The background of the slide is a vibrant, multi-colored forest scene, possibly a digital composite or a high-resolution photograph. The colors range from deep blues and purples to bright yellows and oranges, creating a textured, almost abstract appearance. A faint white grid is overlaid on the entire image, with lines spaced evenly across the frame.

*A part time taxonomists view
of knowledge of the flora of W.A.
and how that affects EIA*

**MALCOLM TRUDGEN
JUNE 2018**

What does “knowledge of the flora of W.A.” mean?

How many species (and subspecies and varieties)?

How many identification aids?

How many flora treatments?

Indigenous knowledge?

How we improve knowledge?

What tools we use to improve knowledge (i.e. how we get knowledge)?

How what we think we know relates to what the actual total is?

Knowledge of whom? Young versus old; herbarium taxonomists versus vegetation field workers; what cows know about how different native species taste and how that differs from what kangaroos know?

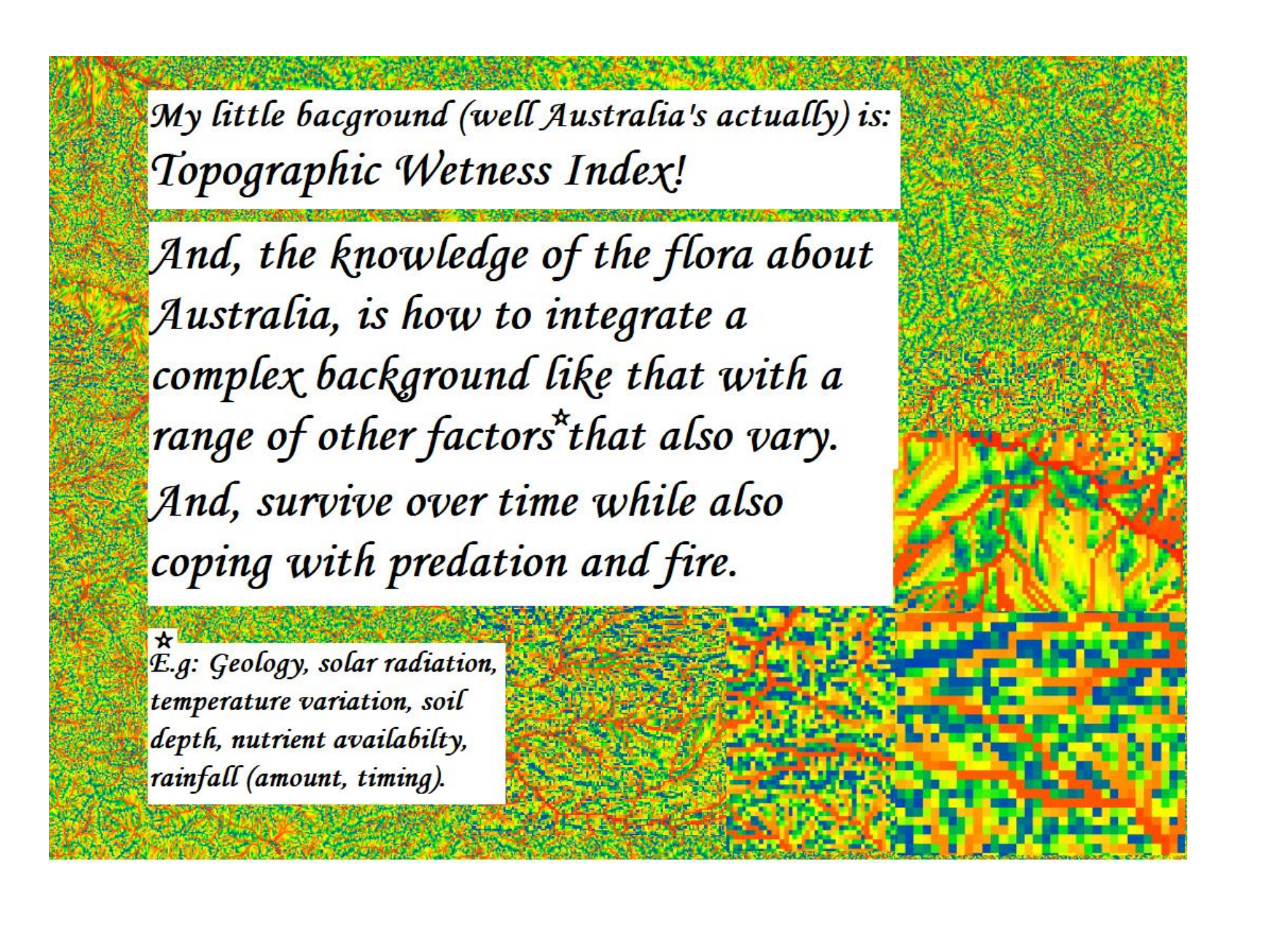
Or, a bit of all the above?

Maybe we should turn it on it’s head and say *the knowledge the flora has of W.A. or Australia.*



The knowledge the flora has of Western Australia

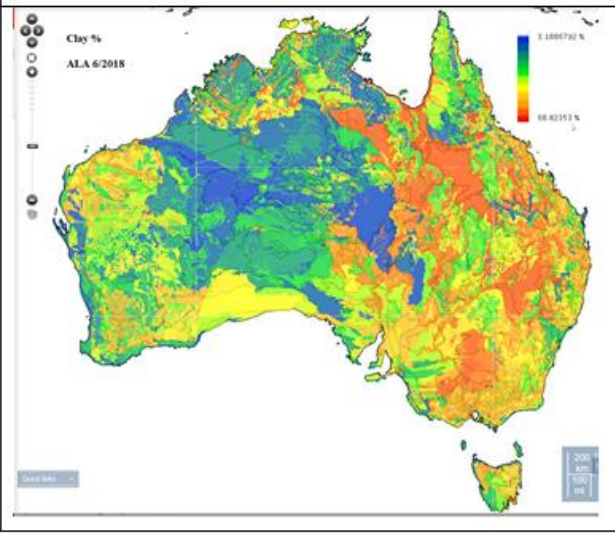
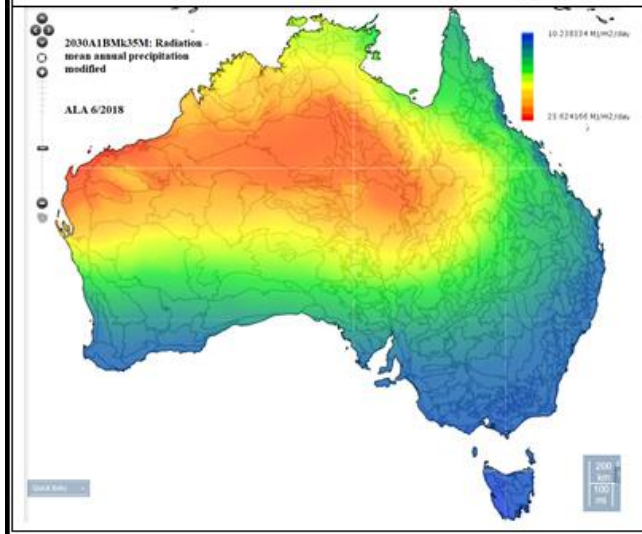
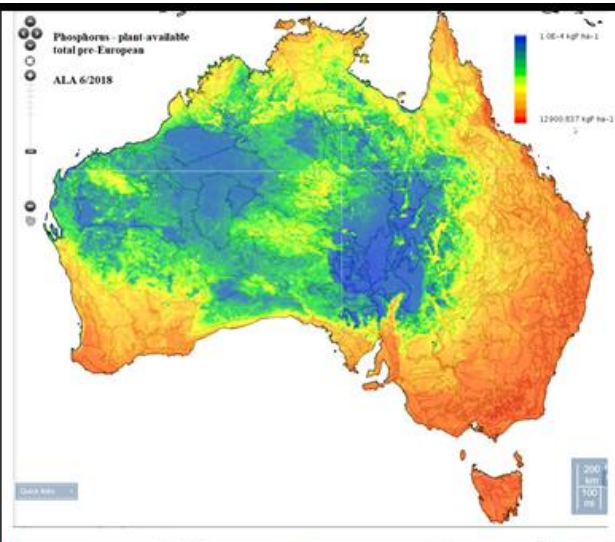
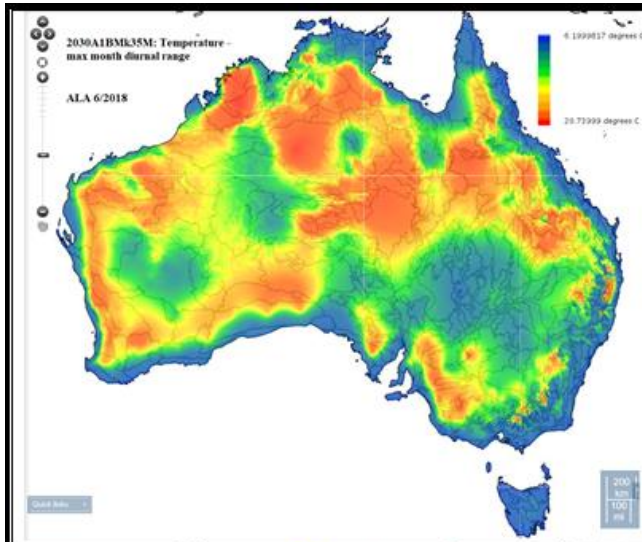
A little background?



