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To the Committee on Graduate Study:

I am submitting to you a thesis written by Chi Yuen Lee entitled "The Impact of TVA on Agriculture." I recommend that it be accepted for nine quarter hours credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

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Major Professor

We have read this thesis
and recommend its acceptance:

Frank B. Ward

Charles P White

Accepted for the Committee

E. L. Waller

Dean of the Graduate School

# THE IMPACT OF TVA ON AGRICULTURE

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A THESIS

Submitted to
The Committee on Graduate Study
of
The University of Tennessee
in
Partial Fulfillment of the Requirements
for the degree of
Master of Science

---

by

Chi Yuen Lee

March 1949

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Limitation and errors are the responsibility of the writer alone.

C. Y. L.

255976

TABLE OF CONTENTS


| CHAPTER | | PAGE |
|---|---|---|
| I. | INTRODUCTION. . . . . | 1 |
| | Purposes of this study. . . . . | 1 |
| | Scope of the study. . . . . | 2 |
| | Physical conditions of Tennessee valley area. . . . . | 3 |
| | Tennessee river and its tributaries . . | 3 |
| | Topography. . . . . | 5 |
| | Climate . . . . . | 6 |
| | Soil. . . . . | 7 |
| | Population. . . . . | 7 |
| | Type of farming . . . . . | 8 |
| | Land use conditions . . . . . | 9 |
| | Mining. . . . . | 9 |
| | Industry. . . . . | 9 |
| | Low production and low income . . . . | 11 |
| II. | THE ESTABLISHMENT OF TVA. . . . . | 12 |
| | The antecedent of TVA--Muscle Shoals. . | 12 |
| | The Muscle Shoals Project . . . . . | 12 |
| | The legislative history of Muscle Shoals. . . . . | 16 |
| | Legal basis . . . . . | 26 |
| | Enactment of the Tennessee Valley Authority act of 1933 . . . . . | 27 |

CHAPTER PAGE

II. (continued)

Amendments to the act of 1933 . . . . . 30

Movement of forces. . . . . 37

III. PURPOSES AND CHARACTERISTICS OF TVA . . . . 47

Purposes of TVA . . . . . 47

Characteristics of TVA. . . . . 52

Organization. . . . . 52

Administration. . . . . 57

Financing of the TVA's activities . . . 73

Electricity Program . . . . . 83

Power system. . . . . 83

Establishment of a policy . . . . . 84

Wider distribution of the power--a local function. . . . . 86

Construction of dam . . . . . 87

Planning and unified building . . . . . 88

Result. . . . . 89

Special characteristics of TVA. . . . . 90

IV. THE AGRICULTURAL PROGRAM OF TVA . . . . . 94

Soil survey and classification. . . . . 95

Preliminary soil and fertilizer investigations . . . . . 98

Fertilizer program. . . . . 102

Fertilizer research . . . . . 102

Fertilizer production . . . . . 104

CHAPTER PAGE

IV. (continued)

Test-demonstration farm. . . . . 108

Classification of test-demonstration farms. . . . . 109

Demonstrating the use of TVA fertilizers . . . . . 112

Test-demonstration activities. . . . . 114

Flood control and navigation . . . . . 115

Flood control. . . . . 115

Cooperation and report by radio. . . . 119

Navigation . . . . . 120

Crop and livestock . . . . . 123

Farm system readjustment . . . . . 124

Processing and marketing farm products 126

Farm machinery . . . . . 128

Forest and woodland. . . . . 130

Objectives . . . . . 131

Activities and accomplishment. . . . . 131

Fish and wildlife. . . . . 135

Developing fishery resources . . . . . 136

Wildlife development . . . . . 136

Community and rural organizations. . . . 138

Agricultural activities outside the valley . . . . . 140

V. INDICES OF THE PROGRESS OF AGRICULTURE DUE TO TVA . . . . . 143

CHAPTER PAGE

V. (continued)

Farm characteristics . . . . . 144
Number of farms. . . . . 144
Size of farm . . . . . 144
Proportion of tenancy. . . . . 147
Farm population. . . . . 147
Analysis of farm characteristics by valley states. . . . . 147
Land use . . . . . 150
Analysis of land use by valley states. 152
Productivities of land . . . . . 152
Specified row crops. . . . . 152
Analysis of productivity of specified row crops by valley states. . . 157
Analysis of the production of hay by valley states . . . . . 157
Small grain. . . . . 163
Analysis of acreage of small grain by valley state. . . . . 163
Livestock and livestock products . . . 163
Analysis of livestock and livestock products by valley state . . . . . 168
Value of farm products sold and used by households. . . . . 168

CHAPTER PAGE

V. (continued)

Analysis of value of farm products sold and used by household by valley states . . . . . 172

Value of farm property. . . . . 172

Analysis of value of farm property by valley state . . . . . 176

Farm facilities . . . . . 176

Analysis of farm facilities by valley state . . . . . 179

VI. SUMMARY AND CONCLUSIONS . . . . . 183

BIBLIOGRAPHY. . . . . 193

LIST OF TABLES


| TABLE | | PAGE |
|---|---|---|
| I. | Percentage of the Area of 7 Valley States Within the Watershed of the Tennessee Valley. . . . . | 4 |
| II. | Land Use Conditions of the 125 Tennessee Valley Counties . . . . . | 10 |
| III. | Capital Structure of TVA Power Distributors. . . . . | 80 |
| IV. | Facts About Major TVA Dams. . . . . | 91 |
| V. | Cumulative Amount of Agricultural Fertilizers by the Tennessee Valley Authority . . . . . | 106 |
| VI. | Freight Traffic, Tennessee River, Calendar Year 1947. . . . . | 122 |
| VII. | Comparison of Number of Farms in 125 Valley Counties with Other Regions 1935-1945 . . . . . | 145 |
| VIII. | Comparison of Size of Farm in 125 Valley Counties with Other Regions 1935-1945 . | 146 |
| IX. | Comparison of Proportion of Tenancy in 125 Valley Counties with Other Regions 1935-1945 . . . . . | 148 |
| X. | Comparison of the Farm Population in 125 Valley Counties with Other Regions 1935-1945. . . . . | 149 |

TABLE PAGE

XI. Comparison of Changes of Farm Characteristics by Valley States 1935-1945 . . . . 151

XII. Comparison of Land Use in 125 Valley Counties with Other Regions 135-1945. . . 153

XIII. Comparison of Land Use by Valley State 1935-1945 . . . . . 155

XIV. Comparison of Acreage and Yield of Specified Row Crops in 125 Valley Counties with Other Regions 1935-1945 . . 158

XV. Analysis of Acreage and Yield of Specified Row Crops by Valley State 1935-1945. 160

XVI. Comparison of Hay Production in 125 Valley Counties with Other Regions 1935-1945 . . . . . 161

XVII. Analysis of Total Hay Production by Valley State 1935-1945. . . . . 164

XVIII. Comparison of the Acreage of Small Grain in 125 Valley Counties with Other Regions 1935-1945 . . . . . 165

XIX. Analysis of Acreage of Total Small Grain by Valley State 1935-1945 . . . . . 167

XX. Comparison of Livestock and Livestock Products in 125 Valley Counties with Other Regions 1935-1945 . . . . . 169

TABLE PAGE

XXI. Analysis of Livestock and Livestock Products by Valley State 1935-1945. . . . 171

XXII. Comparison of Value of Farm Products Sold and Used by Household in 125 Valley Counties with Other Regions 1940-1945 . . . . . 173

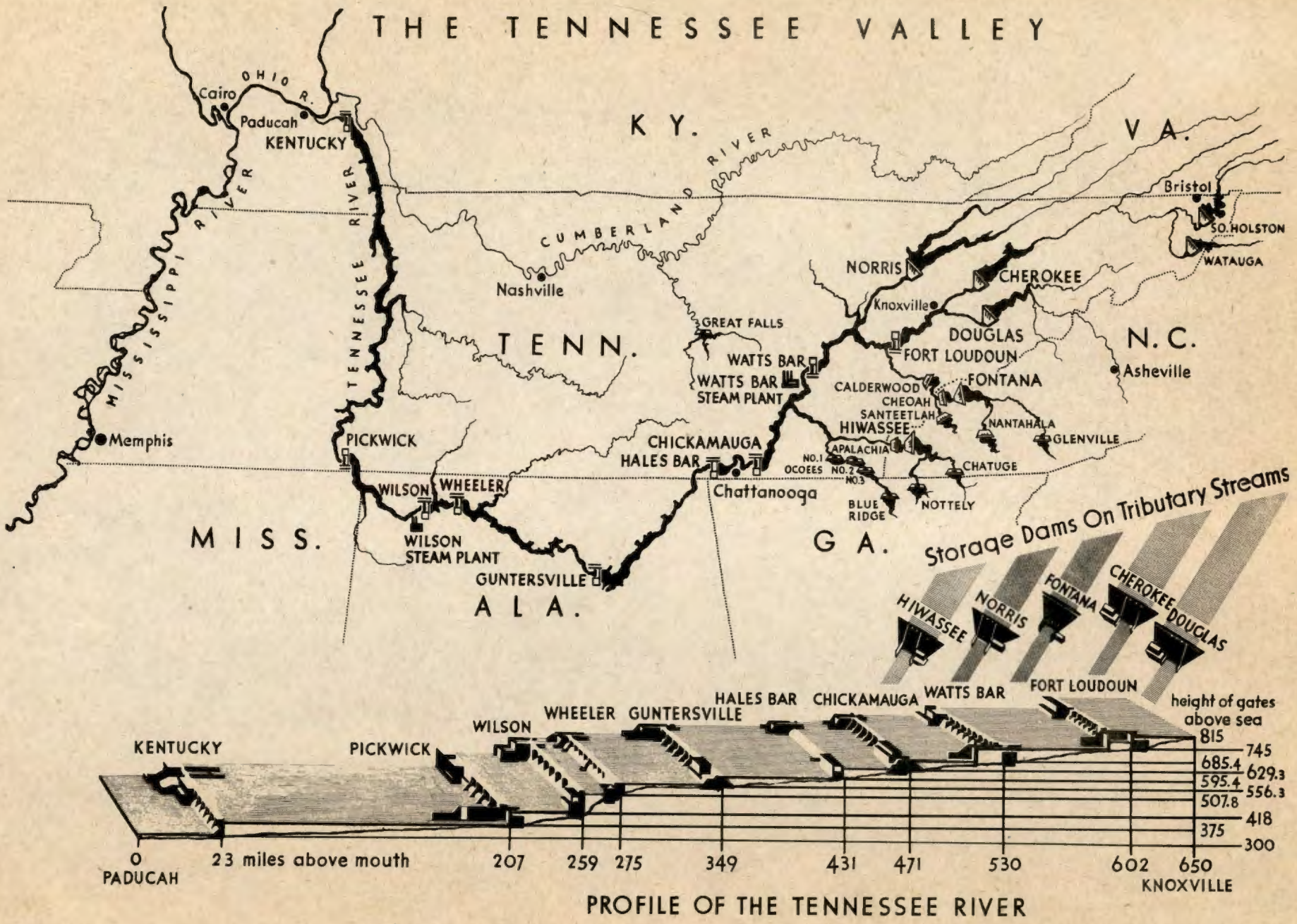
XXIII. Comparison of Value of Farm Products Sold and Used in Home, by Valley State 1940-1945 . . . . . 175

XXIV. Comparison of Value of Farm Property in 125 Valley Counties with Other Regions from 1935 or 1940 to 1945 . . . . 177

XXV. Comparison of Value of Farm Property by Valley State 1935 or 1940-1945 . . . . 178

XXVI. Comparison of Percentage Increases in Farm Facilities in 125 Valley Counties with Other Regions 1940-1945. . . . . 180

XXVII. Comparison of Percentage Increases in Farm Facilities by Valley State 1940-1945 . . . . . 182


THE TENNESSEE VALLEY
Cairo
OHIO R.
Paducah
KENTUCKY
MISSISSIPPI RIVER
TENNESSEE RIVER
KY.
CUMBERLAND RIVER
VA.
Bristol
SO. HOLSTON
WATAUGA
NORRIS
CHEROKEE
Nashville
Knoxville
GREAT FALLS
TENN.
DOUGLAS
FORT LOUDOUN
N.C.
WATTS BAR
WATTS BAR STEAM PLANT
CALDERWOOD
CHEOAH
FONTANA
SANTEETLAH
Asheville
HIWASSEE
NANTAHALA
GLENVILLE
Memphis
PICKWICK
CHICKAMAUGA
HALES BAR
APALACHIA
NO.1
OCOEES
NO.2
NO.3
CHATUGE
WILSON
WHEELER
Chattanooga
BLUE RIDGE
NOTTELY
MISS.
WILSON STEAM PLANT
GA.
GUNTERSVILLE
ALA.
Storage Dams On Tributary Streams
HIWASSEE
NORRIS
FONTANA
CHEROKEE
DOUGLAS
FORT LOUDOUN
WATTS BAR
CHICKAMAUGA
HALES BAR
GUNTERSVILLE
WHEELER
WILSON
PICKWICK
KENTUCKY
height of gates above sea
815
745
685.4
629.3
595.4
556.3
507.8
418
375
300
0
PADUCAH
23 miles above mouth
207
259
275
349
431
471
530
602
650
KNOXVILLE
PROFILE OF THE TENNESSEE RIVER

# CHAPTER I

## INTRODUCTION

TVA[1] will not be a new term again. Even though it is only fifteen years of age, its reputation has gone through the United States and also to the whole world. The existence of TVA has influenced many countries to give more attention to river valley problems and their development; e.g. China had a Yangtze River Valley plan in 1943. Hence TVA is not only a regional planning organization in the United States but also a pattern for international application.

### Purposes of This Study

In the short period of TVA's existence, all types and kinds of dissertations, monographs, articles and books have been written on TVA and its program. Yet a large part of these writings deals with engineering details of construction or operations affecting electricity. As to TVA's agricultural program and its effects, there are very few reports. The writer, in this report, has tried to study and develop this subject.

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[1]The abbreviation, TVA, for Tennessee Valley Authority, will be used in this paper.

He realizes that this subject is too large for his ability and also for the limited time available. But he thinks it will be better to know the whole story of TVA's agricultural program before making a detailed study of a particular field. China, in many regions, needs to develop her natural resources as the TVA has done here. If there will be a chance for him to do so, the writer would like to bring both TVA's spirit and its program to his own country.

There are many different opinions regarding TVA's program and its merit. Some people state that TVA has succeeded on its job; others believe that TVA has been of great expense to the United States Government. Which opinion is more reasonable? Has TVA succeeded in its agricultural program or not? Both of these are problems which the writer will consider in this paper.

## Scope of the Study

In the first part of this report, the writer will make a general review of TVA's history, purposes and characteristics. Later the agricultural program is studied. The last part is the indices of significant changes in agriculture due to TVA. In measuring progress of agriculture, secondary data, recomputed from the Census of the United States, are to be used. The census is a

general survey of the whole country, by which we can see the whole picture of the Tennessee Valley, and is also free from bias.

## Physical Conditions of Tennessee Valley Area

The Tennessee Valley or, more properly, the Tennessee River Drainage Basin or Watershed, is an area of very diverse conditions in physical environment, in character and distribution of population, and in economic levels. The river and its tributaries drain an area shaped like a butterfly, a thousand miles long with a very narrow waist and a maximum width of about 150 miles.[2] Its area is about 40,000 square miles or 25,562,000 acres. It contains 125 counties which cover all of 63 and part of 62 border counties in the seven states, namely Alabama, Georgia, Kentucky, Mississippi, North Carolina, Tennessee, and Virginia. The distribution of these counties by states and their area in the valley are shown in Table I.

## Tennessee River and Its Tributaries[3]

The main river, Tennessee River, begins just above

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[2]Herman Finer, The TVA Lessons for International Application (Montreal, Canada: The International Labor Office, 1944), p. 1.

[3]Tennessee Valley Authority, Norris Project (Washington, D. C: U. S. Government Printing Office, 1940), p. 1.

TABLE I

PERCENTAGE OF THE AREA OF 7 VALLEY STATES WITHIN THE WATERSHED OF THE TENNESSEE VALLEY

| States | No. of Counties | Acreage | Per Cent |
|---|---|---|---|
| Alabama | 15 | 4,185,140 | 16.4 |
| Georgia | 10 | 955,130 | 3.7 |
| Kentucky | 7 | 591,610 | 2.3 |
| Mississippi | 4 | 261,810 | 1.0 |
| North Carolina | 15 | 3,487,500 | 13.6 |
| Tennessee | 63 | 14,079,220 | 55.2 |
| Virginia | 11 | 2,001,790 | 7.8 |
| Total | 125 | 25,562,200 | 100.0 |

Source: Computed from the United States Census of Agriculture, 1945. Adapted from . . . .

Knoxville, Tennessee, at the confluence of the Holston and French Broad Rivers. It flows in a southwesterly direction through Tennessee, crosses Northern Alabama, forms a small portion of the northwestern boundary of Mississippi, and then flows north through Western Tennessee and Western Kentucky to empty into the Ohio River at Paducah, Kentucky, a distance of about 650 miles.

The larger tributaries coming out of the mountains--the Powell, the Clinch, the Holston, the French Broad, the Little Tennessee, the Hiwassee, gather their waters from countless resources among the high places, bring them down thousands of feet, and deliver them into the main river at elevations of seven or eight hundred feet. (See map attached).

Topography

The Valley area has a varied but mostly rough topography, ranging from wide alluvial valleys through rolling hills of varying height, to steep mountain slopes. In elevation, it varies from about 300 feet above sea level, at the confluence of the Tennessee and Ohio Rivers, to mountain peaks towering 6,500 feet above the sea.

Within the Tennessee Valley there are six great natural subdivisions of land: the mountain masses, 20.6% of the Valley; the ridges and valleys, 27.7% of the Valley;

the Cumberland plateau, 12% of the Valley; the Highland Rim, 16.5% of the Valley; the limestone lowlands, 16.5% of the Valley; and the low hills of the West Tennessee, 6.7%.[4]

Climate

I. Temperature

Winter temperatures vary from a minimum of -20° in the northeastern portions to 20° F. in the southern part. Summer temperatures are no less variable. The frost-free period varies from 150 days at high elevations in the northeastern mountains to 300 days in the southern lowlands.

II. Rainfall

The combined rainfall and snowfall varies from 40 to more than 80 inches of water annually in different sections, with an average of 50 inches. It is highest in the mountainous portions where slopes are steepest and danger of water damage greatest.

III. Growing Season

The growing season is varied according to the location within this Valley. It ranges from 150 days to 300 days. The shortest growing season is in the

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[4]Tennessee Valley Authority, Mimeograph.

eastern part of the Valley, while the longest is in the western part.

Soil

A completed soil map of this Valley has not yet been worked out. The soils of this area are very diverse, and these differences are related to the background of the physiographic divisions, or regions. In general, there are two different types which may be classified, residual and transported types.[5] The residual soils are those formed in place from rocks essentially like those now under the surface, and their characteristics are influenced greatly by the nature of the rocks from which they are formed. The transported soils are those moved from a former location to their present resting place through the agency of water, wind or gravity. All the soils are low in lime and seriously acid. They are widely deficient in phosphate and potash required by crops.

## Social and Economic Condition of Tennessee Valley

### Population

According to the Census of the United States in 1940, the total population in the 125 Valley counties was

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[5]Luebke, Atkins & Allred, "Types of Farming in Tennessee," The University of Tennessee Agricultural Experiment Station Bulletin No. 169, p. 194.

3,264,674 persons, of which 23.4% was urban and the remaining 76.6% rural population; about 52% resided on farms, leaving 24.6% in small towns and villages.[6] The human stock is preeminently white American, dominantly of English, Scotch, Irish, and German extraction, except in Alabama in the cotton section where the colored population is large and amounts to about 10% for the Valley as a whole.

Type of Farming

The types of farming vary greatly in the area. Certain districts follow livestock and grain production comparable to that of the corn belt. Other portions exhibit the intensive one-crop farming of the cotton belt. Tobacco, dairying, fruits and truck crops assume major importance in certain localities. In much of the more mountainous area, the agriculture is of the self-contained, self-sufficient, or subsistence type, with corn in small acreage as the dominant crop. There are all gradations between these types. These conditions result in part from the time of settlement and the characteristics of the colonial settlers and in part from differences in soils and topography.

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[6] E. O. Fippin, "Dynamic Agricultural Development in the Tennessee Valley" (unpublished report of the Department of Agricultural Relations, Tennessee Valley Authority, 1945), p. 6.

## Land Use Conditions

According to the United States Census of Agriculture 1945, there were 22,354,892 acres or 61 per cent of the land used in farms out of the 36,286,080 acres in the Valley counties. The uses of farmland are shown in Table II.

## Mining

Extraction of coal, found along the eastern face of the Cumberland Plateau, is the chief mining industry with many other mineral products--zinc, copper, iron, manganese, marble, limestone and cement rock, phosphate rock, and minor minerals in smaller quantities. Usable clays and other minerals also occur in quantities.

## Industry

The Valley is not heavily industrialized, Knoxville and Chattanooga being the chief centers, with new industries developing in the Valley around the combination of low-cost electrical power and the available soil and mineral products. The largest aluminum processing plant of the country using large quantities of electrical power is in the Valley but based on imported ores. Several chemical industries also making large use of electrical power recently have developed in the Valley such as processing phosphate and manganese.

TABLE II

LAND USE CONDITIONS OF THE 125
TENNESSEE VALLEY COUNTIES

| Land Uses | Acres | Per Cent |
|---|---|---|
| Open farmland | 13,627,245 | 61.0 |
| Woodland | 7,656,045 | 34.2 |
| Other land | 1,071,602 | 4.8 |
| Land in farm | 22,354,892 | 100.0 |

Source: United States Census of Agriculture, 1945.

Low Production and Low Income

The inevitable result of uneconomic land holdings, excess population, and sometimes poor soil also, has been a relatively low production per acre and per capita. The gross value of farm products per capita of farm population was $154 as compared with $362 for the whole of the United States.[7] With the lower income, the people living in the Tennessee Valley, on an average, have suffered a low standard of living.

[7]Computed by the Tennessee Valley Authority from Sales Management, April, 1935.

# CHAPTER II

## THE ESTABLISHMENT OF TVA

### The Antecedent of TVA--Muscle Shoals

TVA was established by Congress on May 18, 1933, with the responsibility to develop the resources of the Tennessee Valley. Before discussing either the what or the how of the TVA, some attention must be given to the why. Why was an organization set up with the unusual form and wide range of responsibilities? Why was the Tennessee Valley selected as the area of its operation? The answer to these questions requires the telling of a complicated story. For the TVA Act of 1933 was the end product of the chain of circumstances set in motion by the National Defense Act of 1916. The span between those two dates was in a real sense the formative period of the TVA, when under the name of the "Muscle Shoals Problem" congressional debate and public discussion shaped the solution which was ultimately adopted. It is impossible to understand the TVA without knowing what went on during that period.

### The Muscle Shoals Project

The basic factor in the situation was one of geography and topography--the fact that the Tennessee River

drops 134 feet in the stretch of 37 miles near Florence. The rapids, pools, and exposed rocks of this section of the river were known from the time of white settlement as the Muscle Shoals. Because it constituted an obstruction to navigation on the Tennessee River, Muscle Shoals received national attention as early as 1824 from the Secretary of War, John C. Calhoun.[1] The water power potentialities of the site were recognized before the turn of the century.

Between 1828 and 1890 various canal projects aiming to circumvent the shoals were undertaken under both federal and state auspices, but none of them was completely successful. In 1899 Congress gave its consent to construction of a dam at the shoals for a private power development, but this authorization was allowed to lapse unused. In 1906 the Muscle Shoals Hydroelectric Power Company (later taken over by the Alabama Power Company) began an attempt to secure congressional approval for a joint navigation and power project there, in which the government was to bear a substantial portion of the cost. The company, however, ran into the conservationist temper of the times, newly aroused under President Theodore Roosevelt, and

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[1]C. H. Pritchett, The Tennessee Valley Authority; A Case Study in Public Administration (Chapel Hill, North Carolina: University of North Carolina Press, 1943), p. 5.

despite a ten-year campaign failed to get control of this important water power site.[2]

So it was not until the First World War, when the United States experienced a sudden need for a domestic supply of nitrate, that the type of development to be undertaken at Muscle Shoals was finally determined. When the National Defense Act of 1916 was drafted, the problem of securing nitrates for munition and fertilizers was linked with the provision of adequate hydroelectric power. Section 124 of that Act authorized the President, by investigation to determine the best means for the production of nitrate sites on the navigable or non-navigable rivers for the exclusive use of the United States, and construct dams, locks, powerhouses or other types of plants for the generation of power to be used in the production of nitrates. These plants were required to be operated solely by the government and not in conjunction with any private enterprise.

Under this authority President Woodrow Wilson late in 1917 designated Muscle Shoals as the site for nitrate plant development, and authorized the construction of a gigantic dam there to supply power for the plants. Two

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[2]J. S. Ransmeir, The Tennessee Valley Authority; A Case Study in Economics of Multiple Purpose Stream Planning (Nashville, Tennessee: Vanderbilt University Press, 1942).

nitrate plants were constructed at Muscle Shoals pursuant to this program. The first was an experimental plant for the production of ammonium nitrate by the Haber process. Only one of the three units in the plant was entirely completed, and continuous operation was never achieved. The second plant was designed for the production of ammonium nitrates by the cyanamid process, but it did not get into production until after the War was over. The cost of this plant and appurtenant properties, including two steam generating plants to supply power until the dam was completed, was $69,000,000. At Nitrate Plant No. 1 the cost was almost $13,000,000.[3]

The combined navigation and power project at Muscle Shoals, the original plans for which were drawn up by the Corps of Engineers in 1916, called for the construction of three dams of which the one designed as Dam No. 2 (later named Wilson Dam) was the most important.[4]

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[3]The history of Muscle Shoals development up to 1925 is summarized in "Majority and Minority Reports of the Muscle Shoals Inquiry," House Doc. 119, 69th Cong. 1st Sess. 1925, pp. 11-37.

[4]Dam No. 1 was a small navigation dam, intended to provide a slack-water approach to the lower lock of Wilson Dam, and was completed in 1926. Dam No. 3 was to be located 15 miles upstream from Wilson Dam, completing the navigation project and adding to the power at Wilson Dam. This dam was not constructed until after the TVA had taken over the project, and is the present Wheeler Dam.

In 1922, the dam was finished and the first power was generated in September, 1925. The cost of Wilson Dam project was placed at around $47,000,000.[5]

The Legislative History of Muscle Shoals

National interest in Muscle Shoals dates back to the settlement of Tennessee and Alabama. The boom in internal improvements during the 1820's occasioned an interest in canalizing the Tennessee River around the treacherous shoals area. Numerous proposals and attempts were made during the next 75 years to eliminate this treacherous navigation hazard but the canals which were built provided only a partial solution to the problem.[6]

Towards the end of the nineteenth century with the development of the technique of electric power generation, Muscle Shoals as well as the other sites became of interest to the power trust as a potential water power site. The first bill[7] relative to utilizing the Tennessee River at Muscle Shoals for power production and most of

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[5]C. H. Pritchett, op. cit., p. 7.

[6]House Doc. No. 254, "A History of Navigation on the Tennessee River System," 75th Cong., 1st sess.

[7]H. R. 9335, 55th Cong., 2nd sess. 31 Cong. Rec. 3068.

subsequent legislation relative to Muscle Shoals during the period of about fifteen years emphasized both navigation and power production.

The power phase of the history of Muscle Shoals is tremendously important, but complete review of it is a sizable job in itself and might well be the subject of a separate investigation. This section is only concerned largely with fertilizer aspects which have close relation to the subject of this thesis.

In the period to 1916 efforts of private concessionaires to receive a grant of power rights at Muscle Shoals were unsuccessful for a number of reasons:

1. The conservation movement, spearheaded by Theodore Roosevelt[8] had a number of spokesmen in Congress who were reluctant to give away important public assets which existed on navigable streams including Muscle Shoals. Congress on the other hand was unable and reluctant to face the policy question of governmental participation. Hence the efforts of the conservationists in Congress resulted

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[8]See President Theodore Roosevelt's veto message of bill which granted consent "to N. F. Thompson and Associates to erect a dam and construct a power station at Muscle Shoals, Alabama." 36 Cong. Rec. 3071 ff.

in the legislative terms under which development was authorized which were unattractive to private promoters.

