An integrated assessment of the vascular plant species of the Americas

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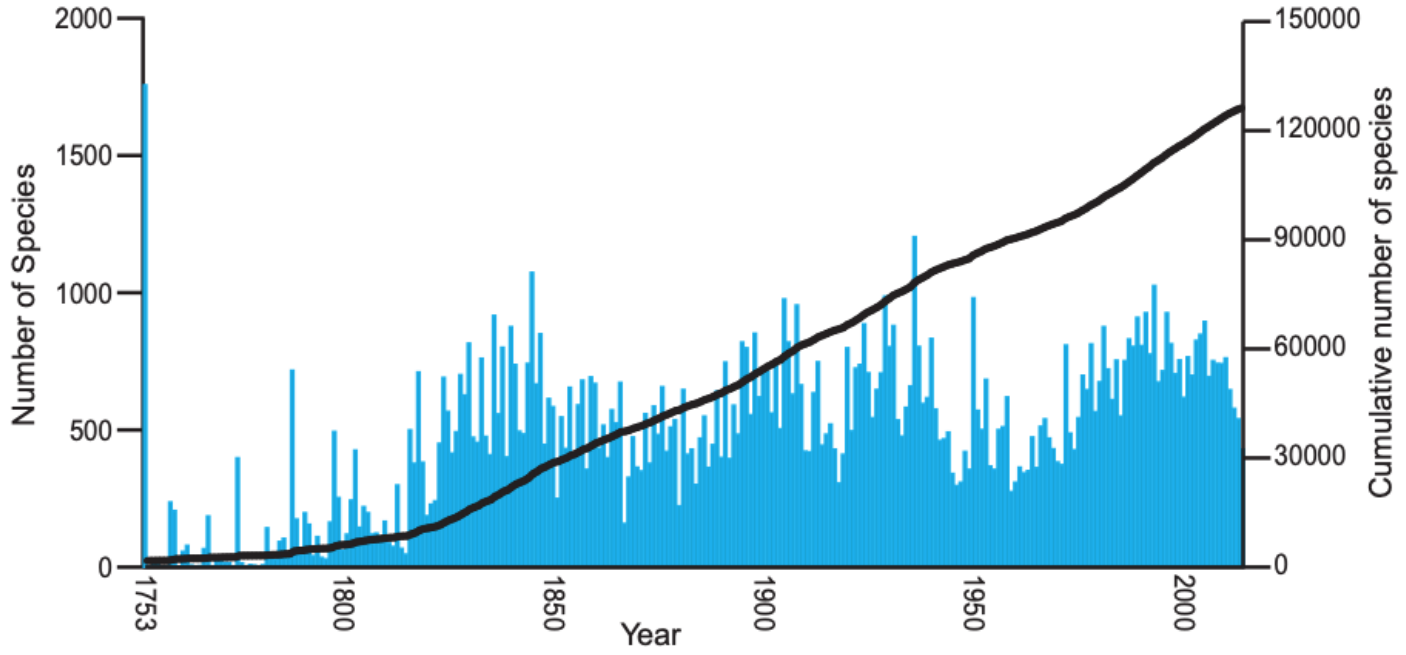
Presentation by Johnny Tian

