## COMBATTING INSECT FOES OF THE FOREST.

Fires, insects and parasitic fungi are the most destructive enemies of our forests. Each season fresh forest areas are swept by fires or devastated by outbreaks of injurious insects and fungi. The extensive balsam injury in Eastern Canada illustrates the serious nature of these insects and fungus enemies. The primary injury was caused by the Spruce Budworm, and in Quebec Province, although the Budworm outbreak has passed by, thousands of balsams have died from the primary defoliation and great numbers of the weakened trees are dying now from attacks of more recent enemies, notably the Eastern Balsam Bark-beetle, the Balsam Bark Weevil, and a very destructive sapwood fungus.

The insect enemies of Canadian Forests are being studied by the Entomological Branch of the Dominion Department of Agriculture. A bulletin dealing with Canadian Bark-beetles has been issued recently by the Forest Insect Division of the Entomological Branch, written by Mr. J. M. Swaine, Parts 1 and 2 have been published thus far. Part 1, "Descriptions of New Species," describes 40 new species of Barkbeetles from Canada and the Northern United States. Part 2 gives "A Preliminary Classification with an account of the Habits and Means of Control." In the First section of the 2nd part, the beetles and their habits are described, with a detailed account of the interesting and sometimes beautiful system of tunnels cut by the adults and their larvae. The Second section deals with Bark-beetle injuries and the means of control. Bark-beeltes are probably our most destructive forest insects. They are very small, dark beetles, varying from one to nine millimetres in length. Both adults and larvae excavate tunnels in the inner bark of trunks and branches of many of our timber trees. When green timber is attacked the multitude of small tunnels girdles the trunk in hundreds of places and the tree usually dies in less than a year from the time of attack. Their most extensive injuries to our forest in recent years have been caused in British Columbia, but they are everywhere destructive throughout the eastern woods. The injury to eastern balsam by the Eastern Balsam Bark-beetle at the present time is a good example. In addition to many "primary" 'species, which attack and kill green timber, many "secondary" species are always found in weakened and dying trees. These secondary enemies

assist the more destructive species in killing trees, following up the original attack, but are often found initiating outbreaks in green timber on their own account.

## Value of Slash Burning.

The Control Measures discussed in this chapter include the destruction of the broods of beetles during winter by modified logging operations, and properly conducted slash-burning. With the destructive species the winter is passed by the beetles and their small whitish larvae or grubs under or in the bark of the trees attacked by them that summer, and in the green slash and stumps. If infested trunks are removed and treated, by driving for instance, so that the broods in the bark are killed before June, and if, in addition, the slash is burned, the number of the destructive species may be so reduced that satisfactory control is effected in one season. Slash-burning is strongly recommended as an effective method of insect and fungus control.

The Third section gives a short account of the structural characters of bark-beetles, sufficient to explain the technical terms employed in the keys for determination in the section which follows.

The Fourth Section, comprising about 100 pages, presents an arrangement of the Canadian Bark-beetles with keys for determination, so that students and foresters with a little training in the use of keys of this kind may be able to determine the species of bark-beetles for themselves.

## Accuracy Essential.

The control measures depend entirely upon the habits of the beetles, and the habits vary with the species. It is therefore necessary to determine exactly which species is causing the primary injury. There may be a dozen species of bark-beetles in the bark of a group of dying spruce, but only one or two of them will be concerned in the primary attack on the green timber.

The bulletin is fully illustrated with 31 full page plates, twenty-seven of these by the heliotype process, and five text figures, over 265 figures in all. It is distributed free in Canada to those interested in forest protection, and may be obtained through the Dominion Entomologist, Entomological Branch, Department of Agriculture, Ottawa.