

University of Montana

## ScholarWorks at University of Montana

---

Graduate Student Theses, Dissertations, &  
Professional Papers

Graduate School

---

1962

### Resource base for expanded markets in the Mountain States

Roscoe B. Herrington

*The University of Montana*

Follow this and additional works at: <https://scholarworks.umt.edu/etd>

**Let us know how access to this document benefits you.**

---

#### Recommended Citation

Herrington, Roscoe B., "Resource base for expanded markets in the Mountain States" (1962). *Graduate Student Theses, Dissertations, & Professional Papers*. 4786.

<https://scholarworks.umt.edu/etd/4786>

This Thesis is brought to you for free and open access by the Graduate School at ScholarWorks at University of Montana. It has been accepted for inclusion in Graduate Student Theses, Dissertations, & Professional Papers by an authorized administrator of ScholarWorks at University of Montana. For more information, please contact [scholarworks@mso.umt.edu](mailto:scholarworks@mso.umt.edu).

RESOURCE BASE FOR EXPANDED MARKETS  
IN THE MOUNTAIN STATES

by

ROSCOE BURWELL HERRINGTON  
B. S., Montana State University, 1951

Presented in partial fulfillment of the requirements  
for the degree of

Master of Forestry  
MONTANA STATE UNIVERSITY  
1962

Approved by:

  
Chairman, Board of Examiners

  
Dean, Graduate School

MAR 9 1962

\_\_\_\_\_  
Date

UMI Number: EP40250

All rights reserved

INFORMATION TO ALL USERS

The quality of this reproduction is dependent upon the quality of the copy submitted.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if material had to be removed, a note will indicate the deletion.



UMI EP40250

Published by ProQuest LLC (2014). Copyright in the Dissertation held by the Author.

Microform Edition © ProQuest LLC.

All rights reserved. This work is protected against unauthorized copying under Title 17, United States Code



ProQuest LLC.  
789 East Eisenhower Parkway  
P.O. Box 1346  
Ann Arbor, MI 48106 - 1346

## ACKNOWLEDGMENTS

The information and counsel contributed by many persons is deeply appreciated and gratefully acknowledged. The author is especially indebted to S. Blair Hutchison, Forest Economist in charge of economic studies at the Intermountain Forest and Range Experiment Station, Ogden, Utah, for his perceptive suggestions and guidance throughout this project. John H. Wikstrom, Forest Economist at the same station, has also been extremely helpful.

The following men have given generously of their time and experience in their review of the manuscript: Wayne D. Criddle, State Engineer, Salt Lake City, Utah; Dr. ElRoy Nelson, Vice President and Economist, First Security Corporation, Salt Lake City, Utah; Dr. Armond J. Eardley, Dean of College of Mines and Mineral Industries, University of Utah; Dr. Jewell J. Rasmussen, Professor of Economics, College of Business, University of Utah; and Dr. George T. Blanch, Head, Department of Agricultural Economics, Utah State University.

## TABLE OF CONTENTS

	Page
ACKNOWLEDGMENTS . . . . .	ii
LIST OF TABLES . . . . .	iv
LIST OF ILLUSTRATIONS . . . . .	v
INTRODUCTION . . . . .	1
I. OPPORTUNITIES FOR EXPANSION OF THE TIMBER RESOURCE . . . . .	6
II. OPPORTUNITIES FOR EXPANSION OF THE MINERAL INDUSTRY . . . . .	20
III. OPPORTUNITIES FOR EXPANSION OF AGRICULTURE . . . . .	30
IV. OPPORTUNITIES FOR EXPANSION OF THE RECREATION INDUSTRY . . . . .	37
V. OPPORTUNITIES FOR EXPANSION OF MANUFACTURING . . . . .	43
VI. CLIMATE AS A FACTOR IN THE EXPANSION OPPORTUNITY . . . . .	53
VII. ADEQUACY OF THE WATER SUPPLY . . . . .	58
VIII. THE OVER-ALL PICTURE . . . . .	70
IX. SIGNIFICANCE OF MOUNTAIN STATES RESOURCE POTENTIAL TO TIMBER DEVELOPMENT . . . . .	74
LITERATURE CITED . . . . .	81

## LIST OF TABLES

Table	Page
1. Mountain States Forest Land Area, 1953 . . . . .	8
2. Mountain States Timber Volume, 1953 . . . . .	9
3. Mountain States Timber Volume by Species, 1952 .	10
4. Commercial Forest Acreage in the Mountain States Area by Timber Stand-size Classes, 1952	11
5. Ownership of Commercial Forest Land in the Mountain States, 1952 . . . . .	14
6. Estimated Life of Mountain States Mineral Reserves at Present Production Rates . . . . .	24
7. Per Cent of Personal Income Derived from Agriculture . . . . .	33
8. National Park Areas in the Mountain States, 1956	38
9. National Forest Areas, 1956 . . . . .	39
10. Percentage Change in Manufacturing Employment 1947-1953 . . . . .	45
11. Gross National Product of the United States (1953 dollars) . . . . .	47
12. Mountain States Water Power . . . . .	61
13. Availability of Water in the West . . . . .	65
14. Industrial Water Requirements Are Large . . . . .	66
15. Volume of Live Sawtimber on Commercial Forest Land, 1953, by Species, in the Mountain States	79

## LIST OF ILLUSTRATIONS

Figure	Page
1. Timber Cut - Mountain States . . . . .	12
2. Mountain States Share of Important United States Resources . . . . .	21
3. Mountain States Farm Production, 1935-1955 . . .	32
4. Per Capita Value Added by Manufacturing, 1953 .	44
5. Mountain States Water Use - 1950 . . . . .	63

## INTRODUCTION

### Purpose and scope

The Mountain States region<sup>1</sup> has nearly one-third of the United States land area but only 4 per cent of the population. This is truly a lightly settled hinterland. The important question, however, is whether the population is small because the region has not yet achieved its destiny or because, although big in area, it is limited in capacity to support people. Does aridity, lack of resources, or some other basic factor impose a low growth ceiling on regional growth prospects?

Historically, those regions having resources have flourished and grown; those regions lacking resources have not. Although demographers' projections of birth, death, and migration rates are an encouraging indication that the population of the Mountain States will not always be small, the basic question still stands: Does this region have the resource capacity to support more people?

This question is fundamental to all concerned with resource development and planning. But it has special significance to foresters. Because of the time required to grow trees, the character of the timber crop a century or

---

<sup>1</sup>Idaho, Montana, Wyoming, Colorado, Utah, New Mexico, Nevada, and Arizona.



more hence is in a large part determined by the decisions made and the actions taken today. Under these circumstances, foresters must anticipate demand further in the future than those involved in other industries.

Within the Mountain States the opportunity for local growth has a peculiar significance to forestry planning. The long distance to the primary markets has retarded regional timber development. To sell the amount of wood they have produced up to this point Mountain States sawmills have had to reach across the country. As a matter of fact, the average board from regional mills travels about a thousand miles before it reaches its ultimate consumer. If the Mountain States have the resource capacity to support the population indicated by current projections, the attendant growth in local markets would effect a reduction in the average freight bill against the products produced. This in turn would improve the competitive position of the region as well as provide additional incentive for greater investment in developing the forest resource.

The purpose of this paper, therefore, is two-fold:

1. To make a reconnaissance survey of what the resources of the region add up to in the way of growth opportunity.
2. Describe the significance of this opportunity to forest management in the region.

A region rich in resources can expect to grow two ways, horizontally and vertically. First is the opportunity for "horizontal expansion" on the resources base. By mining

more coal, cutting more timber, farming more land, and otherwise developing either lightly or fully a variety of resources, a region can expand its total employment and income. The key to opportunity in this case is adequate resource supplies, and the ceiling on long-range expansion will be set by the total economic supply of coal, timber, farm land, and other resources that can be found within the region. The second type of growth, "vertical expansion," is the opportunity for building a bigger manufacturing superstructure on the resource base by expanding the regional capacity to carry the processing or manufacturing of natural resources to a higher level. A plant to manufacture furniture from wood previously exported is an example of vertical expansion. Obviously, any discussion of regional potentialities, to be complete, must take into account both types of opportunities.

### Limitations

A detailed appraisal of the development potential of a region is a large and difficult job, beset with certain limitations. The principal limitation is the data available. Because so much past thinking has been of a short-range nature, data available often provide little more than clues to total potentials. Before the opportunities can be accurately evaluated, technologists in all fields must adopt the long-range view. Geologists, for example, must look at the mineral supply not only from the standpoint of how much mineral wealth might be extracted from the earth today, but

also from the standpoint of how much may ultimately be usable.

Be that as it may, an appraisal of the long-range opportunity cannot be delayed until knowledge in all fields is complete. Future generations will be quicker to excuse us if we make the best appraisal possible on the basis of the available data and relate forestry programing to it than if, because our information is incomplete, we do not squarely face the resource problems.

The task of making such an appraisal is also complicated by the fact that it requires going beyond the limits of current experience. As scientific knowledge takes on new dimensions almost daily, it is obvious that any looking into the future must be accompanied by bold imagination. For example, if we consider the regional coal resource only as a little-used mineral, underfoot for more than a century, we are missing the important point that in its abundance the Mountain States coal supply is a tremendously important asset to a highly technological economy.

Each facet of the situation is, of course, a story in itself. Each deals with a particular sphere of technical knowledge, and no one individual is expert in all the fields to be covered. For that reason, this report is confined to bringing together expert opinion from the many fields to develop a general idea of what the assets of the Mountain States add up to in the way of opportunity for growth and development.

## Procedure

In brief, the capacity for growth in the Mountain States is linked to the opportunity for expansion of:

1. The timber industry
2. The mineral industry
3. Agriculture
4. Recreation
5. Manufacturing

The opportunity for expansion of these industries is, of course, also influenced by climate and adequacy of water supplies, which are also examined.

The procedure followed in this study will be to consider all of these factors of growth separately. In discussing each resource or resource group, attention will be given to three factors.

1. Extent or magnitude of the resource.
2. Current level of use in relation to the sustainable level of use.
3. Circumstances likely to influence future use.

## I. OPPORTUNITIES FOR EXPANSION OF THE TIMBER RESOURCE

### The region has a substantial timber resource

One-fourth of the Mountain States area is forest land. All told, slightly more than 143 million acres are forested (1). Not all of these forest acres, however, are available to the timber industry. Some areas are too steep or too rocky to be logged economically under present technology; some support such stunted tree growth that the wood has no commercial value today; still others have been reserved as national parks and wilderness because it is believed that the recreation values exceed the timber values. When the combined acreages of such areas are subtracted from the total forest, 53 million acres of commercial forest land remain. This remaining area--about 11 per cent of the Nation's commercial forest land--forms the raw material reservoir for the region's timber industry.

Although the commercial forest land is heavily concentrated in the states of Idaho and Montana (Table 1), each state, with the exception of Nevada, contains a sizable forest area.

The commercial part of the forest contains 232 billion board feet of saw timber size trees. These trees form the immediate usable wood supply to the timber industry and

represent about 11 per cent of total national sawtimber supply (1, p. 510). As Table 2 shows, the distribution of this volume among the states of the region is roughly parallel to the distribution of the commercial forest land. The volume is still largely concentrated in the two northernmost states of Idaho and Montana. However, every state contains an active forest industry. For example, the state of New Mexico, ordinarily visualized as mostly desert, produced over 220 million board feet of lumber during 1952 (3).