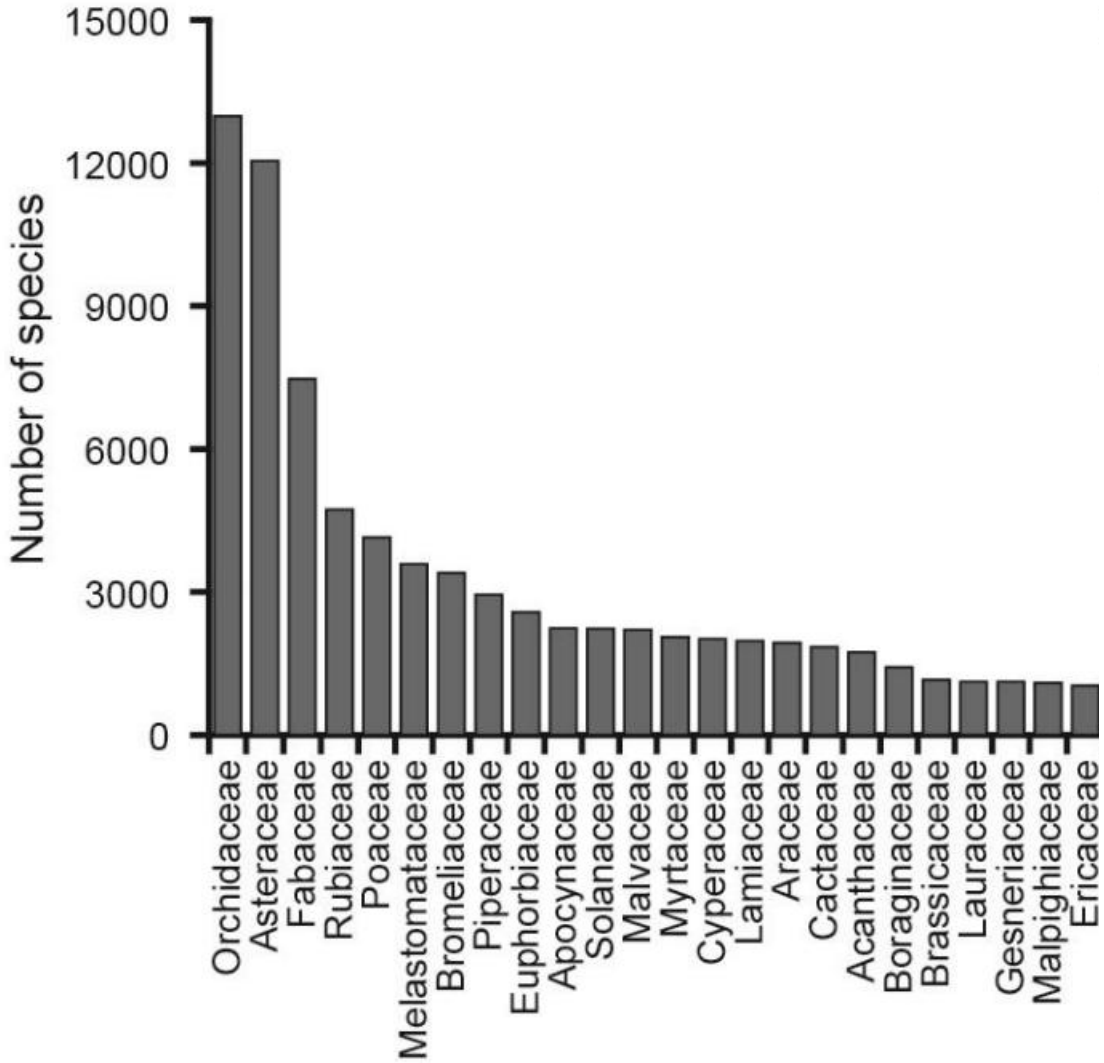
Number of species described and cumulative number of species



12 regions of the Americas

Fig. 1. Map of the Americas showing 12 geographical areas. The areas represent the 12 data sets used to calculate the plant-data summary. For each area, the total number of species of vascular plants and the number of species restricted to that area (in parentheses) are shown.