*My little bacground (well Australia's actually) is:
Topographic Wetness Index!*

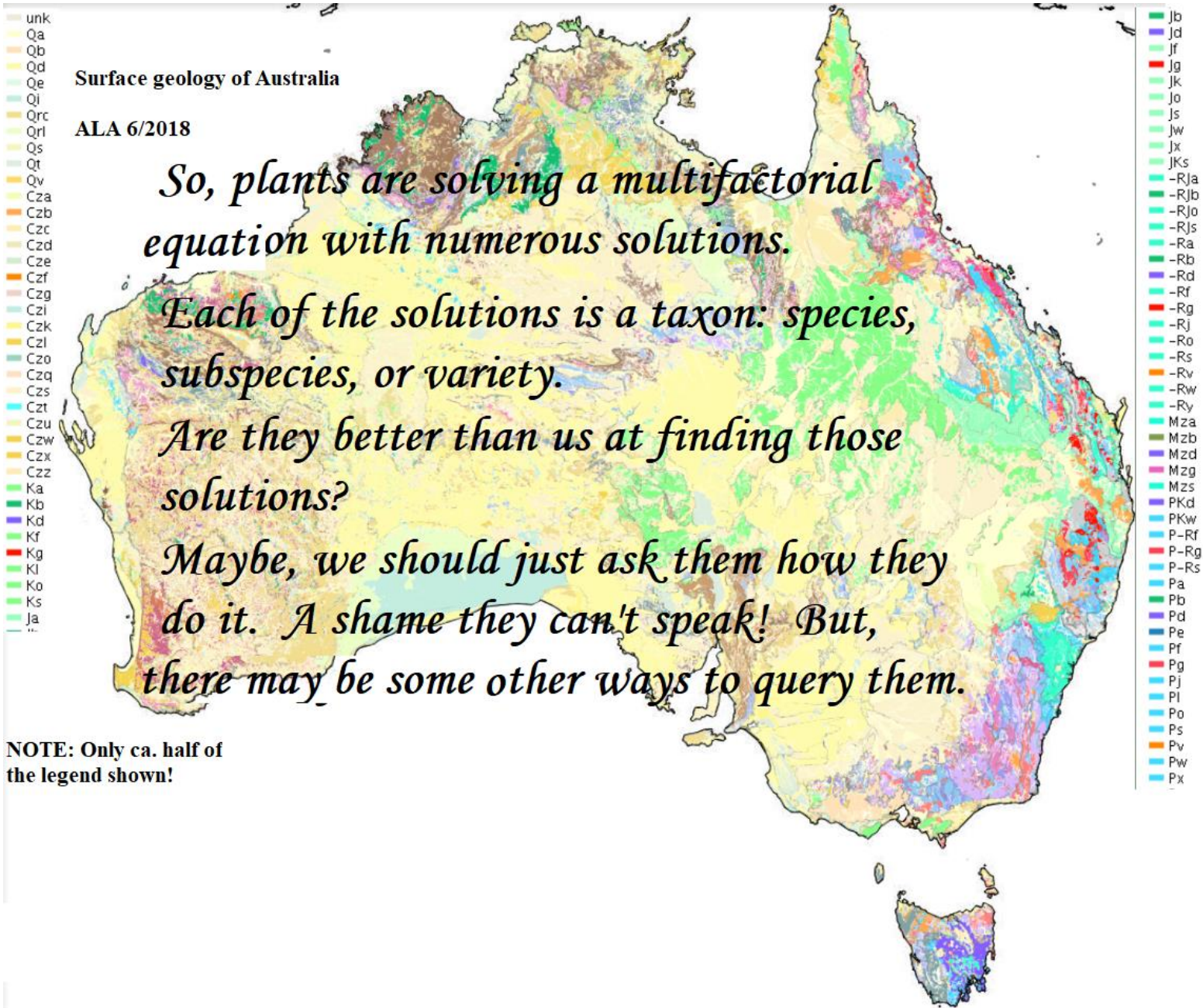
*And, the knowledge of the flora about
Australia, is how to integrate a
complex bacground like that with a
range of other factors[☆] that also vary.
And, survive over time while also
coping with predation and fire.*

*☆
E.g: Geology, solar radiation,
temperature variation, soil
depth, nutrient availabilty,
rainfall (amount, timing).*

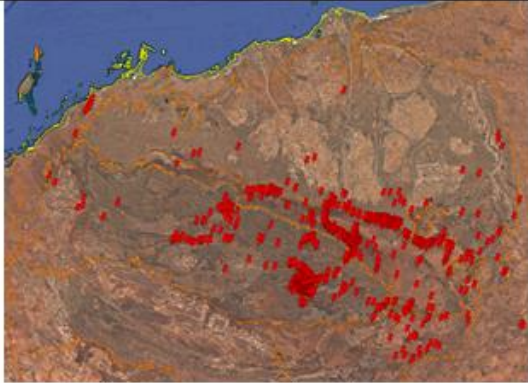


Examples of some environmental factors that plants must cope with.

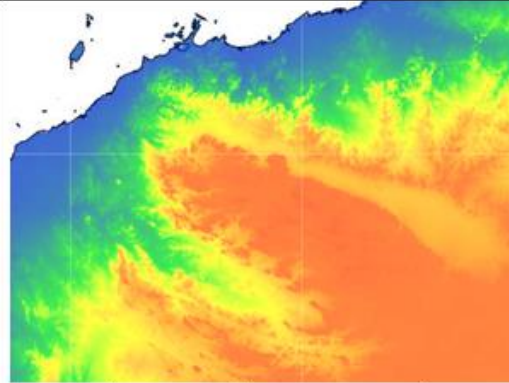
They have co-evolved with the landscape, as such factors have changed over time, partly as the plants also affect the environment.



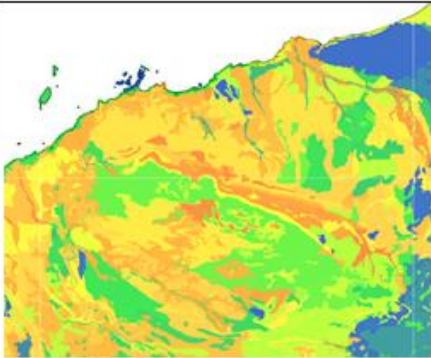
*A fireside chat with Mr Aneura Pilbara; “Mulga” to his mates.
Malcolm to “Mulga”: How do you solve your equation up here mate?*



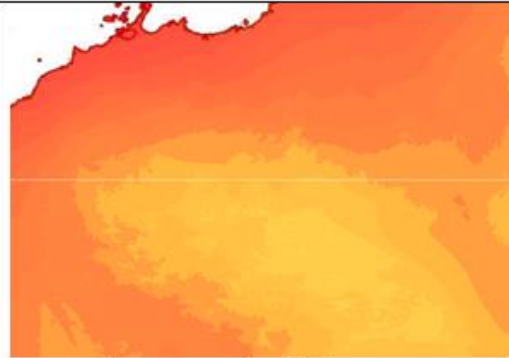
Mulga: I picked a nice neighborhood.



Mulga: Elevation for a nice view.



Mulga: A nice soil is important



Mulga: I do like a good sunny day!

Mulga: But Malcolm, to survive up here you need the right friends!

Mulga hanging out with his big Acacia mates: a species by species matrix of putative Mulga taxa from part of the Pilbara dataset. It shows that the putative taxa occur in combinations that are not random. This shows the putative taxa are behaving as separate entities: species. Some are a bit clichy.