2. Electric power production and distribution was still a new industry in that time, and the tremendous opportunities were visualized only by the more radical promoters. The promoters were impelled to seek substantial aid from the federal government which of course was rationalized in terms of traditional interests of the government in navigation.[9]

It is interesting to note that during this period and in fact until the Smith Bill was introduced in 1916, little thought was given to public development of the power facilities. The outbreak of the First World War in the summer of 1914 had the effect of increasing the interest in Muscle Shoals from the point of view of the electro-chemical industry. A bill favoring private power development was introduced by Senator John V. Shields of Tennessee on January 10, 1916. The House, however, rejected the Shields Bill at this time.

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[9] House Doc. 20, 63rd Cong., 2nd sess, p. 51.

The Smith Bill[10] which started one line of thought that was ultimately to develop into TVA was introduced into the Senate by Senator Ellison D. Smith of South Carolina. This bill provided for public ownership and operation of nitrate facilities. It also provided that the President should designate the necessary water power sites or withdraw them from entry and that the Secretary of Agriculture was authorized to construct, maintain and operate the plants. Senator Smith was a cotton planter, so he was much interested in agriculture, of which nitrate fertilizer was one of those interests. His bill was reported favorably by the Senate Committee on Agriculture and Forestry recommending its passage. A number of changes were made and the section on government operation was made to read unequivocally against any plan[11] which provided for joint development with private and public capital.

But the parliamentary strategy which surrounded the progress of the Smith Bill from a bill supported by the Agriculture Committee to an amendment to the National Defense Act (as section 120) was considerably involved. The Senators separated into many groups possessing

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[10] S. 4971, 64th Cong., 1st sess.

[11] Senate Report 325, 64th Cong., 1st sess.

different opinions. When the amended National Defense Act, as passed by the Senate, reached the House, the lower body disagreed and asked for a conference. Even the conference was not able to iron out the differences that existed between the two houses. In the debate over this proposed substitution a number of amendments were suggested which sought to prevent the power from being sold at the switchboard to the advantage of private power distributors. With amendments, the National Defense Act was passed in June 1916. It became the basis for the Muscle Shoals development--Wilson Dam and Nitrate Plants No. 1 and No. 2.

Mr. Arthur Glasgow, fixed nitrogen director under Secretary of War Newton D. Baker, recommended that all the fixed nitrogen assets of the War Department be taken over for the operation by a government owned corporation. As a bill was drawn up giving effect to this plan, and was introduced in both Houses of Congress in November 1919, at the request of Secretary Baker; it made little progress in the Sixty-sixth Congress.

On July 8, 1921 Henry Ford responded with his famous offer, and proposed to buy the two nitrate plants and accompanying steam power plants for $5,000,000[12] and promised

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[12]The government subsequently realized $3,462,487 by sale of one of the steam power plants above. The Ford offers are contained in House Doc. 167, 67th Cong., 2nd sess. (1922) and House Report 143, 68th Cong., 1st sess. (1924).

to use them for the production of nitrogen and other fertilizer compounds to be sold at a profit not exceeding 8 per cent. In the meantime a variety of other offers came to the War Department, which turned them all over to Congress for consideration. However, none of the offers except Ford's was able to generate any considerable congressional or popular enthusiasm. The Ford proposition got a House majority in the Sixty-eighth Congress on March 10, 1924, and it was not accepted in the Senate which was due primarily to Senator George W. Norris.

Senator Norris first gave evidence of his interest in Muscle Shoals in 1921, when he introduced a bill providing for government operation of the properties there. His first bill was only tentative and was similar to Mr. Glasgow's bill. For the Sixty-eighth Congress he drew up a new bill which entirely separated the function of power production and fertilizer manufacture.[13] He proposed to turn over the nitrate plants to the Secretary of Agriculture, by whose staff they were to be operated for experimental purposes. This bill was substituted by the Senate Committee for the House-approved Ford bill, and when the Senate failed to choose between them during the 1924 session, Ford withdrew his offer.

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[13] Senate Report 678, 68th Cong., 1st sess. (1924), bill originally numbered S. 3214.

In December 1925, a commission which was appointed by President Calvin Coolidge made a report and recommended that all the properties be leased as a unit to a private operator for not more than 50 years, under certain safeguarding conditions. With this report before it, the Sixty-ninth Congress continued a rather half-hearted attempt to secure a satisfactory fertilizer lessee. On May 25, 1928 both houses accepted a bill[14] which was worked out by the House Committee on Military Affairs, but it was vetoed by President Coolidge. Another bill[15] was passed by the House on May 28, 1930 but it was not satisfactory to the Senate. Nine months later the two houses compromised on a measure which limited the leasing principle to the nitrate plants, and provided for outright government ownership and operation of the power plant; it was vetoed by President Herbert Hoover on March 3, 1931[16] because he believed that the nitrate plants could not be leased under the terms of the bill.

It is not necessary to review in detail the numerous offers which Congress considered relative to Muscle

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[14] House Report 2303, 69th Cong., 2nd sess. (1927), p. 2.

[15] House Report 1430, 71st Cong., 2nd sess. (1930), p. 9.

[16] Senate Doc. 321, 71st Cong., 3rd sess.

Shoals up until 1933. No less than 138 bills were introduced affecting the disposition of the Shoals. Broadly speaking, it is possible to identify four separate and distinct groups who were attempting to determine the disposition of the Shoals properties.

1. Those who conscientiously sought to protect the interest of the public at large in the power facilities at the Shoals, and who ultimately, when no adequate private offers were forthcoming, and in the face of the obvious trust and monopoly situation in the power field, favored public operation in the interest of power production. In 1921 this group was small and drew much of its support from the "conservationists" who were strongly opposed to private exploitation, but who were not yet convinced the public operation was the alternative.
2. Those who sought to get the advantages of the hydro-power facilities at the Shoals for the benefit of private corporations. This group in the "twenties" had considerable continuity with the interests that had attempted to secure this site in the early years of the century. They continued to

use various devices and subterfuges to get the concession they wanted, but offers to manufacture fertilizer were as suspect as their earlier offers to provide navigation. In general, the most serious offers were made by the large power companies which were already serving the area and which were ultimately to be combined in the vast Commonwealth and Southern Holding Company which later spearheaded the attack on TVA.

3. Those who sincerely wanted cheap fertilizer for the farmer. This group included those whose interest sprang from the fact that fertilizer represented one of the primary expenses of their farming operations, and those who had an agrarian mistrust of the fertilizer industry as another Wall Street controlled trust out to gouge the farmer. This group drew most of its strength from the South but their arguments had an appeal to other sections which made possible the ultimate coalition between this group and the group that was interested in conservation and public power development.

4. Those who wanted to gain control of the Shoals for private industrial development, principally electro-chemical industry.

In short, even though there were various offers and bills trying to dispose of Muscle Shoals, none of them was successful. The private promoters' bids were not fair to the government, so they could not satisfy Congress. The government corporation plan was not successful because the Muscle Shoals project needed a great deal of money. The leasing proposals which were vetoed by President Hoover in 1931 were also failures. As the failure in that period, a long voice would be raised which would point to the need for a plan of unified development for the Tennessee River. The eight Norris bills were introduced to authorize federal operation of the Muscle Shoals properties, the last of which culminated in the TVA Act.

The first four of the Norris bills were quite similar[17] the principal variation (from the point of view of fertilizer production) was as to who was to run the plants--a government corporation or the Secretary of Agriculture. The fifth version already began to reflect the

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[17] S. 2372, S. Report 678, 68th Cong., 1st sess.
S. 2147, 69th Cong., 1st sess.
S.J. 163, S. Report 1633, 69th Cong., 2nd sess.

ultimate TVA Act for the language of part of section 5 (a) and (b) of this bill introduced on December 5, 1927[18] is identical with that of the TVA Act; and was "pocket vetoed" by President Coolidge. His sixth bill was vetoed by President Hoover. The seventh Norris bill was also to fail because of the House consideration of the Hill bill.[19] The TVA Act as passed was the eighth Norris bill with additions made in the House version which served in the fertilizer sections to broaden the authorization under which TVA was to work.[20]

## Legal Basis

Congressional debate as to an appropriate use or disposition of Muscle Shoals finally was terminated in 1933 when, under the leadership of President Roosevelt, an act was adopted to establish a Tennessee Valley Authority. This authority was charged with the integration of the Muscle Shoals properties into a comprehensive program for conservation and improvement of the land and water resources of the entire Tennessee watershed. In many

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[18] Sj. 46, 70th Cong., 1st. sess. S. Report 228, 70th Cong., 1st sess. 69 Cong. Rec. 4635.

[19] H. R. 11051, 72nd Cong., 1st sess.

[20] Public Act No. 17, 73rd Cong., 1st sess., H. R. 5081, 48 Stat. 58.

respects this legislation was reminiscent of bills for public operation and development in the Tennessee Valley which Senator Norris had sponsored in Congress a decade earlier. Two aspects of the 1933 law, as amended, merit particular notice: it provides for administration of a comprehensive regional program by a decentralized agency of the federal government; and second, it emphasizes the possible cost-finding significance of the agency's power program.

The Enactment of the Tennessee Valley Authority Act of 1933

On April 10, 1933, however, a remarkable message[21] from President Roosevelt directed congressional attention to Muscle Shoals and recommended a comprehensive program for development of the resources of the entire Tennessee drainage basin. A new bill following his specifications was formulated by Senator Norris, and was introduced into the Senate the day after President Roosevelt's message. This bill provided:[22]

> (1) That the objectives of the proposed law should be flood control, national defense, promotion of agricultural and industrial development, improvement of navigation, development of hydroelectric power, reforestation and proper use of

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[21] House Doc. 15, 73rd Cong., 1st sess. printed in full in 77 Cong. Record 1423.

[22] S. 1272 and Senate Report 23, 73rd Cong. 1st sess.

marginal lands;

(2) That the Act should be administered by a Tennessee Valley Authority to consist of three members appointed by the President with the advice and consent of the Senate;

(3) That the Authority should carry on experiments in the production of fixed nitrogen or other fertilizer ingredients;

(4) That the Cove Creek dam on the Clinch River in Tennessee should be completed and interconnected with Dam Number 2;

(5) That the Authority should have power to construct additional dams, reservoirs and power works in the Tennessee Valley;

(6) That the Authority should have power to produce and sell surplus electrical energy, that in sales of energy preference should be given to publicly owned organizations and that to facilitate energy sales the Authority might construct power transmission lines;

(7) That the Authority should pay to Tennessee and Alabama five percent of its gross revenues derived from sales of power generated in each state;

(8) That the President might conduct surveys and demonstrations, and formulate plans for the general improvement of the resources of the Tennessee Valley region.

In the House a companion bill to the Norris Senate measure was sponsored by Representative Rankin (Mississippi), whereby primary consideration was given to a measure of somewhat more restricted scope backed by Representative Lister Hill (Alabama).[23] As compared with the Norris-

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[23] H. R. 5081 and House Report 47, 73rd Cong., 1st sess.

Rankin version the following aspects of the Hill bill are significant:

(1) It also provided for the establishment of a Tennessee Valley Authority dedicated to the prosecution of a multiple purpose program;[24]

(2) It proposed a vigorous program not only of experimental fertilizer production but also of large scale fertilizer manufacture.

(3) It sought to guarantee the economy of the proposed river improvement works by forbidding construction of projects unless it appeared that the demand for power which they would generate would be adequate to repay over sixty years the entire project investment and meanwhile to return two percent annually for interest charges assignable to power investment.[25]

(4) It qualified the Authority's power to construct transmission lines by a dangerous clause against paralleling existing lines. A qualification of this nature was an open invitation to harassing litigation against any program for power distribution.[26]

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[24]The clause of the Hill bill establishing the administering corporation provided as follows: "That for the purpose of maintaining and operating the properties now owned by the United States in the vicinity of Muscle Shoals, Alabama, in the interest of the national defense and for agricultural and industrial development, and to improve navigation in the Tennessee River, and to control the destructive flood waters in the Tennessee River and Mississippi River Basins, there is hereby created a body corporate by the name of the Tennessee Valley Authority of the United States."

[25]H. R. 5081, Sec. 1, quoted at 77 Congressional Record 2181-2185.

[26]House Report 47, 73rd Cong. 1st sess.

After due consideration the Hill bill was adopted by the House and sent to the Senate where Norris measure was adopted as a substitute. Conference was then held. At length, after a White House meeting of the conferees, a conference bill which preserved most of the features of the Senate measure but made concessions to the House in the matter of the Authority's fertilizer program, was accepted by both houses. As the Tennessee Valley Authority Act was passed on May 18, 1933, a program of public development and operation of water control projects in the Tennessee River Valley was born.

Amendments to the Act of 1933

Legal opposition from established power interests retarded the early progress of TVA power marketing and made necessary several clarifying and amplifying amendments of the original law. Further amendments were required to authorize the Authority to purchase certain privately owned power properties and to revise its payments in lieu of taxes. By 1941 most of the major problems of the shift to public ownership and operation of the power business in the Tennessee Valley appeared to be solved.

Legislation of 1935. When the infant public Authority undertook its power marketing problem, there already existed within the Valley numerous privately

owned power utilities with which it was almost inevitable that it would collide. In Congress, executive spokesmen of the utility system were in favor of the proposed TVA, but this endorsement had been conditioned by an urgent recommendation that the power activities of this new agency be limited to sale at the switchboard of energy made available by a comprehensive water program.[27] Thus while the TVA program for river control proceeded approximately according to schedule, injunctions and court proceedings against its transmission program, against the loans and grants which prospective TVA publicly owned customers had obtained from the Public Works Administration, and against the construction activities of TVA local distributors greatly retarded and at times almost reduce the scope for such legal controversy, Congress, in 1935, undertook to clarify the aims and power of the Authority.

The first amendment was the place of power generation and sale in the Authority's comprehensive program. The Authority should seek:

> "to regulate the stream flow primarily for the purposes of promoting navigation and controlling

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[27]United States Congress, House of Representatives, Muscle Shoals Hearing before Committee on Military Affairs, 73rd Cong., 1st sess., pp. 107, 118.

> floods. So far as may be consistent with such purposes, the Board is authorized to provide and operate facilities for the generation of electric energy at any dam for the use of the corporation and for the use of the United States or any agency thereof, and the Board is further authorized, whenever an opportunity is afforded, to provide and operate facilities for the generation of electric energy in order to avoid the waste of water power, to transmit and market such power as in this Act provided, and thereby so far as may be practicable, to assist in liquidating the cost or aid in the maintenance of the projects of the Authority.[28]

The rationale of the water control program was further defined by an amendment of the Authority's original grant of power to construct dams and reservoirs. It was now provided that:

> (The Authority) . . . . shall have power to construct such dams and reservoirs in the Tennessee River and its tributaries, as in conjunction with Wilson Dam, and Norris, Wheeler, and Pickwick Landing Dams, now under construction, will provide a nine-foot channel in the said river and maintain a water supply for the same, from Knoxville to its mouth, and will best serve to promote navigation on the Tennessee River and its tributaries and control destructive flood waters in Tennessee and Mississippi River drainage basins; and shall (have) power to acquire or construct powerhouses, power structures, transmission lines, navigation projects and incidental works in the Tennessee River and its tributaries, and to unite the various power installation into one or more systems by transmission lines.[29]

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[28]Act of August 31, 1935 C. 836, sec. 5, 49 Stat. 1076, 16 U. S. C. A. 831 h-1.

[29]Act of August 31, 1935 C. 836, sec. 2, 49 Stat. 1075, 16 U. S. C. A. 831 c.

The gist of these two amendments was that in both the construction and operation of its water control system TVA should give primary consideration of the requirements of navigation and flood control but that, in so far as it might be consistent with these objectives, hydroelectric power should be generated so as to make a maximum contribution to liquidation of the costs of the comprehensive system.

The second amendment was the matter of power rate policy. Already the Authority had prescribed unusually low resale rate schedules in its contracts with publicly owned distribution agencies, and a violent controversy was raging as to whether or not revenues from the power program either to the Authority or to its "contractors" were adequate to cover power cost. At length, an amendment which expanded the Authority's functions of cost finding and cost reporting stated further:

> It is hereby declared to be the policy of this Act that, in order, as soon as practicable, to make the power projects self-supporting and self-liquidating, the surplus power shall be sold at rates which, in the opinion of the Board, when applied to the normal capacity of the Authority's power facilities, will produce gross revenues in excess of the cost of production of said power and in addition to the statement of the cost of power station as required by section 9 (a) of the "Tennessee Valley Act of 1933" the Board shall file with each annual report, a statement of the total cost of all power generated by it at all power stations during each year,

> the average cost of such power per kilowatt hour, the rate at which sold, and to whom sold, and copies of all contracts for the sale of power.[30]

In addition to the provisions of the 1935 amendatory legislation already noted several other clauses to modify or extend the Act of 1933 were adopted. Among these were the following:

a. The Authority was empowered to prescribe resale rate schedules in its contracts with power distributors.[31]

b. It was authorized to assist by grants of credit, states, counties, municipalities and non-profit organizations desiring to purchase existing distribution facilities in order to contract for TVA power. To finance such grants TVA was empowered to issue up to $50,000,000 in bonds.[32]

c. It was given veto power over the construction of any subsequently proposed works

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[30]Act of August 31, 1935, C. 836, sec. 8, 49 Stat. 1077, 16, U. S. C. A. 831 m.

[31]Chapter 836, sec. 6, 49 Stat. 1076, 16 U. S. C. A. 831 u.

[32]Chapter 836, sec. 7 and 9, 49 Stat. 1076, 1078, 16 U. S. C. A. 831 k-1, n-1.

upon the Tennessee River or any of its tributaries.[33]

The Legislation of 1939. Despite the clarifying effect of 1935 legislation upon the original TVA Act, the Authority remained locked in battle for existence until in 1939 it finally won a favorable decision from the United States Supreme Court in the Tennessee Electric Power Company case.[34] During this period, the Authority took over many small privately owned power properties at negotiated prices, but very little progress was made toward those belonging to the Commonwealth and Southern system which was lying in the heart of the TVA natural service area. On February 4, 1939, when TVA was victorious in the "Eighteen Power Company" (or TEP) case. Agreement was announced that the Tennessee Electric Power Company should transfer its electrical properties in the state of Tennessee to TVA and its associated non-profit municipal and co-operative distributors for a consideration of $78,600,000.[35] Since TEP properties included such facilities and were to be bought as a unit, the Authority requested Congress to amend its bond power to

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[33]Chapter 836, sec. 11, 49 Stat. 1079, 16 U. S. C. A. 831 y-1.

[34]306 U. S. 118, 59 Sup. Ct., 366, 38 Law, Ed. 543.

[35]Wall Street Journal, Feb. 4, 1939, 1:1. New York Times, Feb. 5, 1939, 1,1:4.

permit these otherwise unauthorized uses of borrowed funds. After bitter debate Congress complied with this request, and the Tennessee Electric Power deal was consummated.

The Tax Amendment of 1940. The most important problems of tax adjustment were not in the distribution field but in the fields of generation and transmission where properties were turned over to the TVA. The only provision for tax payments in the 1933 TVA Act which directed the Authority to pay five per cent of its gross revenues from power sales to the states in which the marketed energy was generated had two major weaknesses: (1) general increases in tax rates after 1933 tended to call for a greater TVA contribution by 1940; (2) this payment was directed only to the states and was apportioned among them according to relative kilowatt-hours of TVA energy generated. And no consideration was given to relative assessment value of TVA properties within states or to relative revenues contributed to TVA by consumers in the different states. Nor was any authorization granted for payments to counties or local governments.[36]

In order to face the unsatisfactory nature of the "tax" section of the Original TVA Act, the Authority

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[36]Herman Finer, op. cit., pp. 154-158.

worked out a suggested revision whereby larger total payments in lieu of taxes would be apportioned according to a carefully stated formula among the different states and counties affected by TVA operations. Incorporated into the Norris-Sparkman bill, the plan was introduced late in the first session of the 76th Congress.[37] After debate in Congress, the new tax section was adopted.[38] For the first year in operation of the new tax provisions, combined total "tax" payments by TVA system properties were $3,288,137.[39]

## The Movement of Forces

Besides the legal basis, it is essential, then, to glance at the movement of forces which led to the establishment of the TVA, since this deepens the appreciation of its significance. There were five forces, as stated by Herman Finer, leading to the establishment of the TVA fifteen years ago.

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[37] S. 2925 and H. R. 7424, introduced on June 31, 1939. See 84 Congr. Rec., 10460-10463.

[38] See Tennessee Valley Authority Hearing before Subcommittee of House Committee on Military Affairs on S. 1796, 76th Cong. 1st sess. (1939), p. 298.

[39] "Annual Report, 1941," and "Financial Statements for Fiscal Year Ending June 30, 1941 of Municipalities and Cooperatives Purchasing Power from TVA," (Knoxville: Tennessee Valley Authority).

1. The first was a local interest in the navigability of a short stretch of the river and a wider, but still local, interest in protection from floods in an area continually liable to them.

From the City of Florence to Muscle Shoals, Alabama, in that distance of a 37-mile stretch of the Tennessee River, the river falls 134 feet and is bestrewn with natural obstacles which prevented traffic in an age when roads and railways were not available as alternatives. As a consequence congressionally authorized surveys of nationally important roads and canals were made. The federal authority in 1827 made a grant of land to the State of Alabama for the improvement of Colbert and Muscle Shoals for navigation by means of a canal. Many subsequent local demands for such assistance by federal grants and new works were made to Congress. The deterioration of the railroads during the Civil War added urgency to the provision for river transport, while the United States Army Corps of Engineers observed that important manufactures could have developed out of the local deposits of minerals if navigation had improved.

As to the flood control problem, the location of the river basin in relation to the line of travel of the torrential downpours and storms, and the peculiar

topography, there is a continuous likelihood of high, damaging floods. The time honoured and very widely applied remedies for this were the abandonment of large areas of valuable land and other property and the building of levees. Here again, piecemeal activity in the lower reaches, without cooperation or coordinated works on the upper, could not adequately achieve the object sought. It began to be seen that the Mississippi, the Ohio and the lower Tennessee would have to be safeguarded by means of planned controls, more comprehensive and placed further back, by a radically different method of water control. Thus for more than a hundred years before 1933, the improvement of the Tennessee River was an object of local and then national concern. But many schemes of river improvement, being mostly small and largely unrelated, were correspondingly inadequate. In 1904 Congress authorized certain private interests to establish a dam at Hales Bar, finished in 1913, to canalize the 33-mile stretch of the river below Chattanooga. The river was further improved by the Widow's Bar lock and dam, authorized in 1916 and completed in 1926. The Wilson Dam, authorized in 1916 and completed in 1925, provided a first-class canalized waterway for 15.5 miles over the Muscle Shoals. In 1914, 1922, 1925, 1927 and 1928 Congress authorized comprehensive surveys of the river.

The survey was begun in 1928 by the United States Army Corps of Engineers, and was completed in 1930. The report of this survey led Congress to introduce in the Rivers and Harbors Act of July 3, 1930, an authorization for a 9-foot navigation channel project for the 650-mile stretch of river from Knoxville to Paducah, under which the Wheeler Lock was built by the Army Engineers.

Thus, the broadening of concern from mere local interest to a national interest, the inadequacy of individual local and partial projects, the lack of private enterprise, drive and funds on a sufficient scale, were among the tendencies which ultimately produced the TVA. The need for the wider authority was shown by the increasing range of interests involved.

2. The second was the national interest in the electric power development.

In 1891 the first hydroelectric plant was built in the United States, introducing a new factor in the situation. In 1898 an Alabama representative submitted a proposal to Congress for consent to the construction of an electric plant at Muscle Shoals by a private corporation. This franchise was granted by Congress to the Muscle Shoals Hydroelectric Power Company in 1899, but lapsed, partly owing to disputes between the Federal and State Governments regarding their respective shares of

the charges to be paid by the company for its privileges. A similar franchise was vetoed by President Theodore Roosevelt in 1903 and again in 1908, on public grounds. For public opinion was developing emphatically against the unconditional alienation to private bodies of natural resources, especially water power, which held such promise for the daily welfare of the people. The grounds of this opinion were that resources either were not exploited at all by private concessionaires or were not so planned as to give the maximum development of navigation or power, and so were lost to the public as a property which would help to defray the cost of navigation, flood control and other improvements.

3. Thirdly, the policy of conserving national resources led to the idea of an appropriate area of government with multiple and integrated purposes.

At the turn of the century, the factor of conservation, or the planned preservation of natural resources which were being usefully exploited, and of integrated multiple purpose development entered the stream of tendencies. The conservationist movement beginning with a memorial to Congress from the Ammerican Association for the Advancement of Science in 1874, resulted in the creation of federal administrative departments to take

care of the forests, to cope with drainage, irrigation and power,[40] and in many other subsequent measures down to the present time, including indeed, the TVA. Linked with this movement was the recognition of the reciprocal value of the several uses of naturally integrated resources. Again a United States Army Engineers' report of 1914[41] took a considerable step towards the idea of a public and integrated development authority in the specific case of the area of retarded development around Muscle Shoals, the general prosperity would be greatly increased if its mineral, forest and agricultural resources were full exploited by the use of the power now wasting in the Tennessee River. It was rare, after this report, to hear any opinion voiced except in terms of "the region" or "the basin."

In 1930, the comprehensive plan for the complete development of the water resources of the Tennessee River for navigation, power development and flood control was reported by the Army Engineers. This report presented

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[40]Among the many works of which the United States Reclamation Service was in charge was the building of the great Boulder Dam on the Colorado River (1928) and the Bonneville and Grand Coulee Dams on the Columbia River. Reclamation Handbook (Conservation Bulletin No 32) (Washington, D. C: United States Department of Interior, Bureau of Reclamation), 1942.

two plans for development of the Tennessee River. The first was a combination power, navigation and flood control plan requiring the construction of seven high dams at an estimated cost of approximately $250,000,000. The second plan called for a series of 32 low dams with locks at an estimated cost of $75,000,000 which should give only inferior navigation facilities, and would develop no power. As already mentioned, the project authorized in the Rivers and Harbors Act of July 3, 1930 for a 9-foot channel in the Tennessee River was based on the recommendations of the Army Engineers.

All these developments were important, but for the transformation of ideas, however sound and socially beneficial, into governmental action, a precipitative agent is needed. In the case of the TVA, this was the creation in 1917 of a government nitrate and electricity producing plant at Muscle Shoals for war purposes and its consequent problems, and later the interest in economic planning developed by the great depression that started in 1929.

4. Fourthly, the national defense plants, built in 1916 at Muscle Shoals, raised the problem of their further use.

The National Defense Act of 1916 included a section "to provide for the fixation of atmospheric nitrogen by the development of water power or any other means necessary

to establish an adequate supply of nitrogen," and appropriate the funds for the necessary construction. The purpose was to make the nation independent of foreign sources of nitrogen in time of war. This proposal attracted the interest of various economic groups and also arrested the attention in Congress and Government. The problem whether this proposal was to be worked under a private corporation, government organization, or by leasing to private economic group had been violently debated in the House and Senate many times between the period of 1916 to 1932. This debate has been stated in section 1 of this chapter. But this problem was one factor which helped to precipitate the ideas already described, and others yet to be brought into account, and in the end was to produce the TVA.

5. Finally, the economic depression, beginning in 1932, sharpened the already developing realization that governmental economic planning was essential. This factor in the social situation leading up to the establishment of the TVA was the idea of planning coupled with experience of distress in the great depression.

