. We were fortunate in having a comparatively open winter, so we were not bothered to any great extent by frosts. This was particularly true in the heeling bed, with its southern exposure and favorable air drainage, where plants were being taken in and shipped out daily. We started planting such deciduous trees as cottonwoods, willows, wild plums, and tamarisk in early January, 1935, and have continued, with but few interruptions, until the present.

There has been a constant movement of plants at Nakai Bito, but when the total figures were made up on February 19, they were greater than might have been expected: Stock received at Nakai Bito (plus cuttings from tops), 1,149,120; Dispersed, 101,530; Planted at Nakai Bito, 604,650; Heeled, 361,540; Nursery, 81,500.

Since my part of the work plan for the Navajo Experiment Station deals with human relationships, it was very pleasing for me to note the interest taken by the Navajos in this planting program. One man, a stone mason making $5.00 a day, quit his particular line of work to do planting work for us at $2.40 a day, because he wanted to learn how to take care of plants. The Navajo students have taken hold of the revegetation work with amazing aptitude, and within this short period of time we have developed young men so well trained that they are taking charge of big planting crews putting out thousands of plants daily.

Within one month and twenty days, in 1935, we have handled more than a million plants at Nakai Bito alone. This was perhaps a little more than half of the total plants handled on the Navajo project as a whole. We have great hopes and plans for the future. Each succeeding year should show ever-increasing results of our labors. If only a small percentage of our plantings should grow, they will make an appreciable difference. We hope that once more there will be "tall trees, much grass, and all will be ni-zo-nih."

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Control of Wind Erosion on the Southern High Plains

"Where the wind blows, anything short of eternal vigilance is gross neglect."

By H.H.Finnell

REGIONAL DIRECTOR DALHART PROJECT

In the establishment of a permanent wind erosion control system, a number of factors must go hand in hand. Of greatest importance, probably, is the necessity of maintaining a vegetative cover for the land. Since this involves the correction of agronomic mistakes now widespread among farmers, and since only the farmers themselves can correct these errors, this procedure can only be approached through demonstration and education.

Also, of great importance, is the introduction of moisture conservation practices which serve to aid the farmer in maintaining vegetation through drouthy periods.

As a general aid in lessening wind damage on both cultivated and pasture land, a road-side wind-break tree planting program affords an opportunity of considerable possibilities.

The several phases of wind erosion control, listed in the order of their relative importance, are as follows:

1. Utilization of erosion resisting crop residues.
2. Moisture conservation for maintenance of vegetation.
3. Employment of emergency cover crops.
4. Wind-break tree plantings.
5. Use of emergency tillage operations.

Residue utilization, moisture conservation, and tree plantings should be established features of every high plains farming system. These erosion prevention measures constitute an economic asset to a permanent and stabilized plains agriculture by making material additions to the productive efficiency and soil resource conservation. Emergency cover cropping and emergency tillage should be held in reserve as support for the permanent erosion prevention program, and should be resorted to only in cases of extremely unfavorable conditions.

No method of control which waits until wind erosion has begun can be effective or economical. Advance preparations against drouth hazards are absolutely essential. The ideal system requires, first, that

an erosion resisting type of vegetation be produced at every opportunity, and second, that the vegetative residues from these crops be left on the ground for erosion prevention until a sufficient store of soil moisture has been accumulated to assure the successful start of the next crop. To accomplish this the following procedure is being put into effect on the Dalhart demonstration area.

Where an erosion non-resisting crop is being grown, it is stripped at close intervals with an erosion resisting crop, such as sorghum or small grain. Farmers confining their production to sorghums and small grain do not need strip cropping to provide the desired type of residue material left after harvest, but need only to preserve and utilize wisely what they have in the ground. Extreme care is necessary to prevent the burning off of stubbles, the overgrazing of stalk fields and the overgrazing of growing crops. This deliberate destruction and misuse of protective residue coverings has directly caused more erosion than any other common practice followed in this area.

Gaps in a program of residue utilization are most likely to occur during periods of extended drouth. To avoid crop failures, moisture conservation by terracing and contour tillage provides a most effective supporting phase for the continuance of the vegetative covering. Even when a grain failure occurs, the crop usually will have developed sufficiently to provide protection from erosion. Such other gaps as may occur, due to unfavorable conditions, may be closed by the use of emergency cover crops. These off-season plantings are made with no intention of economical production, being often too late for grain maturity, but are intended solely to provide ground cover.

Wind-break plantings of honey locust, Russian mulberry, Chinese elm, green ash, apricot, and other hardy plains varieties of trees, are being made in natural and engineered sites favorable to the accumulation of excess water from adjacent areas. The best sites occur along road-ways where storm water collects in the ditch, soaking into the soil and providing the moisture supply necessary to enable trees to compete successfully for existence under plains conditions. These wind-breaks are being located with the approval of County Commissioners, and are planted only on the south and east sides of the road to avoid traffic-blocking snow drifts.

Scientific observations by plains experiment stations, including weather records, together with a wealth of supporting farmer experience, indicate a highly practical possibility of maintaining vegetative cover by a complete coordinated effort of advance preparation. Where this is done, tillage methods become unnecessary, and the objectionable expense of non-productive field operations can be avoided.

Fortunately, the continuous cropping and residue conservation

policies of the Soil Erosion Service wind erosion control program fit admirably into the best known systems of fertility conservation that have been worked out for the southern high plains area. Moisture conservation also adds materially both to economical production and the stability of plains agriculture while contributing its part to the continuance of vegetative cover. As worded by Dr. H. V. Geib, foster-parent of the Dalhart project, "Wind erosion control in the Panhandle is merely sound farming put into practice".

When the protective cover has been lost, there may be many months of drouth before an opportunity to restore it occurs. At once the farm becomes unproductive and the farmer frequently is financially unable to continue the unequal battle by means of tillage operations. Preparation for such bad times can only be made in good times; thus the heart of the educational program is to instill vigilance in the minds of the farmers. Where the wind blows, anything short of eternal vigilance is gross neglect.

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A worn-out, eroded field in South Carolina. It was cultivated for a number of years, until soil losses and declining production forced. Under the Soil Erosion Service program, this field will be returned to trees.

Pasture Development in Texas

By V. W. Woodman

CHIEF AGRONOMIST TEMPLE PROJECT

Many methods are being used to maintain Texas pastures in their productive state. Of these contouring is proving the most effective.

The Soil Erosion Experiment Stations, in various parts of the country, have provided ample data to indicate that a good cover of grass is one of nature's best means of combatting runoff rainwater and accompanying erosion. On most of our pasture land, however, the cover of vegetation is not adequate to bring about this highly desirable protection. During the long dry summers, common in this portion of Texas, most of our pastures are badly overgrazed, thereby becoming readily vulnerable to the ill effects of surface runoff.

It is realized, of course, that overgrazing is a mal-practice, but one that is rather strongly intrenched and which cannot be easily overcome. Most of the Texas ranges are overstocked. If we were to carry only the number of cattle, or other livestock, which should be readily accomodated on our pastures during the dry portions of the year, the numbers would have to be so drastically reduced below customary practices that the majority of the stock men could not subscribe to the program. It is evident that some system must be worked out whereby a satisfactory number of cattle can be grazed throughout the dry months without seriously affecting the protective grass cover of the land that is essential in preventing destructive erosion. The land, assuredly, must be preserved for permanent pasture use.

A practice which would be highly beneficial on most of our pastures is that of rotating the fields. To do this, it would probably be necessary to construct a great many more fences than now exist, in order that cattle might be transferred from field to field as needs might appear. This practice would not only produce more pasturage, but would afford the advantage of permitting grasses, on selected fields, to recover sufficiently at the proper season of the year, to produce seed. When this practice is not followed, the pasture will soon become over-run with weeds, and much of the valuable grasses will disappear, leaving a large percentage of the land entirely bare. This is what has actually been happening over extensive areas in Texas.

Another practice which should be followed more diligently and which is applicable, certainly, to those sections of the state where mixed farming is being carried on, is that of raising feed to supplement the pastures during dry seasons. When this is done, the stock can be kept off the pasture fields at critical times when the grass is short and making no growth, and when grazing would be very harmful. Trench silos are cheaply constructed and are entirely satisfactory for storing and preserving ensilage, and supplies can be carried as much as two years, or even longer if necessary. While this practice is not yet general throughout the state, it has been adopted by a sufficient number of livestock men to demonstrate its value. It should go into general use.

On pasture land having any appreciable degree of slope, a large amount of the rainfall will induce serious runoff during seasons when the grass cover is light and where grazing has been heavy. If artificial means were adopted to hold more of the rainfall on the land and effect its penetration into the soil, it would be possible to produce a much greater amount of pasture growth, and, also, control soil loss and prevent serious pasture deterioration.

On the Soil Erosion Service projects in Texas, contouring of pastures is proving most effective. On the Elm Creek project, a considerable amount of steep submarginal land has been taken out of cultivation and planted to pasture grasses. The native grasses in this region consist largely of Andropogons, such as the big and the little blue stem, beard grass, and in places, considerable buffalo grass *(Bulbilis dactyloides)*. Most of these grasses seed so sparsely and the seed shatter out so early that it has been almost impossible to obtain sufficient seed from the species to establish new pastures. We are now working on new systems of collecting seed, and we hope it may be possible to perfect practical methods that can be put into general use.

At present, most of our pasture work consists of setting Bermuda grass or Buffalo grass sod and supplementing these with seed of Rescue grass, Rye grass, Dallis grass, Black medic and Bur Clover. Black medic cannot yet be recommended as entirely practical for the Blackland region. Dallis grass, also, has its limitations because of its lack of adaptability to long, droughty periods.

In setting out new pastures, it is usually the practice to run contour lines at 10-foot horizontal intervals and furrow them out. On land that is fairly regular, these lines are run at 20-foot intervals and the intermediate line is obtained by plowing a furrow about midway between the two lines that have been run accurately with the level. Where Bermuda grass is to be planted, the customary method is to

plow one round with a long mold-board plow, forming a single back-furrow on each contour line. The Bermuda sod is then placed in the furrow on the upper side of the contour. Another round is then made with the plow, which covers the sod and makes the back furrow still higher. If the ground is lumpy or very loose, it is compacted over the sod by means of a roller or with a dual-wheel truck. The sod planted on the upper side of this contour ridge will obtain more moisture than if planted in any other way. If the compacting process destroys the contour ridge it will be necessary to make another round with the contouring plow. We found that in order to get a satisfactory stand from Dallis grass seed, it is necessary to plant the seed in a water furrow on the contour and cover very lightly. Mixing the seed with well pulverized barnyard manure, and putting this manure in bunches in water furrows, has also proven a successful method of getting Dallis grass started.

Where pastures are being planted on hillsides that are extremely low in plant food, and there is doubt as to whether the grasses will survive and spread satisfactorily, it is advisable to apply some treatment of fertilizer before the grass is planted. Barnyard manure or a commercial fertilizer may be used. In order to accomplish a complete coverage of grass as early as possible, it is advisable to plant an additional row of sod between the ten-foot contours. This may be done by opening a single furrow midway between the contour lines, dropping the sod into this, and covering it over with another plow furrow. It is sometimes desirable to place the contours as close as five feet, especially when new pastures are being developed. If this is done, the water is held more nearly where it falls. The objection to this practice is that it adds to the difficulty of clipping weeds while the grass is becoming established. Where the contours are as much as ten feet apart, it is much easier to operate a mower effectively over the field. Very little grazing should be allowed on new pastures until the grass becomes firmly established.

Some very good contouring has been done with a farmall tractor and two-row lister. Pastures of Buffalo grass were bedded at three foot intervals just as though corn or cotton were to be planted, and before the season had closed the furrows had become entirely covered with grass. There was as much pasturage afforded for the season as would have been the case if the pasture had not been disturbed, because an improved condition in the moisture supply induced an extra growth of the grass. During the following season, this particular pasture carried twice as many cattle as an adjoining pasture which had not been treated.

Where old pastures are to be improved and the contours placed at

10-foot intervals, the owner of the land may object on the ground that it would destroy too much grass. In such cases, it may be advisable to place the contours at 20-foot intervals, and when the furrows become covered with grass during the following season, the intermediate contour may be plowed in with the owner's full approval and consent. The contour treatment destroys a small percentage of the grass in any one season, and it produces large benefits of improved quality and quantity of grass the second year. Pasturage destroyed by the additional contours, therefore, cannot be a serious handicap.

Many of the old pastures, located on badly eroded fields once cultivated, but now abandoned, have such a small portion of the surface in grass that it is necessary to set out new pastures at the time the land is contoured. When this is the case, the practice is very similar to that used in setting out entirely new pastures.

On pasture land where there are gullies, or even slightly depressed waterways, it is important that the contour furrows be turned upward within three or four feet of the edge of the waterway, rather than cross in a straight line. Thus the water is carried away from the old established waterway and conserved rather than lost.

Where the old established waterways are quite broad, it would no doubt be beneficial to plow separate contours across the waterways. In some cases, it would be advisable to construct these in the form of an inverted U and thereby set up a plan to direct the water out of the waterways into the main contours. It is best, in most cases, for these furrows to be independent, rather than a part of the main contours.

Where pastures have quite a steep slope, it is usually preferable to build terraces. These terraces should, under most conditions, be built on the level, so that all or nearly all of the water will be held on the land. To get best results, they should be placed rather closely, in which case they need not be built quite so high. This, of course, becomes similar to contouring, the two methods blending under many conditions. Sometimes it is preferable to combine the practices of terracing and contouring, by building the terraces at regular intervals, and contouring at 10-foot intervals between terraces. This is especially desirable on steeper slopes.

Where there is a cultivated field immediately below a pasture, subject to possible damage by runoff from above, it would be advisable to construct protecting terraces on the pasture area.

In many cases where pastures adjoin cultivated land, it is possible to empty terraces onto the pastures. This supplies extra water for the grass, and may also relieve the necessity for extra outlet protection. In the Texas Blacklands, however, due to excessive crack-

ing of the soil during dry seasons even on well vegetated areas, great caution must be exercised in dumping excess water on pastures.

If pastures are properly contoured or terraced, and are not unduly overgrazed, all of the rainwater which falls on the land can be held there. The practice will result in better pasture growth and will, also, give almost complete protection from soil erosion. The same methods can be applied to all land except that which is excessively steep or rocky. It should be the aim of every livestock man to adopt this improved pasture treatment, to the end of attaining better grazing and a better protection of his land.

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BOULDER DAM BED MAPPED TO RECORD SILTING

As an important step in protecting Boulder Reservoir from destructive sedimentation, Dr. W. C. Lowdermilk, Vice-Director of the Soil Erosion Service, has announced plans for maintaining a constant check on the amount of silt and other erosional debris deposited in the huge water storage plant by the Colorado River and its tributaries.

The Service, in cooperation with the Reclamation Service and the Coast and Geodetic Survey, will begin at once the work of mapping the 230 square miles to be inundated behind Boulder Dam. When completed, this map showing original contours of the reservoir bottom will form the basis for future comparative studies to determine changes in the topography of the lake floor due to deposits of sediment.

The information thus obtained will furnish a factual basis for developing protective measures of erosion-control and silt-detention in the watershed of the Colorado River.

