IBRA7 WA Regional Descriptions updated 28Sept2010 by NMcK

AW Avon Wheatbelt

Area of active drainage dissecting a Tertiary plateau in Yilgarn Craton. Gently undulating landscape of low relief. Proteaceous scrub-heaths, rich in endemics, on residual lateritic uplands and derived sandplains; mixed eucalypt, *Allocasuarina huegeliana* and Jam-York Gum woodlands on Quaternary alluvials and eluvials. Semi-arid (Dry) Warm Mediterranean. The south eastern boundary has been modified incorporating a small portion into the Mallee region.

CAR Carnarvon

Quaternary alluvial, aeolian and marine sediments overlying Cretaceous strata. A mosaic of saline alluvial plains with samphire and saltbush low shrublands, Bowgada low woodland on sandy ridges and plains, Snakewood scrubs on clay flats, and tree to shrub steppe over hummock grasslands on and between red sand dune fields. Limestone strata with *Acacia startii / bivenosa* shrublands outcrop in the north, where extensive tidal flats in sheltered embayments support Mangal. Arid

CK Central Kimberley

Hilly to mountainous country with parallel siliceous ranges of Proterozoic sedimentary rocks with skeletal sandy soils supporting hummock grasslands with scattered trees, and with earths on Proterozoic volcanics in valleys supporting Ribbon Grass with scattered trees. Open forests of River Gum and Pandanus occur along drainage lines. Dry hot tropical, sub-humid to semi-arid, summer rainfall.

COO Coolgardie

Granite strata of Yilgarn Craton with Archaean Greenstone intrusions in parallel belts expressed mainly as low ranges. Drainage is occluded. The Granite basement outcrops at mid-levels in the landscape. Upper levels are the eroded remnants of a lateritic duricrust yielding sandplains, gravelly sandplains and laterite breakaways. Valleys have Quaternary duplex and graduational soils, and include chains of salt lakes. Mallees and scrubs on sandplains associated with lateritised uplands, playas and granite outcrops. Diverse woodlands rich in endemic eucalypts characterise the greenstone hills, valley alluvials and broad plains of calcareous earths. In the west, the sandplain scrubs are rich in endemic Proteaceae, in the east they are rich in endemic acacias. Granite outcrops support sedgelands, granite-grass swards, She-oak scrubs and *Calathamnus* thickets. Salt lakes support dwarf shrublands of samphire. In the far east is an Eocene limestone plain characterised by open Eucalypt woodlands over shrublands of greybush and saltbush. Arid to Semi-arid Warm Mediterranean climate with 200-300 mm of rainfall, sometimes in summer but usually in winter.

CR Central Ranges

High proportion of Proterozoic ranges and derived soil plains, interspersed with red Quaternary sandplains. The sandplains support low open woodlands of either Desert Oak or Mulga over *Triodia basedowii* hummock grasslands. Low open woodlands of Ironwood (*Acacia estrophiolata*) and Corkwoods (*Hakea* spp.) over tussock and hummock grasses often fringe ranges. The ranges support mixed wattle scrub or *Callitris glaucophylla* woodlands over hummock and tussock grasslands. Arid, with summer and winter rain.

DL Dampierland
(1) Quaternary sandplain overlying Jurassic and Mesozoic sandstones with Pindan. Hummock grasslands on hills.
(2) Quaternary marine deposits on coastal plains, with Mangal, samphire - *Sporobolus* grasslands, *Melaleuca alsophila* low forests, and *Spinifex* - *Crotalaria* strand communities.
(3) Quaternary alluvial plains associated with the Permian and Mesozoic sediments of Fitzroy Trough support tree savannas of *Crysopogon* - *Dichanthium* grasses with scattered *Eucalyptus microtheca* - *Bauhinia cunninghamii*. Riparian forests of River Gum and Cadjeput fringe drainages.
(4) Devonian reef limestones in the north and east support sparse tree steppe over *Triodia intermedia* and *T. wiseana* hummock grasses.
Dry hot tropical, semi-arid summer rainfall.

ESP Esperance Plains
Proteaceous Scrub and mallee heaths on sandplain overlying Eocene sediments; rich in endemics. Herbfields and heaths, also rich in endemics, on abrupt granite and quartzite ranges that rise from the plain. Eucalypt woodlands occur in gullies and alluvial foot-slopes. Warm Mediterranean.