The development of the idea of governmental planning of large regions or of the economic life of a whole

nation was influenced by the First World War, by European development in the aftermath, and by the idea of public works in the great depression,[42] such as the Colorado and agricultural and industrial progress was established in November 1922 and accepted by Congress in December 1928; the State of Pennsylvania began a survey of the problem of "giant power" (published in February 1925) to relate a power policy with industrial, farm and railroad development in May 1923. In May 1923, the Legislature of New York State established the Commission of Housing and Regional planning, with wide power of research, to study housing needs and to prepare plans to meet them.[43]

The depression had plunged the United States into widespread and bitter distress, all the more painful because the public institutions for dealing with unemployment and business failure were hardly developed in any of the states and were practically non-existent in the Federal Government. Both Senator Norris and President Roosevelt believed in the planned use and development of

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[42] Unemployment and Public Works, Studies and Reports, Series C, No. 15, Public Works Policy, No. 19 (Geneva: International Labour Office, 1931 and 1935).

[43] "Report of the Commission on Housing and Regional Planning," State of New York, May 7, 1926.

national resources for the benefit of "the forgotten man." President Roosevelt was in favor of regulating electric power utilities by means of public ownership, of conservation and reforestation. After touring the Muscle Shoals area with Senator Norris in January 1933, he outlined the scope and particulars of his plans for the area to the press, describing the project as a great experiment which might provide 200,000 jobs. He believed that the multiple purpose project would be self-sustaining. This was also one of the forces to establish the TVA.

## CHAPTER III

## THE PURPOSES AND CHARACTERISTICS OF TVA

### Purposes of TVA

The purposes of TVA were pointed out very clearly in President Roosevelt's message of April 10, 1933,[1] asking Congress to pass the legislation:

> The continuous idleness of a great national investment in the Tennessee Valley leads me to ask the Congress for legislation necessary to enlist the project in the service of the people.
>
> It is clear that the Muscle Shoals development is but a small part of the potential public usefulness of the entire Tennessee River. Such use if envisioned in its entirety, transcends mere power development, it enters the wide fields of flood control, soil erosion, afforestation, elimination from agricultural use of marginal lands, and distribution and diversification of industry; in short, this power development of war days leads logically to national planning for a complete river watershed involving many states and future lives and welfare of millions. It touches and gives life to all forms of human concerns.
>
> I therefore suggest to the Congress legislation to create a Tennessee Valley Authority--a corporation clothed with the power of Government but possessed of the flexibility and initiative of a private enterprise. It should be charged with the broadest duty of planning for the proper use, conservation and development of the natural resources of the Tennessee River drainage basin and its adjoining territory for the general social and economic welfare of the Nation. This Authority

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[1] H. R. Doc. 15, 73rd Cong. 1st sess.

> should also be clothed with the necessary power to carry those plans into effect. Its duty should be the rehabilitation of the Muscle Shoals development and the coordination of it with the wider plan.
>
> Many hard lessons have taught us the human waste that results from lack of planning. Here and there a few wise cities and countries have looked ahead and planned. But our nation has "just grown." It is time to extend planning to a wider field, in this instance comprehending in one great project many states directly concerned with the basin of one of our greatest rivers.
>
> This in a true sense is a return to the spirit and vision of the pioneer. If we are successful here we can march on, step by step, in a like development of other great natural territorial units within our borders.

From this Message to Congress, the concern for the social welfare of the people of the Valley is evident, solid and genuine. There is already included a prevision of achievement and of the kind of governmental instrument necessary to its purposes. It is not only to develop the idleness of the resources of the whole Tennessee Valley but also to extend planning to a wider field through the whole United States.

The Tennessee Valley Authority Act was approved on May 18, 1933, and amended on August 31, 1935, and also in 1939 and 1940.[2] The purposes of the TVA are also defined very clearly in its Act as follows:[3]

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[2]See Chapter II of this thesis.

[3]H. R. 5081, No. 17, 73rd Cong. 1st sess.

> To improve the navigability and provide for the flood control of the Tennessee River; to provide for reforestation and the proper use of marginal lands in the Tennessee Valley; to provide for the agricultural and industrial development of said Valley; to provide for the national defense by the creation of a corporation for the operation of Government properties at and near Muscle Shoals in the State of Alabama, and for other purposes.

The Board of Directors of TVA is given very broad powers to construct such dams and reservoirs on the Tennessee River and its tributaries as will provide a 9-foot channel from Knoxville to the mouth of the river, in order to promote navigation and control floods in the Tennessee and Mississippi drainage basins (see section 4 (j), as amended).

The Act calls for a wide fertilizer program, authorizing the Board to contract for the production of fertilizers; to manufacture and sell fertilizer; to arrange for its use and distribution in new forms through cooperation with farm agencies, and for the prevention of soil erosion; to use and equip the plants at Muscle Shoals for these purposes; to undertake laboratory and practical experiments (see section 5, as amended). The declared policy of the Act is "to improve, increase, and cheapen the production of fertilizer" (section 11). The Board is further directed:

> To make studies, experiments and determinations to promote the wider and better use of electric power for agricultural and domestic use . . . in the application of electric power to the fuller and better balanced development of the resources of the region (section 10).

The Board is expressly directed "in the operation of any dam or reservoir . . . . to regulate the stream flow primarily for the purposes of promoting navigation and control floods." It is authorized, "so far as may be consistent with such purposes," to generate and sell power "in order to avoid the waste of water power," and "to assist in liquidating the cost or aid in the maintenance of the projects of the Authority," (section 9 (a), as amended).

> The policy of the Government . . . . is . . . . declared to be . . . . that the projects shall be considered . . . .primarily for the benefit of the people of the section as whole and particularly the domestic and rural consumers . . . . at the lowest possible rates . . . .in such manner as to encourage increased domestic and rural use of electricity. Municipalities and cooperatives are given preference in these sales (section 11).

The power projects are to be made self-supporting as soon as practicable (section 14, as amended).

The President is authorized to make surveys and "general plans" for the Tennessee Basin and adjoining territory.

> As may be useful to the Congress and to the several states in guiding and controlling the extent, sequence, and nature of development that may be equitably and economically advanced through

> the expenditure of public funds, or through the guidance or control of public authority, all for the general purpose of fostering an orderly and proper physical, economic, and social development of said areas.

Cooperation is authorized with states and municipalities affected (section 22).

The purposes are redefined as flood control; navigation; maximum generation of power consistent with these two; proper use of marginal lands; reforestation; and

> The economic and social well-being of the people living in the said river basin (section 23). This act shall be liberally construed to carry out the purposes of Congress to provide for the national defense, improve navigation, control destructive floods, and promote interstate commerce and the general welfare (section 31).

In short, the purposes of the TVA as defined in its Act are essentially the adoption of a policy of unification for the various lines of the development in the Tennessee Valley. Its purposes are embodied with varying degrees of success in the actual operations of the Authority, and are providing the only known method for solving a network of problems that are by their nature beyond the scope of private initiative, or of state and local government. So, we say the purposes of the TVA are complex rather than single.

## The Characteristics of TVA

### Organization

Based upon the Tennessee Authority Act in 1933, the TVA was organized. But its years' of experience developed a sufficient knowledge of the nature of its problems to permit shaking its organization down into a closer correspondence with the needs of the work. Hence, the TVA has reorganized many times.

The organization of TVA has been described very clearly in its Organizations Bulletin, February 6, 1948, in the following sentences:

> The Board of Directors is the governing body in which all powers are vested by statute. The Board establishes general policies and programs; reviews and appraises progress and results; approves individual actions and projects which are of major importance or which otherwise require Board approval, the annual program and budget, and action involving important external relations; and establishes the basic organization through which programs and policies are executed.
>
> The General Counsel is responsible for advising the Board on legal matters and serves as Secretary to the corporation.
>
> The Office of the General Manager is the principal administrative office. The General Manager is responsible for directing, coordinating, and executing programs, policies and decisions adopted by the Board, subject to such controls as the Board may from time to time establish, for bringing before the Board matters requiring its consideration or approval; for submitting information and recommendations on TVA affairs to the

Board; for directing and organizing TVA activities and approving delegations and major staff appointments; for assisting the Board in presenting the budget to the Bureau of Budget and Congress; and for performing duties otherwise appropriate to the administration of TVA.

The Office of General Manager includes the Budget Staff, Information Staff, and Washington Staff, which aid the General Manager in expediting, coordinating, and disposing of current business, with particular reference to preparation of the budget and official reports, public information, and liaison with Congress and Federal agencies.

Assistance to the General Manager and the several offices in management services is provided by the Personnel, Finance, Law, and Property and Supply.

The Division of Personnel advises and assists in the development, administration, and appraisal of policies and standards in the field of selection, classification, compensation, and training of personnel; employee relations; organization; administrative relations; educational relations; and related aspects of personnel administration.

The Division of Finance advises and assists in the development, administration, and appraisal of policies relating to finances, accounting, and auditing.

The Division of Law handles all legal problems which arise in connection with the business of TVA and advises and assists on legislative matters relating to TVA activities and on negotiations to which TVA is a party.

The Division of Property and Supply advises and assists in the development, administration, and appraisal of policies relating to the acquisition, transfers, and disposal of real and personal property; and to the provision of transportation, and office services and analysis of office methods.

The Office of Chief Engineer develops and executes an integrated plan of water control for the Tennessee River and its tributaries; plans, designs and constructs reservoirs, dams, locks, hydro and steam generating facilities, and other structures required for TVA's water control program; directs the integrated control of water operations of the reservoir system for all purposes and provides other engineering, architectural, and construction services as required.

The Office of the Manager of Power formulates and recommends engineering and other plans, policies, and programs and executes plans and programs relating to the generation, transmission, and utilization of electric power which is developed incident to TVA's integrated water control program; and operates water control facilities at completed dams as directed by the Office of the Chief Engineer.

The Office of the Chief Conservation Engineer formulates, recommends, and carries out or coordinates programs of research in chemistry, engineering, and metallurgy related to utilization of agricultural, mineral, and forest resources, and for national defense, designs and operates chemical plants for fertilizer production and national defense; formulates, recommends, and carries out or coordinates programs for the development of agriculture, forestry, conservation of fish and wildlife, watershed protection, and the improved agricultural use of natural resources, including the development, testing, and demonstration of new and improved forms of fertilizer; and develops and demonstrates improved equipment and engineering practices for the farm and farm home.

The Office of Manager of Reservoir and Community Relations formulates, recommends, and executes or coordinates plans relating to development of effective navigation use of the river and to the general industrial and commercial growth of the region, including the economic possibilities of specific business enterprises; and cooperates with appropriate agencies in matters relating to the administration, finances and physical development of communities affected by the TVA program, and the development of recreational resources. It formulates, recommends,

and executes or coordinates plans for use of the reservoirs and reservoir lands, and for the administration of village properties; and for the health and safety of employees and the public affected by TVA activities.

In order to recognize the relationship between each office or division, a chart is included on the following page.

All the agricultural programs are undertaken in the Division of Agricultural Relations which is under the charge of the Office of Chief Conservation Engineer. Here we need to have a special description about this division.

The Division of Agricultural Relations formulates and recommends objectives, policies, and plans, and executes approved proposals aimed at improving the use of the agricultural resources of the Tennessee Valley, including the control and use of water on the land, and at improving and protecting the fertility of the soil. It advises the Chief Conservation Engineer on these phases of the TVA resource development and conservation program.

The division sponsors tests and demonstrations of the proper use of TVA-developed fertilizers in improved farming systems. It encourages effective use of agricultural engineering equipment, agronomic practices and modern methods of food processing. In planning, executing, and evaluating the work the Division of Agricultural Relations undertakes, sponsors or participates in studies,

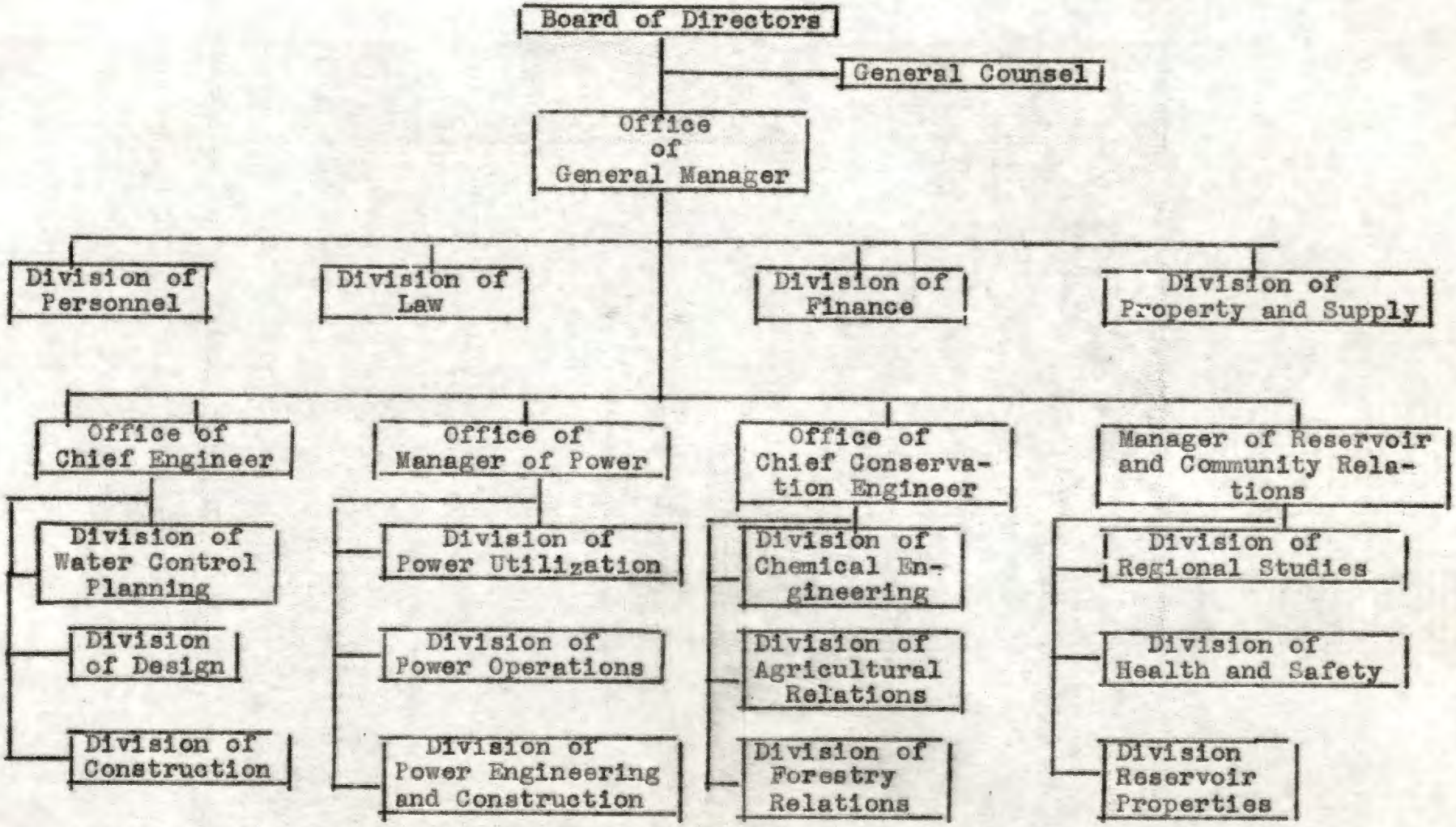



Chart I. Organization of Tennessee Valley Authority

analyses, and experimental research in agricultural economics, agricultural engineering, soils, agronomy, farm management, food processing, nutrition, and other phases of agricultural science. The division integrates its work with that of other TVA divisions participating in resource development and water control activities, subject to the direction of the Office of the Chief Conservation Engineer in planning, initiating, and appraising policies and programs. In carrying out this program the division collaborates with the United States Department of Agriculture, land-grant agricultural colleges, associations of farmers, and other public and private organizations and individuals.

The organization of the Division of Agricultural Relations may be illustrated by Chart II.

Administration

In a number of respects, however, the Tennessee Valley Authority has been regarded among those interested in the broader problems of administrative organizations as a particularly significant development. It may be observed that while the particular functions which the TVA performs may not be unique taken out of their context and considered separately. The total program is probably unique with the respect to the way in which those functions are knit together administratively to

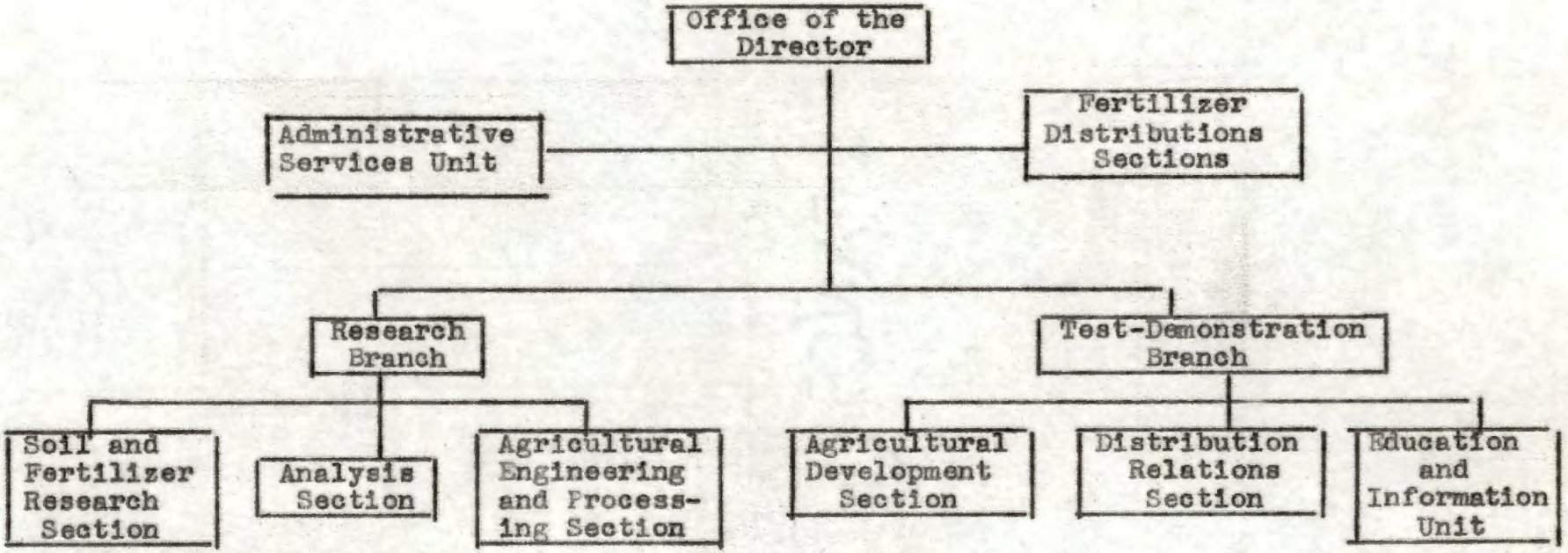



Chart 2. Division of Agricultural Relations

the end that a program, regional in character but unified and comprehensive in scope and result.

The general characteristics of administration of TVA may be abstracted as follows:

1. It has been given by Congress a corporate form and a degree of autonomy and flexibility appropriate to its functions and total program. There has been provided a point of coordination among the various specialized activities which is close to the job being performed and readily accessible to the area and the people affected. It is not as the traditional structures of federal services which have a significant contribution to the problem of highly centralized administration centered in Washington. This means also, of course, that the Authority is of special interest to experts in the field of public administration because in its internal structure the problems of coordination among specialized activities are more clearly apparent, and their resolution in a balanced program can be more directly observed.

2. The Authority's program is a dynamic one. In other words, its activities are largely non-repetitive. Its functions are constantly changing. Several years ago the development of a river was being planned. Thereafter the emphasis was on a vast construction program. Today and tomorrow we find increasing emphasis upon the operations of the system of dams and power facilities for the fullest multiple use for the public. It will be emphasis upon commerce on the river and perhaps upon recreation development hitherto unexpected. This rapidly changing program has dramatized the importance of administration and its ready adaptation.

3. The Authority has paid to the so-called "management's service functions." These are the functions which experts have often described as horizontal; they stretch out across the major line activities no matter what that activity may be. These so-called horizontal needs have been recognized as requiring special attention; specialized departments have been set up to develop and maintain high standards with respect to the management services. Theoretically, of

course, it would have been possible for each major operation to have developed its own office service unit, its own budget office, its own procurement system, its own personal system etc. The recognition of these functions organizationally has, however, contributed to the development of standards and the refinement of managerial policies.

4. It is a "grass roots" or decentralized administration of federal functions.[4] There are three essential characteristics of this administration as defined by David E. Lilienthal. First, it is one in which the great number of decisions are made in the field. Therefore the field officers must be selected, trained and supervised with a view to increasing their capacity to decide questions on the ground. Secondly, a decentralized administration must develop as far as possible the active participation of the people themselves. Thirdly, it must coordinate in the

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[4]David E. Lilienthal, The TVA: An Experiment in the "Grass Roots" Administration of Federal Function (Knoxville: Tennessee Valley Authority), pp. 12-15.

field the work of state and local governments, aiming toward common objectives. As the TVA's agricultural program, test-demonstrations cooperating with the agricultural experiment stations and land grant colleges, is an illustration of "grass roots" administration.

5. As to the personnel--the TVA has its own special system which is well known as the merit system. By this merit system, the Authority can secure a defense against political influence and increase the efficiency appropriate to its special and local tasks. This is a very good system which can be widely applied to many organizations in any country, especially China.

Now that we have a general idea of the characteristics of the TVA, we will discuss the administrative operations.

The Board of Directors. Supreme in the direction of the affairs of the corporation is the Board of Directors. The Statute says (section 2 (g)) that "the Board shall direct the exercise of all the powers of the Corporation." Under this Board there are some thousands of employees, the basic principles of whose selection are stated in

the Statute. As to the organization of departments and committees and councils and the hierarchy of staff by which the executive work of this public enterprise is achieved, the Statute is almost silent. On the basis of Section 3 of the Statute, the Board of Directors is free to establish such organization to fix responsibility and promote efficiency. It also shall without regard to the provisions of civil service laws applicable to officers and employees of the United States, appoint such managers, assistant managers, officers, employees, attorneys and agents as are necessary for the transaction of its business, fix their compensation, and define their duties.[5]

There are three directors, one being chairman. The Board is appointed by the President by and with the advice and consent of the Senate.[6] Directors are removable by Congress at its discretion; they are removable by the President if found guilty by him of applying political tests or qualifications in the appointment and career of officials of the Authority or of acting in such matters otherwise than on a basis of merit and efficiency.[7] The

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[5]Tennessee Valley Authority Act, Section 3.

[6]Ibid., Section 2 (a)

[7]Ibid., Section 6.

directors are appointed for a term of nine years, but the terms of appointment are arranged so as to stagger the term of each director, those first taking office having been given terms of three, six and nine years. The three full time directors are all legally with equal power though one is chairman. Any two directors are empowered to carry on the affairs of the corporation in the absence of the third director from board meetings.

In order to exclude political appointments and influence, and to secure a clear objective devotion to the purposes of the corporation, Congress set three provisions:

1. The long term of office which is longer than that of most commissioners in other government corporations would exclude partisanship.
2. The fact that the Statute had placed the general power of dismissal in the hands of Congress to some degree encouraged the hope that the Chief Executive would not intrude.
3. The staggering of the terms of office of the directors was designed to produce a consistency and continuity in policy which

may not be possible if the reappointment of all directors fell at one time.

As regards administrative competence, Section 2 of the Statute lays down three stipulations. First, no director may have a financial interest in any public utility corporation engaged in the business of distributing and selling power to the public, nor in any corporation engaged in the manufacture, sale or distribution of fixed nitrogen or fertilizer or any ingredients thereof, nor in any business that might be adversely affected by the success of the corporation as a producer of concentrated fertilizers or electric power. Secondly, members of the Board are not, while in office, to engage in any other business, but are to devote themselves to the work of the corporation; that is, they are to be full time officials. Thirdly, all members of the Board shall be persons who profess a belief in the feasibility and wisdom of this Act.

The General Manager and Consultants. The general manager is the chief administrative officer to whom all departments and officials report. He is responsible for the execution of policies and decisions of the Board subject to the latter's control. He prepares the Board's agenda, issues notice of its meetings, presents subject for Board action, and notifies the departments of the

Board's policies and decisions. It is his business to keep the Board currently informed of activities of the Authority, to make recommendations and to prepare special reports upon the Board's request. He exercises considerable unifying power and managerial authority, through his duty to prepare and submit to the Board the annual budget estimates. His duty is not only the tasks of administration themselves, but rather to evoke from the various experts in the employ of the Authority the best that they can give in terms of advice and action.

The work of the Authority and the planning of the Board has been much assisted by the calling in of expert consultants. These have sometimes acted as a committee, as with the committee of three public utility experts who examined and reported upon the problem of allocation of dam costs or when hydraulic engineering experts have been called in to give their opinion on the planning of a dam or some particularly difficult phase of its construction. There are very many instances in which an individual who is master of a special field has been consulted; for instance, on labor policies, legal questions, power finance policies, health and safety problems, tax studies, engineering, employee training, and so on. Advice is sought in connection either with the preparation of a policy or with technological improvements in processes or, again, in the form of a general review and appraisal of work already in progress.

Presidential and Congressional Controls. From the standpoint of control, the TVA's most continuous connection with the federal government is probably that between it and the President of the United States. The Statute gives the President two rights of supreme importance to the TVA: to appoint or remove the three directors by and with consent of the Senate, and to designate which among them shall be chairman.[8] The President continually intervened with encouragement, counsel, assistance, and sometimes command, on major issues, the principles of which were: (a) the speed and magnitude of the construction program; (b) the power policy, especially in relation to the speed and extent of replacement of the private utilities by public enterprise; (c) the annual financial appropriations to the TVA; (d) the relationship between the TVA's power program and economic investment in public utilities in general; (e) the relationship between the TVA and other power enterprises of the United States Government, and the main lines of TVA administration and its standing and prestige before the public. In addition to this, he encouraged the use of the Authority's general social and economic planning powers, helped to defend it against political intervention in its appointment of employees and gave encouragement by occasional ceremonial visits, and legislative

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[8] Ibid., Sections 2 and 6.

support when the TVA required amendment of its power. The President also has to direct that the assistance, advice and service of any officer, agent or employee of any executive department or independent office of the United States shall be rendered to the corporation for the better execution of its duties. Legally, the TVA is clearly put under control of the President.

As to the congressional control, it is far greater than that of the President, for the Congress established the TVA and has the power to abolish it. The power is exerted through five principal means:

(a) Congress has the power to expand, contract, amend, vary and quash the functions and procedures of the Authority by the process of legislation.

(b) It has the power to grant or deny financial provision and to apply the procedure, the accounting, and examination of estimates this entails.

(c) There is a power to call for the report which the Statute requires to be submitted to Congress by the TVA.

(d) There is a power of criticising the administration of the TVA in the course of debate in Congress.

(c) There is a power of investigation.

Federal Administrative Departmental Controls.

(a) Audit by the United States Comptroller General.

Audit is one of the most usual and essential means of government control over the actions of departments, agencies or offices. The TVA Statute provided that the United States Comptroller General, an officer of the federal government, should audit the accounts of the TVA not less frequently than each fiscal year, and through his own personnel.[9]

The TVA claimed that it was exempt from the Comptroller General's audit, as other United States Public Corporations were exempted by statute or by judicial decision, because Congress had intended to endow the Authority with the flexibility of private enterprise. The TVA was prepared to (and actually did) institute an annual audit of its own by a reputable firm of private accountants. But the Comptroller General meant that he would apply to the Authority certain rules applicable to ordinary United States Government departments which would stultify the Authority's progress. In 1935 the TVA's claims to flexibility in its purchasing methods were recognized in an amendment to the Statute. It received exemption from the normal rule of advertisement and acceptance

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[9] Ibid., Section 9 (b).

of the lowest tender and was allowed to act "in a manner common among businessmen" in the case of emergencies, repair parts and equipment required for supplies or services previously furnished or contracted for, and items under $500; and it also permitted them to take into account the quality of the goods and services and the bidder's standing as regards finance, responsibility, skill and reliability. The TVA was also given the right to see any report made by the Comptroller General with a reasonable opportunity to examine his criticisms and compile a statement thereon to the President and Congress.

