

at the beginning of the period. A few references may illustrate the point:

The total expenditures for research in the United States between 1940 and 1953 increased ten-fold, or from 400 million to 4 billion. In a somewhat longer period, from 1937 to 1953, forestry and related research increased sixfold. In the year 1953 all research expenditures in the United States amounted to 1-1/10% of the total national income. In the same year forestry and related research came to only 4/10 of 1% of the total value of forest products. However, this figure badly overstates the percentage because it does not include on the income side the value of forest products other than wood. As to our own state, an informed estimate for the year 1957 indicates that we spent approximately \$2.00 in research for every \$1000.00 of primary value of wood products and live stock produced on our wildlands. In the same year of 1957, research expenditures for agriculture in the United States came to \$3.50 per \$1000.00 primary value of crops sold from farms.

For almost thirty years I have studied the relationship between research and better wildland management. It has become increasingly evident to me that research is indeed the key to better management. We can and do learn much from practice and observation. However, as to trees and some shrubs, the growth cycle is so long that such progress is very slow. Adequate research can speed up progress. With the increasing impact of California's teeming millions, it is vital to improve the management of our forests, watersheds and grazing lands as rapidly as possible.

For many years we have heard much from the advocates of practical versus pure research. The Wildland Research Plan For California deals very obviously and properly with practical research. Personally I think it may be advanced also by some pure research. The answers to some problems we have inventoried may just come easier as the result of pure research in appropriate general areas. Perhaps my knowledge of science is too limited but I find it very hard to draw a line which exactly separates pure research from practical research. So, if a little pure research gets into our California program, we need not worry. It may pay large dividends.

In the final analysis the Wildland Research Plan For California is just a plan. While we call it a "key", that "key" is a potential key and cannot be used unless the plan is implemented. The Planning Committee has finished its assignment and is disbanded. The responsibility for implementing the Plan now falls on the several groups of people most interested in better management of California's valuable wildlands. It is the responsibility of all these groups to advance the Plan by securing the necessary state and federal funds. The first phase of the program should be put into operation in the immediate future. To meet California's needs for better and more productive wildland management, we must change the word *plan* to *action*. For those of you, who live in British Columbia, Washington, Oregon, Idaho, Montana or elsewhere I strongly recommend that you give consideration to the development of similar comprehensive

coordinated research plans adapted to the particular management problems of your respective areas.

MR. CONNAUGHTON: Thank you, Bill Rosecrans. I'm confident as this plan is activated—and it will be—that the base for attaining wise use of California's forest lands will be greatly and vastly facilitated.

Now as the next phase or step in our program, we have a discussion concerned with management of the lands held by a number of our railroads. We recognize this as an important segment of the forest lands of the West and appreciate the opportunity to have the railroads discuss with us their plans and actions in handling these blocks of land which they have had in their care.

To handle this subject, number of speakers and discussions on the general topic of railroad lands, will be Louie Frandsen. Louie is the land manager for the Southern Pacific Railroad here in San Francisco, has been with the company a long time, certainly long enough to know his subject intimately. And it's with real pleasure that I present Louie Frandsen.

(applause)

MR. FRANSEN: Thank you, Charlie. Members of Western Forestry, ladies and gentlemen. Our program chairman, Bill Schofield, asked me what I thought of including this topic "Managing Railroad Lands" on the program of this conference. I said I thought it was a good idea, not realizing who he had in mind.

Railroad construction in the West started almost a hundred years ago. As all of you know, much of this construction was aided by Congressional land grants to the railroads. What many people do not realize is that the so-called grants were actually contracts and the government was very well paid for the lands. Payment consisted of substantially reduced freight and passenger fares to the government over the years, until Congress passed the Transportation Act of 1940. The government received other benefits as well.

Southern Pacific Company and its subsidiary, Southern Pacific Land Company, now own about 4 million acres of this land in California, Nevada and Utah and certain mineral rights underlying about one million acres more.

We are concerned with forest management, management of agricultural and grazing lands and mineral lands, including the operation of a mineral survey at present. Also, we are looking more and more toward such other uses as recreation, commercial and industrial.

I have asked three of my co-workers to expand on our program. First, may I present Kermit Cuff, Chief Forester, Southern Pacific Land Department at San Francisco. Kermit Cuff.

(applause)

MR. CUFF: Mr. Chairman, fellow members of the conference. It gives me great pleasure to have this opportunity to explain our forest management program. The Southern Pacific Land Company is managing its forest land for continuous production and profit under a policy of

wise and careful use. This policy was adopted in 1951 when the company dedicated 425,000 acres to this end as a certified American Tree Farm. Since this company is one of the largest private timberland owners in California, its policies have an important bearing on the present status of industrial forestry in this state.

Prior to the adoption of our sustained yield program, the best and most easily reached of our lands had been sold, frequently at prices which today appear ridiculously low. After having skimmed off the cream, there are approximately 728,000 acres left, scattered over some of the roughest and most inaccessible parts of Northern California.

Now I'd like to show a slide to give you some idea of the distribution of the land.

(shows slides)

This is Lake Tahoe. In the lower right-hand corner is the region of Lake Tahoe and these lands that continue up to the Oregon line. Now the colors in green represent what we consider as commercially operating forest lands. That is, they have enough timber in them to sustain commercial timber operations at present. The orange colored lands are the lands that we're not operating at present.

I think that will suffice for the present. May we have the lights please? (lights on) These lands range all the way from the valley's edge to the crests of both the Sierra and the Coast Ranges. The soils vary from the poorest to the best for tree growth and, as a result of past fires and other land abuses, many acres are either idle or not producing their full quota of wood fiber.

Management of the SP forest lands is no simple problem in view of their complexity and scattered distribution. Nine commercial species of trees are found growing in various combinations, according to topography and elevation. Few stands are even-aged, as they are generally a mixture of all age classes. Harvesting this calls for a high degree of skill and practical knowledge in the application of silvicultural techniques in order to leave our lands as fully productive as possible. Furthermore, the land distribution pattern creates numerous problems for the administration.

