

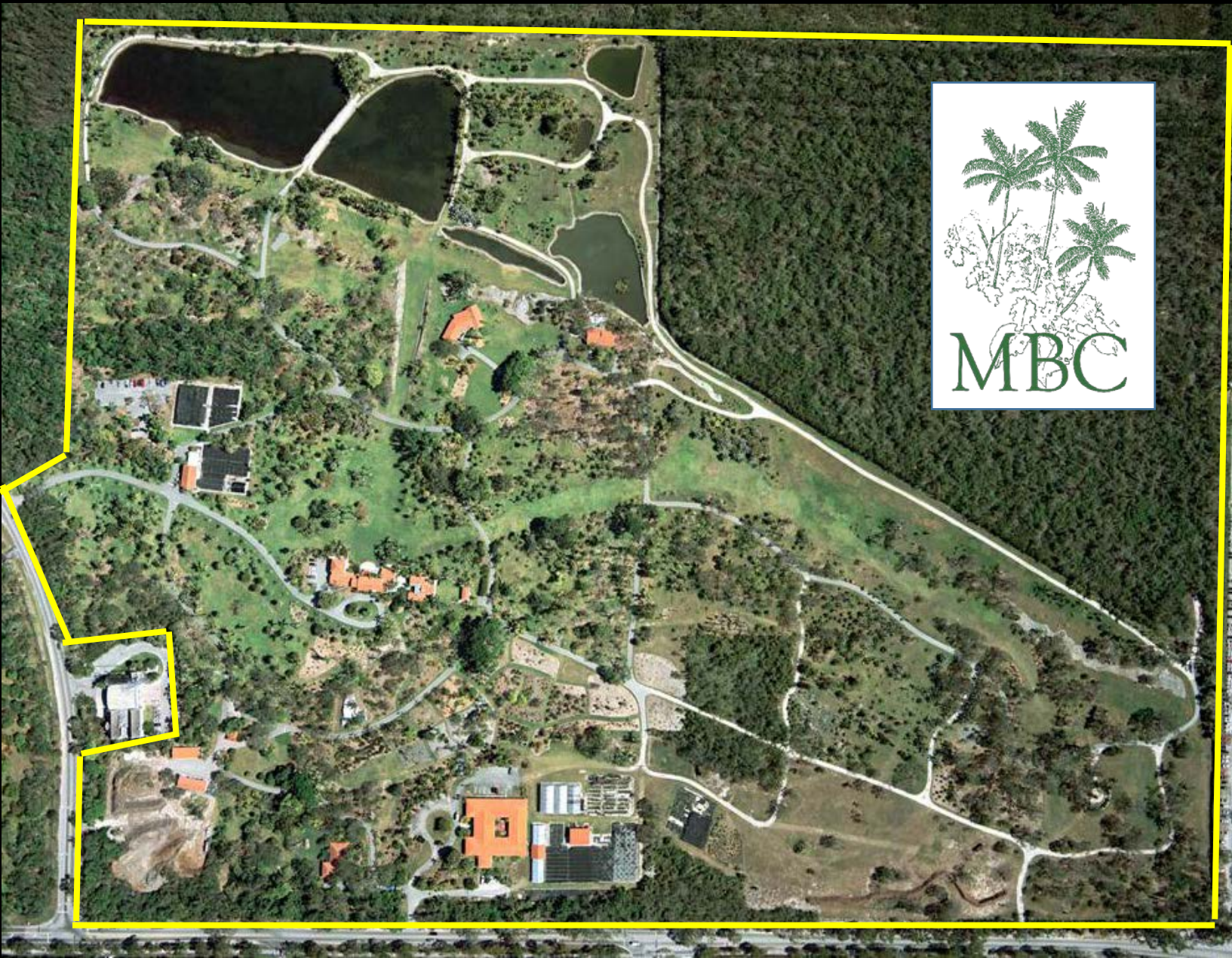
The World List of Cycads

Integrating cycad data
for
Research and Conservation



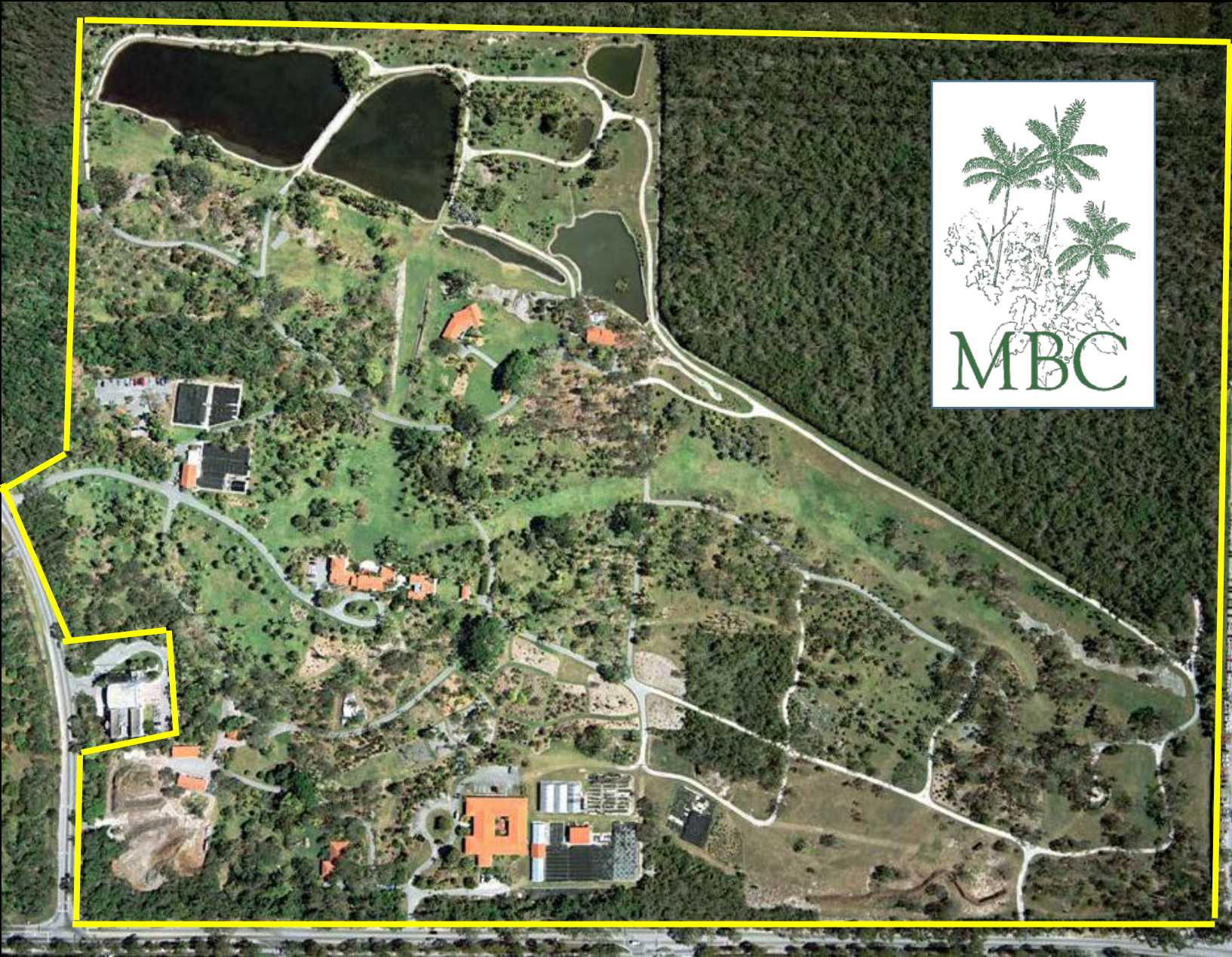
Michael Calonje, Montgomery Botanical Center

