

**ON THE VEGETATION OF WESTERN AUSTRALIA**  
**J.S. BEARD'S VEGETATION SURVEY OF WESTERN AUSTRALIA**

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Western Australia, the western third of the continent, still is one of the less well known parts of Australia-suffice to point to the enormous extent of this western state and to its small, rather unevenly, indeed absolutely marginally distributed population. Mining operations of late tend to alter the general picture locally only.

Referring to vegetation and plant geography of Western Australia, DIELS's classic treatment (1) immediately springs to mind, followed by the rather sobering contemplation that actually nothing much had been done in this line and on this scale for a long while afterwards - and most definitely not of the calibre of DIELS's approach. In fact, it seems J.S. BEARD has been the first in the succession of DIELS to seriously take up the challenge provided by Western Australia's vegetation and decided "to do something about it" - on a different scale altogether than the more or less local projects performed here and there in the meantime.

There have been certain retarding factors : to the observer from afar, this part of the Australian continent with an obvious lack of vertical dimension does not at first hand seem very attractive; in addition it is laden with taxonomical problems, being so different from the rest of the continent. Furthermore the size of the state together with the smallness of the population, tended to slow down development and hindered further exploration. Whereas distance can be overcome by modern means of transport, emptiness is a different matter altogether. Needless to stress, that lack of vertical dimension and "overall uniformity" are preconceived ideas only, as already a closer study of DIELS's work reveals.

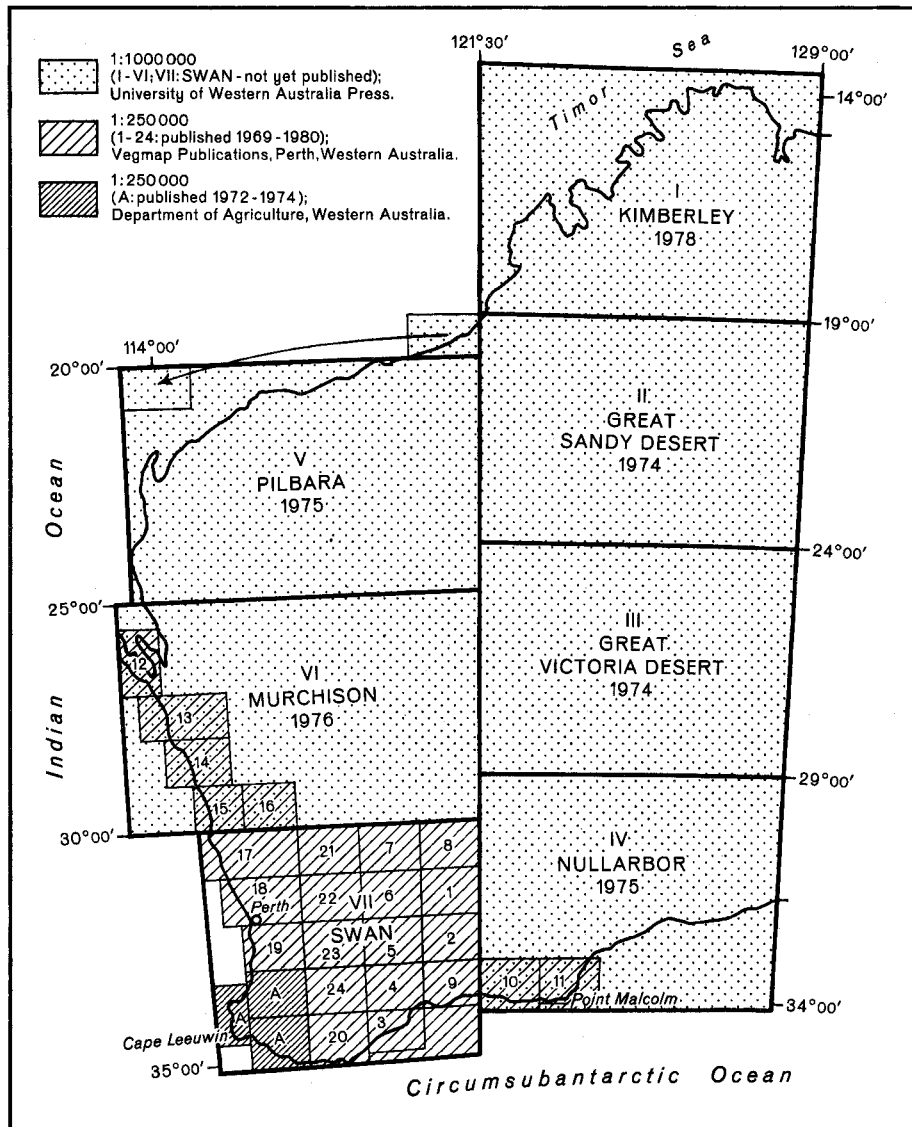
The present reviewer had the chance of seeing parts of the southwest of the state and to study certain locali-