Getting the necessary facts together in order to set up a sustained management program was in itself a big job. It was necessary to take stock of our timber resources, how much and where, and what growth might be expected, and from this information set up a cutting schedule. To obtain the information by old-fashioned cruising methods would have been slow and costly. Fortunately, by means of the science of photogrammetry, we were able to get the job done satisfactorily at a great saving. In brief, the methods employed consisted of mapping from aerial photographs stands of timber similar in density and age classes and applying to these acreages the corresponding volume per acre averages determined from field sample cruises.

In connection with this project we are greatly indebted to the California Forest & Range Experiment Station for a great

deal of advice and information pertinent to our lands.

While the inventory thus prepared is far from complete as to the details we would like to have, it has provided sufficient information to enable us to establish a workable management program.

In our photo interpretations lands were mapped as to whether or not they were suited for the production of commercial saw timber. Non-commercial forests, such as those grown on steep, rocky, unlog-gable canyon slopes, were excluded from our cutting plans. Likewise, unstocked areas such as brush fields were also classified as to whether or not they were potentially productive. Thus, in conjunction with our inventory, we now have timber stand maps which are a valuable asset to management planning, as they show the distribution of the various timber stands. Thus we know that we have 464,000 acres of commercial forest land, of which 300,000 is productive and the basis of our present cutting plans.

Knowing the shortcomings of the present inventory and what further information is desired, we plan to conduct a more comprehensive survey in the near future. It will be designed to give us the areas, volumes, growth, and species composition in greater detail, and the condition of the timber stands and site quality for each parcel of land. Also, areas presently regarded as sub-marginal for commercial logging operations will be given closer scrutiny and non-commercial lands will be more closely defined. We expect this new inventory to be a most important working tool for long-range management and proper land use planning.

In view of the many problems involved, putting our sustained yield policy into practice is a real challenge. In general our management plan calls for covering our lands as rapidly as possible but leaving them as productive as possible. We are now engaged in the first phase of management—that of bringing virgin forests into production or regulation of growth so that we will have a maximum supply of timber becoming ready for harvest in equal amounts annually.

Present actual net growth is practically at a standstill, being offset by losses from older trees as they decay and die out. By removing this material and leaving vigorous, fast-growing trees, we expect the total growth on our lands to amount to at least 64 million board feet per year, assuming of course no changes in timbered acreage, degree of stocking or intensity of management. This is the amount we are now harvesting annually under our program which will cover all of our lands within a 30-year cycle.

Our foresters mark for removal those trees which are no longer producing any net growth and which are a high financial risk because of their susceptibility to insects, diseases and windthrow. The thrifty, younger trees are left to continue growth and produce seed and shelter necessary to establish reproduction.

The degree of cutting varies according to the age and thrift of the stands, but our experience to date shows that about 50% of the volume is removed in the first cut. At this rate we expect to have completely

covered all of our old-growth stands within the next 23 years. We expect that improved access facilities and new information to be developed from our re-inventory and further studies concerning growth will result in modifications of our program, thus permitting us to put the lands into a productive condition sooner and possibly increasing the allowable cut.

At present we are not concerned as to when we will return to any specific lands for the second harvest, but will do so when our foresters find that conditions warrant another cutting. This will be determined by the continuous process of inventorying our timber, keeping up our records pertaining to its growth and condition. In other words, we are just viewing our timber program as the productive capacity of the land.

Our timber is sold on the stumpage basis and the sales programs are worked out annually. The procedure is to gather all available information that is pertinent and to prepare a list of lands from which we can develop sale offerings to equal the allowable cut in each major operating unit. The considerations involved are the plans and needs of our principal applicants, condition of timber in various places, competition for various timber stands; and accessibility and market conditions with respect to various species.

We also plan for efficient use of our manpower by trying to so arrange sales that the work load will be as evenly distributed as possible throughout the year. For example, sales in the low-lying lands are scheduled for completion by the time the high country opens up for logging. We try to log our most productive lands first, so as to obtain the highest possible growth after logging and we try to sell our allowable cut through a minimum number of sales each year for efficiency of administration.

We believe that if we continue to cut what is called for in order to keep our lands as productive as possible and to keep aware of the production on our lands, always limiting cut to growth, we will never have any sudden drastic changes in our cutting program. We will always have timber and will always be free to cut wherever varying conditions and inventory data indicate timber is ready for harvest. We see no need for rigid management plans at this stage of the game.

While we are mainly concerned with covering our lands rapidly to put them into production, we are not overlooking possibilities of improving our income through more intensive forestry practices. We have commenced an advance light salvage program in the vicinity of McCloud to recover high quality trees now dying where cutting operations are not scheduled for several years. Since we are thus salvaging normal mortality losses in advance of scheduled cutting, the volume thus recovered can be considered an addition to our allowable cut. The removal of these insect-infested trees further aids in reducing bug losses by removing sources of infestation.

We have begun thinning dense young stands through sales of poles and expect an improvement in growth to result. This activity is and will continue to be limited

in scope, however, until market conditions become more favorable. We have an estimated 53,000 acres of young timber from which commercial thinnings might be made if the market demand is fully developed, which event would prove a great boon to our program.

Our reforestation program has only begun, being limited so far to 60 acres of recently burned lands because of the scarcity of planting stock and the high costs involved. This company has about 164,000 acres of idle or poorly timbered but potentially productive land which we would very much like to put to work growing wood. We believe this would add another 30 to 40 million board feet to our yearly cut. In terms of potential income we can ill afford to leave this land idle. But, on the other hand, we cannot justify the high costs of an extensive reforestation program except on a limited scale where conditions are especially favorable.

Studies underway by research people on the problems of reforestation offer much encouragement in this respect, although we feel this work should be given greater emphasis. Reforestation of our lands is expected to become a reality as soon as research has developed economically feasible means of doing so. In the meantime, however, we contemplate a small scale planting program on high quality timber soils where little or no land clearing costs are involved.

