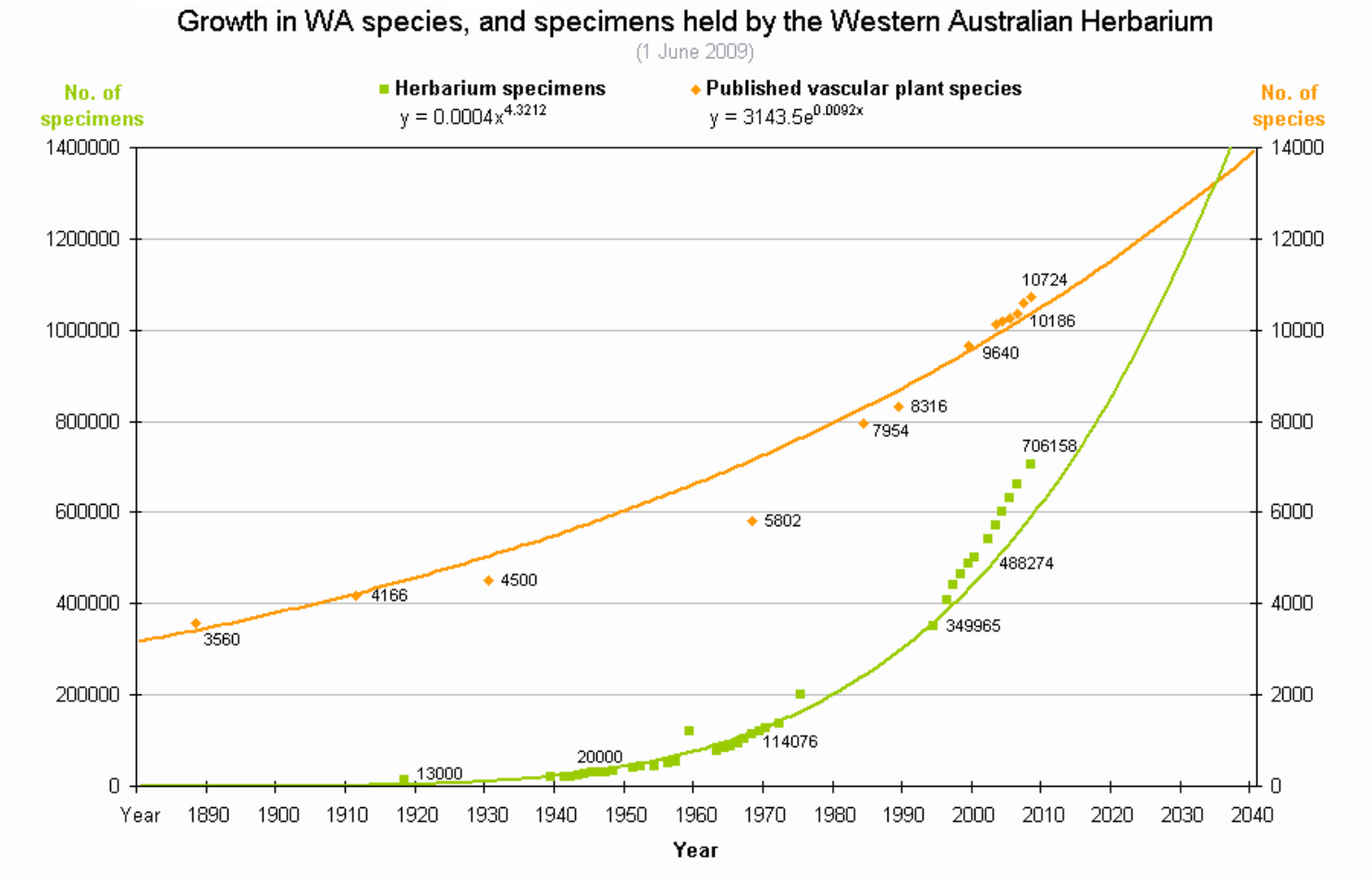
Western Australian Flora - Floristics and Endemism

Floristics

There has been a steady growth in the discovery of new plant taxa over the last century. In 1912 East recorded 4166 native vascular plant species in WA, and in 1969 Beard reported 5802 (see Table 1 below, under Endemism). In the most current table the comparable figure is now 9,844.

