

APPENDIX.

HILL-COUNTRY GRASSLAND.

NOTES BY A. H. COCKAYNE.

HILL-COUNTRY grassland can be divided into two great groups—that where the objective of management is to maintain and increase the percentage of the best grazing-grasses, such as rye-grass, cocksfoot, *poa pratensis*, crested dogtail, and clovers, and that where the objective is to secure and maintain as complete a grass sward as possible irrespective of what grasses it may be composed of. In the first case the objective is to keep out as much as possible grasses, such as danthonia and brown-top, which when dominant are not conducive to high carrying-capacity of wet stock. In the other case the objective is to avoid dominance being secured by objectionable vegetation, such as one or other of the ferns, or scrub growth. Old-established hill pastures where the best English grasses are in the ascendancy are comparatively rare except on certain very fertile soils. The larger percentage of our well-grassed hill pastures are danthonia-dominant, particularly in the drier regions, and brown-top as the dominant element is conspicuous over wide areas where the rainfall tends to be fairly heavy and the ground is not exposed to extreme drying-up in the summer. The present general system of management is tending towards increasing the dominance of danthonia and brown-top over much country that should be supporting a larger percentage of the better English grasses. Better cattle-manipulation, rational subdivision to enable areas to be summer-spelled, and the use of phosphatic top-dressing are the three main factors that are involved in the management of country where danthonia and brown-top are tending to reduce the percentage of wet stock that can be carried. In the drier parts of the North Island, where fern and scrub are gaining the upper hand, methods tending to an increase in danthonia are the keynotes of management; burning, sowing with danthonia, self-sowing of danthonia by sheep from danthonia country, and frequent burning of the danthonia itself are all useful. Later on, when the country becomes danthonia-dominant, efforts should be made to convert the pasture into mixed English grasses and danthonia by all those methods that tend to soil-fertility increase. The problems of the management of our danthonia and brown-top dominant grasslands are as important as those involved in the management of our truly deteriorated hill pastures, and call aloud for extensive and well-directed research work. It has to be remembered that our danthonia and brown-top dominant grasslands have mainly developed from the surface sowing of the lands with grasses that now only represent a fraction of the herbage, the sown grasses giving out more or less rapidly and their place being taken by others more fitted for the lower soil-fertility that has been brought about largely through the exhaustion of the surface fertility present after the initial burn. Over wide areas of the North Island, however, the initial sowing with the so-called best English grasses had not been followed on their thinning-out by an invasion of such grasses as danthonia and brown-top. It is country of this description that is represented in such a county as Whangamomona, where a few years' luxuriant growth of the sown grasses has been followed by invasion, in varying degrees of intensity, of objectionable second growth, most of which probably represents initial stages of reversion, with forest as a final phase. Somewhat similar experiences have not been unknown over many areas that are now well grassed, in counties such as Pohangina and many others; but in all these, very extensive and at the time apparently destructive secondary fires have swept the country from time to time, but they have been of great value, grass recovery having been quicker than secondary-growth recovery. It is rather significant that in a country such as Whangamomona no really general severe burning of the whole country has been experienced; and (although this is pure surmise on my part, until such has taken place I am afraid secondary growth will tend to increase rather than diminish.

The problem of secondary-growth suppression is, however, extremely complex, and varies enormously with regard to the dominant type of vegetation that has to be dealt with. In one place it may be hard fern, in another bracken, in another water-fern, in another manuka, in another wine-berry or fuchsia. Our knowledge of the exact conditions that determine dominance and succession in secondary growth is extremely meagre, and exact research work in this connection is a fundamental prerequisite in the formulation of control methods. It is hardly expected that the Commission can be in a position to state definitely what methods are necessary to suppress second growth on those areas where the initial sowing with English grasses under ordinary accepted methods of management is not followed by permanent replacement by such grasses as danthonia and brown-top. The fact that such large areas of country are rapidly becoming ruined for successful pastoral occupation indicates that the present methods are unsatisfactory. As the evidence gathered together must have been secured in the main from farmers who have not been able to cope successfully and economically with secondary growth, it is clear that any recommendations they may have made can only be in the nature of surmise rather than the result of successful experience. Even in those cases where pasture-permanence has been more or less maintained—a condition that occurs scattered through the whole area under discussion—the exact reasons why partial success has been secured are obscure. The problem appears to present two distinct phases—namely, firstly, what should be done in order to enable present holders to hang on, as it were, to their holdings; and, secondly, the actual try-out under controlled conditions of all methods of secondary-growth suppression, in order to work out an accurate