Another amendment of the law in June 1941 made the TVA specially liable to audit by the Comptroller General, but at the same time allowed it considerable latitude. The Authority was authorized to spend and make contracts and agreements upon such terms and conditions as it thought necessary, including the final settlement of all claims and litigation so long as the Board considered these to be necessary for the carrying out of its statutory powers.

(b) The Federal Power Commission

The state obliges the TVA to keep complete and accurate books of accounts.[10] Further, in order to enable

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[10] Ibid., Section 8 (b).

data to be accumulated on which to base policy regarding the production and sale of electricity and chemicals, the TVA is obliged to keep accounts showing the major components of its costs,[11] to be kept "according to such uniform system of accounting for public utilities," and the Federal Power Commission may prescribe. This Commission is authorized to prescribe accounting systems for public utilities who are directed to comply therewith; the TVA and similar agencies are included.[12] The rules of the Federal Power Commission require annual reports and the TVA accordingly has an elaborate system of plant records to satisfy this requirement. In its contracts the Authority requires its own municipal and cooperative customers to follow the Federal Power Commission's system of accounts for agencies distributing electricity and to furnish an annual report.

Collaboration with Other Government Agencies. When the TVA came into the Tennessee Valley with its own powers and responsibilities, it met a number of governmental agencies already there. The problems of overlapping, some gaps, actual conflict of purposes and uneconomical, inefficient or inconvenient administration due to the

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[11] Ibid., Section 14.

[12] Public Utilities Act, 1935.

non-use of the most suitable agency for the function being fulfilled, occurred very easily. How the TVA faced these problems and solved them is discussed. The TVA, as already noted in connection with its agricultural, power and health program has accordingly entered into scores of contractual relationships with states, counties, cities, local cooperatives, federal departments, academic, civic, and scientific institutions, for specific purposes, and has thus sought to produce a continuous and dynamic interconnection. In the procedure, TVA stands in the center as it were, as the coordinator of activity, usually giving the lead and planning the joint attack on the connected programs of the region, from the earliest stage on. Its contractual arrangements often imply a sharing of expense with the federal agencies or a financial reimbursement, on conditions, from itself to the local agencies, whether states, counties, or universities.

The TVA has solved the problems of cooperating with other governmental agencies based on the following principles: (a) selection of the agency whose legal authority and practical capacity are most appropriate to the power to be exercised; for example, The Bureau of Mines to conduct the later stages of the TVA's ceramic clay researches; (b) clear definition of the share of responsibility assumed by the TVA and its colleague agencies, as illustrated by the Memorandum of Understanding

on farm demonstration or on public health; and (c) where the statutory responsibility for a function is the TVA's and especially where the Authority pays a grant-in-aid for farm demonstration and reimbursement for the public health and research in other fields.

Financing of the TVA's Activities

The financing activities of TVA's multi-purpose system have two chief aspects: (1) the TVA's own financial basis and (2) the financing of the municipalities and cooperatives which are the distributors of TVA's electric power.

TVA's Own Financial Basis. A large part of TVA's funds are provided by Congressional appropriations in much the same way as the ordinary activities of the government, that is, by coming to Congress annually, offering estimates of needs and then, after cross-examination, being awarded what Congress believes to be adequate. If there are no such provisions, as stated in Section 26 of the Act, TVA, itself, has the power to issue bonds to obtain the necessary funds. Because it thereby obtains freedom and business latitude; and because, being obliged to make provision for the payment of interest on outstanding bonds and the repayment of the debt, it would acquire business independence and its own internal

disciplinary power over its operations and administration based on an independent balance sheet. Again there was the TVA's need for a sufficient sum to acquire the property of the private power companies. But Congress considered that if the TVA was given a loan raising power, bond-issuing power, it would escape from Congressional control over its activities. Therefore the principal means of financing came by Congressional appropriations, but it is provided a flexible use as described in Section 26 of the TVA Act and only very small latitude was allowed in the bond-issuing or loan-raising power of TVA.

(a) Congressional Appropriations

TVA has been obliged to come to Congress annually for its financial provisions, except for an annual sum of $1,000,000 secured to it by the Statute, which it may retain for the specific purpose of defraying emergency expenses and ensuring continuous operation. Up to June 30, 1948, TVA had received through Congressional appropriations, $777,329,978.[13]

The annual appropriations have been provided as lump sums in general terms. The lump sum method differs very widely from the usual method of appropriation by

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[13] Financial Statements for the Fiscal Year Ended June 30, 1948 (Knoxville: Tennessee Valley Authority), p. 7. ($41,106,708 of this amount are transfers of property).

minute itemization of purposes and sums for expenditures. It permits financial flexibility within each year. It has often been challenged in the Appropriation Committee of Congress and in the course of debate in Congress itself, yet there remains what may be called a respectful, if not unreserved, acceptance by the majority of the legislators that, since the TVA is so much of a business enterprise and has so many experimental and developmental features, it should be given a reasonable latitude. This does not mean that the TVA has been or is able or desires, to do as it pleases without submission to Congress' wishes. In fact, it, like every other agency of the United States Government, is subject to the Budget and Accounting Act of 1921 and is obliged annually to submit its estimates to the Bureau of the Budget. That is at the three stages--upon inspection of the estimates by the field agent of the Bureau of the Budget, the Director of the Bureau, and the President--the Authority is obliged fully to justify its request by evidence or argument, and is given ample opportunity to offer alternatives.

Consequently, the TVA has given special attention to the problem of displaying the work of the Authority to show clearly to Congress its purposes, its plans and the expenditures in relation to each. To each program, project and item, a very painstaking explanation is

furnished, together with statistical tables and other supporting material, so that Congress may have a thoroughly vivid and realistic account of what the Authority is doing and hopes to do. However, the Congress does not vote the budget in this itemized way, but as a lump sum. And also, any portion of that lump sum on any activity authorized by the provisions of the TVA Statute, as a matter of law, is not bound by the clearly expressed intent of the Appropriation Committee. The result is that the Authority has a practical power of what is known in public financial parlance as diversion of moneys to and from the different items, to an extent never tolerated in the case of ordinary government departments. Examples of Congressional reductions in the amounts asked for by TVA are very limited and, in addition, have only a restricted interest. What is interesting is: firstly, that there is the regular sum of $1,000,00 already mentioned to meet unforeseen contingencies, and secondly, that in its estimates the Authority naturally makes an allowance for contingencies, which the Congress may and usually does accept.

Another special characteristic of the elasticity of TVA's fund is that the Authority was permitted to retain its earned revenues from power and other services it might render, and was not, as in the case of other

government agencies, required to turn the money over monthly to the United States Treasury. In the ordinary case, funds, after being deposited in the Treasury, cannot be drawn out to spend without a special Treasury warrant which must be based upon a legislative appropriation. Section 26 of the TVA Act required the Authority to pay into the Treasury not all its proceeds, but only its net proceeds, and even so to pay them in only at the end of each calendar year. The latitude thus permitted the Authority can be appreciated when it is considered that the definition of net proceeds in Section 26 means proceeds after deducting from gross revenues "the cost of operation, maintenance, depreciation, amortization and an amount deemed by the Board as necessary to withhold as operating capital or devoted by the Board to new construction." Under this system, the TVA has actually established and maintained a "TVA Fund" in the Treasury of the United States, in which are placed all the moneys appropriated to it for the year, and the receipts which come to it in that fiscal year. Thus the Authority has been accorded a considerable amount of latitude.

(b) Bond-issuing

Section 15 of the TVA Act authorized the Board to issue serial bonds to the amount of $50 millions

running 50 years to 3-1/2 per cent, to be issued and sold on the credit of the United States with the approval of the Secretary of the Treasury. The money was used "in the construction of any future dam, steam-plant or other facility to be used in whole or in part for the generation of transmission of electric power." In 1935, the Authority asked for a power to issue $100 millions in 50-year 3-1/2 per cent, but the proposal was rejected by Congress. In 1939, the Authority again asked Congress for a further power to borrow in order to buy out the principal system operating in its area (the Tennessee Electric Power Company) and other smaller systems. Congress did not give the Authority power to borrow an unlimited amount, nor even to raise $100 millions as it wished, but deliberately meted out only the right to raise the exact amounts required for the relevant contracts. Under Section 15 (c) therefore, amending the Statute, the TVA was authorized, with the approval of the Secretary of the Treasury, to issue bonds not to exceed $61 million and the purposes and amount were specifically stated.[14] The bonds were not to bear more

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[14]Not more than $46 million for the Tennessee Electric Power Company and Southern Tennessee Power Company; not more than $6.5 million for certain named parts of the Alabama and Mississippi Power Companies; not more than $3.5 million for rebuilding, replacing and repair of the utilities thus purchased; not more than $3.5 million for construction of various facilities to connect the properties bought with the TVA's power system; and not more than $2 million for loans to public distributors to buy any of the property concerned.

than 3-1/2 per cent interest, nor to be sold at such price as would return more than 3-1/2 per cent on the investment. They were guaranteed by the Treasury. The power to issue bonds was limited to January 1, 1941 except for refunding purposes (TVA Act, Section 15 (c)). Up to June 30, 1948 the total amount of bonds issued by TVA was $65,072,500 of which $11,072,500 had been repaid leaving a balance outstanding of $54,000,000.[15]

Financing TVA Power Distributors. TVA, on the other side, is also permitted to make some investment in its power distributors. TVA municipal and cooperative distributors had on June 30, 1948, a combined capital of roughly $193 million. It is shown in Table III.

There are three ways for distributors of TVA power to finance themselves; one is sale of bonds to the public, a second is by borrowing from Federal agencies, and the third is use of accumulated revenues.

(a) Sale of Bonds to Public

No special observation needs to be made on the capital derived from the sale of bonds to the public by the municipalities and cooperatives. They are secured by the electric revenues and the interest rate from 2.32

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[15] Financial Statement for the Fiscal Year Ended June 30, 1948 (Knoxville: Tennessee Valley Authority), p. 5.

TABLE III

CAPITAL STRUCTURE OF TVA POWER DISTRIBUTORS
(TO JUNE 30, 1948)

| Particulars | | Dollars |
|---|---|---|
| Long-term debt | | $99,054,457 |
| Rural Electrification Administration | $47,190,856 | |
| Bonds held by public | 51,863,601 | |
| Current Liabilities | | 12,827,417 |
| Capital | | 22,701,427 |
| Contributions from consumers for retirement of debt: | | |
| year ended June 30, 1948 | 1,813,972 | |
| prior years | 8,108,466 | |
| Investment of municipalities | 1,005,656 | |
| Memberships of cooperatives | 2,343,902 | |
| Grants from Federal Agencies | 8,972,806 | |
| Other capital contributions | 456,625 | |
| Accumulated net income | | 58,635,854 |
| | | $193,219,152 |

Source: 1948 Annual Report, Tennessee Valley Authority, "140 Municipal and Cooperative Distributors of TVA Power," (Knoxville: Tennessee Valley Authority), p 1-1.

to 4 per cent.[16] Up to June 30, 1948 the total amount of bonds held by the public was $51,863,601.

(b) Borrowing from Federal Agencies

The TVA Statute gave the Authority a variety of powers to make loans to its power distributors. The right to "dispose of surplus power" and "make contracts" and "to exercise such incidental powers as were necessary or appropriate" to the express powers permitted the transfer of real and personal property to municipalities and cooperatives on an installment payment plan to enable them to purchase and distribute TVA power. Then secondly, the TVA had the power, for a period of five years from the enactment date, of "extending credit" to the states, municipalities, counties and non-profit organizations for the purpose of enabling such agencies to acquire, improve and operate distribution facilities as well as inter-connecting transmission lines, preserve existing distribution systems as going concerns and avoid their duplication.[17]

Under both the methods mentioned above, the TVA has made loans to municipalities and cooperatives, in

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[16]Herman Finer, op. cit., p. 191.

[17]Under Section 15 (a) the TVA issued, on January 9, 1939, only obligations in the amount of $272,500 bearing interest at 3-1/2 per cent, due 1948, and sold at par to the United States Treasury. This amount was to enable two electric cooperatives to acquire properties and construct transmission lines.

the form of advances of property[18] work or cash. They were made at the rate of 3-1/2 per cent; were subject to amortization in the time and by the periodical payments set by the TVA; and were secured by a lien on the properties and the revenues of the debtor.[19] Also the distributors of TVA power borrow large amounts of money from the Rural Electrification Administration. Up to June 30, 1948, the total amount of loans made by TVA and still outstanding on June 30, 1948, $84,832--that will be one municipality and two cooperatives; while made by REA, $47,190,856.[20]

(c) Use of Accumulated Revenues

The accumulated revenues are also a large portion of the fund for the distributors of TVA power. Up to June 30, 1948, there were $58,635,854 accumulated revenues which have been continued to be used by the power distributors.[21]

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[18]Another power with the same effect has also been used, though sparingly. This is the strictly time-limited power possessed by the TVA under Section 4 (k) to dispose of real property. Here, however, in order to honour fully Section 12 (a) the TVA did not purchase or construct property for the purpose of resale.

[19]Such loans must be approved by the Federal Power Commission.

[20]1948 Annual Report, Tennessee Valley Authority, op. cit., Exhibit I, p. 1.

[21]Ibid.

## The Electricity Program

The power of the river can do tremendous damage when it is not controlled. But as the dams were built by TVA along the Tennessee River and its tributaries, to bring the river under control, the installation of electric generators has fashioned the power of the river into a usable resource, capable of accomplishing tremendous good. In the first year of its operation, the Authority produced 395,482,000 kilowatt hours of electricity.[22] In 1948 the production of electricity has been increased to 15,000,000,000 kilowatt hours[23] of which 12,244859,000 kilowatt hours have been sold.[24]

### The Power System

There are 26 major water control projects on the Tennessee River and its tributaries and one on a tributary of the Cumberland River. These projects are coordinated and operated as parts of a single multi-purpose river control system. More than 6,000 miles of high tension transmission lines connect these projects with each other, with several TVA-operated system power plants, and with neighboring power systems. Among the hydro-electric

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[22]Herman Finer, op. cit., p. 26.

[23]Financial Statement, op. cit., p. 11.

[24]Annual Report for 1948, op. cit., p. 1.

projects, except eight plants belonging to the Aluminum Company of America and directed by TVA under a long-term agreement, all the production and regional transmission facilities are owned and operated by TVA. The combined generating capacity of all the plants in the system exceeds 2,500,000 kilowatts.

The Establishment of a Policy

When the TVA started to make electricity, there were at least two great difficulties: first it faced severe competition with many utility companies operating in the Tennessee Valley; and secondly, there was the possibility that the powers vested in it by the Statute in respect to electricity were unconstitutional, and therefore liable to challenge and perhaps to invalidation, at the instance of the utility companies. Both of these factors retarded the Authority's progress.

However, the Authority attacked its first problem by establishment of a general policy in August, 1933. The main points are as follows:[25]

> (1) The business of generating and distributing electric power is a public business.
>
> (3) The interest of the public in the widest possible use of power is superior to any private interest. . . .

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[25] Ibid., 1934, p. 24.

(4) Where there is a conflict between public interest and private interest in power which can be reconciled without injury to the public interest, such reconciliation should be made.

(5) The right of a community to own and operate its own electric plant is undeniable. This is one of the measures which the people may properly take to protect themselves against unreasonable rates. . . .

(6) The fact that action by the Authority may have an adverse economic effect upon a privately owned utility should be a matter for the serious consideration of the Board in framing and executing its power program. The most important considerations are the furthering of the public interest in making power available at the lowest rate consistent with sound financial policy, and the accomplishment of the social objectives which low-cost power makes possible. . . .

(9) Every effort will be made by the Authority to avoid the construction of duplicate physical facilities or wasteful competitive practices. . . .

(10) Accounting should show detail of costs and permit a comparison of operation with privately owned plants to supply a "yardstick" and an incentive to both private and public managers.

According to its policy, the Authority immediately set to work to market the power produced at Wilson Dam. It made agreements with the Commonwealth and Southern Corporation and its subsidiaries in Alabama, Tennessee, Georgia and Mississippi. At this stage, the power distribution program of the Authority was carried out by agreement, mainly over the transmission lines of private

power systems. The Authority quickly proceeded to the construction of its own transmission system. The Authority proceeded also to the encouragement of local cooperative power associations in various areas, large and small, as self-governing non-profit corporations.

By the middle of 1934 the power companies realized that the TVA intended to go beyond the generation of electricity and its sale to them; they, therefore, stood up and sued TVA in the courts. But the Authority was upheld by the courts in a series of judgments culminating in complete vindication of its power and the constitutionality of the Statute in 1939 in the case known as "The 18 Companies Case."[26]

Wider Distribution of the Power--A Local Function

By 1941, the TVA had become almost wholly responsible for the generation and transmission of electric power in Tennessee, and in many parts of Mississippi, Alabama and Georgia. While the power production and transmission facilities are operated and maintained by TVA, the distribution of the power to the ultimate consumer is a function of local government and cooperative electric systems. TVA now sells power at wholesale to

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[26]H. N. Martell, "Legal Aspects of the TVA," George Washington Law Review, 1939, pp. 983-1012.

140 municipal and cooperative distributors who in turn distribute power to some 850,000 consumers.[27] The contracts with the 140 locally-owned distribution systems contain the retail rates to be charged and provide for maintenance of a uniform system of accounts. The contracts also provide for the disposition of surplus earning in a way that assures that the benefits of a successful distribution operation will go to the consumers of electricity.

By the low rate of power (the wholesale rate is only from 0.2-0.4 cent per KWH, and the retail rate is from 0.2-3.0 cents per KWH), many new industries have been established in the Tennessee Valley. By the technical and financial assistance, the number of rural customers using electricity has increased nearly seventeen times since TVA was established. According to TVA's Annual Report of 1948, more than half of the farms in the TVA area are now electrified as compared with 28 per cent in 1945, and 3 per cent in 1933 when TVA was created.

## Construction of Dam

All the powers and potentialities of the TVA have their source in the dams and the chain of lakes made by

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[27]Annual Report, op. cit., p. 2.

them as they hold impounded the rains and the tributary waters. The TVA's first and fundamental responsibility was to build the dams.

The Planning and Unified Building

The first problem to the TVA in construction of the dams was whether they should be low or high, for this involved the issue whether the generation of power should be included or not. In 1930, two alternative plans were available, supported by the investigations and recommendations of the Corps of Engineers of the United States Army. One plan, which focused its attention on navigable depth alone, provided for 32 low-lift dams that would provide a narrow navigable channel not nine but about six feet deep. This should have no value for flood control, would have subjected river traffic to erratic levels at the piers, and, of course, would have produced no electricity. The second plan envisaged the construction of seven high dams which, together with those already existing at Wilson Dam, Lock No. 1, and Hales Bar, would give the depth required, and would have the additional advantages of flood control and permit the production of electric energy, as well as help to regulate the navigable depths in the Lower Ohio and Mississippi Rivers. Finally, the Authority chose the second plan, even though its estimated cost was much higher than the first one.

The construction of dams is not merely the problem of pouring so many tons of concrete into the river at a given place. A comprehensive process of planning has to precede the decision where, when, and how to build. The multiple purposes--navigation, flood control, electricity and malaria control by fluctuation of the water level--are in contest for the water of each and all the dams. The land which has to be bought may be very valuable for agricultural purposes; roads and roadways may cross it, and cities and villages may be built on it. Hence a balance of the economy to be produced by the dams requires careful adjustment of site and level of the taking line, with the aid of air mapping and stream-flow prediction. In due order of time, the land must be surveyed and bought, and families, and even churches and cemeteries, must be relocated.

The Result

In 1933, the first dam, Cove Creek, now known as Norris Dam, was started. Further, the Authority took over responsibility for maintenance and operation of Wilson Dam, which had been constructed by the Army Engineers. Later in October 1933, the construction of Wheeler Dam was transferred from the Army Engineers to the TVA and the plans expanded by provision for the

production of electric current, in order to increase employment. Then the other dams were constructed under TVA's planning continually year by year. Up to December 1948, there were 35 dams under TVA's control of which 24 dams were constructed by TVA; 5 dams are the property of the Aluminum Company of America whose operation is coordinated with TVA's system; and 6 dams were transferred from the Army Engineers. The principal features of these dams are listed in Table IV.

As to the shape of the dams, they are for the most part similar in general plan. Each has a concrete gravity section across the river channel, with a lock at one end, a spillway section for control of flood flow in the center, and a powerhouse at the other end. From the ends of the concrete section, earth-fill embankments, protected from wave action by a rock blanket, extend across the flood plain to the hills.

Special Characteristics of TVA

TVA has its own special characteristics which are quite different to other government agencies. First TVA has the essential idea which was listed by David E. Lilienthal as follows:

-- a federal autonomous agency, with authority to make its decisions in the region.

-- responsibility to deal with resources, as a unified whole, clearly fixed in the regional agency, not divided among several centralized federal agencies.

# FACTS ABOUT MAJOR TVA DAMS

**(FOR GENERATING CAPACITIES SEE OTHER SIDE)**

| Main River Projects | River | State | County | | Maximum Height (Feet) | Length (Feet) | Total Storage (Acre-feet) | Useful Storage (Acre-feet)[b] | Length of Lake (miles) | Area of Lake (Acres)[d] | Original River Bed (Acres) | Shore Line of Lake (Miles)[d] | Constr. Started | Closure | Constr. Completed (1st Unit) on Line) | Estimated Cost[e] | Main River Proj. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kentucky | Tennessee | Ky. | Marshall Livingston | J | 206 | 8,422 | 6,002,600 | 4,010,800 | 184.3 | 158,300 | 23,800 | 2,380 | 7- 1-38 | 8-30-44 | 9-14-44 | 116,900,000 | Ky. |
| Pickwick Landing | Tennessee | Tenn. | Hardin | | 113 | 7,715 | 1,091,400 | 418,400 | 52.7 | 42,800 | 9,600 | 496 | 3- 8-35 | 2- 8-38 | 6-29-38 | 43,900,000 | Pick. Land |
| Wilson | Tennessee | Ala. | Lauderdale Colbert | J | 137 | 4,862 | 562,500 | 52,500[c] | 15.5 | 15,800 | 8,800 | 154 | 4-14-18 | 4-14-24 | 9-12-25 | 49,400,000 | Wilson |
| Wheeler | Tennessee | Ala. | Lawrence Lauderdale | J | 72 | 6,342 | 1,150,400 | 347,500 | 74.1 | 67,100 | 17,600 | 1,063 | 11,21-33 | 10- 3-36 | 11- 9-36 | 46,600,000 | Wheeler |
| Guntersville | Tennessee | Ala. | Marshall | | 94 | 3,979 | 1,018,700 | 162,900 | 82.1 | 69,100 | 12,300 | 962 | 12- 4-35 | 1-16-39 | 8- 1-39 | 35,600,000 | Gunters. |
| Hales Bar[a] | Tennessee | Tenn. | Marion | | 112 | 2,315 | 154,400 | 13,100[c] | 39.9 | 6,750 | 3,800 | 162 | 10-18-05 | -- | 11-13-13 | a | Hales B.[a] |
| Chickamauga | Tennessee | Tenn. | Hamilton | | 129 | 5,800 | 705,300 | 329,400 | 58.9 | 34,500 | 9,500 | 810 | 1-13-36 | 1-15-40 | 3- 4-40 | 38,700,000 | Chickaga. |
| Watts Bar | Tennessee | Tenn. | Meigs Rhea | J | 112 | 2,960 | 1,132,000 | 377,600 | 72.4 | 38,600 | 10,300 | 783 | 7- 1-39 | 1- 1-42 | 2-11-42 | 34,100,000 | Watts Bar |
| Fort Loudoun | Tennessee | Tenn. | Loudon | | 122 | 4,190 | 386,500 | 109,300 | 55.0 | 14,500 | 4,500 | 360 | 7- 8-40 | 8- 2-43 | 11- 9-43 | 41,300,000 | Ft. Ldn. |
| Tributary Projects | | | | | | | | | | | | | | | | | Trib. Proj. |
| Norris | Clinch | Tenn. | Anderson Campbell | J | 265 | 1,860 | 2,567,000 | 2,281,000 | 72-96[f] | 34,200 | 3,000 | 800 | 10- 1-33 | 3- 4-36 | 7-28-36 | 30,400,000 | Norris |
| Hiwassee | Hiwassee | N.C. | Cherokee | | 307 | 1,287 | 438,000 | 364,700 | 22 | 6,240 | 1,000 | 180 | 7-15-36 | 2- 8-40 | 5-21-40 | 19,100,000 | Hiwassee |
| Cherokee | Holston | Tenn. | Jefferson Grainger | J | 175 | 6,760 | 1,565,400 | 1,473,100 | 59 | 30,200 | 2,550 | 463 | 8- 1-40 | 12- 5-41 | 4-16-42 | 31,800,000 | Cherokee |
| Apalachia | Hiwassee | N.C. | Cherokee[k] | | 150 | 1,308 | 58,570 | 35,730 | 9.8 | 1,123 | 386 | 31 | 7-17-41 | 2-14-43 | 9-22-43 | 22,400,000 | Apala. |
| Nottely | Nottely | Ga. | Union | | 184 | 2,300 | 184,400 | 184,000 | 20 | 4,290 | 170 | 106 | 7-17-41 | 1-24-42 | -- | 5,500,000 | Nottely |
| Ocoee No. 3 | Ocoee | Tenn. | Polk | | 110 | 612 | 14,440 | 9,370[c] | 7 | 606 | 260 | 24 | 7-17-41 | 8-15-42 | 4-30-43 | 8,100,000 | Ocoee 3 |
| Chatuge | Hiwassee | N.C. | Clay | | 144 | 2,850 | 247,800 | 229,300 | 13 | 7,150 | 107 | 132 | 7-17-41 | 2-12-42 | -- | 7,100,000 | Chatuge |
| Fontana | Little Tennessee | N.C. | Graham Swain | J | 480 | 2,365 | 1,444,300 | 1,157,300 | 29 | 10,670 | 1,650 | 248 | 1- 1-42 | 11- 7-44 | 1-20-45 | 72,300,000 | Fontana |
| Watauga[g] | Watauga | Tenn. | Carter | | 318 | 900 | 677,000 | 627,000 | 17 | 6,400 | 335 | 106 | 2-16-42 | Stopped by WPB | | 32,100,000 | Watauga[g] |
| South Holston[g] | S. Fork | Tenn. | Sullivan | | 290 | 1,550 | 683,000 | 660,000 | 25 | 8,000 | 485 | 168 | 7-22-46<br>2- 2-42<br>12-29-47 | Stopped by WPB | | 33,650,000 | S.Holston[g] |
| Douglas | French | Tenn. | Sevier | | 202 | 1,705 | 1,514,100 | 1,419,700 | 43.1 | 30,600 | 3,170 | 535 | 2- 2-42 | 2-19-43 | 3-21-43 | 41,900,000 | Douglas |
| Ocoee No. 1[a] | Ocoee | Tenn. | Polk | | 135 | 840 | 91,300 | 33,100 | 7 | 1,900 | 170 | 18 | 8- -10 | 12-15-11 | 1-10-12 | a | Ocoee 1[a] |
| Ocoee No. 2[a] | Ocoee | Tenn. | Polk | | 30 | 450 | -- | -- | -- | -- | -- | -- | 5- -12 | -- | 10- -13 | a | Ocoee 2[a] |
| Blue Ridge[a] | Toccoa | Ga. | Fannin | | 167 | 1,000 | 197,500 | 183,000 | 10 | 3,290 | 182 | 60 | 11- -25[h] | 12- 6-30 | 7- -31 | a | B. Ridge[a] |
| Great Falls[a] | Caney Fork | Tenn. | Warren White | J | 92 | 800 | 54,500 | 49,400 | 22 | 2,270 | 850 | 120 | -15 | 12- 8-16 | -16 | a | G. Falls[a] |
| Totals | | | | | | | 22,041,110 | 14,528,200 | | 594,589 | 114,396 | 10,181 | | | | | |

Notes: Power generating facilities are provided at all but two projects, Nottely and Chatuge. The total TVA system installed capacity, including fuel plants and minor hydro plants not listed above, is 2,259,782 kw at June 30, 1948; completion of new generating units under construction will increase the system installed capacity to 2,672,182 kw. Generating units for remaining vacant stalls (except Cherokee 4th and Douglas 4th) would increase this capacity to 2,950,582 kw. The present and authorized capacity of Alcoa plants increase this to a total of 3,291,702 kw.