Montgomery Botanical Center



- Coral Gables, Florida
- 120 Acres
- Palms and Cycads
- Established 1932

Montgomery Botanical Center



- Both collections
Nationally Accredited
by APGA Plant
Collections Network



Plant
Collections
Network

AMERICAN PUBLIC GARDENS ASSOCIATION

Montgomery Botanical Center



Cycad collection

- 229 species (ca. 2/3 of all)
- 4927 plants
- 1758 accessions (85% wild collected)

Montgomery Botanical Center



Hosts Programme Office for IUCN/SSC's Cycad Specialist Group

IUCN/SSC Cycad Specialist Group



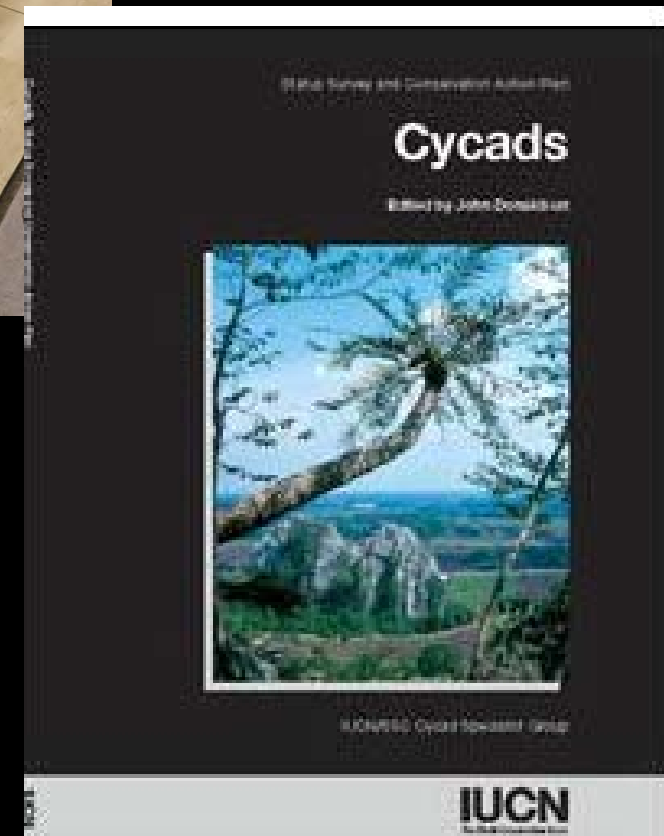
- 36 experts (14 countries)
- Meets triennially during International Cycad Conferences
- Coordinates IUCN Red List Assessments
- Maintains up to date consensus taxonomy for cycads (The World List of Cycads)



Cycad Specialist Group



- Published status survey and conservation action plan for cycads (2003)



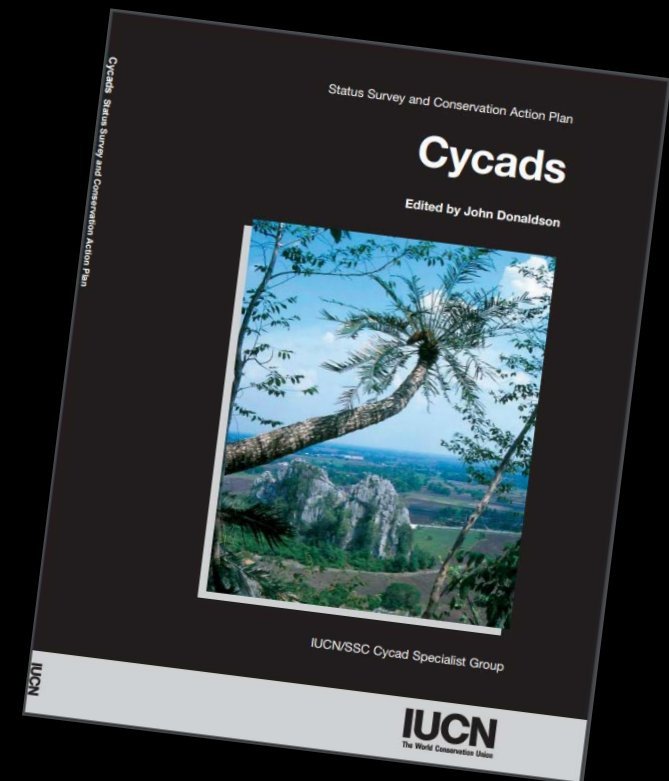
CSG Conservation Action Plan (2003)

Action Proposal: Develop a consistent taxonomy for cycads

- Hold a workshop to develop principles and recommendations for a consistent, practical, and informative taxonomy of the living cycads.



Zamia hamannii [CR]



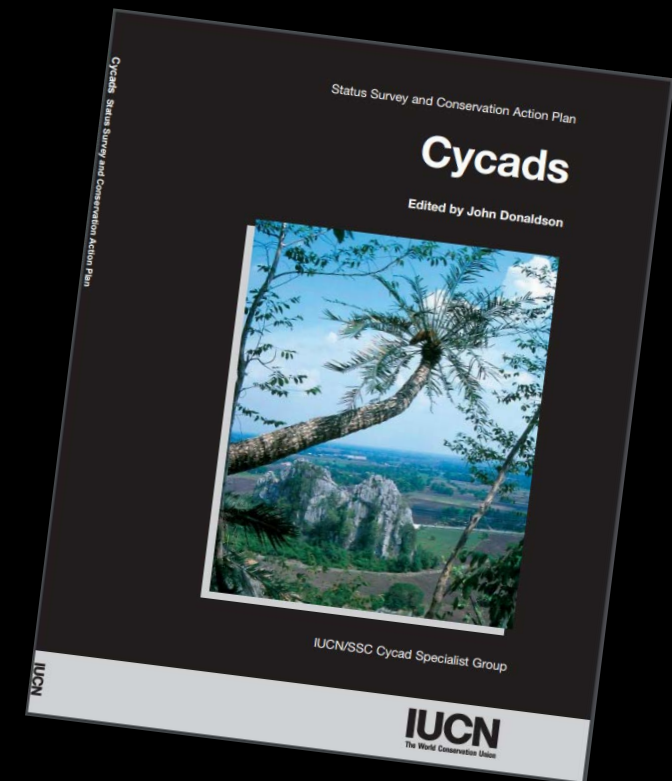
CSG Conservation Action Plan (2003)

Action Proposal: Develop a consistent taxonomy for cycads

- Hold a workshop to develop principles and recommendations for a consistent, practical, and informative taxonomy of the living cycads.