Onth basis of present estimates, it would require about 100 years to fill the 10,000,000 acre feet designed for silt retention and less than 500 years to fill the gigantic reservoir completely.

"The Boulder Dam development, with its far-reaching effect on social welfare in the arid West, must be considered as a permanent alteration in the physiography of the United States," Dr. Lowdermilk declared.

"Although there appears to be little danger that silt deposits will seriously damage the reservoir at least within the next hundred years", he stated, "a proper concept of Boulder Dam demands that steps be taken now to prevent any future curtailment of its utility."

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Frost Must Share the Blame

That chilly nights often injure crops is well-known — but how about the soil itself?

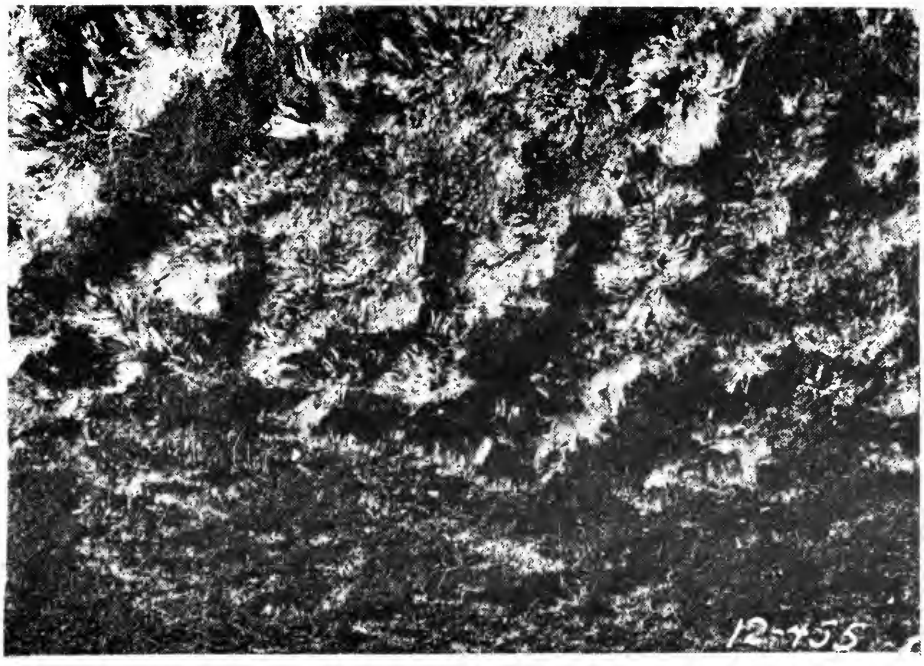
By W. D. Lee

CHIEF SOIL EXPERT HIGH POINT PROJECT

Throughout the southern Piedmont and Appalachian regions during winter and early spring odd ice formations may be observed on exposed road cuts or ditch banks. The peculiar finger-like crystals have apparently grown at right angles to the surface, regardless of the degree of slope. This freezing phenomenon is locally known as "ground-ice" or "jack frost". It is a modified form of soil-heaving, and takes place where the moisture content of the soil is high. The ice-columns, or needle-like crystals, are formed at or near the surface without penetrating the lower depths of the soil. During the formation of the ice crystals, unfrozen water is drawn to them by capillary or film movement from the soil. The growth takes place at the lower end, directly in contact with the soil, and the process forces the entire column upward, simulating straight needles massed together. Observation will show that each ice column is capped by soil particles.

In the southeast, this type of frost action is confined principally to heavy clay soils. It differs from the true "heaving" so often encountered in the highly organic soils of the north central states, where several inches of frozen soil may be lifted by the formation of ice crystals at lower depths. The clay soils of the Piedmont are often affected, especially on "galled spots" representing exposures of subsoil clays in tilled fields, or in gullies or road cuts. Occasionally, a loam or clay loam will show some heaving, but this occurs only where the heavier clay is immediately below the surface. On recently made road cuts in deep clay loam soils, ground-ice crystals may not be readily noticeable above the subsoil. The three conditions essential to the formation of ground-ice are, therefore, heavy-textured soils, moisture, and absence of cover. Clay soils retain more moisture than loams or sandy loams. In the smaller pore spaces, water freezes more readily, and capillary movement is much stronger. A good vegetative cover prevents formation of ground-ice.

The question has arisen: "What ill effects are caused by repeated frost (ground-ice) action?" The answer: severe sheet erosion on gullied areas and in cultivated fields of clay soils; gravitational erosion in deep gullies, road cuts, and ditch banks. On open fields and



Minute evidence of "frost erosion".

the smoother parts of gullied areas, the heavy clays are thoroughly pulverized to a depth of one to three inches by the action of the ice crystals. Upon thawing, this layer dries very quickly. The resultant condition is an inch or two of incoherent, loose powder-like soil resting upon an almost impervious clay. When rain falls, this loose material practically melts away with surface runoff, and another inch or two of good topsoil is lost from the field. On the sides of deep gullies, or road cuts, or ditch banks, the loosened clay material tumbles down, on thawing. When a warm day follows a sharp freeze, as much as two inches of this loosened material may roll downward. This accumulated debris in the bottom of gullies or ditches is carried away by the first outflow of water following a heavy rain. Much cutting-back and caving-in is caused by this repeated process. Where there is sufficient seepage to supply moisture to the lower clay subsoil, ground-ice action continues and severe cave-ins carry the banks back many feet each year.

Control measures, such as planting or seeding on gullies, road cuts, and other severely eroded areas, are often greatly retarded by frost action. Roots of grasses and other seeded plants may be destroyed by the work of ground-ice. Well-set trees may be loosened, or the roots exposed, when material repeatedly disturbed by ice crystal formation is carried away. Heavy mulching is probably essential for

control in many cases. Where heaving takes place in grain fields, the damage is generally inversely proportional to the amount of root growth. Seeding as early as possible, and use of fertilizer to produce vigorous growth and well-developed roots, will lessen winter killing. Plants with deep and well-spread root systems will not be easily lifted out of the ground by ice action. If such lifting does occur the chances are greater that the plants will be supplied with moisture until new growth begins in spring. Here, again, use of stable manure or other litter as a mulch will check serious damage.

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DUST STORMS AFFORD GRIM OBJECT LESSON

The intense dust storm which swept across the mid-west in February is a grim object lesson in the destructive power of wind erosion and a graphic illustration of the imperative need for its control, according to Director H. H. Bennett.

Continued storms of this sort can be expected, he asserted, until adequate steps to prevent their recurrence are taken by farmers in the great plains region where the topography of the land and improper farming methods make soil-blowing a constant menace.

Approximately 60,000,000 acres of land in the arid region of the United States have suffered severe damage from wind erosion, according to a recent survey by the Soil Erosion Service. About 5,000,000 acres have been completely destroyed for any possible cropping purposes by the loss of topsoil or by the deposition of wind-blown sand on fertile areas.

Dust storms, Mr. Bennett stated, can be averted to a large extent by the maintenance of an adequate cover of vegetation on the ground and by scientific and practical methods of cultivation.

At Dalhart, Texas, in the Panhandle region where the most recent dust disturbance originated, the Soil Erosion Service is now conducting an actual demonstration of the most effective measures of wind erosion control. Similar projects have just been launched in Eastern Colorado and central South Dakota. Application of the land use methods employed by the Service in these demonstration areas to the general regions affected by wind erosion, Mr. Bennett declared, will curb the recurrence of soil disturbances caused by high winds.

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Kudzu for Erosion Control

By R. Y. Bailey

REGIONAL DIRECTOR ALABAMA PROJECT

With the emphasis that is being placed on vegetation as a means of erosion control, the question of what to plant for this purpose becomes one of major importance. As a general principle, no plant should be used which will not produce something of value to the owner of the land. With the possible exception of sod used in terrace outlets, all plantings made for erosion control will be appreciated by farmers in direct proportion to their usefulness for other purposes. Shrubs or vines that merely stabilize gullies, but have no value as forage or timber will not add materially to the popularity of erosion control work. If, on the other hand, the plants used satisfy a definite need on the farms, they will serve to popularize the work with farmers and land owners.

Kudzu is probably the most useful plant for erosion control in the Piedmont section of the Southeast. This plant is a perennial viny legume which grows vigorously on practically all types of soil found in the Piedmont section.

The value of kudzu for erosion control is due in large measure to its habits of growth. Runners grow to a length of as much as 50 or 60 feet. These runners take root at the nodes and establish new plants. This is a very important characteristic where kudzu is to be used for gully control or for covering badly eroded areas along shallow gullies where the topsoil has been washed away. The plants can be set in rich soil several feet away from the gully or bare area, as may be desired, and they will spread to the areas to be protected. Kudzu runners climb down vertical banks and even cross gullies, whereas the runners of most other viny plants tend to grow upward and, therefore, do not cover gullies as effectively. No other plant is available that can be depended upon to spread as far from the original plant.

Figure 1 shows an area of approximately three fourths of an acre, which was covered with a dense growth of kudzu from one plant started in the bottom of a deep gully about fifteen years before the picture was made. The gully, in which the man in the picture is standing, was approximately ten feet deep when the plant sprouted from an old vine thrown in the gully. This gully was on a type of Davidson soil which is very erodible, particularly in the B and C horizons. No bank slop-

Fig. 1. Kudzu started by throwing vines in a gully about 15 years before this photograph was made. The man is standing in the deepest part of the gully, which was originally approximately ten feet deep.

ing, check dams, or other mechanical means of control was used. Figure 2 shows the above gully in January when kudzu was dormant. It may be seen from this picture that the gully has not only been stabilized but that it has also been filled with accumulated vegetative and soil debris to such an extent that an automobile could be driven across it.

Kudzu has the further advantage of being a valuable forage plant. It is eaten readily in either the green or the cured state by all classes of livestock. The analysis of kudzu, given in Henry Morrison's "Feeds and Feeding", shows that it has approximately the same feeding value as alfalfa. This plant may be cut for hay at any time during its growth in the summer or fall, whereas other forage plants must be cut at the proper stage of development to avoid quality deterioration, or even serious loss.

Fig. 2. The same gully shown above, while the plants were dormant.

KUDZU NOT A PEST

There is an erroneous idea that kudzu may become a dangerous pest by spreading to cultivated land where it is not wanted. The manner in which new plants are formed precludes any possibility of this plant spreading to cultivated land. As previously stated, the runners take root at the nodes and form new plants. During the first season the roots of these new plants are fibrous and may be easily broken loose from the ground by a one-horse plow or cultivator, as ordinarily used in the cultivation of crops. Thus, if the cultivated field is plowed each year, there is no possibility of new plants, formed at the nodes of runners as described above, becoming sufficiently established to prevent being readily uprooted. At the Alabama Experiment Station, kudzu meadows and cultivated fields adjoin, with no physical barrier between, yet no extra labor or time is occasioned in keeping kudzu runners from spreading to the cultivated areas. Plowing done in the production of crops on the cultivated areas prevents the spread of kudzu to these areas.

HOW TO PLANT

Kudzu is propagated by plants. Only plants with well developed fleshy roots should be used. Care should be exercised in keeping plants moist from the time they are dug until they are set. If plants are allowed to dry before setting, a large percentage of them will fail to live and grow.

Various methods of planting have been used. A very satisfactory one is as follows: Lay off rows 8 to 12 feet apart and throw four furrows to each row to form a bed. Plant on top of these low beds, using a tree planting dibble to open holes for the plants. Be careful to get plants well into the ground so that the crowns will be approximately level with the surface of the ground after the soil is packed around them.

Fig. 3. Close-up view of kudzu planting. One man makes the holes with a tree planting dibble, one man drops plants behind two dibbles, and two men set plants behind each dibble.

Planting should be done during the dormant season, using care to protect any plants on hand from freezing while held in storage.

Little growth should be

Soil Conservation Service
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expected during the first season. Plants must form a well developed root system before vigorous growth can begin. It is advisable to cultivate kudzu during the first year to control weeds and grasses. It is particularly important that weeds be kept down so that runners will be in contact with the ground and thus allow new plants to be formed at the nodes. If given clean cultivation during the first season, kudzu should become sufficiently established to compete with other plants the second year, and thereafter.

WHERE KUDZU MAY BE USED

Gullies. Gullies which are not to be used as terrace outlet channels may be stabilized by first diverting the water from them and then planting kudzu along the banks where soil is available. These plants will require about two years to become well established, but after they are established, they will produce vigorous runners that will cross the gullies, take root at the nodes, and eventually stabilize the gullies. Where check dams have been built in gullies and have collected soil, kudzu plants may be set in this soil.

Plants set in bare B or C material in gullies will require several years to get sufficiently established to make satisfactory growth.

Land unfit for cultivation. On slopes that are too steep or too badly eroded for profitable crop production kudzu may be set in rows over the entire area. In addition to giving a protective cover for such land, kudzu will, after it is well established, produce a crop of good hay.

On fairly gentle slopes where the land is too badly eroded to be terraced and cultivated, kudzu will enrich the soil in a few years to an extent that it will again produce crops.

Provision should be made to get a row or two of corn and velvet beans, cowpeas, or soy beans planted between the rows of kudzu the first season to insure a certain amount of necessary cultivation.

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PLANT DISEASE AND PESTS SPREAD BY EROSION

A new and menacing aspect of the erosion problem has been discovered in the rapid spread of plant disease and weed pests in certain sections of the West. Soil washed from eroding and disease-infected slopes is carrying infection to lower lands which, because of their more resistant character, have hitherto been unaffected, according to a report recently submitted to Vice-Director W. C. Lowdermilk from Ventura, California, county agents.

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Collection of Hydrological Data

By D. B. Krimgold

ASSISTANT AGRICULTURAL ENGINEER

When intelligent control of any phenomenon is attempted it is always necessary first of all to determine the factors influencing it. These factors are then studied and the direction and magnitude of their influence is determined. The control of a phenomenon may consist in retarding or accelerating its rate or it may aim to eliminate it entirely.

Soil erosion is a natural phenomenon, the rate of which in the United States has been greatly accelerated by such unwise practices as deforestation, overgrazing, and faulty agricultural practices.

The task of the Soil Erosion Service is the retardation of the rate of soil erosion and the restoration of its geological norms, thus alleviating such grave consequences of accelerated erosion as depletion of valuable topsoil from agricultural land, the destruction of large tracts of land by gullying, and the silting of expensive artificial reservoirs and irrigation canals and structures. By-products of the work of the Service should be the replenishing of ground water and the diminishing of flood peaks.

Soil erosion is an extremely complex phenomenon. The factors influencing it are themselves quite complex in nature and so closely interrelated that it is virtually impossible to segregate them and treat each of them independently of the others.

Sheet erosion is known to be a function of intensity of precipitation but one can not discuss the effect of this factor in any specific case without knowing a number of other factors such as the type of soil involved, the magnitude of the slope, the type and density of the vegetative cover, and a number of hydrological factors. Gully erosion is dependent on such characteristics of stream flow as rate of discharge, velocity, silt content -- but can one discuss the extent of gully erosion without knowing the texture and structure of the soil composing the banks and bed of the gully in question?

