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That Their Fields Shall Prosper and Their Flocks Increase

Thomas Nickerson

THAT THEIR FIELDS SHALL PROSPER AND THEIR FLOCKS INCREASE

Problems of the Rio Grande Watershed
A Symposium

Edited by *Thomas Nickerson*

INTRODUCTION

There are indications from all quarters that the seriousness of the watershed problem facing the Rio Grande Valley is not fully appreciated by the residents of New Mexico. The continued use of the valley for agricultural and stockraising purposes, and even for mere habitation, is gravely endangered if conditions on the watershed above the valley continue to accelerate the processes of erosion.

Several factors have been responsible for these conditions. They include the unregulated cutting of timber during the early eighties, a practice which continues even to the present time on some privately owned areas. A second factor is the overuse of the range on federal, state, and private lands. Such overuse is largely responsible for the deterioration both of the upper and lower portions of the watershed. Without satisfactory ground cover, we cannot hope to control the flow of water in the watershed—irrespective of any dams and other mechanical structures which might be installed. The river bed will inevitably continue to rise as a result of the deposition of silt from the surrounding areas. There will follow a corresponding rise in the water level in the middle valley. If this aggradation, as it is called, continues unchecked, farms will shortly be waterlogged, business will stagnate, and the inhabitants of the valley will have to seek greener fields elsewhere.

The foregoing may appear to be a radical statement. But these are the facts—facts which have been established by the investigations of various federal agencies over a period of many years. An example familiar to many of us is the town of San Marcial, which several years ago was flooded and ruined by deposition of silt from the Rio Grande. A repetition of this occurrence on a vastly larger scale is an imminent possibility unless comprehensive measures are taken to counteract the present trend. Various

remedial projects are now under consideration by state, county, and federal groups. These should be vigorously prosecuted if the prosperity of the people is to continue. It is important that the public should inform itself upon the extent of the impending danger and upon what measures are capable of combatting it. For it is the public who will either sink or swim. Awareness of the true state of matters is a prerequisite to popular pressure in support of appropriate action.

The studies and plans of the several federal and state agencies over the past ten years provide reliable data for a plan of action. Prior to the war, the Interdepartmental Rio Grande Board[1] endeavored to co-ordinate these plans. In order to expedite action, the Army Engineers have more recently perfected plans and specifications covering the flood control and power phases of such plans.

The initial section of the following symposium sets forth the general problem as viewed by the Army Engineers.

The second section deals with soil conservation as practiced by the Soil Conservation Service. This work is a particularly important factor in any comprehensive program. It has been responsible for the fact that operators on the watershed are practicing better farming methods and better range use of their pasture lands, and are learning how to conserve the water on the ground rather than allow it to run wild and increase erosion on their lands and on that of others. An act known as the Wheeler-Case Act provided a program implemented with funds capable of giving immediate assistance to the rural economy, and of improving pre-existing irrigation structures and supplemental dams. These dams impounded flood waters which could be used later in the growing season without penalizing the valley irrigation. This program should have had far wider application throughout the watershed, for it directly benefited the middle and lower valleys and at the same time bettered the economy of the rural communities, which are in dire need of all assistance possible.

Section three is an excellent treatment of upstream development. There is a feeling in some quarters that any change in the use of irrigation waters in the upper watershed will be immediately reflected in less water for the lower valley. It is felt that this premise is incorrect. For the water which might be held in the upper watershed for supplemental irrigation would normally be wasted in flood times and do damage to the middle and lower valley by aggradation of the river bed through the deposition of silt, and by the cutting away of fertile agricultural lands.

There then follow, in order, sections describing the activities and aims

[1] This board is composed of four agencies of the Department of Agriculture—the Forest Service, the Soil Conservation Service, the Farm Security Administration, and the Bureau of Agricultural Economics, and four agencies of the Department of the Interior—the Indian Service, the Grazing Service, the Reclamation Service, and the General Land Office.

of the Forest Service, the Indian Service, and the Grazing Service. Section eight deals with work among the mountain people, section nine with Middle Rio Grande Conservancy matters, and a final section with the attitude of the businessman toward watershed problems.

The following table may serve to give the uninitiated a clearer understanding of the types of land included in the watershed and the agencies which are responsible for them.

Land Status	*Percent of Watershed*	*Administering Agency*
National Forests	20%	Forest Service, Dept. of Agriculture
Indian Lands	12%	Indian Service, Dept. of the Interior
Public Domain	12%	Grazing Service, Dept. of the Interior
State Lands	6%	State Land Office
Private Lands	40%	Individuals
Miscellaneous, Urban and Railroad	10%	
	100%	

This complex land ownership pattern calls for close co-operation between private landowners and government agencies if the watershed problem is to be solved.

The recently proposed Anderson Bill, in its original draft, was similar to the TVA. It was designed to help remedy the conditions in the valley. However, many of the interested groups felt that a Valley Authority was premature and that it would not solve the problem in its entirety. The Anderson Bill has been substantially rewritten. It provides, among other things, that the Bureau of Reclamation take over the Conservancy District jointly with the Reconstruction Finance Corporation. Regardless of the merit of that proposal, it fails to solve the basic problem which is focused above the middle valley and must be remedied first. For without a stable and controlled watershed, which means a steady flow of clear water into the valley floor, the over-all picture will not be improved. It must be emphasized again and again that conservative use of the range and timber cover is a must, for revegetation on portions of the ranges is essential. Some dams for flood control are necessary, but it should be remembered that the upper watershed is the water-producing area, and that this area, together with the ranges adjoining the agricultural lands, must maintain a proper grass and timber cover at all times. Otherwise, excessive erosion, floods, and aggradation of the river bed will continue to accelerate, and no amount of flood control structures will save the valley, its farms, its railroad, its cities, and its villages.

It should again be emphasized that more conservative use of the watershed is imperative—a use which envisions a co-ordination of water storage and soil conservation upstream with the more dramatic downstream struc-

tures. To achieve this end necessitates the closest possible co-operation between all administering agencies, and between these agencies and the people concerned. And *all of us* are concerned if the middle valley is to be effectively operative fifty years hence, rather than becoming an amplified counterpart of the ghost village of San Marcial. The simile is not a bit farfetched. Unless concerted and unselfish action is taken, and promptly, we'll all go down the river, so to speak, and in the same boat.