Nearly all of the timber of this region is softwood. These softwood species are all widely used, mostly in lumber production. Some of these species, the so-called soft-textured softwoods, are highly prized for their fine qualities of workability, light weight, painting characteristics, and general appearance. As Table 3 shows, the soft-textured ponderosa pine, white pine, lodgepole pine, and spruce-fir species make up the major proportion of the region's sawtimber and growing stock volume. In fact, 39 million of the 53 million acres of the commercial forest in the Mountain States support these high-value, soft-textured species. This is approximately 40 per cent of the national supply area supporting these species of trees (2). Thus, the Mountain States forest resource has been and will continue to be a prime source of quality wood.

A big expansion of the timber industry is feasible

The average area of forest land in the Mountain States is less productive than forest land in either the South or

TABLE 1  
MOUNTAIN STATES FOREST LAND AREA, 1953<sup>a</sup>

State	Commercial forest land	Total forest land
	Thousand acres	Thousand acres
Idaho . . .	13,372	21,025
Montana . .	15,727	22,330
Wyoming . .	3,475	10,513
Arizona . .	3,180	19,212
Colorado . .	8,451	20,834
Nevada . . .	109	12,036
New Mexico .	5,735	21,329
Utah . . . .	3,014	16,219
Total . . .	53,063	143,498

<sup>a</sup>U.S. Forest Service, Timber Resources for America's Future (Washington, U. S. Government Printing Office).

the West. This difference between regional rates of growth can be ascribed to two factors. First, the Mountain States region has a shorter growing season and receives less rainfall than other regions. These factors naturally produce a poorer site for plant growth in general. Second, a large part of the forest in the Mountain States is still in a virgin condition and is stocked with mature trees which are physiologically incapable of growing as fast as younger trees. Most forests in other regions, especially in the East and South, have already been cut and are now restocked with young, vigorously growing trees. In some overmature

TABLE 2  
MOUNTAIN STATES TIMBER VOLUME, 1953<sup>a</sup>

State	Sawtimber	Growing stock
	MM bd. ft.	MM cu. ft.
Idaho . . .	96,015	21,246
Montana . .	55,770	16,143
Wyoming . .	12,070	4,087
Arizona . .	19,988	3,700
Colorado . .	25,394	8,037
Nevada . .	572	151
New Mexico	15,054	3,683
Utah . . .	7,800	2,001
Total . . .	232,663	59,048

<sup>a</sup>U.S. Forest Service, Timber Resources for America's Future (Washington, U.S. Government Printing Office) p. 513.

stands in the Mountain States the annual loss of wood because of disease and mortality exceeds the annual growth. Such stands often have a deficit growth that offsets the better growth of the rest of the forest. As Table 4 shows, nearly one-third of forest area supports old growth sawtimber.

Forests are like farms to the extent that their productivity is closely related to the effort expended. This region has had too little timber growing experience to know exactly how much forest productivity could ultimately be increased. Clearly, productivity will be materially improved when the overmature stands are managed and harvested



TABLE 3  
MOUNTAIN STATES TIMBER VOLUME BY SPECIES, 1952<sup>a</sup>

Species	Volume of live sawtimber	Growing stock <sup>b</sup>
	Billion bd. ft.	Billion cu. ft.
Softwoods		
Douglas-fir . . . . .	49.0	12.2
Ponderosa pine . . . . .	62.1	12.5
True fir . . . . .	21.5	5.3
Hemlock . . . . .	2.3	.6
White pine . . . . .	14.5	2.7
Spruce . . . . .	33.6	7.4
Lodgepole pine . . . . .	22.7	11.4
Larch . . . . .	17.2	3.7
Other . . . . .	5.2	1.1
Total . . . . .	228.1	56.9
Hardwoods . . . . .	4.6	2.1
Total all species . . . . .	232.7	59.0

<sup>a</sup>U.S. Forest Service, Timber Resources for America's Future (Washington, U.S. Government Printing Office) pp. 513, 519.

<sup>b</sup>Growing stock includes both sawtimber and pole-sized timber.

during rotations of more reasonable length. Elimination of the growth-robbing stagnation and overstocking in the pole and sapling stands would also substantially improve growth rates.

Just what degree of productivity could be achieved is unknown. It appears that if present timber management knowledge were realistically applied, the region's forests could

TABLE 4

COMMERCIAL FOREST ACREAGE IN THE MOUNTAIN STATES  
AREA BY TIMBER STAND-SIZE CLASSES, 1952<sup>a</sup>

Timber size	Acres in millions
Old growth sawtimber . . . . .	17.2
Young sawtimber . . . . .	9.8
Poletimber . . . . .	15.6
Seedling-sapling timber . . . . .	6.4
Nonstocked and other . . . . .	4.1
Total . . . . .	53.1

<sup>a</sup>U.S. Forest Service, Timber Resources for America's Future (Washington, U.S. Government Printing Office) p. 505.

grow about 2,300 million cubic feet of wood annually<sup>2</sup>. This would be a remarkable increase over the last reported (1952) growth of 797 million cubic feet and is five times larger than the 1952 cut of 420 million cubic feet (see Fig. 1).

In spite of these potential productivity increases, the Mountain States cannot expect its forests to grow at a rate competitive with either the South or the Far West because of the site problems mentioned earlier. Yet, the more rigorous site is not a complete disadvantage so far as tree growth is considered. Quantity of wood is not an end in itself. As pointed out earlier, one of the big advantages of the Mountain States timber resource lies in the fact that the species of trees which grow here produce wood that is in national demand because of its quality characteristics.

---

<sup>2</sup>From unpublished Forest Service statistics.

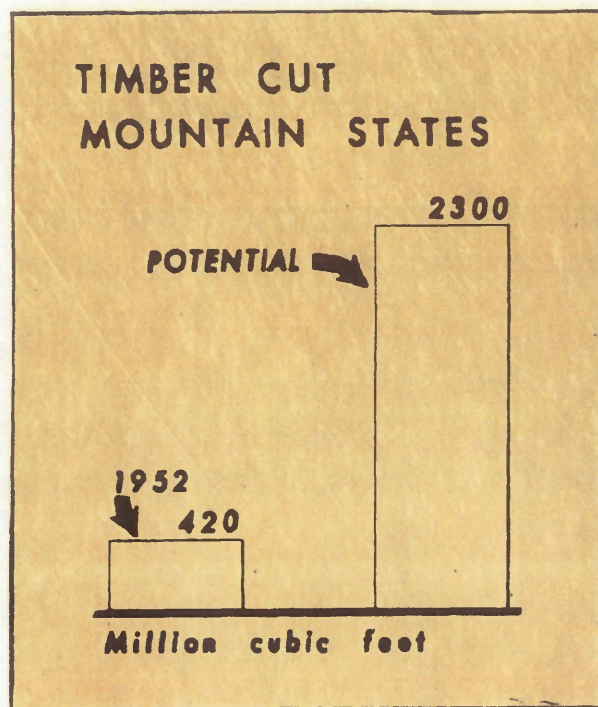


Fig. 1.

This quality is at least partly a factor of slow growth. The narrower rings in the large old growth timber give the Mountain States boards the smooth, even texture that wood workers like and are willing to pay for. Slower growth also has some advantage in fiber material production. Pulp yields from slower growing trees tend to be greater per unit of wood than yields from faster growing trees (4).

Other regions will always grow wood faster than the Mountain States. Yet price differentials between various quality woods seem to at least partly compensate for this apparent disadvantage. The development of the regional timber industry to date has been largely built on the capacity of the forest area to provide wood that competes in the higher priced, quality wood market.

Harnessing the full timber growing capacity of this region will be a big job--one that will require both time and money. The job will be somewhat simplified here in relation to other regions because of the pattern of forest land ownership. As Table 5 shows, a substantial part of the forest land is publicly owned. Certainly the problems of bringing a single property under better management are less difficult than those facing regions with numerous scattered parcels of forest held by many different owners with different goals and uses and needs for their own particular forest acreage.

The forest management job is still imposing, but the potential exists. At present the forest resource is the

TABLE 5

OWNERSHIP OF COMMERCIAL FOREST LAND  
IN THE MOUNTAIN STATES, 1952<sup>a</sup>

Owner	Million acres
Federal . . . . .	38.9
State, county, and municipal . . . . .	2.0
Private . . . . .	12.2
Total . . . . .	53.1

<sup>a</sup>U.S. Forest Service, Timber Resources for America's Future (Washington, U.S. Government Printing Office) p. 536.

basis for a local industry that employs about 25,000 people to harvest and manufacture more than 300 million dollars of timber products each year (3). However, a recent publication indicates that the forest has the capacity to support a future forest industry payroll of at least 150,000 people (2). It seems reasonable to suppose that value of the timber products could increase proportionately. In this case the Mountain States could expect to produce nearly 2 billion dollars of timber products each year.

The potential employment and value of production figures are rather small when compared with those for either the agricultural or mining industries of this region. Yet the timber resource has a much greater potential for expansion than agriculture and offers some advantages lacking in mineral development.

The forest resource offers two rather distinctive advantages to the region. First, timber is a renewable resource. New trees can be grown to replace those cut. Under management, the timber resource will yield a perpetual supply of raw material for wood-using industries. This gives the economy of a timber-based community a degree of permanence that is lacking in mining communities that must rely on depletable resources. No matter how large the mineral supply may be, it will eventually be "mined out". Second, timber operations are generally carried on in areas that have only marginal agricultural importance. Here timber frequently becomes the hub of economic activity and employment.

Obviously the forest resource of the Mountain States can potentially add much to the region's economy. The question, however, is whether the national wood needs will require the full use of this potential. The blunt fact is that in the past this region has had more timber than it could possibly sell. Before the region can utilize its full wood-growing capacity, it must find a considerably bigger market for timber than it has today. Fortunately for the region, a series of factors indicates that the demand for Mountain States timber will increase very substantially during the next 25 to 50 years.

The nation will need more wood

The basic reason for optimism about the future of the Mountain States timber resource is that the United States is

a growing nation. Population experts confidently predict that the Nation's population will reach or exceed 275 million by the year 2000. This staggering prospect will bring about an enormous increase in the use of all types of raw material. This does not mean, of course, that the use of wood will necessarily increase in proportion with the use of all other materials. However, in a recent review of possible future timber requirements, the Forest Service has concluded that the United States may need between 46 and 114 per cent more wood by the end of the century than it consumed in 1952 (1).

This, of course, raises the subsidiary question of whether even these increased wood needs might not be met by other timber-producing regions of the United States without drawing upon the full timber production potential of the Mountain States. The Forest Service's analysis sheds some significant light on this question also. It shows that in terms of prospective wood needs the United States has no excess forest land. To meet the challenge of future wood requirements, this Nation will have to carefully search its woodbox. All, or nearly all, of the United States commercial forest land, wherever it is, must be utilized more completely to meet these expanded wood needs.

The trend towards fuller use of Mountain States timberland has already begun. Since World War II, both the lumber and paper industries have been looking ever more covetously at the wide band of timber that cloaks the Rocky Mountains

from Canada to Mexico. The region's first pulpmill was constructed in Idaho in 1950 and it has more than doubled its capacity since then. In 1953 a new pulpmill was built in Arizona. The first modern pulpmill in Montana began operation in 1958, and another one is now on the drawing board. A new container board plant is being constructed in Idaho. As a result of this post-war expansion the region now has over 900 tons of daily pulpmill capacity. Between 1947 and 1954 regional lumber production increased about 900 million board feet.

This optimistic outlook is underlined by the fact that the forests of this region grow the kind of wood that is in greatest demand. Most of the wood consumed in the United States comes from softwood trees. Practically all of the trees in this region are softwoods. The Forest Service's long-range timber products demand projection indicates that it may be necessary to increase total softwood sawtimber growth in the United States from 28 billion board feet in 1952 to as much as 76 billion board feet by the end of the century (1).