24 most diverse families with greater than 1,000 species in the Americas

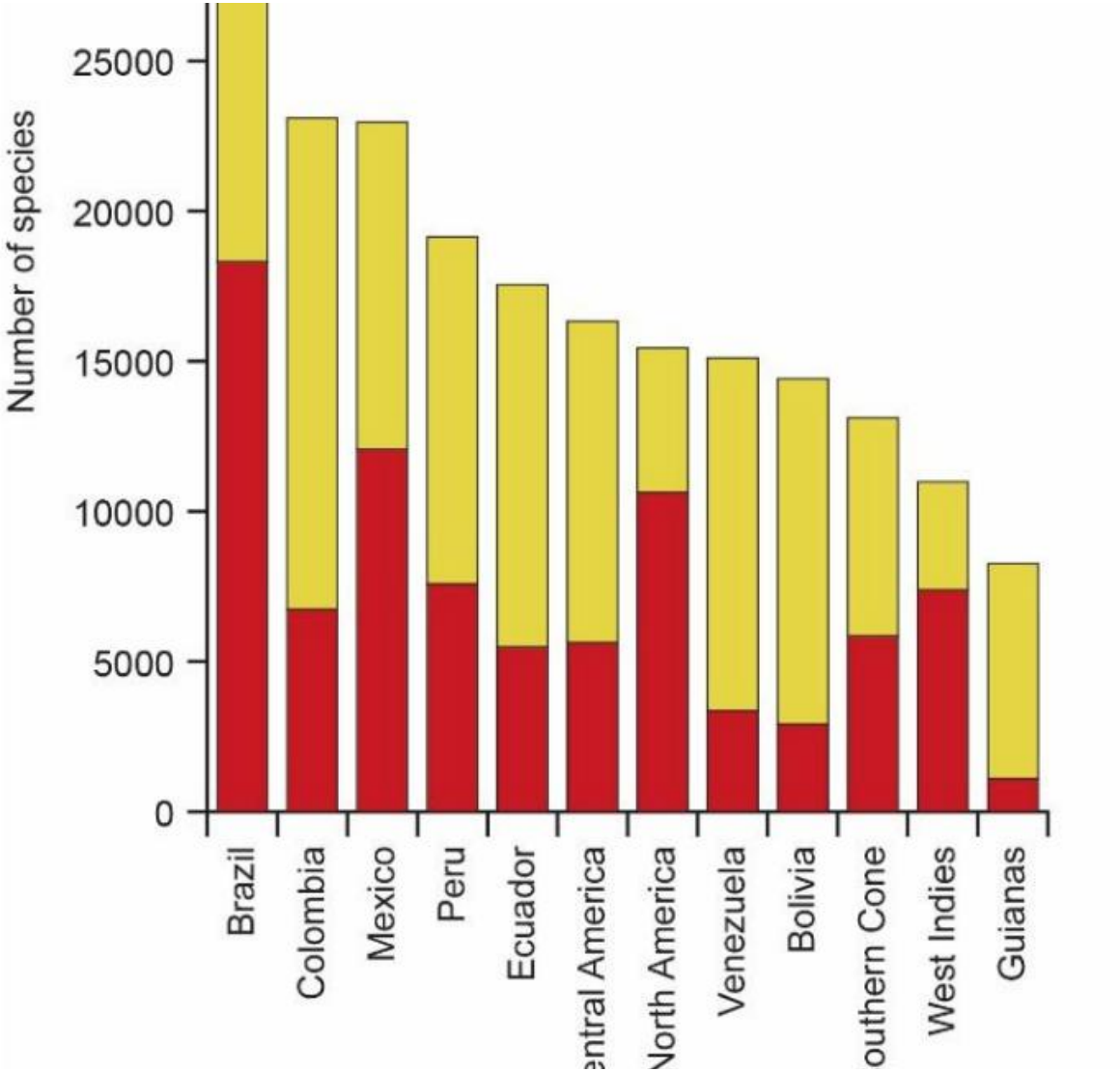


Most common families by region

North America	Peru	Southern Cone	Venezuela
Asteraceae 2,173	Orchidaceae 2,120	Asteraceae 2,008	Orchidaceae 1,441
Fabaceae 1,092	Asteraceae 1,507	Poaceae 1,180	Fabaceae 942
Poaceae 917	Fabaceae 930	Fabaceae 1,052	Rubiaceae 771
Cyperaceae 792	Piperaceae 843	Solanaceae 451	Asteraceae 718
Brassicaceae 636	Melastomataceae 637	Malvaceae 442	Poaceae 667
Boraginaceae 580	Poaceae 633	Orchidaceae 406	Melastomataceae 630
Rosaceae 532	Solanaceae 614	Cyperaceae 378	Cyperaceae 419
Plantaginaceae 400	Rubiaceae 607	Cactaceae 356	Bromeliaceae 370
Polygonaceae 388	Bromeliaceae 456	Euphorbiaceae 337	Apocynaceae 357
Lamiaceae 341	Malvaceae 388	Apocynaceae 262	Araceae 288
Apiaceae 335	Cactaceae 270	Amaryllidaceae 241	Piperaceae 259
Polemoniaceae 313	Apocynaceae 268	Brassicaceae 226	Euphorbiaceae 257
Orobanchaceae 277	Acanthaceae 265	Verbenaceae 216	Malvaceae 249
Onagraceae 271	Euphorbiaceae 257	Amaranthaceae 203	Lauraceae 207
Ranunculaceae 255	Araceae 253	Rubiaceae 202	Myrtaceae 204
Euphorbiaceae 217	Lauraceae 239	Boraginaceae 176	Solanaceae 194
Ericaceae 206	Lamiaceae 231	Convolvulaceae 165	Malpighiaceae 189
Caryophyllaceae 204	Dryopteridaceae 226	Iridaceae 165	Dryopteridaceae 173
Orchidaceae 201	Cyperaceae 212	Apiaceae 159	Polypodiaceae 152
