INTRODUCTION.

In order to understand intelligently the vegetation of any large district, it is important to know something of its climate and soils, for in virgin country, untrammelled neither by outside interference nor disruptive factors within, the vegetation is the direct response to climate and soil. Conversely, when this information has been assimilated, the vegetation provides a guide to the climate and soil types.

Our present knowledge of the Kimberley Division of Western Australia is far from being as complete as we would wish, for it has been for so long neglected. The purpose of this report is to present in a concise for the various factors of climate, soil and vegetation (these being inseparable for the purpose) and to give a picture of the country as it exists today. It has also seemed desirable to give a bried history of its exploration, for it is upon these early accounts that we have to rely to a great extent for information concerning country which has not been otherwise investigated.

I therefore make no apology for the scope and the length of this report, which is made up from personal observations and information gleaned from several sources, as well as from the accounts of those who knew it better than I do. At the present time, when so much interest is being displayed in the problem of its future development, any information that has a bearing on the subject is to be welcomed.

The Kimberley Division of Western Australia is interesting from many points of view, and I found the work entailed in the preparation of this report a pleasurable experience.

GOVERNMENT BOTANIST

Perth, Western Australia
3rd. February 1945.

I. OUTLINES OF THE OROGRAPHY AND GEOLOGY

The narrow bridge or divide which separates the headwaters of the Ord River from the Margaret River, the Mary River and Christmas Creek (which form the main southern branches of the Fitzroy River) is the sole connecting link between the Great Australian Plateau and the main Kimberley Plateau, for which latter I propose the name of The Hann Plateau. This narrow divide extends in the south from the Antrim Plateau, and continuing as the Albert Edward Range, joins with the Hann Plateau in the region of the triangle formed by Mount Wells, Mount King and Mount Luke. To the north the Elvire River flows to join the Ord River, which empties into Cambridge Gulf; to the west the Margaret and Mary rivers, later joined by Christmas Creek, flow into the Fitzroy River which flows west and north-west into King Sound; to the south, the Sturt Creek flows south-westerly into the interior, finally disappearing in the sand of the desert in the neighbourhood of the twentieth parallel of latitude.

The Ord and Fitzroy rivers have carved out broad basins that almost bisect the plateau which continues to the east of the Ord River system as a highland between this river and the Victoria River, while the Fitzroy River system flows on to a large flood plain to the south of which the country rises without any notable escarpments, until the general plateau level is attained many miles to the south in the steppe-desert region. The Hann Plateau is bounded by the King Leopold Range on the south-western side, which range extends from the seaboard between Walcott Inlet and Secure Bay at the head of Collier Bay, to the vicinity of the Mueller Range to the west of Hall's Creek; on the east it is bounded by the escarpment to the immediate west of the headwaters of the upper Margaret River, the Durack Range, and the Cockburn Range. On its littoral margin the Hann Plateau is bounded by the sea which it fronts with high headlands or cliffs, or here and there there are narrow coastal plains of no great width.

The Kimberley Division may thus be orographically divided into four Regions of Subdivisions --- the Hann Plateau, lying between the Ord and Fitzroy River systems; the Ord River Region, and the Fitzroy River Region. There is a fourth region -- the steppe-desert region to the south of the Fitzroy Region, but with this area we are not immediately concerned. It is an area of 'Pindan', steppe and desert, and we know little of its constitution or physiognomy, but red sand is its basis. Of the other three it can be said that they represent three distinct entities, both physiographically, geologically and ecologically. Geologically they are differentiated by the Precambrian rocks of the Hann Plateau (known as the 'Nullagine' series), by the Cambrian :

that occur over the greater part of the Ord Region, and thirdly by the Permian and Devonian rocks of the Fitzroy Region, the Devonian rocks extending along the Napier and Oscar ranges and to the north, between the west end of the former as far as Mount Pierre to the south east of the Geikie Gorge. A ~~ann~~ narrpw zone of granite separates the Nullagine and Devonian rocks between the King Leopold Range and the Napier and Oscar range series, while a similar line of granites, belonging to the Mosquito Creek series, separates in general the Nullagine rocks of the Hann Plateau from the Cambrian rocks of the Ord Region.

These three regions of the Kimberley Division. - the Hann Plateau, the Ord Region and the Fitzroy Region, are thus three natural regions which are clearly defined, based on geological and orographical grounds as well as on phytogeographical grounds, for the soil derived from their rocks affects the ± plant life of these regions. In addition there are climatic changes, for the greater part of the Ord and Fitzroy basins lie at an elevation of less then seven hundred feet above sea level, while the average height of the Hann Plateau appears to be between twelve hundred and two thousand feet. The plateau is thus not only relatively cooler, it receives a higher rainfall also during the rainy summer monsoonal period. In this connection one has only to compare the rainfall for Port George IV (coastal plateau - 50 inches) and Mount Barnett (south east central Hann plateau - 34 inches) with the rainfall for Wyndham (25 inches) and Turkey Creek (27 inches) both of them in the Ord Region, and with Fitzroy Crossing (21 inches) and Derby (25 inches) both in the Fitzroy Region.

The Kimberley Division of Western Australia lies well to the north of the Tropic of Capricorn, and it is therefore a tropical region. Its mean temperatures are high (20° higher than in Perth), but the short monsoonal rainy season, averaging three or four months in duration, and alternating with a cooler dry period of eight or nine months during which no rain can be relied upon, determines the type of its climate and its vegetation. Associated with this long dry period is a low relative humidity, and a high evaporating power of the atmosphere, and it is these facts which determine the type of country and its fauna and flora.

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The Three Regions.

1. THE HANN PLATEAU

This region may be delineated as that bordered by the coastline from the southern end of Collier Bay to the western shores of Cambridge Gulf; on the south side it is limited by the King Leopold Range which extends from the seaboard between Walcott Inlet and Secure Bay, and continues in a south-eatserly direction to terminate in the Mueller Range in Latitude 18° 20' S; to the east the boundary is not so clearly defined because of our want of knowledge of this particular area, but it apparently extends from Mount Amherst northwards along the western wall of the valley of the upper Margaret River, thence by way of the Durack Range to the Cockburn Range and the Steere Hills to the west of Cambridge Gulf. Altitudes are not known in the northern, central and eastern portion of this area, but from Wyndham the Cockburn Range appears prominent enough, and perhaps 1000 feet high. while on the southern margin the King Leopold Range attains a relatively considerable height in the following peaks:-- Mount Ord (3070 ft.), Mount Broome (3040 ft.), Bold Bluff (2760 ft.), Mount Humbert (2480 ft.), Mount Leake (2246 ft.) and Mount Page (1567 ft.). In many places from the coast where it precipitously faces the sea, to Ord Gap at Pandanus Creek, it presents a bold face on its southern side. While it may be regarded as the southern escarpment of the Hann Plateau, the King Leopold Range consists in fact of usually two or three parallel rows or ranges of hills, at least between Bold Bluff and the Ord Gap. The Precipice Range, with Bold Bluff at its western end, the Isdell and Lady Forrest ranges form this second bastion or wall to the true plateau to the north, and these may in turn descend to fertile basalt valleus, or the plateau may continue from this secondary range, as with the Sir John and Warton ranges, which are thus escarpments of the Hann Plateau.

The Precambrian rocks of the Hann Plateau are known as 'Nullagine', and consist principally of a high elevation composed of sandstone or quartzite, with lower elevations occupied by basalt, either in the form of plains, or hilly or undulating country, and frequently with boulders. In many places the basalt underlies the sandstone, as in Mount Broome and Mount Hann; occasionally the basalt is superimposed on the sandstone or quartzite. Brockman mentions that the Synnott tableland (sandstone) is here and there overlaid by basalt, and the same appears to hold true for the high country between

the Mitchell and King Edward rivers, and the Couchman Plateau, but in general the high land is of sandstone or quartzite, almost horizontally bedded or variously folded or contorted.

The "ranges" of the Hann Plateau are in general the higher elevetions of the original and secondary plateaux, usually with steep cliff-like escarpments. There appear to be two such high areas,- the Caroline "Range" and the Princess May-Mount Hann divide. From the former the Hann River flows southwards to join the Fitzroy River; the Isdell River flows south west, skirting the northern base of the King Leopold Range, to enter the tidal estuary of Walcott Inlet; the headwaters of the Charnley River flows west into the main stream which, after cutting through the Artesian-Edkins Range in a deep and wild canyon, enters the same inlet, while to the north the headwaters of the Drysdale and Gibb rivers unite to form the Drysdale River, which empties into Napier Broome Bay. To the east the Durack River takes its souree, to enter the sea at Cambridge Gulf. The Princess May- Mount Hann Tableland is cut in two by the Prince Regent River which, rising at an altitude of about two thousand feet, descends in a series of wild and tortuous canyons to sea level in a distance of less than twenty five miles. It possesses no known tributaries on its northern side, but on the southern side the tributaries descend steeply into the narrow fiord in a labyrinthine system of gorges. The greater part of the river itself is a sunken valley or fiord bounded by perpendicular walls 300 to 400 feet high. The plateau to the north, which culminates in Mount York, is known as the Princess May Range, while the southern plateau is known as the Elizabeth-Catherine Range and the Macdonald Range. From these the Calder, Sale and Glenelg rivers descend to the west coast, together with several tributaries of the Charnley River. On the north eastern side of the Princess May - Hann divide, the Roe and Moran rivers flow through deep gorges into Prince Frederick Harbour, enclosing almost completely a pocket of basalt country; to the north and east of Mount Hann the Woodhouse River flows eastwards to join the Drysdale River, while the Mitchell and King Edward

rivers run north, the former through the greater part of its course dividing the basalt from the sandstone before entering Admiralty Gulf by way of a gorge, the latter, after turning east, flowing northwards into Napier Broome Bay, It is quite impossible to map the course of these rivers from the general contours of the country, since for no apparent reason they will bisect a region of high ground by means of a gorge, as in the case of the Mitchell River; The presence of so many subterranean streams in the North West Kimberley area,- streams that suddenly disappear in the sandstone, to reappear on the further side of a hill- might afford an explanation of how these gorges were formed. On the other hand, there is the theory of the gradual uplift of the country which might also account for this phenomenon. As they exist, they form one of the most curious features of the country. Apart from the two high centres named, for which no official heights have been given, the highest points of the centre of the plateau to be recorded are Mount Hann (2800 ft.) and Mount Agnes (2300 ft.), both of which are residuals of a former plateau, but it is probable that both Mount York and Mount Elizabeth are still higher than these.

While the commonest rocks of the plateau are sandstone, quartzite and basalt, Fitzgerald speaks of clay shales which are frequently met with in the valley of the Isdell River and along the Adcock River to Mount House, besides those in the King Leopold Range. Gibb Maitland refers to volcanic breccias and lava flows as occurring in the King Leopold Range, while Fitzgerald records beds of volcanic ash in the vicinity of what he describes as an old volcanic crater in the lower Isdell River.

Speaking generally of the Hann Plateau, it extends almost everywhere on its northern and western side to the sea, where often cliffs form the headlands. The eastern portion of the plateau is generally more or less flat, very little dissected, except for the gorges of the Durack and Chamberlain rivers,and with thw exception of the Barton Plain on the lower Drysdale river, and a smal outcrop nearthe source of the Durack River, no basalt is recorded. On the xix other hand, laterite is found over a great part of the high plateau extending westwards through

the Conichman Range to Admiralty Gulf, and this produced a distinctive type of vegetation. The western half of the plateau, i.e. to the west of the longitude of the Drysdale River, is much more deeply eroded, especially between the Roe and Charnley rivers, and eastwards to Moount Agnes, where the sandstone and quartzite of the high plateau are carved into deep canyons or gorges, sometimes pabyrinthine in nature, and making travelling difficult. In fact, any route from north to south, or vice versa, in Western Kimberley, must pass to the east of Mount Hann. The exposed basalts in the western part of the plateau occupy probably at least one third of the whole area.

II. The Ord Region

This region embraces the entire watershed of the Ord River. Contrasted with the Hann Plateau the area is much more low-lying, with broader and apparently older valleys, a lower rainfall, and a somewhat different geology. The sedimentary and metamorphic rocks of the Nullagine Series, which predominate on the plateau, are here much more restricted in area, they are not found on the Ord River itself except on the Denison PLains, the Albert Edward Range, and along the Elvire River; the middle Ord River is entirely free from them, and they may be encountered again in small areas below Argyle Station homestead where the river enters a low gorge or series of declivities cut out of quartzite underlying sandstone- a type of country familiar enough on the plateau. This type of country extends to Wyndham in the outcrops and "ranges" which are scattered over the broad flood plain. By far the greater part of the Ord River runs through Cambrian basalts and sediments, such as limestone, sandstone and shales. These extend from the vicinity of Mount Forster to near the confluence of the Negr River with the Ord River. Jutson refers these "Antrim" basalts to the Cambrian period, whereas the Hann Plateau basalts he regards as being Precambrian ("Nullagine"). It is a curious fact that white the basaltic hills and undulations of the plateau produce Grey Box

(Eucalyptus Spenceriana) as an indicative species, and the grasses are principally blue grasses, kangaroo grass and Flinders grass, the Cambrian basaltic hills of the Ord River produce Ridge gum (Eucalyptus pallidifolia), and harsh grasses of the "Spinifex" type (Triodia, Plectrachne and Eriachne); the Grey Box trees seen in the Ord REgion were few in number, and occurred either in sandstone country,or in alluvial soils partially derived from basalt, never on the stony basalt hills

The Ord River and its tributaries in general follow wide valleys. The only gorges known are those of the Elvire River in the Albert Edward Range, and the lower Ord River gorge in the vicinity of Stonewall Creek. Further, the existence of clay flats with Coolibah trees, occasional billabongs along the rivers, and the sometimes massive sandbanks, the position of which may change annually, are characteristics of flood-channel rivers subject to extensive flooding. In this respect the Ord River resembles the the Fitzroy River and the lower distributaries of the Lennard River; further, the absence of any soft-wooded trees, with the single exception of the Leichhardt trees, and the paucity of the riverian vegetation, stand in marked contrast to the rivers of the the plateau, which, springfed or swamp-fed, are mainly permanent, and have distinct jungle-like gallery forests on their banks, with with an astonishing variety of vegetation. There are, in fact , no swampy or damp areas close enoughto the Ord River to support an exotic flora dependent on telluric water, and the lack of this characteristic is perhaps the most disappointing feature of the river. Gouged out by torrential floods, the silty banks are much higher than the lower level of the river, and these banks again are often higher than the surrounding soil of the plain. Rising in dry inland country with a low rainfall and an atmosphere of extrememm aridity throughout most of the year, the Ord River is nowhere permanent. The two principal tributaries are the Bow River and the Behn River. I would estimate that almost as much water was flowing in the Negri River in May 1944 as was flowing in the Ord River past Valentine Creek at the same period.

The Ord River rarely runs after the end of June. Water Channels of intermittent flow, especially when they run rapidly, are much more powerful instruments of soil erosion than permanent streams. The lagoons or "billabongs" of the Ord and Fitzroy rivers together with the sand banks of their beds, and the broad clay coolibah flats subject to inundation, are features not met with anywhere on the Hann Plateau.