ties along the southern coast (in connection with work in New Zealand and Tasmania) (2); also reconnaissance to the north of Kalgoorlie and Coolgardie supplemented by various flights, favoured by good visibility, provided some background to appreciate the work under review.

During a first visit to Western Australia in 1966, the present reviewer had furthermore the good chance to meet Dr. J.S. BEARD and Professor M.J. WEBB, Department of Geography, University of Western Australia, Nedlands, and to become somewhat familiar with the project of the planned vegetation survey of the state when it was still in its infancy.

J.S. BEARD began his Western Australian career as Director of King's Park and Botanic Garden. Very early he developed ideas how to fill the gap in the knowledge of the vegetation of Western Australia, the sheer size of which might have been daunting to lesser characters. BEARD subsequently retired from the directorship of the Botanic Garden and concentrated on his project. In 1966 he started his proposed field work in earnest with extended traverses through the Great Sandy Desert. Under the auspices of "Vegmap" the 1/1 000 000 map set has been published (save the southwestern most sheet VII); in scale 1/250 000, the entire southwest of the state, from Shark Bay in the northwest to Point Malcolm in the southeast, has been completed; three sheets representing the Busselton-Augusta-Pemberton-Collie area, have been published by the Department of Agriculture, Western Australia, in 1972 - 1974 (see sketch map). The 1/1 000 000 set is published in colour, the 1/250 000 set in black and white.

The publication of the 1/1 000 000 set started somewhat incongruently with sheet No. II, proceeding then to No. III and so forth to VI, followed by No. I (see sketch map).



Western Australia : Vegetation Survey

The explanation given for this unexpected procedure is that more work, including on vegetation, had been done already in the north, i.e. in the area covered by sheet No. I, by C.S.I.R.O., for instance. So it seemed less urgent to deal with this area, and there was a greater need to concentrate on the other parts of the state first, not previously surveyed at all. The still outstanding sheet No. VII (southwest) should follow suit, though nothing has been said so far when it is due to be published (or whether we have to please ourselves for this area with the issues in 1/250 000).

The subsequent remarks focus on the 1/1 000 000 set and will refer to the 1/250 000 series only in passing.

Each of the sheets I - VI is accompanied by a memoir of varying size,

but identical appearance. The arrangement in dealing with the subject is quite standard performance. By way of introduction, the reader is informed about the history of each area and the botanical exploration in particular. A description of the area follows, dealing with climate, geology, topography, soils, as well as with human resp. animal interference. The bulk of each memoir is then devoted to the description of the vegetation, preceded by a discussion of classification, mapping, and the formulae used, followed by the description of communities which are arranged according to botanical provinces, regions, etc. Each memoir closes with references.

All the memoirs are attractively bound in dark green brochure; the quality of the paper is excellent which is of importance for the reproduction of

the lavishly supplied photographs; this is gratefully acknowledged and a great help, especially for the lesser known and less accessible parts of the state. More specific details, as to dates of photographs and locality would, however, have been welcome. If for once the still outstanding sheet VII is forgotten, resp. the southwest area covered by 1/250 000 sheets included, one is entitled to state that for the first time now exists a complete coverage of Western Australia by a genuine vegetation map - and this is essentially the achievement of J.S. BEARD.

In the useful introduction, opening memoir No. II, J.S. BEARD and M.J. WEBB set out to discuss the guiding principles: a certain example has been seen in the French enterprise of Carte Internationale du Tapis végétal which already the scale might suggest; the basic aim was general stock taking. For this, no doubt, there is an urgent need: from conservationists, pastoralists, agriculturalists, foresters, geologists, soil scientists, ecologists, etc. The basic material is provided by air photographs available in full coverage for the entire state and without which the survey could not have been undertaken, plus all other relevant material. A great number of field traverses served to check the situation on the spot. Each memoir contains a special map, showing the traverses performed for the sheet concerned.