Num of occurrences

	Acacia aff. aneura (grey flat recurved tips; MET 1)	Acacia aff. aneura (narrow fine veined; site 1259)	Acacia aff. aneura (narrow green; MET 15,850)	Acacia aff. aneura (scythe-shaped; MET 15,743)	Acacia aff. aneura (subterete long; site 1245)	Acacia aneura var. ? aneura	Acacia aneura (flat curved; MET 15 548)	Acacia aneura (grey bushy form; MET 15 732)	Acacia aneura Benth.	Acacia aneura var. (green flat; MET 15 946)	Acacia aneura var. ? aneura/intermedia	Acacia aneura var. aff. longicarpa (MET 16,050)	Acacia aneura var. longicarpa Pedley MS	Acacia_aneura	Triodia wiseana C.A.Gardner
	210	21	296	311	25	75	47	361	204	62	68	148	451	3092	1578
Acacia aff. aneura (grey flat recurved tips; MET 1)	144	1	18	25	2	1	3	35	3	2	2	8	38	210	9
Acacia aff. aneura (narrow fine veined; site 1259)	18	18	2	3	1	2				1	1		1	21	2
Acacia aff. aneura (narrow green; MET 15,850)	230	18	290	35	3	10	4	38	3	6	4	12	46	296	15
Acacia aff. aneura (scythe-shaped; MET 15,743)	214	25	35	214	3	10	3	42	2	8	6	17	50	311	15
Acacia aff. aneura (subterete long; site 1245)	22	2	3	3	22	1		2		1	1			25	
Acacia aneura var. ? aneura	56	1	10	10	1	56	1	6		2	2	4	8	75	6
Acacia aneura (flat curved; MET 15 548)	40	3	4	3		1	40	8	1			2	5	47	3
Acacia aneura (grey bushy form; MET 15 732)	250	35	38	42	2	6	8	250	1	10	6	26	62	361	21
Acacia aneura Benth.	204	3	3	2			1	1	204				2	114	41
Acacia aneura var. (green flat; MET 15 946)	42	2	6	8	1	2		10		42	3	1	7	62	
Acacia aneura var. ? aneura/intermedia	66	2	4	6	1	2		6		3	66	4	6	68	10
Acacia aneura var. aff. longicarpa (MET 16,050)	108	8	12	17		4	2	26		1	4	108	20	148	13
Acacia aneura var. longicarpa Pedley MS	412	38	46	50		8	5	62	2	7	6	20	412	451	59
Acacia_aneura	451	210	21	296	311	25	75	47	361	114	62	68	148	451	3092
Abutilon aff. dioicum (HD72-14)															1
Abutilon aff. hannii															1
Abutilon aff. lepidum (4)															35
Abutilon amplum Benth.														5	

These are currently treated as one taxon. The effect on EIA is that very significant information on vegetation biodiversity is largely ignored.

Mulga: But Malcolm, I do have some little mates as well, I'm not clichy.

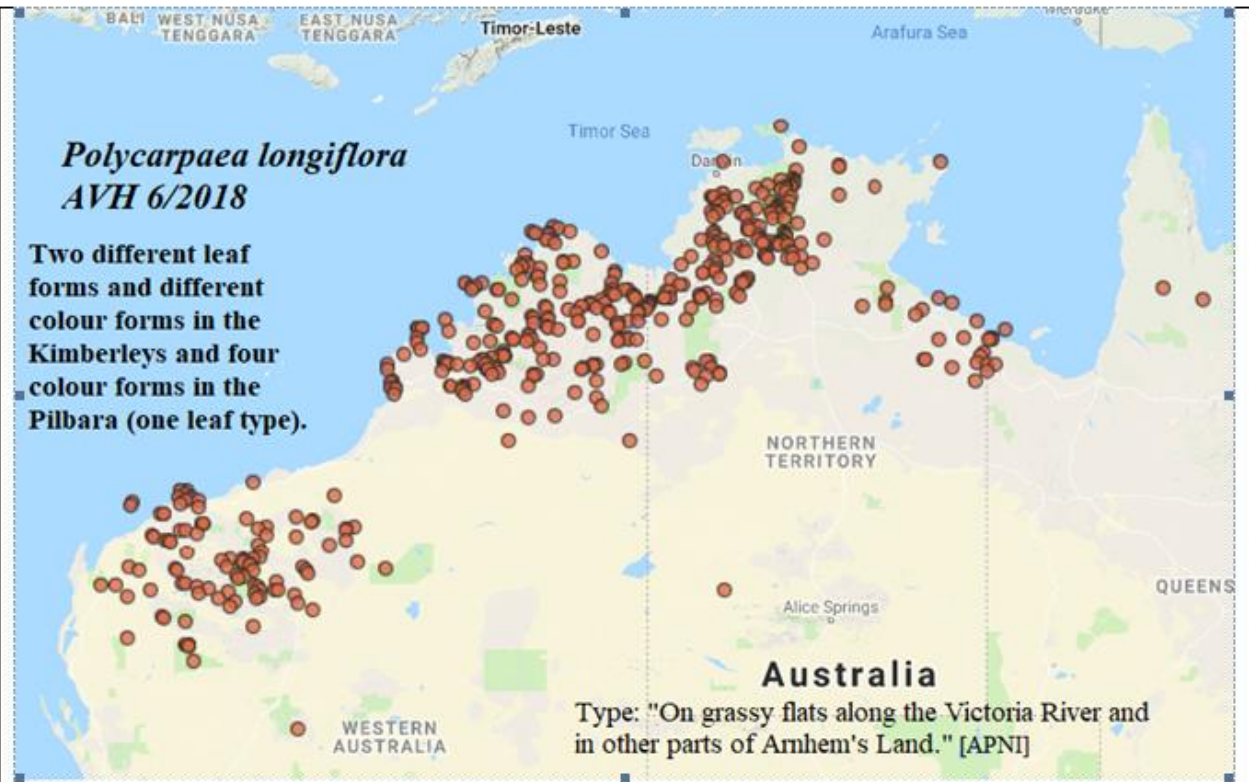
Mulga and some smaller mates. A species- species matrix with some putative Indigofera taxa.

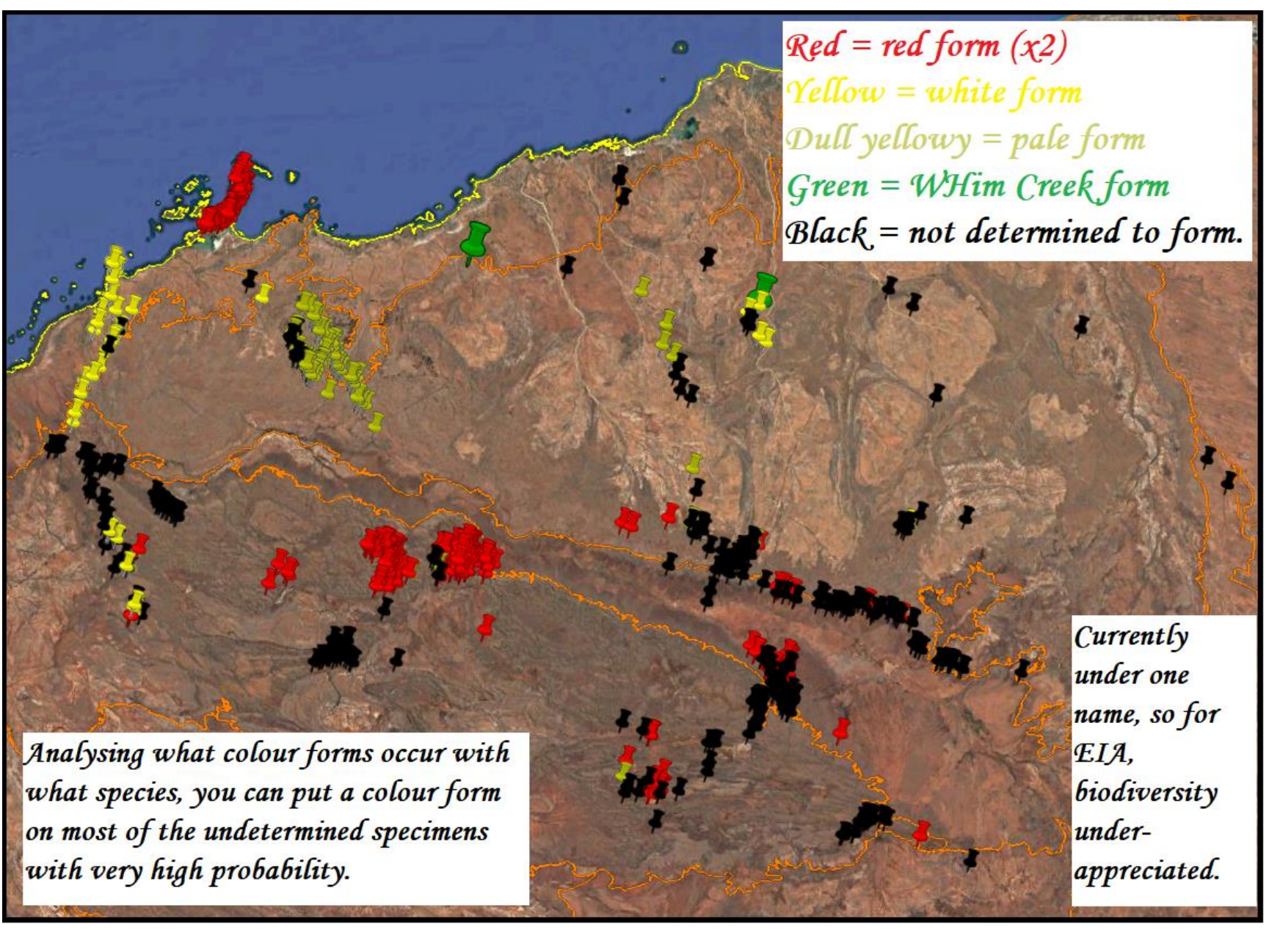
	Indigofera monophylla (FMR35-01)	Indigofera monophylla (grey leaflet form)	Indigofera monophylla (grey/green leaflet form)	Indigofera monophylla (small calyx form)	Indigofera monophylla (small leaflet form)	Indigofera monophylla DC.	Acacia aff. aneura (grey flat recurved tips; MET 1)	Acacia aff. aneura (narrow fine veined; site 1259)	Acacia aff. aneura (narrow green; site 1245)	Acacia aff. aneura (scythe-shaped; MET 15,743)	Acacia aff. aneura (subterete long; site 1245)	Acacia aneura (flat curved; MET 15 548)	Acacia aneura (grey bushy form; MET 15 732)	Acacia aneura Benth.	Acacia aneura Benth. var. aneura	Acacia aneura var. (green flat; MET 15 946)	Acacia aneura var. ? aneura/intermedia	Acacia aneura var. aff. longicarpa (MET 16,050)	Acacia aneura var. confifera Randell	Acacia aneura var. longicarpa Pedley MS	Acacia aneura var. pilbarana Pedley	
Acacia aff. aneura (narrow fine veined; site 1259)	1						1	37	2	3	1	2				1	1					
Acacia aff. aneura (narrow green; MET 15,850)					11		14	2	91	23	3	5	3	28	1	3	3	2			32	
Acacia aff. aneura (scythe-shaped; MET 15,743)	3				21		19	3	23	95	2	6	2	31	2	7	4	7			32	
Acacia aff. aneura (subterete long; site 1245)							2	1	3	2	36	1		2		1	1					
Acacia aneura var. ? aneura					1		1	2	5	6	1	28	1	3		1	1				4	
Acacia aneura (flat curved; MET 15 548)					1		3		3	2		1	48	7	1						3	
Acacia aneura (grey bushy form; MET 15 732)					15		23		28	31	2	3	7	120	1	6	4	8		31	1	
Acacia aneura Benth.		2			5		3		1	2			1	1	69							
Acacia aneura Benth. var. aneura															22							
Acacia aneura var. (green flat; MET 15 946)					2		1	1	3	7	1	1			6						5	
Acacia aneura var. ? aneura/intermedia		2			1		2	1	3	4	1	1	4		4		2	45	1		3	
Acacia aneura var. aff. longicarpa (MET 16,050)	1				2		1		2	7			8		8			1	34		4	
Acacia aneura var. confifera Randell				1	4																26	
Acacia aneura var. intermedia Pedley				1	1										1					2		1
Acacia aneura var. longicarpa Pedley MS	3				22		28		32	32		4	3	31		5	3	4		158		
Acacia aneura var. pilbarana Pedley				1									1								26	
Indigofera monophylla (FMR35-01)	13																					
Indigofera monophylla (grey leaflet form)		39					2	1		3									1		3	
Indigofera monophylla (grey/green leaflet form)			34											2			2					
Indigofera monophylla (small calyx form)				69	1															1		1
Indigofera monophylla (small leaflet form)				1	88	1	10		11	21		1	1	15	5		2	1	2	4	22	
Indigofera monophylla DC.					1	23																