Neither is wind erosion determined by wind alone. It is obvious then that to effectively control soil erosion, due consideration must be given to a multitude of widely varied factors.

The engineering branch when deciding on a type of terrace to be used on a given farm may have to consult the soils branch with regards to the type of soil and its properties; the agronomy branch with regards to the crops to be grown and the methods of cultivation; and the forestry branch with regards to the types of vegetation to be used in controlling the terrace outlets. Each of the branches named may in turn have to consult all or some of the other branches to furnish the best answer to the problem. There is one type of information which is always indispensable to all branches of the Service when they try to give an answer to the problems arising in every day work, and this is the hydrological data for the locality involved.

When an engineer designs a terrace, culvert, spillway, check dam, or interception ditch, he invariably faces the problem of determining the maximum rate of flow and the frequency of its occurrence. The determination of these all-important unknowns involves the knowledge of such hydrological factors as intensity, duration, seasonal distribution, and frequency of occurrence of rainfall, rates of infiltration, and a number of other related factors. When the agronomist chooses a crop to be grown he must have such information as: length of growing season, the amount of available precipitation and its seasonal distribution, maximum and minimum temperatures, hours of sunshine and other factors. The forester and the range management men when dealing with ecological problems must know the annual precipitation and its distribution with elevation; they may also have to know the rates of transpiration of various species; they may need data on the maximum wind velocities. Even the soils man is vitally concerned with such data as evaporation from soils, total precipitation, rates of infiltration, depth of the water table, or the rate of flow of water and velocity distributions in a gully when he attempts to determine the comparative resistance of different soils to erosion.

For the Service as a whole, hydrological data are useful in many ways. It is essential that some means be available by which to show the effectiveness of the work as it progresses. This can be shown by determining the silt and water runoff from a given area before and after control measures have been applied. In a similar way the necessity of control and the benefits derived from it may be shown. The relative value of different control measures can be determined. It is, of course, understood that all related meteorological and other factors are to be determined before conclusions are reached. Gaging the water and silt runoff together with analyses of the silt for organic matter are useful in sounding a warning to farmers whose good topsoil is being washed away without any visible effects on the land. It seems to the author that this warning should be an important part of the activ-

ities of the Soil Erosion Service. Man's activities can be highly effective in accelerating erosion but not as effective in restoring depleted top soil to its original value. A few inches of good rich topsoil represents hundreds of years of slow work by nature through such slow processes as decay of vegetative matter and bacterial activity.

Soil erosion control is a new field and consequently there are a great many problems to which the answer is yet to be found. One such problem to be answered in connection with gully control, for instance, is whether the erosive power of a stream increases or decreases with an increase in its suspended silt load. Many of these problems are being studied by first rate investigators in hydraulic laboratories in this country and abroad. However, results of laboratory studies on such subjects as silt transportation and erosion are greatly in need of verification in the field. The nature of the work of the Service and the wide geographic distribution of its projects make it the most logical agency to verify under actual natural conditions the results obtained in the laboratories. On the other hand there are many problems which are of interest to the Soil Erosion Service only. The laboratory and field investigation of such problems must be undertaken by the Service if it is to carry out its work on a rational scientific basis. An example of such investigations are the experimental plot studies, part of which is the laboratory study of the various types of divisors used to measure runoff from the experimental plots. This study is being carried on by Howard L. Cook, Hydraulic Engineer of the Service, in the Bureau of Standards' hydraulic laboratory. On at least one of the projects, the Gila, the object of the work is to reduce the silting of reservoirs and irrigation structures. There it is important to know whether gully erosion or sheet erosion contributes the greatest amount of silt. Such a problem can be solved only by determining the amount of material carried by the stream at appropriately located sections.

Reliable hydrological data needed for the solution of this and kindred problems can be obtained by careful observation and skillful analysis of the data collected.

Some of the Soil Erosion Service projects are located in regions for which some hydrological information may be obtained from Federal and state agencies such as the United States Weather Bureau, the United States Geological Survey, the Army Engineers, State colleges, and others. However, in most cases the data available were collected with objectives other than erosion control in view, and therefore give only a partial answer to problems confronting the Service.

Director H. H. Bennett and Vice-Director W. C. Lowdermilk realized at the very start that soil erosion is largely a hydrological

phenomenon and that collection of hydrological data must be made an important part of the work of the Service. Arrangements were made for the collection and study of such factors as stream discharge (both water and silt) and ground water studies on the projects. The first step in this direction was taken as far back as December, 1933, when a memorandum signed by Director Bennett was written to the Geological Survey concerning stream gaging and the collection of rainfall intensity data on eight of the Soil Erosion Service projects. In February 1934, ground water studies by the Geological Survey were added to the stream gaging on the eight projects. At that time a memorandum was also sent out to all regional directors instructing them to undertake ground water studies. The regional directors were well aware of the importance of this phase of the work and as a result some hydrological data are being collected on almost all of our projects. In some cases, such as where plot studies are being conducted, complete meteorlogical stations have been established.

Records of the Washington office show that by January 1, 1935, a total of 361 standard Weather Bureau rain gages, 64 recording rain gages, 39 water stage recorders, 1 barograph, 28 maxima and minima thermometers, 7 anemometers, and 8 psychrometers have been ordered for the various projects. The nature of the equipment listed indicates that a considerable amount of hydrological information is being obtained. These data will be of great value, provided a standard and uniform procedure is followed in collecting them. A few examples will illustrate the absolute necessity of standardization and uniformity.

It has been found by the Weather Bureau that objects in the vicinity of a standard rain gage have a marked effect on the amount of precipitation caught by the gage. A. F. Myer, in his book on hydrology, states that no objects near a gage should be within a distance equal or less than their height. It is known that the amount of rainfall caught by a rain gage varies with the elevation of the gage above the surface of the ground. At a height of 43 feet above the ground, only 75% of the rainfall was collected (Myer's Hydrology, P. 81).

Robert E. Horton has shown that an unshielded snow gage collected .43" out of a total of 1.41" during a snowstorm.

To get comparable evaporation data it is necessary to follow the standard procedure employed with a given type of pan. It would not do, for instance, to employ a U. S. Weather Bureau class A land pan and perch an anemometor on an 18 foot tower when it should be 6" above the pan.

The Weather Bureau maintains 6000 cooperative stations from which daily rainfall and temperature data are obtained. Each of these stations necessarily covers a wide territory. To assume that the rain-

fall is uniform over such wide ranges would be rather naive, at least in some parts of the United States.

Too often erroneous conclusions have been drawn based on rainfall data from such widely spaced stations. It is therefore imperative that the rain gages on the Soil Erosion Service areas be well distributed so that isohyetal maps showing the actual distribution of rainfall from a given storm can be drawn. Hours could be consumed in citing additional proof for the necessity of a standard and uniform procedure in collecting and recording hydrological data.

The importance of the records and the necessity of standardization has been fully recognized by Dr. Lowdermilk, who assigned the task of standardization and coordination of the collecting and recording of hydrological data collected on the Service projects to the writer. An all inclusive form for recording meteorological data has been devised which is suggestive to observers. A similar form is being devised for the gaging stations and for the ground water studies. Standard procedure to be followed in the installation of hydrological stations and in collecting the data will be established with due consideration given to the procedure employed by other hydrological agencies.

A memorandum will be sent to all regional directors requesting basic information about established stations. This information will be carefully studied and forms and procedures revised to fit those used by the various projects as much as possible. The writer will visit the projects in the course of his duties to become familiar with the specific conditions of the individual areas; he will assist the local men in their problems, and learn as much as possible from their experience. This procedure will enable an intelligent analysis of the data obtained.

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COMPREHENSIVE SOIL EROSION BIBLIOGRAPHY COMPILED

A complete bibliography on soil erosion, containing references to more than 1,160 sources of information, has been compiled by Miss Lillian H. Wieland, secretary to Director H. H. Bennett. The work, which Miss Wieland began in 1932, is believed to be the most comprehensive catalogue of soil erosion data ever compiled. Every source of information contained in the files of the Library of Congress, the Department of Agriculture, and the Soil Erosion Service, is listed in the 124-page document.

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Repeat Photography

By A.E. Burgess
LINDALE PROJECT

Nothing shows progressive benefits of a soil erosion control demonstration more effectively than follow-up pictures of an identical area before and after changes in land use practices have been made. It is not always easy, however, for the photographer to make an identical photo in point of field outline, for in some instances, no guiding landmarks remain to direct location when the surface cover is changed, save, perhaps, a fence post or a shrub or stump in the near-distance.

Of course, it is possible to make records of original locations based on compass readings, which would enable the photographer to return to the immediate vicinity, but which would not always be adequate for the exact location so necessary for a repeat photograph. Nor could stakes be driven for future use in the face of plows, tractors, graders and laborers.

I have found the following method very satisfactory in obtaining identical follow-up photos. Make a good record at the time of the first exposure, for future reference. Upon returning to the vicinity for a repeat pic ure, consult the "Photographic Record" slip which specifies "Photographer's Position". Set up the tripod as nearly as possible in accordance with this record; open up the camera shutter, focus the lens, and begin rotating the camera until some recognizable part of the original scene appears on the ground glass. Then consult a print of the original shot and select a post, or bush, or tree, or other object as near the center of the original photo as possible.

Move the camera tripod forward or backward as may be needed, until the object chosen shows the same size on the ground glass as on the print. The camera will then be at the same distance from the object chosen as in the original photo. Level the camera and place the print upside down on the ground glass above the object. Rotate the camera until the point of reference chosen shows on the ground glass in exactly the same vertical position as on the print.

Lock the camera in place on the tripod, raise or lower the front until the skyline is exactly the same height on the ground glass as on the print. You are now ready to make a follow-up which will duplicate exactly the field originally covered.

Occasionally, it will be found better not to take an identical

Pasture near Lindale, Texas. Camera 169 feet due NE of large red oak tree shown. Brush in photo has been piled for burning.

view, but one closer up or farther away. In that case, choose some object which is in the center of the original, put it im the center of the ground glass, and let other objects fall where they may.

Same pasture as above, after contouring. A follow-up photograph.

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more about

The Rate of Grazing

By Lyman Carrier

CHIEF OF THE BRANCH OF AGRONOMY

It is impossible for me to pass unnoticed the challenge issued by Robt. V. Boyle in his article, "Overgrazing - A Reality" in the February issue of *"The Land: Today and Tomorrow"*. It is regrettable, I feel, that Mr. Boyle's evident misinterpretation of my earlier article on overgrazing prompted him to dispute my position. For, in everything I have written on pasture management in the past twenty-five years, I have tried to make clear the fact that I was discussing the grazing lands of the humid regions of the United States. It seems, however, that this is not enough. Silence, complete and absolute, appears to be the only condition which will stop the bull from chasing an imaginary red flag.

It has been my pleasure and privilege to know quite a few "Western Ranchers". My opinion is, that as a class, they are neither so ignorant nor narrow-minded as to resent a discussion of the care of humid pastures even when the practices advocated therefor differ from those best suited to dry land conditions.

The grazing lands of the humid regions constitute a large item in the list of our national resources. As the Soil Erosion Service is causing a considerable acreage of formerly tilled land to be rededicated to permanent grass, and as the kind of turf which makes the best grazing is the kind of turf which is most useful for stopping soil erosion, it seems imperative that we give the owners of these pastures the best instructions available as to their care and maintenance. It should be noted that one acre of humid pasture land is the equivalent in producing power of at least 30 acres of the Navajo, and 50 acres is probably more nearly correct. I must, therefore, continue to advocate "close even grazing" for eastern pastures although it may be a discordant note in the western overgrazing chorus.

Mr. Boyle asks whether my recommendation for grazing bluegrass is "based on scientific research or if it is merely empirical." Let the facts speak in answer. From 1908 to 1914 inclusive the writer conducted a series of pasture experiments at the Virginia Experiment Station, Blacksburg, Virginia, on the typical bluegrass sod of that locality. One of the experiments consisted of two fields, one grazed at the usual rate for that region, the other just twice as heavily. This was continued for five years. Grazing was continuous from May to October.

No lime or fertilizer was applied. The heavily grazed sward, grazed to about two inches in height, steadily improved in quality; that of the lightly grazed field deteriorated. Moreover, each of the animals in the heavily grazed field made practically the same gain as the one that had double the area to feed over. Since then, I have seen an abundance of evidence bearing on the subject and it all confirms the results of that experiment. In an excellent bulletin recently issued by the Ohio Extension Service, it is recommended, for rotation grazing, that the grass be allowed to grow to four inches. (See Fig. 1).

New England in the early part of the nineteenth century had a large livestock industry, mainly sheep and cattle. Both the soil and climate of New England are especially suitable for growing grass. For economic reasons, due largely to heavy costs of winter feeding, this livestock industry passed out with the exception of some intensive dairying. One can find in New England all rates of grazing from heavily stocked dairy farms to complete abandonment. I have inspected thousands of acres of these pastures and if there is any evidence that light grazing improves the sward, I have failed to see it.

A few years ago an investigator, who had spent some time on the western ranges, made a trip to New England. He returned to Washington and wrote a bulletin, the burden of which was that New England pastures had been ruined by overgrazing. To prove his contentions he illustrated the bulletin with views of poor, weedy hillsides that probably had not had an animal larger than a cotton-tail rabbit on them in twenty years.

The writer once kept, for two years, a pure stand of Kentucky blue-grass clipped to three-eighths of an inch in height. To do this, it was necessary to use a golf putting-green mower and cut it four to six times a week during the growing season. There was a hundred percent coverage of the ground at all times. This may or may not prove anything, but it does indicate that there may be other factors involved in a poor blue-grass pasture besides overgrazing. (See Fig. 2).

The bluegrass pastures of the middle west are usually dry, brown, and bare in July and August. Most everyone who sees these pastures at that time will say that they are overgrazed. It has been my observation, that even there, pasture turf carrying one animal unit to seven or eight acres is not so good as that grazed twice as heavily. When all grazing is stopped, bluegrass and white clover, the two most valuable pasture plants will, except on the most fertile soils, disappear entirely from the turf. It will take something besides reducing the number of grazing animals to improve the midwest pastures.

Mr. Boyle correctly points out that heavy grazing has in some cases on the western ranges caused the sod forming perennial grasses to

Fig. 1. The Hinman pasture at Cornell University. In 1932 it carried 10 two year old steers from June 1 to July 31 only. In May 1933 it received 600 lbs. superphosphate per acre and the 30 acre field was divided into 4 fields which were grazed in rotation. In 1934 the field carried 20 Angus cows, 5 two year old heifers, 1 bull and 15 calves born on pasture, from May 6 to November 1. The stock received nothing but pasture herbage and the 5 heifers were fat enough for immediate slaughter in October. The pasture now carries a close sward of Kentucky blue grass and wild white clover. The herbage is not allowed to exceed 4 inches in height. Ungrazed herbage is cut very closely with a mowing machine once during the grazing season.

--D. B. Johnstone-Wallace,
Agrostologist, Cornell University.

Fig. 2. A Guernsey cow which holds a world's record, grazing a pasture in Columbia County, New York, which has been improved by superphosphate and close grazing.