III. The Fitzroy Region.

The Fitzroy Region embraces the entire Fitzroy River watershed with the exception of the Upper Fitzroy River above the Sir John Gorge, and Hann and Adcock rivers (northern tributaries) and the upper Lennard River above Inglis 'Gap. The Fitzroy River is the largest of the Kimberley rivers, and the longest tributary is the Margaret River, which rises at the plateau margin near Mount Luke. The Margaret and Mary rivers as well as Christmas Creek, although carrying enormous volumes of water in certain periods of heavy atmospheric precipitation, are strictly flood channels, like the Ashburton and Gascoyne rivers. At other times their courses are dry with only occasional pools, some of which may be permanent. The tributaries which rise on the plateau,- the upper Fitzroy, Hann and Adcock rivers, as well as Pandanus Creek, are spring-fed plateau streams, and the Hann is apparently permanent throughout its course. Hann, speaking of this river in August 1898 when he was above Bella Creek (near its source) said "The river was running still stronger, and I wondered where all the water came from." These rivers supply the regular flow of the Fitzroy River where it enters its flood plain, but the water soon becomes much reduced in volume through seepage, and the river is scarcely permanent at Noonkanbah. The appearance of the Fitzriy River at Noonfambah is typically that of a flood channel. Between its high banks at this point there are the numerous longitudinal sand banks, some fixed, some moving, and the anastomosing channels so typical of the North West rivers. Below Fitzroy Crossing even the

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Leichhardt tree disappears, and few riverain elements continue along its course to King Sound. In this it closely resembles the Ord River. The lower Fitzroy River below Brooking Creek at Fitzroy Crossing traverses an extensive flood plain which continues throughout the remainder of its course: the clay plains and silt plains alternate with sandy areas carrying Pindan scrub and spinifex as the principal features. Better conditions are met with on the lower tributary, the Lennard River, where a richer soil brought directly through the King Leopold and Napier ranges results in rich sepia-coloured soil flats with a wealth of natural grasses. The so-called "black soil plains" of the early squatters are in reality sepia-coloured, and apparently owe their colour to the presence of derived basalts and shale s, or either of these. We do not see these soils on the Fitzroy River at all, they occur on the Antrim Plateau, along the middle and lower Ord River, and again on the Lennard River and its distributaries, the May and Meda rivers.

The Margaret and Mary rivers take their sources in the Nullagine rocks of the Kimberley Gold Field area, but Christmas Creek and the greater part of the lower Fitzroy River flow through limestone country. The Grant Range, Mount Anderson, Mount Wynne and the Saint George Range consist of upper carboniferous rocks. At intervals along Christmas Creek and the lower Fitzroy River, especially near Noonkanbah, small hills of conical form occur. They are formed of alkaline eruptive rocks, principally leucitite, which have protruded through the upper carboniferous strata in the form of volcanic necks.

The Lennard River, which rises behind the first great bastion of the King Leopold Range, flows through a more diversified soil, and streams like the Barker and Richenda rivers, and Wombarella Creek carry with them rich alluvial deposits which, together with the shales in situ, go so far towards the composition of the rich grasslands of the Lennard River. Apart from the basaltic country in which the Lennard River rises to the east of Mount Broome, no basalt occurs in its basin. The

lower and more level streams courses all have their coolibah flats which appear to be indicative of the areas subject to periodic inundation.

II. CLIMATE

The Kimberly climate is profoundly affected by monsoonal conditions. There are two monsoons; a South East Monsoon which blows during the months April-September; and a North west monsoon which operates during the intervening months. These periods are somewhat approximate, since their advent does not appear to be as regular as is the case in India and Burma. The Dry, or South East Monsoon is very well marked at Halls Creek, where the influence of the North West Monsoon is comparatively feeble according to the average afternoonreadings.

The South East Monsoon is really the trade wind circulation which blows obliquely across the continent. Most pronounced in the North West , it is also experienced in Kimberley, especially at Hall's Creek. It is most evident the cool period of the year, when the thermal equator is well to the north of Australia and a pronounced high pressure system dominates the North West Australian tropical regions. These high pressures systems recede southwards with the southern advance of the thermal equator, accompanied by a general decrease in the velosity and "depth" of the south east wind circulation. By the time November arrives the high pressure systems have weakend, and the rate of solar marine and terrestrial surface heating is approaching a maximum. With the weaker cooling south east winds a general increase in temperature of the surface air layers occurs, and thus there is a general increase in the capacity of the air for the retention of water vapour. This increase, representing a general whole pressure decrease. is sufficient to account for the generally weak low pressure system which prevails over Kimberley during the months October - December. Overlying the surface circulation

is the south-east air stream, gradually diminishing upwards and south-wards, and of strikingly different thermo-dynamic constitution. This results in a weak warm and moist surface circulation under a strong relatively dry and cold surface, which gives rise to conditions suitable for the development of thunderstorms through strong convection-directly related in incidence to diurnal heating- and considerable verticalthermal instability due to the general wind circulation. Thus at this time of the year thunderstorms are developed, often of local occurrence only, but affected by the variation of contour etc.

The North West Monsoon is accompanied by the most disturbed and the most rain producing weather of the entire wet season (if we except the incidence of the tropical hurricane or typhoon). It is essentially a cold though moist wind which comes southwards from the equatorial regions. The high rainfall incidence accompanying its arrival is due to the fact that its frontal margin undercuts and uplifts an air mass which, though relatively warm, is already heavily charged with moisture. Its effectiveness as a rain-producing wind is greatly enhanced by elevations of the contour, and thus its effects are more apparent where the high land extends to the seaboard. This will at once be seen by comparing the rainfall of Wyndham, Derby and Broome with that of Port George lv, which is almost on the coast, and nearly two thousand feet above sealevel. The rain bringing North West Monsoon is not effective very far inland, and in Kimberley its effects are much reduced by the time Hall's Creek is reached. It might be compared to a sea breeze on a large scale, in which a deep cold moist air mass of marine origin impinges upon a warm and relatively dry terrestrial air mass. The North West Monsoon prevails from the latter part of December to the end of March. A glance at the rainfall tables will show the difference between theJanuary-March rainfall, compared withthat of November and December. Compare, for example, the number of years in which the season "opens" in December,as against those in which it commences earlier.

The climate of Kimberley therefore can be classed as

a tropical climate with a long drought (normally eight months) during which no rain can normally be expected, and a shott summer "wet" season in which from 79-87 per cent. of the tolal rainfall occurs. These four "wet" months are normally December to March, with a slight margin of rain due to t local thunder storms on either side. The North West Monsoon recedes during the earlypart of March, retreating northwards as it began, and is followed by a brief period of thunder squalls and cloudy weather. It must be remembered that a change is now taking placein the relative thermal properties of the North West Monsoon (marine) air mass and the South East Monsoon (continental) air mass now advanceing to replace it as the thermal equator shifts northwards causing a general continent and marine cooling, and a decreasing air moisture content, accompanied by increasing atmospheric pressure over, and especially to the south of, the area under consideration.

Finally, in discussing rainfall, attention should be drawn to the fact that the annual precipitations are of a irregular nature in regard to periodicity and the quantities precipitated. One has only to consider the rainfall of the station which receives the most regular and the heaviest season -al rainfall (port George IV): in some years the season extends over seven months, while in others it is reducedto three months. In one year (1931) the three months receiving an excess of two inches were January, March and May,.The number of relatively dry Decembers preceded by a wet November calls for comment, and illustrates the uncertainty of a "carry through" of the thunder squalls which precede the Monsoonal weather. But here it will be noticed that in the months January-March, during twenty three years (some of them the driest the station has experienced) only once did the rainfall experienced fall below two inches for any month during this period. This connot be said for any other recording station in Kimberley. The closing weather of April will be found to be unsatisfactory in this respect also, but here again there is a marked contrast between this and other stations. The weakest of the monsoonal rains is further exhibited in the

examples of Hall's Creek and Turkey Creek. For rainfall records of other Kimberley stations see my paper on the Climate and Vegetation of Western Australia. (Journ. Roy. Soc. W.Austr. xxviii (1942)).

a. Temperature

The normal mean annual temperature throughout Kimberley is between 78° and 85°, - twentydegrees higher than that of Perth. On the coast, the mean annual range is between 30° and 40° ; inland it is much higher. For example, at Hall's Creek it is in excess of 50°, a figure almost as high as that for Marble Bar (54.2°), but still considerably lower than that of Mundiwindi. which is 60.1°. The coastal climate therefore is fairly equable but high, and the mean range for Wyndham (31.8°) is relatively low. This, together with the high relative humidity of the summer months, makes conditions very unpleasant, for although the meanannual temperature for Wyndham is lower than that of Darwin, the mean temperature during the summer months of January and February is 8° higher - a rather considerable figure considering the climatic conditions at this period. Comparative figures for Darwin and Wyndham for the summer months are:-

		Mean Maximum	Mean Minimum	Mean	Mean Range
November	Darwin	93.8	77.9	85.8	15.9
	Wyndham	98.3	81.2	89.7	17.1
December	Darwin	92.3	78.0	85.1	14.3
	Wyndham	97.5	81.0	89.2	16.5
January	Darwin	90.5	77.3	80.0	13.2
	Wyndham	96.3	80.2	88.2	16.1
February	Darwin	90.0	76.9	79.3	13.1
	Wyndham	95.6	79.6	87.6	16.0
March	Darwin	91.1	76. 9	84.0	14.2
	Wyndham	95.3	79.2	87.2	16.1

The average relative humidity for the two stations during this period are as follows:

	November,	Decem.	Janu.	Febry.	March.
Darwin	67	73	49	79	80
Wyndham	57	53	32	67	70

In considering the Kimberley temperatures, notice should be taken of Port George IV, which has a mean annual temperature four degrees lower than that of Wyndham, but a correspondingly greater mean range (42.0°). This is an important factor, showing that the littoral climate of the plateau country is more healthy than that of the low lying littoral stations of Wyndham, Derby and Broome, the respective figures for which are: 31.8°. 38.6°. and 35.6°.

Wyndham has an annual mean temperature of 84.4°, which, with the single exception of Darwin, is the highest of any recording station in Australia. The annual range between the monthly mean readings is interesting. At Wyndham in January it is 16° compared with i4.2° at Port George IV, 12.6° at Broome and 23 at Hall's Creek. In July, this range is increased to 19.1° at Wyndham. 32.6° at Port George lv, 32.1° at Hall's Creek, and 24.2 at Broome. These conditions are occasioned by the cloudy skies experienced on the coast during the summer months, while the greater range in July can be attributed to the bright clear skies which prevail during the cool months. In Perth, for example, the reverse holds true: in January the range is 21.4°, while in July it is 15.0°. I draw attention to these figures in order to illustrate the unpleasant conditions prevailing under the high temperatures and comparatively high relative humidity during the Kimberley summer.

The following taple gives temperature figures for certain tropical stations in Australia as well as irrigation areas, with Perth by way of comparison.

Station	Annual Mean	Highest monthly mean maximum	Lowest monthly mean minimum	Mean Range
Darwin	87.6	93.8	67.4	26.4
Wyndham	84.4	98.0	66.2	31.8
Marble Bar	81.8	107.0	52.8	54.2
Derby	81.5	97.8	58.2	38.6
Dale Waters	80.3	102.2	53.4	48.8
Broome	79.8	93.3	57.7	35.6
Port George 1V	79.1	95.0	53.0	42.0
Hall's Creek	77.9	100.1	48.1	52.0
Carnarvon ~~xxxx~~	71.7	88.3	50.9	37.4
Perth	64.2	84.6	47.7	36.9
Mildura	63.5	91.9	39.5	52.4
Griffith	62.5	90.6	39.0	51.¾
Leeton	62.2	89.3	38.8	50.5
Goulbourn	56.3	82.7	33.9	48.8

The appended tables gives complete data concerning temperatures for Wyndham, Port George 1V, and Hall's Creek.

b. Rainfall.

The discussion on the seasonal climatic cycle, and the appended analyses of the seasonal rainfall give all the information which is available on this subject. It only remains to draw attention to the fact that the Hann Plateau receives a much more copious rainfall than the basins of the Ord and Fitzroy rivers, and although we do not know exactly at which point on the plateau the rainfall is the heaviest, it is safe to assume that it lies near to the coast where the plateau is highest, or at some still higher point not far inland. Probable localities are at Prince Frederick Harbour, or the high plateau between Mount York and the Caroline tableland. The annual average rainfall at Port George 1V is 50.39 inches, compared with 34.57 inches at Mount Barnett, 27.78 inches at Beagle Bay, 27.14 inches at Turkey Creek, 25.10

inches at Wyndham, and 25.06 inches at Kimberley Downs. At Broome it falls at 23.01 inches, and at Fitzroy Crossing, shielded by the King Leopold Range, it is 21.10 inches. Rainfall figures do not lend themselves to statistical treatment in climates such as this, since they vary greatly, and are so unpredictable. Averages mean little when applied to a rainfall exhibiting such vagaries as that of Kimberley. The two following tables might be found of interest, since one hears so persistently that the season opens in October or early November. In the first table I have attempted to show that this is not the case. A rainy month for this purpose is one receiving at least two inches of rain, and two or more consecutive months with two inches each or more, each being regarded as being seasonal. This table is compiled from the 1920-1943 rainfall statistics.

	Port Geo.IV.	Wyndham	Turkey Creek	Fitzroy X.	Hall's C
Sept,	nil	nil	nil	nil	1 year
Oct.	1 year	nil	2 years	nil	nil
Novem.	5 years	7 years	2 years	nil	1 year
Decem.	12 years	6 years	9 years	11 years	9 years
Jany.	5 years	7 years	5 years	7 years	5years
Febry.	nil	1 years	2 years	2years	4 years

In the remaining years there does not appear to have been a definite "rainy season", wet and dry months alternating.

Table II.

Number of years in which the rainfall for the number of consecutive months given, was in excess of 2" per month.

	Port Geo.IV.	Wyndham.	Turkey Creek.	Fitzroy X.	Hall's Creek
Seven months					
Oct-April	1	-	-	-	-
Nov-May	1	-	-	-	-
Six months					
Oct-March	-	-	1	-	-
Nov-April	1	-	1	-	-
Dec-May	1	-	1	-	-
Five months					
Nov-March	3	5	-	-	-
Dec-April	4	1	-	-	-
Four months					
Sep- Dec	-	-	-	-	1
Nov- Feb	-	-	1	-	1
Dec-March	7	5	3	7	4
Jan-April	-	-	-	2	-
Three months					
Nov-Jan	-	1	-	-	-
Dec-Feb.	-	-	3	4	1
Jan-Mar.	5	6	4	3	3
Mar.-May	-	-	-	1	-

The value of the North West Monsoon as the "season breaker" as against the earlier thunder squalls will be at once apparent from a perusal of this table.

Humidity and dew are imporyant for plant life. A table giving the relative humidity for 9.0 a.m. and 3.0 p.m. for all recording stations in Western Australia will be found in the paper previously referred to. Humidy is only of importance when considered together with the temperature and rainfall, and here again the importance of the littoral climate over the inland climate is emphasised. We have no official information

regarding dew, but Brockman refers to heavy dews on the plateau in 1901; and in 1921 when traversing the Hann Plateau in the vicinity of the Mount Hann divide, I observed heavy dews frequently in the month of June July and August. The prevalence of permanent rivers and swamps in this area is no doubt an important contributory cause. I observed no heavy dews in 1944, either on the Fitzroy or Ord rivers.

y. Evaporation.

Just as rainfall is necessary for plant life, so is evaporation a very important limiting factor, especially in those regions where it far exceeds the rainfall. The saturation deficit tables are therefore instructive in this respect. I would point out that the afternoon figures are of much more importance than the figures taken from 9.0 a.m. readings, and it is unfortunate that these are unobtainablefor Port George IV.

The most reliable method of ascertaining the evaporating power of the atmosphere is by means of what is known as the saturation deficit, which is the amount by which the partial pressure of water in a given volume of air falls short of the pressure at saturation point. The following figures represent this value as expressed in inches of mercury.