For many corners of the state, these memoirs present the first ever written, comprehensive record. Of course, vegetation takes pride of place, and this central subject is dealt with in an all-out ecological way. BEARD largely finds it congruent to follow the principle of natural regions, first set out for Western Australia by CLARKE (3), which are also reflected in the land use systems of C.S.I.R.O.

The basic aim of the survey is seen in taking stock of the vegetation "as it is", with a tendency towards "natural vegetation". In areas with a century of grazing history this has its limitations and even more so in the southwest, which is - in Western Australian terms - the most intensively utilized area of the state.

The vegetation is characterized on a physiognomic basis by floristic composition, structure, growth form. This leads to classification and terminology, and finally to the BEARD-WEBB-Formulae, which are introduced with this vegetation survey for Western Australia - parallel and in comparison to the internationally well-known schemes of KÜCHLER and of DANSEREAU.

The type of structural diagrams used by DANSEREAU is generally applied as well. Next, there are the extraordinary problems posed by the Western Aus-

tralian flora and its taxonomy. For someone unfamiliar with the conditions of the country, the first impression will be of an all dominating uniformity for which eucalypts and acacias are generally responsible. This first impression may be basically right but it also stresses the difficulties, the plant geographer - ecologist is confronted with in a country, where even to this day nova species may be encountered: for the initiated this means, of course, a major challenge. So, taxonomic considerations do not make the work any easier.

But as with maps, there are the continuous demands to accommodate to scale: the balancing act between accuracy and what the chosen scale permits (in 1/250 000 as well as in 1/1 000 000) - meaning the task or, rather, the burden of generalization. The application of colour for the 1/1 000 000 set poses another challenge in selecting and balancing - and not to forget: by laying everything open, by displaying openly any detail maps generally invite criticism! This all demands an extraordinary sense of balance from the conscious map maker.

In the present reviewer's opinion, the colours applied on the maps are too strong, too harsh; a finer application would have given more leeway for subtlety, for the indication of shades resp. differences. Also under the dominant impact of the strong colours applied, topography, even river courses, are virtually disappearing, barely visible, not traceable any more.

A certain unavoidable criticism arises from the delimitation of the map sheets, which are mathematical. They cut right through the "natural regions" just mentioned and in consequence small chunks of the same natural region may reappear on the neighbouring map and warrant tedious repetition for sake of completeness. This cannot be avoided - the mathematical delimitation is, naturally, a strait-jacket. Furthermore, the uniformity of the Western Australian vegetation over vast stretches of country (see for instance sheet II, III, IV) and the ever-presence of eucalypts and acacias reflect in the text, sometimes demanding repetition and thus making for tiring reading. But all this lies in the nature of things, and the reader feels all the more sympathetic with the author.

What elsewhere would contribute to change is more or less entirely lacking. Hardly any vertical change is worth mentioning - Western Australia's highest peak rises to barely 1 235 m (Mt. Meharry, sheet V), which under 23°S does not provide for much of a vertical change in vegetation. The coast lines in the south and in the west, however, offer most interesting and differing

habitats, but in the scale of 1/1 000 000 these remain naturally of very marginal occurrence.

But there is yet enough change and differentiation, if due consideration is given to edaphic factors. One glance at the legend of each sheet will be quite convincing - unless one is frightened away by the complicated looking formulae BEARD-WEBB apply.

In this part of the world, grassland plays a wide and dominating role. The survey applies seemingly liberally the terms "savanna" and "steppe" - too liberally one may think. The quotation in memoir II, 38: "savanna means closed, steppe open grassland communities" sounds altogether too simple a definition in the light of the savanna-steppe-discussion of old in plant geography. However, the difficulties in applying the thumb-rule accepted elsewhere ("savanna" for tropical grassland and "steppe" for temperate grassland) are obvious; it is difficult to follow in a part of the world like Western Australia, where there is a broad continuous transition from tropical latitudes into subtropical ones, and where no natural obstacles intervene to help for easier delimitations. If nothing else, this vegetation survey has made this "visible" and it would be an interesting argument for future plant geographical research (Perhaps, in memoir No. II, 38, the reader should have been directed more specifically to BEARD's terminological discussion in his contribution to *J. Ecol.* 1967 - see footnote 6).