--D. B. Johnstone-Wallace,
Agrostologist, Cornell University.

replace the annual bunch grass vegetation. It has also been demonstrated on some of the western range lands that where grazing is controlled, the animals properly distributed, and provision made by deferred or seasonal grazing for reseeding of the more valuable species of plants that a larger number of animals can be carried than it took to destroy the original vegetation. By what process of reasoning can it be claimed, in such a case, that the range was ruined by overgrazing? The point which I tried to make in my previous article, and which I will repeat here is: It is impossible to discover a correct remedy with a wrong diagnosis of the ailment. Asserting that pastures are overgrazed when the trouble is lack of fertility, improper distribution of the animals, absence of the best species of plants, or not making provision for the plants to reseed themselves, has never made two blades of grass grow where none grew before.

The cry of overgrazing has been raised in an ever increasing volume for the past thirty years to my personal knowledge. Little, however, has been done about it except on the controlled range lands of the National Forests. Little will continue to be done about it until better range and pasture management practices are worked out and we have something to offer the graziers that is more attractive than a reduced income. Wringing our hands and working ourselves into a frenzy over the "scourge of overgrazing" will not bring about an improvement of grazing conditions in this country.

I believe I am not over-stating the case when I say the propaganda about overgrazing originating on the western ranges has been more harmful to the handling of eastern pastures than it has been beneficial to the range country. Telling a man he is overgrazing his pastures raises the false hope that he may, by merely reducing the number of animals, bring about a desired improvement. In most cases in the east that is not what happens.

Constructive articles dealing with range or pasture management and limited in application to the sections of the country with which the investigator is familiar will accomplish more than long range criticism of something which he does not understand. Let us strive for the proper handling of our grazing lands wherever they may be located and let us not cite moving pictures of foreign scenes as scientific data. The cameraman might see it and hurt himself laughing. This must stop or the flag may be accused of trying to chase the bull.

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Value of Roadside Signs

By E. H. Aicher

CHIEF SOIL EXPERT MANKATO PROJECT

Properly prepared roadside signs can be of great value in calling the attention of the public to Soil Erosion Service areas and demonstrations being conducted. Many people from various sections of the United States pass through the areas constantly. Unless their attention is called to the projects and to the important phases of the demonstrations under way they will have little conception of the work. The future attitude of the public to soil erosion activity will depend upon what the people know about it. Advantage should be taken of every opportunity to acquaint the public with the type of work this service is conducting. Effective signs telling the people of soil erosion control work are just as essential as signs calling attention to other Federal or private activities.

In the Limestone Area in Kansas, a large number of roadside signs are being used to good advantage. These not only define the area for tourists who pass through, but call attention to demonstrations along the highways.

The signs which define the area consist of two sets. One set of three, six feet by eight feet, show a map of the area and give the size of the project. One of these is set on either side of the area on U. S. Highway No. 36 and one on U. S. Highway No. 40N, where this highway touches the southern border of the area. The second set, consisting of four signs, four feet by six feet, are placed at points where main highways cross the project borders. These signs read "The Federal Soil Erosion Project Begins Here". One is placed on either side of the area on U. S. Highway No. 36, and one on Kansas Highway No. 28 on the north border of the area. The fourth is located on U. S. Highway No. 40N and reads "Federal Soil Erosion Project, Southern Border".

In addition to these large signs there are numerous smaller ones calling attention to individual demonstrations. These have to do with terracing, contour farming, gully control, tame grass and alfalfa seeding, pasture contouring, interception ditches, terrace outlets, and similar activities. Certain of these signs aided materially in putting over locally the idea of contour farming and created interest in all phases of the program. Many of them were placed at farms where demonstration meetings were held. In short, the subject matter signs are considered to be of greatest value in this area.

These signs show "where the work begins" in Kansas.

Interested visitors are given an eyeful.

Two more phases of the work are pointed out.

Soil Conservation Service
Region 4
Division of Information and Education

BY WAY *of* BIOGRAPHY

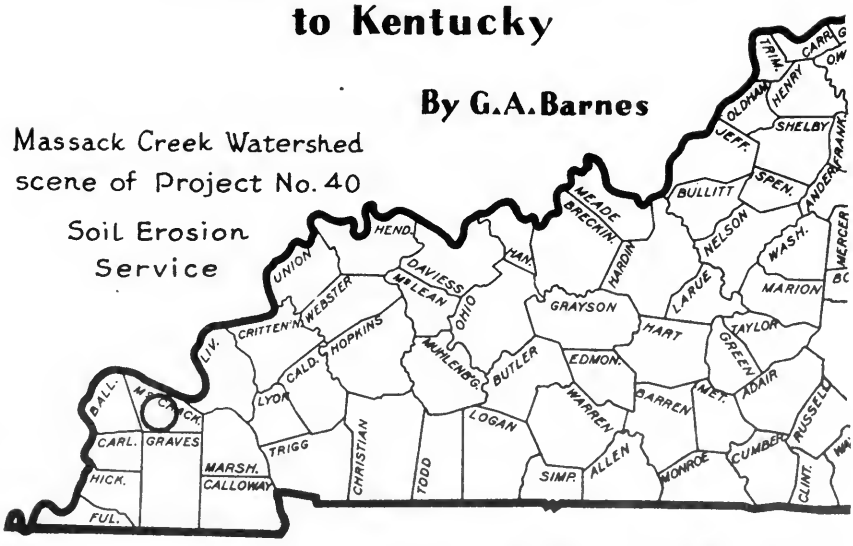
F. A. Fisher

Regional Director, Illinois Project

an Illinois man in charge of an Illinois demonstration area...born in 1888 in Illinois...schooled in Illinois, culminating with a B.S. in agronomy from the University in 1907...for ten years after his graduation, Forrest A. Fisher remained at Urbana as instructor in soils, resigning to handle the varied work of a county agricultural agent... "if any one project brings out a man's ability it is county agent work and all its preambles of the farmer's problems"...and in that capacity he remained until 1930...the next three years with the Farm Management Service, where he handled farm planning and cost records for some 200 farms...under the guidance of the College of Agriculture, he was able to secure a real insight into the farmers' financial problems...published several bulletins, including "The Agricultural Significance of the Tight Clay Subsoil of Southern Illinois"...entered the Soil Erosion Service in 1933 to head one of the first projects established... has had more experience in making soil erosion surveys than any other man in that section of the country, according to authorities...stubby, genial, earnest...

Erosion Control Comes to Kentucky

By G.A.Barnes



Inauguration of the federal soil conservation program in Kentucky has been approved by Secretary of the Interior Harold L. Ickes, with the selection of a 25,000-acre erosion control demonstration project in McCracken County, five miles southwest of the city of Paducah.

Embracing the watershed of Massac Creek, the project is intended as a nucleus for erosion-control activities in the state. Preliminary work will be started at once, according to Director H. H. Bennett of the Soil Erosion Service, with an allotment of $90,000. Project headquarters probably will be at Paducah.

In soil and erosion conditions, Mr. Bennett states, the 25,000-acre project area is typical of approximately 13,000,000 acres of highly erodible land extending from southern Illinois to central Mississippi. Erosion control measures applied in the demonstration area by experts of the Soil Erosion Service will therefore be adaptable to this entire surrounding region.

The area selected for the Kentucky project is thickly settled, with 95 percent of the farms owner-operated. Farms in the area average 50 acres in size. Full cooperation on the part of farmers of the region has been assured by William Johnstone, extension agent for McCracken county, and other Kentucky agricultural officials.

"Although more thickly settled than most of West Kentucky and Tennessee", according to Mr. Johnstone, "from an erosion standpoint the area represents a perfect picture of what is happening throughout this district.

"The rich bottom lands of the valley are rapidly being covered by infertile soil from the surrounding hills. The creek and its tributaries are being filled. Many fields are already abandoned."

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Region 4
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SERVICE TO COOPERATE WITH HOMESTEAD PROJECT

A cooperative arrangement under which the Soil Erosion Service will direct an erosion-control and land-use program on the Federal Subsistence Homesteads project at Monticello, Georgia, has been announced.

Under the arrangement, which combines in one area the activities of two important emergency agencies of the Interior Department, specialists of the Soil Erosion Service will direct Monticello homesteaders in the use of scientific farming methods designed to curb erosion and preserve the land in a permanently productive condition.

The homesteaders will be required, as a part of their agreement with the Subsistence Homesteads Division, to adopt and carry out whatever farm practices and erosion-control measures are recommended by the Service. These will include such measures as terracing, gully control, strip-cropping, contour plowing, reforestation, crop rotation and pasture management. Every farm within the homestead project will be studied by experts of the Service to determine the extent of erosion and the nature of the control measures best adapted to the problems of each parcel of land. A coordinated plan of erosion control treatment will then be worked out for the individual farm and for the project area as a whole.

All material and equipment, except two heavy tractors for terrace construction, will be furnished by the Subsistence Homesteads Division. Actual labor will be done largely by the homesteaders themselves under the supervision and guidance of Soil Erosion Service experts.

The two heavy tractors, to be supplied by the Soil Erosion Service for terracing work, will later be transferred to some other erosion-control project needing equipment of this nature. Supervisory and technical personnel will be drafted temporarily by the Service from the staffs of several other erosion-control projects in the locality.

Because of the highly erodible nature of the soil in this section of the country and the excessive damage to farm lands caused already by erosion, some action to halt the destruction of land values is regarded as imperative if the region is to remain fit for cultivation.

Approximately $14,000 will be spent by the Soil Erosion Service, it is estimated, in carrying out its share of the joint program.

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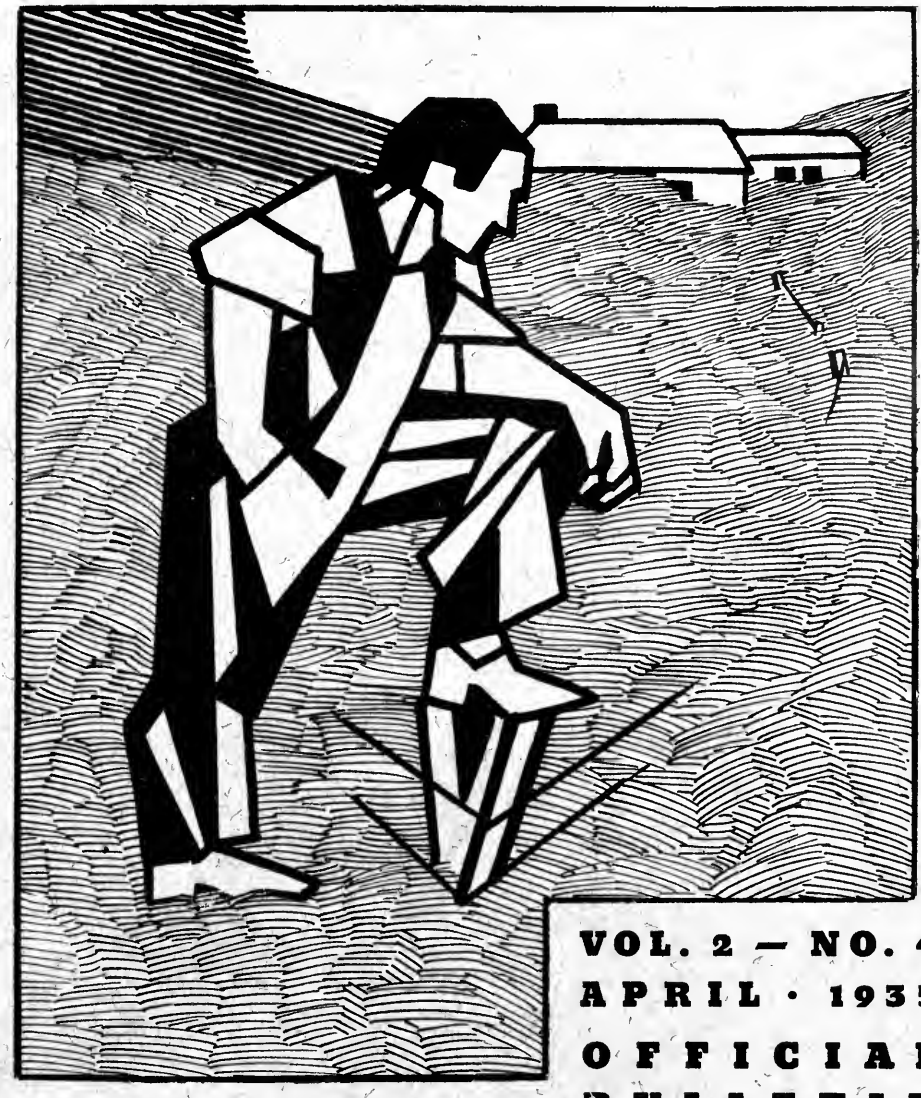
J. J. Coyle.

THE LAND
TODAY AND TOMORROW



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U. S. DEPARTMENT OF AGRICULTURE

THE LAND
TODAY AND TOMORROW

Issued Monthly by the
U. S. Soil Erosion Service
DEPARTMENT OF AGRICULTURE

HENRY A. WALLACE
Secretary of Agriculture

H. H. BENNETT
Director, Soil Erosion Service

EWING JONES · EDITOR

The Contents

PRAYER FOR WEST TEXAS

BY MARTHA NELL LANG

Father--
We wake again this morning
With sounds of the wind's fury
In our ears, the stinging dust
Drawing tears unbidden from
Burning eyes.

Adults
Though we are, we see ourselves as
Frightened children, wondering with a
Gasp of despair, how long --
How long!

Earthquake,
Flood, or fire might leave behind the spark
For re-creation, but how combat this endless
Grinding out of spirit--grim yet almost
Imperceptible?

Build up
Around our hearts, dear Lord, strong
Walls of courage to withstand the rolling
Sand clouds -- sand that threatens to fog in --
To smother stubborn flames of hope still
Flick'ring there.

Blessings
On wives and mothers who let not the fruitfulness
Of homely tasks -- the knowledge that night
Will see the work undone -- destroy
Their purpose!

Renew,
We pray, our heritage of pioneers, indomitable faith,
Rare optimism, that we may face more blinding,
Choking storms with visions of a brighter,
Clearer day!

-- The Dalhart Texan.

Dust Storms Through the Years

By Ewing Jones
SPECIAL ASSISTANT

Homer refers to them in his Iliad, Virgil, in his Æneid — but these dust falls of yesteryear bear scant comparison to the modern scourge of the Great Plains.

"A drop of water hit a man, and they had to throw two buckets of sand in his face to bring him to.

"The dust was so thick I saw a gopher burrowing fifty feet in the air."

Humorous, these quips relayed by the Associated Press from the wind-swept, parched plains of the Middle West, in its reports of the recent dust storms, but behind them lies a tragic story whose grimness cannot be hidden behind jests or indifference.

Cities along the Atlantic seaboard were puzzled, but not startled, a year ago, when a yellow haze filled the sky for an afternoon, bringing a premature dusk. It was not until newspapers explained the phenomenon that thousands of urbanites realized that they had experienced their first dust storm, and the majority was still a bit dubious about the Weather Bureau's declaration that this dust traveled all the way from Nebraska and the Dakotas.