GAS Gascoyne
Rugged low Proterozoic sedimentary and granite ranges divided by broad flat valleys. Open mulga woodlands occur on shallow earthy loams over hardpan on the plains, with mulga scrub and Eremophila shrublands on the shallow stony loams of the ranges. The Carnegie Salient, in the east, is characterised by extensive salt lake features supporting succulent steppes. Arid.

GD Gibson Desert
Lateritised upland on flat-lying Jurassic and Cretaceous sandstones of Canning Basin. Mulga parkland over *Triodia basedowii* on lateritic "buckshot" plains. Mixed shrub steppe of Acacia, Hakea and Grevillea over *Triodia pungens* on red sand plains and dune fields. Lateritic uplands support shrub steppe in the north and mulga scrub in the south. Quaternary alluvia associated with palaeo-drainage features support Coolabah woodlands over bunch grasses. Arid, mainly summer rainfall.

GS Geraldton Sandplains
The Geraldton Sandplains bioregion comprises the central and northern Perth Basin, the Pinjarra Orogen, and the southern tip of the Carnarvon Basin. Mainly proteaceous scrub-heaths, rich in endemics, on the sandy earths of an extensive, undulating, lateritic sandplain mantling Permian to Cretaceous strata. Extensive York Gum and Jam woodlands occur on outwash plains associated drainage. Semi-arid (Dry) warm Mediterranean.

GSD Great Sandy Desert
Mainly tree steppe grading to shrub steppe in south; comprising open hummock grassland of *Triodia pungens* and *T. schinzii* with scattered trees of *Owenia reticulata* and Bloodwoods, and shrubs of *Acacia* spp, *Grevillea wickhamii* and *G. refracta*, on Quaternary red longitudinal sand dune fields overlying Jurassic and Cretaceous sandstones of the Canning, Centralian, Arunta and Armadeus Basins. *Allocasuarina*

decaisneana (Desert Oak) occurs in the far east of the region. Gently undulating lateritised uplands support shrub steppe such as *Acacia pachycarpa* shrublands over *Triodia pungens* hummock grass. Calcrete and evaporite surfaces are associated with occluded palaeo-drainage systems that traverse the desert; these include extensive salt lake chains with samphire low shrublands, and *Melaleuca glomerata - M. lasiandra* shrublands. Monsoonal influences are apparent in the north-western sector of this region. Arid tropical with summer rain.

GVD Great Victoria Desert

Arid active sand-ridge desert of deep Quaternary aeolian sands overlying Permian and Mesozoic strata of the Officer Basin. Tree steppe of *Eucalyptus gongylocarpa*, Mulga and *E. youngiana* over hummock grassland dominated by *Triodia basedowii*. Arid, with summer and winter rain.

HAM Hampton

Quaternary marine dune systems on a coastal plain of the Eucla Basin, backed by stranded limestone scarp. Areas of marine sand are also perched along the top edge of the scarp. Various mallee communities dominate the limestone scree slopes and pavements, as well as the sandy surfaces. Alluvial and calcareous plains below the scarp support eucalypt woodlands and Myall open low woodlands. Arid to semi-arid warm Mediterranean.

JF Jarrah Forest

Duricrusted plateau of Yilgarn Craton characterised by Jarrah-Marri forest on laterite gravels and, in the eastern part, by Marri-Wandoo woodlands on clayey soils. Eluvial and alluvial deposits support *Agonis* shrublands. In areas of Mesozoic sediments, Jarrah forests occur in a mosaic with a variety of species-rich shrublands. Warm Mediterranean.

LSD Little Sandy Desert

Red Quaternary dune fields with abrupt Proterozoic sandstone ranges of Bangemall Basin. Shrub steppe of acacias, *Thryptomene* and grevilleas over *Triodia schinzii* on sandy surfaces. Sparse shrub-steppe over *Triodia basedowii* on stony hills, with River Gum communities and bunch grasslands on alluvial deposits in and associated with ranges. Arid with summer rainfall.

MAL Mallee

The south-eastern part of Yilgarn Craton is gently undulating, with partially occluded drainage. Mainly mallee over myrtaceous-proteaceous heaths on duplex (sand over clay) soils. Melaleuca shrublands characterise alluvia, and Halosarcia low shrublands occur on saline alluvium. A mosaic of mixed eucalypt woodlands and mallee occur on calcareous earth plains and sandplains overlying Eocene limestone strata in the east. In the north-east are areas of Salmon Gum and Morrell woodlands on greenstone, with smaller areas of mallee and *Acacia / Casuarina* thicket on sandplains. Semi-arid (Dry) Warm Mediterranean.

