[Proc. Roy. Soc. Victoria 56 (N.S.), Pt. I., 1944.]

Art. III.—*Ecological Studies No.* VII. *Box-Ironbark Association.*

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[Read 8th July, 1943; issued separately 1st August, 1944.]

Introduction.

The Box-Ironbark forests of the State consist of the Red Ironbark, *Eucalyptus Sideroxylon,* White Ironbark, *E. leucoxylon,* and Grey Box, *E. hemiphloia.* In places, other species may be present, as Red Box, *E. polyanthemos,* Red Stringybark, *E. macrorrhyncha,* and less commonly Long-leaved Box *E. elaeophora,* but these three belong to another association which replaces Box-Ironbark as rainfall increases. Another species Yellow Box, *E. melliodora,* may also occur, but its presence usually indicates a local change in soil conditions and as a rule it is accompanied by a greater amount of grassland.

The Box-Ironbark forests extend discontinuously along the northern foothills of the Divide from Chiltern in the north-east to Stawell in the west. The three trees constituting the association have individually much wider distributions than in the Box-Ironbark forests themselves and are to be found in widely differing habitats.

Grey Box is also essentially a tree of the grasslands of the north where it forms true Savannah. Nearer the foothills of the Divide, the trees come so close together as to constitute Savannah Forest. It is impossible to mark a boundary between this type of forest and true forest. Grey Box is associated with grassland from regions near Tallangatta in the north-east to the south western boundary of the Wimmera. It does not extend southward into the higher elevations but it is only a few miles from the top of the Divide at the Kilmore Gap. Grey Box, however, reappears to the south of the Gap at Broadmeadows where it is again associated with grassland. It occurs at Melton and from there it extends for a few miles both to the south and west of Bacchus Marsh. Grey Box is limited to these restricted areas south of the Divide although grasslands are there abundant.

White Ironbark, which is sometimes known as Yellow Gum, also has a wide distribution north of the Divide, although more restricted than Grey Box. It is plentiful at Mangalore in the east and extends westwards to the Wimmera where it joins Grey Box on the grasslands. White Ironbark, however, is not found with Grey Box on the northern plains. South of the Divide, White Ironbark has a very limited range. It is found in the

Plenty River area and appears again north-west of Melton where it is associated with Grey Box but a characteristic Box-Ironbark forest does not develop. White Ironbark extends southwards along the eastern side of the Brisbane Ranges and is found as far west as Meredith where it occurs on grassland.

Red Ironbark, on the north of the Divide, unlike the other two tree members, is restricted to the association, but in the south it has a very extensive and very curious disconnected distribution. The climatic conditions of some of these southern localities are widely different from those of the northern areas. In the east of the State, Red Ironbark is fairly plentiful at Gipsy Point, on Mallacoota Inlet, and a few trees occur about 3 miles west of Cann River township. From Orbost to Bairnsdale it is plentiful in places, and here both Red Box and Red Stringybark also occur. Further west it also occurs at Toongabbie. To the north-east of Melbourne, Red Ironbark is fairly common in the Panton Hill district, where it again associates with Red Box and Red Stringybark. To the west of Melbourne there is a localized occurrence of rather stunted trees on the hills to the north of Melton, and further west it appears again at Ingliston, just beyond Bacchus Marsh. It is reported to occur in the forest to the south of Ballarat, but the author has not been able to confirm this. In the Melton area, although both Grey Box and White Ironbark are present, they do not mix with Red Ironbark. In view of the hot dry summers and the continental climate generally experienced north of the Divide, these occurrences of Red Ironbark in the south are surprising, but still more so is the presence of this species right at the seaside where it is under the influence of an oceanic climate. To some extent the presence of it at Jemmy's Point, Lakes Entrance, may not be wondered at as it occurs plentifully immediately to the north. However, the occurrence at Airey's Inlet, in the Otway Peninsula, is widely separated from any other.

This association is of great economic importance, since the three trees constituting it, provide very heavy durable timbers and excellent firewood. They also occupy areas which are quite unsuitable for any other purpose, on account of the stony ground. The Box-Ironbark forests are of interest since in many instances they are immediately succeeded on the northern side by patches of Mallee although the main block of the Mallee is very distant and occurs on a very different type of soil. These isolated patches of Mallee occur on the same geological formation as the Box-Ironbark and immediately adjoin. Often Red Ironbark penetrates these patches of Mallee scrub. The contrast in height from Box-Ironbark to Mallee scrub is very striking, and no satisfactory evidence is as yet forthcoming to give any explanation for the sudden change in the several occurrences. Mallee is associated with the Box-Ironbark Association at Rushworth, Bendigo, Ingle-

wood, Wedderburn, and St. Arnaud. It is of interest that just to the west of Melton where the three tree members of the association occur there is also a patch of Mallee, the only occurrence south of the Divide.