Malvaceae 196	Polypodiaceae 207	Bromeliaceae 158	Ochnaceae 149

Brazil	Central America	Colombia	Ecuador
Fabaceae 2,736	Orchidaceae 2,080	Orchidaceae 3,566	Orchidaceae 3,972
Orchidaceae 2,527	Asteraceae 896	Asteraceae 1,202	Asteraceae 925
Asteraceae 1,996	Piperaceae 787	Rubiaceae 1,091	Rubiaceae 713
Rubiaceae 1,372	Rubiaceae 782	Fabaceae 1,060	Melastomataceae 582
Melastomataceae 1,361	Fabaceae 719	Melastomataceae 972	Fabaceae 556
Bromeliaceae 1,345	Poaceae 684	Araceae 759	Bromeliaceae 526
Poaceae 1,267	Melastomataceae 479	Poaceae 715	Araceae 496
Myrtaceae 1,025	Araceae 449	Piperaceae 677	Piperaceae 458
Euphorbiaceae 928	Cyperaceae 317	Bromeliaceae 520	Poaceae 451
Malvaceae 744	Bromeliaceae 312	Malvaceae 400	Solanaceae 355
Apocynaceae 741	Apocynaceae 299	Apocynaceae 374	Gesneriaceae 272
Cyperaceae 649	Dryopteridaceae 288	Gesneriaceae 365	Dryopteridaceae 233
Eriocaulaceae 622	Solanaceae 286	Acanthaceae 347	Malvaceae 232
Malpighiaceae 553	Acanthaceae 272	Cyperaceae 335	Ericaceae 225
Lamiaceae 496	Gesneriaceae 257	Solanaceae 325	Lauraceae 214
Araceae 471	Malvaceae 250	Dryopteridaceae 294	Cyperaceae 211
Piperaceae 452	Myrtaceae 222	Euphorbiaceae 289	Euphorbiaceae 210
Solanaceae 452	Polypodiaceae 214	Ericaceae 274	Polypodiaceae 210
Acanthaceae 442	Euphorbiaceae 211	Annonaceae 260	Apocynaceae 206
Lauraceae 438	Primulaceae 207	Arecaceae 251	Lamiaceae 167