MUR Murchison

Mulga low woodlands that are often rich in ephemerals occur on outcrops and fine-textured Quaternary alluvial and eluvial surfaces mantling granitic and greenstone strata of the northern part of the Yilgarn Craton. Surfaces associated with the

occluded drainage occur throughout with hummock grasslands on Quaternary sandplains, saltbush shrublands on calcareous soils and *Halosarcia* low shrublands on saline alluvia. Also includes the headwaters of the Murchison and Wooramel Rivers. Areas of red sandplains with mallee-mulga parkland over hummock grasslands occur in the east. Arid climate with mainly winter rainfall.

NK Northern Kimberley

Dissected plateau of Kimberley Basin. Savanna woodland of Woolybutt and Darwin Stringy bark over high Sorghum grasses and *Triodia schinzii* hummock grasses on shallow sandy soils on outcropping Proterozoic siliceous sandstone strata. Savanna woodlands on *Eucalyptus tectifica - Corymbia grandifolia* alliance over high Sorghum grasses on red and yellow earths mantling basic Proterozoic volcanics. Riparian closed forests of paperbark trees and *Pandanus* occur along drainage lines. Extensive Mangal occurs in estuaries and sheltered embayments. Numerous small patches of monsoon rainforest are scattered through the district. Dry hot tropical, sub-humid, summer rainfall.

NUL Nullarbor

Tertiary limestone plain; subdued arid karst features. Bluebush - Saltbush steppe in central areas; low open woodlands of Myall over bluebush in peripheral areas, including *Myoporum platycarpum* and *Eucalyptus oleosa* in the east and west. Arid Non-seasonal climate.

OVP Ord Victoria Plains

Level to gently undulating plains with scattered hills on Cambrian volcanics and Proterozoic sedimentary rocks; vertosols on plains and predominantly skeletal soils on hills; grassland with scattered Bloodwood and Snappy Gum with spinifex and annual grasses. The lithological mosaic has three main components:
(1) Abrupt Proterozoic and Phanerozoic ranges and scattered hills mantled by shallow sand and loam soils supporting *Triodia* hummock grasslands with sparse low trees.
(2) Cambrian volcanics and limestones form extensive plains with short grass (*Enneapogon* spp.) on dry calcareous soils and medium-height grassland communities (*Astrebla* and *Dichanthium*) on cracking clays. Riparian forests of River Gums fringe drainage lines.
(3) In the south-west, Phanerozoic strata expressed as often lateritised upland sandplains with sparse trees. This component recurs as the Sturt Plateau Region in central Northern Territory.
Dry hot tropical, semi-arid summer rainfall.

PIL Pilbara

There are four major components to the Pilbara Craton.
(1) Hamersley. Mountainous area of Proterozoic sedimentary ranges and plateaux with Mulga low woodland over bunch grasses on fine textured soils and Snappy Gum over *Triodia brizoides* on skeletal sandy soils of the ranges.
(2) The Fortescue Plains. Alluvial plains and river frontages. Salt marsh, mulga-bunch grass, and short grass communities on alluvial plains. River Gum woodlands fringe the drainage lines. This is the northern limit of Mulga (*Acacia aneura*).
(3) Chichester. Archaean granite and basalt plains supporting shrub steppe characterised by *Acacia pyrifolia* over *Triodia pungens* hummock grasses. Snappy Gum tree steppes occur on ranges.

(4) Roebourne. Quaternary alluvial plains with a grass savanna of mixed bunch and hummock grasses, and dwarf shrub steppe of *Acacia translucens* over *Triodia pungens*. Samphire, *Sporobolus* and Mangal occur on marine alluvial flats. Arid tropical with summer rain.

SWA Swan Coastal Plain

Low lying coastal plain, mainly covered with woodlands. It is dominated by Banksia or Tuart on sandy soils, *Casuarina obesa* on outwash plains, and paperbark in swampy areas. In the east, the plain rises to duricrusted Mesozoic sediments dominated by Jarrah woodland. Three phases of marine sand dune development provide relief. The outwash plains, once dominated by *A. obesa*-marri woodlands and *Melaleuca* shrublands, are extensive only in the south. Warm Mediterranean.