2002 Workshop at Montgomery

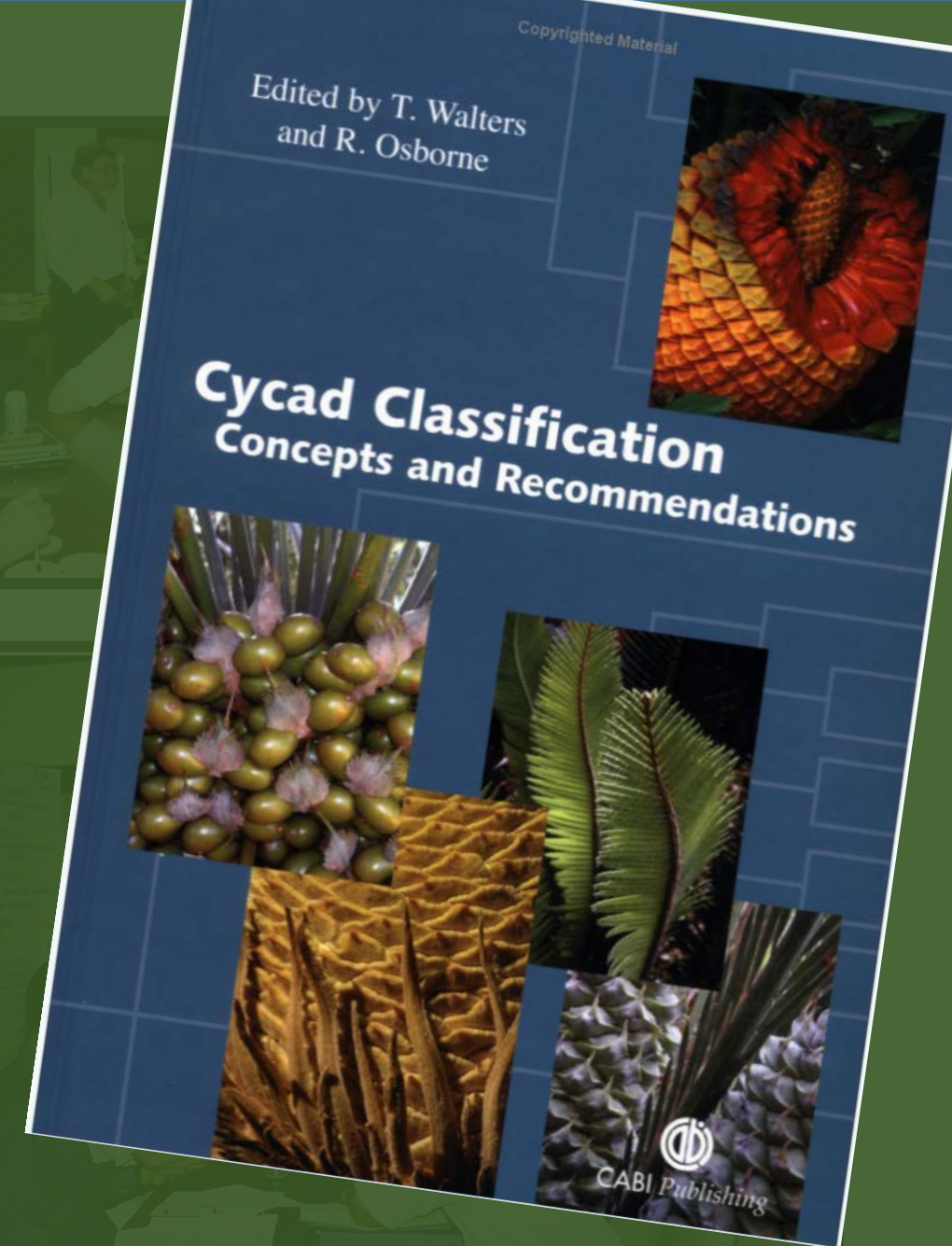


Zamia hamannii [CR]

2002 Workshop at Montgomery Botanical Center

- Considered World List of Cycads as de-facto nomenclatural and taxonomic reference for cycads
- Suggested CSG monitor and manage World List of Cycads

MBC's CYCAD CLASSIFICATION CONCEPTS WORKSHOP



Walters & Osborne, 2004

The World List of Cycads (Print edition)

Taxon	Location	Date	Original Source	Type	Status
BOWENIA Hook. ex Hook.f. (2 species: Australia)		1863	<i>Curtis's Bot. Mag.</i> 89: sub t. 5398		
<i>B. serrulata</i> (W.Bull) Chamb.	Australia (Qld)	1912	<i>Bot. Gaz.</i> 54: 419	L—t. 5	LC
* <i>B. spectabilis</i> Hook. ex Hook. f.	Australia (Qld)	1863	<i>Curtis's Bot. Mag.</i> 89: sub t. 5398	L—t. 5398	LC
Synonyms and other names:					
<i>B. spectabilis</i> var. <i>sernata</i> F.M.Bailey	= <i>B. serrulata</i>	1883	<i>Queensl. Fl.</i> p. 501	I—K	
<i>B. spectabilis</i> var. <i>serrulata</i> W.Bull	= <i>B. serrulata</i>	1878	<i>Retail List [Bull]</i> No. 143: 4, t. 5	L—t. 5	

A list of validly published cycad names

- Includes accepted names, synonyms, and illegitimate names
- First published in 1985 (30+ years), 11 printed versions, last published in 2012
- Additional information
 - Synonymy
 - Geographic distribution
 - Protologue publication information
 - Herbaria where types are deposited
 - Conservation status data

Authorship

- Roy Osborne 1985-2012 (27 years)
 - Retired from WL on August 20, 2010
- Dennis Stevenson 1990-Present (25 years)
- Ken Hill 1995-2012 [† 2010] (17 years)
- J. Hendricks 1985-1990 (3 years)
- Michael Calonje 2012-Present (5 years)
- Leonie Stanberg 2012-Present (5 years)



Roy Osborne

30th Anniversary of The World List of Cycads!

Osborne, R. & J. Hendricks. 1985. A world list of cycads. *Encephalartos* 3:13-17

A WORLD LIST OF CYCADS

by Roy Osborne and John Hendricks

INTRODUCTION

Taxonomy is that discipline of botany which provides a rational basis for the naming of plants. It is an objective science in that set procedures work toward developing a meaningful systematic genealogy. However, problems relating to the selection of criteria of rank result in subjective judgement and opinion; this is especially true in the order Cycadales.

Most cycad species names originated from studies of isolated plants or habitats. When descriptions of these species were later compared on a broader regional basis, many appeared to be synonymous or less differentiated than others, thus names and classifications had to be reassigned. This process may repeat as often as justified, the most recent properly-published names and ranks being accepted as valid. (See Piet Vorster's "Why Plant Names Change", *ENCEPHALARTOS* No. 1, March 1985.)

Apart from the as yet unresolved confusion of the early literature over the identification of some taxa, there are also problems of judgement and of opinion. In addition, there are the problems of known but undescribed new species (e.g. the *Encephalartos* from the vicinity of Voi in Kenya) and there are problems of botanically invalid names applied by collectors to taxa that differ from or have not been reconciled with valid taxa.

Another important factor is that the *Zamia*, *Cycas* and *Ceratozamia* have yet to be fully explored and properly classified. Fortunately, *Dioon*, *Encephalartos* and *Macrozamia* are largely defined, although some changes are anticipated. Only *Bowenia*, *Lepidozamia*, *Microcycas* and *Stangeria* are considered taxonomically complete at this time.

Major advances have recently been made in *Zamia* taxonomy by information from chromosome karyotyping. Biochemical studies too are being used to define genera and give promise of differentiation at lower taxonomic rank. Other modern analytical techniques may have application in future years. Taxonomy in its purest form reflects evolution; the best advances will be made by combining the knowledge from the many relevant interacting scientific disciplines.

The list which follows itemises the currently valid taxonomic ranking at or below the species level to the best of our present knowledge. It is not a listing of all validly published species, nor does it represent our opinion as to 'good' species or suitable classification. Indeed, our opinions and those of many others are at considerable variance from this list, particularly in assignments in the *Cycas*, *Zamia* and *Ceratozamia* genera. Work is proceeding toward an improved cycad taxonomy, though perhaps not of the scope nor at the rate which might be desired. In the interim, it is recommended that labelling of specimen plants is supplemented with any additional appropriate information.

The preparation of this list would not have been possible without the kind assistance of numerous workers; we should mention specifically Willie Tang, John Popenoe, Piet Vorster, Denis Heenan, Paola De Luca, Sergio Sabato and Dennis Stevenson. Final responsibility for the list is, however, ours alone.