JOHN ADAMS, *Chairman*
Interdepartmental Rio Grande Board

I

THE GENERAL PROBLEM

Any plan for the ultimate development of the Rio Grande Basin should provide for the fullest possible conservation and exploitation of the natural resources with which the basin is endowed. Although this area is extremely rich in certain of these resources, some of them have been only meagerly developed to date. This is principally true of agriculture and water power. The importance of these two features in our national economy has been brought out very clearly by the present needs of war, and there is no reason to believe that they will be of less importance during the postwar period.

In the semi-arid Rio Grande Basin the waters of this river must be controlled, conserved, and used to the fullest possible extent, both for the development of agriculture and the generation of power. In addition, steps must be taken to retain the meager rainfall on the land in order to improve grazing conditions and check the deluge of silt from entering the river channel. This involves the contouring of range lands, controlled grazing, erosion control, and the establishment of other effective soil conservation measures on tributary areas within the watershed. It involves the control of floods by the impounding of flood waters in reservoirs so that these waters may be put to beneficial use instead of remaining a destructive force. It involves the desilting of these waters so that the river bed will degrade, thus establishing a well-defined channel which will carry any uncontrolled flood waters as well as allow effective drainage of irrigated lands adjacent to the river. It involves the use of available water for irrigation to the maximum practical extent. It involves the production of the maximum amount of hydroelectric power consistent with other uses of water. It further involves the establishment of the most efficient practices of fish and wildlife conservation and the construction of suitable recreational facilities where practical.

The necessary steps for the development of the Rio Grande Basin enumerated in the preceding paragraph are not in any way in conflict with each other, and all have been under study by appropriate federal agencies.

The Soil Conservation Service, the Grazing Service, and the Forest Service have conducted extensive surveys and are at the present time actively engaged in effectuating measures for rainfall retention on the land, soil conservation, and erosion control. The United States Engineer Department has recently completed surveys and studies for flood control, supplemental irrigation water, hydroelectric power generation, silt control, and degradation of the channel. The United States Bureau of Reclamation is also actively engaged in a study similar to that completed by the United States Engineer Department with special emphasis on the irrigation features. In conjunction with studies made by the United States Engineer Department, the Federal Power Commission has made power surveys of the middle Rio Grande basin and adjacent areas. The Fish and Wildlife Service as well as the National Park Service has investigated the wildlife and recreational features which may be developed in conjunction with other improvements.

The various surveys and studies conducted by the above agencies indicate that a general development of the Rio Grande Basin is feasible from the engineering standpoint and economically justified. Appreciable work has already been done toward soil conservation and erosion control. The United States Engineer Department has evolved a plan for flood and silt control which reduces all floods to safe channel capacity, provides a more dependable irrigation supply, provides for the generation of hydroelectric power, and results in degradation of the channel throughout the middle valley. These results can be obtained without placing an undue financial burden on the middle valley. The plan would remove only a small amount of irrigated land from the tax rolls, and at the same time better drainage would make an appreciable amount of marginal land suitable for irrigation. In developing the plan of improvement, care was exercised to avoid damage to any historical landmarks or Indian Pueblos, which constitute an irreplaceable asset to the basin.

LT. COL. R. E. COLE, *District Engineer*
U. S. Army Engineers Office

II

SOIL CONSERVATION

The continued use of the highly productive areas of the Rio Grande watershed depends upon the solution of three outstanding problems of soil and water conservation—the erosion of farm land by irrigation water, the deposition of silt and gravel on farm lands by side arroyos, and the raising of the ground-water level and flooding of crop land caused by the constant aggradation of the Rio Grande bed.

The Soil Conservation Service believes that the responsibility for achieving and maintaining soil and water conservation and proper land use rests first with the landowners. Even if government agencies could

install all the measures needed to solve these problems, they would not be permanently effective unless the land users believed in them. The solution of many of these problems is in local treatment of farms and ranches, which necessitates the development of local programs. Soil Conservation districts, organized and governed by land users, are legal subdivisions of the State set up to handle these programs. The Soil Conservation Service and other agencies assist these districts as well as other organized bodies which have legal authority and are interested in furthering soil and water conservation and proper land use. The Service does this by providing technical advice on the land itself, in order that each acre on each farm or ranch may be treated in accordance with its individual needs and capabilities.

Irrigation methods that will bring about sufficient water penetration to grow crops and at the same time prevent erosion of the fertile topsoil are being advocated by Soil Conservation Service technicians. The experience of many farmers has proved that larger yields can be obtained with less water if the land is carefully prepared for irrigation and the farm irrigation system is properly laid out. The ideal preparation gives land a very small and uniform slope in one direction and makes it level in the other direction so that when water is applied in sufficient quanity it will spread evenly over the surface. This brings about uniform penetration of water on the whole field without waste. The depth of soil and slope of the land often prevent perfect leveling; in such cases, special irrigating methods must be used in order that water can be kept under full control at all times.

But of even greater danger to irrigated land in New Mexico is the deposition of silt and gravel from summer flash floods in side arroyos. This damage usually comes from a narrow belt, five to twenty miles wide, along the edge of irrigated valleys where the mesa breaks to the valley level. It is possible that vegetation on this sloping land has always been scanty. The natural vegetation was probably further depleted by early settlers along the streams, who allowed livestock to graze these rangelands, thereby denuding them. As the grass cover decreased, natural drainage ways eroded more readily, and more and more silt and gravel traveled down to the farmland.

The Soil Conservation Service encourages conservation grazing in these areas and assists conservation districts in reseeding and other practices that will restore a protective vegetative cover to barren sections.

But probably the most serious problem in the Rio Grande watershed is the rising of the river bed. This process, which is going on at a rate of three inches a year, creates two hazards. It disrupts the drainage system of the valley lands and necessitates the building and maintenance of levees.

The silt deposited in the bed of the Rio Grande comes from all over the watershed, though some parts, such as the Rio Puerco area, are notable contributors. A small amount of this silt can be classed as geologic erosion, and is due to natural processes, but by far the largest part of it comes from gullies and arroyos on range land from which the vegetative cover has been removed, and from caving banks of the numerous arroyos and stream channels. It has been estimated that 35,000,000 to 40,000,000 tons of sediment were carried annually into the middle Rio Grande valley between 1937 and 1941. Two thirds of this was deposited in the river bed and valley lands, and the rest of it was carried into the Elephant Butte Reservoir. This reservoir, the sole supply of water for 155,000 highly productive acres, has lost 17 per cent of its original storage capacity since 1915.