TAN Tanami

Mainly red Quaternary sandplains overlying Permian and Proterozoic strata which are exposed locally as hills and ranges. The sandplains support mixed shrub steppes of *Hakea suberea*, desert bloodwoods, acacias and grevilleas over *Triodia pungens* hummock grasslands. Wattle scrub over *T. pungens* hummock grass communities occur on the ranges. Alluvial and lacustrine calcareous deposits occur throughout. In the north they are associated with Sturt Creek drainage, and support *Crysopogon* and *Iseilema* short-grasslands often as savannas with River Gum. Arid tropical with summer rain.

VB Victoria Bonaparte

Phanerozoic strata of the Bonaparte Basin in the north-western part are mantled by Quaternary marine sediments supporting Samphire - *Sporobolus* grasslands and mangal, and by red earth plains and black soil plains with an open savanna of high grasses. Plateaux and abrupt ranges of Proterozoic sandstone, known as the Victoria Plateau, occur in the south and east, and are partially mantled by skeletal sandy soils with low tree savannas and hummock grasslands. In the south east are limited areas of gently undulating terrain on a variety of sedimentary rocks supporting low Snappy Gum over hummock grasslands and also of gently sloping floodplains supporting *Melaleuca minutifolia* low woodland over annual sorghums. Dry hot tropical, semi-arid summer rainfall.

WAR Warren

Dissected undulating country of the Leeuwin Complex and Albany Orogen with loamy soils supporting Karri forest, laterites supporting Jarrah-Marri forest, leached sandy soils in depressions and plains supporting paperbark/sedge swamps, and Holocene marine dunes with *Agonis flexuosa* woodlands. Moderate Mediterranean.

YAL Yalgoo

This region forms the northern part of the interzone between South-western and Eremaen Botanical Provinces. It is characterised by low woodlands to open woodlands, rich in ephemerals, of *Eucalyptus, Acacia* and *Callitris* on red earth to sandy earth plains of the western Yilgarn Craton and Toolonga Plateau of the southern Carnarvon Basin. The latter has a basement of Phanerozoic sediments. This Bioregion has been extended westwards to include shrubland and heath communities,

rich in endemics, on the undulating sandplains south of Shark Bay, on the Edel Peninsula and nearby Islands. Arid to semi-arid warm Mediterranean.

IBRA 7 WA Sub-regional Descriptions updated 28Sept2010 by NMcK

Victoria/Bonaparte (VB)

1. Arafura: marine plains with sporobolus grasslands, mound springs with monsoon forest, and, on seaward periphery, mangrove creeks and coastal dunes with vine thicket.
2. South: Red- and black-soil plains with savanna woodlands, emergent quartz-sandstone ranges with tree-steppe over hummock grassland and limestone ranges with open-savanna vine thickets.

North Kimberley (NK)

1. Mitchell: high rainfall (1100 – 1500 mm annually) with diverse array of exposed basement strata dissected by rivers, and each with a variety of vegetation-types. Rugged sunken coastline deeply embayed with large mangles, Eucalypt woodlands and hummock grasslands on skeletal sandy soils incompletely mantling sandstone boulder country, woodlands and tussock/cane grasslands on heavier volcanic and dolerite soils. Areas of lateritised upland with open forests. Alluvial floors along major river valleys.
2. Berkeley: medium rainfall, less dissected, upland of mainly Pentecost sandstones more continuously mantled by (sandy) soils, and dominated by open savanna woodland; vine thickets confined to coast.

Central Kimberley (CK)

1. Pentecost: Predominantly middle pentecosts sandstone, with King Leopold and Warton sandstone ranges along its southern peripheries. Large areas are mantled by Cainozoic soils. Moderate dissection by several rivers (Durack, Chamberlain and Fitzroy). This is the Central Kimberley. Rainfall averages 1000 - 750 mm annually. Savannah woodlands (eucalypts over *Triodia*).
2. Hart: Dominated by Hart Dolerite exposed along the eastern edge of the Kimberley Craton, where its basement members are folded and exposed. Rugged topograply. Basement rocks are volcanics, plutonics and sedmentary rocks. Driest part of Central Kimberley (600mm – 700mm). Savannah woodland over Triodia and/or bunch grasses. Headwaters of Ord, Denham and Fitzroy Rivers.
3. Mount Eliza: South-western periphery of Kimberley Craton. Intense folding, exposure of basement strata, very rugged. Shades, granites, sandstones, dolerites, volcanics. Rainfall 800mm. Savannah woodlands – scattered vine thickets towards western end.