Roy Osborne John Hendricks
20 Maryvale Road 110 Brookmeade Ave.
3630 WESTVILLE Statesville NC 28677
RSA U.S.A.

Bowenia = 2
Ceratozamia = 9
Cycas = 15
Dioon = 10
Encephalartos = 43
Lepidozamia = 2
Macrozamia = 14
Microcycas = 1
Stangeria = 1
Zamia = 33

130 Total Species

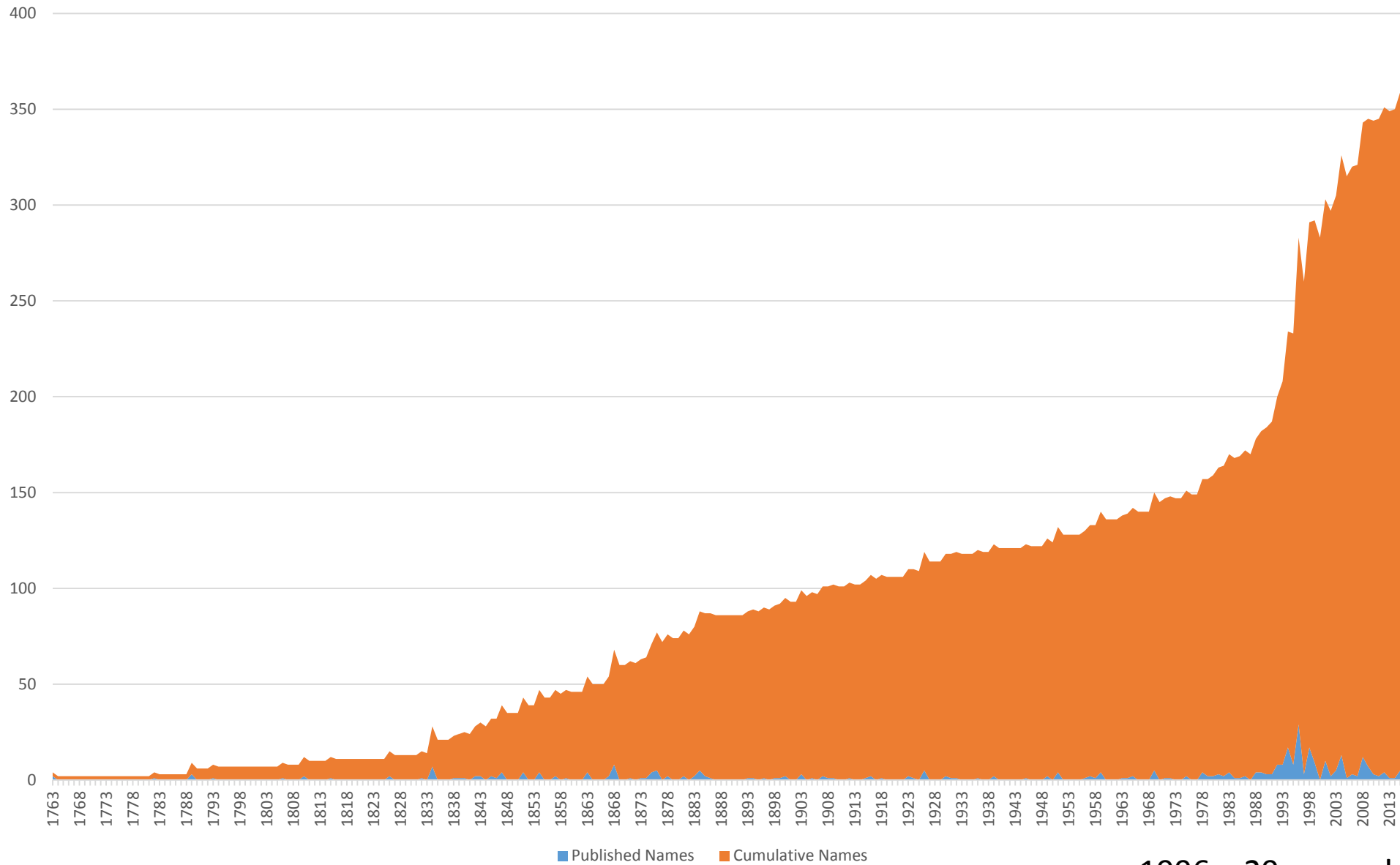
The World List of Cycads (Print edition)

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* <i>B. spectabilis</i> Hook. ex Hook. f.	Australia (Qld)	1863	<i>Curtis's Bot. Mag.</i> 89: sub t. 5398	L—t. 5398	LC
Synonyms and other names:					
<i>B. spectabilis</i> var. <i>sernata</i> F.M.Bailey	= <i>B. serrulata</i>	1883	<i>Queensl. Fl.</i> p. 501	I—K	
<i>B. spectabilis</i> var. <i>serrulata</i> W.Bull	= <i>B. serrulata</i>	1878	<i>Retail List [Bull]</i> No. 143: 4, t. 5	L—t. 5	

Disadvantages

- Difficult to extract statistics
 - Not searchable, sorteable or filterable
- Space limited so only basic data can be presented for each name
- Published triennially, soon obsolete

Accepted Names Published per Year



1996 = 29 names!



2011 Cycad Specialist
Group Meeting
Shenzhen, China

Called for *current*
taxonomy



The World List of Cycads

A Comprehensive Taxonomic Reference

Login

Home

Browse Species

Search Names

About Us

Contact Us

About The World List of Cycads

This site hosts the official online edition of The World List of Cycads, a comprehensive compilation of cycad names including **accepted names**, **synonyms**, **illegitimate names**, **nomina dubia**, and **invalidly published names**.

The printed edition of the World List is published under the auspices of the [IUCN/SSC Cycad Specialist Group](#), in the proceedings of the International Conference of Cycad Biology, which is held every three years. The most recent printed version was published in 2012 in the Proceedings of the 8th International Conference of Cycad Biology and is available [here](#). Additional information about the printed versions of the World List and standards used by the site can be found in the [About Us](#) page.

The online version of the World List of Cycads is periodically updated to reflect changes in cycad nomenclature and taxonomy. The current list consists of a total of **10** accepted genera and **335** accepted species, divided as follows: *Bowenia* (2), *Ceratozamia* (27), *Cycas* (107), *Dioon* (14), *Encephalartos* (65), *Lepidozamia* (2), *Macrozamia* (41), *Microcycas* (1), *Stangeria* (1), and *Zamia* (75).

Users can [search](#) all cycad names using several different fields or [browse](#) all currently **accepted names**. Additional information provided for names includes details associated with their publication, nomenclatural types, distribution, and conservation status.

Search for Cycads



June 20, 2013 – World List of Cycads Website Launched

Authorship & Sponsor

Website Sponsor



Nomenclature Editors

- [Michael Calonje \(Montgomery Botanical Center\)](#)
- [Leonie Stanberg \(Royal Botanic Gardens, New South Wales\)](#)
- [Dennis Stevenson \(New York Botanical Garden\)](#)

Web Design

- [Michael Calonje \(Montgomery Botanical Center\)](#)
- [Cycad Database developed using BRAHMS Botanical Research and Herbarium Management System](#)

- Can instant updates to:
 - Taxonomy
 - Nomenclature
 - Distribution data
 - Red List Status
 - etc..