The silt that is deposited in the bed of the Rio Grande prevents the drainage system of the Middle Rio Grande Conservancy District from functioning as was intended. Drain outlets for the area are now several feet higher than they were when constructed, and the water table is much higher than it would be if the drains could function properly. This condition becomes worse as the river bed continues to rise, and unless this process can be halted, it appears that most of the farm land of the middle Rio Grande valley will in time become waterlogged and useless.

The rising of the Rio Grande stream bed has also reduced the capacity of the channel to carry spring floods. For many years it has been necessary to maintain levees to increase the natural carrying capacity of the river bed, but in spite of these costly efforts, floods continue to break out and ruin crops on valley lands. In 1941, it was estimated that the cost of levee maintenance, crop and highway damage, and other flood damages in the Rio Grande watershed above the Elephant Butte Reservoir amounted to $1,000,000.

The increasing flood hazard has forced the Santa Fe Railway Company to move part of its line out of the valley. Many miles of U. S. Highway 85 have also been rerouted on higher ground. The business section of the city of Albuquerque is definitely menaced because it is now lower than the Rio Grande at flood stage.

It is obvious that the wise use of land all over the watershed is necessary to protect the land from these hazards. The Soil Conservation Service and other agencies are attempting to show the landowners of the watershed that this interdependency exists, but since these problems do not affect all parts of the watershed equally, landowners are not sufficiently aroused in some cases to take the proper preventive measures.

A large part of the Rio Grande watershed is in Soil Conservation districts, organized to attack the problem of land use. When coverage of the watershed by districts is complete, a comprehensive attack can be made.

However, it is apparent that full control of siltation in the Rio Grande

watershed depends upon three definite programs—the construction of large reservoirs on the river and major tributaries, the construction of numerous gully plugs and other upstream engineering structures all over the watershed, and finally, land use practices which will allow a protective vegetative cover to be re-established and maintained.

CYRIL LUKER, *District Conservationist*
Soil Conservation Service
Department of Agriculture

III

UPSTREAM MANAGEMENT

Water conservation in a broad sense means, not simply the use of water for economic benefits, but the conservation of the water resources for the maximum benefit to society as a whole. Water conservation implies, in addition, efficient use, preservation of the source of our water supply—timber and vegetative cover at the headwaters of streams, protection of stream banks to prevent gullying in small tributaries, and retard devices to prevent erosion and ultimate siltation of lower stream beds and reservoirs.

Paradoxically the life and continued usefulness of downstream irrigation and power developments are seriously threatened by upstream abuse, yet the initiation of measures to provide for the best use and conservation of upstream areas is hampered by objections from downstream users. These interests are apprehensive of upstream storage, as well as measures to aid in flood and erosion control.

Most large irrigation developments are downstream—storage dams to store water for irrigation of formerly arid lands. Projects involving large reservoirs are more spectacular, produce more for commercial channels, and hence get more public notice. However, the value of the relatively few large developments, important as they are in themselves, is far outweighed by that of the numerous small direct diversion systems upstream, if we consider the economy of the area and the welfare of people of the region.

All the original settlements on the watersheds of the West were upstream, and irrigation developments here are much older. Unregulated timber cutting and overgrazing has resulted in denuding the drainage areas of the tributary streams of their vegetative cover. The runoff is rapid, both from melting snow in the spring and from summer rains. There is an oversupply of water in the spring and early summer, and critical shortages occur in late summer and fall when water is needed to mature crops.

Where water is abundant in the spring and deficient in late summer, it is frequently the practice of upstream users to flood their fields and to overuse water in the hope of saturating their land sufficiently to alleviate

critical dry conditions later. This practice results in the diversion of more water than is needed for local irrigation.

Failure to effect proper conservation at the source and on tributary streams results in the depletion of the vegetative cover and the water-holding capacity of the soil and in the accumulation of silt deposits in lower stream beds—which in turn causes overflow and inundation of adjacent areas, the destruction of bridges, highways, farm lands, and homes. The siltation of large storage reservoirs is of evergrowing concern to downstream water users. Although small upstream direct diversion developments are older, they cannot exercise their rights without supplemental storage. Opportunities for improvements in the welfare of the people of the region lie in the improvement of the numerous small direct diversion systems.

Small reservoirs are needed in tributary streams. Impounded water would insure a steady supply and prevent overuse in the spring and early summer. It would also make use of summer flash floods which contribute little to downstream storage. A number of small dams on the headwaters would serve in a dual capacity: to control floods and to provide an adequate supply in late summer for upstream irrigators. Protection of the upper drainage areas and stream banks, including the construction of small reservoirs upstream, would help to regulate stream flow and prevent siltation in lower stream beds and large reservoirs. Upstream farmers, assured of a steady supply, would have no inclination to overuse water during seasons of abundance.

Investigations indicate that the wise use of all facilities, both natural and mechanical, to retard the runoff at or near the source and to provide for a saturation into the natural reservoirs at the headwaters will not jeopardize downstream supplies. In fact, some investigations indicate that such a regulated flow would possibly increase the annual supply for downstream reservoirs.

Water conservation, then, demands that the upper watersheds be adequately protected, that small upstream dams be constructed, and that all other retard measures be used to insure a regulated flow of water. The welfare of all the people in a watershed must be considered. Upstream farmers must be enabled to exercise their rights, and downstream residents must be protected from the damages of siltation and floods. From the institution of such conservation measures to prevent floods and silt movement and to stabilize and regulate water supplies, will accrue untold benefits to the entire watershed without infringement upon the rights of any section of it.

GLEN GRISHAM, *State Director*
Farm Security Administration
Department of Agriculture

IV

Downstream Structures

America today stands at the threshold of a new era—an era which will bring into action a revitalized development and conservation of the nation's natural and human resources. Following the war, river floods will be dammed, river navigation will receive attention, flooded areas will be reclaimed, chronically dry areas will be irrigated, and more of the water-power resources of the continent will be harnessed. Whole regions will be transformed in the years immediately ahead. Cities and towns will receive new life blood, the economy of regions will be stabilized, land will be made to support more people better than ever before.

This is not an idle dream. It is in the planning stage. The Bureau of Reclamation's inventory for postwar construction and development in seventeen Western states involves 415 projects, costing approximately five billion dollars. This planned development of the land and water and human resources in the West will employ for a period of several years several hundred thousand persons at the site of construction, and many additional thousands of off-site laborers. In New Mexico alone the Bureau of Reclamation is investigating and planning for seventeen irrigation and power developments for the postwar period.