From even a casual study of these figures for Kimberley some interesting facts emerge. In the first place, the annual mean of .495 (9.0 a.m.) for Port George IV, stands closer to those of Derby and Broome (.493 and .437 respectively) than do those for Wyndham (.550) and Hall's Creek (.715), which indicate a relatively drier atmosphere in the latter stations. The afternoon figures are of much more value than the morning figures, and here the mean annual for Wyndham (.792) and Derby (.786) stand in sharp contrast to those of Broome (.591). The fact that both Derby and Wyndham are situated at the extremities of gulfs, and are therefore almost inland in this respect, may account for this. Hall's Creek, with an afternoon mean annual figure of 1.088 is second only to Marble Bar (1.184) and is even drier than

Mundiwindi (1.005). Such a value represents a very high disiccating power. The Wyndham afternoon values in the winter are comparable with those for Hall's Creek and are much higher than those of Derby and Broome. They are at least twice as high as those for Carnarvon, and comparable with the summer value for Kellerberrin during the greater part of the year. The figures are lowest in January February and March, when the North West Monsoon is in operation, but they rise abruptly in April to fall again in May and June. This characteristic is shared by Broome; in Derby and Hall's Creek there is no such seasonal rise at this period of the year the peak period is in November at the end of the dry season.

Summary of Wind directions, showing prevailing winds

(Expressed as a percentage)

	Port George IV		Wyndham				Hall's Creek			
	9.0a.m.		9.0a.m.		3.0p.m.		9.0a.m.		3.0p.m.	
	NW	SE	NW	SE	NW	SE	NW	SE	NW	SE
July	8	47	13	58	37	42	7	80	16	58
Aug.	11	41	27	52	59	33	16	65	17	48
Sept.	14	47	33	39	76	13	16	58	30	51
Oct.	39	21	56	14	88	8	36	39	32	41
Nov.	35	17	42	19	81	7	33	38	28	50
Dec.	35	25	33	23	67	13	34	38	27	42
Jan.	37	26	26	25	61	18	25	38	23	50
Feb.	33	20	29	28	62	11	32	31	19	51
Mar.	24	21	17	41	48	25	19	56	13	62
Apr.	12	54	11	58	44	38	5	85	10	74
May	10	52	15	57	44	38	7	76	13	66
June	7	52	10	63	29	44	3	81	6	67

WYNDHAM CLIMATE. Wind direction expressed as %

a---9.0 a.m.
b.--3.0 p.m.
c.--wind speed in knots

Month	Time	NE	E	SE	S	SW	W	NW	N	Calm	c
July	a	1	1	33	24	28	4	6	3	0	7
	b	1	1	22	19	16	5	11	21	4	6
August	a	4	1	33	18	15	2	12	13	2	6
	b	2	1	22	10	5	2	12	45	1	6
September	a	3	2	20	17	23	3	10	20	2	6
	b	1	0	6	7	7	6	11	59	3	7
October	a	10	3	5	6	18	6	26	24	2	5
	b	2	0	6	2	2	2	6	80	0	10
November	a	7	2	3	14	24	4	18	20	8	5
	b	4	1	1	5	4	3	11	67	4	9
December	a	3	1	10	12	31	6	16	11	10	4
	b	9	2	7	4	6	1	18	48	5	8
January	a	2	1	9	15	44	5	13	8	3	6
	b	3	2	7	9	15	4	17	40	3	8
February	a	2	2	12	14	35	4	18	7	6	6
	b	12	0	6	5	9	4	20	38	6	7
March	a	6	0	17	24	30	4	6	7	6	5
	b	16	5	12	8	7	3	14	31	4	7
April	a	2	2	30	26	27	3	4	4	2	6
	b	7	2	19	17	7	2	13	29	4	6
May	a	3	3	31	23	23	3	6	6	2	7
	b	7	2	15	21	9	3	12	29	1	6
June	a	2	1	33	29	24	3	5	2	1	8
	b	4	0	20	24	18	6	8	15	5	6

Prevailing winds

July	a	SE	Novem	a	sw	March	a	sw
	b	SE		b	N		b	N
August	a	SE	Decem.	a	SW	April	a	SE
	b	N		b	N		b	N
Septem.	a	SW	Jany.	a	SW	May	a	SE
	b	N		b	N		b	N
Oct.	a	NW	Feby.	a	SW	June	a	SE
	b	N		b	N		b	S

HALL'S CREEK CLIMATE? Wind direction expressed as %

a----9.0 a.m.
b ---3.0 p.m.
c----Wind speed in knots

Month	Time	NE.	E.	SE.	S.	SW.	W.	NW.	N.	Calm.
July	a	8	48	29	3	2	3	1	3	3
	b	9	27	25	6	4	7	5	4	13
August	a	10	41	21	3	3	9	4	3	6
	b	7	18	22	8	8	7	5	5	20
Septem.	a	16	34	19	5	7	9	3	4	3
	b	5	25	19	7	3	12	9	9	11
October	a	12	24	11	4	9	21	6	9	4
	b	11	17	17	7	10	22	9	11	6
November	a	12	22	12	4	11	24	5	4	6
	b	5	20	18	12	10	12	10	6	7
December	a	9	20	14	4	11	20	8	6	8
	b	14	14	19	9	11	11	5	11	6
January	a	7	14	16	8	22	16	6	3	8
	b	6	15	24	11	13	12	6	5	8
February	a	5	8	13	10	23	26	2	4	9
	b	5	14	30	7	14	10	5	4	11
March	a	15	31	19	6	5	9	4	6	5
	b	13	26	27	9	5	7	3	3	7
April	a	4	48	34	3	3	4	0	1	3
	b	9	33	37	4	1	1	2	7	6
May	a	12	52	23	1	1	5	0	2	4
	b	12	31	29	6	1	6	1	6	8
June	a	12	52	26	3	1	1	0	2	3
	b	13	32	27	8	3	4	1	1	11

Summary of prevailing winds

July	a	E	November	a	W	March	a	E
	b	E		b	E		b	SE
August	a	E	December	a	E&W	April	a	E
	b	SE		b	SE		b	SE
Septem	a	E	January	a	SW	May	a	E
	b	E		b	SE		b	E
October	a	E	February	a	W	June	a	E
	b	E & SE		b	SE		b	E

PORT GEORGE IV (Kunmunya) CLIMATE: Wind direction expressed as as %

a -----9.0 a.m.
b -----3.0 p.m.
c ------wind speed in knots

Month	Time	NE	E	SE	S	SW	W	NW	N	Calm	c
July	a	23	29	12	6	14	1	2	5	8	8
	b										
August	a	15	17	18	6	23	2	5	4	10	6
	b										
September	a	10	12	28	7	25	4	8	2	4	6
	b										
October	a	7	8	8	5	30	14	20	5	3	5
	b										
November	a	9	3	7	7	36	8	15	12	3	4
	b										
December	a	12	7	9	9	24	9	19	7	4	4
	b										
January	a	7	6	10	10	29	11	13	13	1	8
	b										
February	a	7	6	6	8	38	10	10	13	2	6
	b										
March	a	10	3	11	7	30	5	9	10	15	4
	b										
April	a	4	20	29	5	19	4	6	2	11	4
	b										
May	a	14	17	29	6	14	3	2	5	10	5
	b										
June	a	22	18	28	6	10	1	3	3	9	8
	b										

PORT GEORGE IV (Kunmunya) Climate: Temperature & Saturation Deficit

Month	Mean maximum	Mean minimum	Normal Mean	Extreme maximum	Extreme minimum	Saturation deficit 9.0 a.m.	Saturation deficit 3.0 p.m.
July	86.0	53.4	69.7	95.8	36.8	.511	.724
August	89.3	56.6	72.9	98.8	40.8	.550	.744
Sept.	93.1	62.7	77.9	103.0	48.0	.612	.758
Oct.	94.4	70.5	82.4	106.0	57.0	.515	.732
Nov.	95.4	75.4	85.4	108.2	59.2	.585	.660
Dec.	93.7	77.4	85.5	106.0	65.5	.474	.500
Jan.	90.6	76.4	83.5	103.0	53.0	.340	.419
Feb.	90.5	75.8	83.1	103.0	63.0	.341	.454
Mar.	91.6	74.7	83.1	101.0	59.5	.374	.551
Apr.	93.0	68.5	80.7	102.0	47.0	.542	.818
May	90.3	61.5	75.9	100.0	41.4	.570	.589
June	86.9	57.0	71.9	99.5	36.0	.523	.728
MEAN							
Annual	91.2	67.4	79.3	....	.....	.495	.658
DEC-March	91.6	76.1	83.8	....	...	.382	.481

WYNDHAM CLIMATE: Temperature and Saturation Deficit.

Month	Mean Max.	Mean Min.	Mean Norm.	Extr. max.	Extr. min.	Satu. def. 9.0.am.	Satu. def. 3.0.pm
July	85.3	66.2	75.7	95.2	50.0	.525	.770
Aug.	88.7	69.5	79.1	99.0	56.1	.569	.760
Sep.	93.8	74.8	84.3	106.0	60.1	.656	.800
Oct.	97.1	79.6	88.3	110.2	68.5	.650	.810
Nov.	98.3	81.2	89.7	111.6	69.0	.608	.820
Dec.	97.5	81.0	89.2	109.5	68.0	.514	.760
Jan.	96.3	80.2	88.2	113.0	67.2	.417	.710
Feb.	95.6	79.6	87.6	108.3	64.0	.380	.700
Mar.	95.3	79.2	87.2	105.0	67.0	.446	.790
Apr.	94.7	77.4	86,0	113.0	63.5	.663	.960
May	90.3	72.4	81.3	102.4	55.2	.629	.880
June	86.1	68.0	77.0	97.5	53.5	.538	.750
Mean							
Annual	93.2	75.7	84.5	....	....	.549	.792
Dec-Mar.	96.2	80.0	88.0	....	....	.439	.740

HALL'S CREEK CLIMATE: Temperature and Saturation Deficit.

A

Month	Mean max.	Mean min.	Mean Norm.	Extr. max.	Extr. min.	Satu. def. 9.0 a.m.	Satu. def. 3.0 p.m.
July	80.1	48.0	64.0	93.2	30.0	.433	.710
August	85.9	52.0	68.9	100.0	32.8	.580	.890
Sept.	92.7	59.1	75.9	104.3	37.4	.795	1.140
Oct.	98.2	69.2	83.7	109.0	48.0	.928	1.300
Nov.	100.3	74.1	87.2	110.6	53.0	.944	1.330
Dec.	99.4	75.3	87.3	111.6	53.8	.707	1.150
Jan.	97.9	75.1	86.5	111.8	61.2	.634	1.050
Feb.	97.1	74.2	85.6	110.8	58.2	.598	1.050
Mar.	95.1	71.1	83.1	107.5	51.8	.695	1.050
Apr.	91.9	65.5	77.7	103.8	45.0	.716	1.800
May	85.5	56.0	70.7	99.0	36.4	.572	.880
June	80.6	50.8	65.7	95.0	32.4	.428	.710
Mean:							
Annual	92.1	64.0	78.0	....	....	.670	1.082
Dec.-Mar.	97.4	73.9	85.6	....	....	.659	1.088

PORT GEORGE IV. CLIMATE: Rainfall (Monthly statistics)

(1920- 1943)

Month.	Mnth. Aver.	Extr. Max.	Extr. Min.	Aver. no. Rainy Days.	Aver. no. Wet x Days.	Max. no. Wet x Days.	Min. no. Wet x Days	Year of Max.	Year of Min.
July	30	221	-	1	-	3	-	(1920)	(Several)
August	4	11	-	-	-	-	-	(1942)	(Several)
September	6	118	-	-	-	1	-	(1920)	(Several)
October	39	205	-	1	-	2	-	(1920)	(Several)
November	184	496	2	4	2	7	-	(1920)	(1933)
December	765	2260	-	12	7	15	-	(1930)	(1929)
January	1512	3463	357	20	11	20	3	(1926)	(1930)
February	1113	2443	145	17	9	17	3	(1930)	(1931)
March	1001	2861	316	17	9	15	2	(1935)	(1938)
April	214	1141	-	5	2	8	-	(1920)	(Several)
May	96	621	-	2	1	6	-	(1926)	(Several)
June	75	690	-	2	1	4	-	(1941)	(Several)

x Wet days are those on which more than 25 points of rain are recorded.

Rainy days are those on which more than one point of rain is recorded.

WYNDHAM CLIMATE: Rainfall (monthly) statistics) 1920-1943

Month.	Mnth. Aver.	Extr. Max.	Extr. Min.	Aver. no. Rainy Days.	Aver. no. Wet Days.x.	Max. no. Wet Days.x.	Min. no Wet Days.x.	Year of Max.	Year of Min
July	16	106	-	1	-	2	-	(1939)	(Several
August	3	46	-	1	-	1	-	(1933)	(Several
September	9	136	-	1	-	1	-	(1920)	(Several)
October	44	108	-	2	-	2	-	(1920)	(Several)
November	109	494	3	6	2	7	-	(1938)	(1933)
December	418	849	28	10	4	8	-	(1930)	(1935)
January	763	2292	115	13	6	19	-	(1937)	(1930)
February	632	2058	54	11	6	13	-	(1942)	(1937)
March	467	1214	10	10	5	13	-	(1925)	(1938)
April	81	177	-	3	1	3	-	(1936)	(Several)
May	24	234	-	1	-	3	-	(1942)	(Several)
June	17	473	-	1	-	2	-	(1939)	(Several)

x. Wet days are those on which more than 25 points of rain are recorded.

Rainy days are those on which more than one point of rain is recorded.

Turkey Creek Climate : Rainfall: (monthly statistics)

(1920-1941)

Month	Mnth Aver.	Extr. Max.	Extr. Min.	Aver. no. Rainy Days.	Aver. no. Wet Days, x	Max. no. Wet Days. x	Min. no. Wet Days. x	Year of Max.	Year of Min.
July	25	380	-	1	-	4	-	(1939)	(Several)
August	9	8	-	-	-	-	-	(1933)	(Several)
Sep.	17	65	-	-	-	2	-	(1922)	(Several)
Oct.	75	281	-	2	1	3	-	(1924)	(Several)
Nov.	199	679	18	6	2	5	-	(1920)	(1929)
Dec.	495	786	15	9	4	10	-	(1926)	(1929)
Jan.	669	1660	7	12	6	16	-	(1937)	(1921)
Feb.	685	1320	110	10	5	12	1	(1921)	(1941)
March	407	1682	-	8	4	8	-	(1922)	(Several)
April	95	297	-	2	1	3	1	(1939)	(Several)
May	19	208	-	1	-	2	-	(1941)	(Several)
June	25	303	-	1	-	4	-	(1939)	(Several)

x. Wet days are those on which more than 25 points of rain are recorded.

Rainy days are those on which more than one point of rain is recorded.

FITZROY CROSSING CLIMATE: Rainfall (monthly statistics)

(1920 - 1943)

Month.	Mnth. Aver.	Extr. Max.	Extr. Min.	Aver. no. Rainy Days.	Aver. no. Wet Days. x	Max. no. Wet Days. x	Min no. Wet Days	Year of Max.	Year of Min.
July	31	399	-	1	-	4	-	(1939)	(Several)
August	5	120	-	-	-	1	-	(1933)	(Several)
Sep.	6	61	-	-	-	1	-	(1920)	(Several)
Oct.	21	117	-	1	-	2	-	(1922)	(Several)
Nov.	88	372	-	4	1	4	-	(1927)	(Several)
Dec.	336	917	9	9	3	11	-	(1930)	(1929)
Jan.	640	1593	29	12	6	10	-	(1927)	(1921)
Feb.	524	1401	62	9	4	12	-	(1921)	(1931)
March	336	909	2	8	4	9	-	(1934)	(1938)
April	64	400	-	2	-	3	-	(1927)	(Several)
May	29	209	-	1	-	3	-	(1923)	(Several)
June	37	351	-	1	-	2	-	(1941)	(Several)

x. Wet days are those on which more than 25 points of rain are recorded.