This shows that the putative Indigofera taxa, currently all under the one name are behaving as species in their distribution/association with other species. Not having this available means biodiversity of species and vegetation types is underated.

*It's a fact that taxonomists largely don't taxonomise on the basis of colour. Which is generally good, but there are always exceptions to a rule. Lets ask *Polycarpea longiflora*, who we unfortunately can't rename *Polycarpaea multichroma*, how she solves her equations.*

She is not a shy flower and likes to grow in the open to show off her different coloured attire, which she changes for different places.





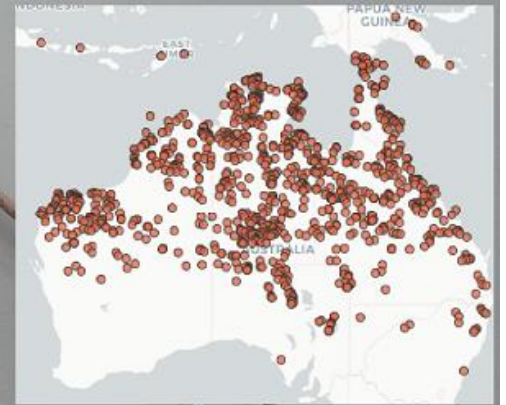
Red = red form (x2)
Yellow = white form
Dull yellowy = pale form
Green = Whim Creek form
Black = not determined to form.

Analysing what colour forms occur with what species, you can put a colour form on most of the undetermined specimens with very high probability.

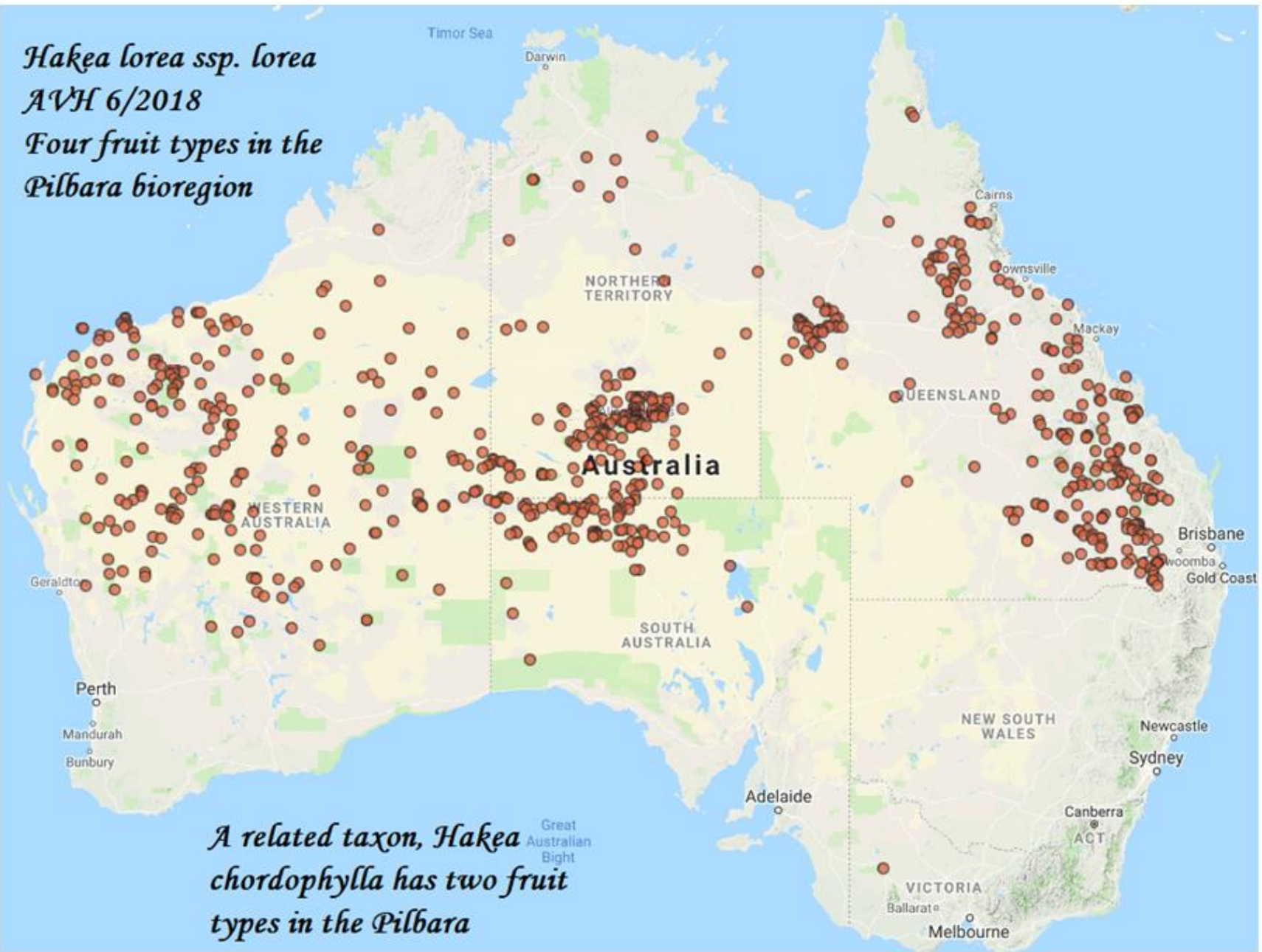
Currently under one name, so for EIA, biodiversity under-appreciated.