Nearer to the Divide the Box-Ironbark is succeeded by the Red Box-Red Stringybark association which is also strongly developed south of the Divide. Generally speaking the trees of this latter association, although growing under more favourable climatic conditions, are smaller in height than those of the Box-Ironbark association. The distribution of the various occurrences of the association is shown in fig. 1. This paper chiefly concerns itself with a general survey of the whole area where Box-Ironbark occurs and where detailed studies have not yet been made.

Physical Environment.

Climate.

Rainfall.

All the individual occurrences of Box-Ironbark receive very similar amounts of rainfall, although they are spread over an area some 225 miles long by a maximum width of about 62 miles. The greatest amount is received by the most easterly area of the association. The annual rainfall received by the various Stations situated in the Box-Ironbark areas (fig. 1) is given in Table I.

Table I.—Annual Rainfall of Stations in Box-Ironbark Areas.

Station.	Mean Annual Rainfall.
Chiltern	26·75 inches
Peechelba	23·46 ,,
Rushworth	19·96 ,,
Heathcote	22·48 ,,
Bendigo	21·24 ,,
Maldon	23·17 ,,
Inglewood	18·07 ,,
Dunolly	19·98 ,,
Maryborough	20·34 ,,
Talbot	21·25 ,,
Wedderburn	18·68 ,,
St. Arnaud	19·36 ,,
Stawell	21·27 ,,

It will be seen from Table I. that the annual rainfall varies from slightly over 18 inches to less than 24 inches with the exception of Chiltern, which lies close to the Eastern Highlands. The southern limit of this association is definitely fixed by climatic conditions, for, where the same soil conditions continue into the higher rainfall and cooler temperature areas, the Box-Ironbark is replaced by Red Stringybark-Red Box association. The northern limits are not well defined for here the boundary is often fixed by a

change in the geology. The presence of Mallee, however, on the northern side of several of the occurrencs of this association does suggest that a climatic limit had been reached. None of these patches of Mallee is extensive, and they are soon succeeded by grassland.