The lakes or reservoirs of the main-river projects on the Tennessee are designed to provide a channel for boats of 9-foot draft from the mouth of the river to Knoxville, a sailing line distance of 627 miles.

a. Purchased with other electric properties from the Tennessee Electric Power Company.

b. Useful controlled storage is the volume between the lowest operating level of the reservoirs and the top of the spillway or spillway gates.

c. Reservoir volume available for pondage, but not for seasonal storage operations.

Notes: d. Maximum normal operating level.

e. Estimated cost includes generating equipment installations in existing stalls at all dams except the fourth stalls at Cherokee and Douglas Dams, but is exclusive of switch yards, the total cost of which is estimated to be approximately $34,507,000.

f. 72 miles on the Clinch River; 56 miles on the Powell River.

g. Under construction.

h. Construction discontinued early in 1926; resumed in March 1929.

j. River is county line.

k. Powerhouse in Polk County, Tennessee.

July 1, 1948

> --a policy, fixed by law, that the federal regional agency work cooperatively with and through local and state agencies.[28]

Secondly, the TVA's personnel is built upon the merit system.[29] It, by a deliberate policy, is selected from every part of the United States, whereas a narrow, sectional interest would follow the provincial practice in many cities and states of confining public employment to local citizens. The Board of TVA by a special provision of the Authority's charter, was made responsible for the employment, promotion and discharge of all its personnel, from general manager to messenger boy. No political test or qualification shall be permitted or given consideration, but all such appointments and promotions shall be given and made on the basis of merit and efficiency.

Thirdly, TVA has been kept out of politics. All its decisions are dependent upon the technical point of view and all employees are selected by the merit system.

Finally, it has a revolutionary administration;[30] decentralization in management and cooperation with other

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[28]David E. Lilienthal, TVA Democracy on March (New York: Pocket Books, Inc., 1944), p. 166.

[29]Ibid., p. 188.

[30]Ibid., p. 186.

agencies. The TVA has brought experts and people to live together. Its works are for the people and by the people.

## CHAPTER IV

## THE AGRICULTURAL PROGRAM OF TVA

Agriculture is one of the principal activities of the people in the Tennessee Valley. According to the United States Census of Agriculture in 1945, there were 22,354,892 acres of land in farms out of the total land area of 36,286,080 acres in the Tennessee Valley counties. About three-fourths of the population is rural and one-half live on farms. Therefore, a substantial portion of the Valley's populace looks to agriculture for their livelihood. Valley agriculture, in turn, looks to its soils which are the basic capital of agriculture everywhere. Advantages of temperate climate with abundant rainfall, mild winters, and varied growing seasons combined with diverse topography and soil types favor a permanent agriculture as the basis of Valley economy. But practical and historical obstacles have produced land-use and farming practices in confliot with the potential advantages of these natural factors.

Before the establishment of TVA in the year 1933, the Tennessee Valley was characterized by eroded and abandoned land, by inadequate housing, by lack of modern farm machines and equipment, and by other conditions which indicated the area's depleted agricultural status.

The soils, which in their natural state were highly acid and seriously deficient in phosphate, had been further depleted through long continued use for production of cultivated crops. And also because of the heavy rainfall, almost seven million acres of the Valley's lands were seriously eroded, with 60 per cent or more of the topsoil gone on three million acres. A large segment of the remaining soil was badly deficient in mineral plant nutrient and was incapable of providing an adequate standard of living for the people dependent upon it.

When TVA entered this valley, its first work for agricultural development was to stop these soil losses by developing a program for restoring and maintaining the fertility of the soil and also to produce the fertilizers and manures which the soil needs urgently. The TVA carried on these programs by cooperating with the land-grant colleges and other agricultural agencies directly with the practical farmers, demonstrating the proper method of soil conservation and new forms of fertilizer or fertilizer practices.

## I. Soil Survey and Classification

The survey of agricultural soils is a national project under way in the principal agricultural sections

of the country. It comprises a public inventory of the soil resources, identifying and classifying soils into numerous categories on the basis of their inherent physical and chemical characteristics, such natural features as stoniness, slope, geographical position and drainage, together with the extent of erosion, the degree of plant nutrient depletion, current production capacity and potentialities and other characteristics.

When TVA undertook a regional program of agricultural resource development, the reliable soil data became of increasing importance. Proper use of mineral fertilizers in sound farm systems must rest upon soil data, much of which could be obtained through a soil survey.

The recognition of the importance of the type of soil data compiled in the soil survey resulted in an agreement between the U. S. Department of Agriculture, the land-grant colleges of the Valley states, and TVA for intensifying soil survey activities in the Valley. Under this agreement, which has been renewed from year to year, 59 counties in the Tennessee Valley have been surveyed. This represents approximately 28,000 out of a total of 41,000 square miles, or nearly 70 per cent of the drainage basin.[1] Mapping has been completed in the

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[1] Tennessee Valley Resources, Their Development and Use (Knoxville: Tennessee Valley Authority, 1947) p. 65.

Valley portions of Georgia, Mississippi, Kentucky, North Carolina, and Virginia. About half of the Valley portions of the states of Alabama and Tennessee remains to be mapped.

The information provided by the soil survey has proved useful in connection with many aspects of the Valley program, including research, teaching, and demonstration, in relation to the best use of agricultural resources. It has served as the basis for making detailed studies of the fertility level of various soil types which aid in determining the fertilizer requirements for adjustments in land use and type of farming. The data from the soil surveys are made available to the agricultural workers in the states and counties comprising the region and are helpful in (1) evaluating the productive capacity of individual farms and determining the suitability of the land for various types of farming; (2) ascertaining the relative proportion of different types of soil within a given area; (3) locating field and branch experiment stations for experimental work; (4) selecting test-demonstration farms; and (5) applying test-demonstration results obtained in one locality or on one farm to the same soil in the other localities and on other farms.

Another particular use in which the soil survey data are of considerable significance relates to specialized developments in particular areas within the Valley. For example, when the construction of TVA dams resulted in flooding of substantial quantities of agricultural lands, a knowledge of the soils in the regions adjacent to the reservoirs was of considerable help in assisting the farmers in readjusting or relocating their farm operations. Soil survey data are also essential to specialized watershed studies which TVA is conducting in various parts of the Valley.

## II. Preliminary Soil and Fertilizer Investigations

The development of new and improved fertilizer products is not merely a problem of developing new processes for producing chemical compounds. After technically feasible processes are perfected, it is necessary to determine the availability of the plant nutrients in these chemical compounds to plants and their effectiveness in maintaining and improving soil fertility.

The testing of these fertilizer materials in TVA involves a definite procedure. First, laboratory studies are made to determine various properties of the new materials. Next, greenhouse experiments conducted in small pots are carried out, followed by tests on

relatively small plots in the field under a wide variety of soil and crop conditions. Finally, if the results from these controlled investigations show the product to be satisfactory, the materials are then tested on practical farms. The latter procedure, which is well known as "test-demonstration," is carried out to determine the value, effect, and best methods of use of these materials when tested under different soil conditions and types of farming.

TVA has arranged with the agricultural experiment stations of the land-grant colleges for research relative to the effectiveness of different fertilizers which it produces. The research conducted by the experiment stations is closely integrated with the process development work at TVA's Muscle Shoals fertilizer laboratories. The experiment stations of all 48 states have tested TVA products in connection with their fertilizer research activities. The most intensive work has been done by the experiment stations of the seven Tennessee Valley states; and TVA has supported much of this research through financial assistance to the colleges under specific project agreements.

Coordination of the research carried on by experiment stations in the Tennessee Valley is achieved through the Research Committee of the Valley States Conference.

This committee is composed of experiment station directors in the Valley states and reviews periodically the research under way and makes recommendations for additional activities. Both of the fertilizers produced by TVA, such as phosphate, nitrogen are designed by the Research Committee, and tested by the experiment station, then put into production and extended to the entire Valley and other states.

The Tennessee Valley fertilizer investigations do not end with experiments to determine the effectiveness of new materials. Because of the broad responsibilities for regional development and soil and water conservation incumbent upon TVA, it has been found necessary to initiate research which would give information as to methods for establishing and utilizing effectively vegetative cover on the land. This has involved research in pastures and forage crops, crop response to various rates of fertilizer application on different soils and animal nutriment. Cooperative research has been conducted with all of the Valley experiment stations to determine fertilizer requirements of various crops on different soils. It has been important to know not only the crops best adapted to different soils and farming conditions but also the yields which could be expected from adequate fertilization. This has been a basic

part of the research with phosphatic fertilizers in the region.

The production of food and feed involves quantity as well as quality. It is essential to assess the relative importance of these factors as they relate to nutrition problems in the Valley. A study of the effect of fertilizer and the soil on the growth and physical condition of farm people is being conducted in Virginia and is nearing the end of the five year period of investigation. The soil-plant-animal-human relationship is a complex one, but an effort is being made to evaluate some of the important factors in this chain that affect the nutritional status of human beings. In animal nutrition research, evaluating certain TVA fertilizers as mineral supplements for livestock has received considerable attention at the University of Tennessee. Also of importance are studies of the value of hays and pasture for livestock produced without supplementary feeding of concentrates.

The joint research program conducted in cooperation with the Valley experiment stations, in addition to aiding the research and production activities at the TVA fertilizer plants, makes available to TVA the accumulated information, trained personnel, extensive research facilities, and brings the results of TVA

fertilizer research closer to application by the farm people of the Valley. The joint program has also advantages to the land-grant colleges in that they have been able to speed up and do a more comprehensive job in their research program.

## III. Fertilizer Program

### Fertilizer Research

The research in the field of fertilizer production was not new with the advent of TVA. Both public and private research agencies had built up a considerable body of research data. TVA's research program is based on a broad concept of fertilizer technology and for the practical application of such research. TVA has carried on an extensive amount of laboratory research as directed by the TVA Act. It has also sought to bridge the gap between laboratory research and plant production by conducting pilot-plant and full-scale operations to determine and demonstrate the economic and technical feasibility of new processes.

The fertilizer research program established by TVA was and still is primarily in terms of phosphates, although research on potash processes and nitrogen production was also undertaken. The trend in TVA fertilizer research has been toward highly concentrated

materials, because frequently more than half the final cost paid by the farmer for fertilizer of low concentrates is made up of freight, bags, handling charges, and other distribution costs, determined by total weight without regard to the concentration of available plant nutrients. In addition, it was felt that these high analysis products would result in savings to the farmer through eliminating, but none the less real, expenses which the farmer incurs in handling low analysis fertilizer. For example, TVA's high analysis phosphates can be stored in from one-half to one-third the barn space required for ordinary superphosphate of the same nutrient value.

TVA's fertilizer program was done with the advice and recommendation of the United States Department of Agriculture and the state land-grant colleges, who pointed out that one of the factors of soil conservation was the shortage of minerals and particularly phosphates. It was asserted, and subsequently reported by the Association of Land Grant Colleges and others have emphasized the fact, that American soils--and particularly soils in the Valley region--were not receiving sufficient phosphate. It has been estimated that farmers need to use several times as much phosphate annually as they now do in order to maintain soil fertility at its present level.

Fertilizer Production

Phosphorus Fertilizer. Even though the smelting of phosphate rock in electric furnaces was done by the Bureau of Chemistry and Soils of the United States Department of Agriculture and some private producers before the establishment of TVA, it had been utilized on a comparatively small scale. TVA, by the help of large quantities of low-cost electric power, used different designs for testing and improving the process and has developed a good result in production of high purity phosphorus.

Besides the electric-furnace method, the blast-furnace method also has been investigated and developed. After considerable experimentation, a pilot plant was constructed in 1939 and operated successfully in 1940-41. The blast-furnace process developed in this work has been carried to the point where engineering and technical data are available for the design of a demonstration or full-scale plant.

Another process of considerable promise developed by TVA is one for producing calcium metaphosphate. This product contains more than 60 per cent available $P_2O_5$ as compared with 45-48 per cent in concentrated superphosphate (triple superphosphate) and about 18-20 per cent in ordinary superphosphate.

The production of fused tricalcium phosphate is also a significant process which TVA has developed and demonstrated as practical. The process grew out of research on defluorination of phosphate rock by heating it to a temperature below the fusion point, which was initiated by the Bureau of Chemistry and Soils of the United States Department of Agriculture. On the basis of the pilot-plant work, TVA designed and built a demonstration plant for the production of fused tricalcium phosphate capable of supplying material for fertilizer use or animal-feed purposes. This plant went into full-scale operation in September 1945 and the product, which contains about 28 per cent available $P_2O_5$, is being used in the Valley agricultural program. This product contains about 50 per cent more $P_2O_5$ than is found in ordinary superphosphate, and is specially significant to the farmers. The process is relatively simple and shows promise of producing a product cheap enough to supply farmers close to the point of production with low cost phosphates. Of even greater significance is the fact that the process uses low-grade phosphate ores which are otherwise uneconomical to use, thus helping to conserve the rapidly disappearing phosphate deposits in Tennessee.

The cumulative amount of phosphate fertilizers that have been produced by TVA up to July 1, 1948 is shown in Table V.

TABLE V

CUMULATIVE AMOUNT OF AGRICULTURAL FERTILIZERS BY THE TENNESSEE VALLEY AUTHORITY

| | To July 1, 1948 | | Unit: Ton |
|---|---|---|---|
| | Inside Valley | Outside Valley | Total |
| Concentrated superphosphate | 271,567 | 602,641[1] | 874,208[1] |
| Calcium metaphosphate | 30,579 | 41,608[2] | 72,187[2] |
| Fused tricalcium phosphate | 63,538 | 4,496[3] | 68,034[3] |
| Ammonium nitrate fertilizer | 59,146 | 658,156 | 717,302 |
| Aqua ammonium | 201 | 569 | 770 |
| Anhydrous ammonia | 1 | 206 | 207 |
| Calcium silicate slag | 675,509 | 686,891 | 1,362,400 |
| Potash phosphate ash | 7,764 | 478 | 8,242 |
| Potassium metaphosphate | 94 | 72 | 166 |
| Dicalcium phosphate | 48 | 85,723 | 85,771 |
| Other materials | 47 | 19 | 66 |
| Grand Total | 1,108,494 | 2,080,859 | 3,189,353 |

Source: Annual Report for 1948 (Knoxville: Tennessee Valley Authority).

[1]Includes exports of 98,324 tons to British Purchasing Commission, etc. and also 60 tons sold for preliminary investigations.

[2]Includes 3,800 tons released to British Purchasing Commission.

[3]Includes 2 tons for export.

Nitrogenous Fertilizer. TVA's interest in nitrogenous fertilizers has been subordinated to the interest in phosphates. In the first place, the possibilities of improving nitrate production processes were slight. In addition, nitrate fertilizers offered few long-range benefits to the farmers of this region, since they had little place in the program of soil and water conservation. And also it is possible for the farmers to produce their own nitrogen by growing legumes at a net cost far below that of commercial nitrates.

In 1935 TVA began negotiations with the War Department for modernization, rehabilitation, and completion of the ammonium nitrate facilities at Nitrate Plant No. 2. In 1940 the War Department approved TVA plans and advanced the funds for building a modern synthetic ammonia plant to replace the obsolete plant and for rehabilitating the ammonium nitrate plant. The facilities produced both ammonia and ammonium nitrate for munitions until late in the spring of 1943 when the War Department curtailed its requirements drastically.

In facing the urgent agricultural requirement for food production TVA took immediate steps to convert its nitrate production from munitions to fertilizer. Production for that purpose began during the summer of 1943, after developing a suitable conditioning treatment to

prevent the caking of ammonium nitrate and to make it a suitable fertilizer. The ammonia and ammonium nitrate facilities have made a significant contribution in the supplying of munitions and of plant nutrient for war food purposes. TVA's ammonium nitrate fertilizer contains about 33 per cent nitrogen as compared with 16 per cent for nitrate of soda and approximately 20 per cent for sulphate of ammonia.

The cumulative amount of nitrogenous fertilizers has been produced by TVA up to July 1, 1948 as shown in Table V.

## IV. Test-Demonstration Farm

The heart of the Valley agricultural program is the test-demonstration farm of which there are about 36,621 in the Valley proper and 4,094 farms outside the Valley, up to the end of 1948. Despite the importance of agricultural research conducted by TVA and cooperating experiment stations to the development of the region's agricultural resources, it must be supplemented by tests on practical farms. TVA's interest in agricultural development in the Valley relates directly to the use of mineral fertilizer on the land. Thus it becomes imperative that information be obtained concerning the plant nutrient requirements of the various crops on the soils

in this region as a means toward increasing soil fertility so that the desired land-use adjustment may be made. The farm tests and demonstrations seek to bring about this adjustment on a sound basis by testing on practical farms the information which is obtained through research. This aspect of the development program is particularly significant because it involves the direct application of research finding to actual farm situations, thus reducing the lag between discovery and use of scientific facts. It is significant also because it is a means of achieving the basic goal of the TVA agricultural resources development program.

The responsibility for guiding the test-demonstration activities rests with the extension of the land-grant colleges. The county extension agents, who are close to the people and can assess their needs, help the farmers and their local organizations to carry out the program for the community or county. TVA provides fertilizer materials for the unified program and reimburses the extension services for additional assistant county agents to supervise the work and to give technical advice and assistance to the farmers and their organizations.

Classification of Test-Demonstration Farms

There are two types of test-demonstration farms, namely, unit and area. The unit test demonstration farm

is practical, individually farm operated as a unit, and representative in respect to major agricultural conditions such as soil types, size, type of farming, and tenure of all farms in the community. It is a tool used for making a unified approach to a solution of problems of testing and demonstrating fertilizers, agricultural development, watershed protection, and farm and home readjustment.

Area test-demonstration is a group of farmers, a small community or watershed, organized around one or more unit farmers for the purpose of carrying on a broad unified program to integrate, develop, and utilize all the resources of the community. Contrasted to the unit farms, the objectives of the area demonstrations are essentially economic determinations and watershed protection; therefore they are located only in the Tennessee Valley. Each of these demonstrations is used to carry on an educational program that will accelerate a spread of practices to all farms of the region.

The emphasis of the joint agricultural program is in the direction of encouraging farmers to readjust or convert their farming activities to a type of agriculture which, resting upon the use of mineral fertilizers in a sound rotation system, will result in the production of a variety of nutritious foods and feeds

in accord with the resource potential of the particular farms.

A cropping rotation is worked out to utilize soil and water resources, to prevent erosion and to make the farm an effective production unit. In the particular instance, cotton acreage is likely to be decreased and hay, legumes, small grains, and pasture increased. Attention is also given to the farm woodlands in order that they can be put on a sustained-yield basis and thus make their maximum contribution to the farm owner. Fertilizer and lime needs are determined and an agreement reached as to what fertilizer material TVA will supply and what fertilizers and lime the farmer will purchase. If terracing is necessary, an agreement is worked out as to how and when it shall be done. Appropriate livestock units for the farm are agreed upon. Finally, the question of records is considered and the specific records which are to be kept are explained. In addition, the farmer agrees to let this farm be used for demonstration purposes and to join with other test-demonstration farmers in administering the community aspects of the program. If needed, a plan for improving the farm structures and farm and home conveniences are incorporated in the over-all farm plan.

Demonstrating the Use of TVA Fertilizers

Usually most farmers use fertilizer principally for increasing the yield of the specific crops to which it is applied. The farmer has considered only how much additional cotton, corn or tobacco he might raise by using fertilizers. However, in many areas on many farms, it has been emphasized too much. It has hastened the depletion of the soil and prevented the establishment of a stable, balanced farm system. The method of fertilizer use frequently has overlooked the natural soil conditions and the suitability of particular soil for particular farming. It fails to recognize, moreover, that the continued successful production of crops requires water, humus, organic matter, good soil conditions, and good soil management in addition to soil minerals. The gullied hillsides of many sections of the country, particularly of the Valley, are grim testimony to the frequent misuse of fertilizers.

The most important long-time value of mineral fertilizers to agriculture is the extent to which they make it possible for the farmer to plan a rotation farm system, supplementing the basic minerals in the natural soil so as to make a productive, arable soil adapted to a wider range of crops than was feasible under the natural conditions of the soil. The rotation system brings

improved soil structure and reduced water run-off as well as economical production of nutritious foods and feeds with the net result of better farm living. The testing aspects of the test-demonstration activities are designed to determine the scientific facts regarding this relationship between the use of soil minerals and the farm system and its implications for the people on the land, while the demonstration aspects are designed to encourage the adoption of proved practices.

Another importance of the demonstration is highlighted by the fact that many farmers in the several sections of this country are unfamiliar with the scientific use of mineral fertilizers and do not understand the adjustments in their farming systems that must accompany such use. By the test-demonstration, the farmers observe and study the practical application of research information in order to apply the information to his own farm situation. Because of the great variety in natural conditions and in types of farming within even a single county, the practical demonstrations must be sufficiently plentiful to be representative of these differences. For this reason, a substantial number of test-demonstration farms per county are essential to determine the varying relationship between fertilizer use and the value, effect, best methods, and economic returns from such use.

Test-Demonstration Activities

Until December 31, 1948, there were 36,621 farms cooperating in test-demonstration activities. Of this number 10,860 were unit test farms and 25,761 were area test farms. This number included all farms cooperating in the program in the entire United States.[2]

In the 125 counties comprising the Tennessee Valley area 4,285 farms are cooperating as unit test-demonstration farms. The number of these farms that are actually receiving TVA fertilizer is 3,177; and the remainder are actively carrying on an educational program and have in the past years received phosphate. In the 125 counties of the Tennessee Valley, of the 25,687 farms cooperating in area test demonstration activities, 8,499 are actually receiving TVA fertilizer and the remainder are carrying on educational programs in cooperation with the agricultural extension service and have in the past received TVA fertilizer.

In the counties of the states in the Tennessee Valley, not actually located in the watershed area, 2,555 farms are cooperating as unit test-demonstration farms. Slightly more than one-half of these farms are actually receiving TVA fertilizer, while the remainder are carrying on an educational program. No area test demonstrations

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[2]Official data, Tennessee Valley Authority, Division of Agricultural Relations.

are carried on in those out-of-Valley counties in the seven Valley states.

## V. Flood Control and Navigation

Even though both flood control and navigation programs are not built for agriculture, there is no doubt that agriculture has received a large number of benefits from these programs. That more than 16 million acres of land are safe from flood damage and many farm products are transported through the controlled river at a low cost are the evident facts of the benefit to the farmers in this Valley.

### Flood Control

The major objectives of TVA's flood control program is to control destructive floodwaters in the river system of the Tennessee Valley by whatever combination of multiple-purpose and single-purpose projects that will provide the maximum amount of flood control to the Valley's cities, industries, rural communities, and farm lands, consistent with the costs involved and in accord with the integrated development of the water, land and other resources of the Valley.

Major Flood Control. Studies as to how to accomplish most effectively the control of the water in the Tennessee River System revealed that there were three

main kinds of problems. The first involved the regulations of the flow of the Tennessee River itself which was only possible through the construction of major storage dams. The second involved supplementary flood protection for such areas and in such cities as could not be entirely taken care of by the control of the main river. The third problem involved protection of small communities or agricultural lands where the effect of floods, although primarily local, were nevertheless destructive to land and other resources.

The first and major problem, that of control of the water in the Tennessee River system, has been accomplished by the construction of multiple-purpose projects on the main river and tributaries. The upper half of the Tennessee River watershed lies above Chattanooga in an area of very heavy rainfall, and the run-off is contributed to the Tennessee River through five main tributaries. By the construction of storage dams on the five tributaries, the flow of the river has been regulated so as to increase minimum flow from about 4,000 second-feet to a minimum of from 25,000 to 30,000 second-feet and to reduce maximum flows very materially throughout the main river. Through careful operation, these reservoirs can be used effectively for navigation regulation, flood control storage, and power production, and thereby serve the

three purposes at a minimum of cost. In addition, the downstream or main-river dams also contribute an amount of flood control storage for reducing flood heights on the lower Ohio and Mississippi Rivers. This is particularly true of the lowest and largest of these reservoirs--the Kentucky Reservoir--which is of great value in controlling floods. The total storage of TVA's dams is more than twenty-two million acre-feet (detail data in Table IV).

As to the second problem, Chattanooga provides an example of a difficult flood control problem. The regulation of the flow in the Tennessee River by upstream reservoirs will reduce heights of floods at Chattanooga as much as 20 feet. But it will still not be protected from severe damage in greater floods which will probably occur. It will reduce the height of such floods to a point where complete protection by means of levees would be feasible. The construction of levees at Chattanooga would also allow greater flexibility in the operation of the storage reservoirs for flood control and thus be a benefit to the entire region. A TVA report covering the investigations and studies of this problem was submitted to the Congress by the President in January 1939, recommending that levees be constructed for the protection of Chattanooga.

Other Flood Control. The third type of problem concerns municipalities on tributaries which are in great danger from floods but where it is determined that the entire region is not sufficiently affected. At these locations, TVA's contribution is limited to general advice and technical assistance with regard to possible means of local protection. The responsibility for developing plans and measures for correcting the condition rests with the local governments. The same applies to small streams where only a local area is involved and where flood control by means of dams or levees is not feasible.

Flood control problems of the small rural watershed in the Tennessee Valley are very extensive and are difficult to solve because of lack of basic data. TVA is developing a project involving an intensive pilot-plant experiment in one of them to discover the most effective administrative and cooperative methods of getting the interested landowners and public agencies to adopt, on a voluntary basis, a unified program for the development of the areas' agricultural, forestry, and other resources. The important part of the experiment is to demonstrate conclusively the most applicable methods of soil conservation, reforestation, and other measures for effectively alleviating erosion which is filling the

channels and causing overflow and flood damage to essential bottom lands on small rural watershed areas. The Chestuee Creek watershed of about 85,000 acres has been selected as the area in which to conduct this intensive experiment. This experiment, if successful, should point the way toward a comprehensive cooperative approach to similar water control problems throughout the entire Valley with far-reaching improvements in its social and economic status.

Cooperation and Report by Radio

In all the flood control work TVA cooperates closely with federal, state and local agencies. TVA uses to the maximum extent the services of the U. S. Weather Bureau and U. S. Geological Survey in securing rainfall and run-off records necessary for most efficient operation. TVA also contributes funds to the U. S. Geological Survey for the maintenance of additional gaging stations for securing run-off data. TVA cooperates with the U. S. Army Engineers in the exchange of information several times with Flood Control Act of 1944 releases of water from the Tennessee River at Kentucky Dam into the Ohio River are according to instructions from the Army Engineers, during danger from floods on the lower Ohio and Mississippi Rivers. On the studies of flood control, TVA also cooperates with many local agencies

such as land-grant colleges and Extension Service. Only through such cooperative effort can an experiment of this kind be successfully carried out.

In the Tennessee Valley, many of these locations are in areas of extremely high rainfall, ranging from 80 inches a year on the average as compared with the valley-wide average of about 52 inches. To meet this situation, TVA has developed unique rainfall and stream gages which report automatically at set intervals by shortwave radio. It now operates 41 such gages,[3] about evenly divided between rain and stream gages, and information as to their construction and use has been furnished by TVA to many organizations both at home and abroad.

Navigation

The Tennessee River has been completely canalized, and the 9-foot channel from the mouth of the river to Knoxville has been essentially completed through the construction by TVA of seven multiple-purpose dam and reservoir projects on the Tennessee River in addition to Wilson Dam, Dam No. 1, and the Hales Bar Dam, in existence prior to TVA. Through these multiple-purpose river control structures, a superior transportation artery has been provided which penetrates deep into the heart

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[3]Tennessee Valley Authority, 1948 (Knoxville: Tennessee Valley Authority), p. 10.

of the Southeast and connects this region, through a network of almost 10,000 miles of improved inland waterways, with industrial centers such as Pittsburg, Chicago, St. Louis, Minneapolis and New Orleans.

Amount of Transportation. Traffic now moving on the waterway amounts to about 352 million miles annually, approximately seven times what it was in 1933. Up to the end of 1948, the amount of various products through TVA's channel are briefly shown in Table VI.