In terms of the national market the future seems bright

As with the other resources, the timber resource has both a short-range and a long-range future that are not quite the same. The short-run opportunity is influenced by the interplay of present costs, values, and competition, and is limited by what can be done today under present costs and values.



However, growing timber is a long-term operation. It appears that as the Nation grows and as its needs for raw material become larger and less easily satisfied, the pressure of circumstance will help draw this region's presently uneconomical timber resources into use. In the long-run, it is assumed that values will change, the part of the end cost which is raw material will increase, and technology will meet the challenge of cost.

From this point of view, there is good reason to be optimistic over the prospects. The Mountain States have an important timber resource. All signs indicate that expanding national wood needs will require more from this resource. It seems reasonable to suppose that the Mountain States will be called upon, in the fairly near future, to produce timber products in quantities which more closely approximate the practical growth potential of the region.

Narrowing the comparison even further, the Forest Service report states that the higher quality woods probably will be in shortest supply in the years to come. The so-called soft-textured softwoods, such as ponderosa pine, white pine, lodgepole pine, and spruce are all in this general high-quality category. The fact that a large part of the commercial forest in the eight Mountain States grow soft-textured softwood trees, as mentioned earlier, is encouraging. (2).

Still another reason for encouragement has been the changing competitive relationship between the Mountain

States and other timber-producing regions. During the past few years, Southern lumber production has declined. Sawmills on the West Coast are gradually running out of the virgin, old growth Douglas-fir, which has traditionally been a strong competitor because of big trees, big yields, and high quality. The second growth timber cut will likely be smaller and lower in quality. This factor promises somewhat easier competition in the future for Mountain States timber (2).

## II. OPPORTUNITIES FOR EXPANSION OF THE MINERAL INDUSTRY

The Rocky Mountain backbone of this Nation is a treasure trove of minerals. Much of today's production of copper, lead, zinc, molybdenum, uranium, and other minerals is concentrated in these western states. Likewise, the greater share of the Nation's reserves of these and other minerals lies within the region. The more important ones are shown in Figure 2. It is not surprising, then, that the United States, with its prodigious consumption of raw materials, should lean heavily on this region for many minerals. To continue its growth and prosperity, the United States will require even larger quantities of all minerals in years to come than it does today. According to one estimate, the mineral requirements of the Nation may be 90 per cent greater in 1975 than they were in 1950 (5, Vol. 1, p. 24). The question is this: Do the Mountain States have adequate mineral supplies to expand production and sustain that expanded production for a long time?

It is difficult to make an accurate estimate of total mineral supplies. Some minerals reveal their presence by surface outcrops so the supply can be estimated fairly easily. Others are so deeply buried that their presence or limits can be determined only by extensive and expensive

MOUNTAIN STATES SHARE OF  
IMPORTANT UNITED STATES RESOURCES

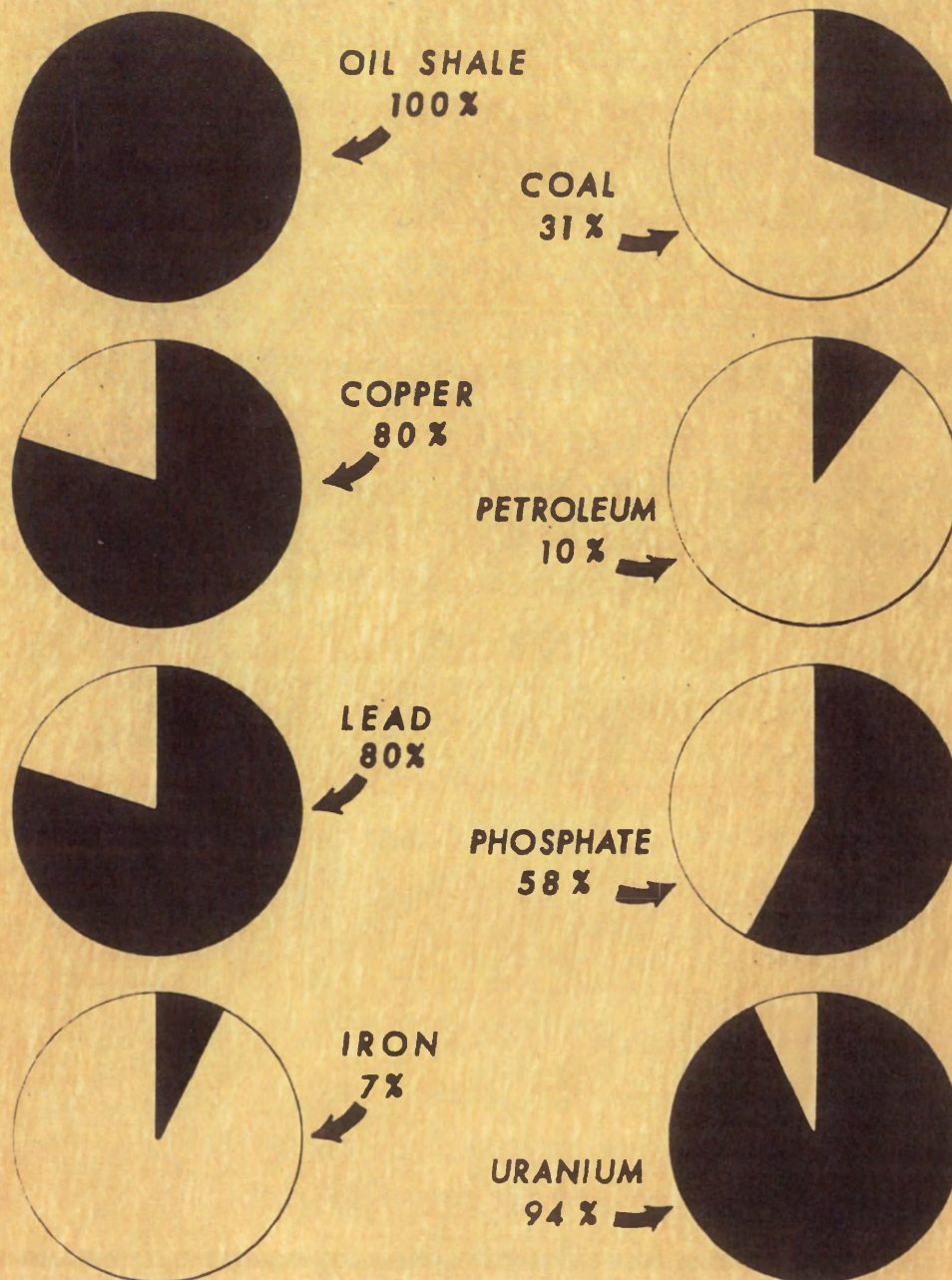


Fig. 2.

exploration. As a result, the amount of exploration done is usually more strongly related to present mineral values than to any other factor. Because many minerals have been little used in the past, the total extent of the Mountain States mineral wealth is largely a matter of speculation, even by geologists.

Another imponderable, which no amount of probing into the earth will answer, is the extent to which future technological advances will change our perspective. For one thing, improved techniques of mining and refining can completely alter the supply situation of any individual mineral by making available low-grade ores now considered economically inoperable and hence excluded from present reserve figures. Then too, improved exploration techniques could reveal vast new mineral deposits located far below the surface of the earth that have completely escaped detection thus far.

The incompleteness of present-day knowledge about the mineral resource is significant chiefly because it suggests that the Mountain States region probably has a larger mineral supply than is now realized. However, these gaps in our knowledge need not prevent us from estimating the industrial expansion possible with the now known mineral deposits which seem potentially operable.

#### Nonmetals offer biggest opportunity

Among the major metals, copper, lead, zinc, and better quality iron ores appear to be in relatively limited supply not only in this region but throughout the United States (6).

Liquid petroleum reserves are likewise limited. In relation to the current rate of consumption and without further exploration, proved petroleum reserves in the Mountain States would last about 11 years, copper 20 years, lead 35 years, and zinc about 25 years. No doubt the actual reserve supply of each of these minerals is several times greater than the present data indicate. For example, no one really expects that lead reserves will be exhausted during the next several decades. But the poor discovery record and the actual decline in lead production during the past 25 years give little basis for optimism that expansion of production could be maintained for any length of time. In the case of copper, both production and reserve supplies have been fairly stable during the last quarter century, and new discoveries apparently are just about balancing the depletion each year. But the quality of copper ore being mined has steadily declined.

All of the above minerals are imported into the United States in ever larger amounts. In spite of belief and hope that the ultimate national supply of these minerals will prove larger than the present data indicate, and recognizing that part of the supply problem may be due to insufficient exploration, it does not seem reasonable to count on these minerals to sustain an output much larger than the present.

The most obvious opportunities for expansion lie in the vast deposits of oil shale, coal, phosphate, and potash. Known supplies of these minerals are so extensive that there

is no doubt about their capacity to support increased production for hundreds of years. As Table 6 shows, little use is presently made of these minerals in relation to their vast reserves. For example, only a start has been made in oil shale utilization.

TABLE 6

ESTIMATED LIFE OF MOUNTAIN STATES MINERAL  
RESERVES AT PRESENT PRODUCTION RATES

Mineral	Life in years <sup>a</sup>
Copper . . . . .	20
Lead . . . . .	35
Zinc . . . . .	25
Petroleum . . . . .	11
Natural gas . . . . .	30
Potash . . . . .	1,000
Phosphate . . . . .	1,000/
Oil shale . . . . .	1,000/
Coal . . . . .	2,000/

<sup>a</sup>Computed from data available from U.S. Bureau of Mines and trade journal sources.

Oil shale, gilsonite, and similar hydrocarbons may well prove to be the most valuable mineral of the Mountain States. Practically all of the Nation's deposits of these nonmetals are located in Colorado, Wyoming, and Utah. They convert fairly readily into oil products, and could supply for more than 250 years as much oil annually as all United States oil fields produced in 1957. Under full development, oil shale alone could potentially provide jobs for as many persons as are now employed in all the manufacturing and mining industries in the Mountain States.

Actual development of the oil shale resource is, of course, dependent upon factors other than supply. These factors are both economic and political in nature. At the present time, for example, high production costs have stifled any large scale commercial attempts to manufacture gasoline from shale. Distance to markets, too, has delayed any real use of this mineral. Improved technology may reasonably be expected to reduce present day production costs. Political factors including tax incentives in the form of depletion allowance, tax rates, or even direct subsidy could hasten development. World tensions and the possible attendant loss of access to other countries' oil supplies could promote increased national interest in shale potentialities. On the other hand, the tempo of domestic oil exploration has been stepped up recently even in the face of increasing exploration costs. If this exploration activity turns up substantial new crude oil reserves, shale development will likely be delayed still longer.

The combination of these factors make time table predictions for oil shale development nearly impossible. These retarding present day conditions do not reduce the long range intrinsic value of this resource. Shale is no longer a laboratory curiosity. In 1957 the Union Oil Company of California produced and marketed 12,000 barrels of fuel from oil shale processed in their Colorado plant (7). The sheer quantity alone of this resource multiplies its present value into a significantly larger future worth. In the long run



we can expect oil shale to play an important part in the future development of this region.

The coal resource of the Mountain States is even larger. The 596-billion-ton regional coal reserve could supply the present coal needs of the entire United States for more than 600 years even assuming that only 50 per cent of the total supply can be recovered. Coal production has declined during the last 10 years because of competition from oil and gas. Future development of nuclear power for industrial purposes may further aggravate coal's competitive marketing problems. In spite of these competitive inroads, coal is still an important basic fuel and some increase in demand for this purpose is likely. This enlarged production will not provide much additional employment because improved technology and equipment is slowly reducing the man-hour requirements per ton of coal mined.