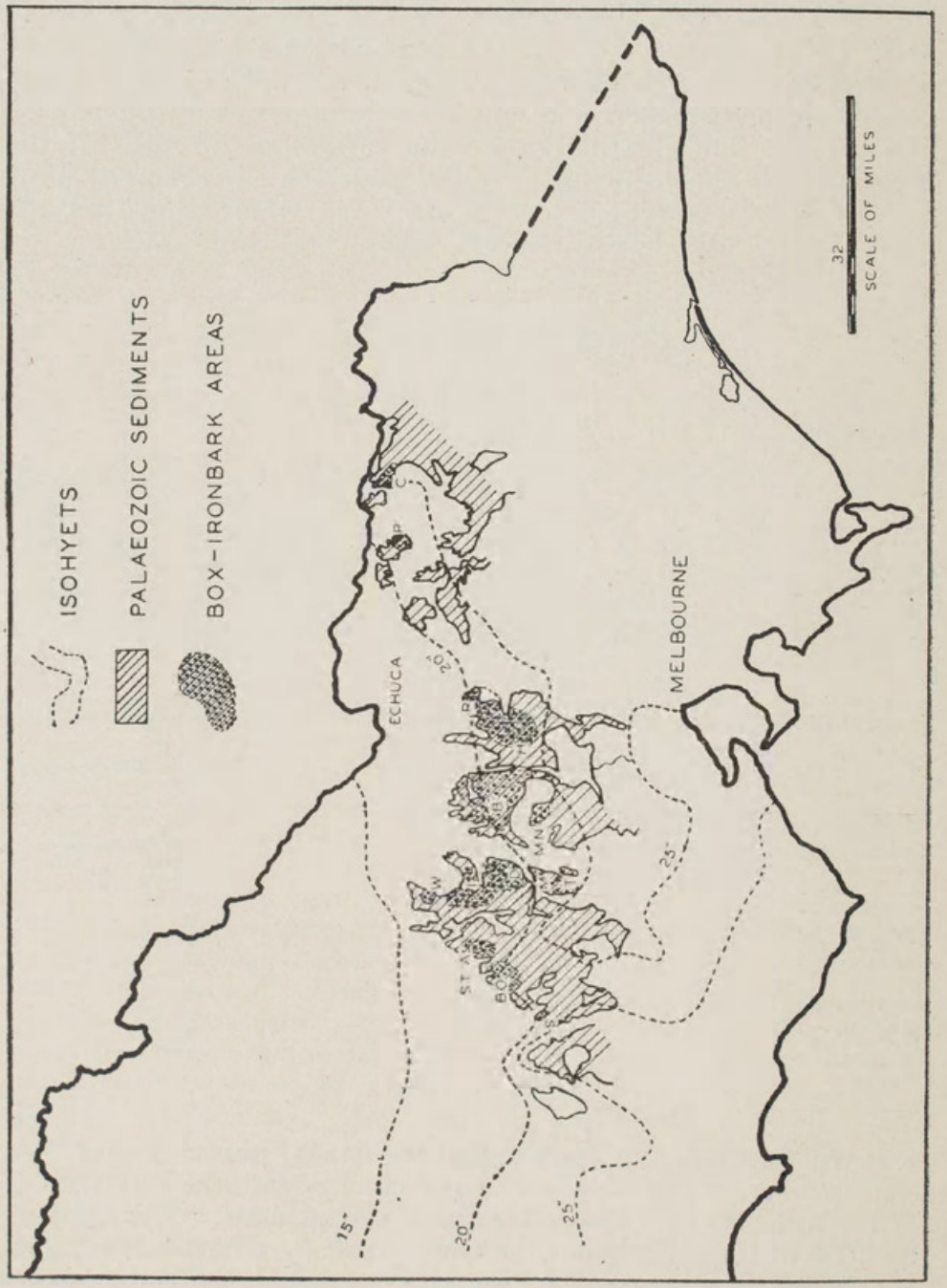

Fig 1.—Distribution of Box-Ironbark Areas in Victoria. B = Bendigo, Bo = Bolangum, C = Chiltern, D = Dunolly, H = Heathcote, I = Inglewood, M = Maryborough, Mn = Maldon, P = Peechelba, R = Rushworth, S = Stawell, St. A. = St. Arnaud, T = Talbot, W = Wedderburn.

The distribution of rainfall over the year is distinctly of a winter type, but this is by no means pronounced. In the southern half of the State an even distribution of rain occurs, as shown by Melbourne records. In fig. 2 is shown a graph of the monthly distribution for Bendigo, which is typical of the remaining Stations. The distribution is also given for Melbourne for comparison.

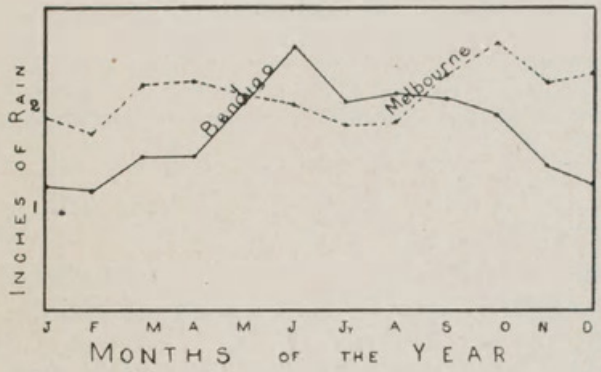

FIG. 2.—Monthly Distribution of Rainfall for Bendigo and Melbourne.

The actual and relative amounts of rainfall received during the six summer months, October to March, and the six winter months, are given in Table II. for selected Stations, which may be regarded as typical of the remainder. Rainfall is approximately half as much again during the winter as in the summer months.

TABLE II.—RATIO OF THE RAINFALL OF THE SIX SUMMER TO THE SIX WINTER MONTHS.

Station.	Rainfall for Six Months.		Ratio.
	October–March.	April–September.	
Bendigo	8·64	12·60	1 : 1·46
Maryborough	8·18	12·16	1 : 1·49
St. Arnaud	7·16	12·20	1 : 1·70
Stawell	8·05	13·22	1 : 1·64

Besides the annual amount of rain and its yearly distribution, the regularity with which it is received year by year is also a factor in the development and character of the vegetation. In Table III. are given the Coefficients of Variability for selected Stations. These values represent a reasonable degree of reliability when compared with a 34.5 per cent. variability for Mildura and 12.3 per cent. for Portland.

TABLE III.—COEFFICIENT OF VARIABILITY OF RAINFALL IN BOX-IRONBARK AREAS.

Station.	Co-efficient of Variability.
	%
Bendigo	24·5
Maryborough	22·33
St. Arnaud	21·71
Stawell	21.43

TEMPERATURE.

Temperature must also be considered from two standpoints, Average Annual Temperature and the Monthly Distribution.

As with the case of rainfall, the temperatures of the various Stations are closely similar. In Table IV. are given the annual temperature of the same stations shown in Table III.

TABLE IV.—MEAN ANNUAL TEMPERATURES OF SELECTED STATIONS IN BOX-IRONBARK AREAS.

Station.	Annual Temperature.
Bendigo	59·0°F
Maryborough	57·4°F
St. Arnaud	58·1°F
Stawell	57·9°F

The monthly distribution of temperature indicates that north of the Divide the climate is becoming decidedly continental. Several of the cooler months of Stations in the Box-Ironbark areas are colder than those of Stations along the coast, and in fig. 3 are given the graphs of Bendigo and Lorne for comparison. Lorne is selected because it is not far from Airey's Inlet where Red Ironbark occurs. The six winter months of Melbourne are also warmer than the same six months of Bendigo. However, the summer months of the latter are very much warmer. The graph for Bendigo is typical of the other stations.