- Additions to Printed World List
 - Detailed Type Information
 - Links to literature, external sites, etc...
 - Photographs

Search Results: 652 total record(s)

Accepted Names (343 species, 15 infraspecific taxa)

Other Valid Names (280 records)

Invalid Names (14 records)

Filter:

Showing 1 to 358 of 358 entries

Species	Distribution	Pub. Year	Publication	Type	Conservation Status	Links
Bowenia serrulata (W.Bull) Chamb. [Images]	Australia (Queensland)	1912	Bot. Gaz. 54: 419  BHL	BAS: B. spectabilis var. serrulata	LC	CP
Bowenia spectabilis Hook. ex Hook.f. [Images]	Australia (Queensland)	1863	Bot. Mag. 89: t. 5398  BHL	LT—Bot. Mag. 89: t. 5398 (1863)	LC	CP

Data Management

Advanced BRAHMS Administration in The World List of Cycads [e:\dropbox\cycadlist\wl_database\database single-user]

File Edit View Goto Tag FastSort Calculate Datalinks Tools

QCL =>syn syn<= nomc ->acc ->syn

Species main list [e:\dropbox\cycadlist\wl_database\database\species.dbf (alias= SP)]

tag	del	mergeto	spnumber	taxstat	syncat	synnote	synof	syntot	family group	order	family	genus	cf	sp1	author1
			398	acc		memo				Cycadales	Zamiaceae	Macrozamia		longispina	P.I.Forst. & D.L.Jones
			399	acc		memo				Cycadales	Zamiaceae	Macrozamia		lucida	L.A.S.Johnson
			400	acc		memo				Cycadales	Zamiaceae	Macrozamia		macdonnellii	(F.Muell. ex Miq.) A.DC.
			401	acc		memo				Cycadales	Zamiaceae	Macrozamia		machinii	P.I.Forst. & D.L.Jones
			402	syn	het	memo	404			Cycadales	Zamiaceae	Macrozamia		mackenziei	Hort. ex Mast.
			403	acc		memo				Cycadales	Zamiaceae	Macrozamia		macleayi	Miq.
			404	acc		memo			1	Cycadales	Zamiaceae	Macrozamia		miquelii	(F.Muell.) A.DC.

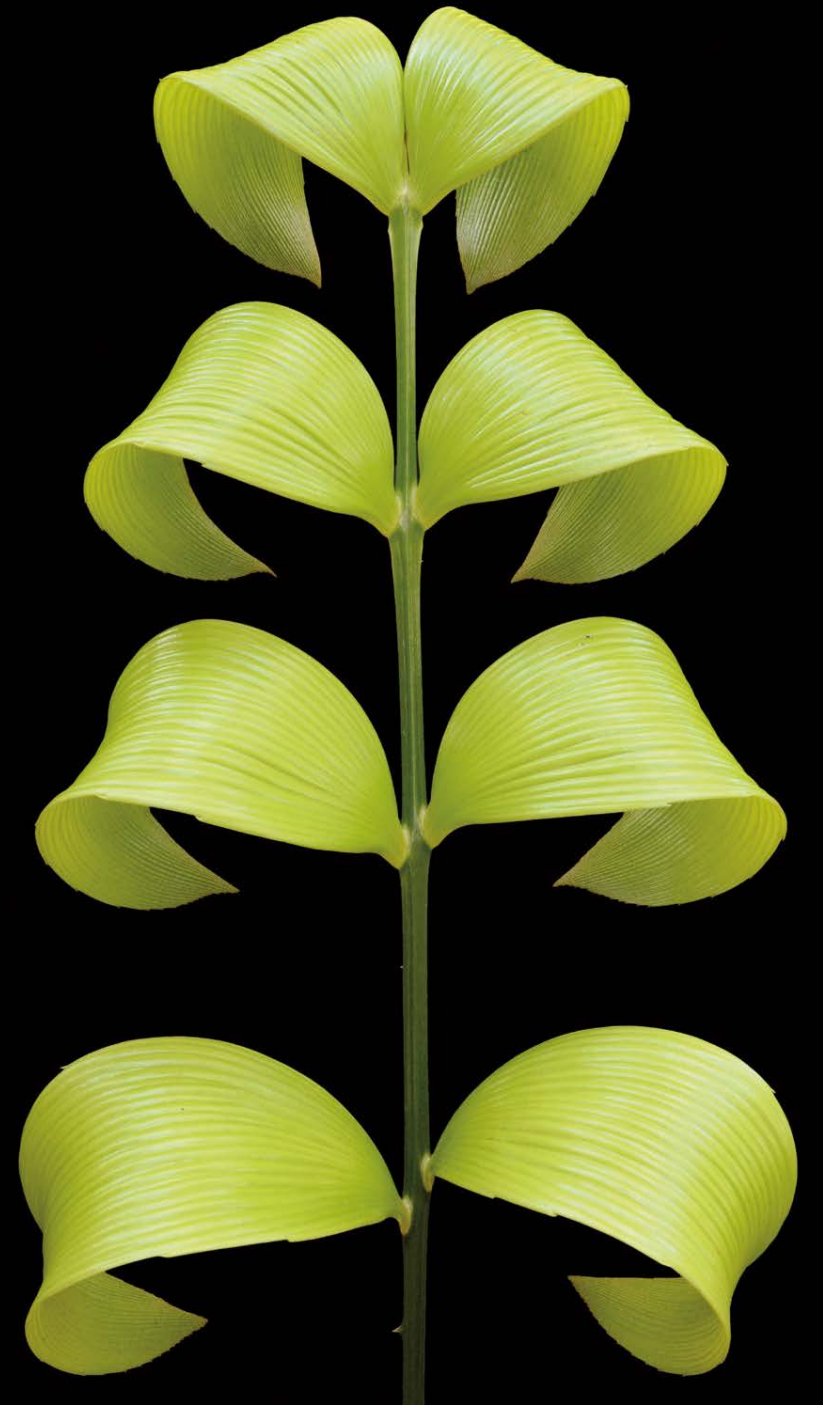


BRAHMS v7

- Custom implementation of data from BRAHMS
- Data managed in BRAHMS and exported to WL website
- Main tables used: species, collections, people, images, literature

Web Design

- Tables exported from BRAHMS and imported into a MySQL database
- Website uses PHP (web programming language) to query database tables and display results
- Zurb Foundation 5 (Web design framework)
 - Allows for Responsive design, etc....




Name Database

- 709 names
- 344 accepted
- 280 synonyms
- 15 invalid

Search for Cycad Names (* To retrieve entire list, simply click the "Search" button, leaving all fields blank)

<input type="text" value="Scientific name"/>	<input type="text" value="Country"/>	<input type="text" value="Conservation Status"/>
<input type="text" value="Genus"/>	<input type="text" value="Year Published"/>	<input type="button" value="Search"/>



Website Sponsor



Nomenclature Editors

- Michael Calonje ([Montgomery Botanical Center](#))
- Leonie Stanberg ([Royal Botanic Gardens, New South Wales](#))
- Dennis Stevenson ([New York Botanical Garden](#))

Web Design

- Michael Calonje ([Montgomery Botanical Center](#))
- Cycad Database developed using [BRAHMS Botanical Research and Herbarium Management System](#)

© Copyright 2016. The World List of Cycads, online edition.

Citation (CSE Style): Calonje M, Stevenson DW, Stanberg L. The World List of Cycads, online edition [Internet]. 2013-2016. [cited 2016 Jun 09].

Available from: <http://www.cycadlist.org>.