Although fuel use now accounts for the biggest part of present coal production, coal is also used by the chemical industry to manufacture plastics, pharmaceuticals, detergents, synthetic rubber, and other chemicals. This product diversity is coal's greatest asset. Increased production of these and new future products will have a growing impact on coal demand. For this reason the big contribution of coal to the regional economy will come from new industries that will eventually be attracted to this abundant and versatile resource.

Sixty per cent of the Nation's phosphates and an even larger portion of its potash supply are located in the Mountain States. The phosphate resource is so extensive that even if the present Mountain States production were doubled, its known economic reserves could support the accelerated production rate for more than 1,000 years. Additional known (but currently economically unavailable) reserve supplies are believed to be six times larger. Potash supplies are smaller in relation to use, but are adequate to sustain the current rate of use for longer than 1,000 years if the quality of the ore mined could be reduced to 5 per cent from the present 14 per cent.

The tremendous supplies of coal, oil shale, phosphate, and potash place these minerals in a class by themselves. They obviously have the capacity for a large expansion of production. Even partial development of these minerals will have far-reaching effects on the Mountain States economy. This is one of the great mineral areas

Numerous minerals are found in the Mountain States. Because of the scope of this report and limitations of available information, it is impossible to evaluate all of their individual possibilities. A few of the minerals like lime, salt, sand, gravel, and molybdenum occur in relatively large amounts. The molybdenum deposits in Colorado, for example, supply about two-thirds of the world requirement for that mineral (6). Reserves of this mineral are sufficient to support expanded production. Clay deposits are

virtually unlimited, and some contain enough aluminum that they can be used to produce that metal. In fact, the Anaconda Company has already started work in a pilot plant to test the recovery of alumina from these clays. Other minerals such as chromium, cobalt, and titanium seem to be rather scarce and therefore have only limited production potentials. The situation of still other minerals is too clouded and fragmentary to piece together a complete picture. For example, the recent intensive search for uranium turned up fairly large ore deposits, nearly all of which are in the Mountain States. It is not known how long these reserves might last because no published information indicates the annual rate of use. But, since the whole field of nuclear energy is just developing, the uranium resource probably could become an even greater asset to the region than it is today.

#### Expansion opportunities in the mineral resource

Much could be gained from a complete appraisal of the mineral resources of the Mountain States that would show their capacity to support additional production. It is apparent, however, that the reserves are still extensive. Although some minerals, like copper, do not seem to offer much opportunity for industrial expansion, others, like oil shale, open truly new vistas. Considering the tremendous appetite of the United States for raw materials, considerable growth of the mineral industries can be expected during the coming decades. Just what additional employment might

be generated by this growth is not known. At present, 94,000 persons are employed in the region's mining activities. The mineral industries have been steadily improving labor output through technological developments. Therefore, employment will probably increase proportionately less than production. Nevertheless, the abundance of mineral resources and the probability of increasing demand for nearly all raw materials indicate a good opportunity for expanding both the income and employment in the mineral industries. This growth in turn will also increase the long-run opportunity for expansion of manufacturing.

### III. OPPORTUNITIES FOR EXPANSION OF AGRICULTURE

Farms and ranches in the Mountain States have been the keystone of this region's economy during most of its relatively short history. However, as other industries have grown in stature and as the farms and ranches have become increasingly mechanized, agriculture no longer dominates the economy to the extent it once did. This change, nevertheless, has been relative, for agriculture is still the biggest source of basic employment in the region. In 1956, nearly one out of every five persons employed in the Mountain States worked in some phase of agriculture. Regional agricultural employment was four times larger than mining employment and half again as large as manufacturing employment (8). In 1955, 12 per cent of the total personal income of the region was paid to agricultural workers. With the exception of the Plains States, the Mountain States still are relatively more dependent on agricultural income than any other region in the United States (9).

Mountain States agriculture has been a rapidly changing industry in a rapidly changing setting. The farm area has expanded. According to census data the area in farms increased more than 50 per cent between 1935 and 1954, from 174 million acres (10) to 261 million acres (8). Some of

this increase is apparent rather than real because of changes in definition of agricultural land. Nevertheless, there has been a significant increase in farm area. Production of both crops and livestock likewise is greater than it once was. Figure 3 shows that the "real" or constant dollar value of all agriculture products doubled between 1935 and 1955.

At the same time, however, economic pressures have forced some important adjustments in agriculture. One has been the trend toward larger farms. There were 34 per cent fewer farms in the Mountain States in 1954 than in 1935 (10) (8). By the same token the pressure for efficiency has shrunk the farm working force during this period.

While farm area and farm production have been rising, other industries have been growing even more rapidly. Some of them have literally mushroomed in the past several decades. Thus, though the farm economy is bigger than ever before it is a smaller part of the total economy than at any time since the fur trappers had these eight states to themselves. Table 7 shows that in every state in the region, agriculture contributed proportionately less to total personal industrial income in 1955 than in 1935. As a matter of fact, from this point of view, agriculture is now about one-half as important as it once was for the region as a whole.

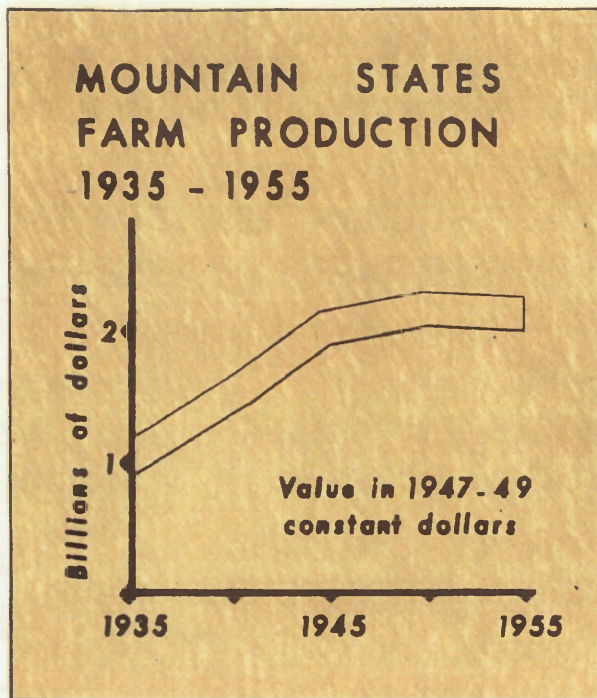


Fig. 3.

TABLE 7  
 PER CENT OF PERSONAL INCOME  
 DERIVED FROM AGRICULTURE<sup>a</sup>

State	1935	1955
New Mexico . . . . .	21	7
Arizona . . . . .	19	11
Montana . . . . .	22	20
Idaho . . . . .	31	16
Wyoming . . . . .	21	10
Colorado . . . . .	12	5
Utah . . . . .	13	5
Nevada . . . . .	9	4
Mountain States .	18	9

<sup>a</sup>Dept. of Commerce, Personal Income Since 1929 (Washington, U.S. Government Printing Office), p. 37.

Agriculture offers some growth opportunities

The agricultural segment of the Mountain States economy has progressed further in its development than other segments. For that reason it appears to have less opportunity for expansion than mining, forest industries, or manufacturing. With minor exceptions, all of the land suitable for agriculture within the Mountain States today is being either cropped or grazed. Thus, the hope for expansion rests primarily on increasing productivity.

During a time of farm surpluses, it may be difficult to see the future need for additional agricultural production. However, the prospective population growth of the Nation from the present 170 million people to 221 million by 1975



and 300 million by 2000 will likely absorb any present surpluses and underline the need for greater future production per acre. It is estimated that national requirements for agricultural products in 1975 will be 40 per cent greater than in 1950. This situation will be aggravated somewhat by the loss of farmland to other uses. Growing cities, with their expanded residential areas, industrial centers, airports, and highways steadily encroach on farmland. An estimated 15 million acres of cropland in the United States will be lost between 1950 and 1975 through urban encroachment (5, Vol. 1, pp. 46-48).

It is difficult to say how much agricultural production in the Mountain States might be increased by intensified effort. National studies of the problem suggest there is room for considerable improvement. In 1950, the President's Materials Policy Commission estimated that it was theoretically possible to step up the production of existing farmlands as much as 200 per cent and well within reason to increase it by at least 75 per cent (5).

Such gains in productivity can be achieved only under much more intensified agricultural management than is practiced today. For example, the carrying capacity of public range land could be increased by at least 30 per cent under such improved range practices as better livestock distribution, use of more fences, more water development, reseeding, and general rehabilitation for previously abused ranges (5). The productivity of cropland and pasture can be

advanced considerably by greater fertilization, further reduction of insect and disease losses, and better irrigation.

Within the Mountain States expanding the total irrigated acreage seems to be one of the most promising ways for increasing crop yields. The region actually has millions of acres that have the fertility and other soil qualities required for cultivation. Unfortunately these acres have everything except water. However, the Bureau of Reclamation has estimated that during the next 50 to 100 years it may be possible to irrigate nearly 5 million new acres in the Mountain States (11). Future plans also call for bringing supplemental water supplies to many acres that are not now allotted enough water for efficient plant growth.

The subject of water for irrigation should not be considered without recognizing the equally important or more important water needs of other users. This question is discussed in a later chapter. It is sufficient to say here that the growing demands for water may not permit as much expansion of irrigation farming as the Bureau of Reclamation now estimates. Nevertheless, if only 3 or 4 million new acres are irrigated in the long-range future, it will be a significant addition to the 11.2 million acres now irrigated (8). The 28 per cent of the Mountain States cropland irrigated today produces about 60 per cent of the crop value (12). Thus, increased productivity is more likely to come from irrigated lands than from dry farmlands.

Fewer workers will produce greater value

The main contribution of agriculture to growth of population and markets in the Mountain States may be indirect. If technology advances as it should, progressively fewer workers will be directly engaged in agriculture, even under more intensive management. However, this situation does not detract from the importance of agriculture. Availability of basic food and fiber products in any area is an important asset to the development of all other resources and opportunities.

#### IV. OPPORTUNITIES FOR EXPANSION OF THE RECREATION INDUSTRY

The shorter work week and the consequent increase in leisure time have made recreation an important part of American culture. Better roads and a highly mobile population have made outdoor recreation such as camping, picnicking, boating, fishing, hunting, hiking, and sightseeing more popular throughout the Nation (13). This trend is a natural outgrowth from the recreational opportunities provided by this country's forests, mountains, deserts, lakes, sea-shores, and streams. It makes these recreational attractions themselves an increasingly valuable economic asset. The Mountain States have a big recreational resource

The Mountain States have the climate, variety of scenery, and abundance of fish and game for those who seek vacations away from the tensions of urban living. Equally important, the region has the elbow room for those who seek to "get away from it all". The region's nine national parks include some of the most spectacular scenic natural attractions on the American continent. The 4.7 million acres of national parks (14) are supplemented by 96.1 million acres of national forest (15). Thus, the Mountain States with one-fourth of the Nation's land and 4 per cent of the population can list among its assets 42 per cent of the Nation's

national park area and 57 per cent of the national forest area (see Tables 8 and 9).

TABLE 8

NATIONAL PARK AREAS IN THE MOUNTAIN STATES, 1956<sup>a</sup>

Area	Thousand acres
Bryce Canyon . . . . .	36
Carlsbad Caverns . . . . .	46
Glacier . . . . .	1,000
Grand Canyon . . . . .	673
Grand Teton . . . . .	300
Mesa Verde . . . . .	51
Rocky Mountain . . . . .	256
Yellowstone . . . . .	2,213
Zion . . . . .	128
 Total Mountain States . . . . .	 4,703
Total Continental U.S. . . . .	10,999

<sup>a</sup>National Park Service, Areas Administered by the National Park Service (Washington, U.S. Government Printing Office) pp. 1-10.