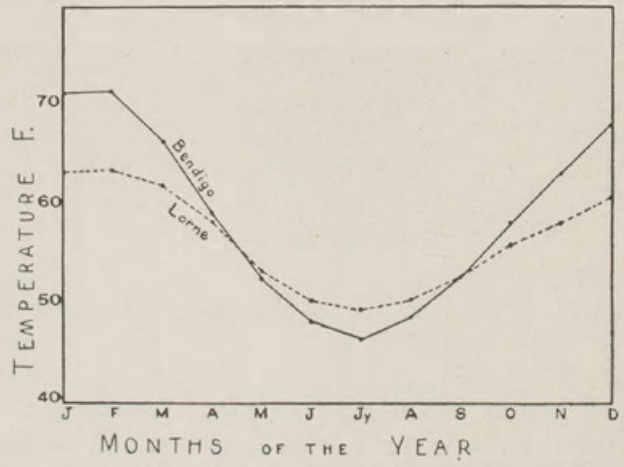

FIG. 3.—Monthly Distribution of Temperature for Bendigo and Lorne.

The highest temperatures occur during February, and this is the same for all other stations, while the lowest are in July. This makes the graph asymmetric since there are only five months from the peak of summer to the trough of winter. The range of monthly temperatures for Bendigo is 25.1°F., and the lowest range for Box-Ironbark is 22.7°F. Lorne having an oceanic climate has a range of only 15°F.

Evaporation.

There are no Stations recording evaporation near any of the Box-Ironbark forests, and the values given in Table V. have been calculated from other weather data. These indicate that the average annual evaporation lies approximately between 45 and 50 inches.

Table V.—Annual Evaporation in Box-Ironbark Forests.

Station.	Annual Evaporation (calculated).
Bendigo	50·53 inches
Maryborough	45·95 ,,
St. Arnaud	50·80 ,,
Stawell	46·44 ,,

The monthly distribution of evaporation is naturally affected by the continental character of the temperature range. In fig. 4 is given the monthly distribution of evaporation for Bendigo.

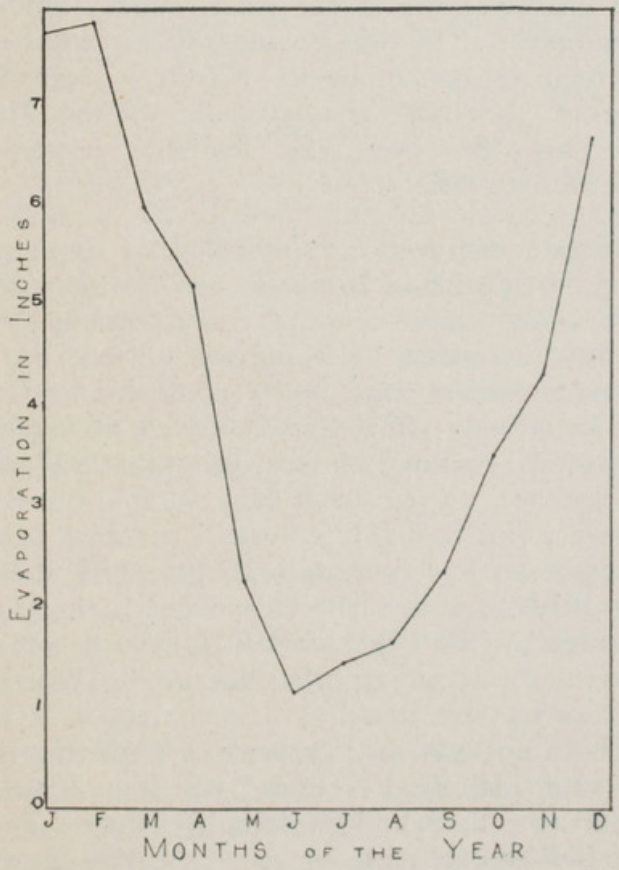

Fig. 4.—Monthly Distribution of Evaporation for Bendigo.

Summary of Climate.

The general features of the climate in the Box-Ironbark areas agree fairly well with the chief characteristics of that of the Mediterranean, as outlined by Kendrew (1937). Kendrew observes that most of the rainfall occurs in the winter half of the year and that in summer there are more or less drought conditions, which do not last more than three months. As will be shown later there is an absence of floral activity for about three months of the year. Kendrew also says that the winters are mild, the coldest month having a mean temperature above 40°F. Of all the Stations in the Box-Ironbark areas where temperature records are kept, the lowest monthly mean is 45.1°F. at Maldon; in summer the warmest monthly mean exceeds 70°F. This also agrees reasonably well with the January temperatures of all the Box-Ironbark stations. For Box-Ironbark the lowest January mean temperature, the month in our climate corresponding to July in the northern hemisphere, is 67.5°F. at Maldon. In all cases where temperature is recorded February is the warmest month.

The third characteristic is the clear, sunny, almost cloudless sky during summer. This is a feature of our areas north of the Divide and requires no comment. Kendrew regards the Olive Tree as one of the most characteristic of the Mediterranean vegetation. This has evergreen leathery leaves, a feature characteristic of our eucalypts.