Improvement Equipment and Increased Terminal Facilities. Improvement of navigation channels is resulting in development of new floating equipment to take advantage of them. Among them are new articulated or jointed barges representing an advance over the barge towboat combination much as the latter was an improvement over the freight packet of the Mark Twain era. The Commercial Clipper and Commercial Express, put into service by Commercial Barge Lines, are high-speed for transportation of automobiles. Each is composed of a square-end middle section fitting between stern and bow sections and is capable of carrying a cargo of 600 automobles at speeds up to 17 miles an hour. Other articulated barge units are used successfully to carry grain and oil, among them the Cartasca, designed to haul grain in bulk.

TABLE VI

FREIGHT TRAFFIC, TENNESSEE RIVER
CALENDAR YEAR 1947

| Classes and Commodities | Internal In-bound Tons | Internal Out-bound Tons | Up-bound Tons | Down-bound Tons | Total Tons |
|---|---|---|---|---|---|
| Products of Agriculture: | | | | | |
| Wheat | 35,316 | | | | 35,316 |
| Corn | 37,249 | 2,984 | | 212 | 40,445 |
| Oats | 7,002 | | | | 7,002 |
| Grain, N.O.S. | 2,000 | | | | 2,000 |
| Animals and Products: | | | | | |
| Shells | | 1,928 | 3,059 | 3,233 | 8,220 |
| Products of Mines: | | | | | |
| Coal | 198,050 | 25,880 | 34,552 | 113,672 | 372,124 |
| Coke | 15,594 | | | | 15,594 |
| Gravel and Sand: | 345,635 | 32,200 | 885,185 | 573,029 | 1,836,049 |
| Limestone | | | 50 | | 50 |
| Clay | | | | 37,060 | 37,060 |
| Products of Forests: | | | | | |
| Logs, barged | | 300 | | | 300 |
| Posts, poles and piling | | 1,000 | 125 | | 1,125 |
| Ties, railroad, wooden | | 53,432 | | | 53,432 |
| Lumber | | 6,338 | 150 | | 6,488 |
| Acid wood | | | 8,997 | 100 | 9,097 |
| Manufactures & Miscellaneous: | | | | | |
| Gasoline | 301,220 | | 7,439 | 1,563 | 310,222 |
| Kerosene | 11,426 | | | | 11,426 |
| Fuel oil | 1,984 | | | | 1,984 |
| Lube oils and grease | 3,157 | | | | 3,157 |
| Contractor's equipment | | | 1,294 | 320 | 1,614 |
| Boilers and furnaces | | 850 | 200 | | 1,050 |
| Steel products (1) | 1,453 | | 1,410 | 20 | 2,883 |
| Drums, iron and steel | | 126 | | | 126 |
| Aluminum | 5,132 | 1,956 | | | 7,088 |
| Automobiles | 24,023 | | | | 24,023 |
| Phosphates, N.O.S. | | 3,359 | | | 3,359 |
| Sulphuric acid | | | 1,193 | | 1,193 |
| Total | 989,241 | 130,353 | 943,624 | 729,209 | 2,792,427 |

TOTAL ton-miles, 352,739,600

(1) 4,427 tons new steel vessels not included in tabulation.

ADDITIONAL TRAFFIC

| | | |
|---|---|---|
| Car-ferry, Guntersville to Hobbs Island, 21.3 miles | 143,445 | Tons |
| Total ton-miles, 3,055,379 | | |

NOTE: Data preliminary and subject to revision.

As to the terminal facilities there have been 23 new waterfront terminal developments established by private industries along the banks of the Tennessee River: by the close of 1948, privately owned terminal facilities, including storage facilities, constructed along the river above Paducah were estimated to be worth $2,000,000; and it handled more than 340,970,426 tons of miscellaneous freight. Five grain-handling terminals were in operation. Eleven terminals for oil, with bulk-storage facilities had been completed; three terminals for petroleum products at Knoxville and one at Chattanooga were completed in 1947. A 315,000 grain terminal, elevator, and feed mill were practically completed at Decatur, Alabama. Another grain terminal at Decatur doubled its elevator capacity to 800,000 bushels, and major additions and improvements were made to two grain terminals at Guntersville.[4]

## VI. Crop and Livestock

All the works for the improvement of crop and livestock are done by TVA in cooperation with the land-grant college agricultural experiment stations and through the test-demonstration farmers. In other words, TVA provides the facilities; the land-grant college agricultural experiment stations do the research; and the test-demonstration farmers put into practice. Their relation is like a triangle.

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[4]Annual Report for 1948, op. cit., p. 13.

Farm System Readjustment

Even though plant and animal breeding are the essential method for the improvement of crop and animal, the significant characteristics of TVA's improvement on crop and livestock are rather on the whole farm system readjustment than a single breeding variety of crop or livestock.

The first work done by TVA through its test-demonstration program on the farm system readjustment is the shifting to soil-building and water-holding crops. The proper use of soil minerals, particularly in the Valley region, involves basic readjustments in land use for water control. One of the most important of these is the shifting of row crops to the land best suited for such use. This means decreases in the acreage of row crops accompanied by larger total production through larger yields per acre, and at the same time increase in acreage of legumes, grass, and pasture crops. The procedure here is double-edged: the required shifts in cropping patterns cannot be achieved without the use of soil minerals. Nor can the over-all objective of water control and of the welfare of the farmer himself, be fully effective without the shift in cropping patterns. The shifts which have been occurring are illustrated by a study of 68 test-demonstration farms in the Valley counties

of Georgia.[5] The study, in summary, showed a 22 per cent decrease in the acreage of row crops--cotton, corn, and tobacco--between 1935 and 1945, and an increase of 68 per cent in pastures, meadows and cover crops. But the production of row crops increased from 100 to 175 per cent. Corn increased from 20 to 40 bushels per acre; cotton went from 268 to 491 pounds per acre; wheat doubled from 11 to 22 bushels per acre; and oats went from 12 to 43 bushels per acre. Similar results were shown in Mississippi and also North Carolina.

The second work done by TVA for the farm system readjustment is livestock development. The shifts in agricultural use of land from row crops to legume and hay crops and improved pastures meet the need for expansion which is necessary to grow livestock. The Tennessee Valley is well suited to this readjustment as it compares favorably with other regions in which livestock growing and dairying have been the mainstay. For example, in North Georgia,[6] 575 test-demonstration farms constitute less than 5 per cent of the total of 12,221 farms in the area. But these farms are far more rapidly building up the grade of their livestock than are the farms in the area as a whole. Of 92 purebred beef sires purchased in the area,

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[5] Ibid., pp. 39-40.

[6] Ibid., p. 41.

22 or nearly one-quarter were purchased by test-demonstration farmers. Of purebred dairy bulls, numbering 43, the test-demonstration farmers purchased 13 or nearly one-third.

Processing and Marketing Farm Products

As stated in the above section, we know TVA's program for crop and livestock emphasizes on the diversification and production of new farm products. The increasing production of truck crops and livestock needs a proper method to market these products. The farm products processing research in TVA is concerned with two phases of the processing problem. In the first place, farm families throughout the Valley are confronted with storing produce for their own use. Secondly, greater economic returns to the farm producer are possible if the agricultural products of the area are marketed in a finished or processed form. In helping solve the first aspect of the problem, TVA and cooperating agencies have engaged in research on farm community freezer lockers and storage plants, on home and community dehydration of foods, on methods of curing and processing meat, and on research in similar fields where the results would make it possible for the farm families not only to use profitably the new products of diversified farming but at the same time to improve and stabilize their year-round diets.

To help overcome the second part of the problem TVA and Valley agencies have undertaken research which resulted in an improved oil seed cooker for cotton and other oil seeds and research in the processing of food products for market use. The latter development has been centered in a food processing laboratory and pilot-plant where research is being conducted on quick-freezing process and on the storage of frozen foods.

The problem of getting agricultural products processed requires a step beyond the research stage. Some individual, private business concern, or cooperative must actually manufacture and sell the product. In addition to technical research on a pilot-plant scale, which determined the technical feasibility of the processes and equipment and supplied estimates of cost under commercial, economic market studies have been undertaken. These studies were needed to appraise the number of new plants that could profitably be established in the Tennessee Valley region and to give prospective manufacturers practical information on the kinds of products in demand. The studies show the need for many more commercial quick-freezing plants and new locker plants in the region. A number of developments have already occurred since the market studies were made up to June 30, 1948. There were 35 plants devoted to freezing and preparation for freezing in the Valley where there were none in 1933. In 1946

their output was about $5,126,000 according to the reports of the operators, and they paid farmers $3,870,000 for raw materials. The number of locker plants has grown from none in 1933 to 236 in 1948; in 1948 they handled products with a farm price estimated at $8,800,000 and a retail value of almost $25,000,000.[7]

## VII. Farm Machinery

The readjustment or conversion of the predominant farming system which requires equally simple implements, the farmers of the Valley are shifting to a complex and diversified system requiring specialized machinery and equipment of various kinds. This is equally true of the widespread use of low cost electricity on farms, which has created a new opportunity, as well as a readjustment, and is fitting admirably into improved methods and machinery. In fact, without proper equipment and facilities the farmer cannot save money and labor while improving his finished products; the readjustment may prove unsuccessful or uneconomic; and likewise, the use of mineral fertilizers may be ineffective because of the inability of the farm operator to utilize his resources effectively. In both these fields TVA has joined with

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[7] Ibid., p. 57.

states and land-grant college experiment stations and extension services to conduct necessary research, testing and demonstration.

An example of a completed project is the trailer-thresher, designed by TVA to assist in soil building practices by enabling farmers on small and hill farms to harvest their own legume and small-grain seed. The thresher was demonstrated under actual farm conditions by the various extension agencies of the Valley, and the states. Approximately 900 of the threshers have now been produced by a firm in North Carolina, 200 of which are in use in the Valley states.[8] In most communities where these threshers are in use they have become the center of community activity, each thresher being used on the average of 40 farms a year.

Another example is the hay-drier. One of the serious handicaps to hay production in the region is the frequent rains which prevent adequate field drying and cause substantial hay loss. In solving this problem, TVA with the cooperation of the experiment stations of the Valley land-grant colleges, has developed a successful barn hay drier which produces a much higher quality of

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[8] Tennessee Valley Resources, Their Development and Use (Knoxville: Tennessee Valley Authority, 1947), p. 68.

product than can be obtained from conventional field drying methods. Approximately 650 installations,[9] essentially all of which are electrically operated, are in use in the southeastern states and more in other parts of the country. Research on hay drying equipment is now being conducted by experiment stations in 18 states and has led to research on the drying of small grains, legume seeds and corn.

Grain-drying in bins was also under investigation, both in the experiment stations and as demonstrations on farms throughout the Valley. The need for grain-drying installations arises largely because of the increased use of combines to harvest grains, legumes and grass seed. Other farm engineering research being conducted by TVA and Valley experiment stations, all of which is very closely related to the needs of the Valley program, covers farm irrigation, fertilizer distribution equipment, sweet potato curing, smut control equipment, lime distributors, pumps and plumbing for the farmstead, seed scarifiers, and feed grinding.

## VIII. Forest and Woodland

Restoration of the region's forest resources is also one of the important programs of TVA. It is estimated

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[9] Ibid., p. 68.

that the full potentialities of forest land for timber production in this Valley are 14 million acres or 54 per cent of the total Valley land area.

Objectives

TVA's forestry program aims to develop full production and utilization of the forest resources of the region, as well as water control on the land through watershed protection. It is a cooperative program conducted with and through public agencies, institutions, and organizations to assist and strengthen the efforts of woodland owners, timber operators and others to apply constructive forestry practices throughout the Valley. The forestry program includes assistance in reforestation and erosion control; in forest protection, development, and management; and in harvesting, marketing, and utilizing forest products. It involves experiments and studies, fact-finding surveys and investigations, demonstrations of good forestry practices, and other educational measures to enlist the active participation of timber owners and operators and the intelligent support of an enlightened public.

Activities and Accomplishment

Forestry Investigation and Research. TVA recognized the necessity for basing plans and activities of a unified forest development program upon factual

information. Accordingly as directed in Section 22 of its Act, investigative projects were initiated by TVA to obtain dependable data regarding the extent, location, composition, condition, and ownership of the forest resource, together with the facts concerning its rate of utilization and depletion in comparison with growth. A similar survey was undertaken to determine the fundamental facts concerning sawmill operations and wood-using industries dependent upon the forest resources. Other investigations included the problems of forest fire control, reforestation, and erosion control for soil and water conservation, and the opportunities for additional income from improved methods of wood utilization as well as from special tree crops and forest by-products.

These studies do not duplicate those of other agencies. In 1939 a formal memorandum of understanding was established with the Forest Service to provide for mutually beneficial cooperation in research projects with the Forest Products Laboratory and the three forest experiment stations bordering the Valley region. In 1941, at the suggestion of the U. S. Bureau of the Budget, another cooperative agreement was established between the Bureau of the Census, the U. S. Forest Service, and TVA to provide for effective collaboration in the annual lumber production census. Similar cooperation has been

developed with the U. S. Soil Conservation Service in their investigations of erosion problems and control methods, and with the Bureau of Plant Industry in the introduction of new tree species and improved varieties. And also cooperative agreements have been developed with the land-grant colleges and state agricultural experiment stations for work on problems of farm forestry.

Forest Protection and Development. Through landowner cooperation, the state extension services and the U. S. Forest Service until 1942, more than 162,000,000 forest tree seedlings produced in TVA nurseries have been planted in some 18,000 reforestation demonstrations involving 128,000 acres of serious erosion. These demonstrations also included more than 3,000 projects of engineering control on nearly 60,000 acres involving terraces, water outlets, and gully check-dams. A subsequent survey of the problem in the Valley indicates that for eroding lands requiring reforestation, the job has been only 25 per cent completed. However, in 116 Valley counties the people now have demonstrations of the forestry measures necessary to prevent or control erosion of land unfit or exhausted for cultivation.[9]

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[9]Tennessee Valley Resources, Their Development and Use, op. cit., p. 89.

Forest fire control is one of the serious problems in the Tennessee Valley for in the average year 10,000 fires burn over 700,000 acres of the Valley's woodlands. Since TVA's emphasis on public education for the need for fire prevention and organization for control, the active interest and participation of thousands of citizens, landowners and local agencies has been enlisted. Thirty-two additional counties with more than 6,000,000 acres of woodland have been organized for protection under state administration.[10] In other counties the quality of protection has been raised. In the Virginia project average annual per cent of forest area burned has been reduced from 1.84 to 0.32.[11]

Forest Products Utilization. In the Tennessee Valley now, cheap electric power and water transportation developed by TVA together with abundant labor and available supplies of many kinds of valuable timber, offer definite opportunities for the establishment of expansion of wood-processing industries.

The valley's 14 million acres of forests and farm woodlands, together with some 4,000 sawmills and wood-using industries, now contribute more than $100,000,000

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[10] Ibid.

[11] Ibid.

annually to the income of the region.[12]

Much of the timber produced in the Tennessee Valley is used locally, and assistance in problems of utilization is part of the forestry program developed by TVA through cooperation with the state extension services in farm forestry and through the state divisions of forestry with the operators of industrial and other woodlands.

The problem of closer and more profitable utilization requires the development of new or improved methods, not only of cutting and logging, but also of industrial processing, so that waste may be avoided and all wood put to its best use. TVA cooperates with U. S. Forest Service installing a pilot plant to test the feasibility of producing laminated lumber from such waste and cull materials; and also TVA cooperation with Georgia School of Technology designing the new types of equipment, including a continuous glue-press machine.

## IX. Fish and Wildlife

Conversion from river to reservoir conditions, following TVA impoundment of water with a total surface

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[12]Data collected from TVA Department of Agricultural Relations.

area exceeding 600,000 acres and with some 10,000 miles of new shoreline, has greatly changed environmental conditions for fish and for certain species of wildlife.

Developing Fishery Resources

The first step of TVA was to acquire basic information regarding the problems of reservoir environment, with emphasis on development of fishery resources. Investigations include technical studies of water conditions; surveys of the extent, size, distribution and composition of fish populations; studies of their life histories, food supplies, rates of growth, spawning, and adaptation to the new environment.

Under TVA's operation, the amount of fishing and the total catch have greatly increased since impoundment, not only of game and food fish but also of rough fish species caught for market by commercial fishermen. Commercial fishermen caught 1,550,000 pounds of non-game fish during 1947, and their combined gross income was nearly $300,000;[13] more than a million pounds of non-game fish were taken from the Alabama portions of TVA reservoirs, a minimum sixfold increase over the catch taken before the dams were built.

Wildlife Development

The Mississippi flyway used by waterfowl in their

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[13]Annual Report, 1948, op. cit., p. 22

seasonal migrations between Canada and the Gulf of Mexico constitutes a serious bottleneck for large numbers of ducks and geese. The U. S. Fish and Wildlife Service has for years been greatly interested in diverting some migratory waterfowl from the Mississippi River flyway through the development of Tennessee Valley impoundments. TVA agreed to dedicate for refuge purposes the use of some of the property it had acquired, and accordingly in 1938 approximately 40,000 acres of land and water was designated by Presidential proclamation as the Wheeler National Wildlife Refuge. In order to avoid duplication in matters of mutual interest, several thousand acres of land acquired by TVA in the development of the recently impounded Kentucky Reservoir have been transferred to the Fish and Wildlife Service as part of the Kentucky Woodlands National Wildlife Refuge, a refuge primarily for upland game development.

Accordingly, the Fish and Wildlife Service and TVA, in cooperation with the state conservation departments of Kentucky and Tennessee, developed plans for setting aside some 50,000 acres of the Kentucky Reservoir properties as wildlife refuge. The Tennessee Department of Conservation operates three upland game refuges on land adjacent to Norris Reservoir, totaling

7,500 acres and a 7,500-acre waterfowl and game refuge on Chickamauga Reservoir.

## X. Community and Rural Organizations

TVA's interest in community and rural organizations grows out of its direct program responsibilities. The type of agricultural development which is the long-time objective of the Valley agricultural program requires increasing amounts of group action. In this activity TVA staff members work closely with the land-grant college staffs and various agencies of the U. S. Department of Agriculture interested in cooperative organization.

TVA's interest in cooperatives expresses itself in two types of activities. One type involves advisory management assistance to the cooperatives and the other involves studies to aid farm groups in identifying opportunities for Valley cooperatives. TVA relies upon such cooperative groups to distribute its electric power in rural areas. Similarly, TVA looks to county associations of farmers to distribute its fertilizers for test-demonstration activities.

TVA, in cooperation with the State Agricultural Extension Services, seeks to strengthen these organizations so that they have every reasonable opportunity of

success. Advice and information are supplied in order that associations may be properly organized, developed, and operated; that they meet applicable legal requirements; that they are sound financially; that they have adequate management; and that they function in accordance with established cooperative principles.

Up to the end of 1945, a total of 175 farmer's associations, of which 57 were incorporated and 118 were unincorporated, were serving farmers within the Tennessee Valley. These cooperatives then had a total of 133,332 patrons who transacted over $20,000,000 worth of business through these cooperatives, of which $11,782,327 was accounted for by the marketing of agricultural commodities, which included dairy products, tobacco, cotton, fruit and vegetables, poultry and poultry products, wool, sheep, frozen foods, and other commodities. Cooperatives operating within the Tennessee Valley purchased $7,932,449 worth of farm supplies for their patrons during 1948, consisting chiefly of feed, seed, fertilizers, liming materials, building materials, and miscellaneous farm production supplies.[14]

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[14]Collected from Tennessee Valley Authority, Cooperative Branch.

## XI. Agricultural Activities Outside the Valley

There are two significant agricultural activities of TVA in the area outside the Tennessee Valley. The first one is the influence of American farmers and agricultural leaders to give more attention to river valley problems and the relationships between narrow problems of agriculture and more general development. It is indirect. The second activity is through its fertilizer test-demonstration program in which the TVA has taken the initiative.

The first activity is more complex and also some points are unable to be measured. However, some significant results can be seen clearly. The Hill-Bankhead-Flannagan "National Fertilizer Policy Bill" (S. 882) which was introduced in the 79th Congress was the product of the stimulation of TVA's fertilizer program. This bill, supported by both the Farmers Union and the American Farm Bureau Federation is largely based on TVA experience and seeks among other things to intensify test-demonstration activities on a national basis. Clearly, also, TVA activities have served to emphasize in the public mind the problem of soil fertility and the role of soil minerals, especially phosphate, in the maintenance of that fertility. In recognition of

this contribution of TVA, Dr. Charles E. Kellog has said:[15]

> Not until the creation of the Tennessee Valley Authority was there public recognition in this country of the essential role of fertilizers in developing and maintaining arable soil without excessive erosion in humid forested regions.

As to the second activity, it is clearly seen that TVA's highly concentrated fertilizer, which can be stored in from one-half or one-third the space required for ordinary fertilizer, and also can save one-half of the cost of delivery, has spread to the whole United States. The laboratory tests of TVA fertilizers (some of which TVA has financed) which have been conducted by the land-grant college experiment stations in 47 states have added to scientific information regarding fertilizers.

In addition to the test-demonstration farms in the Valley, there are 4,094 out-of-Valley test demonstrations carried on in 19 states, of which 4,020 farms are unit test-demonstration and 74 farms are area test-demonstration farms. About 2,077 of the unit test farms and 26 of the area test farms are receiving phosphate and others are carrying on an educational program in

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[15]In a MSS copy of his lecture given at Cornell as a part of the Messenger Series in March, 1945.

cooperation with the agricultural extension service and have in the past received phosphates.

## CHAPTER V

## INDICES OF THE PROGRESS OF AGRICULTURE DUE TO TVA

Many dissertations, monographs, articles and books have been written on the Tennessee Valley to evaluate the progress in various fields due to TVA's program. In this chapter, the writer will use data re-computed from the United States Census of Agriculture in 1935 and 1945[1] in order to find what changes have been made in the Valley during the period in which the Authority's agricultural program has been in operation. The census is a general survey, not a special study of some particular fields or problems. It is reliable and free from bias. Also, since these data from the census include every county of the Valley, we can see the whole picture of the area.

It is well known that agricultural changes are affected by many factors such as location of land, climate, methods of farming, transportation, and other economic and social conditions. In order to eliminate these other effects, there are two factors to be chosen in this analysis; one is the time factor, and the other the regional factor. We are not only to analyze the significant changes of agriculture in the 125 Tennessee Valley

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[1]All data used in this chapter are computed by the Analysis Section, Division of Agricultural Relations, TVA, and rearranged by the writer.

counties from the year 1935, which was near the beginning of TVA's operation, to the year 1945 which is the latest census year in the United States, but also to compare the agricultural changes within the same period with other regions, outside of the Tennessee Valley in the seven states, the seven valley states as a whole, eight middle west states, and the United States as a whole. The eight middle west states include Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio and Wisconsin, which were chosen because they are the best agricultural region in this country.

## I. Farm Characteristics

### Number of Farms

During the period 1935 to 1945, the number of farms decreased in all regions. It decreased 12.5 per cent in the 125 Tennessee Valley counties, 12.8 per cent in the non-valley counties in seven states, 12.7 per cent in the seven states as a whole, 10.8 per cent in eight middle west states, and 14 per cent in the United States as a whole. Detail data are shown in Table VII.

### Size of Farm

The average size of farm in the whole country increased during the period from 1935 to 1945. In the 125 Tennessee Valley counties it increased 4.1 per cent while

TABLE VII

COMPARISON OF NUMBER OF FARMS IN 125 VALLEY COUNTIES WITH OTHER REGIONS 1935-1945

| Regions | 1945 (Number) | 1935 (Number) | Changes 1935-1945 Per Cent |
|---|---|---|---|
| 125 Valley Counties | 305,286 | 349,032 | -12.5 |
| Non-valley Counties in 7 Valley States | 1,340,903 | 1,537,330 | -12.8 |
| 7 Valley States | 1,646,189 | 1,886,362 | -12.7 |
| 8 Middle West States | 1,594,617 | 1,787,429 | -10.8 |
| U. S. A. | 5,859,169 | 6,812,350 | -14.0 |

Source: U. S. Census of Agriculture 1935, 1945.

TABLE VIII

COMPARISON OF SIZE OF FARM IN 125 VALLEY COUNTIES WITH OTHER REGIONS 1935-1945

| Regions | 1945 (Acre) | 1935 (Acre) | Change 1935-1945 Per Cent |
|---|---|---|---|
| 125 Valley Counties | 73.2 | 70.3 | 4.1 |
| Non-valley Counties in 7 Valley States | 83.9 | 76.4 | 9.8 |
| 7 Valley States | 81.9 | 75.3 | 8.8 |
| 8 Middle West States | 137.0 | 122.6 | 11.7 |
| U. S. A. | 194.0 | 154.8 | 25.8 |

Source: U. S. Census of Agriculture, 1935, 1945.

in the non-valley counties in the seven states 9.8 per cent, and the United States 25.8 per cent.

Proportion of Tenancy

During the ten years between 1935 and 1945, the proportion of tenancy decreased in the whole United States. It is especially significant that in the 125 Tennessee Valley counties the decrease was 38.1 per cent, while in the United States as a whole it decreased 24.7 per cent only.

Farm Population

The farm population in every region decreased more than 23 per cent from 1935 to 1945. The percentage decrease in the Tennessee Valley was about the same as in other regions in this country.

Analysis of Farm Characteristics by Valley States

The trend of changes in farm characteristics in the Valley counties and among the Valley states from 1935 to 1945 was generally in the same direction; but the degree of change was different. The number of farms decreased in every Valley state. It was especially large in Kentucky, 25.25 per cent decrease. The average size of farm was generally increased, except among Valley counties in Georgia and North Carolina. The range of decrease in the proportion of tenancy was from 25.74 per cent to 59.94 per cent. The farm population in

TABLE IX

COMPARISON OF PROPORTION OF TENANCY IN 125 VALLEY COUNTIES WITH OTHER REGIONS FROM 1935-1945

| Regions | 1945 (%) | 1935 (%) | Change 1935-1945 (%) |
|---|---|---|---|
| 125 Valley Counties | 26.5 | 42.8 | -38.1 |
| Non-valley Counties in 7 Valley States | 44.9 | 54.6 | -17.8 |
| 7 Valley States | 41.7 | 52.4 | -20.4 |
| 8 Middle West States | 26.9 | 33.9 | -20.6 |
| United States | 31.7 | 42.1 | -24.7 |

Source: U. S. Census of Agriculture 1935, 1945.

TABLE X

COMPARISON OF THE FARM POPULATION IN 125 VALLEY COUNTIES WITH OTHER REGIONS 1935-1945

| Regions | 1945 (Person) | 1935 (Person) | Change 1935-1945 Per Cent |
|---|---|---|---|
| 125 Valley Counties | 1,324,333 | 1,739,098 | -23.8 |
| Non-valley counties in 7 Valley States | 5,810,067 | 7,679,087 | -24.3 |
| 7 Valley States | 7,134,400 | 9,418,185 | -24.2 |
| 8 Middle West States | 6,019,431 | 7,849,043 | -23.3 |
| United States | 23,558,488 | 31,800,907 | -25.9 |

Source: United States Census of Agriculture, 1935, 1945.

the Valley counties, among the Valley states, decreased from 16.84 to 36.12 per cent. The detail data are shown in Table XI.

## II. Land Use

During the period 1935 to 1945, the uses of land in each of the four regions and the United States as a whole showed an increase in open pasture and a decrease in idle or fallow crop land. The increasing area of the open pasture land meant that more animal products could be produced than before; and the decreasing area of idle or fallow crop land meant the same areas could produce more products. In the Tennessee Valley, there was a decrease not only in the acreage of idle or fallow crop land but also in the area harvested and/or failure crop land. A large part of the decrease was due to TVA's reservoirs, which cover a total of 22,041,000 acres.[2] The area of all farm land decreased 8.9 per cent in the 125 Tennessee Valley counties, 5 per cent in the 7 Valley states, and 0.3 per cent in the 8 middle west states; but it increased 4.2 per cent in the non-valley counties of the seven Valley states, and

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[2]This thesis, Table IV.