Rainy days are those on which more than one point of rain is recorded.

HALL'S CREEK CLIMATE: Rainfall (monthly statistics)

(1920 - 1943)

Month	Mnth. Aver.	Extr. Max.	Extr. Min.	Aver. no. Rainy Days	Aver. no. Wet Days x	Max. no Wet Days. x	Min. no. Wet Days x	Year of Max.	Year of Min.
July	25	276	-	1	-	4	-	(1934)	several
August	9	98	-	1	-	1	-	(1933)	several
Sep.	16	207	-	-	-	3	-	(1920)	several
Oct	52	229	-	2	-	2	-	(1920)	(1933)
Nov,	137	396	-	5	1	5	-	(1927)	(1933)
Dec.	316	862	29	8	3	11	-	(1930)	(1931)
Jan.	554	2274	20	11	6	15	-	(1926)	(1921)
Feb.	433	984	27	9	4	12	-	(1938)	(1937)
March	292	1452	-	8	3	7	-	(1922)	(1924)
April	69	178	-	2	1	3	-	(1923)	several
May	37	244	-	1	-	3	-	(1941)	several
June	26	279	-	1	-	3	-	(1941)	several

x. Wet days are those on which more than 25 points of rain are recorded.

Rainy days are those on which more than one point of rain is recorded.

PORT GEORGE IV. CLIMATE: Number of wet days with 25 points or more of rain

(1920 - 1943)

Year	Jul	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.
1920	3	-	1	2	7	9	11	8	8	8	1	-
1921	-	-	-	-	1	6	7	14	11	-	4	-
1922	-	-	-	-	2	13	11	13	11	2	1	-
1923	-	-	-	-	1	8	13	11	11	1	1	2
1924	-	-	-	-	2	1	8	3	2	2	-	-
1925	-	-	-	-	-	4	11	11	7	-	-	-
1926	-	-	-	-	2	12	16	6	11	4	3	-
1927	-	-	-	-	5	2	20	10	13	2	-	-
1928	1	-	-	-	1	5	8	8	9	5	-	-
1929	-	-	-	-	-	-	6	9	12	1	-	-
1930	-	-	-	-	2	15	3	10	4	2	-	-
1931	-	-	-	-	1	1	15	3	8	1	3	-
1932	-	-	-	-	-	10	12	8	7	5	1	2
1933	-	-	-	-	-	12	5	4	8	2	-	-
1934	3	-	-	1	-	4	14	17	15	4	-	-
1935	-	-	-	-	1	3	6	5	15	-	-	-
1936	-	-	-	-	1	6	14	9	7	1	1	-
1937	-	-	-	-	1	8	19	6	6	-	-	2
1938	-	-	-	-	4	8	14	9	4	1	-	1
1939	2	-	-	-	-	3	8	14	9	-	-	1
1940	-	-	-	2	-	5	15	7	9	2	-	-
1941	-	-	-	-	1	7	12	10	11	2	4	4
1942	-	-	1	-	2	9	18	11	8	4	6	1
1943	1	-	-	-	2	7	7	14	7	1	-	-

WYNDHAM CLIMATE) Rainy days (25 points & over)
(1920 - 1943)

Year.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Ma	April	May.	Jun.
1920	-	-	1	1	5	7	3	1	3	3	-	-
1921	-	-	-	-	3	4	2	13	7	-	-	-
1922	-	-	-	2	1	5	9	4	8	1	1	-
1923	-	-	-	1	4	5	6	7	5	1	1	1
1924	-	-	-	1	1	1	6	6	4	1	-	-
1925	-	-	-	-	-	7	6	10	7	1	-	-
1926	-	-	-	-	2	7	10	4	5	-	1	-
1927	-	-	-	-	7	4	6	5	8	1	2	-
1928	1	-	-	-	3	2	4	5	2	-	-	-
1929	-	-	-	-	1	1	5	5	7	-	-	-
1930	-	-	-	1	1	8	2	10	-	-	-	-
1931	-	-	-	-	3	1	12	2	4	-	-	-
1932	-	-	-	-	1	5	1	5	6	1	-	-
1933	-	1	-	-	-	4	2	3	6	2	-	-
1934	1	-	-	1	1	2	3	6	6	2	-	-
1935	-	-	-	-	1	-	4	5	13	-	-	-
1936	-	-	-	-	2	2	4	3	3	1	-	-
1937	-	-	-	1	1	2	19	-	2	-	-	-
1938	-	-	-	-	5	3	6	6	-	0	-	-
1939	2	-	-	-	3	2	2	9	4	-	-	-
1940	-	-	-	-	-	5	11	6	4	1	-	-
1941	-	-	-	-	1	7	7	2	6	-	-	-
1942	-	-	1	1	1	4	15	11	3	-	3	1
1943	-	-	-	-	2	2	6	5	5	-	-	-

TURKEY CREEK CLIMATE : Number of wet days per month with 25 points of rain or more (1920-1941)

Year	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.
1920	1	-	-	1	5	4	6	3	3	1	-	-
1921	-	-	-	-	2	3	-	12	8	-	-	-
1922	-	-	2	3	3	6	10	5	8	1	1	-
1923	-	-	-	1	1	10	10	4	7	1	-	1
1924	-	-	-	2	3	3	7	2	2	-	-	-
1925	1	-	-	-	-	2	7	10	4	-	-	-
1926	-	-	-	-	-	9	14	5	5	1	1	-
1927	-	-	-	-	3	2	7	6	5	1	2	-
1928	-	-	-	-	1	5	4	5	1	-	-	-
1929	-	-	-	-	-	-	2	1	8	1	-	-
1930	-	-	-	2	3	7	5	8	1	-	-	-
1931	-	-	-	1	-	2	9	2	3	3	-	-
1932	-	-	-	1	3	2	3	4	2	1	2	1
1933	-	-	-	-	-	6	2	2	5	-	-	1
1934	2	-	-	-	5	-	6	4	2	1	-	-
1935	-	-	-	2	5	3	7	4	7	-	-	-
1936	-	-	-	1	2	6	3	1	-	-	-	-
1937	-	-	-	-	1	3	16	3	3	1	-	2
1938	1	-	-	-	3	1	7	6	-	-	-	-
1939	4	-	-	1	4	4	3	10	1	3	-	3
1940	-	-	-	1	2	7	9	10	1	1	-	-
;941	-	-	-	1	4	5	5	2	6	1	1	4

FITZROY CROSSING CLIMATE: Number of wet days with 25 points of rain or more.

(1920 - 1943)

Year	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.
1920	-	1	1	-	1	5	3	3	6	-	-	-
1921	-	-	-	-	1	1	-	12	8	-	1	-
1922	-	-	-	2	1	4	4	7	4	-	-	-
1923	-	-	-	-	-	1	8	1	3	3	3	1
1924	-	-	-	-	1	-	6	2	1	-	-	-
1925	1	-	-	-	2	2	7	9	4	-	-	-
1926	-	-	-	-	2	9	9	2	1	1	2	-
1927	-	-	-	-	4	1	10	4	5	1	-	-
1928	-	-	-	-	-	8	5	4	4	2	-	-
1929	-	-	-	-	-	-	-	4	6	-	-	-
1930	-	-	-	-	2	11	5	3	3	1	-	-
1931	-	-	-	-	-	2	8	1	3	-	-	-
1932	-	-	-	-	1	6	8	5	2	-	2	1
1933	-	1	-	-	-	-	2	2	5	-	-	1
1934	2	-	-	-	2	-	8	4	9	1	-	-
1935	-	-	-	-	1	3	8	-	4	-	-	-
1936	-	-	-	-	1	3	5	3	-	-	-	-
1937	-	-	-	1	-	3	10	1	1	-	-	-
1938	-	-	-	-	2	1	3	8	-	-	-	1
1939	4	-	-	-	1	2	4	4	2	1	-	2
1940	-	-	-	1	-	3	10	3	1	-	-	-
1941	-	-	-	-	2	4	5	3	6	-	1	2
1942	-	-	-	1	-	2	8	7	4	-	-	-
1943	1	-	-	-	-	3	6	6	3	1	-	-

HALL'S CREEK CLIMATE: Rainy days (25 points and over)
(1920 - 1943)

Year	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.
1920	1	-	3	1	4	4	1	2	2	-	-	-
1921	-	-	-	-	2	2	-	8	7	-	-	-
1922	-	-	-	2	3	8	4	5	7	1	-	-
1923	-	-	-	1	1	6	4	2	3	2	1	1
1924	-	-	-	-	-	1	6	1	-	-	-	-
1925	1	-	-	1	1	3	7	12	3	-	1	-
1926	-	-	-	-	-	9	15	3	4	3	1	-
1927	-	-	-	1	5	1	13	5	5	-	1	-
1928	-	-	-	1	1	6	2	3	1	1	-	1
1929	-	-	-	-	2	-	1	2	5	-	-	-
1930	-	-	-	1	3	11	4	7	-	-	-	-
1931	-	-	1	-	1	-	7	1	3	-	-	-
1932	-	-	-	-	1	6	9	2	2	1	3	2
1933	-	1	-	-	-	4	1	2	3	-	-	-
1934	4	-	-	-	2	1	4	6	4	2	-	-
1935	-	-	-	-	-	1	6	5	5	-	-	-
1936	-	-	-	1	1	3	2	3	1	-	-	-
1937	-	-	-	-	-	3	15	-	2	1	-	-
1938	1	-	-	-	3	1	4	6	-	-	-	1
1939	3	-	-	-	3	1	3	7	2	1	-	1
1940	-	-	-	1	-	-	7	4	-	1	-	-
1941	-	-	-	-	-	3	2	-	6	-	1	3
1942	-	-	-	1	3	-	13	5	4	-	2	-
1943	1	-	-	-	-	4	5	4	6	-	-	-

PORT GEORGE LV (Kummunya) Climate Rainfall: months above (x) 2inches..

Year	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.
1920	x	-	-	x	x	x	x	x	x	x	-	-
1921	-	-	-	-	-	x	x	x	x	-	x	-
1922	-	-	-	-	-	x	x	x	x	-	-	-
1923	-	-	-	-	x	x	x	x	x	x	-	-
1924	-	-	-	-	x	-	x	x	x	-	-	-
1925	-	-	-	-	-	x	x	x	x	-	-	-
1926	-	-	-	-	x	x	x	x	x	x	x	-
1927	-	-	-	-	x	x	x	x	x	-	-	-
1928	-	-	-	-	-	x	x	x	x	x	-	-
1929	-	-	-	-	-	-	x	x	x	-	-	-
1930	-	-	-	-	x	x	x	x	x	-	-	-
1931	-	-	-	-	-	-	x	-	x	-	x	-
1932	-	-	-	-	-	x	x	x	x	x	-	-
1933	-	-	-	-	-	x	x	x	x	x	-	-
1934	-	-	-	-	-	x	x	x	x	x	-	-
1935	-	-	-	-	-	-	x	x	x	-	-	-
1936	-	-	-	-	-	x	xx	x	x	-	-	-
1937	-	-	-	-	-	x	x	x	x	-	-	-
1938	-	-	-	-	x	x	x	x	x	-	-	x
1939	-	-	-	-	-	-	x	x	x	-	-	x
1940	-	-	-	-	-	x	x	x	x	-	-	-
1941	-	-	-	-	-	x	x	x	x	-	x	x
1942	-	-	-	-	-	x	x	x	x	x	x	-
1943	-	-	-	-	x	x	x	x	x	-	-	-

WYNDAM CLIMATE Rainfall: months above (x) and below 2 inches

Year	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.
1920	-	-	-	-	x	x	x	-	x	-	-	-
1921	-	-	-	-	x	x	-	x	x	-	-	-
1922	-	-	-	-	-	x	x	x	x	-	-	-
1923	-	-	-	-	x	x	x	x	x	-	-	-
1924	-	-	-	-	-	-	x	x	x	-	-	-
1925	-	-	-	-	-	x	x	x	x	-	-	-
1926	-	-	-	-	x	x	x	x	x	-	-	-
1927	-	-	-	-	x	x	x	x	x	-	-	-
1928	-	-	-	-	-	x	x	x	x	-	-	-
1929	-	-	-	-	-	-	x	x	x	-	-	-
1930	-	-	-	-	-	x	-	x	-	-	-	-
1931	-	-	-	-	x	-	x	x	x	-	-	-
1932	-	-	-	-	-	x	-	x	x	-	-	-
1933	-	-	-	-	-	x	-	-	x	-	-	-
1934	-	-	-	-	x	-	x	x	x	-	-	-
1935	-	-	-	-	-	-	x	x	x	-	-	-
1936	-	-	-	-	-	-	x	-	x	-	-	-
1937	-	-	-	-	-	x	x	-	-	-	-	-
1938	-	-	-	-	x	-	x	x	-	-	-	-
1939	-	-	-	-	x	x	x	x	x	-	-	x
1940	-	-	-	-	-	x	x	x	x	-	-	-
1941	-	-	-	-	x	x	x	x	x	-	-	-
1942	-	-	-	-	-	x	x	x	x	-	x	-
1943	-	-	-	-	-	-	x	x	x	-	-	-

TURKEY CREEK CLIMATE: Rainfall: months above (x) ans below (-) 2 inches

Year	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.
1920	-	-	-	-	x	-	x	x	x	-	-	-
1921	-	-	-	-	-	x	-	x	x	-	-	-
1922	-	-	-	x	x	x	x	x	x	-	-	-
1923	-	-	-	-	-	x	x	x	x	x	-	-
1924	-	-	-	x	x	-	x	-	-	-	-	-
1925	-	-	-	-	-	x	x	x	x	-	-	-
1926	-	-	-	-	-	x	x	x	x	-	-	-
1927	-	-	-	-	-	-	x	x	x	-	-	-
1928	-	-	-	-	-	x	x	x	x	-	-	-
1929	-	-	-	-	-	-	-	-	-	-	-	-
1930	-	-	-	-	x	x	x	x	-	-	-	-
1931	-	-	-	-	-	-	x	-	x	x	-	-
1932	-	-	-	-	-	x	x	x	x	-	-	-
1933	-	-	-	-	-	x	-	x	x	-	-	-
1934	x	-	-	-	x	-	x	x	x	-	-	-
1935	-	-	-	-	x	-	x	x	x	-	-	-
1936	-	-	-	-	-	x	x	-	-	-	-	-
1937	-	-	-	-	-	x	x	x	-	-	-	-
1938	-	-	-	-	x	-	x	x	-	-	-	-
1939	x	-	-	-	x	x	x	x	x	x	-	x
1940	-	-	-	-	-	x	x	x	-	-	-	-
1941	-	-	-	-	-	x	x	-	x	-	x	x
1942	(No rainfall records after May 1942)											

FITZROY CROOSING CLIMATE: Rainfall: months above (x) and below (-) 2 inches

Year.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Ju.
1920	-	-	-	-	-	x	x	x	x	-	-	-
1921	-	-	-	-	-	-	-	x	x	-	-	-
1922	-	-	-	-	-	x	x	x	x	-	-	-
1923	-	-	-	-	-	-	x	-	x	x	x	-
1924	-	-	-	-	-	-	x	-	-	-	-	-
1925	-	-	-	-	-	x	x	x	x	-	-	-
1926	-	-	-	-	-	x	x	x	-	-	-	-
1927	-	-	-	-	x	-	x	x	x	x	-	-
1928	-	-	-	-	-	x	x	x	x	-	-	-
1929	-	-	-	-	-	-	-	x	x	-	-	-
1930	-	-	-	-	-	x	x	x	x	-	-	-
1931	-	-	-	-	-	-	x	-	x	-	-	-
1932	-	-	-	-	-	x	x	x	-	-	-	-
1933	-	-	-	-	-	-	x	x	x	-	-	-
1934	x	-	-	-	-	-	x	x	x	-	-	-
1935	-	-	-	-	-	-	x	-	x	-	-	-
1936	-	-	-	-	-	x	x	x	-	-	-	-
1937	-	-	-	-	-	x	x	x	-	-	-	-
1938	-	-	-	-	-	-	x	x	-	-	-	-
1939	x	-	-	-	-	-	x	x	-	-	-	-
1940	-	-	-	-	-	-	xxx	x	x	-	-	-
1941	-	-	-	-	-	x	x	x	x	-	-	x
1942	-	-	-	-	-	x	x	x	x	-	-	-
1943	-	-	-	-	-	-	x	x	x	x	-	-

HALL'S CREEK CLIMATE: Rainfall; months above (x) and below (-) 2 inches .