This largest "playground" area of the Nation has become increasingly popular with tourists and others who seek outdoor recreation. For example, 700 thousand persons visited Glacier National Park in Montana during 1956 (8, p. 189). This was a sevenfold increase since 1933 (16). During the same year, Yellowstone National Park recorded 1.5 million visitors (8, p. 189). National forests have shared this rise in popularity. Nearly 20 million visits were made to the national forests within the Mountain States during 1956 to utilize the campgrounds, picnic areas, winter sports

TABLE 9

NATIONAL FOREST AREAS, 1956<sup>a</sup>

State	Thousand acres
Arizona . . . . .	11,391
Colorado . . . . .	14,372
Idaho . . . . .	20,326
Montana . . . . .	18,573
Nevada . . . . .	5,058
New Mexico . . . . .	9,355
Utah . . . . .	7,923
Wyoming . . . . .	9,141
Total Mountain States . . . . .	96,139
Total Continental U.S. . . . .	167,342

<sup>a</sup>U.S. Forest Service, National Forest Areas (Washington, U.S. Government Printing Office) pp. 1-6.

areas, summer homes, hotels, and dude ranches within the forests<sup>3</sup>.

It has been said that the Mountain States recreation resource lacks only a seashore. Certainly, persons seeking outdoor pleasures other than the ocean spray can find them within the region. Recreational opportunities run the full gamut from balmy Arizona winters to alpine ski slopes. Fishing, hunting, picnicking, and camping are all available. Each year finds more people skiing. The Mountain States have some of the Nation's best ski areas in places such as Alta, Utah; Aspen, Colorado; Sun Valley, Idaho; and Big Mountain, Montana. Other excellent ski areas await development.

---

<sup>a</sup>From unpublished Forest Service statistics.

Recreation will become an increasingly important source of income

It is not possible to fully evaluate either the present or potential contribution of recreation as a source of income. Not enough data on this industry have been collected. However, it is apparent that the recreation industry represents a big opportunity. The Curtis Publishing Company has estimated that between April 1, 1952 and March 31, 1953--one year--82 million Americans took vacations lasting 3 or more days. Furthermore, they spent about 8 billion dollars during those vacations (17). Satisfying vacation wants provided jobs for many people. According to one estimate, more than two-thirds of Santa Fe's 30,000 residents draw their livelihood directly or indirectly from the tourist trade (18). Undoubtedly other cities in the Mountain States are, or will become, similarly specialized.

A Fish and Wildlife Service report shows that hunters and fishermen in the United States spent 3 billion dollars in pursuit of their hobbies during 1955 (17). In Mountain States 4 million people hunted and fished in 1955 (19). In Utah alone, during that year hunters and fishermen spent 44 million dollars, an amount that exceeded the combined value of all field crops and fruit grown in the State that year (20).

Although the Mountain States have the natural attractions for an even bigger recreational industry, these resources cannot make their maximum contribution unless they

are complemented by considerable development. For example, additional roads and highways are needed to bring more area into use. More cabins, hotels, and dude ranches will be needed to serve the additional recreationists. Both the National Park Service and the Forest Service are expanding the capacity of their recreational facilities. Development of new reservoirs on the upper Colorado River will add extra fishing and boating uses to an area that until now has been used mainly for an occasional river exploration trip. It can be expected that the new lakes formed along this river will soon be used as intensively as Lake Mead in Nevada.

Aside from its direct economic influences, availability of recreation can favorably influence the location of new industries. Other things being equal, available recreational opportunities for their employees could be the clinching factor in the site selection decision of industrial planners. Certainly this factor influences the decisions of families contemplating moving to a new area; for some, it may even over rule other considerations.

The recreational opportunity may be summed up in this way:

The number of persons enjoying outdoor recreation has increased rapidly during recent years. It seems fair to assume that if the trend of more people with more leisure continues, recreation of all sorts will become an even bigger part of the American way of life. This is significant to the Mountain States because the varied and extensive



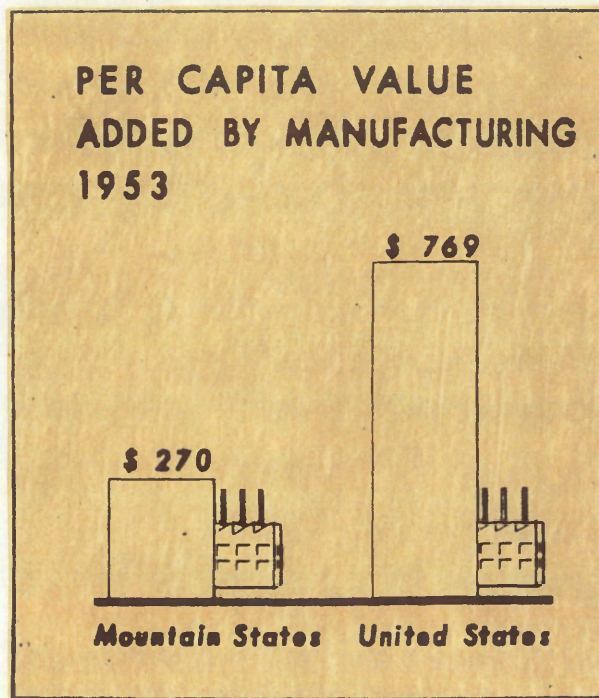
outdoor recreation resources can care for many more people than they have. It should offer the opportunity to expand regional tourist and recreation industries.

## V. OPPORTUNITIES FOR EXPANSION OF MANUFACTURING

### The Mountain States lack manufacturing industries

With some oversimplification, the economy of the Mountain States can be described as having a good foundation but only a partially developed superstructure. The region relies primarily on its extractive industries for livelihood and has less than a proportionate share of industries that carry raw materials to a higher level of manufacture. There is little doubt about the Mountain States' capacity to increase the utilization of its resources in the future. However, the employment and income generated by such horizontal expansion probably will be smaller than that which could be generated by vertical growth of manufacturing industries.

How much the manufacturing industry of this region can be expected to expand is impossible to know. However, comparative statistics for this region and the Nation give a clue. In 1950 one person in four in the United States labor force was employed in manufacturing. In the Mountain States one person in ten was so employed (8, pp. 201-206). The result, as Figure 4 shows, is that on a per capita basis, manufacturing contributes much less to the Mountain States than it does to the United States.

Fig. 4.<sup>a</sup>

<sup>a</sup>Dept. of Commerce Statistical Abstract of the United States, 1957.

Several factors encourage the belief that future regional growth will lessen this disparity. Manufacturing is already becoming increasingly important in this region's economy. The proportion of the regional labor force engaged in manufacturing increased from 8.4 per cent to 9.5 per cent between 1940 and 1950. However, the most spectacular increases have occurred since the end of World War II. Between 1947 and 1953 manufacturing employment increased 27 per cent in the Mountain States as compared to 13 per cent in the Nation (8, pp. 201-206) (21). This increase has not been uniform throughout the region as Table 10 shows. While Arizona recorded a startling rate of manufacturing employment growth, Montana statistics show a small decline. Obviously all parts of the region do not have equal locational attraction for the manufacturing industry.

TABLE 10  
PERCENTAGE CHANGE IN MANUFACTURING  
EMPLOYMENT, 1947-1953<sup>a</sup>

Area	Per cent
United States . . . . .	+12.8
Mountain States . . . . .	+26.6
Arizona . . . . .	+89.8
Colorado . . . . .	+18.3
Idaho . . . . .	+15.6
Montana . . . . .	-.6
Nevada . . . . .	+33.3
New Mexico . . . . .	+82.2
Utah . . . . .	+22.3
Wyoming . . . . .	+4.8

<sup>a</sup>Dept. of Labor, Employment in the Mountain States, 1947-1953 (Washington, U.S. Government Printing Office) Table A.

Since 1956 new industries have settled within the region. The Marquardt Aircraft Corporation opened a new plant in Utah in 1957 and has announced plans for expansion. A new iron ore processing plant and a new coke and char plant have been announced for Wyoming. During 1955 a new aluminum plant began operation in Montana, and recently a new iron ore processing plant was announced for that state.

Several developments are taking place in the chemical and fertilizer industries. The National Potash Company began operations at a new plant in New Mexico early in 1958. A new phosphate mill is being constructed by Central Farmers Fertilizer Company in Idaho. The first commercially produced petroleum from oil shale was marketed during 1957. These recent developments point to continued growth of manufacturing throughout the region.

There is reason to believe that present trends will continue for many years. The population of this Nation is growing rapidly. As population pressures build up, it seems likely that, to the extent they are able to support more people, the more lightly settled areas will continue to grow at a more rapid rate than the rest of the Nation.

Another factor favoring expansion of manufacturing in the Mountain States stems from the national defense strategy. A large part of this Nation's manufacturing industry is clustered around a few metropolitan centers. With the recent development of fantastically destructive weapons of war, this situation is not a particularly desirable one from

the standpoint of national security. One official of the Department of Defense has this to say:

A successful attack against our 50 largest metropolitan areas would devastate over 60 per cent of total manufacturing production and over 70 per cent of production of the critical hard goods industry. Actually, the effect on production would be even more severe because of imbalances and bottlenecks, at least as our industrial pattern now exists (22).

The international situation does not seem to require a relocation of existing industry with all the hardship and expense that would involve. However, a national industrial dispersion program has been undertaken to channel future industrial expansion away from areas that seem dangerously crowded. If that effort is even partially successful, it will strongly affect the economies of many less industrialized areas, because the Nation's total production is expected to be 78 per cent greater in 1975 than it was in 1953. If the experts are correct, it will triple or quadruple by the year 2000 (1, p. 9) (see Table 11).

TABLE 11

GROSS NATIONAL PRODUCT OF THE UNITED STATES (1953 dollars)<sup>a</sup>

Year	Billions of dollars
1953 . . . . .	354
1975 . . . . .	630
2000 . . . . .	1,200

<sup>a</sup>U.S. Forest Service, Timber Resources for America's Future (Washington, U.S. Government Printing Office) p. 9.

Industrial dispersion will involve expansion of manufacturing in the outlying suburban areas surrounding the large metropolitan communities. It can and should also involve expansion into underdeveloped regions. This is reflected by the recent moves of Sperry Rand, Atlas Powder, and Thiokol corporations into Utah.

Many of the factors which have retarded development of the regional manufacturing industry in the past will continue to do so in the coming years. The impact of some will be less than before; others will remain severe barriers to regional growth. The Mountain States region is the newest part of our Nation. Long before the territories were made into states, a well established manufacturing industry existed in the Eastern part of the Nation. Prior establishment has given strength to these older firms. Moreover, this advantage has been cultivated by devices such as the basing point system and freight rate differentials. Aside from the competition of prior establishment, certain specific factors influence the locational decisions of industry. Thirteen factors are listed by Garnsey as prime determinants of industrial location (23). Some of the more pertinent ones, at least so far as this region is concerned, are discussed below.

Location of production materials.--Raw material supply is an important factor influencing plant location for many industries. Availability of raw material explains much of today's manufacturing activity in the Mountain States.

Because of the large weight loss incurred when raw materials are converted into manufactured goods, it is usually cheaper to bring the plant to the material than to bring the material to the plant. For example, sawmills and pulp mills are inevitably built near the forest. As the preceding chapters have already shown, an abundant raw material supply is the Mountain States most persuasive industrial inducement.