We are confident that, through reasonably intensive forestry measures as described, we will eventually be able to more than double our present allowable cut.

Production and sale of Christmas trees has become an integral part of our operations as our annual cut amounts to about 40,000 trees per year from our true fir forests. We have found that stumpage sales usually result in overcutting—a situation we are taking steps to correct through better control of the cutting operations.

In the Tahoe region we have already intensified our management activities, cutting trees ourselves and doing considerable stand improvement work such as thinning, pruning and shocking trees to cause them to develop better crowns. We are also doing work to develop turnups from stumps of trees previously harvested. We expect through these treatments to at least triple our present rate of production. This work is new and a great deal remains yet to be learned. It appears to offer great possibilities for stepping up income from low quality timber lands and has our foresters very much enthused.

We firmly believe in conservation through well considered and careful use. We are aware that exploitation in itself usually results in diminishing resource values and potentials. Resource management, therefore, becomes essential to continued growth of this nation and likewise to the Southern Pacific Land Company. We believe that maintaining the productivity of the lands is more important in the long run than cashing in on its current assets. This can be accomplished by practicing good forestry and cooperating with nature.

We, therefore, take considerable pains to conserve our basic resources. We recognize soil conservation as fundamental to

assuring continuous flows of good water and wood products. Research has shown that the ability of the soil to store water and to grow timber is directly related to its depth; the deeper the soil, the more water and wood it will produce.

With this in mind, we insist upon such erosion control measures in logging roads and skid trails as will prevent erosion and thus keep the soil in place on the side of the mountain where it will continue to grow trees for tomorrow. Logging in or adjacent to running streams is avoided to prevent injury to watersheds and fishing waters. Our sales are so conducted as to minimize damage to residual trees and thus leave the land in as productive condition as possible. We believe that by cooperating with nature in the manner of harvesting timber and leaving seed trees, regeneration of the forest will largely take care of itself.

Protection of the forest from fire, insects and disease is of prime concern. This protection is handled by the California Division of Forestry and we feel they are doing a good job.

We cooperate with both State and Federal agencies in conducting surveys of forest insect and disease conditions. The SP contributes toward blister rust control work on its lands and this year assisted in arresting a serious bark beetle outbreak in the vicinity of the 1955 Haystack Burn on the Klamath River. By means of salvage sales in 1958, we removed over 4 million board feet of insect infested timber. We believe this action materially assisted in halting what might have become a major epidemic.

This Company endorses the multiple use concept of forestry, realizing that forest lands can contribute other services in conjunction with production of wood and water. In particular we consider the wild life and recreational aspects as far as reasonably can be expected. Our lands are accessible to hunters and fishermen without restriction. Logging in the vicinity of especially scenic spots is carefully planned so as not to damage recreational values, and we are giving considerable thought to developing some of them for potential homesites. We believe this aspect of our multiple use program has a great potential, but it has not as yet been fully explored.

Adoption of our tree farming program was of signal importance to the industry in California since it helped set a trend and encouraged others to follow. Keeping this program alive and growing is a great challenge which stimulates the interest and enthusiasm of our staff of 23 foresters. We realize that we have barely begun in this business of forestry—that much remains to be done and much is yet to be learned about managing our resources. Much hard work is involved, but the results are well worth while.

The whole idea I have attempted to put across may well be summarized by a recent statement made by Southern Pacific President D. J. Russell: "Since Southern Pacific started its Tree Farm Program in 1951, results prove conclusively the value of our effort both to our Company and to the public." Thank you.

(applause)

MR. FRANDSEN: Thank you, Kermit. Next will be Mr. J. P. VanLoben Sels, Assistant Manager of the Southern Pacific Land Company Land Department, San Francisco, who will present a paper on our grazing and agricultural program. Mr. VanLoben Sels.

MR. VANLOBEN SELS: Ladies and gentlemen. I might first show a slide which depicts our entire field of operation that Mr. Frandsen mentioned in the four western states. May we have that slide, please? (slide is shown) I think you can recognize San Francisco in the center of the map on the left. Our main land running across Nevada and Utah consists of most of our grazing lands. The area which Mr. Cuff talked about runs up north to Oregon, mainly our timber lands. Although some are in the Lake Tahoe area also.

Our main agricultural area is in the San Joaquin Valley about the center of the map, and I'll show you an enlargement of that. We have additional grazing lands down toward the desert areas of California toward the Arizona border. Could we have slide 3?

This is the San Joaquin Valley, about half way between Los Angeles and San Francisco. Fresno is at the top of the map, Bakersfield down here near the bottom. Most of our land, as you see, is in an area known as the West Side of the San Joaquin Valley. It's in Fresno and Kings counties, but some in Kern. Thanks.

Our grazing lands are widely scattered and are in this familiar checkerboard pattern. In many cases intervening lands are owned by the United States and we cooperate closely with the Bureau of Land Management, especially in Nevada and on the desert of Southern California. We also cooperate through grazing agreements with the United States Forest Service when our lands are intermingled with the Forest Service lands. They charge us a fee for managing our lands and we receive the rental income, a very good arrangement.

The grazing lands don't really pay a very good return at present, most of them. As was the case in our timber lands, we sold the easily developed and easily saleable agricultural lands throughout the years. We occasionally have to buy a piece back and it's rather a shock what we have to pay for it.

We own about 150,000 acres of agricultural land developed, irrigated, and being farmed. We don't farm any of it ourselves; it's all leased to farmers. They are share croppers. Occasionally we have a cash rental lease but not very often. Some of these share croppers you may not recognize from that term because, if you go up to their ranch, you have to fight your way in past a couple of airplanes and two or three Cadillacs. They're large-scale operators.