*Two, possibly four
seed types in a
fairly small part
of the Pilbara.
The "dead"
specimen is the
best one, it has
the seeds.*

*Cleome viscosa, once
thought to be a weed in
Australia.*



Hakea lorea ssp. lorea
AVH 6/2018
Four fruit types in the
Pilbara bioregion



A related taxon, Hakea
chordophylla has two fruit
types in the Pilbara

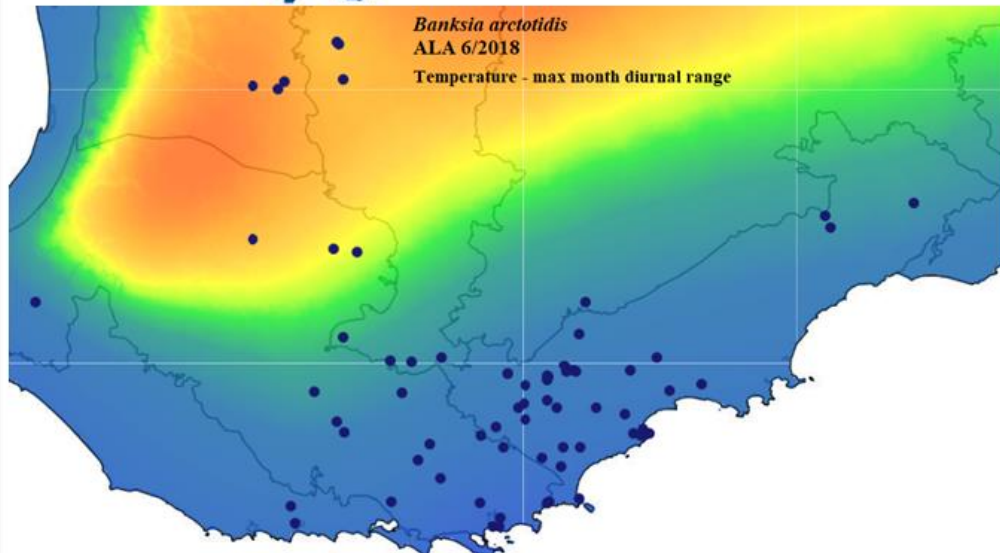
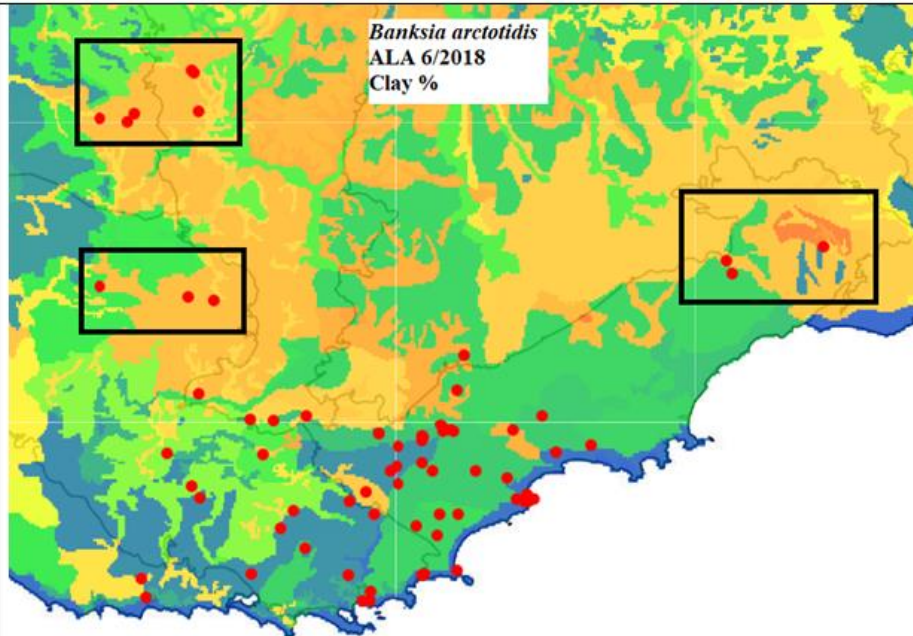
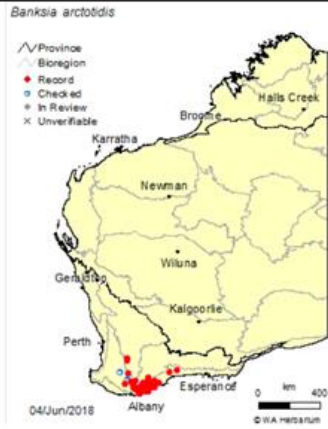
There are many undescribed taxa in the Pilbara, but it's a long way from Perth and was poorly collected until recently.

So how could we get an idea of how well known the flora is in the South-west or Western Australia. Let's poke around a bit and see what turns up.

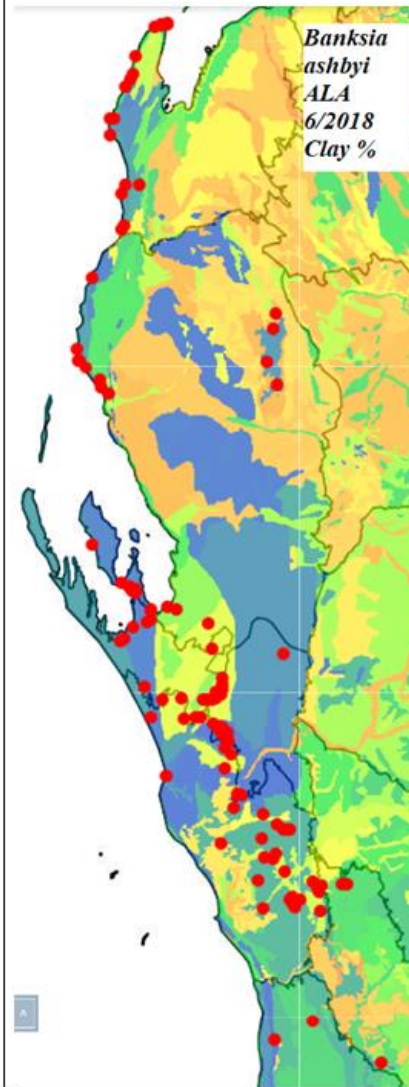
I thought a trawl through part of an icon genus might be fun!

Banksia arctotidis (R.Br.)
A.R.Mast & K.R. Thiele

1. Has probable varieties or subspecies.



Banksia ashbyi
Baker f.



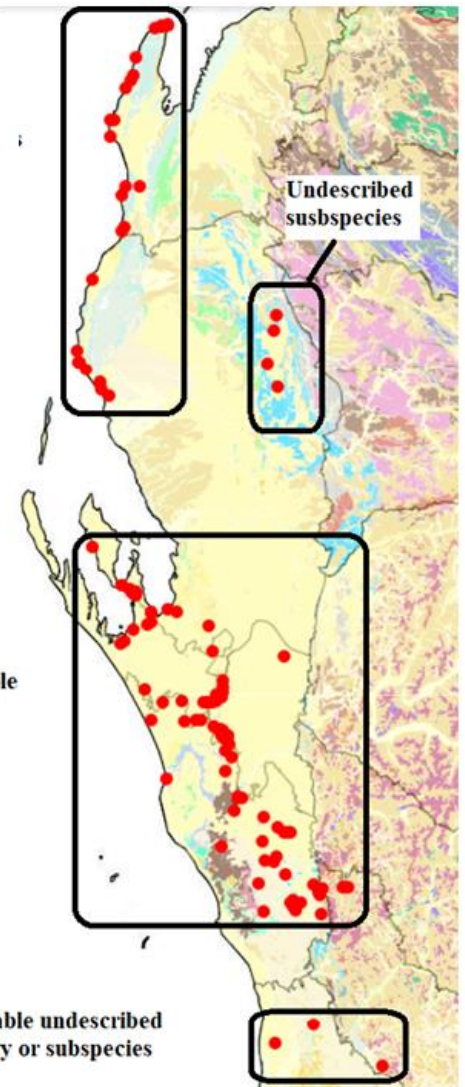
Ssp. boreoscaia

Ssp. ashbyi

May not be simple

Probable undescribed
variety or subspecies

Undescribed
subspecies



Banksia biterax A.R.Mast & K.R. Thiele

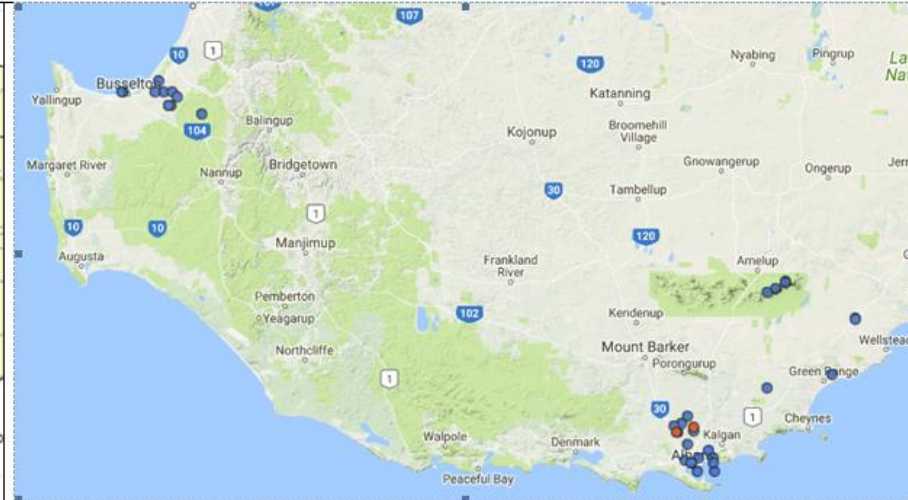
1. On the FiraBase map, fairly clearly has two subspecies that are not currently discriminated.

2. However, the eastern records are not continuous. There is an Albany group separated from the Stirling Range and eastern records by the Porongorups and/or the Young/Kalgan River.