Year	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.
1920	-	-	x	x	x	x	-	-	-	-	-	-
1921	-	-	-	-	-	-	-	x	x	-	-	-
1922	-	-	-	-	-	x	x	x	x	-	-	-
1923	-	-	-	-	-	x	x	-	x	-	-	-
1924	-	-	-	-	-	-	x	-	-	-	-	-
1925	-	-	-	-	-	x	x	x	x	-	-	-
1926	-	-	-	-	-	x	x	x	x	-	-	-
1927	-	-	-	-	x	-	x	x	x	-	-	-
1928	-	-	-	-	-	x	x	-	-	-	-	-
1929	-	-	-	-	-	-	-	x	x	-	-	-
1930	-	-	-	-	x	x	x	x	-	-	-	-
1931	-	-	-	-	-	-	x	-	x	-	-	-
1932	-	-	-	-	-	x	x	x	-	-	-	-
1933	-	-	-	-	-	x	-	x	x	-	-	-
1934	x	-	-	-	-	-	-	x	x	-	-	-
1935	-	-	-	-	-	-	x	-	x	-	-	-
1936	-	-	-	-	-	x	-	x	-	-	-	-
1937	-	-	-	-	-	x	x	-	-	-	-	-
1938	-	-	-	-	-	-	x	x	-	-	-	-
1939	-	-	-	-	-	-	x	x	x	-	-	-
1940	-	-	-	-	-	-	x	x	-	-	-	-
1941	-	-	-	-	-	x	x	-	x	-	x	x
1942	-	-	-	-	x	-	x	x	x	-	-	-
1943	-	-	-	-	-	x	x	x	x	-	-	-

RAINFALL VARIABILITY

Table showing annual rainfall and departure from the average

Aver.	Port Geo. (5039)	Turkey Cr. (2714)	Derby. (2530)	Wyndham (2510)	Fitzroy (2110)	Hall's Ck (1961)
1901		2870+ 156	1374-1156	2064- 446	2304+ 194	1825- 136
1902		2474- 240	1593- 937	3017+ 507	1272- 738	1736- 226
1903		5041+2327	2579+ 49	5325+2815	3002+ 892	4202+2241
1904		2884+ 170	3314+784	3574+1064	3091+ 981	3055+1094
1905		2158- 556	1610- 920	1440-1070	1165- 945	854-1107
1906		3097+ 383	3243+ 713	2834+ 324	2239+ 129	1589- 372
1907		3713+ 999	2482- 48	2551+ 41	2819+ 709	2141+ 180
1908		3290+ 576	3060+ 530	1531- 979	2285+ 175	1383- 578
1909		3393+ 679	3262- 369	2074- 436	1095-1015	1944- 17
1910		4549+1835	2313- 217	3511+1001	1756- 354	2400+ 439
1911		2805+ 91	1343-1187	2071- 439	1418- 692	2170+ 209
1912		2492- 222	2747+ 217	2320- 190	1979- 131	1190- 771
1913		3165+ 451	1739- 791	2791+ 281	1992- 118	1559- 402
1914		4115+1401	2893+ 363	2050- 460	2808+ 698	3622+1661
1915	~~6074+1035~~	3022+ 308	2496- 34	2032- 478	2504+ 394	1677- 284
1916	6099+1060	2872+ 158	3227+ 697	3205+ 695	3195+1085	2292+ 331
1917	8146+3107	3076+ 362	9485+6955	3070+ 560	2289+ 179	2220+ 259
1918	5730+ 619	3505+ 791	2401- 129	2922+ 412	2028- 82	2019+ 58
1919	4835- 204	2672- 42	2900+ 370	3622+1112	2100- 10	1718- 243
1920	7567+2428	2345- 369	2995+ 465	1759- 751	2067- 43	1369- 592
1921	5475+ 436	2583- 131	1577- 953	2560+ 50	2485+ 375	1975+ 14
1922	4897- 142	4293+1579	2046- 484	2710+200	1866- 244	3336+1375
1923	5713+ 674	2963+ 249	2163- 367	2380- 130	2429+ 319	1994+ 33
1924	2068-2971	1465-1249	439-2091	1722- 788	940-1170	869-1029
1925	3313-1726	2204- 510	1609- 921	3419+ 909	2089- 21	1873- 88
1926	8243+3207	3694+ 980	4690+2160	3584+1074	2722+ 612	3997+2036
1927	5194+ 155	2418- 296	2050- 480	2861+ 351	3359+1249	2396+ 435
1928	2436-2603	1498-1216	1398-1132	2510+	2384+ 174	1228- 732
1929	4412- 627	1215-1499	1835- 695	2336- 174	1243- 867	987-- 974
1930	5977+ 938	2380- 334	3364+ 834	2472- 38	2699+ 589	2738+ 777
1931	3509-1530	1765- 949	3316+ 786	2463- 47	1042-1068	1184- 777
1932	4087- 952	1701-1013	3640+1110	1745- 765	2272+ 162	1634- 327
1933	3508-1531	1690-1024	2045- 485	1576- 934	1232-878	1207- 754
1934	6174+1135	1669-1045	2633+ 103	2075- 435	2414+ 304	1577- 384
1935	4613- 426	2755+ 41	2211- 319	2247- 263	1454- 656	1724- 237
1936	3020-2019	1506-1208	1588- 942	1438-1072	1229- 881	110-1081
1937	4672- 367	3687- 27	1783- 747	2814+ 304	1508- 602	1612- 349
1938	3879-1160	1816-1598	1422-1108	1818- 692	1626- 484	1780- 181
1939	5335+ 296	2878+ 164	1978- 552	2998+ 488	1709- 401	2028+ 67
1940	5112+ 73	3060+ 346	2413- 118	3841+1331	2164+ 54	1299- 662
1941	5258+ 219	---- ~~2888~~	2538+ 8	2012- 498	2012- 98	1723- 238
1942	6437+1398	---- ----	3421+ 691	5634+3124	2434+ 324	2241+ 280
1943	4324- 715	---- ----	3278+ 548	2204- 306	2438+ 328	1825- 136
1944	---- ---	---- ----	---- ---	2629+ 119	---- ---	---- ---

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III. DISCOVERY AND DEVELOPMENT

It was on the Kimberley shore that William Dampier landed in 1699 in H.S."Roebuck". near a point where Broome stands today. His description of the country was anything but reassuring, and it it was not until the early years of the last century that any attempt was made to survey even the coastline. Between 1800 and 1820 coastal surveys were made for the British Admiralty by Captain King and officers of the 'Beagle' under Captain Wickham and Captain Stokes. The Fitzroy River was discovered and named; and Alan Cunningham, the botanist who accompanied Captain King, made two or three voyages to the Kimberley coast between 1816 and 1820, collecting plant specimens, principally in the vicinity of King Sound, the Prince Regent River, Brunswick and Vansittart bays and Cambridge Gulf. It is plain from the nature of these extensive collections that Cunningham travelled at least some little distance inland.

The first inland party to explore part of the Kimberley plateau was that under Lieut Grey (afterwards Sir George Grey). Landing at Hanover Bay on the 2nd. December 1837, Grey remained until the middle of April 1838, during which time he explored the country around Camden Sound, the Prince Regent River estuary and the Lushington Valley; and, striking across the MacDonald Range, he came to the Glenelg River, which he explored from near its estuary to a point near the Elizabeth-Catherine Range, from whence he had to return, being defeated by the nature of the country, including the flooded streams, as well as experiencing trouble from the natives. Grey's Description of the basaltic country between Mount Lyell and Mount Trevor mentions thirty or forty miles of plain or low-lying luxuriant country broken only by conical peaks and rounded hills richly grassed to their summits. He states, "Since I Have Visited this spot I have traversed large portions of Australia, but have seen no land, no scenery to equal it. We were upon the confines of a great volcanic district, cloth-ed with tropical vegetation to which the Isle of France bears a greater resemblance than any other portion of the world which I am acquainted with; the rocks in both places are identical; many of the trees the same, and there are several other close and strik

striking points of similarity." From the MacDonald Range Grey had seen the "remarkable blue peaks to the south" which are the King Leopold Range, but the perpendicular cliffs of the Elizabeth Catherine Range proved a barrier too formidable for him to cross. When first landed the party experienced difficulty in finding fresh water at the coast, but soon the complaint was of too much water, of tropical thunderstorms which lasted for days. The "dry cascades" that fell over cliffs two hundred feet in December were in January transformed into waterfalls that carried masses of large stones, and it is interesting to note that in December, when he speaks of these " dry cascades", that is, before any mention is made of rain, Grey refers to the Lushington Brook as being a rapid stream. On the Glenelg River the party was held up for some time by extensive tracts of marshy ground near the river and its tributaries. In February torrential rains were experienced accompanied by cold weather, wind and thunder, and the rain often lasted unintermittently for several days. Six wet days occurred late in December; 19 in January; seven in February, twelve in March and two in April before the 12th. day of the month. In January it rained without ceasing from the 12th. th the 29th. Grey states in reference to the heaviness of the showers, "One single heavy tropical shower of only a few hours' duration, washed down, over a plot of ground which was planted with barley, a bed of sand nearly five inches deep, which in succeeding showers again swept off, carrying it further upon its way to the sea." Mention is made in the report of groves of nutmeg trees, and forests of Callitris pine. Two types of valleys are described: those which are ravines, broad and deep, and valleys of great width bordered by fertile plains, often extensive and occurring where the basaltic rocks have developed. Grey also mentions the occurrence of the numerous partially subterranean streams.

In 1856, A.C. Gregory, accompanied by his brother and the Government Botanist of Victoria (Baron Sir Ferdinand von Mueller) reached the Victoria River and Sturt Creek on a journey of exploration, one of the purposes of which was a search for the missing explorer Leichhardt. The party traveres Sturt Creek in Western Australia as far south as Latitude 20°16' s., and discovered en route the Denison Plains and the Antrim Plateau. The pastoral

richness of this area resulted in country being settled shortly afterwards in the Victoria River district.

Traverton C. Shaw explored to the south of the Prince Regent River in 1865, crossing the King Leopold Range; and in the following year Surveyor Cowle explored between Roebuck Bay and Port Walcott, giving a favourable account of the coutry he traversed. An attempt was made shortly afterwards to establish a settlement at Camden Sound for the purpose of devoloping the glenelg River district. Sholl, who was in charge of this travelled along the Glenelg River in 1867, and entered the country to the south which Grey had seen only from its northern boundary. This basaltic undulating tract he named the "Panter Downs."

In 1879, Alexander Forrest travelled from the De Grey River to Beagle Bay, and thence traversed the Fitzroy River for two hundred and forty miles. From here he turned northwards in an attempt to cross the King Leopold Range, but he reached the seaboard at Secure Bay without discovering a practicable pass; and returning to the Fitzroy River, traversed the Margaret River to its source near Hall's Creek, later reaching the Ord River. Forrest speaks of the "splendid grassland" he traversed on the highlands near Hall's Creek. In 1882, Surveyor Pentecost explored the country to the west of the Ord River, ascending the plateau and discovering and naming the Bow and Durack rivers. John Forrest landed at Roebuck Bay in 1883, and traversed the Fitzroy, Margaret May, Lennard and Richenda rivers, discovering rich grass plains. E.T.Hardman, the geologist attached to the party, found gold between Mount Broome and the upper Margaret River during this journey. Hardman's discovery of gold in Kimberley led to further explorations along the Fitzroy and Ord Rivers as far as the confluence of the Ord and Negri rivers in 1884, and in the following year Johnson and Nyulasy mapped the course of the lower Ord river including the tributaries Fraser and Behn rivers. In 1885 Hall and Slattery discovered gold at Hall's Creek. In 1896, the Calvert Expedition, travelling from Lake Way (Wiluna), via Joanna Springs, reached the Fitzroy River in the vicinity of Noonkanbah.

So far, with exception of the short fourneys made by Grey, Shaw and Sholl, and the eastern ascent of the plateau made by Pentecost nothing was known of the vast plateau area, while the country along the Fitzroy and Ord rivers had been fairly thoroughly explored. Already, attracted by the descriptions given by Alexander Forrest and Pentecost, the Durack brothers, in search of land for pastoral purposes had travelled overland from Queensland, and settled at Argyle Station on the lower Ord River in 1885. By this time pastoral development had commenced on the Lower Fitzroy River, and the discovery of gold in considerable quantities at Hall's Creek was attracting further development . In this way the route from Derby to Wyndham was opened: Emanuel Brothers were developing the Fitzroy lands, and the Durack Brothers the Ord country, while the increasing importance of Hall's Creek determined the route of this overland track from Broome to Wyndham, while at the same time Hall's Creek was situated in a spot which rendered any passage of the plateau unnecessary, and thus the country " over the Leopolds" still remained a terra incognita. In 1890, during the months March, April and part of May, Mr. Joseph Bradshaw, accompanied by Allen Conducted a private exploring expedition from Camgridge gulf to the Prince Regent River, discovering the Drysdale Carson and Woodhouse rivers en route, as well as exploring the upper Prince Regent River on its eastern side, and the country near the head of the Roe River. Bradshaw is commemorated by Mount Bradshaw, a magnetic hill not far removed from the source of the Moran River.

It was left to another explorer private explorer to accomplish in the closing years of the last century what Alexander had Forrest had failed to do nearly twenty years earlier, namely , the northern crossing of the King Leopold Range. Frank Hugh Hann left Lawn hill, on the Gulf of Carpentaria on the 1st. April 1896 for Western Australia. Leaving Victoria River Station he travelled by way of the Baines River and Auvergne Station. Following the Baines River to its source he travelled across the divide and along the Negri River to the Ord River. He followed the Ord River to Hall's Creek and thence travelled sixty miles to the south of Mount Dockerell. From here it was his intention to travel directly across to the Oakover River, but after nearly perishing in the desert he abandoned this attempt. Discovering Christmas Creek on the 25th. December 1896, he followed it down to the Fitzroy River, and , travelling by way of Broome and the Nineyt Mile Beach, Roebourne, and the Fortescue River, he at last

reached the Oakover, and discovered and named the Rudall River to the east. Having lost several horses from poison plants, Hann's intention was to return to Queensland, but while in Derby on the return trip he met Inspector Ord of the Police Department, who advised him to go to mount Broome where, at the foot of the King Leopold Range gold diggers were securing gold. Although both prospector and pastoralist, Hann was first and formost an explorer, and immediately upon arrival he ascended Mount Broome, as he says " with difficulty", because of the steep track for horses, and descending the northern slope came to the upper Lennard River and Bell Creek, but found turther progress barred by the Precipice Range and Bold Bluff. Ascending the latter he viewed excellent and well watered country to the north and east, and after exploring eastward as far as Mount Ord, which he named, he was obliged to return down the Lennard River, and, skirting the western side of Bold Bluff passed along the northern face of the Precipice Range to the Adcock River, Mount House and Mount Clifton. After turning north west he came to the Isdell River, which he followed as far as a "terrible gorge". He determined to select an area of this marvellous country and since the natives proved hostile and supplies were running short he resolved to return to Derby to equip himself for a further exploration. He therefore returned via Bold Bluff, and Mount Broome, after an encounter with the natives in a narrow valley in the King Leopold Range.