We have one farmer who leases 30,000 acres from us—a big ranch. And he owns about the same amount of land also. We have smaller farmers, 20 acres, 100 acres. We have two women who are farmers. They do a very good job—been with us a long time. Several of our tenants who are lessees, as we generally call them, are father and son arrangements and they've been with us 30 to 40 years.

Our share rent is geared to the actual conditions we encounter. The cost of water, the soil type, what it will produce and what the farmer can make. We want our farmers to make money and they do make money. We make some also. The share rent varies from as low as 1/10 to as high as 1/4, depending on those conditions.

The average return to us from agricultural land, our better lands, is around \$15 an acre. Exceptional crops return as high as \$60 an acre. Most of our acreage is in grain—barley. Next highest acreage is in cotton, but it yields the highest return to us. We get some fabulous cotton yields in the San Joaquin Valley, as high as 4 bales per acre. The national average is less than 1 bale per acre. And California's average is about 2 bales per acre; so we think we do pretty well, or our farmers do. I hand them the credit for it.

We don't participate very much in their activities. We don't tell them what to do or how to do it. We try to get the type of farmers, tenants, who we think will do that job and do the maximum job for us.

Our farming area is typical of the interior valley of California. It gets very little rainfall, 5 or 6 inches a year. It is supposed to be raining right now, although we have had none yet. Generally December and January are our heavy months.

We rely on underground pumping for most of our irrigation supply. It's expensive. We have water wells averaging 2,000 feet deep. The actual pumping lift averages about 400 feet. We use 200 or 300 horsepower electric motors. It's expensive water and you have to have crops that will make returns.

We hope eventually that plans for an imported water supply from Northern California, which are under way by both Federal and State agencies, will benefit our properties. We're in a little bit of a pickle there because we don't want to sell our land. Our land is off the market and we want to manage it ourselves and lease it. And certain Federal restrictions and regulations pose quite a problem in that respect. We've made some offers and some proposals that we think possibly will allow us to pay interest on the Federal share of any development of that nature and allow us to retain our property and lease it. That has not yet been effected.

In the conservation field it's a little difficult to bring in exactly what is accomplished, except to state that a great deal of our land is in soil conservation districts. We and our farmers cooperate with them. Also our grazing tenants. We work with other Federal and State agencies in the proper use of grazing lands, observing carrying capacities, seeing that they're not exceeded, and controlling erosion and runoff—that type of thing. We've done some reseeding and fertilizer work in cooperation with other agencies on range lands to see if we can increase the carrying capacity and utilization.

On the farming lands the crop rotation, type of crops, planting and wind erosion have been a problem. We've gone through the series of cover-cropping experiments and planting windbreaks and that type of thing. But we find that the best solution to that is just proper farming, proper time

MINERAL SURVEY

to irrigate, proper time to cultivate, proper type of cover crop to have.

We've contributed plots of land on several occasions to the University of California for range experiments and the U. S. Department of Agriculture has conducted experiments on our land. There have been a great many undergraduate and graduate students from the different colleges and campuses who have worked on them. We feel we've made a contribution there. And in turn they are contributing to the general welfare of the agricultural industry and we participate in it.

A great deal of work is done with airplanes in our farming. A lot of the seeding is done by plane, a lot of the fertilizing is done by plane. Almost all of the pest control work, insecticide work, is done by plane.

We experimented recently with a number of new crops since we are faced with these Federal crop surpluses and Federal acreage control programs, especially with cotton and other price-supported crops. We've developed some favorable indications that other crops are adaptable but the limited water supply and, in some cases, the questionable quality of our water is a very definite factor in holding us back. We hope that will be corrected. As I mentioned to Mr. Rosecrans, he and some committees he's been working with have done a lot of work in that direction.

Some of the new crops we've tried are castor beans for castor oil for the kiddies and oil for airplane engines; various oil seeds; sesame seed, those little seeds you find on the Palace Hotel buns, I guess. Soy beans, which have proven quite successful in the central and middle-western states, have been a dismal failure out here. We don't know why yet, but we're still working on that.

We're an absentee landlord. We operate out of San Francisco. But we have an agronomist and two fieldmen who live down in the area and contact the farmers as often as possible, make recommendations on lease terms, if necessary collect the rent. They're not partners at all nor even paid advisors. They're supervisors and liaison men for the Company in San Francisco. They do a fine job. We have very high calibre men.

We don't hold a high degree of supervision. There are some properties we don't see even every year, especially the grazing lands. There are some properties we own that I have never seen. I hope to see them all eventually.

We make money from our agricultural lands. Grazing lands, many of them, just carry themselves; but the Company makes about a million and a half dollars a year from agriculture. We think that will increase gradually during the years and we think it's a fine ace in the hole for the railroad business. Thank you.

(applause)

MR. FRANDSEN: Thank you, Van. Next will be our Chief Geologist, Mr. William C. McCulloch, who has prepared a paper on our minerals program. Mr. McCulloch.

MR. McCULLOCH: Thank you, Mr. Frandsen, ladies and gentlemen. If this transition from trees and crops to rocks bores any of you, I'll try not to talk too loud so that you can sleep safely through the dissertation.

The public has in recent times become interested in activities leading to the discovery and development of mineral raw materials. This interest has been generated by articles outlining our so-called "have not" status on certain raw material products in relation to other nations. Public interest has also been stimulated by the activities of the Atomic Energy Commission and success of uranium prospectors and the exciting modern growth of our oil companies. In the West, people are particularly aware of the economic contribution of raw material industries such as lumbering, mining, and agriculture since they form the principal base for our domestic business activity.

Geologists are trained to be keen observers of natural phenomena. They are hampered somewhat in this activity by the proclivity of Mother Nature to conceal interesting facts from direct observation. The advent of the sack dress tends to illustrate what I mean. You see it floating by and suspect there may be something interesting under it, but you can't make out the details without considerable mental projection.

A geologist, therefore, indulges in some mental gymnastics in order to reach a conclusion about something he generally can't see and which is based on assumptions, derived from projections of partly concealed facts. This definition is meant to be confusing but has its serious aspect. If we see one of our men sitting out in the woods for eight hours without moving, we don't assume he is not working—he is probably trying very hard to imagine what the inside of the next mountain looks like.