Name Database

- 709 names
- 344 accepted
- 280 synonyms
- 15 invalid

Search Results

- Sortable
- Filterable

Search for Cycad Names (* To retrieve entire list, simply click the "Search" button, leaving all fields blank)

Scientific name Country Conservation Status

Genus Year Published



Search Results: 709 total record(s)

Accepted Names (344 species, 15 infraspecific taxa)

Other Valid Names (335 records)

Invalid Names (15 records)

Filter:

Showing 1 to 359 of 359 entries

Species	Distribution	Pub. Year	Publication	Type	Conservation Status	Links
Bowenia serrulata (W.Bull) Chamb. [Images]	Australia (Queensland)	1912	Bot. Gaz. 54: 419 BHL	BAS: B. spectabilis var. serrulata	LC	CP
Bowenia spectabilis Hook. ex Hook.f. [Images]	Australia (Queensland)	1863	Bot. Mag. 89: t. 5398 BHL	LT—Bot. Mag. 89: t. 5398 (1863)	LC	CP
Ceratozamia alvarezii Pérez-Farr., Vovides & Iglesias [Images]	Mexico (Chiapas)	1999	Novon 9(3) 410-413, fig. 1 BHL	H—CHIP	EN	CP
Ceratozamia becerrae Pérez-Farr., Vovides & Schutzman [Images]	Mexico (Chiapas, Tabasco)	2004	Bot. J. Linn. Soc. 146(1): 123-128, figs. 1-7 BHL \$	H—XAL	EN	
Ceratozamia brevifrons Miq. [Images]	Mexico (Veracruz)	1847	Tijdschr. Wis- Natuurk. Wetensch. Eerste Kl. Kon. Ned. Inst. Wetensch. 1(1): 41-42 BHL	N—XAL	[VU]	

Searchable fields

- Genus
- Publication year
- Country
- Conservation Status
- Scientific name

Search for Cycad Names (* To retrieve entire list, simply click the "Search" button, leaving all fields blank)

Scientific name Country Conservation Status

Genus Year Published Search



Search Results: 709 total record(s)

Accepted Names (344 species, 15 infraspecific taxa)

Other Valid Names (335 records)

Invalid Names (15 records)

Filter:

Showing 1 to 359 of 359 entries

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Ceratozamia becerrae Pérez-Farr., Vovides & Schutzman [Images]	Mexico (Chiapas, Tabasco)	2004	Bot. J. Linn. Soc. 146(1): 123-128, figs. 1-7 BHL \$	H—XAL	EN	
Ceratozamia brevifrons Miq. [Images]	Mexico (Veracruz)	1847	Tijdschr. Wis- Natuurk. Wetensch. Eerste Kl. Kon. Ned. Inst. Wetensch. 1(1): 41-42 BHL	N—XAL	[VU]	

Species pages

- Type info
- Literature
- Images

Search for Cycad Names (* To retrieve entire list, simply click the "Search" button, leaving all fields blank)

Scientific name	Country	Conservation Status
Genus	Year Published	Search



Search Results: 1 total record(s)

Accepted Names (1 species, 0 infraspecific taxa)

Filter:

Showing 1 to 1 of 1 entries

Species	Distribution	Pub. Year	Publication	Type	Conservation Status	Links
Zamia montana A.Braun [Images]	Colombia (Antioquia, Risaralda)	1875	Monatsber. Königl. Preuss. Akad. Wiss. Berlin: 376-377 BHL	N—NY	CR	CP

Website Sponsor



Nomenclature Editors

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- Leonie Stanberg (Royal Botanic Gardens, New South Wales)
- Dennis Stevenson (New York Botanical Garden)

Web Design

- Michael Calonje (Montgomery Botanical Center)
- Cycad Database developed using BRAHMS Botanical Research and Herbarium Management System

Filter:

Showing 1 to 1,032 of 1,032 entries

Author(s)	Year	Title	Publication	Abstract
Abraham, A; Mathew, PM	1962	Cytological studies in the cycads: sex chromosomes in <i>Cycas</i> \$	Ann. Bot. (Oxford), n.s. 26(2): 261-266	[Abstract]
Abraham, A; Mathew, PM	1966	Cytology of <i>Encephalartos hildebrandtii</i> A.Br. & Bouche 	Ann. Bot. (Oxford), n.s. 30(2): 239-241	[Abstract]
Ackery, PR; Nash, RJ; Bell, EA; Norstog, K	1993	Sequestration of MAM-Glycosides by insects	Proc. Second Int. Conf. Cycad Biol. : 3-7	
Acuña, RH	2010	A new species of <i>Zamia</i> (Zamiaceae) from Costa Rica [<i>Zamia gomeziana</i>]	Brenesia 73-74: 29-33	[Abstract]
Acuña, RH; Gómez, LD	2009	Selección de un lectotipo para <i>Zamia fairchildiana</i> L.D.Gómez (Zamiaceae)	Brenesia 71-72: 65-66	[Abstract]
Acuña, RH; Marín-Méndez, WA	2012	Some aspects of the foliar anatomy of two <i>Zamia</i> species from Costa Rica: <i>Z. fairchildiana</i> L. D. Gómez and <i>Z. neurophyllidia</i> D. W. Stev. \$	Mem. New York Bot. Gard. 106: 192-203	[Abstract]

- Over 1,000 cycad-related references so far
- Accessible via literature and/or linked to species entries

Image Database

- 4,860 in-situ images
- 45% of species
- Creative Commons Licensed
- Searchable by many fields
- Custom, hyperlinkable galleries possible (e.g. by Author, Country, etc..)

Search for Cycad Images (*You must fill in at least one field to obtain results)

Custom Image Gallery

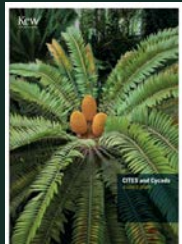
Bowenia serrulata (W.Bull) Chamb. ([Visit species page](#))



Bowenia spectabilis Hook. ex Hook.f. ([Visit species page](#))



Current Usage



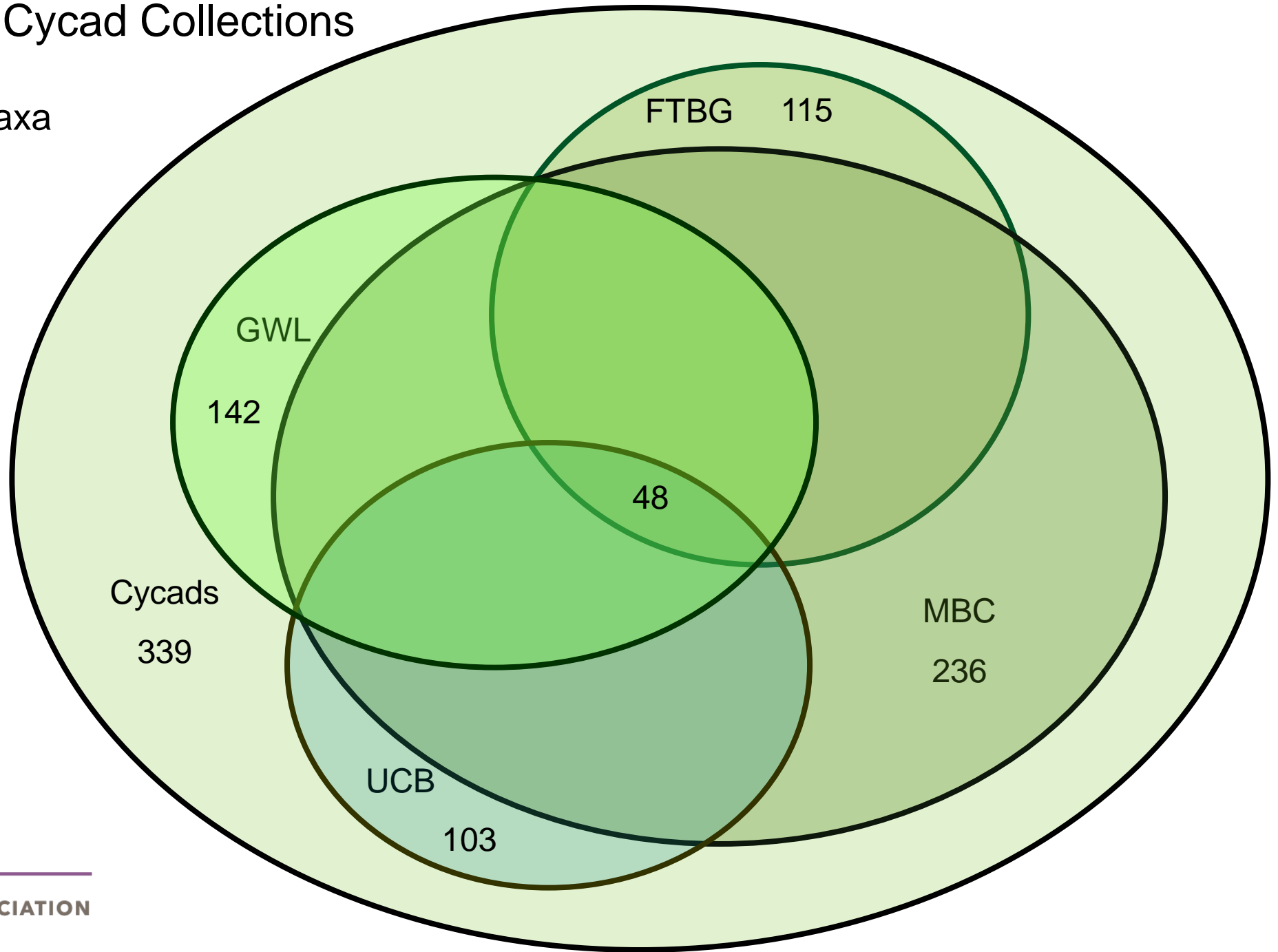
CITES and Cycads – a User's Guide.

