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The Grasses and Grasslands of South Africa. by J. W. Bews

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## REVIEW

**Bews, J. W.** *The Grasses and Grasslands of South Africa*. Pietermaritzburg (Davis & Sons, Ltd.), 1918, pp. 161, 24 figs. and 1 map. 7s. 6d.

The need for books of reference on the crop plants of the various parts of the British Empire is obvious. The systematic "Flora" is generally forthcoming, but this as a rule fails to convey the relative economic value of the species, and it rarely presents any picture of the relation to environment. Grasses are a formidable group because they require consideration from many points of view—taxonomic, morphological, ecological and economic. Few of the many books have done the grasses justice. The herbarium specimen and the laboratory transverse section are too obvious in the more exact books, while the more popular are generally superficial. The living grass, its mode of life, habitat and economic value does not seem to be easy to express. *The Grasses and Grasslands of South Africa* is in the first place ecological, and its perusal leaves a more satisfied feeling. It is one of a series of contributions by the author, which began with a general account of the vegetation of Natal (1912), and each year has seen some addition which either extended the area under survey, or dealt more intensively with some plant formation. When the time came for a more detailed treatment of grasslands, the material required more than a Society's Transactions, and this book is the result.

South Africa has over 500 grasses, almost all unfamiliar in the north temperate countries. The preliminary part of the book is therefore a taxonomic key (40 pp.). This is based on floral characters and it is workable so far as one can judge from familiar species. Simplicity is promoted by carrying the analysis in the first instance to the genus only; a set of supplementary keys is provided for the remaining species. How much the genera differ from European ones is seen at a glance: *Andropogon* (32 species), *Aristida* (24), *Eragrostis* (45), *Panicum* (38), *Pentstemon* (38), etc. Ordinary European grasses play a very minor part, the majority being colonists. To become acquainted with this large and unfamiliar flora, is in itself no small task for the author, who went from Britain to his present post about fifteen years ago.

The third section of the book (37 pp.) consists of ecological notes on the principal species, "to set forth the principal facts that have been ascertained, regarding the part played by all the more important species in the grassland plant succession, and also by means of selected examples, to illustrate the general differences which are shown in morphological characters, and particularly in leaf anatomy." In estimating the value of a grass as herbage, emphasis is laid on leaf structure. Thus a grass which is forced to protect itself against excessive transpiration must be hampered in photosynthesis, hence xerophytic grasses, with some exceptions, grow slowly and are less valuable pasturage than mesophytic grasses. Again, xerophytic grasses have generally a high proportion of sclerenchyma, hence they are avoided by stock. The more important grasses are illustrated by about twenty figures of leaf anatomy. The ecological notes are informative though brief, so that one sees at a glance that *Anthistria imberbis* is the most important grass in South Africa, whereas Marram grass is planted only. Information is also given whether the grass is a coloniser in the early stages of a succession, or a constituent of one of the later stages.

These preliminary sections prepare the way for the main thesis—"A general sketch of

the Grasslands of South Africa and their development" (50 pp.). The nomenclature used is that of F. E. Clements in "Plant Succession," reviewed in this JOURNAL (4, pp. 198-204, 1916). Five grassland regions are recognised and indicated on a map: the Cape region passes northwards into the Karroid Central region, and this again into the Sand Veld or Kalahari region; the remaining two regions are broad zones following the western and eastern coasts<sup>1</sup>.

*South-western or Cape region of Fynbosch (Macchia).* This is the region of Marloth's "Das Kapland," with extensions eastwards at higher altitudes. The winter rainfall and dry summers are unfavourable to grassland, though 200 species of grasses are recorded. The lithosere is extensive, and is followed by the xerosere with mosses and isolated flowering plants. Accumulation of soil is accompanied by a Macchia with hundreds of species of sclerophyllous shrubs. The grasses are temperate in type, with the Aveneae conspicuous and including *Danthonia*, *Achneria*, *Pentaschistis*, etc.; a large proportion are endemic. The hydrosere is related to springs and stream banks, habitats favourable to grassland in northern temperate countries, but here in the Cape region too unstable and liable to drought to favour grassland. The psammosere of the extensive coastal dunes is colonised mainly by *Sporobolus pungens* or by *Eragrostis* spp. The general succession everywhere is towards a Macchia of sclerophyllous shrubs. Numerous ruderal grasses, etc., mark the initial stages of a sub-sere, which is naturally replaced by Macchia, but under the influence of man—burning, stock-grazing, etc.—this may become relatively stable, as on ostrich farms.