We also employ geophysicists, and these, in contrast to geologists, don't have to think at all. They use instruments that smell around electronically, or by other mechanical means. The geophysicist doesn't pay any attention to geology. He just watches his little black box to see if it says yes, no, or maybe. It generally says, maybe this is the spot. Then the most positive tools of mineral exploration are used—the pick and shovel—or their big brothers, the bulldozer and dragline. If you dig and expose an ore deposit, you are doing "development work," if you dig and don't discover anything, you are doing "exploration work."

Seriously, I think most of you will agree that some reasonable comprehension of earth science by the general public is necessary so that it can obtain support for new and approved methods and applications. Geology is a science. The discovery and development of entirely new mineral deposits is *essential* to provide ourselves and future generations with basic raw materials needed for the continued manufacture of the gadgets, widgets, and tools we believe we can't live without. Mineral deposits are not like crops that can be recreated year after year. Once exhausted

they are gone for good and new ones must be discovered.

How many of you have paused to consider the many things you use daily that are made of metal produced from the mines of the world? From the time you get up in the morning and use your razor or your breakfast knife, fork, and spoon to the time you go to bed and sink down on your innerspring mattress, you are using objects of metal that you consider essential to daily living.

Yet each of the mines that produce the ore from which the metal is made is subject to exhaustion. Consider that a steel company uses three million tons of ore a year. It becomes necessary, if that company is to stay in business, for someone to discover and develop thirty million tons of new ore every ten years. The steel industry in this country now has the capacity to produce 144,000,000 tons of steel per year, which could use about 300,000,000 tons of iron ore per year.

We cannot exhaust our ores at this rate without replacement through discovery.

I believe this will be done, because only a very small percentage of the mineral resources of the world have been discovered to date. One guess is as good as another because we don't know the amount undiscovered but the amount discovered may be as low as 5% of the total potential.

The reason for this low estimate is apparent when you consider that about 95% of our country is covered by deep layers of sand, gravel, and soil, recent lava flows, and water. Most mineral deposits that have been discovered in the past and on which we now depend occur in areas where the skeleton of the earth, that is, the basic component rocks of the earth's crust are at least partly or completely exposed.

In this relatively small area, we have found our mines, and it is known that under the remaining vast covered area are rocks similar in type to those in which mineral deposits occur. Therefore, it is reasonable to infer that many more deposits exist than have been found to date.

I know that ways now known and new technology not yet developed will be applied to this necessary task.

There is a lot that can be done yet, however, with what you can see on the surface and with geophysical, and geochemical equipment now known. In states like Nevada where mining has played a large part in a limited economy, surprisingly enough, vast areas have never been geologically mapped.

Our company owns considerable land in these areas and is interested in its mineral potential. We, therefore, decided to organize a team of men trained in the practical application of the earth sciences to gather and evaluate as much information as possible about the economic resources of this area.

I will endeavor to answer six questions relative to the scope of this work.

These are:

1. Where is it being conducted?
2. Why is it necessary and desirable?
3. How is it being done?
4. What does it cost?
5. What are the results to date?
6. What future benefits are anticipated?

FIRST, AS TO WHERE IT IS BEING CONDUCTED

In portions of California, Nevada, and Utah within 20 miles of our railroad lines, there are areas in each state in which the Company owns land acquired by various granting acts of Congress. The present ownership is about 1/3 of the original 15,000,000 acres of land granted to S. P. Co. and predecessors in interest. Currently our ownership in the area is about 4 1/2 million acres of land and reserved mineral rights. Our mineral survey, however, will cover about three times this area, or approximately 14,000,000 acres. Individual parcels are generally a section of land of one square mile each. In order to obtain all possible surface information about Company-owned lands, it is necessary to gather practically as much information about adjoining land, and project it, as is recorded on Company lands. As a result, we are conducting the survey not only on Company-owned lands and reserved mineral rights, but on almost all other land within one mile of any lands owned. Over all, we will geologically map and examine about 14,000,000 acres, of which about 37% is Company owned.

SECOND, AS TO WHY THE SURVEY IS CONSIDERED NECESSARY AND DESIRABLE

Fundamentally, the S. P. Co. has not realized very much income from mineral deposits, other than oil and gas. We would like to show a larger return but without dependable up-to-date information on the location and size of mineral deposits, we are in a poor position to capitalize on such potential as we may have.

Almost all of our land has been examined by mining engineers in the years of ownership. Previous efforts were limited, however, to the tools then available and by the objectives of such examinations. As a result, information on the possible mineral potential of the land is sketchy and we are not now in position to evaluate it or to supply essential data to anyone who may be interested in developing it.

Early examiners considered only a limited list of mineral products which could be mined at a profit at the time of the examinations. Generally, the list was limited to commercial occurrences of gold, silver, copper, lead, and zinc. Since expansion of our industrial complex in this area, the list of commercial raw materials required by industry has also expanded and older economic concepts have changed with technological progress in transportation and mining methods.

It is, therefore, desirable at the present time to re-evaluate our holdings to determine if some of the property may be made to yield a larger return from minerals, form a basic supply for new or established industry and supply additional freight revenue.

AS TO QUESTION No. 3—HOW IS IT BEING DONE

We have a modern, up-to-date, qualified and well-equipped geological team. This group is equipped with about \$20,000 in geophysical instruments which are designed to yield understandable reactions

over concealed ore deposits. Sometimes they do and sometimes they say maybe rather than yes, and sometimes yes to some condition other than an ore body. This leads to some soul searching known as interpretation of results. So far, we have been lucky.

There are 32 people directly engaged in the survey work. The basic group who are gathering information and evaluating it are the geologists in the field. There are 21 geologists engaged in field work. Office forces consist of one geologist, six draftsmen, research personnel, clerks and stenographers, supported by the basic Land Department staff.