Transportation facilities.--Regional manufacturers have reasonably good rail, truck, and air facilities to distribute their products. But they frequently find themselves at a competitive disadvantage so far as the cost of these services are concerned. In the first place, as might be expected, transportation costs are high because of the generally long distance to major markets. Producers nearer these markets are expected to pay lower freight bills because of the shorter haul involved in reaching the same market. This is part of normal competition. However, because of existing freight rate structures, regional manufacturers have found that they pay higher freight charges than their rivals even when shipping equal products equal distances to the same market. In some cases, rates are higher for the Mountain States producer when actually shipping shorter distances than a competitor. Numerous cases of such apparent rate discrimination have been recorded (23). Hutchison has described the adverse impact of freight rates on the Idaho and Montana lumber industry (24).



A complete study of freight rates and their intricate workings are beyond the scope of this paper. The concensus seems to be, however, that the present freight rate structure is a serious handicap to the development of regional manufacturing opportunities. It should be noted that rates can be changed. This has happened several times in recent years to the benefit of specific groups of Mountain States manufacturers (23). Until more rates are changed, this factor will continue to discourage manufacturing in this region.

Markets.--The importance of market proximity is demonstrated by the presence within the region of the many division plants of national manufacturing firms. Swift, Coca-Cola, du Pont and others maintain factories here because of the marketing efficiencies achieved by supplying the local markets from these plants rather than from a single central plant. Other kinds of manufactured goods such as automobiles, require a much larger market before the efficiencies of plant decentralization can be realized. The present small local market renders this region unattractive to this kind of industry even when other factors are favorable.

Many industries rely on both a local and national market in which to distribute their products. As mentioned earlier, the long distance to the principal non-regional markets and unfavorable freight rates again discourage many industries from locating within the Mountain States.

The prospective regional population growth described earlier should expand the local market opportunities. Access to the national market would be facilitated by an improved freight rate structure.

Industrial fuel and power.--Much of the manufacturing done in the Mountain States is of a raw-materials-processing nature. Such industries use large quantities of power. The importance of low cost power is obvious. The region has ample supplies of coal, natural gas, and hydro-electric power. Future development of the regional hydro-electric resource may be expected to expand the total available industrial power supply. Development of atomic energy, too, may play a significant role in changing the relative cost of industrial power.

Tax structure.--Excessive taxes are certain to discourage industry. While it is difficult to generalize a region's laws and regulations, few states seem to have offered tax incentives to attract industry. This region must maintain taxes that are at least competitive with other areas if it is to attract new industry.

It is evident from the above comments that the region must overcome numerous handicaps before it can expect to achieve its full industrial potential. In spite of these considerable problems, significant progress has already been made. During 1956, approximately 221,000 workers were engaged in manufacturing industries in the Mountain States (8, pp. 201-206). Just how well the region may succeed in

enlarging this employment is difficult to foresee. Industry interest, circumstance, and regional initiative will all influence the result. If the Mountain States region is favored on all counts, manufacturing employment may exceed one-half million workers by 1975. At present, it is sufficient to say that the manufacturing industries offer a substantial opportunity for regional growth.

## VI. CLIMATE AS A FACTOR IN THE EXPANSION OPPORTUNITY

The development of any area is heavily influenced by its climate. Agriculture in the Midwest is as much the product of warm moist weather as fertile soil. The timber industry of the Pacific Northwest is basically the result of a climate that promotes the growth of extraordinarily big trees. While these two areas have many differences, they have one thing in common--a climate that is both productive and livable. Other places, notably the tropics, may be potentially even more productive, but their climates are frequently unlivable or at least so uncomfortable that settlement and development are slow.

### The Mountain States have a desirable climate

Although the general climate of the region can be described as semi-arid (less than 20 inches of rainfall a year), each state actually has a number of climatic zones. This is partly the result of topographic differences. The elevation range of this region is from less than 1,000 feet to more than 13,000 feet and elevation differences of 10,000 feet are common within individual states. The length of the region--1,200 miles from north to south--also contributes to climatic differences. As a result, the farmer in southern Arizona grows cotton, citrus fruits, and vegetables during

the long, warm growing season of nearly 300 days each year. In Montana, a growing season of 90-120 days supports wheat, sugar beets, and some fruit. The Utah growing season of 100-160 days allows fruits, vegetables, sugar beets, wheat, and potatoes to ripen properly (25). When supplied with adequate water, the Mountain States soil and climate support a wide variety of agriculture. The pioneers, familiar with the humid East, largely bypassed this region in favor of West Coast areas that more closely resembled the land they knew. Today, having largely overcome the problem of aridity by harnessing the water resource, we are finding the dry climate has much to recommend it.

The statement that any climate is healthful or comfortable usually needs some defense. In the first place, it is difficult to find agreement on just what combinations of temperature and humidity are comfortable. So far, air conditioning experts have found it impossible or impractical to devise a climatic condition for stores or factories that will be rated as "comfortable" by more than 65 per cent of the people. Nevertheless, doctors generally agree that the ideal yearlong climate for mental and physical health and comfort of most people is one "marked by frequent but moderate changes in weather, variation in temperature from day to night, and gradual seasonal changes" (26). Such a climate, with a relative humidity between 30 and 70 per cent, is physically and mentally stimulating and generally considered healthful and comfortable.

Under this definition, nearly all of the temperate zone would be classified as healthful, comfortable, stimulating, and livable. Nevertheless, various combinations of climatic factors within the temperate zone lead people to decide that one area is more comfortable than another. Because the climate of the Mountain States varies so greatly from north to south and from mountain to valley, nearly anyone should be able to find a suitable climate within the Mountain States region.

Dryness can be an asset

The dryness of the Mountain States that created such a problem for early settlement now often proves to be an advantage. The warm dry winters of the southern part of the region have considerable appeal. Many persons retire in this area for this reason. Manufacturers of precision instruments have discovered that humidity controls are much easier to maintain in this climate. Storage of many items is simple here because the climate inhibits both rust and rot. This fact apparently influenced the selection of military storage areas in Utah.

The climatic variations common to the Mountain States also provide an excellent basis for recreation. During the winter, skiing is possible in every state. During the summer, the cool mountain climates provide an ideal vacation change from warmer valley temperatures. If solar energy holds the promise claimed by the visionaries, sunshine can prove to be one of the Mountain States most important

assets. The southwest corner of the region shares with part of California the distinction of being the sunniest spot in the Nation and averages more than 280 sunny days annually. Although the Mountain States have only 29 per cent of the Nation's total land area, they contain nearly 60 per cent of the land in the United States that receives 200 or more days of sunshine a year (25).

It is estimated that the solar energy falling on an average house is easily enough to heat the house if the summer heat could be stored for winter use (5, Vol. 4, p. 152). So far no solar storage unit has been developed to do this; however, a 9-room house is being built in Denver, Colorado, that will receive up to 75 per cent of its necessary heat from the sun (27).

In summing up the Mountain States climate four things may be said:

1. Although the limited water supply is one of the region's biggest problems, the characteristic dryness of the climate is an advantage for some purposes.
2. The climate falls well within the tolerance limits for comfort and health. The variety of available climates should appeal to many persons.
3. The climate is an important asset for attracting the tourist trade, and offers advantages to certain industries.

4. The long periods of sunshine may provide an additional source of power as technology perfects means for using and storing solar energy.

All in all, the principal weather characteristics of the area--low humidity, sunshine, seasonal changes in temperature, cool nights and warm days--add up to a healthful, comfortable, and productive climate, one that should strongly promote future growth.



## VII. ADEQUACY OF THE WATER SUPPLY

### Water will be the critical factor in development

It is impossible to overemphasize the importance of the water resource. Historically, man's relation to water has been simple and direct--without water there could be no life. Even in this age of technological "miracles" when "rubber" for tires may never have seen a rubber tree and "silk" stockings come from a chemist instead of a cocoon, no substitute has been discovered for water.

Modern living has only intensified man's dependence on water. During the last 50 years the per capita use of water for domestic, industrial, and agricultural purposes in the United States has doubled. A recent estimate indicates the national use of 185 billion gallons of water daily in 1950 will soar to 350 billion gallons by 1975 (5, Vol. 5, pp. 84-94). Because of the increasing demand for water and the obvious fact that there is no excess of it in the Mountain States, it is prudent to examine critically the capacity of the Mountain States water resource to support future regional expansion.

### Water serves in many ways

Billions of gallons of water flow out of the Mountain States daily. Before it leaves the area, however, nearly

all of the water is "used" in some way; some of it is used several times. The term "used" here is not limited to water consumption or even to water withdrawal. Any beneficial work done by water is considered water use. Entire rivers are channeled through power generators to produce electricity. The churning of the generators changes neither the quantity nor the quality of the water. Under these conditions the total streamflow is available for re-use.

Many cities and industrial plants use nearby streams as a vehicle for removing their sewage. If the sewage load is not too great, the river not only carries the wastes away, but also purifies itself within a few miles so that the entire river is again available for downstream re-use. Even if the sewage load is excessive, the river may still adequately remove the sewage from the community or industrial plant, but it may not cleanse itself sufficiently for immediate downstream use without extensive purification by the subsequent user.

Nearly all domestic, industrial, and agricultural uses require that water be removed from the stream. Furthermore, some industries actually consume a large part of the water they withdraw. However, most domestic and industrial water use is nonconsumptive for on the average, cities and industries return, in the form of waste water and sewage, about 90-95 per cent of the water they have withdrawn (5, Vol. 5, pp. 84-94). On the other hand, a substantial part of the water withdrawn for irrigation is physically consumed by

crops or removed from the total immediate water supply by evaporation or by non-essential vegetation. However, part of the water withdrawn for irrigation seeps back into the stream or becomes a part of the ground water reserve where it is available for further use.

Since development of the other resources of the region hinges on full development of the water resource, the problem will be to generate as much power, irrigate as many acres, operate as many industries, and furnish water to as many people as is feasible before the water flows on to similarly serve other downstream communities. Meeting this challenge of maximum water resource use will require considerable development work simply to make the water available. It will also require intelligent allocation of water among the alternative water users and efficient use of the allocated water.

Most of the water in the Mountain States is already used to varying degrees for one or more purposes. With intelligent planning and efficient use, it would seem that the water resource is potentially capable of doing much more work that it does today. The question is: How great is that potential?

The hydroelectric potential is great

During 1953, the streams and rivers of the Mountain States produced more than 3 million kilowatts of electric power. It is estimated that the region could increase its total power output to approximately 25 million kilowatts

through full development of its available sites (28). This would be more than an eightfold increase.

As Table 12 shows, about two-thirds of the potential water power capacity is located in Idaho and Montana. Nevertheless, every state except Nevada could expand its present power output to meet increased future demands.

TABLE 12  
MOUNTAIN STATES WATER POWER, IN THOUSANDS OF KILOWATTS<sup>a</sup>

State	Present capacity	Potential capacity
Arizona . . . . .	980	4,271
Colorado . . . . .	144	1,849
Idaho . . . . .	737	8,731
Montana . . . . .	763	6,900
Nevada . . . . .	587	698
New Mexico . . . . .	25	234
Utah . . . . .	95	1,310
Wyoming . . . . .	107	1,063
Total . . . . .	3,438	25,056

<sup>a</sup>National Industrial Conference Board, The Economic Almanac, 1956, p. 29.

Because of heavy transmission losses, it is generally impractical to move electricity more than a few hundred miles from the generator (5, Vol. 1, p. 117). Thus, most of the Mountain States power potential will probably be available for local use.