Ord-Victoria Plains (OVP) in WA

1. Ord: Major river system draining low lying plains and hilly tracts northwards (Ord River). Average rainfall between 500 and 800 mm annually. Phanerozoic strata of the Ord Basin strata have been well exposed, including sandstones, limestones and volcanics.

2. South Kimberley Interzone: In the east, it comprises a gently undulating, elevated erosional plain, drained southward into the desert by Sturt and Wolfe Creeks, and separated from the dissected valley of the Ord River by steep breakaways. Much of the plateau is covered by cracking clay plains developed over Antrim Plateau Volcanics, although large areas a covered by thick laterite that has been partly dissected to form mesas, and is mainly covered by extensive desert sandplains. More dissected at the western end, which is drained westwards by the headwaters of Christmas Creek, a tributary of the Fitzroy River. Lower rainfall than either the Ord or Fitzroy Sub-regions.

Dampier Land (DL)

1. Fitzroy Trough: The semi-arid northern periphery of Canning Basin. Middle and lower catchment of the Fitzroy River. Includes the alluvial plains associated with this river (mainly erosional products from Central Kimberley, but also from the South Kimberley Interzone via Christmas Creek), and areas of sandplain and eroded dune surfaces derived from the Canning Basin. Extensive coastal mud flats are associated with the Fitzroy delta. Devonian limestone barrier reef structures are preserved along its northern and eastern peripheries. woodlands of Pindan, Boab and Eucalyptus, rainforest patches and hummock grassland on limestone, riverine vegetation. Rainfall averages 500 – 800 mm anually.
2. Pindanland: Sandplains of the Dampier Peninsular and western part of Dampier Land, including the hinterland of the Eighty Mile Beach. Fine-textured sand-sheet with subdued dunes and includes paleodelta of Fitzroy River. Pindan vegetation. This is the coastal, semi-arid, north-western margin of the Canning Basin (450 – 700 mm annual rainfall) receives slightly lower rainfall than the Fitzroy Trough Sub-region..

Tanami (TAN) in WA

No divisions in WA.

Great Sandy Desert (GSD) in WA

1. McLarty: Influences by monsoon. Morning fogs in dry season. Includes the Mandora Paleoriver System. Red-brown dunefields with finer texture than further south. Includes gravelly surfaces of Anketell Ridge along its northern margin. Owenia reticulata savannas and mafer prop n bunch grasses. Sub-humid component in flora and fauna.
2. Mackay: Tropical inland 'red-center' desert. Includes 'Percival' and 'Auld' palaeoriver systems.

Gibson Desert (GD)

1. Lateritic Plain – Pisolitic gravelly sandplains and laterite breakaways on Cretaceous sediments of Gunbarrel Basin.
2. Dune Field – red dune fields mantling Permian strata of Gunbarrel Basin.

Little Sandy Desert (LSD)

1. Rudall: The Rudall Complex, Throssell Group and Lamil Group of the Patterson Orogen. Proterozoic hill country of Throssel, Mount Sears, Broadhurst and Harbutt Ranges. Includes headwaters and course of Rudall River. Extensive areas of tussock grass are associated with footslopes. River Gums communities along drainage.
2. Trainor: 'Red centre' desert on Neoproterozoic sedimentary basement (Officer Basin).

Central Ranges (CR)

No divisions in WA, but now extended to include a strip of sandplain to the south that is on the proterzoic basements that characterise this bioregion.

Great Victoria Desert (GVD) in WA

1. Shield: western end is underlain by Yilgarn Craton. Higher proportion of sandplains and predominance of Mallee's (*Eucalyptus kingsmilli, E. youngiana* etc.
2. Central: underlain by Permian sediments of Gunbarrel Basin, dune fields extensive.
3. Eastern: underlain by Devonian sediments of Gunbarrel Basin. Sandplains extensive.

Nullabor (NUL) in WA

1. Northern band - (Carlisle Plain) deeper soil profiles with high proportion of red sand mixed with loams and calcaveous clays. Low woodlands of Myall over bluebush – inland desert climate.
2. Central band – shallow calcaveous soils, thinly mantling massive lifetare scrublands. Temperate arid. Saltbush and Bluebush low open shrubland.