TABLE XI

COMPARISON OF CHANGES OF FARM CHARACTERISTICS BY VALLEY STATES
1935-1945

(In Percentage)

| Item and Region | Total | Ala-bama | Geor-gia | Ken-tucky | Missis-sippi | North Carolina | Tennes-see | Vir-ginia |
|---|---|---|---|---|---|---|---|---|
| Number of farms | | | | | | | | |
| Valley counties | -12.5 | -15.2 | -10.6 | -25.3 | -12.9 | - 4.5 | -12.8 | - 7.9 |
| Non-valley counties | -12.8 | -19.5 | - 9.8 | -13.6 | -15.6 | - 4.5 | -16.5 | -13.3 |
| Average size of farm | | | | | | | | |
| Valley counties | 4.1 | 5.9 | - 2.9 | 15.2 | 7.4 | - 7.5 | 5.5 | 5.0 |
| Non-valley counties | 9.8 | 23.5 | 4.1 | 11.1 | 18.5 | - 1.5 | 14.0 | 6.3 |
| Proportion of Tenancy | | | | | | | | |
| Valley counties | -38.1 | -25.7 | -42.7 | -50.4 | -26.5 | -59.9 | -45.6 | -48.6 |
| Non-valley counties | -17.8 | -23.0 | -17.0 | -26.6 | -14.6 | - 6.1 | - 3.7 | -28.0 |
| Farm population | | | | | | | | |
| Valley counties | -23.8 | -25.3 | -23.2 | -36.1 | -22.9 | -18.6 | -24.9 | -16.8 |
| Non-valley counties | -24.3 | -28.8 | -28.0 | -25.0 | -21.1 | -19.3 | -25.1 | -25.3 |

Source: U. S. Census of Agriculture, 1935, 1945.

8.3 per cent in the United States. The detail data are listed in Table XII.

Analysis of Land Use by Valley States

From 1935 to 1945 all land in farms in the Tennessee Valley decreased 8.9 per cent. Kentucky, the highest, decreased 14.0 per cent, while Virginia, the lowest, decreased 3.27 per cent. A significant change in land uses in Tennessee during this period was the decrease in area of open farm land, especially the idle or fallow crop land; and an increase in the area of open pasture. This was probably due to TVA's farm readjustment program. For the sake of water control and soil conservation, TVA encourages farmers to shift from row crops to pasture.

## III. Productivities of Land

Specified Row Crops

Here we select only three kinds of row crops--corn, cotton and tobacco to make a comparison. The acreage of corn and cotton crop land decreased very significantly in the Valley counties, the non-valley counties, and in the seven Valley states; but increased in the eight middle west states and the United States as a whole. The acreage of tobacco increased in every region from 1935 to 1945. The average yield per acre

TABLE XII

COMPARISON OF LAND USE IN 125 VALLEY COUNTIES WITH OTHER REGIONS 1935-1945

| Land Uses | 1945 | 1935 | Change Per Cent |
|---|---|---|---|
| I. Open farm land[a] | | | |
| 125 valley counties | 13,627,245 | 13,799,212 | - 1.1 |
| Non-valley counties in 7 valley states | 64,456,142 | 63,311,222 | 1.8 |
| 7 valley states | 78,083,387 | 77,090,434 | 1.3 |
| 8 middle west states | 174,801,458 | 170,575,723 | 2.5 |
| United States | 931,710,894 | 825,139,621 | 12.9 |
| (1) Crop land (harvested or failure) | | | |
| 125 valley counties | 6,780,659 | 7,458,500 | - 9.1 |
| Non-valley counties in 7 valley states | 35,394,094 | 37,388,558 | - 5.3 |
| 7 valley states | 42,174,753 | 44,847,058 | - 6.3 |
| 8 middle west states | 117,128,828 | 112,002,066 | 4.6 |
| United States | 363,162,937 | 359,305,953 | 1.1 |
| (2) Crop land (idle or fallow) | | | |
| 125 valley counties | 1,212,111 | 1,364,418 | -11.2 |
| Non-valley counties in 7 valley states | 6,394,002 | 7,553,663 | -15.4 |
| 7 valley states | 7,606,113 | 8,918,081 | -14.7 |
| 8 middle west states | 5,025,075 | 9,099,862 | -44.8 |
| United States | 40,082,105 | 56,028,978 | -28.5 |
| (3) Open pasture[b] | | | |
| 125 valley counties | 5,634,475 | 4,956,294 | 13.7 |
| Non-valley counties in 7 valley states | 22,667,776 | 18,369,001 | 23.4 |
| 7 valley states | 28,302,251 | 23,325,295 | 21.3 |
| 8 middle west states | 52,647,555 | 49,473,795 | 6.4 |
| United States | 528,465,852 | 409,804,690 | 29.0 |

TABLE XII

COMPARISON OF LAND USE IN 125 VALLEY COUNTIES WITH OTHER REGIONS 1935-1945 (continued)

| Land Uses | 1945 | 1935 | Change Per Cent |
|---|---|---|---|
| II. Total wood land | | | |
| 125 valley counties | 7,656,045 | 9,293,014 | -17.6 |
| Non-valley counties in 7 valley states | 43,185,983 | 47,584,805 | - 9.2 |
| 7 valley states | 50,842,028 | 56,877,819 | -10.6 |
| 8 middle west states | 29,901,005 | 36,272,234 | -17.6 |
| United States | 166,336,429 | 185,474,965 | -10.3 |
| III. Other land in farms | | | |
| 125 valley counties | 1,071,602 | 1,455,359 | -26.4 |
| Non-valley counties in 7 valley states | 4,852,807 | 6,554,703 | -26.0 |
| 7 valley states | 5,924,409 | 8,010,062 | -26.0 |
| 8 middle west states | 13,734,024 | 12,340,415 | 11.3 |
| United States | 43,568,041 | 43,900,525 | - 0.8 |
| All land in farms | | | |
| 125 valley counties | 22,354,892 | 24,527,585 | - 8.9 |
| Non-valley counties in 7 valley states | 112,494,932 | 117,450,730 | 4.2 |
| 7 valley states | 134,849,824 | 141,978,315 | - 5.0 |
| 8 middle west states | 218,436,487 | 219,188,372 | - 0.3 |
| United States | 1,141,615,364 | 1,054,515,111 | 8.3 |

Source: U. S. Census of Agriculture, 1935, 1945.

[a]Includes all crop, pasture land except wood land pastured.
[b]Includes all land pastured except wood land pastured.

TABLE XIII

COMPARISON OF LAND USE BY VALLEY STATE 1935-1945

(In Percentage)

| Item and Region | Total | Ala-bama | Geor-gia | Ken-tucky | Missis-sippi | North Carolina | Tennes-see | Vir-ginia |
|---|---|---|---|---|---|---|---|---|
| Open farm land | | | | | | | | |
| Valley counties | - 1.1 | - 2.0 | - 0.1 | - 7.4 | 8.6 | - 2.4 | - 1.5 | 4.5 |
| Non-valley counties | 1.8 | 4.3 | - 2.9 | 3.5 | 9.0 | - 0.2 | 3.9 | - 4.7 |
| Crop land (harvested or failure) | | | | | | | | |
| Valley counties | - 9.1 | -10.3 | -16.7 | - 9.8 | - 9.3 | - 9.3 | - 9.0 | 3.8 |
| Non-valley counties | - 5.3 | -16.8 | - 9.7 | - 2.0 | - 3.5 | - 2.8 | - 6.3 | 2.1 |
| Crop land (idle or fallow) | | | | | | | | |
| Valley counties | -11.2 | 13.0 | 12.7 | -15.0 | 19.5 | -16.0 | -23.7 | -17.0 |
| Non-valley counties | -15.4 | 14.9 | - 5.3 | -28.7 | 5.3 | -28.3 | - 5.8 | -45.2 |
| Open pasture | | | | | | | | |
| Valley counties | 13.7 | 28.4 | 35.9 | - 2.1 | 54.6 | 6.8 | 15.0 | 7.4 |
| Non-valley counties | 23.4 | 66.5 | 34.0 | 13.8 | 37.7 | 15.5 | 28.9 | 1.9 |
| Total wood land | | | | | | | | |
| Valley counties | -17.6 | -20.5 | -19.8 | -21.6 | -15.5 | -16.7 | -15.7 | -19.6 |
| Non-valley counties | - 9.2 | - 4.3 | - 7.5 | -16.3 | - 7.7 | - 8.0 | -24.5 | -10.2 |

TABLE XIII

COMPARISON OF LAND USE BY VALLEY STATE 1935-1945 (continued)

(In Percentage)

| Item and Region | Total | Alabama | Georgia | Kentucky | Mississippi | North Carolina | Tennessee | Virginia |
|---|---|---|---|---|---|---|---|---|
| Other land in farm | | | | | | | | |
| 125 valley counties | -26.4 | -18.7 | -27.7 | -44.0 | -41.8 | -39.7 | -24.4 | 6.3 |
| Non-valley counties | -26.0 | -20.7 | -31.1 | -27.0 | -26.9 | -34.3 | - 9.5 | -21.8 |
| All land in farm | | | | | | | | |
| 125 valley counties | - 8.9 | -10.2 | -13.1 | -14.0 | - 6.5 | -11.7 | - 8.0 | - 3.3 |
| Non-valley counties | 4.2 | - 0.6 | - 6.1 | - 4.0 | 0.1 | - 6.0 | - 4.9 | - 7.9 |

Source: U. S. Census of Agriculture.

of these three row crops increased in every region, and in the United States as a whole. The percentage of increase in production per acre in the Tennessee Valley was not more significant than in any other region, except for tobacco, in which the Valley counties had the highest percentage increase among all regions. Detail data are shown in Table XIV.

Analysis of Productivity of Specified Row Crops By Valley States

In order to see the differences, changes in productivity of specified row crops from 1935 to 1945, between the Valley counties and the non-valley counties, by Valley states, the next table (Table XV) is shown.

Hay. From 1935 to 1945, the acreage of total hay produced in the United States as a whole increased 16.9 per cent, while in the Tennessee Valley it increased 22.5 per cent. The average of alfalfa, clover and timothy, and lespedeza was generally increased in every region; but those of small grain hay and other tame and wild hays was decreased. Both of these changes, as stated above, were very large in the Tennessee Valley.

Analysis of the Production of Hay by Valley States

The acreage of total hay produced in the Valley counties increased more rapidly than that in the non-valley counties in the Valley states of Tennessee and

TABLE XIV

COMPARISON OF ACREAGE AND YIELD OF SPECIFIED ROW CROPS IN 125 VALLEY COUNTIES WITH OTHER REGIONS 1935-1945

| Item | 1945 (Acre) | 1935 (Acre) | Change Per Cent |
|---|---|---|---|
| **Acreage** | | | |
| Corn | | | |
| 125 valley counties | 2,824,531 | 3,517,812 | -19.7 |
| Non-valley counties in 7 valley states | 13,962,041 | 17,115,531 | -18.4 |
| 7 valley states | 16,786,572 | 20,633,343 | -18.6 |
| 8 middle west states | 43,172,049 | 38,394,307 | 12.4 |
| United States | 92,259,098 | 87,476,444 | 5.5 |
| Cotton | | | |
| 125 valley counties | 826,996 | 995,112 | -16.9 |
| Non-valley counties in 7 valley states | 5,531,218 | 7,629,002 | -27.5 |
| 7 valley states | 6,358,214 | 8,624,114 | -26.3 |
| 8 middle west states | 396,740 | 316,442 | 25.4 |
| United States | 18,961,891 | 26,753,697 | -29.1 |
| Tobacco | | | |
| 125 valley counties | 97,893 | 90,780 | 7.8 |
| Non-valley counties in 7 valley states | 1,247,376 | 950,891 | 31.2 |
| 7 valley states | 1,345,269 | 1,041,671 | 29.2 |
| 8 middle west states | 56,795 | 45,838 | 23.9 |
| United States | 1,630,221 | 1,237,117 | 31.8 |
| **Yield per acre** | | | |
| Corn (bushel) | | | |
| 125 valley counties | 21.9 | 19.5 | 12.3 |
| Non-valley counties in 7 valley states | 18.3 | 14.7 | 24.5 |
| 7 valley states | 19.0 | 15.5 | 22.6 |
| 8 middle west states | 44.1 | 25.6 | 72.3 |
| United States | 33.1 | 18.8 | 76.1 |

TABLE IV

COMPARISON OF ACREAGE AND YIELD OF SPECIFIED ROW CROPS IN 125 VALLEY COUNTIES WITH OTHER REGIONS 1935-1945

| Item | 1945 (Acre) | 1935 (Acre) | Change Per Cent |
|---|---|---|---|
| Cotton (bale) | | | |
| 125 valley counties | 0.79 | 0.52 | 51.9 |
| Non-valley counties in 7 valley states | 0.77 | 0.47 | 63.8 |
| 7 valley states | 0.77 | 0.48 | 60.4 |
| 8 middle west states | 1.03 | 0.74 | 39.2 |
| United States | 0.63 | 0.35 | 77.1 |
| Tobacco (pound) | | | |
| 125 valley counties | 1,259 | 852 | 47.8 |
| Non-valley counties in 7 valley states | 1,073 | 810 | 32.5 |
| 7 valley states | 1,086 | 813 | 33.6 |
| 8 middle west states | 1,268 | 1,007 | 25.9 |
| United States | 1,091 | 826 | 32.1 |

Source: U. S. Census of Agriculture.

TABLE XV

ANALYSIS OF ACREAGE AND YIELD OF SPECIFIED ROW CROPS BY VALLEY STATE 1935-1945

(In Percentage)

| Acreage and Yield | Total | Alabama | Georgia | Kentucky | Mississippi | North Carolina | Tennessee | Virginia |
|---|---|---|---|---|---|---|---|---|
| **Acreage:** | | | | | | | | |
| Corn | | | | | | | | |
| Valley counties | -19.7 | -17.0 | -28.2 | - 8.1 | -13.4 | -27.4 | -21.8 | -20.3 |
| Non-valley counties | -18.4 | -24.9 | -26.0 | -15.9 | -20.1 | - 4.4 | - 9.9 | -13.4 |
| Cotton | | | | | | | | |
| Valley counties | -16.9 | -11.4 | -47.5 | -90.3 | - 9.9 | -- | -26.9 | -- |
| Non-valley counties | -27.5 | -45.5 | -40.4 | -29.5 | - 9.3 | -26.4 | - 6.9 | -49.3 |
| Tobacco | | | | | | | | |
| Valley counties | 7.8 | -83.6 | -82.6 | -46.2 | -- | 96.9 | 22.6 | 97.2 |
| Non-valley counties | 31.2 | 40.5 | 83.3 | 34.1 | -81.0 | 33.7 | -26.6 | 20.5 |
| **Yield per acre:** | | | | | | | | |
| Corn | | | | | | | | |
| Valley counties | 12.3 | 22.1 | 47.4 | 37.4 | 34.4 | 62.4 | - 0.5 | - 2.6 |
| Non-valley counties | 24.5 | 24.4 | 36.9 | 11.3 | 17.0 | 29.7 | 14.7 | 23.1 |
| Cotton | | | | | | | | |
| Valley counties | 51.9 | 50.0 | 35.3 | 34.1 | 83.3 | -- | 39.6 | -- |
| Non-valley counties | 63.8 | 57.0 | 40.0 | 51.5 | 84.1 | 45.5 | 65.4 | 54.0 |
| Tobacco | | | | | | | | |
| Valley counties | 47.8 | 132.9 | 115.8 | 29.5 | -- | 70.3 | 46.4 | 42.4 |
| Non-valley counties | 32.5 | 135.5 | 52.2 | 43.3 | -26.9 | 25.8 | 27.3 | 36.5 |

Source: U. S. Census of Agriculture.

TABLE XVI

COMPARISON OF HAY PRODUCTION IN 125 VALLEY COUNTIES WITH OTHER REGIONS 1935-1945

| Hay and Region | 1945 (Acre) | 1935 (Acre) | Change Per Cent |
|---|---|---|---|
| Alfalfa | | | |
| 125 valley counties | 105,260 | 32,292 | 226.0 |
| Non-valley counties in 7 valley states | 395,131 | 250,166 | 58.0 |
| 7 valley states | 500,391 | 282,458 | 77.2 |
| 8 middle west states | 5,772,007 | 4,310,269 | 33.9 |
| United States | 14,977,223 | 11,669,135 | 28.4 |
| Clover or timothy | | | |
| 125 valley counties | 348,778 | 304,399 | 14.6 |
| Non--valley counties in 7 valley states | 763,905 | 777,849 | - 1.8 |
| 7 valley states | 1,112,683 | 1,082,248 | 2.8 |
| 8 middle west states | 13,410,269 | 9,555,892 | 40.3 |
| United States | 22,602,650 | 19,978,691 | 13.1 |
| Lespedeza[1] | | | |
| 125 valley counties | 803,515 | 488,380 | 64.5 |
| Non-valley counties in 7 valley states | 2,453,044 | 1,047,238 | 134.2 |
| 7 valley states | 3,256,559 | 1,535,618 | 112.1 |
| 8 middle west states | 1,496,351 | 605,476 | 147.1 |
| United States | 5,941,370 | 2,564,667 | 131.7 |
| Small grain hay | | | |
| 125 valley counties | 31,970 | 62,252 | -48.6 |
| Non-valley counties in 7 states | 110,367 | 178,637 | -38.2 |
| 7 valley states | 142,337 | 240,889 | -40.9 |
| 8 middle west states | 168,132 | 2,241,061 | -92.5 |
| United States | 1,542,316 | 6,980,258 | -77.9 |

TABLE XVI

COMPARISON OF HAY PRODUCTION IN 125 VALLEY COUNTIES WITH OTHER REGIONS 1935-1945 (continued)

| Hay and Region | 1945 (Acre) | 1935 (Acre) | Change Per Cent |
|---|---|---|---|
| Other tame and wild hay[2] | | | |
| 125 valley counties | 193,718 | 323,171 | -40.1 |
| Non-valley counties in 7 valley states | 826,501 | 1,002,561 | -17.6 |
| 7 valley states | 1,020,219 | 1,325,732 | -23.0 |
| 8 middle west states | 4,039,850 | 4,576,183 | -11.7 |
| United States | 24,060,672 | 17,930,813 | 34.2 |
| Total | | | |
| 125 valley counties | 1,483,241 | 1,210,494 | 22.5 |
| Non-valley counties in 7 valley states | 4,548,948 | 3,256,451 | 39.7 |
| 7 valley states | 6,032,189 | 4,466,945 | 35.0 |
| 8 middle west states | 24,886,609 | 21,288,881 | 16.9 |
| United States | 69,124,231 | 59,123,564 | 16.9 |

Source: U. S. Census of Agriculture.

[1]Data for 1935 includes sweet clover with "lespedeza" instead of with "other tame hay."

[2]"Other tame hay" includes sweet clover, old meadows, millet, sudan grass, Johnson grass, velvet beans, and vetch cut for hay. "Wild hay" includes marsh, prairie or range grasses, but not volunteer grasses following cultivated crops.

Georgia. But in the other five Valley states the increasing percentage of total hay production in the non-valley counties was greater than that in Valley counties. As an average, the percentage increased in hay production in the non-valley counties and it was larger than that in the Valley counties.

Small Grain

During the period 1935 to 1945, the planted acreage of all small grains changed significantly in the Tennessee Valley: the acreage of mixed small grain, oats, unthreshed oats, and barley was increased, while that of rye and wheat decreased.

Analysis of Acreage of Small Grain by Valley State

The change in acreage of small grain in the Valley counties and in the non-valley counties among the seven Valley states, from 1935 to 1945 was quite variable. It increased in Alabama, Kentucky, Mississippi and Tennessee, but decreased in the remainder of the states. Here (Table XIX) we select only the acreage of total small grain for illustration.

Livestock and Livestock Products

During the period 1935 to 1945, the number of cattle and calves, chickens, and the amount of milk produced were increased in every region of the United States. The number of cows and heifers milked, and the number of workstock decreased in every part of the country. The

TABLE XVII

ANALYSIS OF TOTAL HAY PRODUCTION BY VALLEY STATE 1935-1945

(In Percentage)

| Region | Total | Ala-bama | Geor-gia | Ken-tucky | Missis-sippi | North Carolina | Tennes-see | Vir-ginia |
|---|---|---|---|---|---|---|---|---|
| Valley counties | 22.5 | 15.9 | 36.4 | 11.4 | 29.8 | 26.3 | 17.5 | 42.8 |
| Non-valley counties | 39.7 | 35.1 | 35.8 | 20.7 | 75.5 | 87.2 | 6.6 | 57.2 |
| 7 valley states | 35.0 | 28.8 | 35.9 | 20.1 | 73.9 | 85.7 | 13.5 | 54.9 |

Source: U. S. Census of Agriculture.

TABLE XVIII

COMPARISON OF THE ACREAGE OF SMALL GRAIN
IN 125 VALLEY COUNTIES WITH OTHER REGIONS
1935-1945

| Small Grain and Region | 1945 (Acre) | 1935 (Acre) | Change Per Cent |
|---|---|---|---|
| **Mixed** | | | |
| 125 valley counties | 29,513 | 4,539 | 550.2 |
| Non-valley counties in 7 valley states | 57,848 | 10,603 | 445.6 |
| 7 valley states | 87,361 | 15,142 | 476.9 |
| 8 middle west states | 325,651 | 867,579 | - 62.5 |
| United States | 1,146,249 | 1,272,493 | - 9.9 |
| **Oats** | | | |
| 125 valley counties | 106,699 | 38,852 | 174.6 |
| Non-valley counties in 7 valley states | 1,049,145 | 240,155 | 336.9 |
| 7 valley states | 1,155,844 | 279,007 | 314.3 |
| 8 middle west states | 19,248,090 | 16,384,173 | 17.5 |
| United States | 35,424,960 | 24,588,766 | 44.1 |
| **Oats, unthreshed** | | | |
| 125 valley counties | 126,730 | 79,241 | 59.9 |
| Non-valley counties in 7 valley states | 868,326 | 632,123 | 37.4 |
| 7 valley states | 995,056 | 711,364 | 39.9 |
| 8 middle west states | 912,571 | 1,670,541 | - 45.4 |
| United States | 4,187,410 | 4,032,010 | 3.8 |
| **Barley** | | | |
| 125 valley counties | 77,718 | 22,348 | 247.8 |
| Non-valley counties in 7 valley states | 234,551 | 73,893 | 217.4 |
| 7 valley states | 312,269 | 96,241 | 224.5 |
| 8 middle west states | 1,096,152 | 2,712,995 | - 59.6 |
| United States | 11,693,751 | 6,193,095 | 88.8 |

TABLE XVIII

COMPARISON OF THE ACREAGE OF SMALL GRAIN
IN 125 VALLEY COUNTIES WITH OTHER REGIONS
1935-1945 (continued)

| Small Grain and Region | 1945 (Acre) | 1935 (Acre) | Change Per Cent |
|---|---|---|---|
| **Rye** | | | |
| 125 valley counties | 34,478 | 53,299 | -35.3 |
| Non-valley counties in 7 valley states | 120,509 | 141,898 | -15.1 |
| 7 valley states | 154,987 | 195,197 | -20.6 |
| 8 middle west states | 475,670 | 1,057,043 | -55.0 |
| United States | 2,023,338 | 1,913,771 | 5.7 |
| **Wheat** | | | |
| 125 valley counties | 368,163 | 423,240 | -13.0 |
| Non-valley counties in 7 valley states | 1,593,630 | 1,677,303 | - 5.0 |
| 7 valley states | 1,961,793 | 2,100,543 | - 6.6 |
| 8 middle west states | 7,776,770 | 9,970,663 | -22.1 |
| United States | 58,286,103 | 41,943,387 | 39.0 |
| **Total** | | | |
| 125 valley counties | 743,301 | 621,519 | 19.6 |
| Non-valley counties in 7 valley states | 3,929,009 | 2,775,975 | 41.4 |
| 7 valley states | 4,667,310 | 3,397,494 | 37.4 |
| 8 middle west states | 29,824,904 | 32,662,994 | - 8.7 |
| United States | 112,761,811 | 79,943,522 | 41.1 |

Source: U. S. Census of Agriculture.

TABLE XIX

ANALYSIS OF ACREAGE OF TOTAL SMALL GRAIN BY VALLEY STATE 1935-1945

(In Percentage)

| Region | Total | Ala-bama | Geor-gia | Ken-tucky | Missis-sippi | North Carolina | Tennes-see | Vir-ginia |
|---|---|---|---|---|---|---|---|---|
| Valley counties | 19.6 | 151.5 | -11.3 | 114.8 | 209.6 | -48.2 | 27.9 | -11.8 |
| Non-valley counties | 41.4 | 118.3 | 55.4 | 22.2 | 911.9 | 22.7 | 47.6 | - 3.5 |
| 7 valley states | 37.4 | 124.5 | 53.7 | 25.5 | 905.5 | 17.0 | 33.5 | - 4.6 |

Source: U. S. Census of Agriculture.

main reason for the decreasing number of workstock was more tractors used on the farms than before. The number of hogs and pigs decreased in the Tennessee Valley, but increased in other regions.

Analysis of Livestock and Livestock Products by Valley State

Both the production of livestock and of livestock products has changed significantly in Tennessee. The number of all cattle and calves, and cows and heifers milked increased 14.8 per cent and 6.0 per cent respectively from 1935 to 1945. The amount of milk produced also increased 32.8 per cent.

## IV. Value of Farm Products Sold and Used By Households

One way to roughly measure the farm income is by the value of farm products sold and used by the household, as these are two main ways by which farmers distribute their products. The more farm products sold, the more money the farmer gains, and the more farm products used in home, the higher standard of living the farmer has. In the Tennessee Valley, both the value of farm products sold and those used by the household increased from 1940[3] to 1945. The percentage increase in value of farm products sold in 125 Tennessee Valley

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[3]The data in 1935 was not available.

TABLE XX

COMPARISON OF LIVESTOCK AND LIVESTOCK PRODUCTS
IN 125 VALLEY COUNTIES WITH OTHER REGIONS 1935-1945

| Livestock, Products and Region | 1945 | 1935 | Change Per Cent |
|---|---|---|---|
| All cattle and calves[1] (number) | | | |
| 125 valley counties | 1,629,245 | 1,493,129 | 9.1 |
| Non-valley counties in 7 valley states | 7,045,087 | 6,132,419 | 14.9 |
| 7 valley states | 8,674,332 | 7,625,548 | 13.8 |
| 8 middle west states | 25,745,033 | 21,049,717 | 22.3 |
| United States | 82,654,417 | 68,284,409 | 21.0 |
| Cows and heifers milked (number) | | | |
| 125 valley counties | 662,275 | 663,898 | - 0.2 |
| Non-valley counties in 7 valley states | 2,326,613 | 2,491,283 | - 6.6 |
| 7 valley states | 2,988,888 | 3,155,181 | - 5.3 |
| 8 middle west states | 9,766,990 | 10,195,517 | - 4.2 |
| United States | 22,802,764 | 24,581,669 | - 7.2 |
| Hogs and pigs[2] (number) | | | |
| 125 counties | 888,542 | 917,599 | - 3.2 |
| Non-valley counties in 7 valley states | 6,338,789 | 5,698,897 | 11.2 |
| 7 valley states | 7,227,331 | 6,616,496 | 9.2 |
| 8 middle west states | 25,403,877 | 19,011,655 | 33.6 |
| United States | 46,735,417 | 37,212,967 | 25.6 |
| Chickens on hand[3] (number) | | | |
| 125 valley counties | 12,689,758 | 12,376,893 | 2.5 |
| Non-valley counties in 7 valley states | 49,603,029 | 46,866,761 | 5.8 |
| 7 valley states | 62,292,787 | 59,243,654 | 5.2 |
| 8 middle west states | 163,416,337 | 143,370,668 | 14.0 |
| United States | 433,110,674 | 371,603,136 | 16.6 |

TABLE XX

COMPARISON OF LIVESTOCK AND LIVESTOCK PRODUCTS
IN 125 VALLEY COUNTIES WITH OTHER REGIONS 1935-1945 (continued)

| Livestock, Products and Region | 1945 | 1935 | Change Per Cent |
|---|---|---|---|
| Workstocks[4] (number) | | | |
| 125 valley counties | 462,620 | 488,899 | - 5.4 |
| Non-valley counties in 7 valley states | 2,083,249 | 2,181,225 | - 4.5 |
| 7 valley states | 2,545,869 | 2,670,124 | - 4.6 |
| 8 middle west states | 3,338,274 | 5,266,213 | -36.6 |
| United States | 11,628,794 | 16,676,010 | -30.3 |
| Milk produced (gallons) | | | |
| 125 valley counties | 286,938,815 | 235,673,489 | 21.8 |
| Non-valley counties in 7 valley states | 956,900,781 | 824,827,105 | 16.0 |
| 7 valley states | 1,243,839,596 | 1,060,500,594 | 17.3 |
| 8 middle west states | 5,695,893,322 | 4,622,613,358 | 23.2 |
| United States | 12,710,514,595 | 10,666,065,473 | 19.2 |

Source: U. S. Census of Agriculture

[1]For 1935 and 1945 all ages were included and inventory date was January 1.