These climatic conditions are reflected in the vegetative and floral activity of the Box-Ironbark association. Plant life is dormant for about three months corresponding to the three drought months indicated by Kendrew. After the drought is over the lower temperatures retard, but do not inhibit, plant activity. In the closely allied Red Box-Red Stringybark association of the south, as shown by the author in 1937, the curve of flowering commences to rise from May; but in the Box-Ironbark there is little activity until after June. In other associations of the south, as shown by the author in 1933 and 1936, the curve of flowering is the same as in Red Box-Red Stringybark. In the southern examples of Red Box-Red Stringybark both August and September are very active months, but in the Box-Ironbark the amount of flowering in August and September is little more than in July. In both associations, the peak of flowering is in October with a very rapid fall to December, which in both instances is due to rising temperatures and declining moisture. In the climatic conditions at Bendigo, as with the other occurrences of Box-Ironbark, the length of the period of the year favourable to plant

activity is more restricted than in the associations given south of the Divide. In fig. 5 is shown the distribution of flowering over the year for Bendigo.

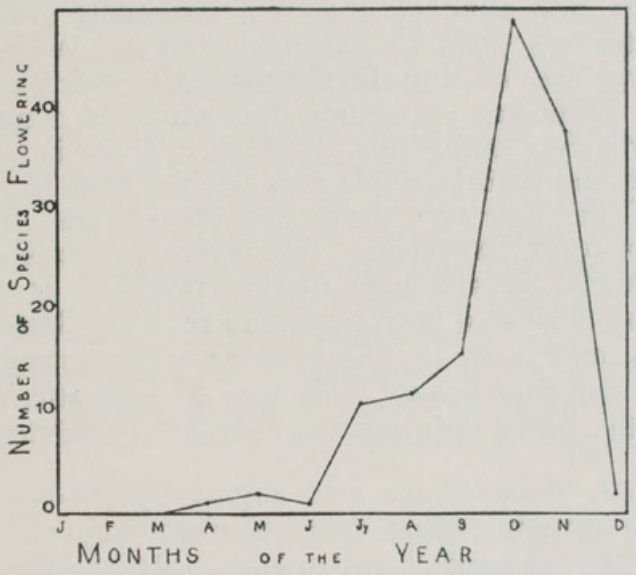

Fig. 5.—Monthly Distribution of Flowering Box-Ironbark Association.

Geology.

All the Box-Ironbark forests are situated to the north of the Central Highlands, the lower limit of these being taken for botanical purposes at 1,000 feet. The greatest elevation of any of the Stations for which climatic data were given is 818 feet, at Talbot, which is the most southerly point of the Box-Ironbark forests. Here they are limited both on the east and on the west by the long stretches of the newer basalt which connects with the basalt plains south of the Divide. The southward extension is prevented by the basalt so that the climatic limit has not been reached.

The contour of the land where the various examples of this association occur is never very steep, but fairly gentle. Hence, neither the degree nor the aspect of the slope is a factor influencing the vegetation of the area.

It has already been mentioned that the Box-Ironbark forests are discontinuous, and that they are separated from one another by areas of natural grassland or savannah. In the long stretch of country through which the various stands of Box-Ironbark are situated there are four geological formations of considerable

extent, namely Granite, Ordovician, Newer Basalt and Post-Tertiary Sediments. There is a broad belt of Newer Basalt running up from the south, nearly across the Western Highlands which is strictly grassland; the surface is flat and the soil is well developed. The Post-Tertiary Sediments belong to the Murray River system, and although they are essentially grassland, they vary from treeless plain to Savannah forest. West of Stawell there is a large area of Post-Tertiary deposits which is a continuation of the Wimmera grasslands, but which is dominated by a forest of Grey Box and White Ironbark. There is no Red Ironbark present, and therefore this area has not been included in fig. 1. Both of the first two mentioned species pass out into the grassland to form Savannah. Wherever the trees steadily increase in density, the character of the grass floor is not lost and when the land is cleared good grassland results. These Savannah forest areas may best be regarded as a compromise between climatic and soil influences. This type of vegetation was extensive where the plains join the foothills of the Divide.

The Granite breaks down into a gravelly porous soil which, according to contour, bears two different types of vegetation. To the east of Chiltern it is covered with Red Box and Red Stringybark, with a strong admixture of *Callitris calcarata.* This is a very special variation of the Red Box-Red Stringybark association so common in the State. Granite immediately adjoins the Peechelba stand, but this is also clothed with Red Box-Red Stringybark. In both of these areas the country is sharply contoured and, taken generally, mountains are covered with forest.

South of Bendigo at Big Hill where the granite commences there is a sudden termination of the Box-Ironbark association. The granite country is generally grassland and gently undulating, with scattering trees, among which is River Red Gum *Eucalyptus rostrata.* East of Castlemaine where it rises into Mount Alexander it is forest clad. South of the granite outcrop the Box-Ironbark again appears from Maldon to Castlemaine, so that the granite here has this association on both sides of it.