3. The Stirling Range records are all high in the landscape; so are in a significantly different habit.

4. Conservation status of the three probable entities needs urgent review. DNA analysis of the Albany, eastern and Stirlings collections highly desirable, to ensure there are not four taxa.

[The ALA spatial portal does not have more records.]



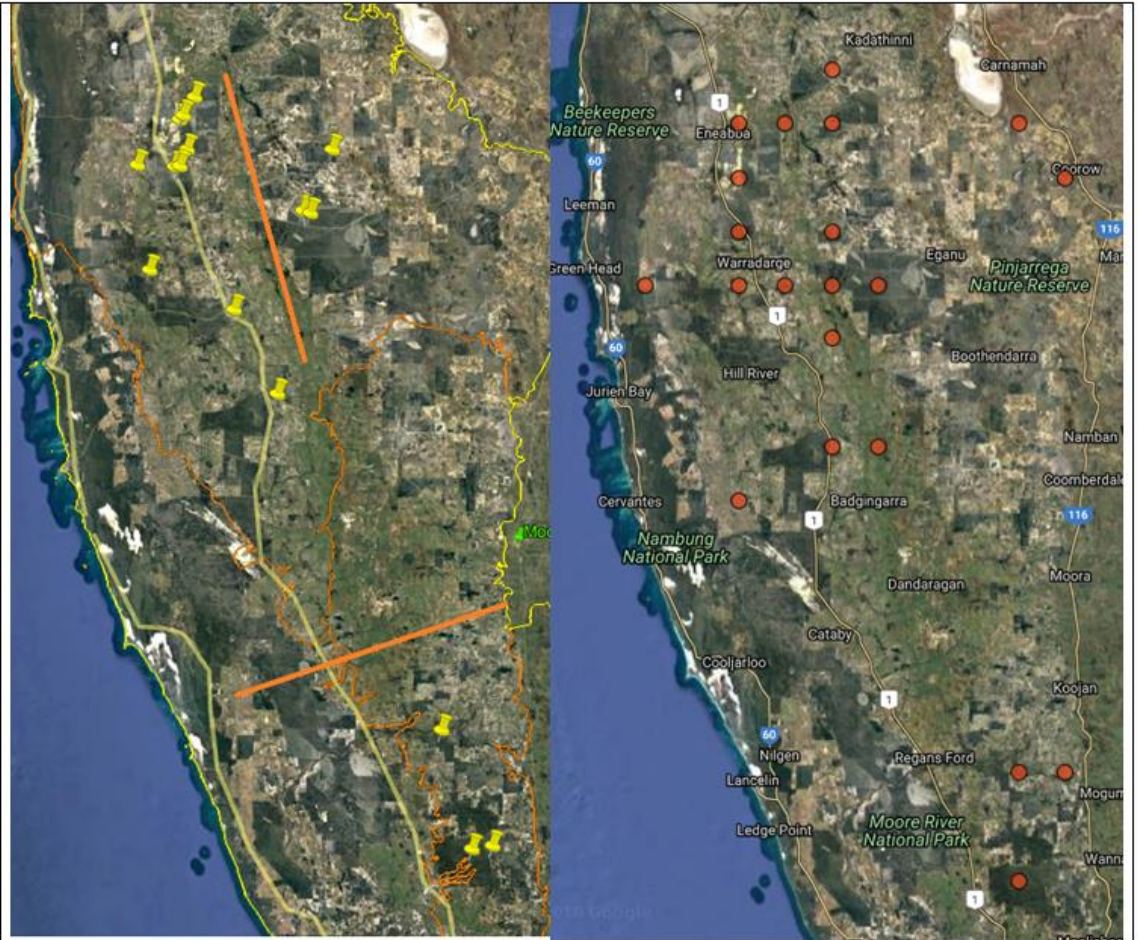
Banksia chamaephyton
A.S. George

Currently P4 (June 2018).

1. On vegetation data has two disjunctions, both separated by surface geology. Its not so clear for the first on AVH data that is "fuzzied".

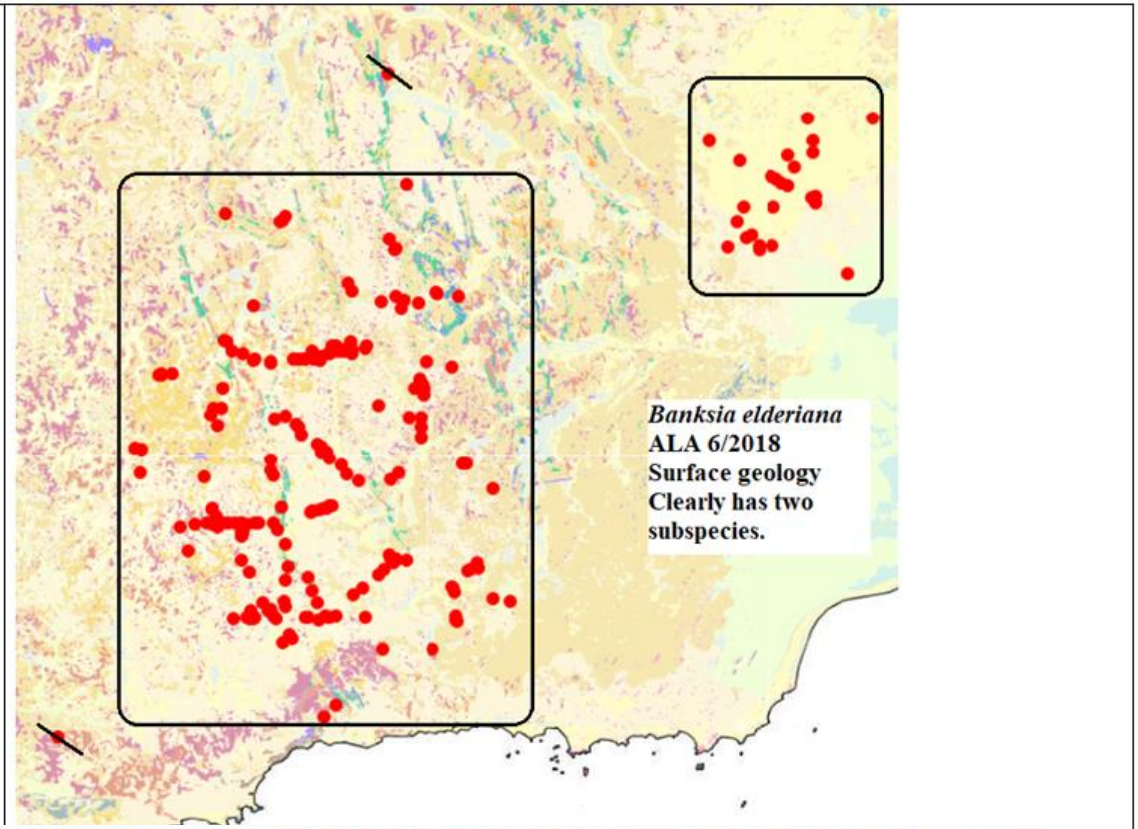
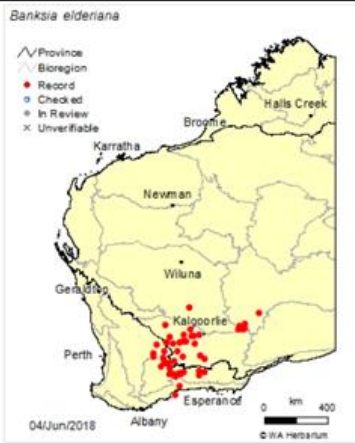
2. ON AVH/ALA data there is a disjunct occurrence in the Coorow to Camamah area.

3. So, likely to be 3 or possibly four taxa, if three, then two should be DRF (3, if 4).



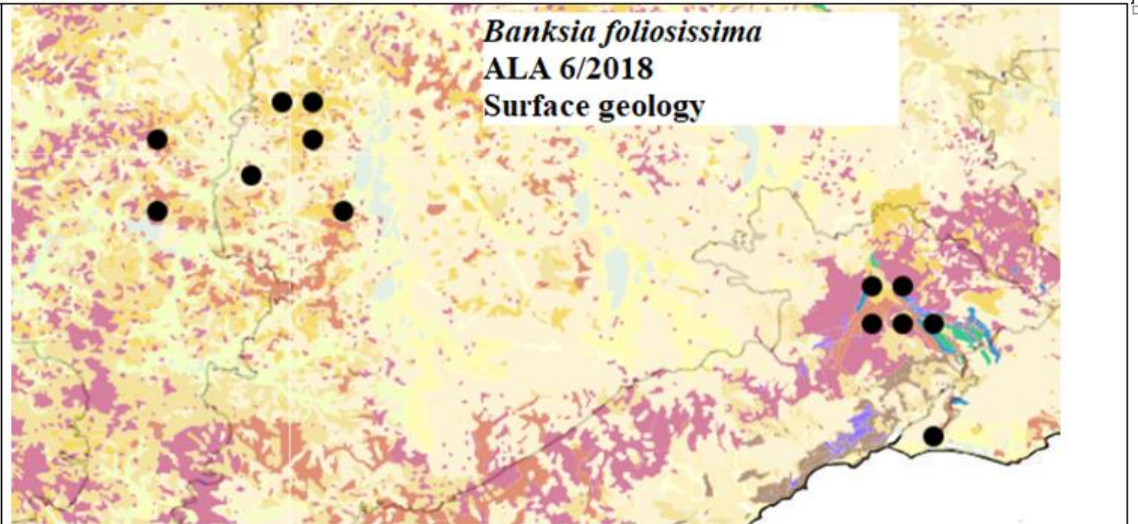
Banksia elderiana F. Muell. & Tate

1. Clearly has two subspecies.



Banksia foliosissima
(C.A. Gardner) A.R. Mast & K.R. Thiele

1. The two clusters are on different geologies, are disjunct by ca. 75 km and are separated by paleo drainage channels. Probably deserve subspecies distinction.