The services of Inspector Ord being available, Hann retured toMount Broome, crossing on the west side of the mountain on the 9th. July 1898, thence again up the Lennard River to the vicinity of Mount Ord, and via the Broadhurst Pass to the foot of Bold Bl uff. Skirting the Precipice Range he encountered rich basaltic country which he followed to the Adcock River. Travelling northwards he then came to the Isdell River near Plover Hill; traversing this as far as the middle gorge in the Isdell Range he retraced his steps and followed the Adcock River to Mount House, and after passing Mount Clifton continued along the Adcock River to its confluence with the Fitzroy River. It was in this vicinity that Ord left Hann, returning to Fitzroy Crossing. Both Hann and Ord are

in agreement in describing this country as excellent pastoral c country, well providee with permanent running streams, rich in basaltic plains and undulations with fine grass, and rivers well stocked with fish. Hann continued with his small party of Queensland natives, and after the circumambulation of Mount Brennan and meanderings to the east came once more to the Fitzroy River at the Sir John Gorge, which he describes as being two hundred feet deep and cut through solid rock, the Fitzroy River following this course between the Sir John and Warton ranges. Further progress to the east being impossible, Hann turned northwards, following a stream which he named the Phillips, but which is now known as the Hann River, the principal and only permanent tributary of the Fitzroy River. Hann describes the Hann River as one of the finest streams he had seen, flowing through excellent pastoral country, but Hann, being unable to negotiate the Phillips Gorge, travelled round the west end of the rangr via the Packhorse Range, and followd the Barnett River down to its confluence with the Hann River, only to find himself confronted with a further gorge upstream through the Barnett-Harris plateau. Retracing his steps he travelled west round Mount Barnett, and returned to the Hann River at Bella Creek. He was now near the source of the Hann River, but being puzzled by the quantity of water running down its bed, which increased the nearer he got to the source, he determined to investigate. Very rough sandstone country howeverprevented him from doing this, and at Mount Elizabeth he was compelled to make a detour to travel westwards to Rocky Mountain at the source of the Isdell River, He was now on top of the Main divide of the plateau. To the north he saw Mount Agnes, but the rough country intervening prevented him from travelling much further in this direction. He still describes the country on the divide as being well watered with running streams (and this is August towards the driest period of the year). Travelling westwards from Rocky Mountain he came to the Headwaters of the Charnley River, where black bream were abundant. Hann gives a vivid description of the rough travelling down the Charnley River, and of the wild gorges through which the streams from the north enter the Charnley River. There are two sandstone ranges in theis locality: one, the Edkins,

lies parallel to the river on its northern side, while to the south is the Artesian Range. They are probably the same physiographical feature, obliquely bisected by the Charnley River which traverses the system through a series of gorges, of which one is over twenty miles long and between four and five hundred feet deep. Here Hann's troubles commenced. He was losing horseshoes at a rate which he could not replace, and the country was extremely rough. He speaks of grand grass and springs everywhere. "The river now came round to the South West for four miles, after which the course was generally west. I now had to leave the river as its banks were too rough for travel, and by keeping South I hoped to get down the range. The shoes were being lost wholesale, the nails were nearly all gone, and there seems to be bad time looming ahead for the unshod horses. The flood marks here are very high, and as we rode along the country was something fearful for stones, and the river had cut clean through a big range. To look along that range it would appear incredible that any river could cut its way through, yet it has done so." Proceeding further along the river, Hann at last came to the main Charnley gorge, which he describes as being four hundred feet deep and completely blocking any further passage to the west. One of Hann's statements at this point is worthy of mention, " Nature has been a wonderful engineer here. She has the ranges terribly rough, and forgot to leave any room for the rivers to pass, so she set to work to cut a passage for them through the ranges." The statement is certainly descriptive, for the streams do not follow the courses one would expect, and the number of subterranean streams causes one to surmise that some of these strange gorges were originally formed below the surface.

Turning southwards, Hann traversed the Artesian Range, which he named from the prevalence of springs; and, proceeding by way of the basalt country, he passed the Dromedaries and Quartz Hill, arriving at the lower Isdell River near the Sprigg River and Junction Hill.Crossing the IsdellRiver, he ascended Mount (Mt.Phil and discovered with little difficulty a route which at the cost of " a few hundred pounds" could be made into a good dray track.

The pass, which is eleven miles long, is well watered, and cuts th through the King Leopold Range by means of a deep gorge on the south east side of Mount Mathew. This pass is called 'Hann's Pass', and when I travelled over it in 1921, the baobab trees which Hann used to mark his route still bore the letters 'F.H.' quite clearly cut on the trunks. It was late September or early October when Hann again crossed the King Leopold Range. While giving a glowing account of the country he had recently traversed most of which was excellent pastoral country with the exception of poor country encountered on the Caroline Range and the Charnley River he said: "as soon as we left the Range we found the country changed rapidly for the worse; I have not seen the Barker but I think this must be the same river. The creek here does not run, and the water is bad. That night we had to dig holes in the sand to water our horses. What a change from the country we had just passed through."

After passing over the spot in October 1921, my impressions were much the same as Hann's, and there is no doubt that the country "over the Leopolds" is another world compared to the land to the south of the King Leopold Range.

Hann's explorations, embracing a considerable portion of the plateau which it is proposed should bear his name, brought to a close the Kimberley exploratory work of the last century.

In 1901, F.S.Brockman, with a large party, including Mr. Charles Crossland as Second in Command, Mr.A.Gibb Maitland, Government Geologist, Mr. Gibson, Assistant Geologist, and Dr. F.M House, Surgeon, Naturalist and Botanist, spend seven months in exploring the Hann Plateau. Ascending its eastern escarpment by way of a declivity from the narrow valley of the Pentecost River (Chamberlain River) in Lat. 17° S., the party travelled over an elevation of roughly one thousand feet across undulating tableland country of a poor description. The Durack River, where it was crossed, was described as second class country.A change was noticed when the basalt country was encountered at Bella Creek on the Hann River, Brockman speaking of the basaltic soil as being w washed down from the country to the north. The Hann River was traversed, and the party travelled westwards to the Isdell River

which was followed upstream near its source for ten miles to Rocky Mountain and the head of the Charnley River along Hann's Route. Speaking of the upper Charnley River, Brockman says that this lies at a lower elevation than the surrounding country, and is flanked on the south side by well grassed basaltic hills and plains, while to the north are high sandstone ranges. All the rivers and their tributaries contain good supplies of water ,and some of the pools conrained considerable numbers of fish. The greater part of the country, howeveer, is described as being of a very poor description, unfit for stock raising or for cultivation, the plateau being seamed by deep gorges, and the country generally very rough. Brockman travelled down the CHarnley River to Hann's tree 'H32' near the junction of the Pearson River, after which five days were spent in endeavouring to discover a north west passage along the river, but without success, owing to the rugged nature of the terrain. Establishing a depot camp at 'F.B.32, (Long 125° 19', Lat. 16° 25') Crossland and Maitland went southwards to examine the country to the south as far as the King Leopold Range, and ascertain the source of the Isdell River, While Brockman and Gibson started northwards to connect with Grey's exploration of the Glenelg River. Crossing the Charnl ey River at Hann's camp 33, which brockman erroneously describes as Hann's furthest west camp on the Charnley River, Brockman Crossed the Edkins Range, discovering the Calder River, and travelled through well grassed basaltic hills and valleys to the Sale River, which divides the basalts to the south from the high sandstone country to to the north. This latter terrain was traversed through rugged country with deep gorges, until further westward, progress being impossible with horses, a course was set on foot for Mount Methuen, near the Whately Range and Ginson's Creek, which is described as a fine stream late in June. Returning twelve miles to the horses, and travelling south, the Sale River was again reached, and from the 15th. to the 20th. July, the basaltic country south of the Sale River and the head of Walcott Inlet were explored. Here, on the Calder River, the prospector Calder, of Derby, was met, who stated that he had not been able to get through to the

ranges to the immediate south of the Prince Regent River. Recrossing the Edkins Range, Brockman rejoined Crossland at 'F.B.32'. Returning north brockman traversed the Calder River for twenty five miles to where it emerges from a gorge in the sandstone country, and continuing northwards, reached on the 6th. August, a small tributary of the Prince Regent River in Lat. 15° 49' ('F.B.50'). Finding that he could not progeed further north, he travelled east for eleven miles to a canyon descending abruptly into high sandstone ranges, and following this canyon for ten miles he came to the fiord of the Prince Regent River, from which he sighted Mount Waterloo. Here Brockman found extensive sandstone caves on the south western cliffs of the Prince Regent fiord , together with native paintings. Retracing his steps to 'F.B.50' on the August, and exploring the roughly gorged sandstone country falling into the Prince Regent River, a practicable route was at last discovered in the direction of Mount Agnes. Turning north west once more, from 'F.B.50', a traverse was made to Bachsten Creek and the headwaters of the Glenelg River, which was followed to its estuary, the course being through rugged sandstone ranges with occasional basaltic intrusions(? Gibson), the country on the whole being described as poor. Mount Lyell and Mount Trevor were ascended on the 19th. August. Both are basaltic hills. Describing this country Brochman says:"The country in the neighbourhood of Mount Lyell, and stretching westwards from the angle of the Glenelg River is basaltic and splendidly grassed. The area, is however, not so well watered as most of the country, and the good pastoral land does not exceed a quarter of a million acres." Grey's route was followed on the 23rd. and 24th. August to a point where he crossed the glenelg River in Lat. 15° 47'. The greater partof this distance was over sandstone ridges with occasional basaltic valleys carrying good grass. Proceeding thence by way of rugged sandstone country, Brockman returned to the head of the Calder River.. Travelling slightly to the south of east, he ascende d Mount Agnes (Crossland having preceded him) and followed Crossland's tracks to the Drysdale River near Mount Hann on the 1st. September (C9). After ascending Mount Hann, which Crossland describes as resting on a

basaltic base, and spending a few days in this vicinity, the party again divided; Crossland, with Gibb Maitland, travelled east to explore the upper Drysdale and Gibb rivers, and portion of the Durack and Carson rivers; Brockman, travelling north west, came to the Moran and Roe rivers ~~flow below their~~ and followed these to the deep gorge into which the two rivers flow below their confluence. Here he noted a rich pocket of basaltic country almost surrounded by the two streams. Ascending Mount Bradshaw, (which he described as being basalt), rough country to the north was traversed until he came to the King Edward River, whichwas followed almost to Admiralty Gulf. For the first ten miles the river flows through well grassed basaltic country, after which it enters sandstone country, While mention is made of "ironstone." Steep sandstone cliffs to the east and south of Admiralty Gulf barred further progress, but the country behind them is described as being basaltic and well grassed. Returning to the King Edward River, Brockman followed this, mostly through fine basaltic grasslands, to the estuary. From here exploratory work was continued in a westerly direction to Vansittart Bay. Returning by way of Monger's Creek, Brockman crossed the King Edward River at the head of its basaltic gorge, and continued to the Drysdale River, near its estuary. The Drysdale River was traversed southwards across the fertile Barton Plain to 'F.B.90', where the river makes a sharp bend to the east, emerging from an impassible gorge in a rough sandstone range. The Barton Plain is described as being about twelve miles wide, bordered on the east side by a steel sandstone face, and on the west of the Drysdale River by undulating basalt country. After spending two days at the gorge, the time from the 31st. Oct. to the 3rd. Noverber was spent in traversing the river above the gorge through rugged sandstone country and gorges for about forty miles 'C.41', on an eastern tributary of the river at the north end of the Ashton Range. Banjo Creek and the Durack River country were then examined, and travelling by way of Mount Lawley and Mount Edith through "very patchy country", the party made a descent into the valley of the Chamberlain River (Pentecost) to the west of the Cockburn Range, Wyndham being reached on the 29th. November.

In his summary, Brockman speaks of two types of country on the Hann Plateau- a sandstone area comprising roughly three

quarters and a basaltic area embracing one quarter." Basalt appears to have originated in the neighbourhood of the 16th. parallel of latitude between 125° and 126° East Longitude, where it reaches a maximum altitude of 2500 feet. From there it extends irregularly in a South by West direction to the King Leopold Range, and North by East to the shores of Napier Broome Bay, with narrow arms following a number of valleys falling westerly to the coast on the east side of the Prince Regent River. The basalt appears to overlie the sandstone, since we found that the rivers and creeks were almost invariably running on sandstone beds. The sandstone area consists largely of tablelands with light sandy soils which (except in the neighbourhood of the higher basalt country) are very poorly grassed. They are usually seamed by deep gorges with very rugged sides."
(The italics are mine).

The last Kimberley Exploration Expedition was that led by W.R.Easton in 1921, to which I was attached as botanist. Leaving Kimberley Downs Station on the 10th. April, we travelled by way of the Lennard and Barker rivers and Wombarella Creek past Mount Amy to MountHart, passing through the King Leopold Range by a deep gorge recently discovered, and known as Gardiner's Gap. From here the basalt country was followed up the Isdell River to the vicinity of Grace's Knob. Crossing the Isdell River, and travelling through about twenty miles of good undulating basalt country, thence through sandstone plateau country of the Synmott Range, we made a descent, and after travelling over more undulating basalt country to the Charnley River at the head of a deep gorge in the Edkins Range, the depth of which was estimated to be five hundred feet. At this point the river is faced with a steep cliff on its southern side before it descends by waterfalls into the gorge, which is estimated as being about twenty five miles long. Having rafted supplies over the river, we crossed the Edkins Range after encountering some trouble in finding a practicable route for the horses and mules, and came to the Calder River, in basaltic country. Travelling in a N.N.W. diredtion over fertile basaltic country the Sale River was reached, where we were confronted by the very rough sandstone country mentioned by Brockman. After much searching, a route was discovered over the

PORT GEORGE CLIMATE

Number of wet days with 25 points or more of rain

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1945

1946

1947

WYNDHAM (ditto

1944

1945

1946

1947

TURKEY CREEK

1944

1945

1946

1947

FITZROY RBOSSING

1944

1945

1946

1947

HALL'S CREEK

1944

1945

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1947

RAINFALL 1944, 1945, 1946, 1947

Port George IV.

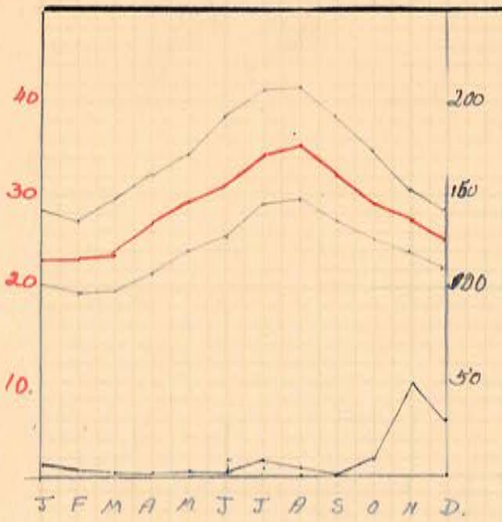
WYNDHAM

1941 onwards Turkey Creek

Fitzroy Crossing.