The fourth geological formation, the Palaeozoic Sedimentary rocks, is the home of the Box-Ironbark. Not every outcrop, however, bears this forest, for it too may carry open forest, with a grass floor where it has a very flat contour and adjoins grassland. It is difficult to speak of soil in the ordinary usage of the word, for but little exists. The rock lies at or near the surface, and therefore the roots of the plants must pass into the disintegrated rock or even between the strata. At the bottom of the

slopes in hilly or undulating country, there is an accumulation of clay, and here one may speak of soil in the ordinary sense. The upper slopes may be very stony. In places quartz lies freely on the surface and these areas can be practically destitute of lower vegetation.

Composition.

One of the remarkable features of the Box-Ironbark association is the large number of species that are very rare or infrequent, but which are common in associations having a higher rainfall and a lower temperature. Many plants common south of the Divide as *Leucopogon virgatus, Daviesia ulicina, Dillwynia floribunda, Correa rubra, Leptospermum myrsinoides, Lomandra filiformis, Drosera Menziesii, Plantago varia* and *Craspedia uniflora* are in this association, but are sparsely represented, and this is due to the fact that they are reaching their limits of distribution or that conditions are very unfavourable for their free development.

Other species which are common in other associations, as well as here, represent those which have a wide amplitude as regards habitat factors. These ubiquitous species have been designated as ecological wides, Patton (1930). Such species, being found in a number of associations, are said to possess a very low degree of fidelity to any particular one. Among these are *Poa caespitosa, Dianella revoluta, Dichopogon strictus, Glossodia major, Ranunculus lappaceus, Tetratheca ciliata, Wahlenbergia gracilis* and *Microseris scapigera.* Such species, existing as they do under widely differing conditions, may be expected to show a great deal of variation, and this is the case with *Poa caespitosa* and *Wahlenbergia gracilis* but not with others. The question arises as to whether these different forms are actual species and not varieties. The separate forms, however, may be ecotypes.

Those species, which very definitely distinguish an association, are known as Characteristic Species. Besides the three species of Eucalyptus there are others which are equally distinctive. These characteristic species may be confined to a particular association and therefore show a high degree of fidelity to it. On the other hand, a species may be equally well developed in another association and there also characteristic of the second. In such instances as the latter the species show a lower degree of fidelity. Thus *Acacia acinacea* and *A. diffusa* are characteristic both of Box-Ironbark and Red Box-Red Stringybark associations. On the other hand *A. pycnantha* (Golden Wattle), is perhaps the most characteristic species and shows a high degree of fidelity. Other characteristic species are *Grevillea alpina, G. ilicifolia, Brachyloma daphnoides* and *Eriostemon obovalis.*

Another feature of the vegetation, but by no means a obvious one, is the number of very small annuals that occur. Such small plants are best spoken of as Minutae. The presence or absence of these, their abundance, and the degree of development are controlled by the weather in any particular year. So small are many of these plants that as many as four species have been found in a single square inch. Among the Minutae are *Levenhookia dubia, Toxanthus Muelleri, Millotia tenuifolia* and *Helipterum demissum.*

In the Box-Ironbark Association there is a good representation of the most prolific families and genera of Victoria. Of the ten most prolific families given by Patton (1935), no less than eight are present. The two families which are absent have rather specialized habitats, and therefore their absence occasions no surprise. Of the fifteen genera with the greatest number of species in Victoria, twelve are present. The absence of Olearia is a matter of interest since this genus is abundantly present from the wettest to the driest parts of the State, so that apart from this genus, the flora of the Box-Ironbark association is therefore quite representative of the State.

The family Myrtaceae provides the three dominants of the association, but other than these it is poorly represented. *Leptospermum myrsinoides,* which is very rare, is the only other representative. At Maryborough *Calytrix tetragona* is locally abundant. The family Epacridaceae is very well represented by no less than five genera and six species; only one genus Leucopogon, however, has more than one species present. Of the six species of this family only one, *Brachyloma daphnoides,* is abundantly present. All species have small, thick, leathery leaves.

There is only one genus, Grevillea, of Proteaceae and this has two species present. *G. alpina* has usually a red flower, but a white variety regularly occurs, which is said to be the only form present at Rushworth. The genus Acacia is the most important member of Leguminosae. At the type area there are five species present, and three of these *A. acinacea, A. armata,* and *A. vomeriformis* possess very similar characters. The inflorescence is a globular head and the phyllode is small and uninerved.