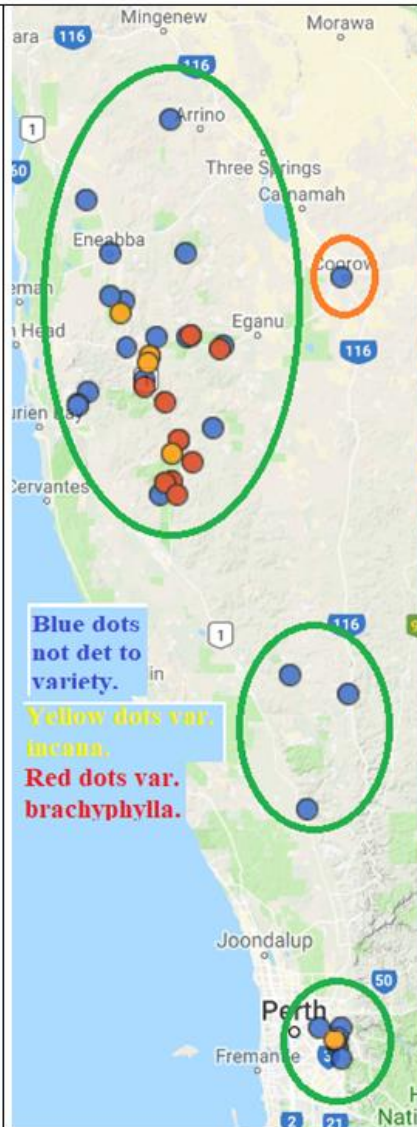
Banksia incana A.S. George

1. The overlap of blue, red and yellow dots in the large ellipse tells us that the varieties are probably not well based.

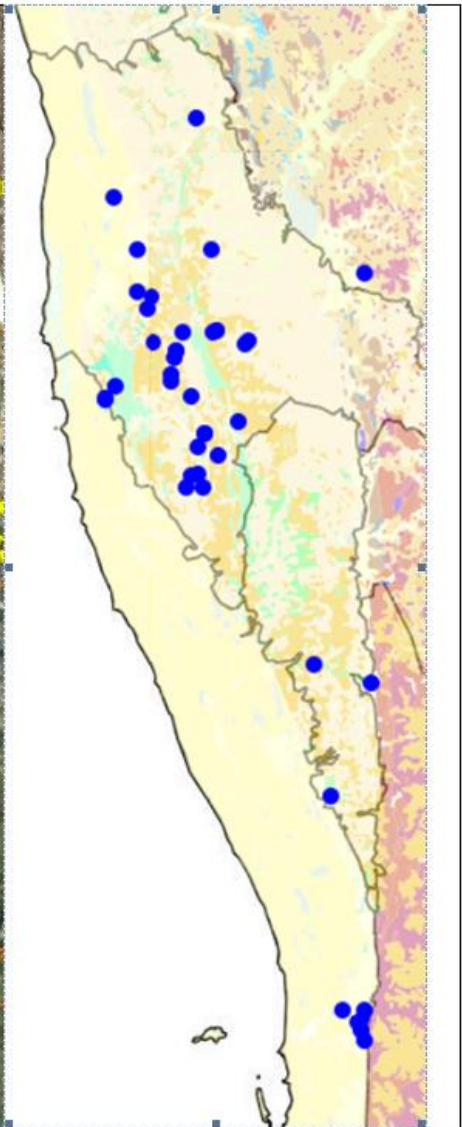
2. The three disjunct occurrences in the green ovals are in different bioregions/subregions and suggest we have three taxa (subspecies?), two of which should be on the priority/DRF list.

3. The northern records (one in each data set) north of the Arrowsmith River also need investigation as this may be a barrier.

4. The isolated collection from near Coorow also needs investigation. Another possible conservation taxon.



Blue dots not det to variety.
 Yellow dots var. *incana*.
 Red dots var. *brachyphylla*.

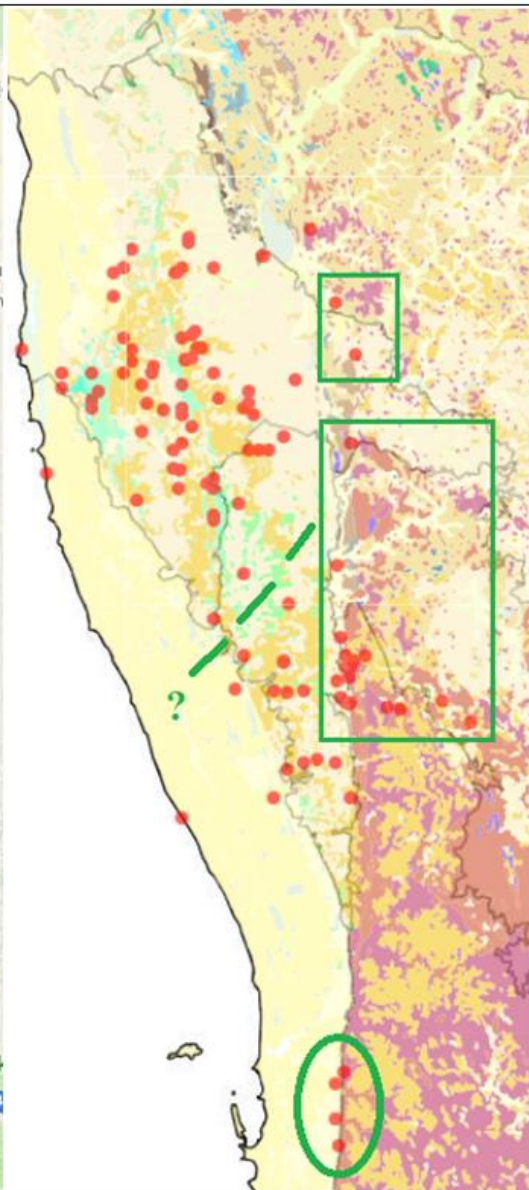


Banksia kippistiana (Meisn.)
A.R.Mast & K.R.Thiele

1. The two varieties overlap almost entirely in the northern area.

2. The Darling Scarp population is likely to be a subspecies.

3. The populations in the green rectangles are likely to be different to what is on the Northern Sandplain and Dandaragan plateau.



*So how does that sort of analysis extend to other groups?
A sample from the metadata file for a West coast data set:*

175	Proteaceae		Y		2255	Persoonia angustiflora				Has a fairly well defined occurrence near Perth, and a scatter of records from Geraldton to N of Ravensthorpe.
175	Proteaceae		Y		2256	Persoonia articulata	x		Persoonia longifolia TaxonID 2267	Florabase referral.
175	Proteaceae				2258	Persoonia comata			OK	Occurs as a band near the coast from Perth to near Jurien, with 3 outlying records.
175	Proteaceae		Y		2259	Persoonia coriacea			Needs review	Has a large distribution from inland from Jurien to Kalgoorlie , Nof Esperance and NE of Albany, with some clustering and small disjunctions.
175	Proteaceae		N		2260	Persoonia diadema	x		Persoonia saundersiana	Florabase referral.
175	Proteaceae		Y		2262	Persoonia elliptica			Needs Urgent review	Has three clusters of records, 1 inland from Perth, but also with some records on SCP, 1 on the Capes area and just east and the third (smaller) around Albany.
175	Proteaceae		Y	2	14563	Persoonia filiformis			OK	Has a small, well defined range in the Jurien area.
175	Proteaceae		N		2267	Persoonia longifolia			OK	Has a moderate to large range in a broad band from near Perth (in forests) to the Capes and then a narrower strip to Albany.
175	Proteaceae		Y	3	2269	Persoonia pungens			Needs review	Has a small cluster of records in the NS, that is disjunct from a scatter of 5 sites in the central SW
175	Proteaceae		Y		2270	Persoonia quinquenervis			Needs review	Has a large range in the central & eastern SW, with some outlying records in the NS & northern SCP & 1 on the south coast.
175	Proteaceae		Y	3	2271	Persoonia rudis			OK?	Has a fairly small range from just N of Perth to Nof Jurien, some clustering on Fbase, not obvious in EAG's data.
175	Proteaceae		Y		2272	Persoonia rufiflora			Needs review	Has a small occurrence N of Geraldton then from NE Of Jurien to ENE of Perth has a larger, poorly defined occurrence (some small disjunctions) and 1 record SE of Perth. EAG's data has 2 clusters that correspond to 2 on Fbase.
175	Proteaceae		Y		2273	Persoonia saccata			Needs review.	Occurs from just N of Perth to the Capes with a small disjunction (clearing?), then has scattered records along the coast to Albany. Possibly has some forms (limestone, base of hills) that need investigation. The Lectotype is from Shark Bay. OOPS!!
175	Proteaceae		Y		2274	Persoonia saundersiana			Needs review	Has a fairly large but poorly defined distribution in the central & eastern SW and adjoining Eremaean to near Kalgoorlie, with a large disjunction to 1 record in the NS area and another to 2 records at the S end of Shark Bay.