The experience gained in more than forty years of planning, construction, and operation of irrigation, flood control, and power generating projects is being used by the Bureau in designing its program for the immediate future. In these plans, the Bureau is co-operating to the fullest possible extent with all state and federal agencies. If projects planned for New Mexico are carried forward to their conclusion, at least 2,000 new farms, with a proportionate increase of 50,000 persons in the rural and urban areas of the state, will result. It is estimated that these projects would cost approximately $175,000,000, with resulting annual benefits of more than $16,000,000.

In our present approach we ask whether the development of the entire river basin will return benefits to the people who live within it commensurate with expenditures. This cannot be measured alone in direct cash returns, but in the economic development that will be stimulated, the abatement of the menace of floods, the benefits from river transportation, the value of municipal and industrial water supplies, and other satisfactions which come from health-giving recreational facilities.

Co-ordinated river basin development is not conceived merely as the completion of great engineering enterprises, but of laying the economic foundation for richer and happier living, which will enable our men and women to perform their necessary economic tasks with less effort and greater profit, and to devote more time to citizenship and cultural growth.

That is the way not only to preserve our freedom and independence as a nation, but to become a nation of men and women who will be regarded by other nations as wise and generous, to be envied, not for our wealth alone, but because we understand and appreciate what is good in life, including a sense of international justice.

The creation of prosperous and happy communities benefits more than the people directly involved. Such communities contribute value to the entire nation. Their industry enriches the nation and provides a market for all manner of goods produced in other sections.

Individual industry is in keeping with the tradition of the West. It made possible a war production which astounded the world. It, together with a development of natural resources which makes the application of human energy more effective, is no less important in the economy of peace.

JOHN L. MUTZ, *Acting Area Planning Engineer*
Bureau of Reclamation
Department of the Interior

V

PLANT COVER AND THE NATIONAL FOREST

The war has brought home to all of us that it is possible, even in this land of plenty, to have shortages of many things formerly taken for granted. Many of the short items are products of the land—some renewable like timber and grass, and some nonrenewable such as oil and minerals. These shortages naturally lead to more thinking about the management of our basic resource—the land. When one considers that only a quarter of the earth's surface is land and that a considerable part of this, for various reasons, is not usable for the maintenance of populations, which are increasing, the extreme importance of protecting and managing what is available becomes apparent.

This thought was back of the establishment of the national forests, the aim being to maintain the productiveness of the land within these forests so that it would continue to produce maximum yields of the products for which it was suited and to provide for the distribution of these products so as to render the "greatest good to the greatest number in the long run." The New Mexico national forests, of which there are five wholly within and divisions of two others partly within the state, have the above objectives.

Our national forests include the mountainous portions of the state, since only at the higher elevations is the annual precipitation sufficient for the growth of timber crops. The two broad timber types of New Mexico are the woodland, composed of juniper, pinon, and oak, and the sawtimber forests of pine, fir, and spruce. The woodland requires from twelve to seventeen inches of precipitation annually, and the sawtimber forests

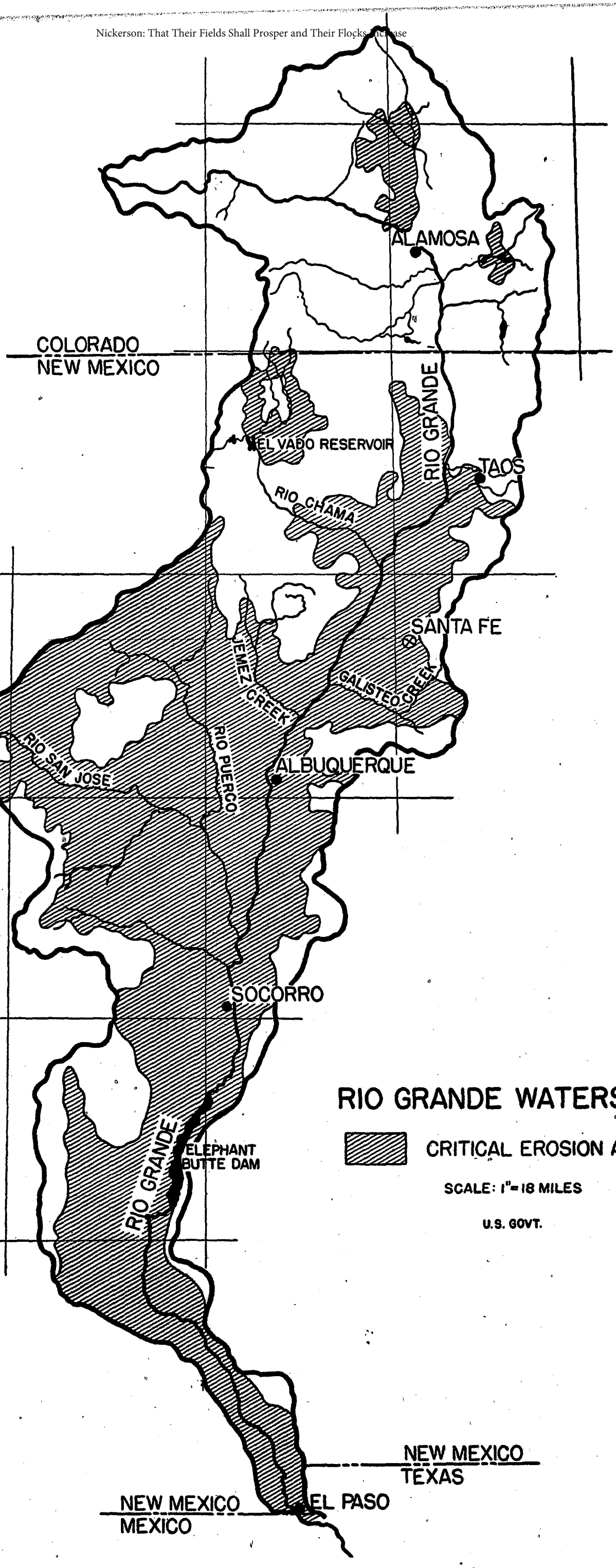
need in excess of nineteen inches. The topography of the forests is in general rough and the climate severe, which eliminates the use of the land for the usual farm crops. However, regardless of these adverse factors, the land can, if properly protected and managed, be made to yield on a continuous basis products and services of very great value to the product so as to avoid high cost of importing lumber from distant states. people living on or near them.

