

14,500,000 board feet of mining timber to take out 1,400,000 tons of ore. The ponderosa pine of the Black Hills has been a very important factor in the development of the local mining industry. White man came to the Black Hills for one particular purpose and that was for the mining of gold, and ever since the discovery of gold in 1874 there has been a continuous demand for timber from both public and privately owned lands. Lumber operations have come and gone with varying degrees of stability. Timber operations for the mining industry have gradually increased because of an assured, steady market for the products. This timber market will be dependable as long as the mineral resource lasts.

On April 9, 1876, the Homestake lead was discovered at what is now known as the town of Lead, S. D. Shortly afterward the claims were sold to the Homestake Mining Company. During the first year \$5,000 worth of gold was taken out of the mine. From that time on developments have gradually taken place until it is now the largest gold producing mine in the United States. Its present average annual production is around 1,400,000 tons of ore which produce some \$19,000,000 worth of gold.

Complexities in such a gigantic operation are numerous. Annually the company drills 303 miles of holes in which 3,108,234 sticks of dynamite are exploded with 1,000,000 caps and 773 miles of fuse. Thus 36,000 feet of tunnels are opened up and the ore made accessible. In order to do this about 14,000,000 board feet of timber per year are needed. During the past year around 16,700,000 board feet of timber was cut by the company. Of this amount 14,500,000 board feet was for its own use and was milled into square sets, lacing, lagging, ties, and various sizes of rough and finished lumber. The lumber was used for everything from construction work to patterns in the pattern shop. The 2,200,000 board feet of timber not used by the company consisted of reject mining timbers and was sold to mines in which the rock formation permit their use. It also included some lath and rough lumber sold to lumber dealers. The company is able to use about 85 percent of the timber it cuts, of which probably 75 percent goes underground. The remaining 15 percent consists of cull mining timbers and by-products that are not needed.

The company has been cutting timber since its organization, which was 22 years prior to

the establishment of the Black Hills National Forest. In 1898 it made application for a timber sale. Six sections containing some 14,000,000 feet were advertised at \$1 per thousand board feet. The company was authorized to start cutting in 1899. This was the first sale authorized by the Forest Service. Since that time cutting has been alternated between public and privately owned lands. During the past 64 years the operation has been subjected to the evolutions of the timber industry. Transportation of logs has passed through the heydays of oxen, horses, narrow gauge railroads, gasoline trucks, and now Diesel trucks. The manufacturing end has progressed from the broad axe to the electrically operated mill.

During the past ten years the company has operated three separate mills. These mills were located largely with reference to certain tracts of timber rather than with any idea of permanence. A new mill, with a 72,000-board-foot, per eight-hour shift, capacity and electrically operated, is now being constructed and will take the place of the other three. In this new mill improved economic and social ideas were incorporated. Since it is now economically possible to haul logs up to fifty miles, it is no longer necessary to confine mills to woods locations in the Black Hills. The new mill is therefore being located at Spearfish, S. Dak. This location is accessible to an annual yield of 10,500,000 board feet of government timber and several million feet of privately owned timber. Social and economic conditions for the 175 employees and their families moved to the new location will be greatly improved. They will have all the advantages of a small town supporting a normal school. The company is making it possible for each family to own its own home. In other words, stability, both economically and socially, is being stressed throughout the redevelopment of the company's timber department.

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CUTWORM DAMAGE TO SEEDLINGS IN CALIFORNIA PINE STANDS

Cutworms, Noctuidae larvae,¹ frequently cause serious damage to natural and planted seedlings

¹Specimens have been identified as *Euxoa excellans infelix* (Sm) by the Bureau of Entomology and Plant Quarantine. Probably other species also injure seedlings.

in the California pine region. Observations during several years in California and reports from other regions suggest that these insects contribute to frequent failures of plantations and natural reproduction. Careful study of the insects with a view to their control seems justifiable.

In the western white pine type Haig² found losses caused by cutworms as high as 26 percent of the total germination of a species in a particular site. Isaac³ reported losses of Douglas fir seedlings from cutworms but did not separate cutworm loss from that of other biotic agencies.

In California, most serious damage occurred to seedlings for one or two months after germination, although some injury to planted nursery stock also has been noted. The larvae, night feeders, were found about one inch under the soil, usually in the immediate vicinity of recently eaten or partly eaten seedlings. Several types of damage were recognizable. At times the cotyledons were cut back to basal stubs. Seedlings occasionally survived this type of injury. More frequently the cotyledons were eaten entirely and only a stump of the stem was left. Such damage closely resembled that by rodents and birds. In some instances the stem of the seedling was cut part-way through above or just below the ground line and caused the seedling to topple over. Seedlings thus destroyed resemble superficially those killed by heat or damping-off. A distinctive type of damage was that in which the stem was eaten and the cotyledons were left intact. It appeared that the stems had been pulled below the soil surface by the cutworm.

In Table 1 the extent of the damage is indicated by a summary of the losses caused by insects for a five-year period in five artificially seeded study areas, representing cutover and virgin sites in the ponderosa pine and sugar pine—white fir types in the Stanislaus National Forest.

The losses in the north slope sugar pine—white fir type were significantly higher in cutover stands than in virgin timber. Losses in the cutover sugar pine—white fir type also were higher than losses in the south slope ponderosa pine type cutover and virgin stands. The differences in losses between species were significant.

TABLE 1.—SUMMARY OF SEEDLING LOSSES CAUSED BY CUTWORMS

Species	Total germinated	Percent killed
Incense cedar	2,314	52.9
Sugar pine	1,536	7.9
Ponderosa pine	3,054	28.6
White fir	511	34.4
Total	7,415	32.3

Differences between years were unimportant. There was no preference by cutworms for any particular species in any one area.

Cutworm damage was revealed also by examinations of seed-spots in northern California brushfield plantations. In the Burney Spring experimental planting, in 2,100 seed-spots each of ponderosa pine and Jeffrey pine, all seedlings in 45.8 percent of the ponderosa pine spots and in 7.5 percent of the Jeffrey pine spots were killed by cutworms. In addition, some of the seedlings in 22.7 percent more of the ponderosa pine spots and in 32.4 percent more of the Jeffrey pine spots were killed by cutworms.

In the Burgess Spring seeding experiment,⁴ records of about 5,600 ponderosa pine and Jeffrey pine seedlings show that 18.6 percent of the ponderosa seedlings and 20.4 percent of the Jeffrey pine seedlings were destroyed by cutworms.

The importance of cutworms as a factor in regeneration may be appreciated by a comparison with the losses from other causes. In the Stanislaus areas the insects killed more seedlings than any other agency; they were responsible for 44 percent of the losses. In the Burgess Spring area, cutworms killed only half as many seedlings as died from drought, but still were responsible for 21 percent of the mortality.

Selective feeding by the insects may have an important influence on the species composition of mixed stands. In the Stanislaus locations, where several species were available, incense cedar and white fir seedlings were eaten most frequently.

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²Haig, I. T. Factors controlling initial establishment of western white pine and associated species. Yale Univ. School Forestry Bull. 41. 1936.

³Isaac, L. A. Factors affecting establishment of Douglas fir seedlings. U. S. Dept. Agric. Circ. 486. 1938.

⁴Lloyd, L. D. Field study of germination and mortality of Jeffrey and ponderosa pine seedlings at Burgess Spring experimental range. Calif. Forest and Range Exp. Sta. office rep. 1937.