Farmers are the biggest consumers of water

During 1950, irrigators received 97 per cent of all the water withdrawn from streams in the Mountain States. More

than 15 trillion gallons were used to support the 11-million-acre irrigation economy of these states (29). This is in contrast with the 511 billion gallons used by the region's homes and industries, as Figure 5 shows.

According to the U. S. Bureau of Reclamation, the total irrigated acreage of the Mountain States might ultimately be increased another 5 million acres with optimum water development. This would bring the total irrigated acreage of the Mountain States to about 16 million acres (11). Apparently this is approximately the maximum expansion possible under foreseeable water and economic conditions; but there are still more acres that would be good cropland if enough water were available.

Irrigation water could undoubtedly be used much more efficiently than it is. As much as 20 per cent of the water withdrawn for irrigation finds its way back to the streams or into ground reservoirs where it is available for use again. The other 80 per cent is consumed. However, much of that water is wasted or at least it serves no effective purpose. Surface evaporation and leaks from reservoirs and drainage ditches, transpiration by non-essential vegetation, and over irrigation all take their toll. Prevention of even part of the loss from this evaporation would provide large quantities of readily available water. On the average about one-fourth of the water carried in open delivery ditches in the West is dissipated before it reaches the farmer (30). Not all of this water is really lost, for the water from

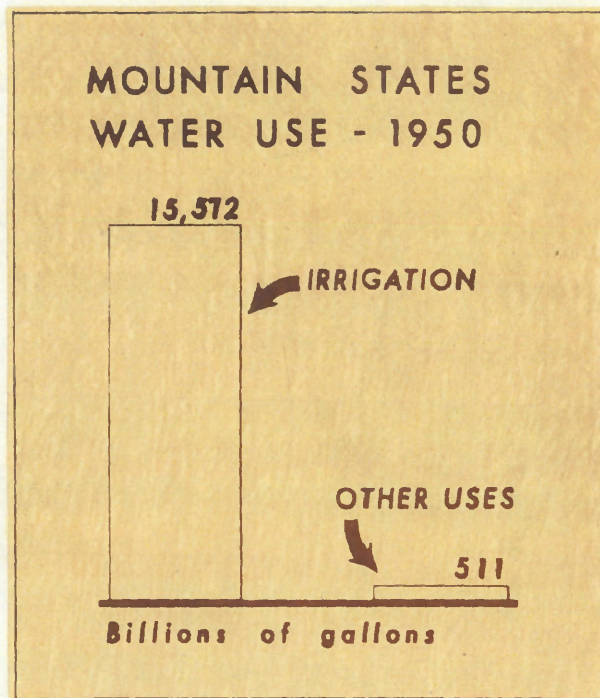


Fig. 5

leaky ditches may subirrigate nearby crops, eventually return to a nearby stream, or become a part of the underground water reservoir. It is therefore difficult to determine how much water is really wasted and how much is used. Nevertheless, most irrigation engineers agree that considerable water could be saved in irrigation delivery systems and through more efficient application.

There are no good estimates of just what the total of all irrigation losses might actually be. There is even less to go on when it comes to estimating how much of this loss could be salvaged. It appears, however, as much as 5 or 10 billion gallons a day could be saved by greater efficiency in the storage, delivery, and application of irrigation water in the Mountain States.

The squeeze will be on domestic and industrial use

How the available water will be divided in future years no one can tell now. However, the Bureau of Reclamation has estimated that under optimum development in the 17 western states, about 10 billion gallons a day would be available ultimately for cities and industries. However, about 7.5 billion gallons a day are already being used in the West for these purposes (5, Vol. 5, pp. 84-94). This would leave only 2.5 billion gallons a day for new industries or bigger cities--an uncomfortably small margin in the face of the large population expansions now predicted (see Table 13). The problem in the Mountain States and other parts of the

West is going to be one of finding enough water to do all that we would like to do.

TABLE 13  
AVAILABILITY OF WATER IN THE WEST<sup>a</sup>

Item	Billion gallons per day
Susceptible of development, including present use . . . . .	120
Ultimately planned for irrigation . . . . .	110
Ultimately available for in- dustrial and domestic uses . . .	10
Withdrawn for industrial and domestic uses, 1950 . . . . .	7.5

<sup>a</sup>President's Materials Policy Commission, 1952, Resources for Freedom (Washington, U.S. Government Printing Office), 5:90.

Of course, the available water supply can be stretched by using it more efficiently. When water is abundant, it is used lavishly, yet when water is scarce any given job is likely to be done with less water. For example, the Kaiser steel mill in California uses only 1,400 gallons to produce a ton of steel, while older steel mills use up to 65,000 gallons (31) (see Table 14).

Similar conservation practices can be applied to domestic use of water. An energetic program to reduce leakage and waste in Chicago, Illinois, reduced per capita water consumption from 288 gallons a day to 234 gallons a day (29).



TABLE 14

INDUSTRIAL WATER REQUIREMENTS ARE LARGE:<sup>a</sup>

Paper--64,000 gallons of water to make  
1 ton of sulphate paper

Steel--65,000 gallons of water to make  
1 ton of steel

Oil --18 barrels of water to make  
1 barrel of oil

<sup>a</sup>President's Materials Policy Commission, 1952, Resources for Freedom (Washington, U.S. Government Printing Office), 1:51-52.

The problem of providing enough water for future regional growth probably cannot be solved solely by wasting less in lawn sprinkling, flushing toilets with smaller quantities, repairing leaky faucets, or using water more efficiently in industries. The full population and industrial potential probably will not be realized unless some water is diverted from agriculture. Although household and industrial uses of water are largely non-consumptive, they are fairly steady yearlong uses, and some of the water they return to the streams during 8, 9, or 10 months of the year would be unavailable for agriculture.

Pollution can be a big source of waste

Most cities and industries use nearby streams as convenient, inexpensive, and effective methods for disposal of sewage and other waste. It is a perfectly proper water

use as long as it does not foul the rivers to the point of retarding or eliminating downstream uses.

Every stream possesses the capacity to carry certain quantities of foreign matter without impairing the quality of its water for most other uses. However, the quantity of waste a stream can carry without being polluted is extremely small in comparison with the volume of water in the stream. Each stream has its own carrying capacity, depending on such factors as the volume and hydraulics of its flow, and the amount of foreign matter already contained.

The waste carrying capacity of some rivers, especially in the eastern part of the United States, has been so far exceeded that they have actually become open sewers in every sense of the term. Such rivers can provide only the lowest quality water unless expensive purification is undertaken. According to the United States Public Health Service the job of cleaning up the Nation's streams to a "reasonable degree" would cost as much as 12 billion dollars (32). As is so often the case, correction is usually more expensive than prevention. Furthermore, it may not be possible to restore some streams to full usefulness because of previous pollution damage.

Fortunately, many streams in the Mountain States are still clean. If this region can learn and profit from the mistakes made by others, the high quality of its water can be maintained. This must be done. Unless positive steps

are taken to prevent pollution, the lack of clean water may well be the factor limiting further growth.

It seems only reasonable that as water use increases, conflicts between sewage disposal uses and non-contaminating uses must be resolved in favor of the other uses, because stream pollution can be avoided by proper treatment of sewage or waste.

The region may face a problem of allocation

Because of water scarcity, this region is not likely to have enough water to satisfy every user. Further expansion of agriculture depends heavily on more water. Further development of all other natural resources depends in one way or another on adequate supplies of water also. Political, economic, and social considerations will all play a part in resolving the water conflict. However, because the dollar return from industrial use of water is greater than that from agricultural use, action probably will be taken to make water available to industry. The President's Materials Policy Commission points out:

Relative to many other uses, irrigation is a very uneconomic user of water. In 1947, about 25 trillion gallons of water were used to produce irrigated crops in the West valued at about 2.4 billion dollars..... The value of the crops was equal to about 10 cents for each 1,000 gallons of water withdrawn. In comparison, about 15 trillion gallons of water were used nationally in 1947 in producing goods having a value added by manufacture of 74.4 billion dollars or about 5 dollars for each 1,000 gallons of water withdrawn (5, Vol. 5, pp. 84-94).

Mountain States economic hopes need not wither for lack of water if available supplies are used efficiently and not

wasted. The water resource of the region is adequate to support a considerable industrial expansion and a modest expansion of the irrigation economy. In fact, there appears to be enough water for a fivefold increase of population.

The water situation seems to sum up to this:

1. Not enough water is available to do all the things we would like to do.
2. But the existing water supply will support a substantial expansion of the economy if it is used efficiently and if necessary adjustments are made as needs arise.

## VIII. THE OVER-ALL PICTURE

The population in the Mountain States tripled between 1900 and 1950 while the United States population only doubled (8, pp. 12-13). Demographers, examining trends of birth and death rates and migration, estimate that the region will continue to expand more rapidly than the rest of the Nation. The Stanford Research Institute has estimated that 9.6 million people will live in the Mountain States by 1975, 3.8 million more than lived here in 1954 (33).

At this stage we are unable to fit together the complete picture of the Mountain States capacity to support more people because of the gaps in our knowledge. Nevertheless, those parts of the puzzle assembled thus far leave no doubt that this region can continue to grow more rapidly than the rest of the Nation for some time in the future. Of course, what happens in the future will depend upon technological progress and upon the initiative and imagination with which the region's advantages are exploited. However, the data in the preceding pages emphasize rather than minimize the opportunities for growth. They also substitute a basis of fact for mere pious hope that the future looks bright.

The dominating fact that provides the setting for any consideration of people and resources anywhere in the country is that the Nation has not ceased to grow. Current estimates of 275 to 300 million persons in the United States by the end of this century may prove to be conservative. Even 275 million people would be an enormous increase over the present population of 170 million. Such an increase becomes even more startling in terms of resource needs. Words like "prodigious" and "tremendous" fail to describe the magnitude of the Nation's present consumption of raw materials. However, as the population climbs to new peaks, demands for raw materials will become even greater, the demand for manufactured goods will increase, and living space will become more valuable.

This national outlook makes the region's substantial resources especially significant. It is inconceivable that time and circumstance will not force relatively full use of the Mountain States resources. All the facts add up to the simple conclusion that notwithstanding its limitations, the region has the capacity for considerably more growth.

The characteristics of the region and its resources foreshadow a substantial change in economic patterns as the region grows. This change, of course, will be merely a continuation of trends already occurring as the region moves from what was once a completely agrarian economy to a more industrialized one.

While agriculture will probably cease to dominate the region if the other basic industries develop as expected, increased efficiency and productivity will boost farm production to new heights. This will probably be achieved with less labor per unit of production and possibly even with less total farm employment.

Much of the future's promise certainly lies in the largely untapped mineral resources such as oil shale. Forest industries will make a bigger contribution to the region's wealth than they have in the past. Income possibilities of the recreational resource are far from being fully tapped. However, the brightest star on the economic horizon is the manufacturing opportunity.

The Mountain States have the basic raw materials required to manufacture many items used in modern living. This assures the region the opportunity to go beyond the production of basic products into the manufacture of ultimate consumer products.

This look at industrial potentials necessarily underlines an often made point--the importance of water. The region has enough water for a very large expansion of both population and industry. However, expansion will come to pass only if the people are willing to use their water resource efficiently and give priority to those uses that will maximize long-run benefits. If this region fails to achieve its economic aspirations, the most likely cause will be inefficient use of the limited water supplies.

As the region grows, the economic problems of developing the forest land and other resources should be more easily solved. If there is any lesson to be drawn, it is this: The resources of the Mountain States should be managed and developed with bold imagination to meet the needs of a greatly expanded population in the relatively near future.