Pilbara (PIL) <u>Does not include Barrow Island, the Monte Bello Islands and the Lowendal Islands.</u>

1. Chichester - Northern section of the Pilbara Craton. Undulating Archaen granite and basalt plains supporting shrub steppe characterised by Acacia pyrifolia over Triodia pungens hummock grasslands. Snappy Gum tree steppes occur on ranges. Semi-desert-tropical (300mm); drainage to north via numerous rivers (e.g. De Grey, Oakover).
2. Fortescue – Alluvial plains and Fortescue River frontages. Salt marsh, mulga – bunch grass, and short grass communities on alluvial plains. River Gum woodlands fringe the drainage lines. Scrub steppe on sandstone. Semi desert tropical (300mm). Drainage to north-west.
3. Hamersley – Southern section of the Pilbara Craton. Mountainous area of Proterozoic sedimentary ranges and plateaux, dissected by gorges (basalt, shale and dolerite). Mulga low woodland over bunch grasses on fine textured soils, and Snappy Gum over *Triodia brizoides* on skeletal sandy soils of the ranges. Semi-desert tropical 300mm.
4. Roebourne: Quaternary alluvial coastal and sub-coastal plains with a grass savanna of mixed bunch and hummock grasses, and dwarf shrub steppe of

Acacia translucens over *Triodia pungens*. Samphire, *Sporobolus* and mangal occur on marine alluvial flats and river deltas. Arid (semi-desert) tropical with summer rain (300mm).

Gascoyne (GAS)

1. Ashburton: mountainous range country associated with Ashburton River Catchment. of the Ashburton Basin (shales, sandstones and conglomerates), and the north-western part of Bangemall Basin (sandstone, shale, carbonates). Mulga/Snakewood low woodlands. Low mixed shrublands on hills. Areas of Triodia. Arid (desert) climate with bimodal (winter and summer) rainfall, tropical monsoon influences its western periphery.
2. Carnegie: Underlain by the Eraheedy Basin of the Capricorn Orogen (Proterzoic) and the south-eastern extension of the Bangemall Basin. Extensive samphire and saltbush steppes are associated with the extensive salt lake systems. Low Mulga communities occur on hills and plains. Desert climate, with bimodal rainfall.
3. Augustus: Southern and inland sections of the Bangemall Basin (shales, sandstone and carbonates). Also includes the Narryera Complex and Bryah Basin of the Proterozoic Capricorn Orogen (on northern margin of the Yilgarn Craton), as well as the Archaean Marymia and Sylvania Inliers. Although the Gascoyne River System provides the main drainage of this sub-region, it is also the headwaters of the Ashburton and Fortescue Rivers. There are extensive areas of alluvial valley-fill deposits. Mulga woodland with *Triodia* occur on rises, while the plains are covered by Mulga parkland. A desert climate with biomodal rainfall.

Murchison (MUR)

1. Eastern Murchison: The northern parts of the 'Southern Cross' and 'Eastern Goldfields' Terranes of the Yilgarn Cration. Characterised by its internal drainage, and extensive areas of elevated red desert sandplains with minimal dune development. Salt lake systems with areas of saltbush and samphire are associated with the occluded Paleodrainage system. Broad plains of red-brown soils and breakaway complexes support Mulga communities, while red sandplains support *Triodia* hummock grasslands. Arid climate, with mainly winter rainfall (200mm)
2. Western Murchison: Northern part of the 'Murchison' Terranes of the Yilgarn Craton. The headwaters of the Murchison and Wooramel Rivers, which drain the sub-region westwards to the coast. Mulga (usually with bunch grasses) occurs on the on extensive hardpan washplains that dominate and characterise the sub-region, as well as the red-earth plains. Arid climate with bimodal rainfall that usually falls in winter.

Carnarvon (CAR)

1. Cape Range: northern part of Carnarvon Basin. Rugged tertiary limestone ranges, extensive areas of red aeolian dunefield, Quaternary coastal beach dunes and mud flats. Acacia shrublands over *Triodia* hummock grasslands on limestone and red dunefields, Eucalyptus woodlands on Cape Range. An extensive mosaic

of saline alluvial plains with samphire and saltbush low shrubalns along the eastern hinterland of Exmouth Gulf. Tidal mudflats of Exmouth Gulf with mangroves. Beach dunes with *Spinifex* communities. Arid, semi-desert to sub-tropical climate, with variable summer and winter rainfall. Includes Barrow Island, the Monte Bello Islands and the Lowendal Islands.