The basic geological information gathered by field geologists is recorded on maps and described in reports. Areas indicated to be mineralized by the investigation are given a project number and assigned for more detailed study by a special project group which operates independently of the larger group of reconnaissance geologists.

The special projects group does geological mapping in detail. This group is also equipped with a number of geophysical instruments which are used to obtain an idea of the geology under the surface and indicate if there are subsurface features hidden by a mantle of barren surface material. Should the special projects group find indications either by geology or geophysics, that are indicative of a possible valuable deposit, samples obtained by diamond drills, or by bulldozing off the surface material are analyzed to determine the average mineral content of the deposit.

In Nevada and part of Utah is an area aggregating 5,000 square miles that has never been surveyed topographically. In this area we have employed an aerial surveying company to make base maps ahead of our geologists and provide us with aerial photos for use of our photogeologists.

AS TO QUESTION No. 4—WHAT DOES IT COST?

The over-all cost of the entire survey will aggregate about \$2,000,000 over a six-year period or an expenditure of approximately \$350,000 per year. In addition to this will be costs of drilling and other special projects work that cannot be estimated until the jobs are individually analyzed.

On a per-acre basis, our costs are about 9 to 13 cents per acre for reconnaissance work on the 14,000,000 acres to be surveyed. Since we own 37% of the total, the costs will be 25-35c per acre of Company ownership.

Costs of special projects examinations vary with the size, location and depth of the deposit but fall between \$30,000—\$250,000 per project.

AS TO QUESTION No 5—WHAT ARE THE RESULTS TO DATE?

Reconnaissance field geology has been completed on about 4,300,000 acres and represents about 31% of the total job.

In this area investigation has turned up about 60 mineralized areas worth further special projects work. The occurrences vary from non-metallic minerals such as clays to metallic, such as iron, titanium

and gold ores. No uranium occurrences worthy of interest have been found.

An occurrence of special interest at present is an iron ore body in Nevada discovered by geophysical work. Currently, this property is being investigated by the special projects group. About 40,000 feet of diamond drilling, sampling, and drill core logging is planned at a cost of about \$250,000. To date 26,000 feet of drill hole indicates that the deposit might contain about 60,000,000 tons of iron ore. Should further work confirm this figure, this one deposit could return the entire estimated cost of the survey.

QUESTION No. 6—WHAT BENEFITS WILL RESULT IN THE FUTURE?

It is hard for anyone to look in a crystal ball and predict the future, as the most positive statements have a habit of bouncing back. However, we know that the West is growing in population and that demands for use of our land holdings will increase. With a fair knowledge of the mineral potential of each parcel we own, we will be in better position to manage the property over all than we are now. Those parts that contain natural resources can be brought to the attention of consumers with factual data as to location, quality and size and this ready reference material might permit a user to start work many months or even years sooner than could otherwise be anticipated.

Non-mineral lands can be managed for their surface value exclusively without concern as to whether or not a mining operation might interfere.

I have covered the following points briefly:

1. Why have the survey?
2. Where is it operating?
3. How is it done?
4. What it costs?
5. What are the results?
6. What future results may be?

I have enjoyed talking to you about our mineral program and wish to thank you for your kind attention to the subject.

(applause)

MR. FRANDSEN: Thank you, Bill. Next will be some comment by Mr. S. G. Merryman, Manager, Timber and Western Lands, Northern Pacific Railway Company. Mr. Merryman.

MR. MERRYMAN: I'll turn this back to Lou just a moment. There's been a slight change in plans.

MR. FRANDSEN: It's been suggested that we take a short break, and we'll adjourn for, say, 5 or 10 minutes.

(Short recess)

MR. FRANDSEN: O.K., gentlemen. Will you take your seats, please, and we'll conclude this in a very short time. (pause) We will now have a few comments by Mr. Merryman, Manager of Timber and Western Lands, Northern Pacific Railway.

MR. MERRYMAN: I didn't want to dispose of the audience entirely with my suggestion. The main thing I had in mind was, when I was down here before, I carried

away a lasting impression of the last conference and that impression was primarily the seats in the Fairmont.

I have been asked to comment on points of similarity between the present management program of my Company, the Northern Pacific, and that of the Southern Pacific as just presented to you. In searching over my assignment here I decided that, being both land grant companies, our programs were quite similar and I wouldn't want to subject you to going over the detailed yes, yes, yes that would be necessary to confirm the fine program that the Southern Pacific has presented to you.

I believe they should be congratulated on their progressive approach to forest management. We're proud of our operation too. Our railroad is dieselized, we have electronic sorting yards, we have vista domes and we have stewardess nurses.

Our Properties and Industrial Development Department may not have any stewardess nurses, but we have eight charming young girls whom we call photo clerks who do such assorted jobs as preparation of aerial photographs for mapping and weighing portions of maps cut up by an analytical balance for the determination of map acreages.

We maintain our own airplane and one of the best-equipped photo laboratories on the West Coast, we believe. Each is staffed with technically trained personnel. In fact, after five years of aerial survey business, we boast that we can interchange our crews on the two-platoon system.

The Northern Pacific has come a long way in the past two decades in land management. We, too, followed a liquidation program up until about 1940 when the Transportation Act was passed. This Act gave the land grant railroads a freer hand to manage their lands and paved the way for transition from a liquidation policy to that of a permanent management for continued yield of renewable natural resources.

Technically trained people now staff the timber, minerals, grazing and cultivation divisions of the Properties and Industrial Development Department and are coordinated under eastern and western managers who are professionally trained in forestry and geology.

The Railway Company staff includes specialists in many fields, from agriculture to aviation, whose judgment is freely coordinated for the maximum good of the Company.

The Northern Pacific's geology exploration program varies from that of the Southern Pacific in that our program started in 1953 and is expanding its staff gradually, utilizing young specialized geologists to effect its program to explore all of its 8 million acre mineral estate. I believe the Southern Pacific has expanded its exploratory staff rapidly to complete its program in a few years.