Hall's Creek

Derby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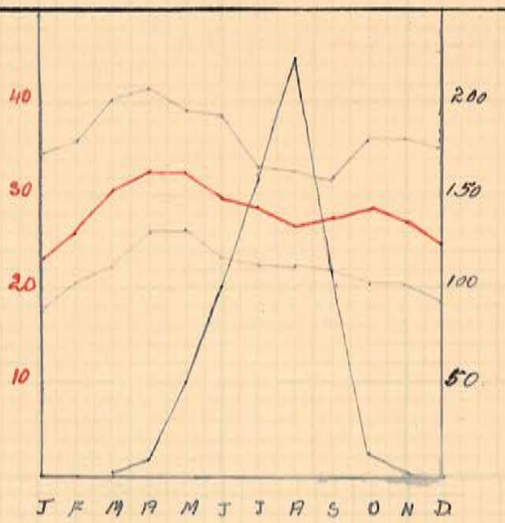
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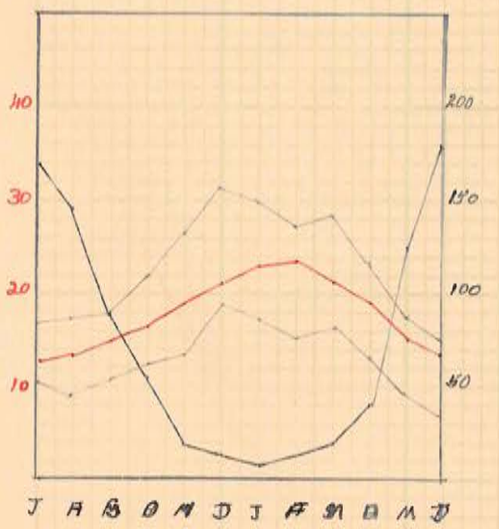
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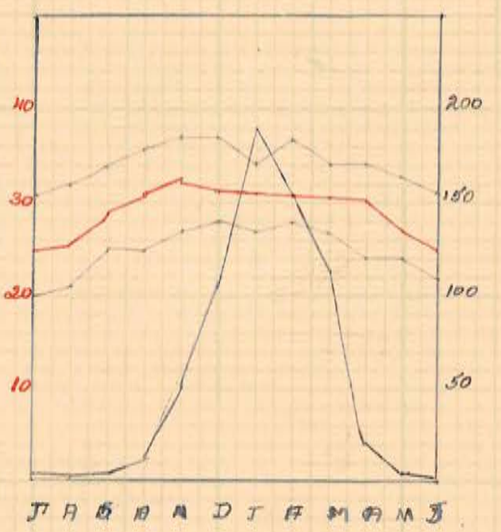
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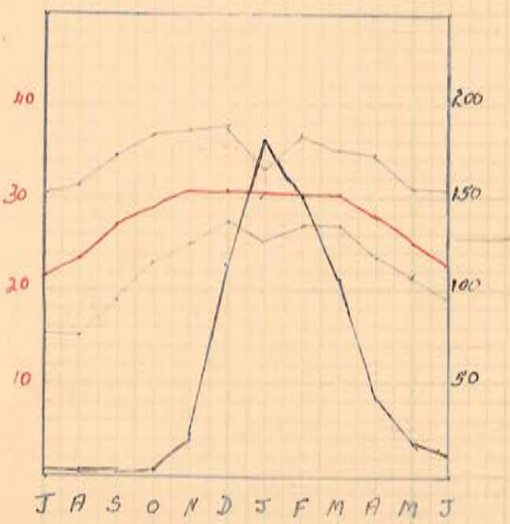
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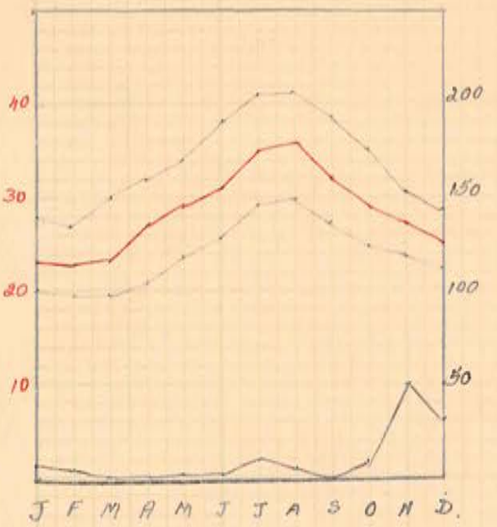
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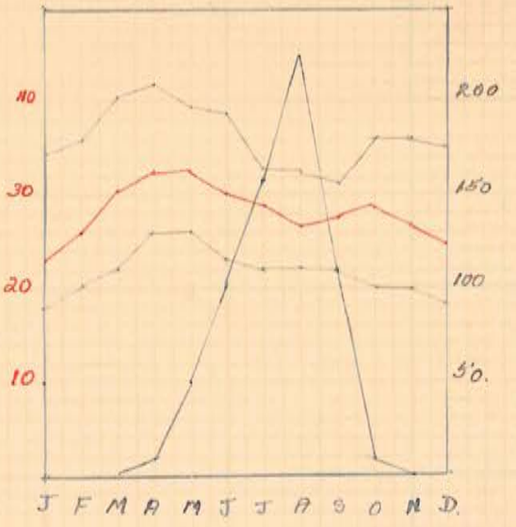
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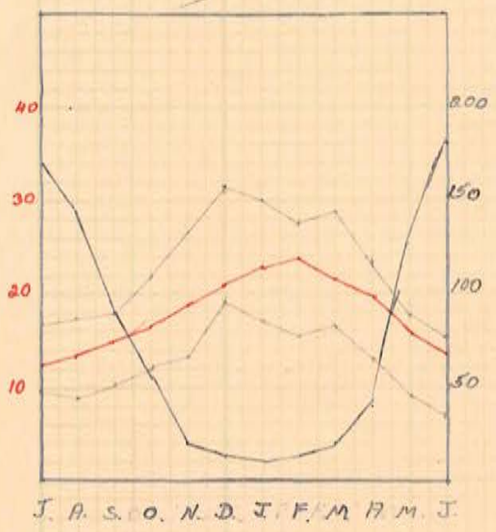
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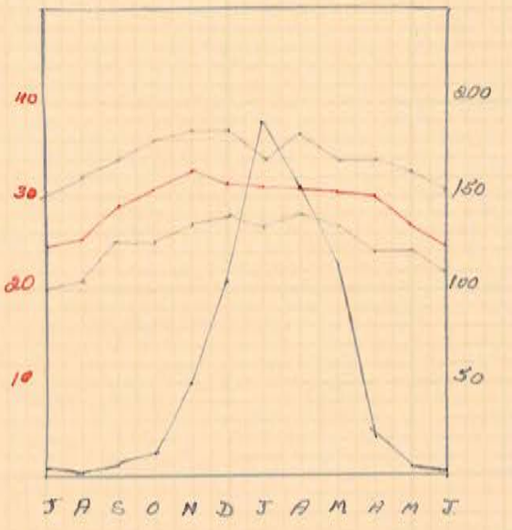
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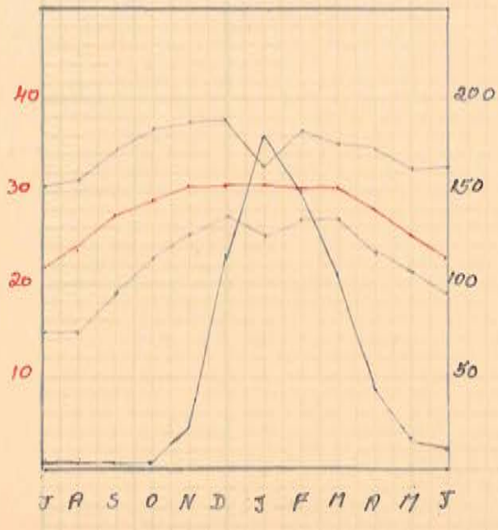
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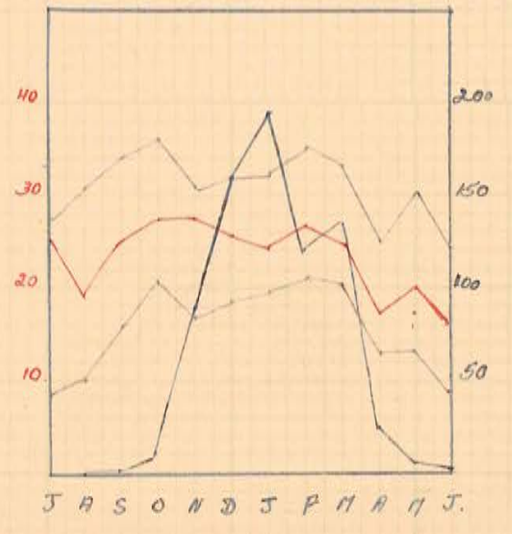
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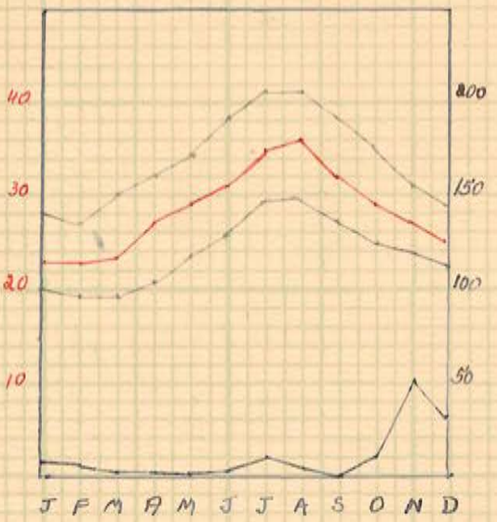
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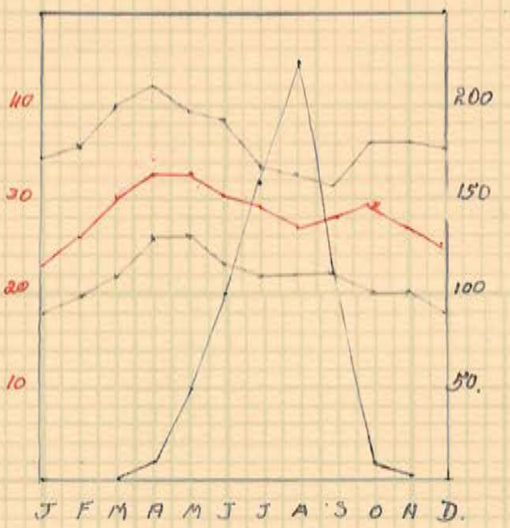
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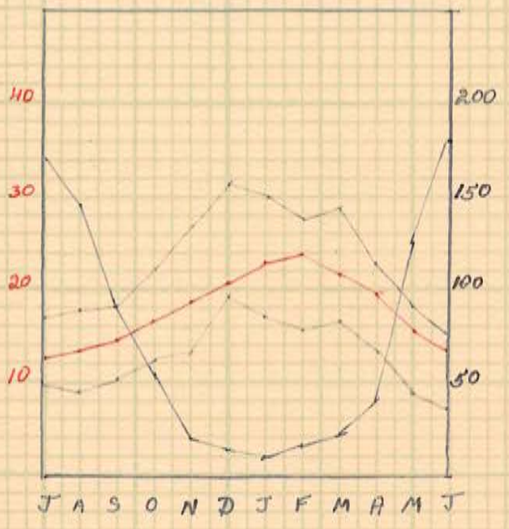
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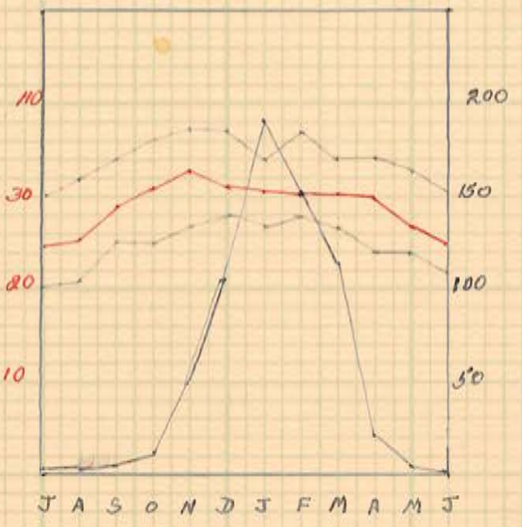
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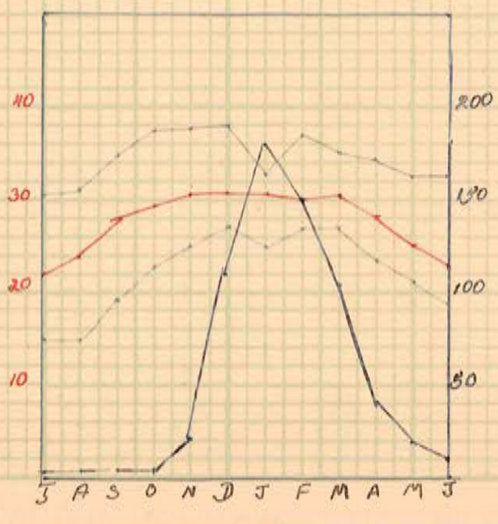
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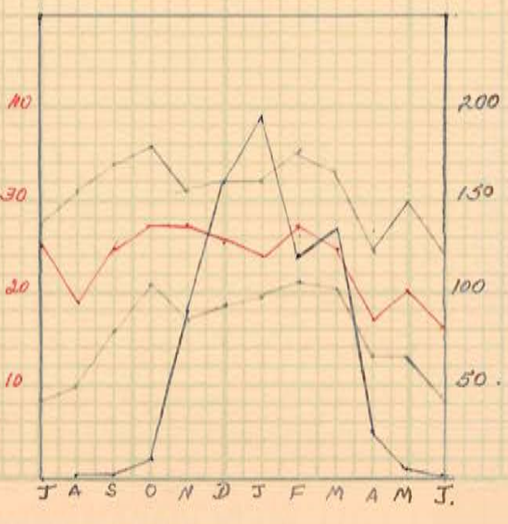
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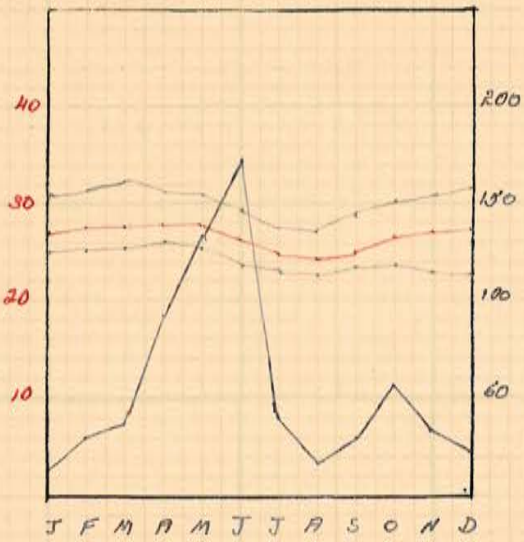
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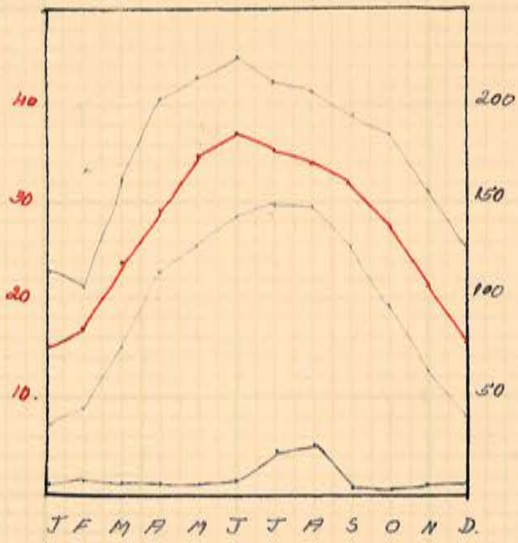