The most important aspects now that the general stock taking has been performed are the exciting problems apparent or, rather, appearing, more clearly visible with the maps and memoirs at hand - for instance:

distribution of mangrove along the coast of Western Australia; the problems of the so-called "monsoon forests" in Western Australia - both problems representing links of Western Australia with the tropics and tropical plant geography;

or: the more specific problems of the vegetation of Australia's western third, like "mulga" and "pindan", and what BEARD calls the Acacia-Trioda line (see V); there should now be a spurt for more specifically regional research and ecological investigation, for instance, to mention only a few examples, into the ecology of the limestone country south of the Fitzroy River (4), or ecological research into the coastal vegetation by way of concentration on specific habitats, barely traceable on the 1/1 000 000 maps, more specifically referred to in the 1/250 000 memoirs. Ecological research along the coasts would

be of absorbing interest: from the plant geographical and ecological point of view, also with reference to coastal climates, especially along the southern coast of the state, where the climate of the coast is so very different from the hinterland and in fact rather unique in the impact of subantarctic influences from the cold Circum subantarctic Ocean under latitude 34°S (Cape Leeuwin) or even less (Great Australian Bight). (See, for instance, the following maps and explanatory memoirs of the 1/250 000 set: the vegetation of the Newdegate and Bremer Bay Areas, No. 4 - 3, 1976; Esperance and Malcolm Areas, No. 10 - 11, 1973; Shark Bay and Edel Area, No. 12, 1976; Ajana Area, No. 13, 1976; Geraldton Area, No. 14, 1976; Dcn-gara Area, No. 15, 1976; also SCHWEINFURTH, U.: 1978 - see footnote 2).

There should also be initiated research into the vertical differentiation of vegetation in the state, where it actually exists (Stirling Range ? - Mt. Meharry. Mt. Bruce ? King Leopold Range - Mt. Ord ? etc.) and this may lead to a three-dimensional appraisal of the state's vegetation discussing the change of vegetation from west to east, south to north and sea-level to higher altitude.

Special mention deserves BEARD's interesting contribution on the elucidation of "palaeodrainage patterns" through vegetation mapping (5). Everyone flying across relevant parts of Australia and the southwest in particular, with good visibility, will immediately be attracted by the arrangement of "lakes" resp. old drainage patterns, which only the bird's eye view - together with field work - reveal: most convincingly via vegetation patterns. It elucidates splendidly, how vegetation mapping leads onwards to new concepts and methods of research of landscape development, a subject barely touched in Western Australia and a promising field for further research.

BEARD himself dealt more intensively with some of these questions; it seems appropriate to direct attention to these contributions here in connection with this survey (6).

This may suffice to indicate some of the lines of research which seem particularly promising and for which BEARD has prepared the ground.

BEARD in his acknowledgements gives ample recognition to assistance received; but there cannot be much doubt that this vegetation survey of Western Australia owes its existence to his own determination and perseverance and is really his work. This fact counts all the more if seen against the background

of the areal extension of the state, which means against the sheer size of the area under survey.

The complete set of 1/1 000 000 represents for the first time (save sheet VII so far) a thorough stock taking of the entire state of Western Australia vegetationwise. It represents a true landmark in the botanical exploration and vegetation surveying, a regional inventory and, last, but not least, an academic achievement. This achievement deserves full appreciation.

BEARD presents as the result of about 15 years of toil and labour - and excitement! - the first overall survey of the vegetation of Western Australia in maps, text, and photographs. If one has worked his way carefully through the details amassed, one cannot but help to await now a concluding volume and, perhaps, still another map, presenting the vegetation of the state on one handy sheet; in short: a summary in text and map. In the Western Australian Atlas, 1979, BEARD presents a map in 1/10 000 000 together with some notes (7). What is now needed is something on a scale in between 1/1 000 000 and 1/10 000 000, plus a comprehensive volume, summing up the particularly interesting questions raised during the survey, now that the "donkey work" of the survey has been done.

There is abundant scope for further research, especially for ecological field studies. The more serious student may in conclusion be referred to the 24 sheets published in 1/250 000 for the southwestern part of the state (see sketch map); being black and white, they afford more intensive devotion to detail; the memoirs of this set are invaluable for local studies.

Finally, it may be stressed; the vegetation survey of Western Australia is an outstanding achievement not only as far as Western Australia is concerned, but in the context of the continent of Australia as a whole. The international scale 1/1 000 000 lends the maps to ready comparison and links them up with the Carte Internationale du Tapis

végétal. This survey opens up a part of the world, hitherto not known in its vegetation arrangement, and represents therefore an important contribution to plant geography in general.

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