The following graph plots the increase in formally recognised vascular plant species (including naturalised aliens) between 1889 and 2009, and includes a trend-line indicating an estimated size for the WA vascular flora in 2040 approaching 14,000 published species. Also included is data and a trendline of growth in the WA Herbarium specimen collection over a similar period, useful for estimating the size of the collection space required during the development of plans for the Herbarium in DEC's new Biodiversity Science Centre, due for completion in 2010.



Increase in the number of published vascular plant species recognised as occurring in WA

Author	Mueller	East	Gardner	Beard	Green	Hnatiuk	Paczkowska & Chapman	FloraBase	FloraBase
Year	1889	1912	1931	1969	1985	1990	2000	2005	2009
Species	3560	4166	4500	5802	7954	8316	9640	10186	10724

Note. Figures for East (1912) and Beard (1969) represent published native species only; all others include naturalised alien

species.

References

Beard, J.S. (1969). Endemism in the Western Australian flora at the species level. *Journal of the Royal Society of Western Australia* 52: 18—20.
East, J.J. (1912). The flora of Western Australia. *In: Cyclopedia of Western Australia* (ed. J.S. Battye). Kussey & Gillingham, Adelaide, pp 37—45.
Gardner, C.A. (1931). *Enumeratio plantarum Australiae Occidentalis: a systematic census of the plants occurring in Western Australia*, Govt. Printer, Perth.
Green, J.W. (1981). *Census of the Vascular Plants of Western Australia.* 1st edn. Western Australian Herbarium, Perth.
Mueller, F.J.H. von (1889). *Second systematic census of Australian plants, with chronologic, literary and geographic annotations. Part 1. Vasculares.* Govt. Printer, Melbourne.
Paczkowska, G. and Chapman, A.R. (2000). *The Western Australian Flora - A Descriptive Catalogue*. Wildflower Society of Western Australia (Inc.), the Western Australian Herbarium, CALM and the Botanic Gardens & Parks Authority, Perth.

The following three tables and full citations for references mentioned are available from:
Paczkowska, G. and Chapman, A.R. (2000). *The Western Australian Flora - A Descriptive Catalogue*. Wildflower Society of Western Australia (Inc.), the Western Australian Herbarium, CALM and the Botanic Gardens & Parks Authority, Perth.
A complete version of the introduction to this book is available in PDF format (requires Acrobat Reader).
Note that data presented in these tables was sourced from the information systems of the Western Australian Herbarium on 20th January 2000.

Table 2
Size of vascular plant divisions to species level

	Families	Genera	Species
Pteridophytes	21	44	95
Gymnosperms	6	7	24
Monocotyledons	51	398	1809
Dicotyledons	148	1094	7712
Total	226	1543	9640

Note. Includes naturalised alien species to maintain comparability with Green (1985).

Table 3
Analysis of vascular plant divisions for various categories of name

Category	Pteridophytes	Gymnosperms	Monocots	Dicots	Total
Total records [A]	140	33	3200	13202	16575
Non-current names [B]	36	9	834	2734	3613
Current names [C]	104	24	2366	10468	12962
Current taxa [D]	97	24	2230	9571	11922
Current species [E]	95	24	2084	8652	10855
Manuscript names [F]	0	0	162	458	620
Phrase names [G]	0	0	113	482	595
Published species [H]	95	24	1809	7712	9640
Published alien species [I]	7	5	320	720	1052
Published native species [J]	88	19	1489	6992	8588

Notes. A - total number of records in the database, B - number of synonymous, excluded or misapplied names, C - number of currently accepted plant names including species names for which subspecies are also recorded, D - number of currently accepted taxa (ie. including terminal taxa only), E - number of currently accepted species, F - number of proposed but unpublished species, G - number of assigned but unpublished species, H - number of formally published species names, I - number of published naturalised alien species, J - number of published species native to Western Australia.