Complete agreement as to the most important values received from these properties is not possible. The recreationist naturally would place the cool climate and scenery high on the list. The fisherman and hunter would have decided opinions and place a good game and fish supply first. The local purchaser of timber would press for a continuous supply of this The farmer in the valley dependent on a readily available supply of water would vote "yes" to the importance of the forest as a productive watershed. The stockman would also be present to say a word for the value of the forage on winter ranges and especially on the summer ranges at higher elevations. The management of the national forests must take into account these various viewpoints and direct the growing and harvesting of the products so as to maintain a flow of all products consistent with the quality of soil and amount of precipitation.

It is relatively easy to maintain the producing capacity of land if it is retained in virgin condition, but the job becomes progressively difficult when such a diversity of crops must be grown and harvested and new crops started.

The timber resources on the national forests are managed on a "sustained yield" basis. This requires that the volume of timber removed each year shall not exceed the growth. Starting with virgin stands, the problem is to harvest the portion that is ripe for cutting, leaving the younger portion with added space for growth as a reserve stand to form the basis for a second cut and to produce seed for the starting of a new timber crop which in later years can again be harvested. Under local climatic conditions, light rainfall and relatively short growing seasons, growth is naturally slow; but sufficient time has elapsed since the forests have been under protection and management to demonstrate that the sustained yield system will and does work since some of the early cutover land has produced a second cut of timber and is now growing future crops.

The same general sustained yield is the aim in managing the forage resource. It is necessary, if the land is to be protected from the destructive ravages of erosion and if the vigor of forage plants is to be maintained, to protect the density and quality of plant cover. This in the long run will yield a continuous supply of food for domestic livestock and game, meeting the demand of the stockman and hunter and sustaining watershed cover in good condition. Plant cover is essential to prevent erosion. It cushions



the fall of rain and delays runoff so that the moisture required to nourish plants and to feed springs has a better opportunity to be absorbed in the soil.

The mountains of New Mexico, largely within the national forests, are the major producing watersheds from which comes the water to fill storage reservoirs so essential to farming in the state. Much late fall and winter precipitation at the higher elevations comes in the form of snow which banks up and melts in the spring over a rather extended period. This moisture in part replenishes underground water sources feeding mountain springs and streams during the dry summer period and providing supplies for large reservoirs.

The maintenance of a timber stand and a good forage cover goes a long way toward preserving in place the good rich topsoil which is essential if any land is to continue growing the products needed to support a population. Consequently, in all phases of national forest operation this need is kept in the foreground. Once the productive capacity of the land is severely impaired it is only a short time before this loss is reflected in the economic condition of the dependent population.

Between the soil, trees, grass, and springs of the watershed and valley dwellers there is a life chain. There is an interdependence of crops and services; houses in the valley are built of timber from the mountains; alfalfa grown in the valley finds its market through the livestock raised in the hills. But most important are the little streams which join and grow into the "Big River," because without them there would be no crops in the valley. If that chain is not kept strong the valley cannot prosper.

P. V. Woodhead, *Regional Forester*
United States Forest Service
Department of Agriculture

VI

The Pueblos—Good Neighbors

In the latter part of the sixteenth century, the Conquistadores entered what is now New Mexico, following the course of the Rio Grande northward and claiming the land for Spain. The Spanish Crown, in accepting these claims, recognized the prior occupancy rights of the Pueblo Indians, an essentially agricultural people who had long since established fortified villages along the valley as a means of securing themselves against their enemies. In recognition of prior occupancy rights, the Spanish government granted land to the Pueblo Indians. Such land constituted square or rectangular areas surrounding their villages and became known as Spanish Crown grants.

The Mexican government, during its brief ascendancy in this region, recognized and honored the Spanish Crown grants, as did likewise the

United States when, in accordance with the Treaty of Guadalupe Hidalgo, 1849, the region became incorporated into the Union as the Territory of New Mexico. Congress subsequently confirmed these grants by issuing patents in the name of each pueblo.

The Pueblo Indians have, since long before the coming of the Spanish, occupied the approximate present sites of their villages except when they were forced from them at the point of the sword or because of devastations by fire or flood or the failure of the water supply. Archaeological remains along the Pajarito Plateau reveal that the Indian homes hugged the diminishing water supply of the springs in ever-narrowing circles before the people moved into the valley to take advantage of the life-giving water of the river. There the Spanish, upon their arrival, found extensive and ingeniously developed Indian irrigation systems already in existence.

These primitive irrigation systems have subsequently been improved and modernized under the direction of the United States Indian Service. The Service, through the United Pueblos Agency, has likewise installed stock waterings, dams, reservoirs and diversions, and instituted measures calculated to combat the forces of erosion. Programs to promote proper farm and range management have been instituted, and modern equipment and approved methods have been introduced.

In brief, the objective of the Agency's resources department may be said to be to encourage the fullest possible use of resources consistent with sustained yield. This involves, among other things, the rotation of crops, the regeneration of the soil and limitation of the livestock load to the established carrying capacity of the range. The responsibility for preservation of natural resources applies to the original Spanish Crown grants and to two other principal types of land used by the Indians: reservations made available for Indian use by Executive Order, and Government purchase areas.

To insure economic and social independence to the Pueblo Indian constitutes the Agency's ultimate objective. His economic level raised, and equipped with knowledge of matters beyond his present physical and spiritual horizons, he will ultimately share to the fullest the benefits of the citizenship which is his.

In the meantime, and in direct relation to this objective, it is the opinion of the Agency that a "watershed approach" should at all times be preserved. No net gain in the solution of watershed problems will be accomplished if the interests of one group are served to the detriment of those of another. Let it not be forgotten that the greatest resource of any given area is its citizenry, no matter how rich or poor it may be in other respects. Regional planning which is not conceived and executed with human values as its core of motivation is doomed to failure.

Any permanent solution should take into consideration the rights and

needs of all persons, all groups, all interests dependent upon the watershed for their livelihood. Each of these elements should have a full voice in any planning for the solution of watershed problems. Such planning would naturally, I assume, also take the fullest possible advantage and make the fullest possible use of the facilities of existing agencies—federal, state, county, municipal, and private.

The co-ordination of the interests of the inhabitants, as well as of the facilities available to established agencies, would, in my estimation, result in insuring the utmost in economic and social benefit to all resident citizens in the watershed. The experience of the TVA, and the proposals to establish river valley authorities in all parts of the nation, either patterned on the TVA or under the aegis of an established governmental department, give rise to the thought that perhaps in this direction lies the ultimate solution to the complex problems of the Rio Grande watershed.

Whatever the sponsorship, the Pueblo Indians, whose past cultural and economic contributions to the area are admittedly of incalculable value, stand ready to assume their full share of the responsibility for the furtherance of their own stake in the valley's future, as well as that of their neighbors.