*The Western region* extends from the Namib northwards towards Damaraland, and is largely unexplored. It begins in the south-west with initial stages of the desert which rarely attain to grassland, but northwards it passes into a moister and tropical climate where grassland increases.

*The Sand Veld of the Kalahari and Central region.* This is the third region of the central series, Cape, Karroo, Sand Veld. It extends from the Orange River to Bechuanaland, and abuts on the eastern region about Kimberley. The dominant feature is sand or fixed sand dunes with no surface water, because the ten to twelve inches of rainfall passes quickly into an underground drainage. *Aristida* Veld characterises the south-western drier parts, but with increasing rainfall eastwards there is a transition to the High Veld grassland of the Transvaal and Natal. The Sand Veld links up the Western, Karroo, and Eastern regions. It presents a contrast to the Cape region because the grass tribes are tropical and sub-tropical Paniceae, Stipeae, Andropogoneae, etc. The Grass Veld in many places proceeds to Tree Veld with Acacias, etc.

*The Karroo and Karroid Central region.* This lies central to the other four regions, and marginally it grades into them. The climate is continental and dry (3-14 in. rainfall). The dominant vegetation is a succulent and sclerophyllous dwarf shrub type, made up of Crassulaceae, Aizoaceae, and Compositae. There is no definite grassland type, except such as follows streams and depressions, and this is subject to considerable fluctuation, increasing with rainfall and decreasing with drought. Between the Karroo and the Eastern Grass Veld there is a transitional belt where Karroo and Composite Veld occur as patches interspersed with grassland. The Karroo vegetation follows soils with the surface dry and hardened, and this condition is extending eastwards because through overstocking the grasses are eaten out, and the stock-tracks tend to become dongas which encourage the run-off of water and thus promote a baked surface. The succession on this xerosere shows three stages which may be taken as typical. In the early stages Kweek-grass (*Cynodon incompletus*) is one of the more widespread consocieties which often forms a prostrate turf, useful for grazing. This is followed by an associates distinguished by *Aristida*—*Eragrostis*—

<sup>1</sup> Cf. Bews, J. W. "The chief Types of Vegetation in South Africa," this JOURNAL, 4, pp. 129-159, 1916.

*Sporobolus*, which passes under suitable conditions into a climax stage, the *Anthistiria-Andropogon* Veld, one of the characteristic types of the Eastern Grassland region. Better grazing is obtained from the *Anthistiria* or Red-grass, than from the *Aristida* type, but the farmers by burning and overstocking destroy the former, and throw the succession back to the earlier and less useful stage. Another succession has its climax in "Haas-gras" Veld (*Danthonia purpurea*). There is evidence that this has replaced the Red-grass veld as a result of the white settlers and their stock.

*The Eastern Grassveld region.* This, the chief grassland region of South Africa, includes most of the Orange Free State, Transvaal and Natal. It is a climatic formation distinguished by summer rainfall and a dry period coinciding with the season of lower temperatures. Within this greater formation there are well-marked and extensive divisions, even in the grasslands. Two main factors operate to bring about differentiation: the distribution of the rainfall, and the rapidly increasing altitude from the coast to the mountains culminating in the Drakensberg. The chief features of the region have already been described by Bews, and reviews of them in this JOURNAL may be consulted<sup>1</sup>. The rain-bearing winds come from the Indian Ocean, and deposition takes place so that the slopes and terraces (High Veld) receive more than the valleys of the river systems (Low Veld). These two types of grassland—High and Low Veld—make up most of the area. A coastal grassland from Durban northwards has more tropical conditions, while beyond the Veld formations a tussock grassland is developed at higher altitudes on the Drakensberg, etc. The author has evidently found the same complexity in delimiting grasslands as is met with in other grassland countries. The present book affords an opportunity of testing the value of the successional mode of study, and the results are distinctly helpful. Thus we have separate studies on the succession in the xerosere, the hydrosere, and the psammosere. The xerosere begins with initial stages: lichen colonies, Cyanophyceae, Mosses and Hepatics, *Selaginella*, etc. The initial grassland consists of pioneer grasses; chiefly species which are xerophytic, deep-rooted, and light-demanding, e.g. *Aristida* spp. There is thus a similarity between the initial stages of the Eastern grassland, and the climax stages in the Western and Karroo regions, as already indicated. *Aristida-Eragrostis-Sporobolus* and *Cynodon* or Kweek-grass, are prominent genera in these initial stages. The climax stages of stable grassland begin when grasses, mostly Andropogoneae (e.g. *Anthistiria imberbis*) appear. These are less xerophytic and form mats which protect the surface of the soil and at the same time suppress the pioneers. The climax stages include many plant societies and clans, including Compositae, Leguminosae, etc., which distinguish and add considerably to the vernal aspects that accompany the first rains.