Table 4
Distribution of endemic vascular plant species in the three Botanical Provinces

	Endemic to WA	Non-endemic	Total
Northern Province	306 (14.3%)	1834	2140
Eremaean Province	2003 (50.4%)	1974	3977
South-West Province	4524 (79.2%)	1186	5710
Whole State	5244 (62.1%)	3207	8451

Notes. Adapted from Beard, Chapman and Gioia (unpublished) and based on Beard's phytogeographic regions. The number of published native species found in WA (8451) differs from the figure given in Table 3 due to difficulties assigning geographical distribution for 137 species. However, it should be noted that these figures were tabulated within the same period and from approximately the same raw data as used for this publication.

Endemism

The following three tables are taken from:
Beard, J.S., Chapman, A.R. and Gioia, P. (2000). Species richness and endemism in the Western Australian flora. *Journal of Biogeography* **27**, 1257-1268.
A complete version of this paper is available in PDF format (requires Acrobat Reader).

Table 1 Endemic and non-endemic species of native vascular plants in the Botanical Provinces of Western Australia according to various estimates.

	Species number and percentage of total					
	East (1912)		Beard (1969)		Present authors*	
Northern Province						
Northern only			355	24.6%	241	11.3%
Northern and Eremaean			64	4.4%	47	2.8%
All Provinces			11	0.8%	18	0.8%
Total endemics	780	64%	430	29.8%	306	14.3%
Non-endemic	441		1015	70.2%	1834	85.7%
Total	1221		1445		2140	
Eremaean Province						
Eremaean only			532	29.2%	432	10.9%
Northern and Eremaean			64	3.5%	47	1.2%
Southern and Eremaean			519	28.5%	1506	37.9%
All Provinces			7	0.4%	18	0.4%
Total endemics	614	87%	1122	61.6%	2003	50.4%
Non-endemic	92		700	38.4%	1974	49.6%
Total	706		1822		3977	
South-West Province						
South-West only			2472	68.5%	3000	52.5%
Southern and Eremaean			519	14.3%	1506	26.3%
All Provinces			11	0.4%	18	0.4%
Total endemics	2013	90%	3002	83.2%	4524	79.2%
Non-endemic	226		609	16.8%	1186	20.8%
Total	2239		3611		5710	
Western Australia						
Total endemics	3407	82%	3953	68.0%	5244	62.1%
Non-endemic	759		1849	32.0%	3207	37.9%
Total	4166		5802		8451	

* Figures for endemism are calculated with the Interzone incorporated in the Eremaea.

Table 2 Attributes of Mediterranean floras of Western Australia, South Africa, California and Italy (native species only)

	South-West Province SWP	Cape Floristic Region CFR	California CFP	Italy IMZ
Area (km²)	309,840	90,000	324,000*	195,000
No. of families	143	150	154	120
Endemic families	1	6	?	0
No. of genera	711	989	895	1069
Endemic genera	92 (12.9%)	197 (19.5%)	55 (6.1%)*	7 (0.7%)
No. of species	5710	8504	4839	4948
Endemic species	3000 (52.5%)	5783 (68%)	2128 (44.9%)*	628 (12.5%)
Species/genus	8.0	8.6	5.4	4.6
Percentage of flora				
15 largest families	70.3%	64%	66%	70.5%
10 largest genera	27.3%	20.4%	16.0%	11.6%

* Indicates figures for California Floristic Province. Others are for California State.
For SWP, figures are for provincial endemics, for consistency with the other regions.
Sources: South Africa: Bond & Goldblatt (1984), Cowling *et al.* (1992); California Raven & Axelrod (1978) (area); California (endemic genera and species) R. F. Thorne, personal communication (1996); other figures Hickman (1993); Italy: S. Pignatti (personal communication 1999).