Rutherford, C., Donaldson, J.,
Hudson, A., McGough, H.N., Sajeve,
M., Schippmann, U. and Tse-
Laurence, M. (2013). Royal Botanic
Gardens, Kew



Nationally Accredited Cycad Collections

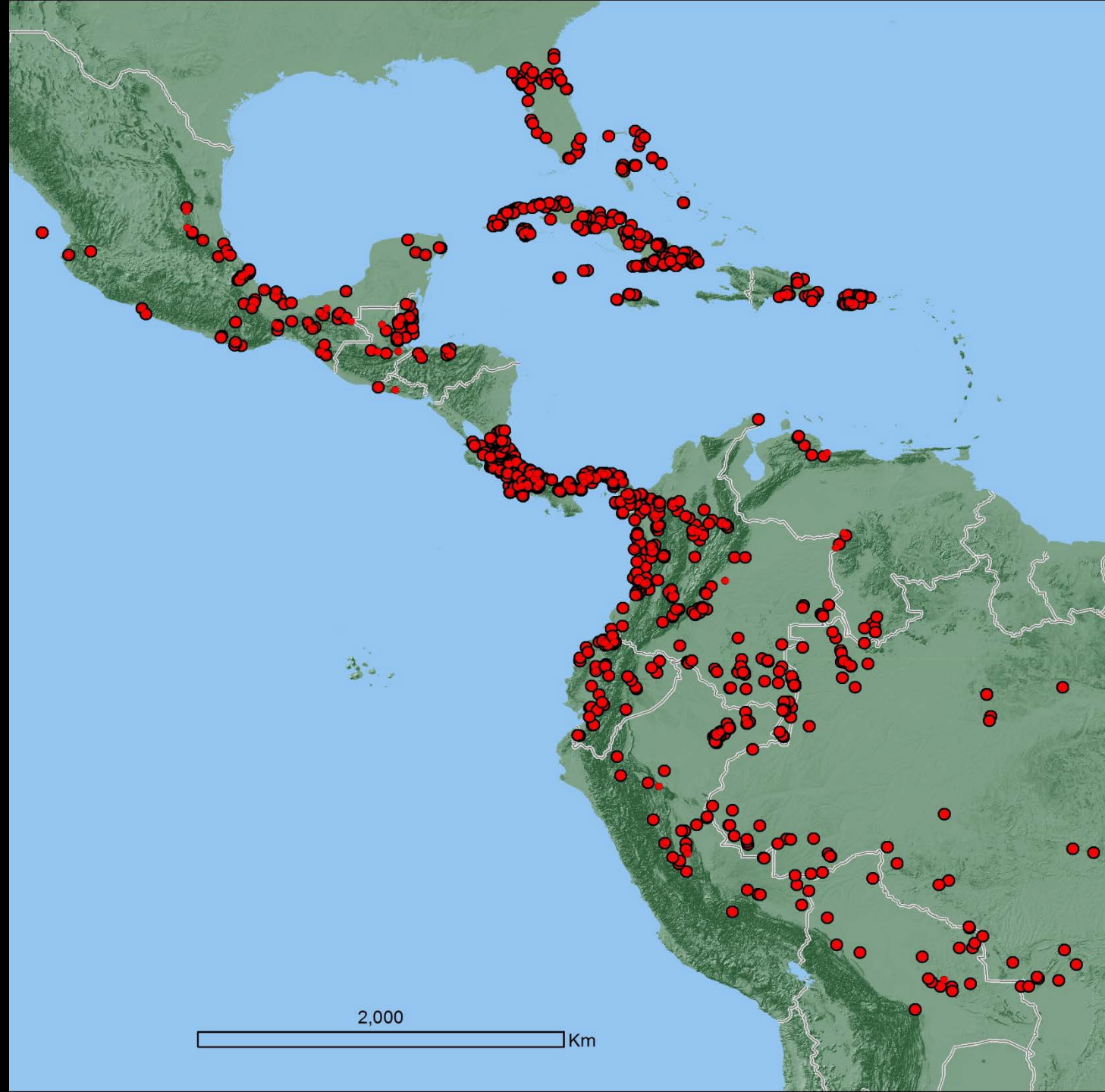
Pooled coverage = 265 taxa



**Plant
Collections
Network**

Herbarium Specimens

- Over 4,000 records
- World List distribution data based on vouchered occurrences



Herbarium Specimens

- Used for taxonomic research

Additional specimens examined BRAZIL. Acre: Teraucá, *Daly et al.* 8342 (NY); *Figueiredo et al.* 874 (NY).

PERU. Amazonas: Prov. Bagua, 550 m, *Figueroa et al.* 20108 (MO); 695 m, *Plowman* 5336 (GH). HUÁNUCO: 750–800 m, *Plowman & Ramirez* 7575 (AAU, F, GH, MO, NY); 700–780 m, *Plowman et al.* 11232 (F, FTG, GH, K, MO, NY). LORETO: 155–210 m, *Winters* 5373 (F, US). PASCO: 380 m, *Forster* 7933 (MO). SAN MARTÍN: 500 m, *Gentry et al.* 25710 (MO); *Plowman* 7601 (F); 700 m, *Rimachi* 5183 (K, MO, NY); 750–1000 m, *Rimachi* 5356 (MO); 475 m, *Plowman & Schubert* 11543 (F, K, MO). UCAYALI: 800–850 m, *Graham* 2694 (F, FTG).