[2]Ibid.

[3]For 1945 only chickens over 4 months old were included with inventory date January 1. In 1935 only those 3 months old were included with inventory date January 1.

[4]Includes mules, mule colts, horse and colts including ponies.

TABLE XXI

ANALYSIS OF LIVESTOCK AND LIVESTOCK PRODUCTS BY VALLEY STATE 1935-1945

(In Percentage)

| | Total | Alabama | Georgia | Kentucky | Mississippi | North Carolina | Tennessee | Virginia |
|---|---|---|---|---|---|---|---|---|
| All cattle and calves | | | | | | | | |
| Valley counties | 9.1 | 1.5 | -11.0 | 0.5 | -11.2 | 2.6 | 14.8 | 13.8 |
| Non-valley counties | 14.9 | 17.0 | 4.3 | 18.1 | 19.3 | 6.1 | 12.3 | 19.6 |
| Cows and heifers milked | | | | | | | | |
| Valley counties | - 0.2 | - 8.2 | -17.0 | -27.2 | -10.3 | - 2.3 | 6.0 | 12.1 |
| Non-valley counties | - 6.6 | -13.2 | -17.3 | 0.3 | - 8.6 | - 1.5 | - 6.5 | - 3.6 |
| Hogs and pigs | | | | | | | | |
| Valley counties | - 3.2 | 4.6 | 1.7 | 1.0 | -10.0 | - 1.5 | - 3.7 | 0.5 |
| Non-valley counties | 11.2 | 13.5 | 20.3 | 1.3 | - 0.1 | 18.6 | 2.0 | 29.9 |
| Chickens on hand | | | | | | | | |
| Valley counties | 2.5 | 12.4 | 12.8 | - 7.0 | - 5.0 | - 1.5 | - 1.7 | 4.5 |
| Non-valley counties | 5.8 | 6.6 | 9.1 | - 7.3 | 11.0 | 13.6 | - 7.0 | 4.9 |
| Workstock | | | | | | | | |
| Valley counties | - 5.4 | -14.6 | - 2.0 | -19.2 | 7.6 | 12.2 | - 4.2 | 5.3 |
| Non-valley counties | - 4.5 | -11.9 | -12.5 | - 5.2 | 5.8 | 23.7 | - 6.0 | - 9.0 |
| Milk produced | | | | | | | | |
| Valley counties | 21.8 | 4.7 | 20.9 | - 4.9 | 11.8 | 13.5 | 32.8 | 26.1 |
| Non-valley counties | 16.0 | 6.9 | 6.3 | 26.8 | 11.3 | 18.6 | 10.1 | 21.8 |

Source: U. S. Census of Agriculture.

counties was highest of all, compared with other regions and also with the United States as a whole. This change was probably due in part to TVA's program. The amount and percentage increase in farm products sold and used by the household are shown in Table XXII.

Analysis of Value of Farm Products Sold and Used By Household, By Valley States

In comparing the value of farm products sold and used by households in the Tennessee Valley with that of non-valley counties among the seven Valley states from 1940 to 1945, the trend of change was in the same direction, but in different amounts. Some rates of change were higher in the 125 Valley counties, while some were lower. As to the farm products sold, the percentage increase in the Valley counties was greater than that of non-valley counties in the States of Alabama, Mississippi, North Carolina and Tennessee. The percentage increase in farm products used by households in the Valley counties of Tennessee, Virginia and North Carolina was greater than those of the non-valley counties of those states, expecially in the State of Virginia. The detailed data are shown in Table XXIII.

## V. Value of Farm Property

The value of farm property increased from 1940 to 1945 in every region of the United States. In the Tennessee

TABLE XXII

COMPARISON OF VALUE OF FARM PRODUCTS SOLD AND USED BY HOUSEHOLD IN 125 VALLEY COUNTIES WITH OTHER REGIONS 1940-1945

| Item and Region | 1945 (Dollar) | 1940 (Dollar) | Change Per Cent |
|---|---|---|---|
| I. Farm products sold | | | |
| 125 valley counties | 274,465,812 | 110,802,652 | 147.7 |
| Non-valley counties in 7 valley states | 1,847,162,810 | 746,924,425 | 147.3 |
| 7 valley states | 2,121,628,622 | 857,727,077 | 147.4 |
| 8 middle west states | 5,249,118,097 | 2,330,525,661 | 125.2 |
| United States | 16,230,627,204 | 6,681,581,292 | 142.9 |
| (1) All crops | | | |
| 125 valley counties | 153,419,400 | 59,388,800 | 158.3 |
| Non-valley counties in 7 valley states | 1,334,536,049 | 538,199,647 | 148.0 |
| 7 valley states | 1,487,955,449 | 597,588,447 | 149.0 |
| 8 middle west states | 1,337,579,834 | 818,374,403 | 63.4 |
| United States | 7,507,597,166 | 3,094,947,321 | 142.6 |
| (2) All livestock and livestock products | | | |
| 125 valley counties | 116,613,310 | 49,253,189 | 136.8 |
| Non-valley counties in 7 valley states | 488,813,954 | 198,320,689 | 146.5 |
| 7 valley states | 605,427,264 | 247,573,878 | 144.5 |
| 8 middle west states | 3,896,187,184 | 1,505,482,030 | 158.8 |
| United States | 8,644,670,850 | 3,547,482,358 | 143.7 |
| II. Forest products sold | | | |
| 125 valley counties | 4,433,102 | 2,160,663 | 105.2 |
| Non-valley counties in 7 valley states | 23,810,807 | 10,404,089 | 128.9 |
| 7 valley states | 28,245,909 | 12,564,752 | 124.8 |
| 8 middle west states | 15,350,779 | 6,669,228 | 130.2 |
| United States | 78,359,188 | 39,151,613 | 100.0 |

TABLE XXII

COMPARISON OF VALUE OF FARM PRODUCTS SOLD AND USED BY HOUSEHOLD IN 125 VALLEY COUNTIES WITH OTHER REGIONS 1940-1945 (continued)

| Item and Region | 1945 (Dollar) | 1940 (Dollar) | Change Per Cent |
|---|---|---|---|
| III. Farm products used by household | | | |
| 125 valley counties | 117,232,779 | 70,495,605 | 66.3 |
| Non-valley counties in 7 valley states | 448,677,278 | 260,748,940 | 72.1 |
| 7 valley states | 565,910,057 | 331,244,549 | 70.8 |
| 8 middle west states | 468,853,205 | 320,984,072 | 55.4 |
| United States | 1,877,505,290 | 1,132,063,275 | 65.8 |

Source: U. S. Census of Agriculture.

TABLE XXIII

COMPARISON OF VALUE OF FARM PRODUCTS SOLD AND USED IN HOME, BY VALLEY STATE 1940-1945

(In Percentage)

| Item and Region | Total | Alabama | Georgia | Kentucky | Mississippi | North Carolina | Tennessee | Virginia |
|---|---|---|---|---|---|---|---|---|
| Farm products sold | | | | | | | | |
| Valley counties | 147.7 | 187.4 | 102.2 | 112.2 | 343.6 | 171.5 | 134.0 | 111.1 |
| Non-valley counties | 147.3 | 172.5 | 148.5 | 166.1 | 143.0 | 144.5 | 125.4 | 131.1 |
| All crops sold | | | | | | | | |
| Valley counties | 158.3 | 182.3 | 50.7 | 91.7 | 428.0 | 232.4 | 131.3 | 157.0 |
| Non-valley counties | 148.0 | 175.5 | 136.3 | 200.6 | 139.0 | 142.9 | 125.3 | 131.8 |
| All livestock and products | | | | | | | | |
| Valley counties | 136.8 | 212.6 | 178.9 | 135.4 | 197.4 | 115.3 | 138.6 | 87.2 |
| Non-valley counties | 146.5 | 164.8 | 200.5 | 128.8 | 162.4 | 162.2 | 125.2 | 130.6 |
| Farm products used by household | | | | | | | | |
| Valley counties | 66.3 | 77.1 | 86.2 | 7.7 | 44.7 | 102.1 | 42.2 | 59.5 |
| Non-valley counties | 72.1 | 83.3 | 85.5 | 29.8 | 73.1 | 78.0 | 24.5 | 31.0 |

Source: U. S. Census of Agriculture.

Valley, the increase was large. However, the value of farm property is always affected by the purchasing power of money. It is not an accurate method of measuring the gains or losses of the farms, unless the effect of purchasing power of money is eliminated. Here we analyze the changes in the Tennessee Valley and in other regions to indicate the comparative improvement from 1935 to 1945.

Analysis of Value of Farm Property by Valley State

The increase in value of total farm property in 125 valley counties was greater than in the non-valley counties from 1940 to 1945 in the States of Alabama, Mississippi, North Carolina and Virginia. As to the livestock, the percentage increases in value in the non-valley counties were generally greater than those in the 125 Valley counties. The data are presented in Table XXIV.

## VI. Farm Facilities

There are many things included in the field of farm facilities. Here we select only five of them--electricity, telephone, truck, tractor and automobile, which are considered important facilities for farmers.

By analysis we find that these facilities have greatly increased in the Tennessee Valley. The percentage of farms using electricity increased 81.9 per cent from 1940 to 1945; 18.3 per cent in telephone; 44.2 per

TABLE XXIV

COMPARISON OF VALUE OF FARM PROPERTY IN 125 VALLEY COUNTIES WITH OTHER REGIONS FROM 1935 OR 1940 TO 1945

| Items and Regions | 1945 (Dolla | 1935 or 1940 (Dol.) | Change Per Cent |
|---|---|---|---|
| **Total** | | | |
| 125 valley counties | 1,288,564,386 | 925,560,605 | 39.2 |
| Non-valley counties in 7 valley states | 5,791,401,867 | 4,173,172,703 | 38.8 |
| 7 valley states | 7,079,966,253 | 5,098,733,308 | 38.9 |
| 8 middle west states | 22,016,227,515 | 15,450,257,742 | 42.5 |
| United States | 60,008,207,993 | 41,227,849,287. | 45.6 |
| **Land and buildings**[1] | | | |
| 125 valley counties | 1,041,248,943 | 652,412,428 | 59.6 |
| Non-valley counties in 7 valley states | 4,578,833,444 | 2,909,133,862 | 57.4 |
| 7 valley states | 5,620,082,387 | 3,561,546,290 | 57.8 |
| 8 middle west states | 16,930,657,723 | 11,541,510,058 | 46.7 |
| United States | 46,388,925,560 | 32,858,844,012 | 41.2 |
| **Implements and machinery** | | | |
| 125 valley counties | 85,171,981 | 48,987,168 | 73.9 |
| Non-valley counties in 7 valley states | 406,186,746 | 230,572,389 | 76.2 |
| 7 valley states | 491,358,727 | 279,559,546 | 75.8 |
| 8 middle west states | 2,001,216,229 | 1,231,356,358 | 62.5 |
| United States | 5,146,851,100 | 3,060,187,389 | 68.2 |
| **Livestock** | | | |
| 125 valley counties | 162,143,462 | 109,605,814 | 47.9 |
| Non-valley counties in 7 valley states | 806,381,677 | 492,802,953 | 63.6 |
| 7 valley states | 968,525,139 | 602,408,767 | 60.8 |
| 8 middle west states | 3,084,353,563 | 1,644,202,555 | 87.6 |
| United States | 8,472,431,333 | 4,525,923,172 | 87.2 |

Source: U. S. Census of Agriculture.

[1]Comparing with 1945 and 1935.

TABLE XXV

COMPARISON OF VALUE OF FARM PROPERTY, BY VALLEY STATE 1935 OR 1940-1945

(In Percentage)

| Items and Region | Alabama | Georgia | Kentucky | Mississippi | North Carolina | Tennessee | Virginia |
|---|---|---|---|---|---|---|---|
| Total | | | | | | | |
| Valley counties | 46.9 | 40.1 | 33.4 | 38.6 | 52.0 | 33.6 | 45.0 |
| Non-valley counties | 42.3 | 44.0 | 35.4 | 44.1 | 39.2 | 38.2 | 32.1 |
| Land and buildings[1] | | | | | | | |
| Valley counties | 56.9 | 67.3 | 66.5 | 56.4 | 71.3 | 54.9 | 69.6 |
| Non-valley counties | 49.5 | 51.6 | 63.6 | 75.2 | 60.0 | 59.2 | 42.5 |
| Implement and machinery | | | | | | | |
| Valley counties | 96.3 | 100.9 | 64.5 | 127.4 | 92.6 | 67.3 | 28.5 |
| Non-valley counties | 91.1 | 104.2 | 70.0 | 86.9 | 66.8 | 61.0 | 55.5 |
| Livestock | | | | | | | |
| Valley counties | 34.2 | 31.3 | 40.5 | 42.7 | 55.2 | 48.4 | 75.9 |
| Non-valley counties | 72.6 | 63.7 | 56.4 | 66.5 | 61.0 | 54.4 | 73.0 |

Source: U. S. Census of Agriculture.

[1]Comparing with 1945 and 1935.

cent in truck; 117.6 per cent in tractor; and 14.4 per cent in automobiles. In general these percentages are about the same as for other regions.

Analysis of Farm Facilities by Valley State

The increase in number of farms having electricity, tractors, automobiles was greater in the 125 Valley counties than in the non-valley counties. Among the states they were greater in Georgia, Kentucky, Mississippi, North Carolina, Tennessee and Virginia. As to percentage increase in number of telephones and trucks, these were greater in the non-valley counties than in the 125 Valley counties.

TABLE XXVI

COMPARISON OF PERCENTAGE INCREASES IN FARM FACILITIES IN 125 VALLEY COUNTIES WITH OTHER REGIONS 1940-1945

| Item and Region | 1945 Per Cent | 1940 Per Cent | Change Per Cent |
|---|---|---|---|
| **Electricity** | | | |
| 125 valley counties | 32.2 | 17.7 | 81.9 |
| Non-valley counties in 7 valley states | 30.2 | 18.2 | 65.9 |
| 7 valley states | 30.6 | 18.1 | 69.1 |
| 8 middle west states | 61.3 | 44.6 | 37.4 |
| United States | 47.6 | 33.3 | 42.9 |
| **Telephone** | | | |
| 125 valley counties | 11.0 | 9.3 | 18.3 |
| Non-valley counties in 7 valley states | 9.4 | 7.7 | 22.1 |
| 7 valley states | 9.7 | 8.0 | 21.2 |
| 8 middle west states | 54.3 | 43.8 | 24.0 |
| United States | 31.8 | 25.0 | 27.2 |
| **Truck** | | | |
| 125 valley counties | 11.1 | 7.7 | 44.2 |
| Non-valley counties in 7 valley states | 11.4 | 7.4 | 54.1 |
| 7 valley states | 11.4 | 7.5 | 52.0 |
| 8 middle west states | 21.6 | 16.0 | 35.0 |
| United States | 22.2 | 15.5 | 43.2 |
| **Tractor** | | | |
| 125 valley counties | 7.4 | 3.4 | 117.6 |
| Non-valley counties in 7 valley states | 9.0 | 4.2 | 114.3 |
| 7 valley states | 8.7 | 4.0 | 117.5 |
| 8 middle west states | 55.5 | 39.3 | 40.5 |
| United States | 34.2 | 23.1 | 48.0 |

TABLE XXVI

COMPARISON OF PERCENTAGE INCREASES IN FARM FACILITIES IN 125 VALLEY COUNTIES WITH OTHER REGIONS 1940-1945 (continued)

| Item and Region | 1945 Per Cent | 1940 Per Cent | Change Per Cent |
|---|---|---|---|
| Automobile | | | |
| 125 valley counties | 32.6 | 28.5 | 14.4 |
| Non-valley counties in 7 valley states | 37.8 | 32.1 | 17.8 |
| 7 valley states | 36.8 | 31.5 | 16.8 |
| 8 middle west states | 82.6 | 80.8 | 2.2 |
| United States | 62.0 | 58.1 | 6.7 |

Source: U. S. Census of Agriculture.

TABLE XXVII

COMPARISON OF PERCENTAGE INCREASES IN FARM FACILITIES, BY VALLEY STATE 1940-1945

(In Percentage)

| Item and Region | Total | Ala-bama | Geor-gia | Ken-tucky | Missis-sippi | North Carolina | Tennes-see | Vir-ginia |
|---|---|---|---|---|---|---|---|---|
| **Electricity** | | | | | | | | |
| Valley counties | 81.9 | 83.1 | 60.7 | 111.2 | 91.7 | 65.9 | 93.8 | 56.1 |
| Non-valley counties | 65.9 | 95.5 | 68.5 | 68.8 | 102.2 | 44.9 | 72.5 | 42.4 |
| **Telephone** | | | | | | | | |
| Valley counties | 18.3 | 15.4 | 11.9 | 1.5 | 32.7 | 44.1 | 21.6 | 13.1 |
| Non-valley counties | 22.1 | 54.1 | 55.2 | 13.0 | 33.3 | 13.3 | 14.4 | 24.5 |
| **Truck** | | | | | | | | |
| Valley counties | 44.2 | 56.6 | 47.1 | 56.6 | 47.1 | 46.5 | 39.5 | 25.6 |
| Non-valley counties | 54.1 | 63.5 | 50.0 | 49.3 | 66.1 | 53.7 | 60.0 | 38.4 |
| **Tractor** | | | | | | | | |
| Valley counties | 117.6 | 91.5 | 170.1 | 129.7 | 231.8 | 160.0 | 126.3 | 163.6 |
| Non-valley counties | 114.3 | 145.7 | 136.0 | 109.6 | 103.7 | 127.1 | 98.1 | 90.3 |
| **Automobile** | | | | | | | | |
| Valley counties | 14.4 | 13.6 | 11.9 | 18.3 | 14.4 | 19.9 | 16.4 | 3.3 |
| Non-valley counties | 17.8 | 32.0 | 14.1 | 14.1 | 13.7 | 17.3 | 14.8 | 12.9 |

Source: U. S. Census of Agriculture.

# CHAPTER VI

## SUMMARY AND CONCLUSIONS

TVA was created by the Congress of the United States on March 18, 1933, with responsibility for development of the resources of the Tennessee Valley. It covers an area consisting of approximately 40,000 square miles or 25,562,000 acres. This area, well known as the Tennessee Valley, possesses many natural advantages which have not been developed by a unified program before establishment of TVA. Through a long period of erosion, losses from floods, and reduced returns from forests, the people living in the Valley were not making maximum use of their resources. These were problems for TVA to face and endeavor to solve. How TVA does its work is dependent upon the provisions of the Act.

The TVA Act, proposed by Senator George Norris of Nebraska, was the outcome of various legislative proposals for disposition of the Muscle Shoals properties, development of which by the federal government was begun during World War I. The Act provided a plan for the unified development of all the resources of a region, in contrast with a piecemeal method of resource development. The TVA Act was passed in 1933, and amended as to a few provisions in 1935, 1939, and 1940 respectively.

The purposes of TVA were defined in its Act:

> To improve the navigability and provide for the flood control of the Tennessee River; to provide for reforestation and the proper use of marginal lands in the Tennessee Valley; to provide for the agricultural and industrial development of said valley; to provide for national defense, by the creation of a corporation for the operation of government properties at and near Muscle Shoals in the State of Alabama, and for other purposes.

TVA partakes of the nature of both an industrial and a government enterprise. As President Roosevelt's message of April 10, 1933 to Congress proposing the creation of TVA said: ". . . I therefore suggest to the Congress legislation to create a Tennessee Valley Authority. . . a corporation clothed with the power of government but possessed of the flexibility and initiative of a private enterprise."

The supreme governing body of TVA is the Board of Directors, consisting of three members appointed by the President of the United States for staggered nine-year terms, one of the members of the Board being designated by the President as Chairman. The Board is clothed with all the powers of the corporation, and serves as the chief policy-making body. The chief administrative officer is the General Manager, appointed by the Board of Directors and responsible for effectuating the policies of the Board. Management service functions are performed by the twenty different offices or divisions. All

agricultural programs are undertaken in the Division of Agricultural Relations, which is also divided into eight different sections.

The special characteristics of TVA's administration is dynamic, horizontal, flexible, and decentralized. In undertaking its program, TVA always endeavors to cooperate with other Federal and local agencies, thus seeking to produce a continuous and dynamic interconnection. In the procedure, TVA stands in the center, as it were, as the coordinator of activity, usually taking the lead and planning the joint attack on the connected programs of the region, from the earliest stage on.

Although TVA funds are obtained primarily from Congressional appropriations, it is provided a flexible use as described in the Section 26 of the TVA Act. Up to June 30, 1948, TVA had received through Congressional appropriations more than 777 million dollars. TVA also was authorized to issue bonds, but this power was limited to January 1, 1941, except for refunding purposes. The total amount of bonds issued by TVA was $65,072,500, of which $11,072,500 had been repaid, leaving a balance outstanding of $54,000,000.

TVA contractual arrangements often imply a sharing of expense with other Federal agencies, or a financial reimbursement, on conditions, from itself to local

agencies. TVA also grants loans to its distributors of power.

In the fifteen years since its establishment, TVA has constructed twenty-two new dams. Two additional dams are now under construction. A nine-foot navigable channel over the entire 650 miles of the Tennessee River from Knoxville, Tennessee, to Paducah, Kentucky is now virtually complete. Up to the end of 1947, freight traffic on the Tennessee River amounted, cumulatively, to about 352 million ton-miles. The production of electricity has been increased to 15 billion kilowatt hours.

TVA's agricultural program is a unified development that also devises methods for carrying out its program. Considerable literature on the subject of "regionalism" was available to guide TVA in formulating and developing its program, policies, procedures and administrative devices. TVA's program for the development of agriculture has been carried on in cooperation with the principal federal and local agencies established to serve the farmers of the country in order to avoid duplication and increase efficiency.

An important contribution of TVA to agriculture is its fertilizer program and test-demonstration farms. The total distribution of fertilizer by TVA has amounted to 3,189,353 tons, of which 1,108,494 tons were put on

the Tennessee Valley, the remainder, 2,080,859 tons, on regions outside the Valley. The test-demonstration farms are classified into two groups, namely, unit and area. The farmer is a practical individual farm operated as a unit, and representative of the area in respect to major agricultural conditions such as soil type, size, type of farming, tenure, etc. The latter is a group of farmers, a small community or watershed, organized around one or more unit farmers for the purpose of carrying on a broad unified program to integrate, develop, and utilize all the resources of the community. To the end of 1948, there were 40,715 test-demonstration farms, of which 10,860 were unit test farms in the Valley, 25,761 were area test farms in the Valley, and 4,094 test farms including 4,020 unit-test, 74 area-test, outside the Valley.

Another contribution of TVA to agriculture is in flood control. Many lands have been prevented from flooding, and many properties have been saved from damage. But the result is hard to measure, so an exact figure is not available.

In order to face the soil fertility problem, TVA's farm readjustment system is also worthy of mention. The shifting in use of land from row crop to pasture or other suitable use has brought good results. Acreage of row crops has been decreased and the area of pasture increased.

From the data presented from the United States Census of Agriculture, it appears that agriculture in the Tennessee Valley has been undergoing considerable changes from 1935 to 1940; but when compared with areas outside the Valley and with other regions these results are not as significant as we usually imagine. From 1935 to 1945, the number of farms in the Tennessee Valley decreased 12.5 per cent, and the size of farm increased 4.1 per cent; while in the area outside the Valley regions increased in the same direction with about the same percentages. The proportion of tenancy decreased 38.1 per cent in the Tennessee Valley. This was significant as compared with other regions. The farm population in the Tennessee Valley decreased in the same proportion as in other regions, 23.8 per cent.

As to land use, the crop land, including harvested or failure and idle or fallow, decreased about ten per cent in the Tennessee Valley, and the open pasture increased nearly fourteen per cent. Both acreage of wood land and other land in farms decreased over eighteen per cent. The trend of change in the outside Valley regions was the same as in the Tennessee Valley, only different in amount.

The production of row crops in Tennessee Valley from 1935 to 1945, decreased in acreage but increased

in yield per acre. It decreased 19.7 per cent in acres in corn, 16.9 per cent in cotton; and increased 12.3 per cent in yield of corn, 51.9 per cent in cotton. The production of tobacco increased 7.8 per cent in acreage and also increased 47.8 per cent in yield.

Production of hay and small grain increased very significantly in the Tennessee Valley. Alfalfa hay increased 226 per cent in acreage, and mixed small grain increased 550.2 per cent.

As to production of livestocks the number of cattle, calves, and chickens increased, while that of cows, hogs, pigs and workstocks decreased. The changes are nearly in the same proportion as in other regions. The production of cows milked increased 21.8 per cent in the Tennessee Valley, being only a little lower than that of the eight middle west states, but larger than all other regions, even than the United States as a whole.

Farm products sold in the Tennessee Valley from 1935 to 1945 increased 158.3 per cent in all crops, 136.8 per cent in all livestock and livestock products and 105.2 per cent in forest products; while the increasing percentages in other regions were nearly the same. The farm products used by households in Tennessee Valley increased 66 per cent and in the United States as a whole 65.8 per cent.

The total value of farm property increased 39.2 per cent in Tennessee from 1935 to 1945; this is larger than that of outside-valley in seven Valley states, and also of the seven Valley states, but smaller than that of eight middle west states, and also the United States as a whole.

Farm facilities have greatly increased in the Tennessee Valley. The percentage of farms using electricity increased 81.9 per cent from 1935 to 1945, while in other regions, the maximum increase was 69.1 per cent. As to the percentage using farm tractors, the Valley area also had the highest number compared with other regions. The increase in percentage of farms using trucks and automobiles was also significant.

In short, from analysis of agricultural data in the United States Census of Agriculture for 1935 and 1945, we find that agriculture in the Tennessee Valley has made many changes. As compared with other regions out of the Valley, some changes are significant and some are not; as a whole, the changes are not very significant. But some considerations should be noted here:

1. Agricultural progress is not measured in a single year, nor in ten. A conclusive evaluation of TVA's contributions to agriculture must await

investigation in the future.

2. This analysis is only taking a piece of the whole work. What degree of changes in agriculture, both in the Tennessee Valley and other regions before 1935 we do not know. If there was nothing or very little progress in the Tennessee Valley before 1935 as compared with other regions, then by the above data we can definitely say that agriculture in the Tennessee Valley has made a great deal of progress; because during the period of 1935 to 1945, agriculture in Tennessee underwent about the same changes as that of other regions.
3. This analysis is affected by agricultural conditions in each region in 1935 and 1945. Suppose there was an abnormal condition in any region, such as especially high or low in production in 1935 or 1945, when the percentage of change in that region would be affected. In that case in using percentages to compare that region with other regions would not be accurate.

4. From the results reported by the TVA test-demonstration farms, it appears that their progress has been higher than this study indicates for the area as a whole. This is because there are many farmers in this Valley who are never directly contacted by the TVA agricultural program.
5. There are many programs of TVA, such as recreation and other invisible activities which are hard to measure and to express in figures.

Anyhow, we can say that the impact of TVA on agriculture is very significant. Even if from the pure economic point of view the income from TVA's program perhaps cannot cover its total investments and expenses, there is no doubt that TVA has set up a unified agricultural program in the Tennessee Valley, and this program is beginning. What actual result can be gotten must await for the future to determine.

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