It took 1935's repetition of the menace of shifting farm lands to bring wind erosion to prominence in the public mind. When headlines everywhere repeatedly flashed the news that the worst dust storm in history was being experienced; when six deaths in a week were attributed to a strange malady dubbed "dust pneumonia"; when a disheartening evacuation of some 2,000,000 acres threatened to begin overnight; then the nation knew that these billowy clouds of yellow dust in the east, echoing the howling, blustering winds of the middle west, were an omen which could not be ignored.

A new era in land use for the High Plains had been ordered. The handwriting upon the wall was unmistakable.

Dust storms are not new. The falls of reddish dust common to Southern Europe have been known since earliest times. Homer refers to them in his Iliad, Virgin in his ÆEneid. Investigations in 1847 cited a number of authenticated cases in the first three or four centuries before Christ.

Pioneers trudging across the great plains of the then unexplored American southwest during the latter part of the 19th century frequently ran into brief local disturbances, and occasionally encountered a strenuous dust storm that came from somewhere "beyond the rim of the earth."

Dust showers succeeding the eruptions of Krakatoa in 1882 were collected as far as 1,100 miles from their origin in the East Indies. In 1902, a dust storm swept over the coast of Northern Africa into Italy, as far as the British Isles, Russia, and Denmark. It had started in the desert of El Erg, in the southern part of Algeria. Scientists noted then that the quantity of earth deposited on the earth gradually became less as it traveled, while the fineness increased as quantity diminished.

Improvident exploitations has been a frequent cause of sand drifts and wind erosion. The drifting sands of Cape Hatteras were started, authorities declare, by timber cutting following the close of the Civil War. The cutting of forests on the north German coast -- because Frederick I needed money -- has since cost the German government in reclamation work many times the amount obtained for the timber.

Sand shifting and swirling dust have had varied effects besides the destruction of valuable farm lands and the covering of cities. After 11 years service, telegraph wires along the Trans-Caspian Railway were removed because their diameter had been diminished one-half by sand blast corrosion. Destruction of the wooden telegraph poles through the San Bernardino Pass in Southern California is so rapid that the Southern Pacific Railway has been forced to protect them with piles of rock or with short supplementary poles on the windward side. And according to Dr. W. J. McGee, the Casa Grande ruins of Arizona were reduced to their present delapidated state largely by the sapping of their walls by sand drifts.

This photograph of two automobiles was taken at 4 P.M., with the camera held ten feet from the headlights.

When dust clouds from the West hovered over Washington. Photo courtesy The Washington Post.

The first known scientific description of dust storms was in 1646. However, it was not until 1911, when the Bureau of Soils of the U. S. Department of Agriculture published E. E. Free's monograph on the movement of soil material by the wind, that official cognizance was given the modern Aeolian problem. This monograph was thorough. It was a masterpiece. According to Free, the soil of any particular field is continually changing under the action of the wind. This action, when moderate, is beneficial to fertility; when excessive, it is one of the most serious obstacles to successful agriculture, and must be controlled by various expedients, such as windbreaks, cover crops and rotation schemes. Free's work was a digest of existing information upon the subject -- this, mind you, a quarter of a century ago.

The cause of the present series of destructive storms in the Great Plains has been told and retold in recent weeks. The war period brought high prices, and farm land was at a premium. Frantically men plowed up the sod in the high semi-arid country. The soil which had been bound by sagebrush and buffalo grass and *agropyron smithii* was freed. Bare, it became an easy prey for the hot, parched winds which came with the in-

evitable cycle of dry years. Those dust storms of yesteryear bear scant comparison to these of 1935, as far as devastation is concerned.

And midwestern children last month scurried to school with moistened cloths clutched to their noses; a Kansas oil driller reported that "in digging a cellar for an oil well we dug down 18 feet and it was dry powder all the way down, with no semblance of moisture"; and the sage of Emporia, William Allen White, related: "In a real estate office this sign greets the townspeople: 'Great bargains in real estate. Bring your own container!'"

Bronze sunsets in the east, mid-day darkness in the West -- they are here. Man was incautious when he provided the cause; his prudence must provide the cure.

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Soil collected in highway, due to drifting from an adjacent wheat field. Soil loss per acre: 80 tons.

Wind Erosion in the Great Plains

By F. L. Duley

REGIONAL DIRECTOR KANSAS AREA

Where there is any crop residue, little soil blowing has taken place —— wind erosion, Duley says can be controlled only by radical changes in cropping methods

The dust storm which struck central Kansas on March 15 was unusual only because of its severity. In parts of this region, it was probably the most severe storm in years, although there is always a tendency for people to remark that, "This is the worst I have ever seen". There are some very fundamental reasons, however, why dust storms are more severe this spring than usual.

During the storm of March 15, I placed a flat bread pan filled with water in my back yard. When the storm had passed, I permitted the water to evaporate and weighed the soil remaining in the pan. The deposit was sufficient to indicate a general deposit of 3.25 tons per acre in the area over which the dust had blown. In this calculation, however, no consideration was given to the fact that all dust falling in the water was halted, while that falling on the ground may have been blown along the surface or lifted again into the air.

Measurements were also made of soil drifts which had accumulated along a snow fence and in a road ditch at the edge of a badly blown wheat field during two dust storms. These drifts, it was shown, contained soil equivalent to approximately 40 tons per acre. Another field lost some 80 tons an acre, according to similar calculations. Neither of these measurements took into account the fact that only the heavier soil particles were deposited in drifts and that tons of lighter particles were carried on to greater distances.

During these same storms, the dust accumulating along a snow fence in a good pasture amounted to only 860 pounds per acre, showing the importance of protecting the land with grass or other close-growing vegetation.

Last year was the dryest growing season on record and widespread

crop failures left the soil with little or no protective cover. This lack of protection on very dry soil is generally agreed to be one of the principal causes of soil blowing. Another reason seems to be that many soils in this region become floury and fluffy after winter freezing and are very vulnerable to dry spring winds.

"Black snow" drifts.

Where there is any crop residue or plenty of Russian thistles on the ground, little blowing has taken place. Cornstalks may protect land to some extent, but in many cases the stalks are thin or have been pastured too extensively to afford much of a cover. This year there is practically no corn crop residue on the land and many cornfields are losing large amounts of soil.

Sod, under ordinary conditions, is the best protection against wind erosion. At the present time, however, nearly all sod land has been severely overgrazed due to the drought of last summer. This overgrazed pasture land is now blowing badly and will continue to do so until rain falls.

Lister furrowing at intervals of one or two rods will do much to reduce wind erosion.

A luxuriant fall growth of winter wheat is one of the best protections against wind erosion. This year however, winter wheat made very little fall growth due to drouth, and some of the most severe blowing is taking place on these poorly covered wheat fields; in many cases, wheat in the ground has been destroyed. Even fields which had turned green with spring growth have turned a distinct brown since the last two storms. In some fields, blowing has progressed to such an extent that much of the wheat has been blown out or covered. The extent of this damage is difficult to estimate with any degree of accuracy at this time.

One measure of wind erosion control. Fields in the Mankato area listed on the contour have suffered relatively little from blowing.

The effects of our work in this area are evident in many places. Fields listed on the contour have suffered relatively little from blowing. Some of the furrows are drifted nearly full, but practically no soil has left the ground. Terraces have caused the deposition of soil on the lee side in some cases but there is considerable blowing between terraces where the wind has a clear sweep, particularly where it blows horizontally with the terrace.

Any cultivation which roughens the surface tends to reduce blowing. A shovel cultivator which turns up pieces of moist soil to form a cloddy surface, will do much to check movement by the wind. The lister is also effective when used for this purpose. Lister furrows, run through at intervals of about one rod and at right angles to the prevailing wind direction, will lessen blowing appreciably. These are only temporary measures, however, and should be employed only in emergency. More complete control will come with the establishment of proper cropping systems.

Planting a field to several different crops offers one of the most practical methods for reducing the amount of blowing, although it is more permanent in nature and requires time to become established. During the past year, our plans for covering the land with vegetation in belts across the slopes have been retarded because there has been insufficient rain to get grass, alfalfa or small grain crops started.

Rain in the near future would reduce blowing this year and might give an opportunity for farmers to get some spring crops started on the land. At the present time there is hardly enough moisture in the soil to bring up oats or sweet clover. Some of these are being planted more in the hopes of rain than anything else. We hope to delay our grass

seeding until the soil has obtained sufficient moisture to bring the plants up quickly.

We have every reason to believe that wind erosion can be controlled effectively in Western Kansas and much of the Great Plains territory. However, we know it can be done only by instituting radical changes in cropping methods and in the handling of fallow land. This should form a very important part of any Soil Erosion Control program in the Great Plains country.

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Conditions in Western Kansas

by L.E.Call, Director
KANSAS AGRICULTURAL EXPERIMENT STATION

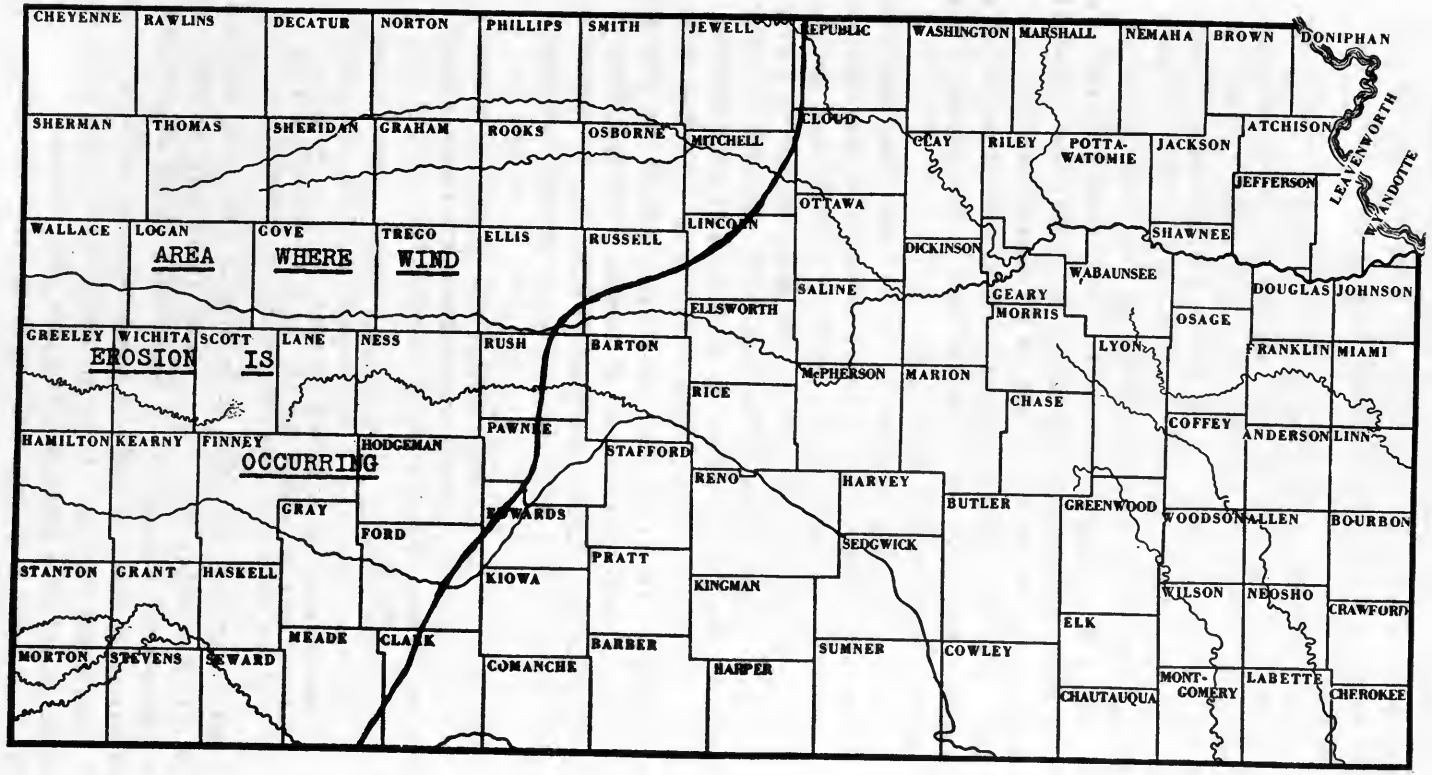
Last month I traveled through much of the territory in Western Kansas where trouble is being experienced with blowing, conferring with farmers, business men, county commissioners and county agents from 19 southwestern Kansas counties.

The accompanying map gives the area in the state where destructive soil blowing is occurring. There are a few areas east of the line indicated on the map, especially in the north central part of the state, where some blowing is occurring, and there is much territory west of the line where there is sufficient wheat and other soil cover to prevent destructive blowing.

It is estimated that there are approximately ten million acres of cultivated land in the territory lying west of the line indicated on the map. It is further estimated that it will be necessary to list between two and three million acres of this land to control soil blowing. The cultivated land remaining in this area should be listed either solidly or strip listed as a protective measure against blowing and as a preparation for the planting of spring crops and for fallow.

The conditions in the area where blowing is occurring may be classified under three types:

1. Areas in which there is a soil cover of growing wheat. These areas represent sections where showers last fall made it possible to start wheat and maintain the crop through the winter. Very little



AREA WHERE WIND EROSION IS OCCURRING

blowing has occurred in these areas. The fields, however, are covered with a thin layer of dust and should be strip listed wherever the wheat is thin, with one lister furrow about every rod east and west across the field as a protection against blowing until good rains settle the dust.

2. *Areas in which extreme blowing has occurred and where the surface condition of the soil is such that the soil blows whenever heavy winds occur.* These areas vary in size from two to three sections to 100 sections or more. It is futile for individual farmers to attempt to control soil blowing in such an area. The soil will drift in over a listed field from surrounding territory as fast as it can be worked by a single listing unit. Soil blowing on such areas can be controlled only through cooperation of a sufficient number of listing units to cover the entire area in a comparatively short period of time. This will require careful, well-planned organization and good execution. Every foot of cultivated land in a territory of this kind should be listed solidly and deeply.

3. *Areas intermediate between the two extremes described above.* This class embraces from 50 to 75 percent of the cultivated land shown on the map as being in the blowing territory. In this area there are many individual fields ranging in size from small patches to a single section or more. These fields are surrounded by sod land, by cultivated land with a sufficient cover, or by cultivated land that has been worked to prevent blowing. Such areas can be controlled by individual farmers if the fields that are blowing are solidly listed and if the surrounding territory subject to blowing is strip listed.

There are several factors that make it difficult to perfect an organization to control blowing, some of which are the following:

Land operated by non-resident owners.
Land owned by non-resident owners and operated by resident tenants who do not have sufficient interest or who are not financially able to do the work necessary to control blowing.
Land in the hands of resident owners and operators who do not have sufficient funds to purchase feed, oil, gas and repairs for equipment needed to do the work.
Lack of funds available for the county commissioners to pay for work that they have authority to order.

It was the general concensus of opinion of the county commissioners from the 19 counties that if sufficient funds could be made available to purchase oil and gas and to keep lister shears sharp while the work was being done, it would be possible to do the work necessary to control the blowing. It is my opinion that $1 for each acre to be listed would be a sufficient fund for this purpose.