To date our program has not turned up any significantly large mineral discoveries such as the iron ore deposit by the Southern Pacific. It has lent, however, invaluable assistance to the Traffic Department and to the Timber Division for the evaluation of the mineral potential of proposed exchange lands while paying its way through administration of iron ore, coal,

gravel, and miscellaneous leases. The geology program is still expanding. Trained geologists are taking every advantage of up-to-date methods, including geochemistry, geophysics and photogrammetry, in evaluating the Company's resources.

The Northern Pacific, as you may know, holds tremendous reserves of coal, lignite and iron ore. The Northern Pacific owns approximately 8 million acres of oil and gas rights, more than 5 million acres of which are in productive or potentially productive areas of Montana, North Dakota and Wyoming. The Oil Development Department, headed by a Vice President experienced in the oil business and staffed with competent petroleum geologists, engineers, landmen, attorneys, and accountants, was established in 1952.

Net oil production is now approximately 7500 barrels a day and more than half of this is working interest in production from 560 oil wells at the present time, of which 270 are in the Williston Basin in eastern Montana and North Dakota. Income in 1957 was a little over \$6,000,000. It will exceed \$7,000,000 this year. The Oil Development Department is operating under a broad flexible policy and has entered into a large variety of leases.

Grazing and cultivation are handled over the entire system by professionally trained specialists. Over 1,000,000 acres are under grazing leases.

Cultivation is not as significant with the Northern Pacific as with the Southern Pacific. We have a number of leases, however, which generally are on a crop-share basis. These vary from 25% for grain to a much larger percentage for crops on more productive lands.

Most of the Company's holdings are wild lands best suited for grazing or timber management.

Many thousand acres of Northern Pacific lands have been developed into farm units with irrigation waters of the Grand Coulee Dam. A trained specialist has worked with the Bureau of Reclamation in the development of this property. Farm units have been sold to individual farmers as required by law. The Northern Pacific, needless to say, benefits greatly from their development through agricultural traffic produced.

Organization of Timber and Western Lands. Our Seattle office is divided into three principal divisions: 1. Administration, 2. Land management, 3. Forestry and Timber Sales.

Administration of records for lands now held and previously sold (the Northern Pacific actually received approximately 39 million acres in its original grant), road rights-of-way, power lines and dams is an extremely large chore. Cabin sites, industrial sites, camp grounds and trespass also help to keep the work varied and interesting.

The Forestry and Sales are handled by a managing forester, who has an assistant, sales forester, forest engineer, and inventory forester, all on his Seattle staff.

District foresters are in charge of five principal districts—Western Washington and Oregon, East Slope of Cascades, Northeastern Washington and Northern Idaho, Montana, and Minnesota. They have under them eight resident foresters. A

number more are contemplated when the eight permanent foresters now assigned to inventory are freed in 1960. Several more personnel are assigned to the Seattle and Montana District offices for deployment where needed.

A limited amount of research is now carried on by staff personnel. Our long range outlook envisions a permanent, full-time research forester.

Of the 2½ million acres of fee land Northern Pacific now owns, approximately 1½ million acres are located west of Yellowstone Park in Montana and are primarily timber lands in character. These lands, and all timber from Washington to Minnesota, are administered by the Timber and Western Lands office in Seattle.

We now have seven certified Tree Farms totaling nearly ¾ million acres, and contemplate that nearly all of the 1½ million acres will be certified following completion of our inventory in 1960. There are now 27 trained foresters on the staff, who are handling up to 300,000 acres of inventory per year with the aid of seasonal college forestry students. They have well under way the evaluation of up to 250,000 acres of land in contemplated exchanges with the Forest Service, and have prepared and sold more than \$2,000,000 worth of stumpage in 1958. Continued expansion of sales is programmed.

Tree farming is truly a profitable business for the Northern Pacific. We estimate, by contract and in cooperation with the Forest Service and other agencies, that we are building timber access roads in 1958 valued at approximately ½ million dollars. On our staff are two graduate forest engineers to assist in this work.

To comprehend the size of the area managed by the Northern Pacific, one need only consider that due to the scattered nature of the Company's holdings, and in consideration of the length of the railroad right-of-way, it would take a man walking an average of 10 miles a day 17 years to travel all of the Company's exterior fee and mineral land boundaries.

The job is so large the Company has never been able to complete an inventory of its holdings. By the use of modern photogrammetric methods, we estimate in the 5-year period ending in 1960 that we will, for the first time, have a complete timber inventory.

The land varies in elevation from sea level to 10,000 feet, from the Pacific Ocean to Lake Superior, from extremely poor to extremely good. We plan, through an active exchange program, to consolidate our holdings for better administration. We believe the low-valued lands and the inaccessible lands can best be managed by the Government. Incidentally, many of these lands are well suited to wilderness area management. (laughter)

The Company owns lands within the boundaries of Yellowstone National Park, the Selway-Bitterroot Wilderness area and the Mission Mountain Primitive area. We hope, through exchange, to resolve this ownership pattern. Savings in administration will result to both the Northern Pacific and the Forest Service by consolidation. For your information, we are exchanging on a dollar basis.

Northern Pacific lands are generally open to the public for recreation. Most roads, as well as lands, are open where compatible with timber management use and providing such use does not create undue hazard or damage.

The Company protects its lands from fire under contract with the Forest Service, State or protective association administering the protective area. Acreage loss has been extremely low. The Company cooperates in insect research and control programs where feasible. Over 150 million feet of insect-Engelmann spruce have been salvaged in Montana and Idaho since 1953. While reduced in intensity, we are continuing to salvage both new attacks and old where accessible. Due to major unsanitized timber stands located in adjacent wilderness and primitive areas, this appears to be a yearly process. One rotten apple generally contaminates its neighbor. Insects and fire constitute a real hazard to properties adjacent to inaccessible areas.