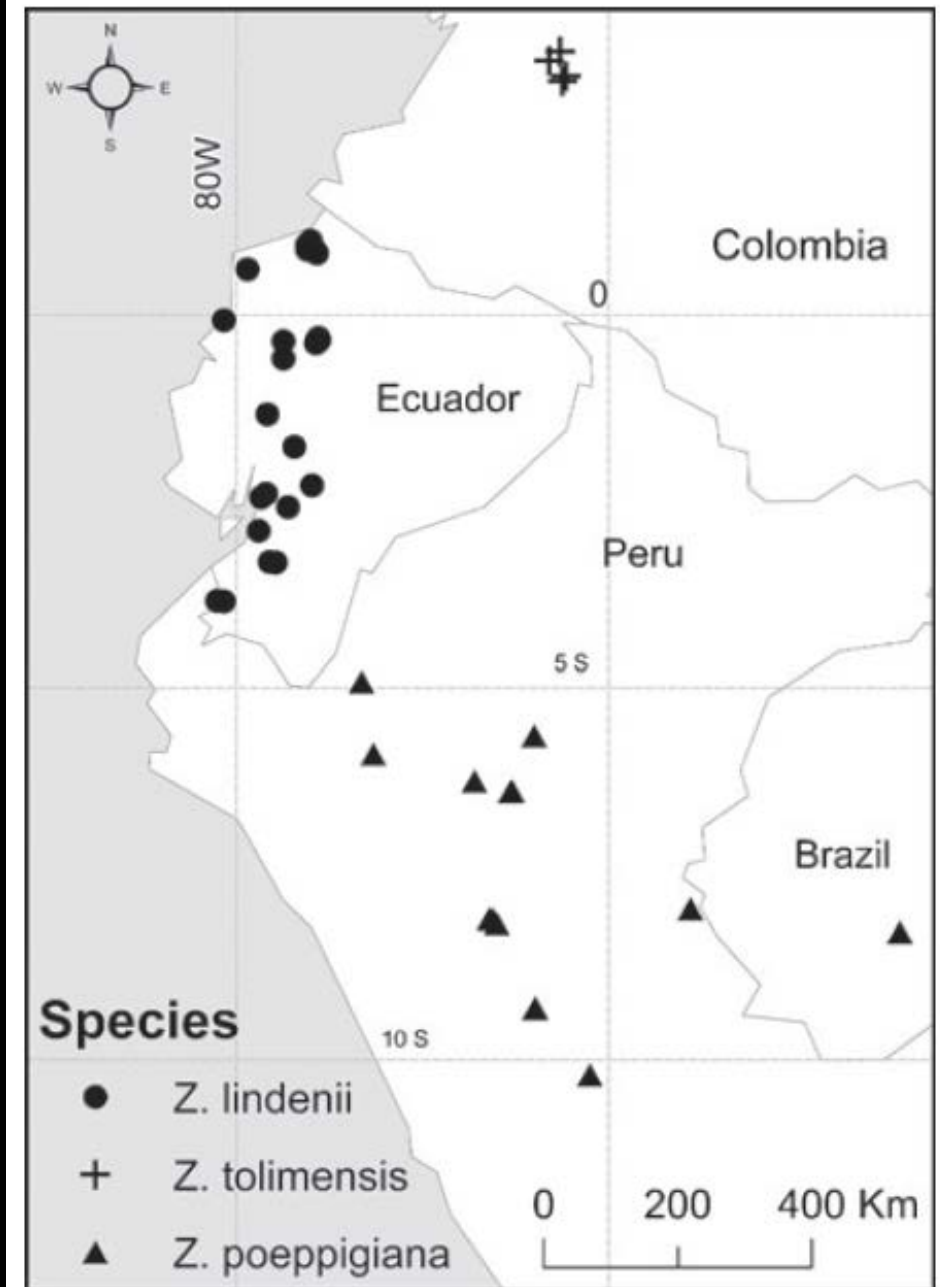
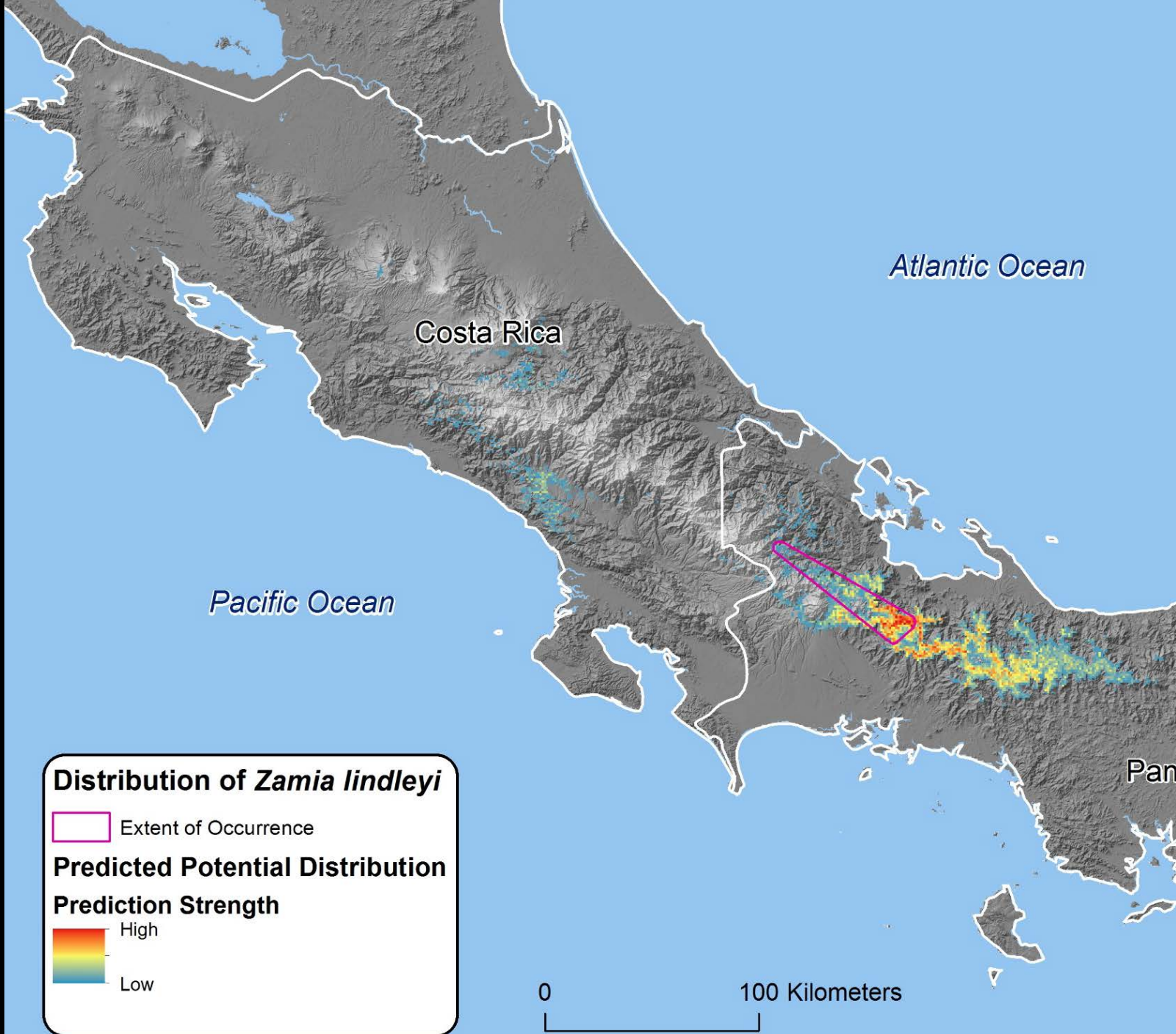


FIG. 4. Distribution of *Zamia lindenii*, *Z. poeppigiana*, and *Z. tolimensis*.

Herbarium Specimens

- Mapping
- Expedition planning
- IUCN Red List Evaluations



Summary

The World List of Cycads uses BRAHMS Botanical Database to integrate data from many sources to advance cycad research and conservation.



Acknowledgements

- Roy Osborne (WL coordinator 1985-201
- Montgomery Botanical Center
 - Hosting the WL website
 - Development time
- Denis Filer
 - Adapting BRAHMS for use in TWLoC
- Claudia Calonje
 - Putting up with hours of sleepless ni developing the website



Cycas revoluta