A little lesson on how easy it is to not observe what is actually there:

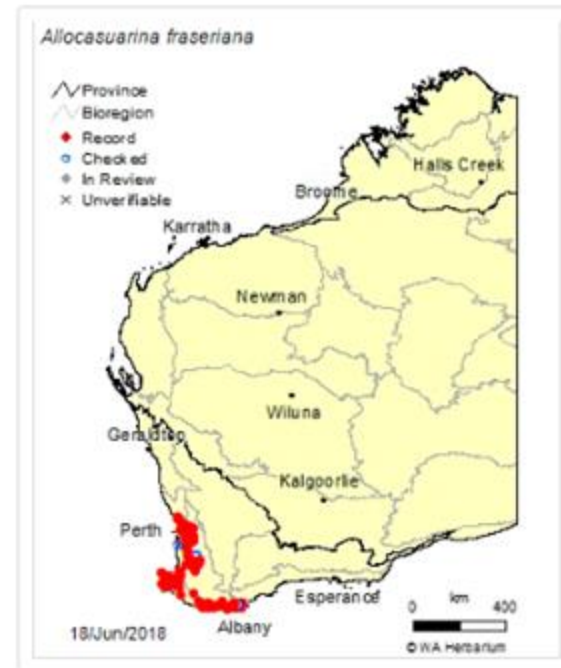
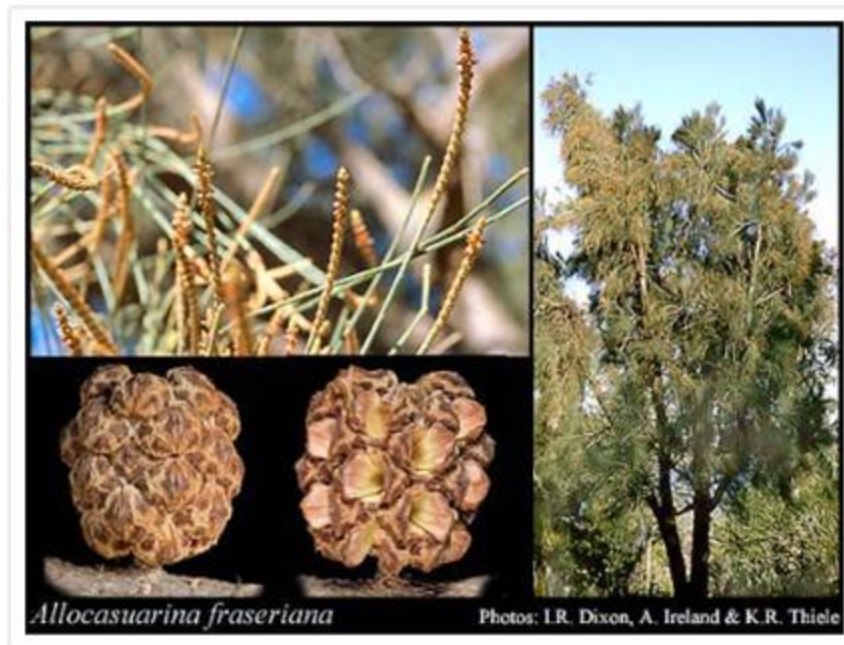
Allocasuarina fraseriana (Miq.) L.A.S.Johnson Sheoak

J.Adelaide Bot.Gard. 6:75 (1982)

Conservation Code: **Not threatened**

Naturalised Status: Native to Western Australia

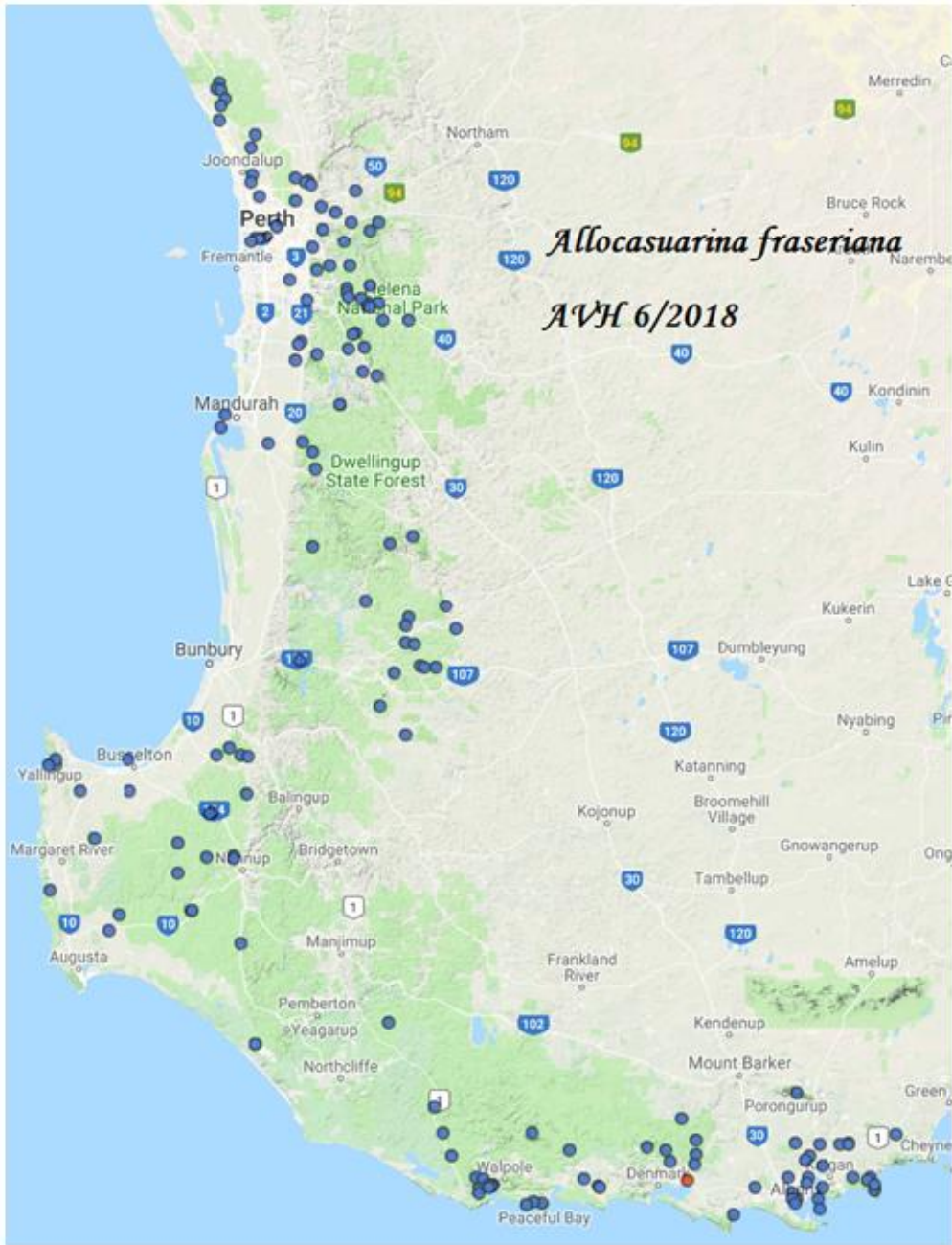
Name Status: **Current**



Brief Description

Amanda Spooner, Thursday 3 January 2002

Dioecious, erect tree, 5-15 m high, bark fibrous, reddish-brown. Fl. brown, May to Oct. Lateritic soils, white, grey or yellow sand. Jarrah forest, sand dunes.



What appears to be six different fruit types from She Oak tree Allocasuarina species from dune sites on the Swan Coastal Plain. The only tree Allocasuarina recorded from such sites is Allocasuarina fraseriana. These are from a few localities.



Where does that leave us for flora taxonomy and EIA?

- 1. There is a lot more out there than on Government data set such as Florabase or AVH.*
- 2. It is not adequate to simply compare specimens to the Herbarium reference set. You have to look at AVH maps and ALA layers and make sure you don't hit an outlying population that could be a new taxon.*
- 3. When I review Pilbara collections before I will carry out an analysis for another person, I usually find about 20% error.*
- 4. Most workers rely on their memory far too much: collect, collect, collect.*
- 5. The level of vouchering is low, and the Herbarium should take much more than it seems to take. The collections are not anywhere near adequate.*
- 6. The number of taxonomists working in the State is too low; less than in the 1970s.*