The Grassveld is a widespread climax stage, but there is evidence that on parts of the High Veld, the succession will go on to forest or post-climax grassland. The first stage is replacement of *Andropogon-Anthistiria* Veld by taller species of *Andropogon*, etc. ("Tambookie"). In the transition to forest, these give place to shrubs or other flowering plants, in places to *Pteris aquilina*. The forest phase includes *Podocarpus* (yellow-wood), *Leucosidea*, or it may be Bush Veld or Thorn Scrub. From the stock-grazing outlook this transition to Tambookie or Bush is not advantageous, and the succession is prevented by burning the coarser grasses, thus maintaining the *Anthistiria* stage.

Economic applications are dealt with in a special section, which contains the nucleus of an important branch of Agrostology. One important thesis is that the effect of grass-burning depends on the type of grassland, and on the stage at which the plant succession has arrived. If the grass veld is primitive or semi-open, burning prevents the succession from proceeding further: thus a less useful grassland (e.g. *Aristida-Eragrostis-Sporo-*

<sup>1</sup> (a) "The Vegetation of Natal" (1912), this JOURNAL, **1**, p. 75.

(b) "An Ecological Survey of the Midlands of Natal" (1913), *idem* **2**, p. 206.

*bolus*) may be prevented from becoming a better type, although for the current year burning may improve the edible qualities of the grasses. If the grass veld has proceeded further towards a more stable type (*Anthistiria* stage), then burning will tend to throw back the succession to an earlier stage, probably less useful, but careful grazing will maintain the better herbage. Should the Veld show indications of passing on to the rougher herbage of "Tambookie," then burning is required to check this and to maintain the *Anthistiria* stage. Grass-burning also increases the vernal plant societies, thereby adding to the colour effects; but this does not improve the grazing.

Grazing by stock also influences the herbage. An immediate effect follows on the selection of the finer grasses, which leaves the surface more exposed and favours extension of the more xerophytic species. A less obvious effect results from trampling of the soil, whereby the texture of the surface is deteriorated, and along tracks the run-off of water leads to formation of channels. The general result is to promote conditions favourable to pioneer and ruderal species, rather than the more stable types.

Within an abstract it is possible to indicate only a few main topics, in the present case plant succession has received attention. This may give the impression of vague references to a few outstanding genera, but the book itself must be used to fill up specific names, and to amplify the constituent species of the various plant societies. Again, the book is almost limited to grasslands, thus giving a somewhat one-sided outlook which requires compensation by reference to the author's earlier contributions on forest, bush and other plant communities.

W. G. SMITH.

## *NOTICES OF PUBLICATIONS OF GENERAL BEARING*

### THE PRACTICAL VALUE OF ECOLOGICAL RESEARCH

**Hole, R. S.** "Plant Oecology and its bearing on problems of economic importance in India," Presidential Address to the Section of Botany, Asiatic Society of Bengal. *Journ. and Proc. Asiat. Soc. Bengal*, **14**, 1918, pp. clvi-clxvii.

**Cockayne, L.** "The importance of plant ecology with regard to agriculture." *New Zealand Journ. of Science and Technology*, 1918, pp. 70-74.

Mr Hole's address brings out very clearly the great importance of ecological research to practical sylvicultural and other problems of land utilisation in India. Specific problems are cited, and the progress made towards their solution described. Thus we have the lack of adequate rejuvenation in the valuable Sal (*Shorea robusta*) forests of Dehra Dun and other parts of India. This has been shown to be due in some cases to lack of soil aeration (see notice of the author's work in present issue of the JOURNAL, under "Soil Aeration," p. 89), and in other cases primarily to drought. These two factors, however, interact, because on badly aerated soils the seedling roots are unable to penetrate during the rainy season below the top six inches of soil, and it is this top layer of soil which is dried out during the dry season, leading to the death of the seedlings. Lack of rejuvenation in teak (*Tectona*) forests is due to shading and the fire protection which prevents the opening of the forest to sun heat. The seeds appear to require a higher temperature for germination than they can get under these shade conditions. In 1911 it was shown that given types of soil naturally