Table 3 Number of species and endemism in the 15 largest families and 10 largest genera in comparable mediterranean regions. Columns show the number of native species and the percentage endemism of these. Figures for SWP are for provincial endemism.

South-West Province SWP			Cape Floristic Region CFR			California (State)			Italy IMZ		
	Spp.	Endemism		Spp.	Endemism		Spp.	Endemism		Spp.	Endemism
Families											
Myrtaceae	807	(54%)	Asteraceae	986	62%	Asteraceae	627	31%	Asteraceae	624	23%
Proteaceae	681	(73%)	Ericaceae	672	97%	Papilionaceae	285	38%	Poaceae	419	10%
Papilionaceae	424	(67%)	Mesembryanthemaceae	660	77%	Scrophulariaceae	257	35%	Papilionaceae	378	8%
Mimosaceae	398	(53%)	Papilionaceae	639	82%	Poaceae	251	16%	Brassicaceae	239	16%
Asteraceae	263	(19%)	Iridaceae	612	79%	Liliaceae *sensu lato*	214	49%	Caryophyllaceae	216	16%
Epacridaceae	187	(84%)	Liliaceae *sensu lato*	418	57%	Brassicaceae	197	29%	Apiaceae	211	13%
Goodeniaceae	180	(45%)	Proteaceae	320	96%	Polygonaceae	196	42%	Lamiaceae	188	12%
Orchidaceae	167	(62%)	Restionaceae	310	94%	Cyperaceae	193	13%	Scrophulariaceae	176	18%
Cyperaceae	164	(51%)	Scrophulariaceae	310	52%	Polemoniaceae	168	37%	Liliaceae *sensu lato*	171	13%
Stylidiaceae	154	(75%)	Rutaceae	259	93%	Boraginaceae	140	35%	Rosaceae	162	3%
Poaceae	141	(19%)	Campanulaceae	222	71%	Hydrophyllaceae	139	32%	Ranunculaceae	151	14%
Rutaceae	120	(64%)	Orchidaceae	206	60%	Onagraceae	137	37%	Boraginaceae	95	20%
Chenopodiaceae	118	(6%)	Cyperaceae	203	61%	Rosaceae	136	29%	Cyperaceae	88	6%
Liliaceae *sensu lato*	111	(52%)	Poaceae	181	42%	Apiaceae	132	32%	Orchidaceae	87	3%
Sterculiaceae	99	(65%)	Polygalaceae	139	84%	Lamiaceae	105	48%	Campanulaceae	84	19%
Genera											
Acacia	397	(53%)	Erica	526	96%	Carex	131	17%	Carex	80	6%
Eucalyptus*	254	(47%)	Aspalathus	245	93%	Eriogonum	113	39%	Ranunculus	70	14%
Grevillea	182	(58%)	Ruschia	138	79%	Astragalus	96	47%	Trifolium	66	5%
Stylidium	146	(77%)	Phylica	133	89%	Phacelia	94	38%	Centaurea	60	45%
Melaleuca	106	(48%)	Agathosma	130	96%	Lupinus	71	54%	Silene	57	18%
Leucopogon	104	(87%)	Oxalis	129	70%	Mimulus	63	46%	Euphorbia	57	12%
Hakea	93	(62%)	Pelargonium	125	51%	Arctostaphylos	56	84%	Allium	49	8%
Verticordia	93	(63%)	Senecio	113	52%	Juncus	53	45%	Festuca	46	35%
Dryandra	91	(93%)	Cliffortia	106	90%	Penstemon	52	38%	Galium	45	33%
Daviesia	90	(76%)	Muraltia	106	90%	Cryptantha	52	37%	Vicia	43	7%

* Excludes *Corymbia*.
Sources: South Africa, Bond & Goldblatt (1984); California, Hickman (1993); Italy, S. Pignatti (personal communication 1999).

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Compiled by Alex Chapman; last updated on 10 August 2009.