To the east of Bendigo, in the Box-Ironbark forests as well as in other areas, two other closely related species *A. aspera* and *A. obliqua* occur, while to the north in the Whipstick Mallee are two more closely related species, *A. brachybotrya* and *A. lineata,* the

latter being recorded by Patton in (1924). Six of these species may be regarded as being derived from the simple common form, *A. acinacea*, in which the phyllode is symmetrical, or almost so, narrow and about half an inch long. *A. armata* has an undulate phyllode, and the stipules are developed into spines. In *A. aspera* the phyllode is slightly undulate and it is covered with glandular hairs which make it very rough. The phyllode of *A. brachybotrya* is generally slightly longer than in *A. acinacea* and broader in proportion to its length. The surface is covered with soft pubesence, making it very glaucous. In the remaining three, asymmetry which is more or less present in the others, becomes marked. In *A. vomeriformis* the asymmetry takes the form of one side of the phyllode being developed into a triangular lobe at the base, while in *A. obliqua* one side is shortened. The asymmetry in *A. lineata* is caused by one side of the phyllode failing to develop thus bringing the midrib near to one edge. The suggested relationship of all these species is given in fig. 6.

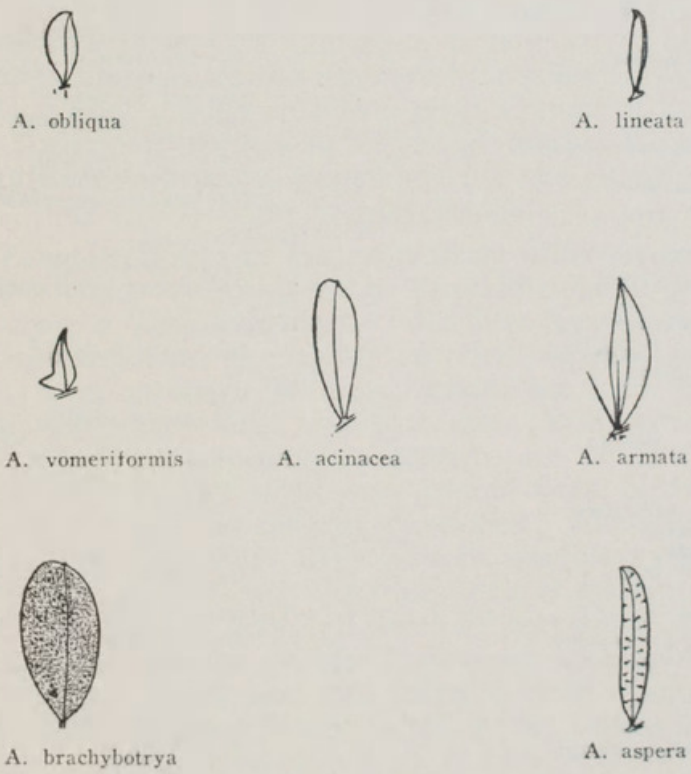

FIG. 6.—Relationship of species of Acacia with small Uninerved Phyllodes (natural size).

The species given in the following list have all been collected at Bendigo, between Kangaroo Flat and Big Hill, and for a distance about 2 miles west of the Highway. This area is taken as the type of the Association. Species found in other parts of the Bendigo district are not given.

MONOCOTYLEDONAE.

GRAMINEAE—
Stipa Drummondii
S. scabra
S. mollis
Dichelachne crinita
D. sciurea
Danthonia geniculata
D. pallida
D. semiannularis
Aira caryophyllea
Poa caespitosa

LILIACEAE—
Burchardia umbellata
Anguillaria dioica
Bulbine bulbosa
Thysanotus Patersonii
Dichopogon strictus
Tricoryne elatior
Dianella revoluta
Lomandra filiformis

AMARYLLIDACEAE—
Hypoxis glabella

ORCHIDACEAE—
Calochilus Robertsonii
Cyrtostylis reniformis
Caladenia carnea
C. coerulea
C. praecox
C. testacea
Glossodia major
Diuris maculata
Pterostylis cycnocephala
P. longifolia
P. nana
P. nutans
P. parviflora.

DICOTYLEDONAE.

ARCHICHLAMYDEAE.

PROTEACEAE—
Grevillea alpina
G. ilicifolia

SANTALACEAE—
Exocarpus cupressiformis

CHENOPODIACEAE—
Rhagodia nutans

CARYOPHYLLACEAE—
Sagina apetala

RANUNCULACEAE—
Ranunculus lappaceus
R. parviflorus

LAURACEAE—
Cassytha glabella

DROSERACEAE—
Drosera auriculata
D. Menziesii
D. peltata
D. Whittakeri

CRASSULACEAE—
Crassula Sieberiana
C. micrantha

PITTOSPORACEAE—
Bursaria spinosa
Cheiranthera linearis

ROSACEAE—
Acaena ovina

LEGUMINOSAE—
Acacia acinacea
A. armata
A. aspera
A. diffusa

LEGUMINOSAE—*continued*
A. vomeriformis
A. pycnantha
Daviesia ulicina
Pultenaea largiflorens
P. laxiflora
Dillwynia ericifolia
D. floribunda
Hardenbergia monophylla

GERANIACEAE—
Geranium pilosum
Pelargonium Rodneyanum

OXALIDACEAE—
Oxalis corniculatus

RUTACEAE—
Eriostemon obovalis

TREMANDACEAE—
Tetratheca ciliata

DILLENIACEAE—
Hibbertia acicularis
H. sericea

THYMELAEACEAE—
Pimelea humilis
P. involucrata

MYRTACEAE—
Eucalyptus Sideroxylon
E. leucoxylon
E. hemiphloia
E. melliodora
E. macrorrhyncha
E. polyanthemos
Leptospermum myrsinoides

UMBELLIFERAE—
Daucus glochidiatus
Hydrocotyle capillaris
H. laxiflora.