There are limited areas in the territory where the soil is too

dry and sandy to hold following listing. There are other areas that have been poorly tilled in the past where the soil is so hard and dry at this time that it cannot be worked satisfactorily by ordinary farm implements until soaking rains fall. County road machinery may be available in limited amounts for work on this type of land.

While a general soaking rain is urgently needed to settle the dust on all fields and to put the soil in better condition for working, it should be recognized that rains of this character will not solve the problem completely where extreme blowing has occurred. The soil will blow again within a comparatively short time after a heavy rain in such areas as described under Type 2 above. The soil must be listed before blowing will be completely checked. There are many fields near heavily blown areas where cover such as heavy stubble or a heavy growth of Russian thistles has caught and held the loosely blown soil to such an extent that these fields are covered with a layer of dry dust of sufficient depth to be almost impervious to water. These fields must be listed before they will absorb moisture readily. Many of these fields are not a menace to surrounding land in their present condition. However, on fields only partially covered with thistles the soil has blown into large mounds several feet high, around which the soil continues to blow with every heavy wind. It will be necessary to work areas of this kind with a lister before the blowing can be checked, although this work probably should be delayed until surrounding land in better condition for working has been listed.

Seriousness of conditions in the areas where extreme blowing has occurred cannot be overemphasized. Houses in such regions will not exclude the fine dust. Living conditions become impossible and farmers are compelled to move their familes out of such areas. The dust is a menace to livestock and some stock is dying. The dust has also severely injured the stacked and shocked feed in the territory where extreme blowing has occurred. Buffalo grass pastures have been blown to such an extent that the exposed crowns of the plants are destroyed by livestock grazing such pastures.

It should be recognized that these conditions are not confined to the state of Kansas. They are conditions prevailing throughout the Central Plains States embracing, in addition to western Kansas, parts of Nebraska, Wyoming, Colorado, New Mexico, and the Panhandles of Texas and Oklahoma. These conditions should be attacked as an interstate problem.

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Soil Conservation Service
Region 4
Division of Information and Educatio

Utilization of Crop Residues to Reduce Wind Erosion

By B.W. McGinnis

AGRONOMIST DALHART PROJECT

Farmers of the high plains are confronted with the problem of producing crops under conditions of a minimum of moisture and a maximum of wind. Continuence of agriculture under plains conditions requires intensive moisture conservation to produce adequate vegetative cover and thus protect the soil from blowing.

Much of the land in the wind-swept areas has been farmed by ranchers and livestock farmers who generally used crop residues for feed. While this method has been of temporary financial benefit to the stockman, its abuse has resulted in an enormous loss of soil resources. On many farms, no sooner had the crop of grain sorghums been harvested or a cover of green growing wheat established, than the farm stock, or worse still, large herds from nearby ranches were turned into the field to consume the crop residues and trample the ground into an ideal condition for blowing.

Several abandoned farms that have been ruined by wind erosion, due to the absence of vegetative protection, are on the soil erosion control project at Dalhart. The owners of these farms testify that after good crops of grain sorghums were harvested in 1931 and 1932, the crop residues were entirely removed, either by overgrazing or harvesting for fodder. In the case of several wheat farms, either the growing wheat was destroyed by overgrazing or allowed to mature, and the straw burned from the field to facilitate subsequent tillage operations. The farms themselves bear mute witness to this wasteful system of soil robbing which has turned once productive land into desolation and ruin.

These fields, from which the rich topsoil has been stripped by wind and piled up in roadsides and adjacent fields, give unmistakable warning of what will follow if measures are not taken to establish and preserve a vegetative cover, continuously, on all land in the wind-swept area. The only hope for survival of plains agriculture is to establish a program of intensive moisture conservation to insure a continuous crop cover.

In bright contrast to the abandoned farms are those on which the crop residues, in the form of stalks and stubble, have been left to protect the land from blowing. These farms have not suffered from wind erosion. The depth of soil in this region is sufficient to make possible the reclamation of many abandoned farms and to justify every

effort being made to save the topsoil on all farms from further wind damage.

During 1933 and 1934 the rainfall was not sufficient to produce adequate vegetation on most fields under common tillage practices. Eight years' experiments show that on terraced and contour tilled land, the supply of soil moisture made available to plant roots was increased twenty-five percent, compared with land farmed in the ordinary way. As a result, the average crop yield increased thirty-three percent. During the 1934 season, one of the driest years on record, the increased yield of forage crops on terraced land was thirty-seven percent greater than on unterraced fields.

Wind-swept field near Dalhart. Marks of the plowshare may be seen plainly.

In view of these conditions and in the light of experiment, the job of the Soil Erosion Service in the high plains region is to bring about terracing and contour farming of all land subject to water run-off and to insist on the maintenance of sufficient vegetation on the land to protect it from the ravages of wind.

To be effective, any wind erosion control program must provide a continuous crop cover on the land through long periods of excessive drouth. There is considerable variation in the adaptability of crops for protection from wind erosion. They naturally fall into two classes, resistant and non-resistant. All stooling varieties of grain sorghums have proven most effective in anchoring the soil. The tough, fibrous stalks and abundant root systems of milo maize, kaffir corn, hegaria, sudan grass and cane are sufficiently durable to anchor the ground from season to season. On one 500 acre field in the worst wind-damaged section, milo maize stubble has been holding the soil since the fall of 1933.

Corn and cotton fall in the non-resisting class. Under semi-arid conditions they do not develop an adequate root system and the stalks are not sufficiently tough to survive long periods of punishment by wind and weather. When corn or other non-resisting crops are grown, strip-cropping with grain sorghums should be employed. Land that is being summer-tilled in preparation for wheat can be very well protected by wide-space rows of grain sorghums without detriment to the wheat crop. The width of the strips and intervals between strips should be governed by the type of soil, the topography of the field, and any

other factors that might contribute to the danger of wind erosion.

If, for any reason, regular crops fail on land subject to wind erosion, off-season plantings of emergency cover crops must be made without regard to immediate commercial returns. The residues from regular crops, as well as all emergency crops, should be left on the land until conditions are favorable for the resumption of the regular crop program.

Although the farming hazards may be great in this land of minimum rain and maximum wind, it should be borne in mind that by the application of a sane system of conserving rainfall, and by exercising constant diligence in the utilization of the resultant vegetation for soil protection, those hazards will be materially reduced.

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AND IN A LIGHTER VEIN...

(We can't vouch for the veracity of these.
-- The Editor).

Many farmers in the Dalhart section have devised a novel means of determining the exact condition of the weather. A long heavy log chain is tied on a post about four feet above the ground. When the wind blows hard enough to straighten the chain, then the farmer decides possibly it might be too windy to work so gathers up his family and goes visiting.

A farmer going along the highway out north of town was caught in a sandstorm which was so bad that he had to stop his car because he found himself climbing up on the sand in the air. He decided to wait until the worst was over. When the worst had passed and the visibility was such as he could see what had happened, he observed a Stetson hat over in the field on top of a sand dune that was not there before the storm hit. Thru curiosity, he investigated. He discovered it on a man's head.

After scratching away a little of the dirt, he asked, "Could I help you out?"

"I don't think that's necessary", the man replied. "I am on my tractor and by tomorrow the wind will come from the other direction and blow the sand away and I can drive out".

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Possibilities of Vegetative Restoration on the Gila

By B. P. Fleming and C. J. Whitfield

GILA PROJECT

The eight and one-half million acres of mountainous, mesa and valley country comprising the upper Gila watershed extend from Coolidge Dam on the Gila River through southeastern Arizona, and southwestern New Mexico into the high country of the Mogollen range. In this area are a diversity of elevations, soils, climates, and vegetation, the latter ranging from some of the heaviest timber remaining in the United States to scant desert vegetation at the lower elevations. Elevations range from 2600 to 10,000 feet above sea-level, while the annual mean precipitation varies between 7.48 and 19.92 inches.

The Gila River is a torrential stream. Flood flows occur mainly in the summer months, following heavy rains on the watershed, but the river also may have spring rises due to melting of snow in the higher elevations. The valleys through which the Gila and its tributaries flow are for the most part filled with alluvial debris. Under primitive conditions these tributary valleys are known to have been covered with comparatively dense growths of perennial native grasses valuable for forage. The streams in the valleys generally occupied shallow meandering beds, and though in flood time they overflowed, the adjacent meadows were so thoroughly covered with grass that cutting or erosion did not occur. In contrast to these docile primitive conditions, the entire watersheds of the Gila and its tributaries now present one of the most savage and melancholy spectacles of man-induced accelerated erosion in the United States.

Extensive agricultural interests in the alluvial valleys along the Gila and some of its branch streams are now threatened with submergence by annual floods. It is estimated that in the past twenty years approximately 20,000 acres of rich irrigable lands has been lost as a result of side-cutting and bank erosion on the main Gila. No less serious is the rapid diminution of the storage capacity of the great Coolidge Reservoir which was created under the auspices of

A fine expanse of tobosa grass, prevalent throughout the Gila when the white man reached the region.

the Indian Service to supply irrigation water to the 100,000 acre San Carlos irrigation project. Recent surveys indicate an alarming rate of sedimentation in the reservoir, due to erosion in the contributing drainage area. The conditions undoubtedly have their origins in the improvident and harmful grazing practices of the past seventy years. The climate and pastoral resources of the pristine country led to the introduction of vast herds of cattle, sheep, and goats, and the public lands policy of the United States permitted ruthless exploitation of the grass lands by the grazing interests. As a consequence the grasses have almost disappeared and the soil is either wholly exposed or is covered with a sparse vegetation consisting principally of what is known as burro weed *(Haplopappus heterophyllus)*, creosote bush, *(Covillea tridentata)* and varying amounts of annual and weed vegetation. The only exceptions are found in the extensive areas of the natural forest and certain fenced areas. The alluvial valleys once covered by dense growths of tobosa, sacaton and other native grasses, are now intersected by deeply intrenched arroyos which drain the adjoining lands so that this former growth of grass has entirely disappeared over considerable areas.

Franklin flats, an area that was once similar to that shown in the photograph left above.

The meandering stream has left this bridge utterly useless.

One of the most important objectives of investigative studies on the Gila Project is the determination of the possibility of restoring vegetation on these depleted range lands. Reestablishment of proper vegetative cover will not only aid in preventing erosion but will provide valuable forage for grazing purposes on areas that are now practically denuded. The decrease in carrying capacity of these range lands, due to overgrazing and accelerated erosion, is perhaps the most serious loss that has been suffered in the southwest cattle country.

During the winter of 1933-34 fenced plots were established to study the response of natural vegetation to protection from grazing. Results obtained thus far are especially enlightening as to the possibilities of restoring vegetation by natural means over large parts of the watersheds. In a plot near Duncan, Arizona, for instance, there was a marked recovery in the volume of native perennial vegetation, indicating that with a little protection from grazing a very much more favorable cover could be secured. As this plot has been established for only a year it would indicate that this particular type of country would recover very rapidly. In other plots annual grasses and weeds have grown abundantly, thus adding desirable humus to the soil, and helping in the reestablishment of the longer lived plants. Another interesting observation in some protected areas is the fact that shrubs are crowded out and killed by grasses. This is highly important on the Gila watershed as shrubs generally invade heavily grazed areas and kill out the more palatable grasses.

In addition to the natural recovery, enough artificial reseeding work has been done to indicate the trends that this work should take and to illustrate that the possibilities of success are fairly good. Also, over 20,000 plants from the U. S. Forest Service Nursery at Superior, Arizona, have been planted in different soil types at various altitudes. Fully 95% of these plants have survived.

In all of this work further study will be necessary, but enough has been done on the Gila project and in the Southwest to indicate that the possibilities of restoring the native vegetative cover are good. Grazing must be regulated, however, and enough check dams and other engineering works established to effect some measure of stabilization of soil conditions and to retain in the denuded areas a greater percentage of the rainfall.

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Woodland Conservation and Wild Life Preservation

By Ernest G. Holt

CHIEF FORESTER LA CROSSE PROJECT

The work program of the Soil Erosion Service is unique in that it unites all erosion control methods of proven value in a single, closely coordinated plan.

Forestry and wild-life conservation are but parts, integral and important, to be sure, yet parts only of this comprehensive program, and neither would retain its full effectiveness if sepasated from the whole.

After all, why should we conserve our woodland and preserve our wild-life? Like Will Rogers, I can do no better than turn to the newspapers for my texts.

The first headline of a current paper to catch my eye was this: "8,000 Persons Now Homeless in Flood Areas." A grim tragedy. A local journal recently devoted three columns to discussion of conservation matters, winding up with an argument for a crow hunt. In order to obtain proper perspective for consideration of these questions, let us lift our eyes a moment beyond the bluffs that fill our immediate foreground, and survey the national scene.

What do we see? Thousands driven from their homes in the lower Mississippi Valley; other thousands choking in dust storms in Kansas and Texas; still more thousands, beaten and hopeless, doggedly trying to eke out a living on eroded farm lands from which every vestige of topsoil has been washed. Dissimilar though the cases may seem, the underlying cause is the same. Man's careless misuse and abuse of the land resulting in soil depletion and denudation is that cause.

When Joliet and Marquette reached the Mississippi, practically unbroken forests undulated over the hills as far as the eye could reach. This condition continued for many years thereafter, but in the '40's came the axe and the plow, and the face of nature was lifted in more than a metaphorical sense. Styles for hills as well as for men have changed, and the hills, like the descendants of the bearded pioneers, now go clean shaven. Today no less than four hundred million tons of soil washed from unprotected fields are carried out to sea by the Mississippi River each year.

Mature, unburned, ungrazed forest is the best protective covering that Nature has yet devised for the soil. By the same token, it is her best agent for the prevention of runoff, and her most effective in-

surance for the stabilization of stream flow and for the life of those sparkling springs that mean so much to everyone.

By actual measurement, a forest experiment station has demonstrated that the amount of rain running from fields, even when cultivated on the contour, during a 2-year period was more than 64 times as great as the runoff from mature oak forests. Moreover, this same runoff swept 1750 times as much soil from the fields as the woods. From fields with rows running up and down hill, the soil loss was nearly 5,000 times greater than that from the woods. Could there be more convincing proof of the protective value of woodland?

It must be remembered, however, that the woods in which these measurements were taken were unburned and ungrazed. The effectiveness of woodland in preventing runoff and erosion is a measure of the porosity of its soil, and this in turn is conditioned by the state of the ground cover. Forest from which the spongy floor-covering of leaf-mold and litter has been removed by fire is practically worthless from an erosion control standpoint. Overgrazing is scarcely less disastrous to the forest, and has but little more justification than burning. An investigator has truly said, "A woods pasture is a poor pasture and a poor woods."

Now, we are not Utopian enough to try to bring back pristine conditions. The frontier has passed, and this has become an agricultural country. Our farmers cannot grow corn or cotton or tobacco in the woods. Therefore, the program of the Soil Erosion Service is designed to meet conditions as they are, and we ask nothing that is not reasonable and practicable.

What we do expect of our cooperators is that they will cease to clean-cut the timber from steep slopes; that they will refrain from burning and pasturing their hillside woods; and that they will rededicate to forest, all land steeper than a certain critical gradient. So vital are these measures for the control of erosion and for the general welfare of the community that we gladly furnish the trees for reforesting such places, and set them out ourselves.