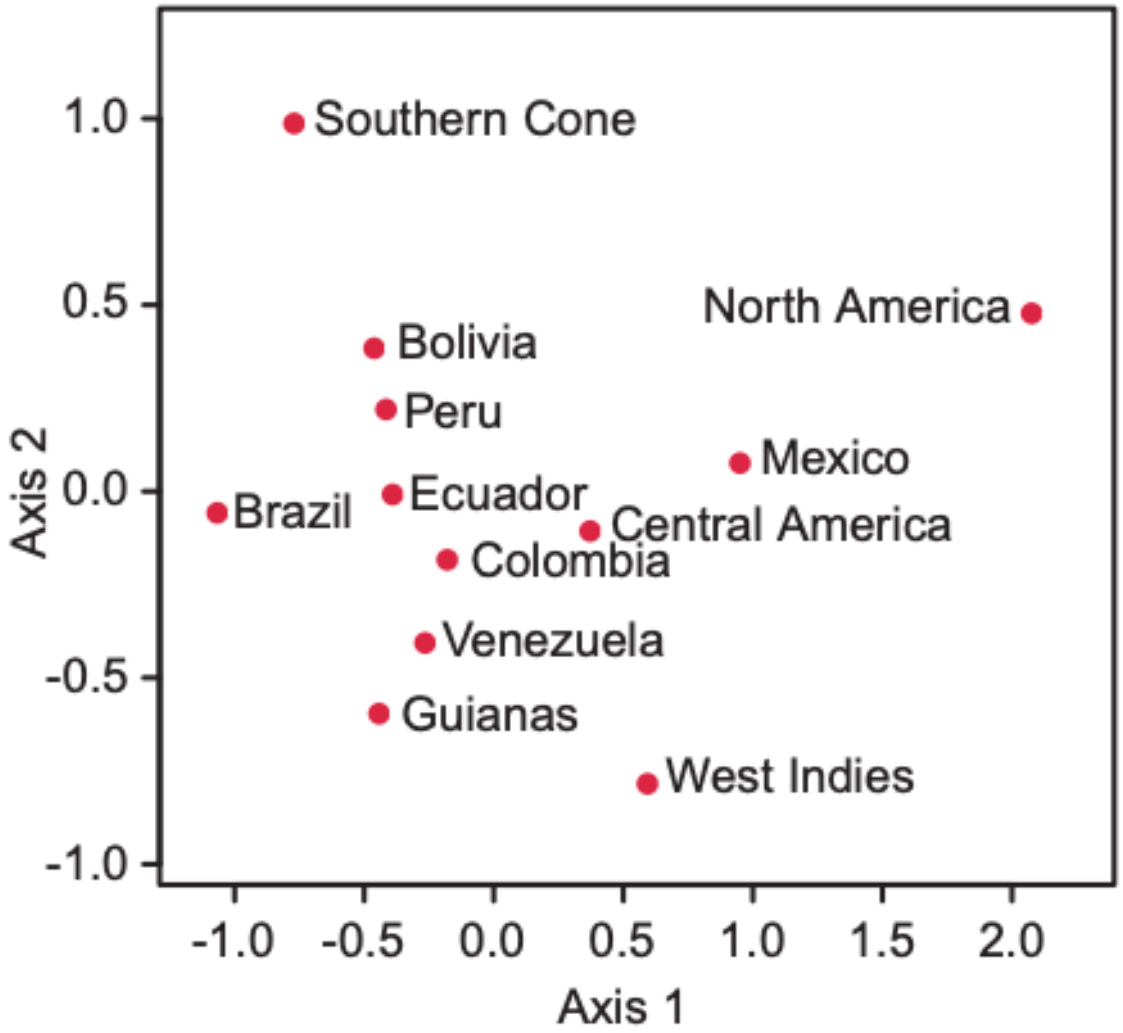
Shared and restricted species by region



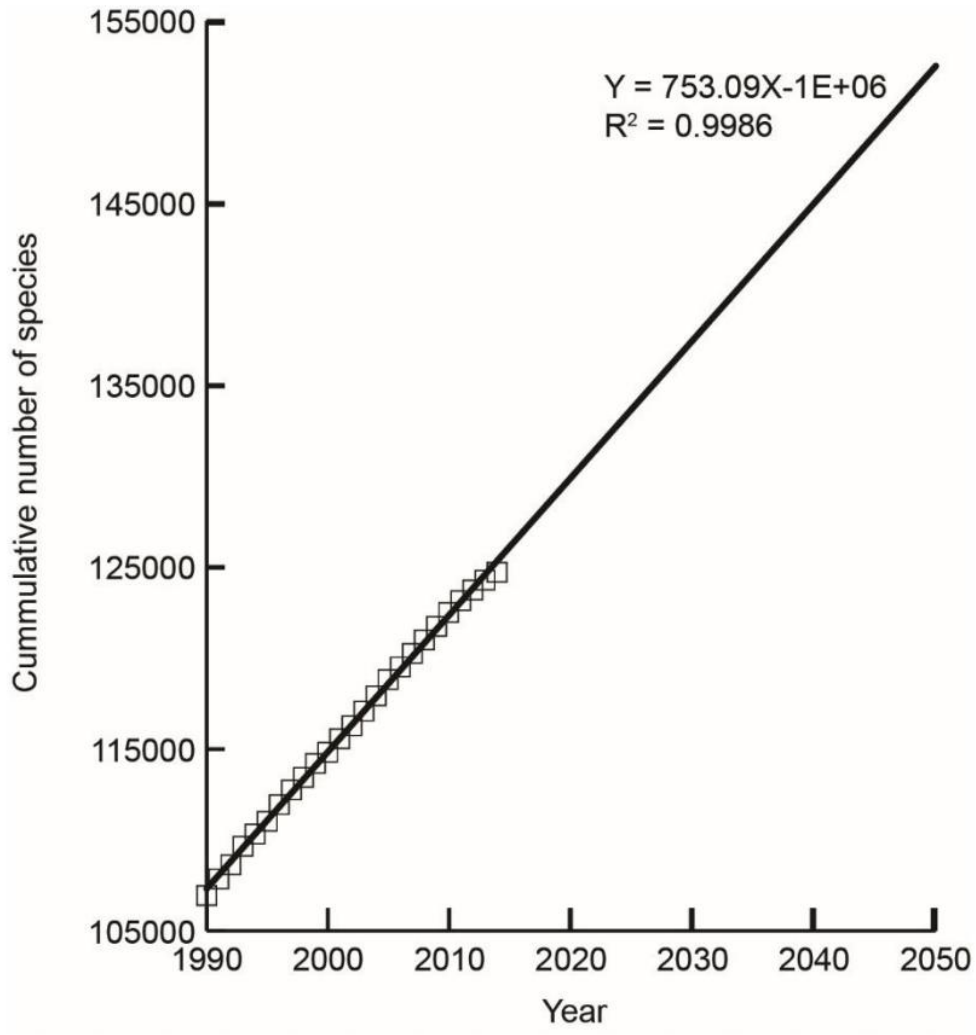
Number of species shared between regions(above diagonal)

	Bolivia	Brazil	Central America	Colombia	Ecuador	Guianas	Mexico	North America	Peru	Southern Cone	Venezuela	West Indies
Bolivia	**14,431**	6680	2823	5343	4715	2920	2071	582	6395	4488	4292	1650
Brazil	0.28	**33,161**	2928	6865	4238	5770	2024	560	5293	4911	6859	1894
Central America	0.18	0.12	**16,335**	6015	3927	2203	7043	1087	2954	1205	3923	2450
Colombia	0.28	0.24	0.31	**23,104**	9226	4241	3216	713	6799	1638	8700	2354
Ecuador	0.29	0.17	0.23	0.45	**17,548**	2661	2275	559	7259	1426	4784	1719
Guianas	0.26	0.28	0.18	0.27	0.21	**8,271**	1454	394	2889	1003	5462	1524
Mexico	0.11	0.07	0.36	0.14	0.11	0.09	**22,969**	4307	2021	1234	2662	2232
North America	0.04	0.02	0.07	0.04	0.03	0.03	0.22	**15,447**	506	596	678	1134
Peru	0.38	0.20	0.17	0.32	0.40	0.21	0.10	0.03	**19,147**	395	446	467
Southern Cone	0.33	0.21	0.08	0.09	0.09	0.09	0.07	0.04	0.02	**13,125**	1489	954
Venezuela	0.29	0.28	0.25	0.46	0.29	0.47	0.14	0.04	0.03	0.11	**15,116**	1489
West Indies	0.13	0.09	0.18	0.14	0.12	0.16	0.13	0.09	0.03	0.08	0.11	**10,992**
Area in km^2	1,098,581	8,514,877	510,974	1,141,748	256,370	462,353	1,967,138	20,278,800	1,285,216	4,118,264	916,445	230,074