## IX. SIGNIFICANCE OF MOUNTAIN STATES RESOURCE POTENTIAL TO TIMBER DEVELOPMENT

The problems which have harassed the development of the timber resource of the Mountain States over the years have been economic in nature. A number of factors have combined to create these problems. Consequently, there is no single answer to the question of how the roadblocks standing in the way of full timber resource development might be removed. Nevertheless, one of the big factors holding back timber development in this region has been the relative smallness of local markets for wood. It is in this connection that the population growth prospects of the Mountain States become extremely significant to the future of timber use and forestry in this region.

### The population projections look reasonable

Perhaps our biggest gain from an appraisal of the total resource base in the Mountain States is a fresh confidence in the estimates that the population of the eight states is destined to climb from the present level of 5.9 million people to something like 9.6 million by 1975 and 13.6 million people by the year 2000 (2). A point often forgotten is that these projections have been derived from analyses of birth and death rates and migration trends. They have perforce been unable to take proper account of the factor of

resource capacity to support people, which is a serious weakness in a nation of highly mobile individuals.

The impressive array of resource development opportunities in the Mountain States lends new substance to the optimistic projections of regional population growth and takes them out of the realm of wishful thinking. It is, in fact, difficult to conceive that there will not be substantial population growth in response to the opportunities offered by extensive supplies of shale and other minerals, the abundance of timber, and climatic advantages as well as the manufacturing opportunities.

From a forestry standpoint these growth prospects do more than promise a bigger local market. They provide the means for the timber industries of this region to take full advantage of changes which are taking place in the national timber supply situation.

Studies of the national timber situation indicate that this country will eventually need a much larger volume of timber products than it is using now. Even if these national estimates are discounted considerably, it is evident that if supplies are adequate, the Nation will be using a lot more wood in years to come than it does today. Also evident is the fact that the country will be unable to supply much larger quantities in future years without dipping deeply into the woodpile of every region. As Hutchison has stated, ". . . to meet wood needs at the end of the century will take all or nearly all of the growth capacity of the United

States which can be harnessed at that time. From this it may be inferred that Rocky Mountain timber will eventually be in greater demand than it is now" (2).

#### Costs limit timber development

These prospects of rising demand for the timber of this region might seem almost a guarantee that the marketing problems which have plagued local timber producers will eventually melt away. However, the situation is not quite that simple. As pointed out, the timber of this region must overcome a sizable handicap. For example, data presented in a recent publication show that some of the less accessible sawtimber in the region must bear stump to mill costs that exceed current average West Coast costs by 20 to 25 dollars a thousand board feet (34). With such a handicap, the attendant freight costs virtually prohibit this wood from entering the national market.

Before such wood can be economically utilized, the burden of cost must be reduced. Technological improvements in logging and milling may help some as will development of more fiber industries. Likewise, rising wood prices will improve the opportunity to exploit more of the resource. Yet, the cost handicap of such wood is so large that it is not likely to be completely offset by these factors during the period included in the population projections. These circumstances underline the importance of fully exploiting local markets for which at least transportation costs would be lower.

Just how much the local market might increase is, of course, conjecture. However, if present trends continue and if the regional population does expand to over 13 million people by the year 2000, this region may be consuming 2.9 billion board feet of locally grown lumber alone each year. The assumption involved here is that the regional consumption of locally produced lumber will increase in proportion to the expanding Mountain States population. To do this, either local per capita lumber consumption rates must remain fairly stable or lumber imports must drop. Because the proportion of the regional lumber market supplied by local industry is increasing, the assumption seems reasonable. During 1922, 64 per cent of the local lumber needs were imports. Today only 34 per cent is imported (24, p. 10a). The present trend of almost complete reliance on other regions for paper products will be modified by future development of the regional fiber industry.

The timber industry of the Mountain States has always been nationally oriented; that is, it has had to cover the length and breadth of the Nation looking for customers. This is a natural outgrowth of the fact that each type of wood has its own special utility. The strength of Douglas-fir, the beauty of the hardwoods, the rot resistance of redwood, and the workability of white pine are each prized for a particular use. The qualities sought in lumber are not evenly distributed on a geographical basis. Therefore, more or less localized supplies must serve a national need and

must be marketed nationally to achieve full value. For the most part, the local need for a particular quality of wood is much smaller than the production of that quality. Thus, California trades redwood for hardwood flooring, the East trades the beauty of its hardwood for the strength of Douglas-fir, and so on.

In playing the quality-trade game, the Mountain States provide a major part of the Nation's soft-textured softwood lumber needs. Although regional mills produce only 8 per cent of the total national lumber supply, they produce nearly one-third of the lumber in the soft-textured category. This situation is only natural because the region has about 40 per cent of the national capacity for producing this kind of wood (2). Table 15 shows the volumes of timber available by species.

This national orientation of the timber product industries is not likely to change. Lumber and paper products will undoubtedly be shipped as far 50 years from now as they are today. Growth of local markets, therefore, becomes important not as a means of developing a self contained economy but as a means of offsetting, to a degree at least, the high cost of cross country transportation.

Higher consumptive capacity also is significant from another point of view. It undoubtedly offers the region a chance to escape from its so-called colonial status. A chronic complaint has been that the Mountain States ship out raw materials later to buy back these same raw materials in

manufactured form. This has been due partly to the fact that industries tend to grow and expand in localities where historical accident has placed them. However, it is also due to the fact that much remanufacturing is market oriented and the Mountain States have not in all cases offered a big enough market to be attractive as manufacturing centers. A 100 per cent plus increase in population will certainly do much to make the Mountain States a more reasonable location for remanufacturing plants. This kind of growth may not mean any larger total market. It will mean a closer, less expensive market. It will mean a larger operating margin for the forest manager who will realize part of the cost saving in supplying wood to a closer market.

TABLE 15

VOLUME OF LIVE SAWTIMBER ON COMMERCIAL FOREST LAND,  
1953, BY SPECIES, IN THE MOUNTAIN STATES<sup>a</sup>

Species	Million board feet	Per cent of total
Ponderosa pine . . .	63.0	27.1
Douglas-fir . . . .	49.0	21.1
True fir . . . . .	21.4	9.2
White pine . . . . .	14.5	6.2
Hemlock . . . . .	2.3	1.0
Spruce . . . . .	33.6	14.4
Lodgepole pine . . .	22.6	9.7
Other . . . . .	26.3	11.3
Total . . . . .	232.7	100.0

<sup>a</sup>U.S. Forest Service, Timber Resources for America's Future (Washington, U.S. Government Printing Office), p. 513.

In anything as complex as the timber development problem in the Mountain States there is always the danger of over-analyzing a single facet of the situation. Trends in freight rates, advances in logging techniques, and a number of other factors also hold some of the answers to the future economics of utilizing the 53 million acres of commercial forest in the region. Nevertheless, the abundance of resources in the Mountain States and the steady climb of population which should result from this abundance, give us added reason to believe that the marketing handicaps which have plagued timber producers here for almost three-quarters of a century will diminish with the passage of time. Taken together with the outlook for greater national wood demands, the sound growth prospects of the Mountain States underline the wisdom of looking beyond immediate problems and planning for the time when Mountain States timber will serve a bigger need under supermarginal circumstances.

## LITERATURE CITED

1. U. S. FOREST SERVICE. 1958. Timber Resources for America's Future. Forest Resource Report 14.
2. HUTCHISON, S. BLAIR. 1957. Market Prospects for Mountain States Timber. U. S. Forest Service, Intermountain Forest and Range Experiment Station Research Paper 50.
3. U. S. BUREAU OF CENSUS. 1954. Census of Manufactures, 1954. Lumber Bulletin MC-24A.
4. U. S. DEPARTMENT OF AGRICULTURE. 1954. Greater Pulp Yields Per Acre Per Year. Forest Products Laboratory Paper No. 1993, p. 4.
5. PRESIDENT'S MATERIALS POLICY COMMISSION. 1952. Resources for Freedom.
6. U. S. BUREAU OF MINES. 1957. Molybdenum and Materials Survey. Information Circular 7784, p. 17.
7. ANONYMOUS. 1958. Oil from Shale. Mining World 2:78-80.
8. U. S. BUREAU OF CENSUS. 1957. Statistical Abstract of the United States, 1957.
9. U. S. OFFICE OF BUSINESS ECONOMICS. 1956. Personal Income by States, p. 37.
10. U. S. DEPARTMENT OF AGRICULTURE. 1937. Agricultural Statistics, 1937, p. 391.
11. U. S. BUREAU OF RECLAMATION. 1948. The Reclamation Program, 1948-1954, p. 10.
12. U. S. DEPARTMENT OF AGRICULTURE. 1948. Irrigation Agriculture in the West. Miscellaneous Publication 670, p. 3.
13. ANONYMOUS. 1961. Ah, Wilderness? Time Magazine 78 (2):46-53.



14. U. S. DEPARTMENT OF THE INTERIOR. 1956. Areas Administered by the National Park Service, pp. 1-10.
15. U. S. FOREST SERVICE. 1956. National Forest Areas.
16. U. S. DEPARTMENT OF THE INTERIOR. 1951. Glacier National Park Tourist Survey.
17. DANA, S. T. 1957. Problem Analysis: Research in Forest Recreation. U. S. Forest Service, Washington, D. C.
18. DEWHURST, J. F. AND ASSOCIATES. America's Needs and Resources. The Twentieth Century Fund, New York, p. 350.
19. U. S. BUREAU OF THE CENSUS. 1956. Statistical Abstract of the United States, 1956, p. 707.
20. BUREAU OF ECONOMIC AND BUSINESS RESEARCH. 1957. A Study of the Economic Value of Fishing and Hunting in Utah. University of Utah, Salt Lake City, pp. 3, 16.
21. U. S. BUREAU OF LABOR STATISTICS. 1955. Employment in the Mountain States, 1947-1953.
22. WOOD, MARSHALL K. 1955. Industry Must Prepare for Atomic Attack. Harvard Business Review, May-June 1955, 33(3):116.
23. GARNSEY, M. E. 1950. America's New Frontier. Alfred A. Knopf, New York.
24. HUTCHISON, S. B. 1959. Production-distribution Trends and Freight Rates as They Affect Mountain States Lumber Producers. Intermountain Forest and Range Experiment Station, Research Paper 59.
25. U. S. DEPARTMENT OF AGRICULTURE. 1941. Climate and Man. Yearbook, pp. 761-1210.
26. HIRSH, JOSEPH. 1941. Comfort and Disease in Relation to Climate. U. S. Department of Agriculture Yearbook 1941:241.
27. NEWS LETTER FOR THE ASSOCIATION FOR APPLIED SOLAR ENERGY. Sept. 1956. The Sun at Work, p. 3.
28. NATIONAL INDUSTRIAL CONFERENCE BOARD. 1956. The Economic Almanac, 1956, p. 29.

29. MacKICHAN, KENNETH A. 1951. Estimated Use of Water in the United States, 1950. Geological Survey Circular No. 15.
30. McCULLOCK, ALLAN W., CRIDDLE, WAYNE D. 1950. Conservation Irrigation. Soil Conservation Service, Agricultural Information Bulletin No. 8.
31. U. S. DEPARTMENT OF AGRICULTURE. 1955. Water. U. S. Department of Agriculture Yearbook 1955:654.
32. AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. 1956. Water for Industry, p. 10.
33. NIELSON, HOWARD C. 1955. Population Trends in the United States through 1975. Stanford Research Institute, p. 5.
34. HUTCHISON, S. BLAIR, WIKSTROM, J. H. 1957. Industrial Opportunities in the Headwaters Timber Development Unit. Intermountain Forest Range Experiment Station, Research Paper 45, pp. 41-66.