Thus woodland conservation occupies an important place indeed in our program. Conservation, however, does not mean bottling up in a museum; it means wise use, with adequate provision for perpetuation. Under our program therefore, a woodlot is not fenced off and forgotten; it is managed to obtain maximum rainfall absorption, maximum protection against erosion, maximum sustained yield of timber, and maximum sustained yield of wild-life.

As all of our activities are prededicated on conservation, with the first objective the conservation of our most basic natural resource -- the soil -- our program must be essentially one of correct

land use. Such a program would certainly not be complete if it made no provision for wild-life.

Our bumper crop of restrictive laws regulating the taking of game got its start soon after the Mayflower landed, but the game crop has prospered in inverse ratio. When laws failed, we turned our attention to predators and proceeded to persecute every creature that so much as cast a hungry eye in the direction of anything we ourselves wanted to eat, or wanted to kill just for the fun of it. And still the game declines. Obviously something is wrong.

In our zeal to advance civilization we have unwittingly and otherwise destroyed habitats that are absolutely essential to the wild-life we would preserve. We would hardly expect ducks to raise their broods in a dry pasture or quail to thrive in a clean-tilled corn field, yet that is in effect what we are asking them to do.

It is the purpose of our program to correct this situation insofar as is compatible with the primary use of the land. We are asking our cooperators to let us help them restore the environmental conditions essential to the welfare of desirable wild-life. Generally this means the re-establishment of adequate food and cover, which in large part can be accomplished as an erosion control measure.

In a word, we are trying to restore wild-life by scientific management of environments. This does not mean predator control. This is about the last thing contemplated, though some degree of local control may sometimes be necessary. If man had not destroyed essential wild-life condition, predators would never need be considered at all.

Old-timers love to dwell on the great abundance of game that flourished in this country during pioneer days, yet there was no cry raised against predators then. Why should it be raised now? If the game on which the predators depend for food has declined, it is plain that the predators themselves must have declined proportionately. Yet some advocates of extermination contend that the predators have increased while their food supply has dwindled. Perhaps they have learned to live on the climate.

A writer in a recent paper urged hunters "to organize and do a little conservation missionary work" by exterminating crows, apparently on the grounds that they are responsible for the decrease in waterfowl. Such proposals are deplored, not because of any great harm that they may bring to crows as a species, but because of their advancement in the name of conservation.

The crow has been persecuted for generations. One state has even revived the barbarity of the World War to bomb the crow while he sleeps. But has any good been accomplished by this war to exterminate the crow? Precisely as much as by the "War to Make the World Safe for Democracy."

When the vegetative cover of the lake shores of the duck country has been destroyed by overgrazing, it should be perfectly obvious why crows find and destroy the duck eggs. The remedy should be equally obvious. Yet, instead of applying it, we go out and wage war -- an utterly futile war -- on the crows.

I was told recently by a scientist who investigated conditions on Canadian duck nesting grounds last year, that in not a single instance did he find anyone who had seen with his own eyes a crow breaking up a duck's nest. We know perfectly well that a crow would not refuse a meal of duck eggs spread in plain view before him. It is significant, however, that the great hue and cry that has been raised against the crow since the decline in ducks became so acute is, like so many charges against predators. In general it is based not upon scientific evidence, but upon the say-so of someone who has ammunition to sell, or somebody else who has some other axe to grind.

This is not a defense of the crow. He needs none. I merely use the crow to drive home the fact that we have fallen into the habit of taking our conservation, like our politics and religion, on hearsay, when we should be using our brains to get at the real causes of the decline of our natural resources, and find cures for them.

Instead of passing the buck to the crows and the hawks and the owls, we should get out and do something about restoring the conditions essential to the existence of desirable wild-life if we expect to check its disappearance. Likewise we should restore conditions essential to the existence of good forest cover if we would check the erosion from our steep hillsides. This is what the Soil Erosion Service is doing on the Coon Creek Watershed.

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SANDSTORMS AFFECTING PUBLIC HEALTH

Some conception of the tragic aspect of the duststorm cataclysm in the Great Plains may be gained by a study of the reports from the health officers in eighteen counties. With but one exception these officials report an unusual number of cases of pneumonia and throat trouble, either directly caused or aggravated by the inhalation of dust. Five of the officials report fatalities caused by complications attributable to dust.

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Asphalt Terrace Outlet

By J. M. Downing

AGRICULTURAL ENGINEER ROCK HILL PROJECT

Because of the small acreage drained by the average terrace, the cost per acre of constructing terrace outlets is often excessively high in proportion to other costs involved in the erosion-control program of the Soil Erosion Service. Although stone and other native materials ordinarily used in outlet construction are usually available at little or no expense, the assembling of materials at desired locations, together with expense of excavating for structures, brings about a high unit cost. In some localities, scarcity of native building materials has made the cost of permanent outlet construction prohibitive.

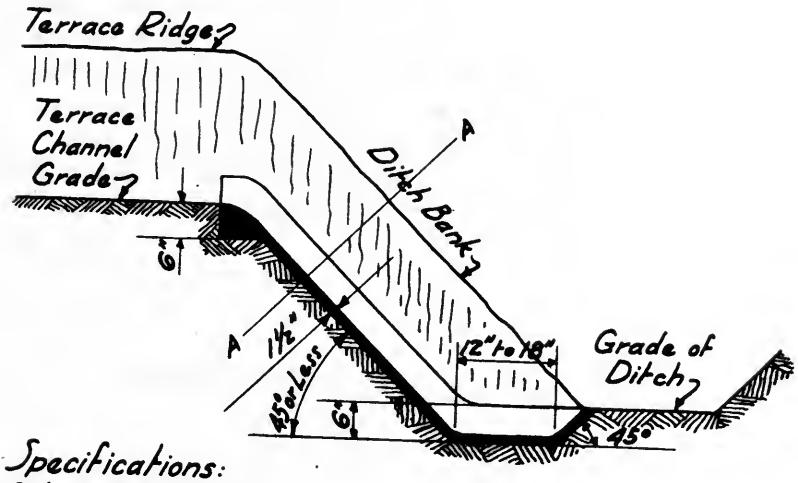
In meeting this problem of costs, we have experimented with excellent results in South Carolina by constructing asphalt outlets. The materials used are coarse sand and asphalt; the sand is always readily available and the asphalt costs 15¢ to 20¢ a gallon. Five gallons of asphalt will build the average terrace outlet.

Excavating costs are low since only shallow excavations are required. As the accompanying illustration and diagram show, an outlet excavation should be made with a broad, flat bottom and flared sides. This design not only makes it easy to lay the asphalt, but serves to spread out-flow water. One man can excavate and lay the asphalt for an average outlet in half a day.

After experimenting with different mixtures and combinations of materials, we found that best results are obtained by using 12 parts dry coarse sand and one part liquid asphalt, the asphalt containing 20 to 30 percent naptha, and of 40 to 60 percent penetration. The mixture is used by the South Carolina State Highway Department and supplies can be had at their warehouses. The sand must be dry and clean. It would be well to dry

Asphalt terrace outlet

Asphalt Terrace Outlet



Specifications:
Cut back asphalt
30% Naptha
40-60% Penetration
1 part asphalt to
12 parts sand

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by artificial means, heating a small quantity at a time on a piece of sheet-iron over a fire.

The sand and asphalt should be thoroughly mixed with a hoe or shovel, piled up and allowed to take an initial "set" for a period of 24 to 36 hours. It is absolutely useless to put the mixture in place on an incline before this initial "set" is completed.

After the preliminary "set", the asphalt mixture is ready to be placed in the excavation. It should be spread in a layer about 1½ or 2 inches thick and tamped until it is compact. *Tamping is the most important part of the construction of an asphalt outlet.* It is our experience that a spade, because it is light enough to be used effectively on an inclined place, is the best tamping tool.

This work is of course experimental at present, and time alone must prove its effectiveness. However, results obtained thus far have been very encouraging.

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GAME SANCTUARIES IN SOUTH CAROLINA

By J. S. Barnes

CHIEF FORESTER SPARTANBURG PROJECT

As a start at restocking the 33,000-acre game preserve set up within the erosion control project at Spartanburg, S. C., 116 pairs of Bob-white quail were recently released on posted land. The quail were purchased by the State Game Department and released by A. A. Richardson, Chief Game Warden. The Game Department reserved the right to trap birds and release them in other sections of the county at any time, should it be found that the preserve is overstocked.

Sportsmen and game associations, quick to realize the possibilities of game preservation in the soil erosion control program, are exhibiting a great interest in the work in this section. Vegetation planted to check erosion will, also, furnish food and cover for quail and other birds and small animals.

The game sanctuary within the Tyger River project was launched last summer through the cooperation of sportsmen, state game officials and the landowners. Before the opening of the current hunting season owners of 33,000 of the 120,000 acres in the watersheds signed agreements prohibiting hunting on their lands for a period of five years.

These game sanctuaries are a good example of cooperative effort in game conservation and it is expected that the local quail coveys will soon be the envy of other sections of the state. Game conservation means care of the vegetation, food and cover for the birds, and a step in erosion control.

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A First Course in Soil Erosion

By W. L. Powers
SOIL SCIENTIST OREGON AGRICULTURAL COLLEGE

In response to an increasing demand for instruction in soil erosion control, one of the first college courses treating the subject as an entity was offered at Oregon State College during the 1934-35 winter term. This course consisted of some 14 lectures, recitations, and a dozen laboratory periods of 3 or 4 hours' duration each. Over 200 recent references on erosion were supplied covering the various topics discussed. Several of the students reviewed as many as from two to three dozen references. In the absence of any text, a search for recent literature was necessary. The mimeographs supplied by the U. S. Bureau of Agricultural Engineering proved to be especially good text material.

Lecture subjects included extent and effect of erosion, (illustrated with nearly 100 views); geological aspects of erosion; measurement of rain, snow, runoff and washoff; methods of studying soil erosion; wind erosion and its control; farm windbreaks, shelter belts, and wood lots; soil characteristics related to erosion; soil organic matter, soil granulation and erosion; terracing; gully control; ter-

Erosion and runoff plats studied by the class.

Building a simple wire and brush check dam for gully control.

racing machinery; vegetative cover; soil erosion and land use; and a summary of soil erosion control measures. Four staff members outside of the Soils Department, and a representative of the Soil Erosion Service, participated in this lecture series.

The recitation periods included two illustrated lectures, two quizzes, and discussions and reports. One term paper was prepared in competition.

The laboratory work included surveying and mapping of a quarter section, determination of dispersion ratio, moisture equivalent, erosion ratio, maximum settling volume, natural state of aggregation, measurements of field runoff and washoff, determinations of solids; for graduate students, determination of total nitrogen lost, a gully survey, inspection of forestry erosion plats, terrace survey practice, production of gully stops, survey for a stream dike and mattress, measurements of runoff and washoff from erosion plats, measurement of the transporting power of wind through a wind tunnel, and a field trip to the northwest erosion demonstration area and experiment station.

New equipment secured especially for the course included a wind tunnel 2' x 2' in cross-sectional area, and 24' long, of veneer with triangular 2" strips in the corners, flared at the exist end to double the area, a screened frame with muslin being placed at that end to collect the lightest dust. A honeycomb made of heavy paper tubes 2" in diameter and 6" in length was included to eliminate eddies in the tunnel. An anemometer and a 16" electric fan were used. A strip of

butcher paper placed in the bottom of the tunnel and ruled off in 2' intervals was used to collect the dust of different sized particles introduced in front of the honeycomb into the tunnel a little at a time. The tunnel is made in 8' sections and is portable. Cost of the tunnel material was $8.00.

The same check dam, completed, being given a severe test.

Eight erosion plats 3.3 feet by 13.2 feet were made by surrounding these areas with creosoted 1 x 6 lumber sunk 4 or 5 inches into the soil to form boundaries. A galvanized tin gutter was provided at the lower end of each plat to catch the runoff, which was collected in discarded 5-gallon paint cans. The plats were subjected to different treatments. Cost of material was $2.00 per plat. A metal Parshall flume with a 6" throat was secured at a cost of $18.00, and a Geib type divisor box of metal secured at a cost of $16.00. The arrangement of plats is shown by the accompanying illustration. Six gully-stops of old woven fencing and stump posts were installed. This work when underway and after completion is shown by the illustrations on this and the preceding page. Two dozen students took this course, which was offered on short notice as an elective.

Mr. Powers' course in soil erosion and its control is the most complete to come to the attention of this desk. Many other colleges, however, have included theoretical instruction on this subject as a part of other courses.
-- The Editor.

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One Lesson out of Thousands — A True Story

By Harold G. Anthony

EDUCATIONAL ASSISTANT, LOUISIANA PROJECT

There was a time when Aunt Jane Austin and her family of pickaninnies lived on the fat of the land. Even after the death of her husband, Aunt Jane and her "chilluns" tilled their little forty-acre farm and came out at the end of each crop season with money in the bank.

That was a long time ago -- at least in the comparative time of a life's span. But those happy days are gone forever for Aunt Jane Austin. The big cotton crops, the bank accounts, are only memories of the past.

But I'm getting ahead of the story. Let's go back to 1900 and briefly bring the farming history of the Austins up to date.

It was in the opening year of the twentieth century that Aunt Jane's husband moved his family into a new house on a 40-acre wooded tract which he had bought in Jackson Parish, Louisiana. The forty acres sloped eastward from the top of the hill where the house was built. Aunt Jane's husband industriously set about clearing the timber from the little place. He made a clean job of the work, for when he finished there were only a few trees left on the plot and those were around the house on top of the knoll.

Aunt Jane's husband was a one-horse farmer. But he made that one horse a means of producing as high as ten bales of cotton in addition to a fine vegetable garden and corn crop which, with sugar cane in the damp spot around the spring and a 'tater patch, fed the family nicely. Little wonder there was money in the bank and the Austin brood dressed well and paid their "burying lodge" dues promptly.

Life was good for a number of years. The cotton land produced heavily and the corn, 'tater and cane production was high.

Aunt Jane's husband never did know why the production of his forty acres gradually grew less and less with the passing years. He went to his grave figuring the land was just naturally wearing out and there was nothing he could do about it.

Aunt Jane and the "chillun" farmed the little place and year after year the crops became shorter and shorter. True enough, right after the World War there was a nice profit -- cotton prices were high and five bales of cotton kept the family in comparative comfort.

Cultivating the forty acres was not as easy a task in 1920 as it had been in 1910, however. Little gullies had started forming down the gently sloping hill. Sure enough, the farm was wearing out.

Then in 1921 came a big storm and a deluge of rain. The water rushed from the eaves of the house and formed a small channel down the hillside.

"It wa'n't no time befo' dat gully was too big to jump a mule across," Aunt Jane says, reminiscingly. "Befo' I hardly knowed whut was happenin' it just seemed dat gully was ten feet deep."

Let's jump a few years. That gully is now more than thirty feet deep. It has grown and spread to make nearly half of the original forty acres useless for farming. Other smaller gullies have ripped the hillside to shreds. On the few spots between the gullies where it is still smooth enough to run a plow, Aunt Jane and her now grown children and grandchildren are renting farming land from a neighbor.