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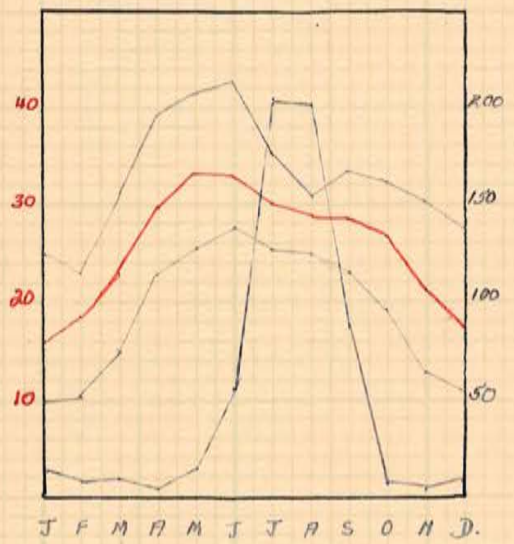
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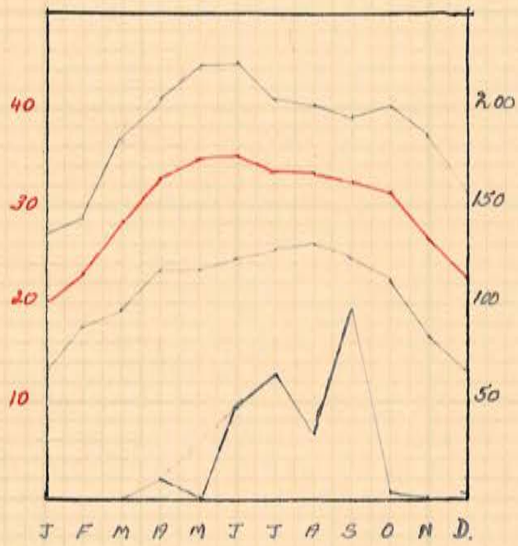
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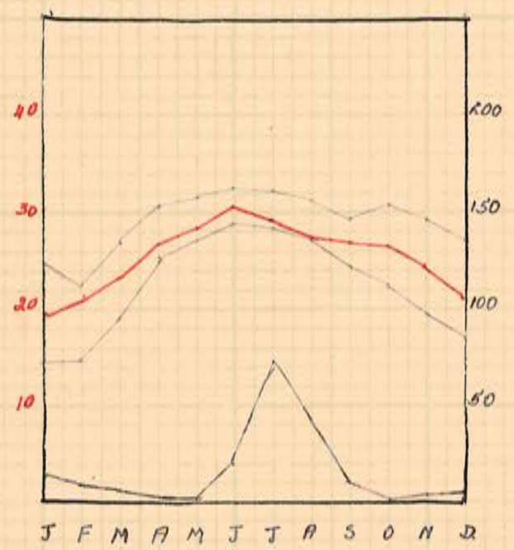
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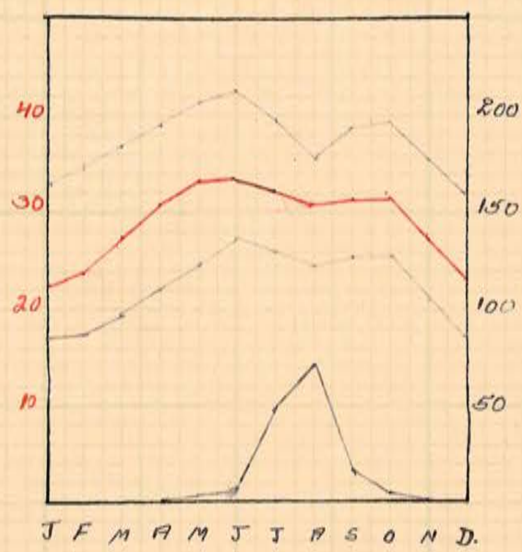
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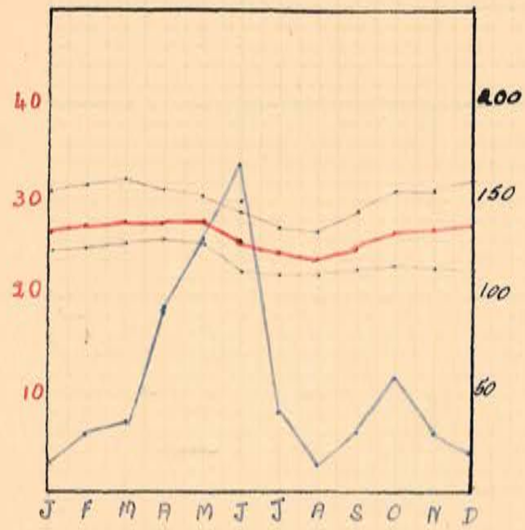
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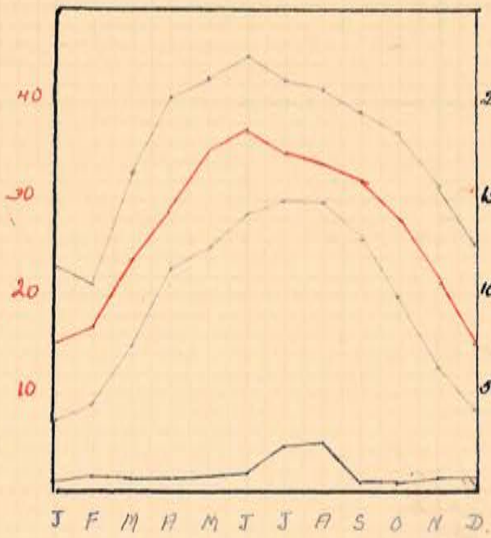
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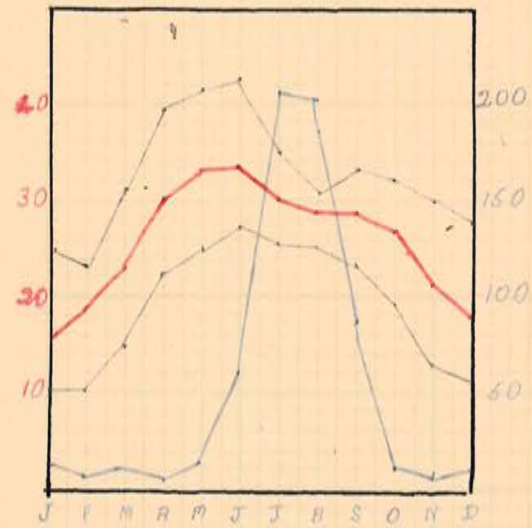
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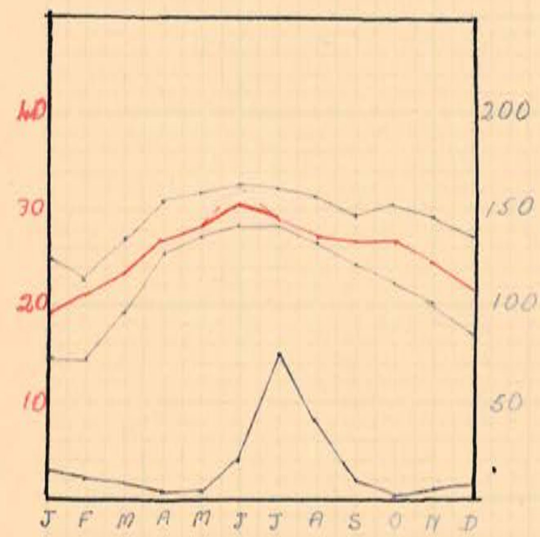
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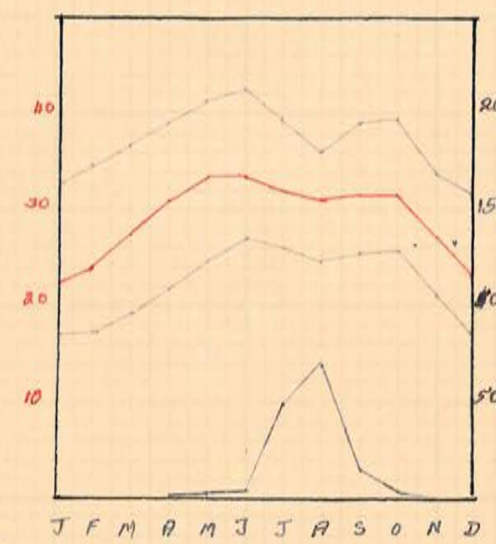
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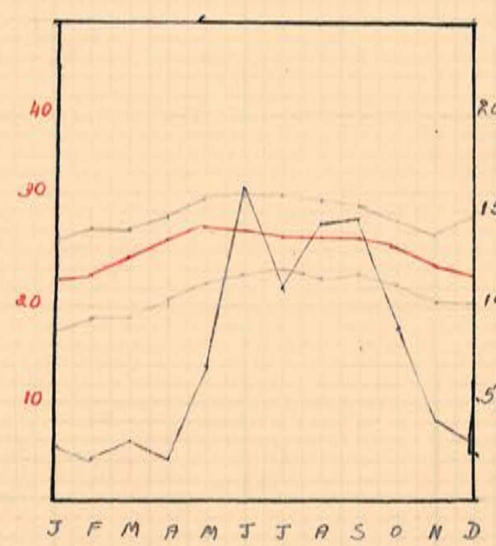
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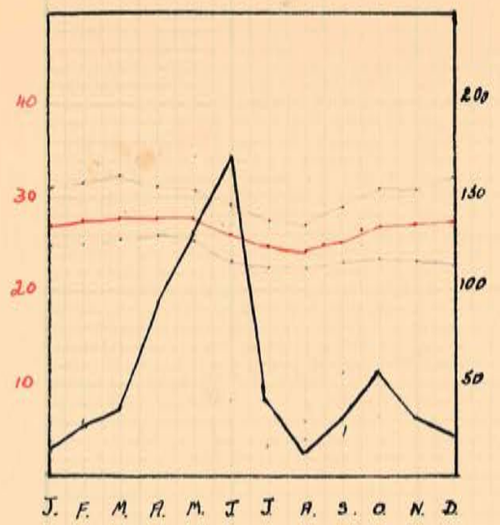
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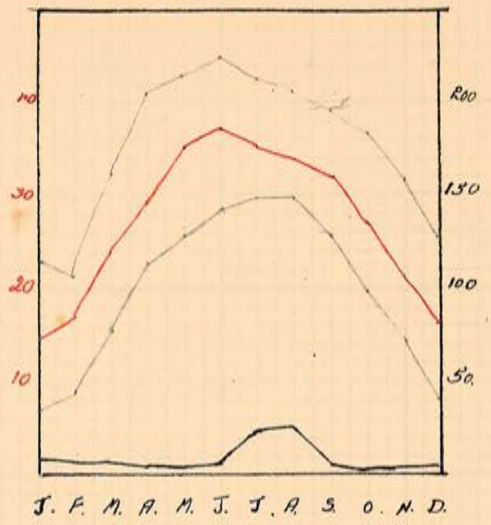
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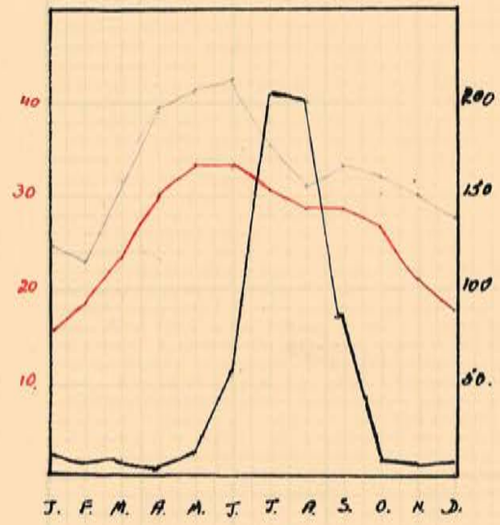
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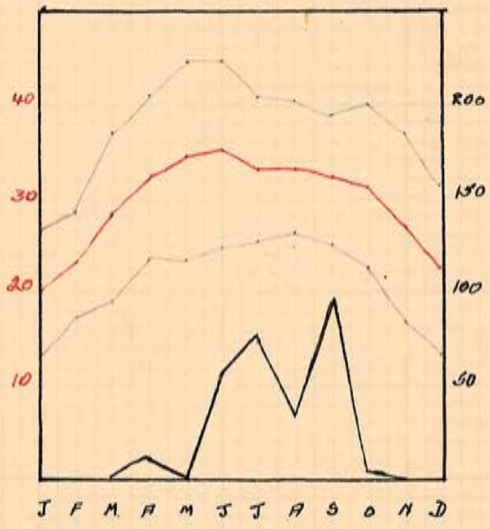
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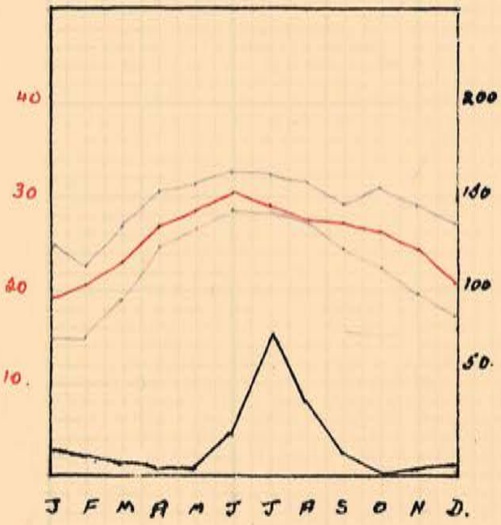
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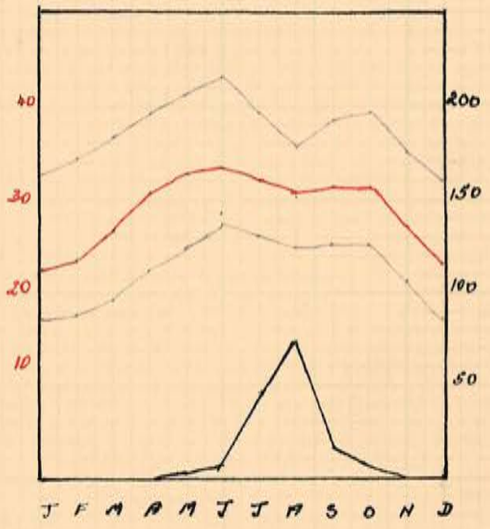
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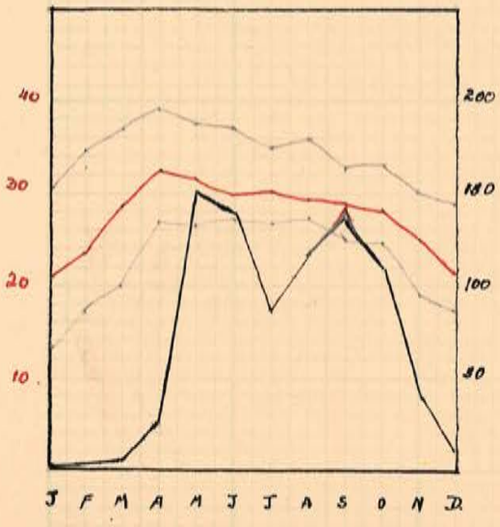
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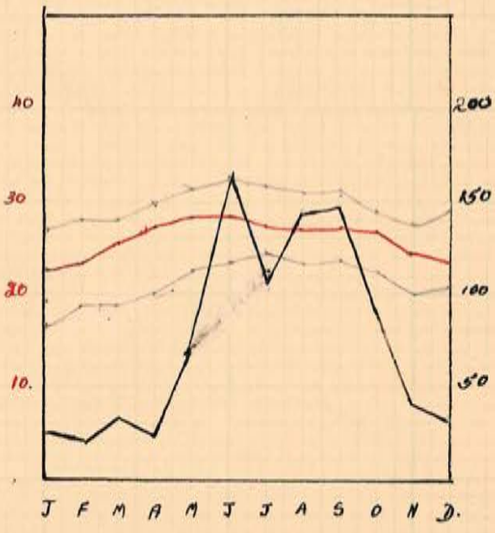
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