2. Wooramel: Central parts of Carnarvon Basin. Alluvial plains associated with downstream sections and deltas of Gascoyne Minilya and Wooramel Rivers. Includes Lake MacLeod and Kennedy Range. Aeolian dunefields are extensive in the north and east as well as on top of Kennedy Range. Permian sediments are common in northern parts. Southern areas comprise limestone plateaux such as the Carble Plateau, overlain by red sand plains. Acacia shrublands (Mulga, Bowgada, Coriacea) over bunch grasses on red sandy ridges and plains. Mangroves confined to small areas around Lake MacLeod and near Carnarvon. Saline alluvial plains with samphire and saltbush low shrublands in near-coastal areas. Aseasonal arid climate, tending towards bimodal rainfall.

Yalgoo (YAL)

1. Edel: Parts of the southern Carnarvon Basin as well as the sandplain country inland from the Zuytdorp Cliffs (North of Kalbarri), including the Edel Peninsula, and Dirk Hartog, Bernier and Dorrie Islands, it is underlain by phanerozoic sediments and characterised by proteaceous tree-heaths and *Acacia-Casuarina* thickets on pale red Quaternary sand (white sand on the coast).
2. Tallering: Underlain by the north end of the phanerozoic Perth Basin, and by parts in the west of the Murchison Terraines and in the south-west corner of the Narryer Terraine of the Yilgarn Craton. It is characterised by low woodlands to open woodlands of *Eucalyptus*, *Acacia* and *Callitris* on red sandy plains.

Geraldton Sandplains (GS)

1. Geraldton Hills: Southern end of Carnarvon Basin and northern end of the Perth Basin, with exposed areas of Permian/Silurian siltstone and Jurassic sandstones, mostly overlain by sandplains, alluvial plains, coastal limestones. Sand heaths with emergent *Banksia* and *Actinostrobus*, York Gum woodlands on alluvial plains, proteaceous heath and *Acacia* scrubs on limestones depending on depth of coastal-sand mantle, low closed forest of *Acacia rostellifera* (now cleared) on alluvial plains of Irwin River (behind beach dune system south of Geraldton). Also includes the Pinjarra Orogen which is an area of Proterzoic basement. Hill country supports proteaceous shrublands and mallees while valleys support York Gum and 'Jam'. Semi-arid to Mediterranean climate with 400 – 500 mm of rainfall.
2. Lesueur Sandplain: coastal Aeolian and limestones, Jurassic silstones and sandstones (often heavily lateritized) of central Perth Basin. Alluvials associated with drainage systems. There are extensive yellow sandplains in south-eastern parts, especially where the sub-region overlaps the western edge of the Yilgarn Craton. Shrub-heaths occur on a mosaic of lateritic mesas, sandplains, coastal sands and limestones. Heath on lateritized sandplains along the sub-region's north-eastern margins. Mediterranean.

Swan Coastal Plain (SWA)

1. Dandaragan Plateau: plateau bordered by Darby and Dandaragan Faults. Cretaceous marine sediments mantled by sands and laterities. Characterised by *Banksia* low woodland, Jarrah - Marri woodland, Marri woodland, and by scrub-heaths on laterite pavement and on gravelly sandplains. Mediterranean (700 mm)
2. Perth: Colluvial and aeolian sands, alluvial river flats, coastal limestone. Heath and/or Tuart woodlands on limestone, *Banksia* and Jarrah-*Banksia* woodlands on Quaternary marine dunes of various ages, Marri on colluvial and alluvials,. Includes a complex series of seasonal wetlands. Mediterranean (1000 – 600 mm).

Avon Wheatbelt (AW)

1. Re-juvenated Drainage: Erosional surface of gently-undulating rises to low hills with abrupt breakaways. Continuous stream channels that flow in most years. Colluvial processes are active. soil formed in colluvium or in-situ weathered rock. Includes woodland of Wandoo, York Gum and Salmon Gum with Jam and Casuarina. Some areas of heath.
2. Ancient Drainage: The eastern part of the bioregion is an ancient peneplain with low relief. There is no connected drainage; salt lake chains occur as remnants of ancient drainage systems that now only function in very wet years. Lateritic uplands are dominated by yellow sandplain. Mosaic of scrub and woodland.