JOHN G. EVANS, *General Superintendent*
United Pueblos Agency
United States Indian Service
Department of the Interior

VII

THE SOIL MANTLE AND THE PUBLIC DOMAIN

The forces of nature such as wind, rain, snow, freezing, and thawing have, since the beginning of time, been engaged in a never-ending effort to reduce the earth's surface to a common plain. In order to combat the effect of these forces and hold them in check, nature has but one agency—the vegetative cover. The function of vegetation is (1) to protect the soil mantle; (2) to sustain life. Life and civilization as we know them today are directly dependent for their existence upon the products of the soil. It follows therefore that nature intended that forage should be used, but what we must learn is the degree to which such utilization may be made without impairing its ability to protect effectively the soil resources. Man in his use of the forage resources has the power to elect on which side he will align himself. Destruction of the protective vegetative cover through continued overgrazing or unwise harvesting of the timber or brush cover, exposes the soil mantle to the full effect of the degrading agencies, with the result that the soil, which has taken centuries to develop, is carried away to the sea and forever lost. Conversely, with proper utilization and management of the forage and timber resources, man is allied with the

one agency of nature designed to protect and preserve the soil and thus becomes an active member in the field of conservation.

The character of the streams flowing out of an area serves as a fairly dependable guide as to the general condition of the vegetative cover of the stream basin. Clear streams, flowing in well-defined channels, generally indicate a stabilized soil, whereas meandering, silt-laden streams indicate an unstabilized condition. The Rio Grande is of the latter type, but it is not to be assumed that the entire basin is so affected. As a matter of fact, a major portion of the silt load is contributed by a number of the larger tributaries, and it is in these basins that it is reasonably safe to conclude that the vegetative cover has lost much of its ability to hold the soil in check.

Steps to provide for more effective erosion control in these basins stand out as one of the major problems confronting the agencies concerned in planning for an over-all program for development of the Rio Grande basin. The problem is further intensified by the extremely complex land status. The success of control measures such as regulated grazing, augmented by the construction of mechanized structures of various types, will depend to a very great extent upon the degree of co-operation had with owners of the privately controlled land.

The author does not wish to leave the impression that it is possible to eliminate entirely the silt problem. Softness of the surface formations, together with the torrential nature of the storms, is a factor that cannot be entirely overcome. There is no reason for not believing, however, that under a properly co-ordinated program the silt load may be materially reduced.

The Rio Grande watershed is located in parts of three grazing districts in New Mexico and one in Colorado. Administration of the public grazing lands within these districts is authorized by the Taylor Grazing Act approved June 28, 1934 (48 Stat., 1269), as amended June 26, 1936, and July 14, 1939. In this act Congress recognized grazing as the highest use of the larger part of the remaining public lands, and established objectives for the control of the lands: "To stop injury to the public grazing lands by preventing overgrazing and soil deterioration, to provide for their orderly use, improvements, and development, to stabilize the livestock industry dependent upon the public range and for other purposes."

Much has been accomplished towards carrying out the objectives of the Taylor Act during the relatively short time the public lands located within the Rio Grande watershed have been under administration. In carrying out this program the livestock operators have been most co-operative and the progress that has been made is due in a large measure to their ability to see and realize the need for protecting the forage cover on which they depend for grazing. With not to exceed 30 per cent of the

Rio Grande drainage basin under jurisdiction of the Grazing Service, it is manifestly impossible to accomplish a great deal towards a complete solution of the problem. The program of all land-management agencies operating within the basin must be co-ordinated and expanded to include all land—public, state, and private—if the objectives of the over-all program are to be realized.

E. R. GREENSLET, *Regional Grazier*
United States Grazing Service
Department of the Interior

VIII

THE COUNTY AGENT AND THE MOUNTAIN PEOPLE

There is a group of watershed residents which until relatively recently has derived only small benefit from governmental agencies, whether federal, state, or county. There are some 250 Spanish-American families living in the mountainous areas in the southeastern corner of Bernalillo County. When three years ago the County Agricultural Extension Agent first undertook to assist these neglected people he found the older ones among them so wedded to their traditional way of life as to be resentful of intrusion and resistant to the advice of outsiders. It was for this reason that the younger and more amenable people were concentrated upon—and with success. Four-H clubs were organized, entrants into the Sears Roebuck replacement pig contest were secured, and certified corn, bean, and potato seed clubs were established. Sixty-three children under the age of eighteen were enrolled in the potato club; and, despite the fact that they had never cultivated this crop before, many of them won prizes in a contest conducted by the Kiwanis Club. The children are making a good start; but, curiously enough, their efforts are limited by a bottleneck not directly related to agriculture. This bottleneck is *roads.*

In this forty-seven-mile-wide valley, roads, for all practical purposes, are nonexistent. Such as exist, even under the most favorable weather conditions, are frequently not negotiable. There are but six bridges in the whole region, all of them unsafe. Roads, consequently, are a primary and pressing need of these isolated and impoverished people—roads to permit the introduction of certified seed, improved breeds of stock, modern farm machinery, and equipment for digging wells and installing water conservation structures; roads to facilitate the marketing of agricultural produce and livestock products; roads over which a monthly motor clinic may bring medical aid to a people who have never enjoyed such benefits; roads to enable the children to attend school where they may learn to read English and to appreciate the advantages which are to be derived from diversification, crop rotation, regeneration of the soil, and other modern agricultural methods. Delegates from this area have not been

able to sign their names to petitions that some attention be paid by politicians to their pressing needs. Until recently, when three private libraries were started with the assistance of money donated for shelving, there were no books in the area. Yet, so avid for learning have the people become, that they voluntarily foregather to hear those of their number who know English read agricultural bulletins to them aloud.

Work among these backward people is abundantly rewarding, not only because of their growing appreciation for assistance, but because their lands are among the richest in the county. Removal of the bottleneck imposed by the lack of roads would not only immeasurably improve their economic state but would make available to the city of Albuquerque agricultural and livestock products of which that community is sorely in need. At the present time, 90 per cent of the city's wood supply derives from this area. These people constitute a large potential source of corn, feed, poultry, meat, eggs, and vegetables. The region is capable of developing a dairy industry which would supply nearly the entire milk needs of the city. And the area is in many ways ideally suited to fruit growing. It is such communities as these which form the foundation of the watershed's economy—a fact which war shortages have re-emphasized. It is estimated that in the course of two years the advantages which the introduction of roads would bring to these people would increase the present value of their produce by two and a half times—a matter of some quarter of a million dollars.