Now is the plight of Aunt Jane Austin could be pointed out as the only horrible example of what unrestrained erosion can do to a hill farm, we would not be so concerned. But Aunt Jane's farm is simply one of thousands that have been ruined by the great enemy erosion.

Not just one person or one family has been deprived of independence, but millions of acres of formerly productive farm land have been washed into "dat big gully".

In round figures, according to a national reconnaissance survey recently completed by the Soil Erosion Service, a total of 709,000,000 acres have been found to be affected generally by gullying alone. Of this total 458,000,000 acres are moderately gullied, 247,000,000 acres are severely gullied generally, and the astounding total of 3,936,000 acres of land have been completely destroyed by gullying. Nearly one-half billion acres of land have been seriously affected by less spectacular sheet erosion. The report further shows that out of a total acreage of more than one and one-half billion acres of land survey, only a little more than 540,000,000 acres were found to show little or no erosion.

When we look at these figures, then we realize that the case of Aunt Jane Austin, along with thousands, yes, hundreds of thousands just like her, must have attention if we are to keep millions of citizens off the relief rolls of the future and preserve the welfare of our nation as a whole.

We must get busy on those farm lands which have not been entirely dissipated by uncontrolled erosion and bring those acres back to some semblance of their past productiveness.

Two hundred yards from Aunt Jane's little cabin is one of the most beautiful stands of timber in Louisiana. There's a wonderful lesson in conservation to be drawn between the several hundred acre protected forest and Aunt Jane Austin's deeply eroded hillside farm!

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Farmers of 40 Centuries Speak to the Farmers of America

By Mrs. Inez Marks Lowdermilk

Doubtless many people think of China in terms of famines, floods and low standards of living. The 1933 Census gives China a population of 492,000,000 people -- almost a half billion, sprawled half way across Asia, where they have lived since the dawn of history. Almost 350,000,000 are rural peoples.

China's first settlers found, as did our pioneers, a land comparable in size to the United States and equally well endowed with forested mountains, rich valleys and other natural resources. China dates the periods of her "Golden Age" from 200 B.C. to 1200 A.D., when there was abundance for all and every one was honest. Then why this poverty and decline?

One evidence greets the traveler on the ocean, a hundred miles before land is sighted, in the form of a great yellow pathway coming out of the mouth of the Yangtse River as it pours forth rich silt-laden waters from the farm and mountain lands of central China. The Yellow Sea is so named because for centuries the Yellow River has dumped billions of tons of soil from the loess lands and denuded watersheds of north China, until the Sea is yellow with China's lost productivity and a portion of her population in the hinterland lives on one or two meals a day.

The appalling thought that should arouse every thinking person in the United States is that we have exploited and are destroying our natural resources at a rate never before known in the history of the world. It took China several thousand yesrs to exploit and destroy land resources that we have done in from fifty to two hundred years.

What is this destructive force which has already totally destroyed here in the United States during our few years of exploitation, over 51 million acres of our good farm lands and is in the process of destroying 200 million acres more? It is *soil erosion*, by water and wind. These appalling figures have just been compiled from field studies of the Soil Erosion Service. In China, as well as here, as long as there were new lands to exploit, the farmer moved on as old lands lost their productivity. The Chinese cut the forests in the mountainous regions, not primarily for wood, but to cultivate the rich humus soils which had been centuries in the making. Without vegetative cover, these soils, exposed to torrential rains, washed off as

A view from Shansi, northern China, where the cultivation line has been invading the forests for the last century. Note the results of erosion following cultivation of steep slopes

liquid mud in from 3 to 20 years according to the steepness of the slopes. Incalculable quantities of soil have thus been removed from hundreds of millions of acres from the watersheds of North China by this method of suicidal agriculture, leaving the slopes sterile and barren, affording a scanty living for sheep and goats. A few temple forests, still reproducing naturally, show that man's destructiveness and not climatic changes have reduced North China to her present condition.

No connection was made by the Chinese between this destruction of hill soils and the increased sudden overflowing of rivers in the lowlands and the silting up of canal irrigation systems. They ascribed their floods to the anger of the Gods. Nothing was done, except to build dykes and allow the silt to continue its destruction just as we in America have been disregarding the silting of our costly irrigation dams. Centuries ago the Chinese began dyking the Yellow River just as we have recently dyked the Mississippi. Periodically the dykes in China break with unthinkable loss of life and property, as in 1851 when the Yellow River changed its course 400 miles. Now the entire Yellow River has again silted until the stream is flowing above the level of the plain confined only by dykes. A heavy rainy season will bring another ca-

tastrophe. Why blame China for ignorance? We have spent altogether almost two billion dollars on the Mississippi, and are only now beginning to realize that there must be coordination between flood control on the lowlands and erosion control in the watershed areas.

In China one can see after several centuries what it means to have irrigation systems put out of commission by silt. In the Weipei, and other places, we found poverty stricken farmers struggling to farm regions subject to droughts and severe famines. These regions had formerly been rich irrigated lands. We saw where they had removed piles of silt twenty times the amount of the original excavation of the canals, before they had given up the fight. Here in the United States we have many millions of acres of good irrigation lands equally dependent upon reservoirs that are silting up at an alarming rate. When these reservoirs are out of commission, these areas will be reduced to the hazards of dry farming, droughts and famines. Regarding floods: do you realize that probably the greatest tragedy of human history happened in 1931 in China? Colonel and Anne Lindbergh told us of the flood, but we were too absorbed with our own depression at that time to understand. Silt and heavy rains were the cause of this flood. Dykes broke in the fertile lowlands where 1164 people lived to the square mile. 25,200,000 farm people, about the equivalent of the entire farming population of the United States, were driven from their homes, their farms buried under an average depth of nine feet of water. The damage was placed at two billion and the drowned at from half a million to two million, besides the vast number who died of starvation and disease which always stalk in the wake of such tragedies. Farmers will be interested to know that some of our surplus wheat was sold to China. Besides feeding millions of women and children in refugee camps, it was paid out as wages to two million men who built 3,000 miles of new dykes and by primitive methods moved a quantity of earth into these dykes equivalent to a mound of earth six feet square around the equator.

View of the landscape in Anwhei, central China, showing cultivation of steep slopes up to the very tops of the mountains.

North China has long been known for her fearful dust storms. The Chinese removed nature's vegetative cover from the fine-textured soils and they began to blow. No one who has ever experienced the horrors of these storms can forget them. Last year, the same forces which wrought havoc in China initiated us to dust storms here in America. We are having a repetition now. That soil wastage by wind erosion can largely be controlled by intelligent treatment has been proved on demonstration areas of the Soil Erosion Service on the Texas panhandle. If immediate and thorough steps are not taken to check this monster of wind erosion in our own plains, its raids will continue with increasing frequency and severity, and the desert will encroach upon grazing and farm lands of the west.

May the spectacles of China arouse us as a nation to give our lands a new deal before it is too late! We have ruthlessly cut our forests with no thought of sustained productivity. We have overgrazed our hill lands until areas, formerly a grazing paradize, are now unable to feed one head per square mile. Deprived of their vegetative cover, these lands as well as millions of acres of our sloping farm lands, are in the grip of sheet and gully erosion. Erosion is like a giant octopus, reaching out its tentacles over our lands, sucking away the moisture and fertility and leaving a wasted heritage for future generations.

Our golden age of exploitation is passing. There are no new lands to exploit. Either we must save the productivity of our lands from wastage by soil erosion, or, by neglect or lack of understanding, like the Chinese, condemn posterity to poverty and low standards of living.

Gully erosion on a gigantic scale in the province of Shansi. Abandoned terraces on the ridges between the gullies show that this area was once intensively cultivated. The gully here is about 600 feet deep.

BY WAY of BIOGRAPHY

R. H. Davis

Regional Director LaCrosse Project

looks like a flippant lad just out of college, but don't let that fool you...has had lots of experience in studying and controlling soil and water runoff in his 29 years...born in Jasper County, Missouri, June 1, 1906...the first sixteen years were spent on farms in southwestern Missouri, western North Dakota, and northeastern Kansas...graduated from Kansas State College in 1927...since then, all of his work has

in the field of agriculture, with specific attention paid to soils and erosion studies...was assistant in soil survey and instructor in soils at K.S.A.C....Became superintendent of the Soil Erosion Experiment Station at Hays, Kansas in 1929...while there, developed a hole-digging cultivator ...named superintendent of a similar experimental post at LaCrosse Wisconsin in 1931, remaining there until called to the Soil Erosion Service in 1933 to head Project No. 1, on the Coon Creek watershed...since then, two subprojects have been placed under his wing...knows erosion conditions of the Upper Mississippi Valley region intimately...has keen insight into his problems and knows how to face them...short...possesses boundless energy...likeable...

Mapping the Cohocton Valley Watershed Soils

By Henry R. Adams

SOIL EXPERT NEW YORK PROJECT

One of the youngest projects of the Soil Erosion Service is now getting well underway in the upper Cohocton watershed in Steuben County, New York.

Located in the Northern Appalachian plateau and Plateau Border region, its surface configuration is characterized by deep, rather steep-walled valleys separated by broad, flat-topped ridges. The valleys range up to two miles in width and the larger ones have a floor of glacial outwash material. The ridges are one or more miles in width.

Soils of the region are formed by the weathering of deep glacial material, but are so immature that they have little profile development. Frequently, there is an inch or more of podzol layer in virgin areas, but tillage has destroyed all trace of this layer in the cultivated fields. Because of this fact, the recognition and classification of sheet erosion is much more difficult than in some other sections of the country where A and B horizons are readily identified by color, texture, or other properties.

Although potatoes are practically the only cash crop in the region, our surveys indicate that about two-thirds of the total area is used each year for the production of small grains, hay and pasture. This varied use, together with the protection afforded by four months of frozen ground and snow cover, has partially controlled erosion, and has made it possible to farm slopes up to 25% or more without inducing destructive erosion.

With two-thirds of the land planted to close-growing crops, erosion might appear to be a problem of little moment in this region. On most farms, however, the fields are improperly arranged and the close-growing crops are distributed over the slopes in a manner which fails to provide adequate protection for the soil. Also the farmers have not been content to use land which could safely be plowed, but slopes exceeding 50% have often been used for the production of field crops.

Under these conditions, the proposed remedies for sheet erosion are the removal of the steeper land from cultivation, and the practice of strip-cropping, contour farming and cover cropping on the gentler slopes. It is probable that little use can be made of terracing in this area.

On these deep glacial till soils our slope classes have been arranged as follows:

A.	0-5%	Little or no control measures necessary.
B.	5-15%	Recommend for cultivation if strip-cropping and contour farming are practiced.
BB.	15-25%	Recommended primarily for close-growing crops, either annual or otherwise. It may be used for intertilled crops if the farm has too little A and B land, but in such cases the strips must be narrow, and cover only a small percent of the total slope.
C.	25-35%	Not recommended for tillage but may be used for permanent meadow or pasture.
D.	35%	Too steep to effectively control erosion unless forested.

In mapping slopes, we are using a combined symbol, with numbers dividing the slope into 5% increments, and letters indicating proper land use programs. Thus we may classify a slope as 5B if the slope is between 5% and 10%, as 30C if the slope is between 30% and 35%, etc. This classification has had considerable value in correlating erosion with slope to establish the slope use classes, and will also aid in drawing up cooperative agreements.

In other sections of the watershed, there are large areas of glacial till underlain at a depth of a few inches by a hard, impervious clay. Our studies on such soils indicate that cultivation should be limited entirely to slopes of less than 15%, but as yet no slope classes have been definitely worked out.

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College trainee group receiving instruction in gully control.

Terracing Alone Insufficient for Erosion Control

By Ernest Carnes

CHIEF EROSION SPECIALIST, SPARTANBURG PROJECT

The casual observer traveling the highways of certain parts of the Piedmont section will be impressed with the large amount of farm terracing which has been done in the past, yet soil erosion is advancing at a terrific rate. It is estimated in the section around Spartanburg and Greenville, South Carolina, that ninety percent of all the land has been terraced, yet gullied hillsides can be seen on every hand. Streams are running red with the blood of the soil and it is estimated that approximately twenty-five percent of the land in the Piedmont has been ruined by erosion.

A local business man recently stated that the first terracing done in Spartanburg County was in 1884. While farm terracing has been practiced for more than fifty years in this region, erosion has continued at an accelerated rate. Abandoned hillsides, now covered with trees, still show the marks of the old terrace ridges.

There are several reasons why farm terracing has not been more effective in the past:

(1). Most of the terraces have had too much grade or fall, which caused the terrace channels to scour, especially at or near the outlets, and practically all of the topsoil has been lost. Fields are usually redder near the terrace outlets. Farmers have done very little to control the water at the terrace outlet. The increased volume and velocity of water at this critical point has resulted in severe gullying in many instances.

(2). Terracing is a form of hillside drainage. The small terrace embankments used in the past have been inadequate in most instances to properly dispose of the runoff. These smaller ridges should have been spaced closer for maximum efficiency. The majority of terraces have been too small, especially during periods of high rainfall intensity. Farmers generally have underestimated the hydraulic effects of water passing down the slopes of cultivated fields.

(3). Lack of equipment to build a sufficient terrace embankment is another important cause of failure of the old terracing system.

(4). Very often lands were not terraced until practically all of the topsoil was lost. The runoff from such areas is much greater than from those having the original profile, thereby making it difficult to build terraces that would hold. Farm machinery on the average farm is inadequate to build a sufficient ridge under these conditions.

(5). Many of the slopes that were terraced in this section of the Piedmont were entirely too steep for mechanical structures. Such lands should never have been cleared and put into cultivation.

(6). Farmers generally have not used the proper system of terrace maintenance. Improper plowing of terraces has greatly lowered their efficiency. Very few farmers in this section have maintained a definite water channel above the terrace ridge, which is so essential to the proper functioning of the terracing system.

(7). Probably one of the greatest causes for the failure of many of our terraces in the Piedmont has been the lack of proper vegetative control of hillside lands. Many of our farmers have continued to grow cotton on steep slopes. This practice cannot be continued under average conditions if we are to save our soils.

Farmers must visualize the necessity of proper land use and be guided by these principles in the future, if the remainder of the good soils of the Piedmont is to be saved for future generations. Definite rotations, which would have greatly aided in keeping terraces from breaking, have not been followed as a rule. In a great majority of cases the greatest benefits which have been derived from the present terracing system has been the resultant contour cultivation which goes hand in hand with a proper terracing program.

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MUDDY RAIN FALLS NEAR PULLMAN

Not to be outdone by the choking dust storms of the Central States and the floods of the South, the Pacific Northwest came across with a combination of silt and rain Sunday night, March 24, centering in the vicinity of Pullman, Washington.

Dust, blown from the wind-swept regions of central Oregon and Washington into the precipitation belt in the Palouse area, converted the rain into muddy water. The silt burden was so heavy that windshield wipers left the glass murky.

The muddy rain emphasized to the people in the Pullman district the necessity of wind erosion control in the Northwest as well as in the Great Plains, Regional Director W. A. Rockie reports.

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