METACHLAMYDEAE.

EPACRIDACEAE—
Astroloma humifusum
Melichrus urceolatus
Leucopogon virgatus
L. rufus
Acrotriche serrulata
Brachyloma daphnoides

GENTIANACEAE—
Sebaea ovata

SCROPHULARIACEAE—
Veronica plebeia

PLANTAGINACEAE—
Plantago varia

CAMPANULACEAE—
Wahlenbergia gracilis

GOODENIACEAE—
Goodenia geniculata
Brunonia australis

STYLIDIACEAE—
Stylidium graminifolium
Levenhookia dubia

COMPOSITAE—
Brachycome perpusilla
Craspedia uniflora
Toxanthus Muelleri
Rutidosis multiflora
Millotia tenuifolia
Leptorhynchus squamatus
Helichrysum bracteatum
H. obcordatum
H. semipapposum
Helipterum australe
H. demissum
Gnaphalium indutum
Erechthites quadridentata
Microseris scapigera

Structure.

The structure of the association is simple. The trees stand well apart from one another (Plate 1) so that their crowns do not meet. Thus ample light reaches the forest floor, but the entry of light is further assisted by the habits of the trees themselves. Grey Box is a fairly tall tree commonly with the two main branches forming a capital Y (Plate 1). The foliage is restricted to the ends of the ultimate branchlets and is not dense (Plate 1). Such a habit enables a great amount of light to filter through the crown and reach the forest floor. White Ironbark has no distinctive habit of branching, but the crown is not very dense and this enables light to pass through.

Red Ironbark, however, has an entirely different habit. Typically, the lateral branches of young to middle-aged trees are short and emerge at a very wide angle. Old trees become very scraggy. The foliage is borne right along the trunk (Plate 1), so that in an open grown specimen the tree presents the form of a narrow cylinder. Thus very little shade is cast. Both Grey Box and Red Ironbark, by their habit of growth, are favourable for the growth of an abundant shrub and ground flora, but these lower strata, however, are not strongly developed. There is no second stratum of trees, but occasionally isolated specimens of *Exocarpus cupressiformis* are present. At times *Acacia pycnantha* is abundant and forms a very open tall shrub or very small tree stratum. When in full bloom the golden flowers are strikingly contrasted against the dark stems and dull green crowns of the dominant trees. *A. diffusa* grows nearly as tall as the Golden Wattle, but is not so plentiful. Even when these two Acacias are present there is still an abundance of light reaching the forest floor. The degree of development of the medium shrub and undershrub strata varies widely. At times, the surface of the soil is quite bare even though the trees are spaced widely enough apart for full light to reach the ground. In such cases quartz is frequently very

abundant at the surface. In contrast to this, the medium shrub stratum may be strongly developed and give the soil complete or almost complete cover. The members of this layer are the characteristic species *Brachyoma daphnoides* and *Grevillea alpina*. This stratum is particularly well developed on rising stony ground where Red Ironbark predominates. On the lower slopes, Grey Box may be in a pure stand, and here the soil has a high percentage of clay. In such places the two characteristic shrubs are generally absent. The shrub stratum is therefore very discontinuous. Of the undershrubs, *Hibbertia acicularis* forms very dense bushes which are covered with a brilliant mass of yellow flowers in spring. This undershrub story is also very incomplete and therefore there is a large percentage of the soil exposed to the weather. Although there are a number of grass species present, none are abundant, and, therefore, do not assist in forming a soil cover.

Geophytes are fairly common, particularly in the spring, but they do not have much influence as regards soil cover. Two orchids *Glossodia major* and *Caladenia testacea* are very abundant in some years and give tinges of colour to the landscape. The forest then is very open and the ground cover very incomplete. The protection of the soil is further decreased by the small ericoid leathery leaves of the shrub strata, with the exception of *Grevillea ilicifolia*. Associated with the poor cover of the soil is the slowness of decay of debris from the trees, the amount of humus reaching the soil is therefore small.

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Description of Plate.

PLATE I.

Fig. 1. Box-Ironbark Forest with absence of lower strata, soil very gravelly.
Fig. 2. Box-Ironbark Forest with lower strata well developed, consisting partly of re-growth of eucalypts.
Fig. 3. Red Ironbark, Eucalyptus sideroxylon.
Fig. 4. Bark of Red Ironbark.
Fig. 5. Bark of Grey Box.
Fig. 6. Grey Box, E. hemiphloia.

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