The long-range objectives of the county agent's program include many of those referred to in the foregoing sections of this symposium—soil conservation and regeneration; crop rotation and diversification; education in proper land use and modern farm and range management methods. To these classic aims are added others specifically applicable to these particular people—aims which strike at the heart of their problems. These include the construction of the aforementioned roads in order that the barrier to aid by the county agent and by state and federal agencies may be thrown down; assistance in securing for these people an adequate market for their produce; development in the community of widespread interest and local pride in agriculture; guidance in establishing returning war veteran farmers on the soil; and the development of a spirit of co-operation between business, industry, finance, and agriculture. For it is only through realization of the necessity for integration of each and every facet of our economy, however small, that the fullest possible development of the watershed may be achieved.

CECIL PRAGNELL, *Agricultural Extension Agent*
Bernalillo County

IX

The Conservancy District

The New Mexico Legislature created the Middle Rio Grande Conservancy District in the late twenties, authorizing an appraisal and assessment and the borrowing of about nine million dollars which was used to build the El Vado Flood and Irrigation Control Dam in Rio Arriba County and the construction of levees and riverside drains for irrigation and flood control on the Rio Grande from Pena Blanca to the head of the Elephant Butte Lake. The District is operated by a board of directors appointed by the senior judge of the Second Judicial District. The directors serve without compensation and are removable at the pleasure of the court.

The District was set up to bring under irrigation and flood control about 150,000 acres of Rio Grande land, one half of which is under cultivation at present. The tax levied each year against the farm land in the District for bond retirement, interest, and operation amounts to about $4.50 per acre per year, which is one of the lowest-cost operations in the country. The physical condition of the levees, drains, and canals is fair. Much work could be done to improve them, but inasmuch as only 80 per cent of the taxes levied each year are paid, the directors are limited in the amount of money they can spend on the upkeep of the District works.

Inasmuch as this whole area is well populated and there is no colonization problem before the District, and because the winters are mild and the summers not too hot, some people have the expectation that the District could support a million people.

The Army Engineers and the Reclamation Bureau have both made surveys and have expressed a willingness to construct flood control, irrigation, and power development dams at three or four places in the District. Without much doubt, some of this work will be done at government expense within the next few years, as that is the kind of work that the government feels itself responsible for. Such work will give employment to many thousands of men returning from the wars.

In normal times most of the land of the valley is used for subsistence farms, there being very few large operations, which is a desirable condition. People of three bloods occupy the District with more or less success—the immemorial Indian, the Spanish-American, and the Anglo.

Principal farming activities of the District are the growing of alfalfa, corn, wheat, vegetables, and dairying. Though the District is capable of raising all its own needs and exporting some, at present alfalfa, corn, wheat, butter, cream, and milk are brought into the District from the outside. Vegetables are transported in huge refrigerated trucks from Arizona and California to the market, but local vegetables would be preferable.

At the best this proposed solution will require a great deal of time. Business is eager to see it get started as soon as possible. The bonded indebtedness of the district, no matter to what agency it may be transferred, will remain. It is a debt and the investors holding the bills must be paid. At present what the Conservancy District officials want, and what informed businessmen want, is authority to start toward carrying out the plan roughly outlined above. It is necessary to find out what the people want —the landowners in the valley and the owners of property and business within the confines of the district. The district was organized in 1927 under an act of the legislature and is a political subdivision of the state with powers to finance conservancy improvements. When plans have been completed, all parties and interests, including the state government, will have their day in court. It is not unlikely that this proceeding, which will be necessary, will have to take its course through all the courts and possibly to the Supreme Court of the state. That is necessarily a long procedure and it is important that it be instituted at the earliest possible moment and that authority to proceed be obtained at the earliest possible time.

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being executed. These are the United States Army Engineer Corps, whose primary interest is storage for damage control, and the United States Reclamation Service, which stores for irrigation. Watershed management, on the other hand, is being promoted by several general agencies including the Soil Conservation Service and the Farm Security Administration. The work of these two groups of agencies is being supplemented by that of services whose activities are restricted respectively to lands of particular status. These include, among others, the Forest Service, the Indian Service, the Grazing Service, the County Agricultural Extension Agent, and the Middle Rio Grande Conservancy District.

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The work of all these agencies is hampered by a complicated and, in many places, checker-boarded land pattern, by the often divergent interests [illegible] authority principle such as the T.V.A., by which an agency is appointed or created to assure the co-ordination of pre-existing agencies.

No matter what vehicles are selected, the warning is sounded that positive action is imperative if the continued deterioration of the watershed

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The following are the few simple needs of the District:

1. For the people who live on the small farms to pay their taxes, which are not large, without expecting the politicians to save them from tax-paying as they have done in the past.

2. The organization, whether co-operatively or privately, of vegetable and fruit-packing concerns to handle local produce.

To take a broader view of our needs, history shows us that postwar periods have been times of unrest. Returning war veterans have traditionally demanded an opportunity to make an honest living. No one in his right mind would deny them this privilege. The absence of opportunity is a cause of revolution. We in this country—possibly rashly, possibly unthinkingly—have promised jobs to millions of war veterans. Industry cannot be expected to absorb them all. Hope lies in the direction of the government-approved development of our natural resources, and in making them accessible; in the building of dams and roads and waterways. Through this means, both our human and our natural resources are served. New Mexico should claim its fair share of such development.

ALBERT G. SIMMS, *Chairman*
Middle Rio Grande Conservancy District

X

THE BUSINESSMAN

I have been asked to discuss briefly the attitude of business "as to the way the watershed problems of the middle Rio Grande valley might be solved." This, of course, means the solution of the problems of the Middle Rio Grande Conservancy District, which comprises all of the irrigable land in the middle Rio Grande valley, the area from White Rock Canyon to the village of San Antonio in Socorro County, a distance of 150 miles.

While the reclamation of the irrigable area is a major problem, the problem of adequate flood protection is of equal importance; first, because the reclamation of the area of irrigable land cannot be carried out successfully without flood protection; and, second, because flood protection is necessary for the safety and further growth of the cities, towns, and villages along the river within this 150-mile area.

The total area within the exterior boundaries of the conservancy district is approximately 210,000 acres, of which 123,000 acres are within the benefited limits, that is to say, subject to agricultural development and use. Of this 123,000 acres, about 20,000 are Indians lands, and about 5,000 acres are taken up by cities, towns, and rights-of-way of railroads and highways, leaving approximately 98,000 acres of non-Indian agricultural lands subject to irrigation and cultivation. In 1944 approximately 75,000 acres were in some form of cultivation.