The Northern Pacific in the early 40's stopped making outright sales of land and timber. Five years later, in the mid 40's, lump sales of timber only were common. By the last half of the decade, timber sales were being made almost entirely on a cut-out scale basis. Coinciding with this, the Company decided to hold all of its timber and grazing lands for management on a permanent yield basis. All timber is marked or designated for cutting under best available economic forest practices.

Today the Company sells property only when, in its opinion, it has reached its optimum state of development for its highest and best use. The Northern Pacific's resources are a valuable asset and contribute greatly to its financial soundness. Thank you.

(applause)

MR. FRANSEN: Thank you. Next we'll have a comment by Mr. R. G. Sackerson, General Manager, Milwaukee Land Company.

MR. SACKERSON: Thank you, Mr. Frandsen, ladies and gentlemen. I must say I'm impressed by these millions of acres these railroads own. The Milwaukee Land Company, by comparison, is small and I hope mighty. The report you've just heard on the Southern Pacific Land Company's land management and development program and the Northern Pacific's program, I believe, present an example of conservation and development through wise and careful use.

Southern Pacific's California tree farm management as Mr. Cuff has outlined it is a great asset that will increase in value in the years to come. The mineral survey program outlined by Mr. McCulloch was most interesting and seems to have endless possibilities. I'd like to say, if you have any idea how to wring a little oil out of the lands up in Washington, I'd surely be glad to have you come up.

The management of the agricultural lands of the Southern Pacific was quite interesting. Certainly an income of a million and a half dollars a year is not to be sneezed at.

I think possibly the land company's management program and our ownership

are quite dissimilar in many respects. We're not a land grant road. At one time we owned in excess of 500 thousand acres, not 5 million acres, of land in Idaho and Washington, all of which was purchased either from land-holding companies or from early day homesteaders.

During the period from 1910 through 1940 our land and timber were available for outright sale and during that period we sold over 50% of it. During those years we made a number of land exchanges with other timber companies and concentrated our very widely scattered holdings into three general areas. In Idaho we now have 100,000 acres of land; in Washington, 125,000 acres.

I'm sure that the early liquidation of our land had a lot to do with the development of forest industries along our railroad that are still in existence. And the lands that we sold to them, and the timber, are still contributing to their operations.

We don't have a program of partial cutting or selective cutting. All of our timber land has been submitted to industries that are along our railroad who are good Milwaukee shippers. They look upon our lands as something they can draw on as their needs arise.

I don't know if I could add anything more. Our present policy in land cutting is to clear-cut as the operation progresses and, as soon as the lands are in condition, we now are restocking them either by direct seeding or hand planting. In the past five years we've cut over about 8,000 acres and have reseeded or replanted in excess of 6,000 acres. I think that's the best means of conservation that we can carry on at this time. That's about all I have to offer at this time.

(applause)

MR. FRANSEN: Next will be some comments by Mr. O. B. Calvin, Forester, Glacier Park Company, Great Northern Railway.

MR. CALVIN: Members of the Western Forestry conference, I believe that we are, now that the other railroads have gone before, the smallest. We have a Tree Farm in Montana with about 150,000 acres. It's located in western Montana. We have about 75,000 acres of virgin timber which we are selectively logging at this time. The rest of it is in cutover land. We have quite a Christmas tree production in that country. We produce about 20 to 25,000 bales of Christmas trees a year there. That's one of our largest sources of revenue for our cut-over land.

We attempt to selectively log all of our virgin timber. That is, we use a modification of the California Risk System in all of our cutting or marking, and we salvage all blowdown or bug trees that are economical to salvage. All of our timber is now being held for cross-tie production for the Great Northern Railroad.

We're not a land grant road, and so all of our land was purchased locally from the homesteaders or different owners there in Montana.

(applause)

MR. FRANSEN: That concludes the railroad part of it, Charlie, so I'll turn the program back to you.

MR. CONNAUGHTON: Thank you and members of your group, Louie, for this presentation. All of these companies have roads too, although I guess you're cutting down—just once every three days now, or something like that. (laughter) At least the Shasta Daylight has been announced under a new schedule. I thought I'd get that in.

Now we have one other major section of our panel, W. S. Swingler, Assistant Chief of the United States Forest Service, Washington, D. C., who will present a report on discussions which have been held during the last several weeks on the small owners, and small woodland management.

As you may recall, shortly after the Timber Resource Review was issued, an announcement was made that a series of meetings would be held to discuss various ways and means of considering, handling and meeting the problems faced in the management of small tracts of forest land. Mr. Swingler has that topic for discussion which is in the nature of a progress report, obviously, because all of the discussions have not been completed as yet on the subject. Mr. Swingler.

(applause)

MR. SWINGLER: Thank you, Charlie, and I also thank the audience. You people are good for my ego. Any time this many people stay around this long to listen to me makes me feel good. But I am glad to be here. I know that's a trite expression. I have a perfect right to say that. This is the first time in a good many years that I've had the opportunity to meet with this group. About ten years ago I used to be a regular member. About half of you I recognize; the other half are newcomers who have come into the picture in the last ten years.

As I recall, most of the meetings, possibly all of them back in those days, were held up in Portland. I came through Portland yesterday and I could well remember, the setting was just the same. As I climbed up on the airplane, it was raining.

The second reason I'm glad to be here, of course, is that I would like to have an opportunity to talk to you people about these small ownership meetings which have had quite a lot of publicity throughout the United States.

We've known for a good many years, you fellows have known it, we've known it, practically all foresters and conservationists have known it, that the cutting practices on the small woodlands were not keeping pace with the cutting practices on the publicly owned land, with the cutting practices on the large commercial timber lands. We tried to do something about it. But it wasn't until the TRR came along that we really had pointed out to us with such emphasis the importance of those small woodlands in our total forest picture.

I'm not going to go into any long and detailed analysis of TRR. That has been analyzed and re-analyzed a good many times by speakers before this group. In fact, I can see half a dozen fellows in the