Similarities between species by region



Predicted number of species by decade

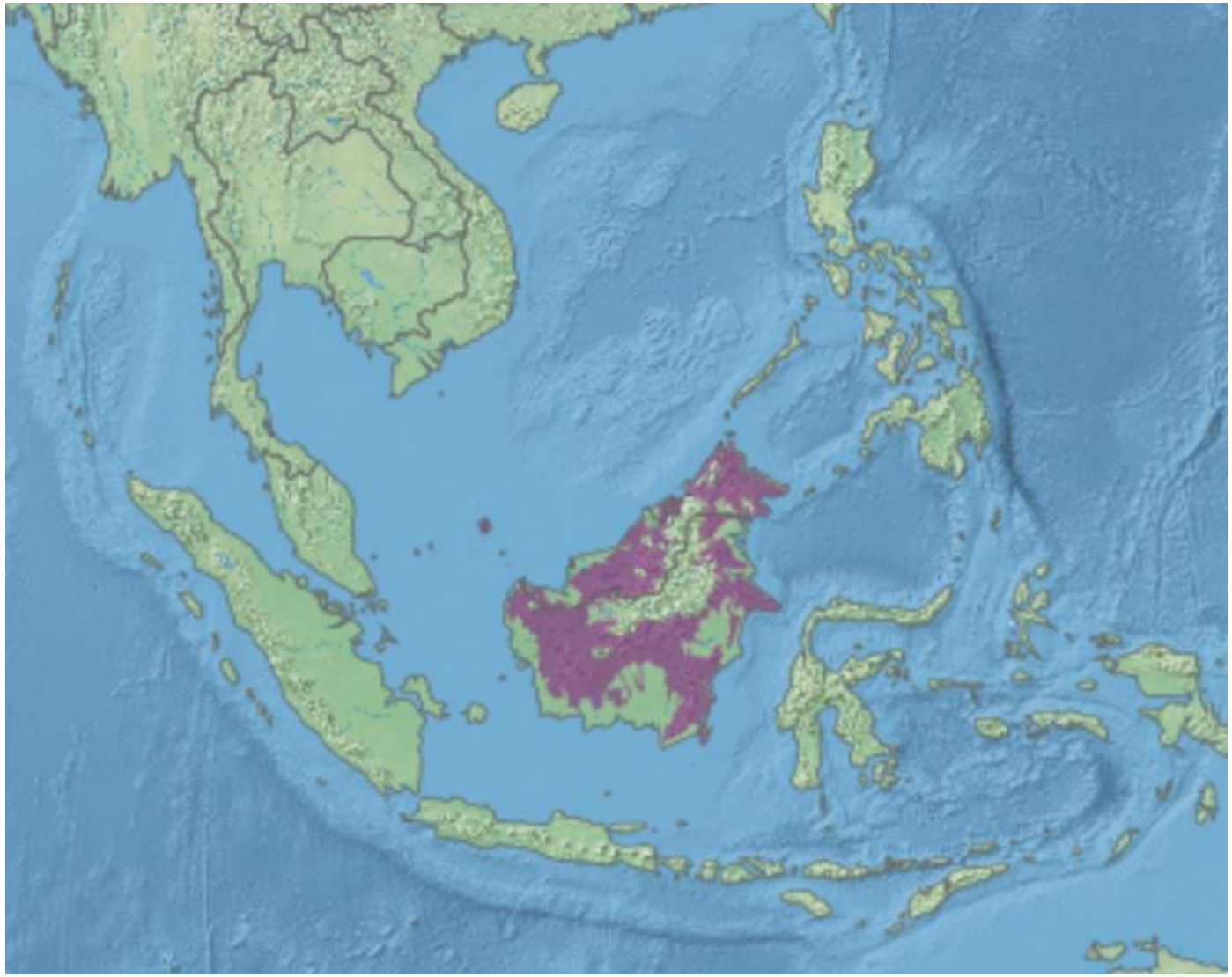


Global patterns of plant diversity and floristic knowledge