Jarrah Forest (JF)

1. Northern Jarrah Forest: The area east of the Darling Scarp, overlying Archaean granite and metamorphic rocks of an average elevation of 300 m, capped by an extensive latertic duricrust, dissected by later drainage and broken by occasional granite hills. In the east the laterite becomes deeply dissected until it compresses isolated remnants. Rainfall is from 1100 mm on the scarp to ca. 700 mm in the east and north. Vegetation comprises Jarrah - Marri forest in the west with Bullich and Blackbutt in the valleys grading to Marri and Wandoo woodlands in the east with Powder bark on breakaways. There are extensive but localised sand sheets with *Banksia* low woodlands. Heath is found on granite rocks and as a common understorey of forests and woodlands in the north and east.
2. Southern Jarrah Forest: South of Collie the plateau broadens and slopes gently to the south coast, Drainage is still dissected in the west but broadening and leveling of the surface in the east causes poor drainage and large (Lake muir) and numerable small wetlands. The ironstone becomes less evident being buried beneath sands. Rainfall is from 1200 mm in the south west to ?700 mm in the east. Vegetation comprises Jarrah - Marri forest in the west grading to Marri and Wandoo woodlands in the east. The are extensive areas of swamp vegetation in the south - east dominated by Paperbarks and Swamp Yate. The understory component of the forest and woodland reflects the more mesic nature of this area.

Warren (WAR)

Some obvious lower level subdivisions (Leewin-Naturalist Ridge, Scott Coastal Plain, Karri Belt, eastern coastal plain), but heterogeneity is too low for subregion-level subdivisions equal to those of Pilbara and Dampier Land Bioregions.

Esperance Plains (ESP)

1. Fitzgerald: metamorphosed sandstones. Eocene marine sediment basement with small areas of Gneiss outcropping. Archaen greenstones – sand sheets with varying levels of lateritization. Vegetations include: scrub heath, mallee heath, coastal dune scrub, mallee, woodlands on greenstone, Yate and York Gum woodlands on alluvials, and Jarrah/Marri woodlands in the west. Temperate Mediterranean (600 – 800mm). Active drainage (rejuvenated) to south.
2. Recherche: Proterozoic gneiss and granite as well as Eocence and more recent coastal limestones. Quaternary coastal sandplains and dunes. Numerous granitic islands. Heath, coastal dune scrub, mallee, mallee-heath and granite heath. Temperate Mediterranean (500 – 700mm).

Mallee (MAL)

1. Eastern Mallee: calcareous clays and loams as duplex soils that often contain sheet and modular kankar, outcrops of metamorphosed sandstone, and white and yellow sandplains and loamy plains with numerous salt pans (pan fields). Mallee on sandplains, samphire around small salt lakes, mallee and patches of woodland on clay, and scrub-heath on sandstone. Mallee with Boree (*Melaleuca pauperiflora*) on calcareous clay and loam. Mediterranean to semi-arid, winter rainfall 500 – 300mm.
2. Western Mallee: clays and silts underlain by Kankar, exposed granite, sandplains and laterite pavements. Salt lake systems on a granite basement. Occuded drainage system. Mallee communities occur on a variety of surfaces; *Eucalyptus* woodlands occur mainly on fine-textured soils, with scrub-heath on sands and laterite. Warm Mediterranean; 250-500mm rainfall..

Coolgardie (COO)

1. Mardabilla: Eocene marine limestone plain, on a granite basement in its western parts. Red-brown loams and aeolian sands over sheet and nodular kankar. Mainly *Eucalyptus* woodland over broomebush/greybush, bluebush and saltbush. *Dodanaea* scrub occur on granites of the Fraser Range. Arid climate, with 250-300mm of winter rainfall.
2. Southern Cross: lies on the 'Southern Cross Terranes' of the Yilgarn Craton. Sandplains are of yellow sand and characterised by Proteaceous shrublands.
3. Eastern Goldfield: lies on the Yilgarn Craton's 'Eastern Goldfields Terranes'. Sandplains are comprised of red 'desert' sand characterised by *Acacia* thickets and scrub-heaths.

Hampton (HAM)

No subdivision.