It is apparent at once that business must be in favor of the full development of this entire area and that it is strongly in favor of adequate and permanent flood protection at the earliest possible time.

Unfortunately, a majority of businessmen and property owners in the district, both urban and rural, are not fully informed as to the conditions surrounding the origin and development of the Conservancy District. There is a vague idea among the people, including perhaps a majority of businessmen and investors, that the United States Bureau of Reclamation can come into this district, take over its indebtedness, and relieve landowners, investors, and all other interested people of all their debts, with the federal government benevolently paying the bills. Of course, this will be found to be impossible as a growing number of people acquaint themselves with the problem.

No project carried out by the United States Reclamation Service relieves the landowners of the cost of construction and operation. In all such districts cost of construction is assessed against the land and is payable over a long period of years. Operating costs of the land, that is, the furnishing of water, cleaning and repairing of main irrigation canals, and upkeep of drainage canals, are payable by the landowner or operator on the basis of an annual charge.

There is an idea in some quarters that the operating expenses of the Middle Rio Grande Conservancy District are excessive. This is not the case. Investigation will disclose that the operating costs of this district are lower than any other United States Reclamation Service project.

During recent years an increasing number of businessmen and landowners have given careful study and thought to the over-all solution of the problems of the district, that is to say, the control of flood waters from the tributaries of the Rio Grande and its watersheds and the building of adequate defenses against possible disastrous floods which might cause enormous damage, not only to the agricultural area, but to the city of Albuquerque and the smaller towns and villages within the district. As a matter of course, business favors the solution of these problems at the earliest possible time.

Informed opinion strongly advises the carrying out of plans which have been made after a long period of investigation by United States Army Engineers and engineers of the Reclamation Service, in co-operation with the officials of the Conservancy District. Roughly, this plan provides for the construction of three and possibly four dams along the river which would impede flood waters of tributary streams, check silting, and hold back the flow of flood water; second, the channeling of the river; third, the construction of permanent flood defenses; and finally, the placing of the irrigable area under the supervision of the United States Reclamation Service.

At the best this proposed solution will require a great deal of time. Business is eager to see it get started as soon as possible. The bonded indebtedness of the district, no matter to what agency it may be transferred, will remain. It is a debt and the investors holding the bills must be paid. At present what the Conservancy District officials want, and what informed businessmen want, is authority to start toward carrying out the plan roughly outlined above. It is necessary to find out what the people want —the landowners in the valley and the owners of property and business within the confines of the district. The district was organized in 1927 under an act of the legislature and is a political subdivision of the state with powers to finance conservancy improvements. When plans have been completed, all parties and interests, including the state government, will have their day in court. It is not unlikely that this proceeding, which will be necessary, will have to take its course through all the courts and possibly to the Supreme Court of the state. That is necessarily a long procedure and it is important that it be instituted at the earliest possible moment and that authority to proceed be obtained at the earliest possible time.

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OSCAR LOVE, *Vice-President*
Albuquerque National Trust and Savings Bank

SUMMARY

To summarize the problems of the Rio Grande watershed would require the wisdom of Solomon. Yet possibly a useful purpose would be served if an attempt were made to draw together the threads which run through the foregoing sections.

It has been pointed out that in an essentially agricultural and stock-raising state such as New Mexico, the manner in which the soil and water problems are solved reaches directly into the pocketbooks and lives of every individual. This concept has been expressed in terms of a life chain which includes the trees of the forestlands, the springs and streams along the slopes, the vegetative cover of the plains, the water which finds its way into the irrigation ditches, and the residents of the valley. The links in this chain have meaning to the people in terms of timber, forage, and food. The life chain must be strong if the valley is to prosper. No link in the chain should be neglected—both for its own sake and for the sake of maintaining an unbroken progression of interdependent benefits.

There are two major aspects of the watershed problem: upstream management and downstream structures. These overlap and must necessarily be worked out together. Two agencies have formulated comprehensive plans for large-scale improvements which, having been co-ordinated, are

being executed. These are the United States Army Engineer Corps, whose primary interest is storage for damage control, and the United States Reclamation Service, which stores for irrigation. Watershed management, on the other hand, is being promoted by several general agencies including the Soil Conservation Service and the Farm Security Administration. The work of these two groups of agencies is being supplemented by that of services whose activities are restricted respectively to lands of particular status. These include, among others, the Forest Service, the Indian Service, the Grazing Service, the County Agricultural Extension Agent, and the Middle Rio Grande Conservancy District.

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The work of all these agencies is hampered by a complicated and, in many places, checker-boarded land pattern, by the often divergent interests of economic groups, and by failure of the general public to appreciate the gravity of the problem.

Attention has been drawn to the fact that all groups have a stake in the watershed—farmers, stockmen, lumbermen, sportsmen, vacationists, industrialists dependent upon hydroelectric power, and the resident and businessman whose welfare depend upon the general prosperity of the watershed and whose very safety rests upon the extent to which the forces of nature are properly utilized and the habitability of the valley maintained.

It has been pointed out that the fullest possible development of the natural resources of an area not only makes for greater profit with less effort and for a fuller life with more leisure, but also strengthens the general fabric of the state and of the nation at large, and fortifies our position among the family of nations.

The important of close integration of the services of all agencies has been stressed. It has been stated that the Anderson Bill, which places emphasis upon the Reclamation Service and the Army Engineers, may, if passed, provide a vehicle for the promotion of such integration. And always in the offing is the possibility of establishing an adaptation of an authority principle such as the TVA, in which an agency is appointed or created to assure the co-ordination of pre-existing agencies.

No matter what vehicles are selected, the warning is sounded that positive action is imperative if the continued deterioration of the watershed

is to be forestalled, and that in such action the people must play a prominent part. How intelligent, how unselfish, how farsighted their action proves to be will depend upon the extent to which they post themselves upon the conditions which prevail and upon the remedial measures which are capable of correcting them.

It was for the purpose of clarifying some of the complex issues involved that this symposium—admittedly incomplete and purposely non-controversial—has been undertaken. In the final analysis, the governing factor is *what the people want and how badly they want it.* Agencies—federal, state, and county—have been created to translate the people's wishes into action—a fact which, curiously enough, is sometimes lost sight of. An era of re-employment of war veterans and of postwar government spending is at hand. It remains for the people to express their mature and well-considered will.

THOMAS NICKERSON, *Administrative Assistant*
United Pueblos Agency
United States Indian Service
Department of the Interior