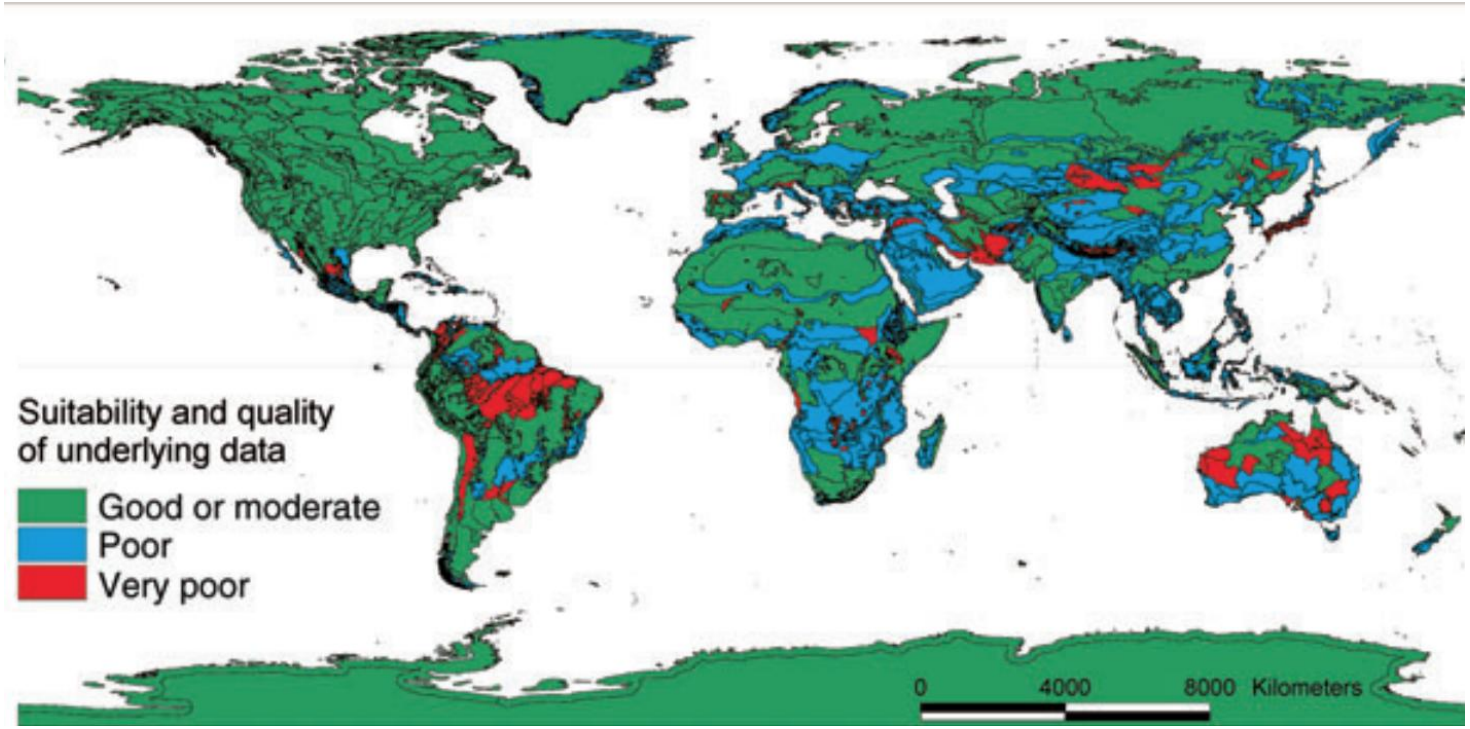
Gerold Kier, Jens Mutke, Eric Dinerstein , Taylor H. Ricketts , Wolfgang Ku¨per , Holger Kreft and Wilhelm Barthlott

Presentation by Johnny Tian

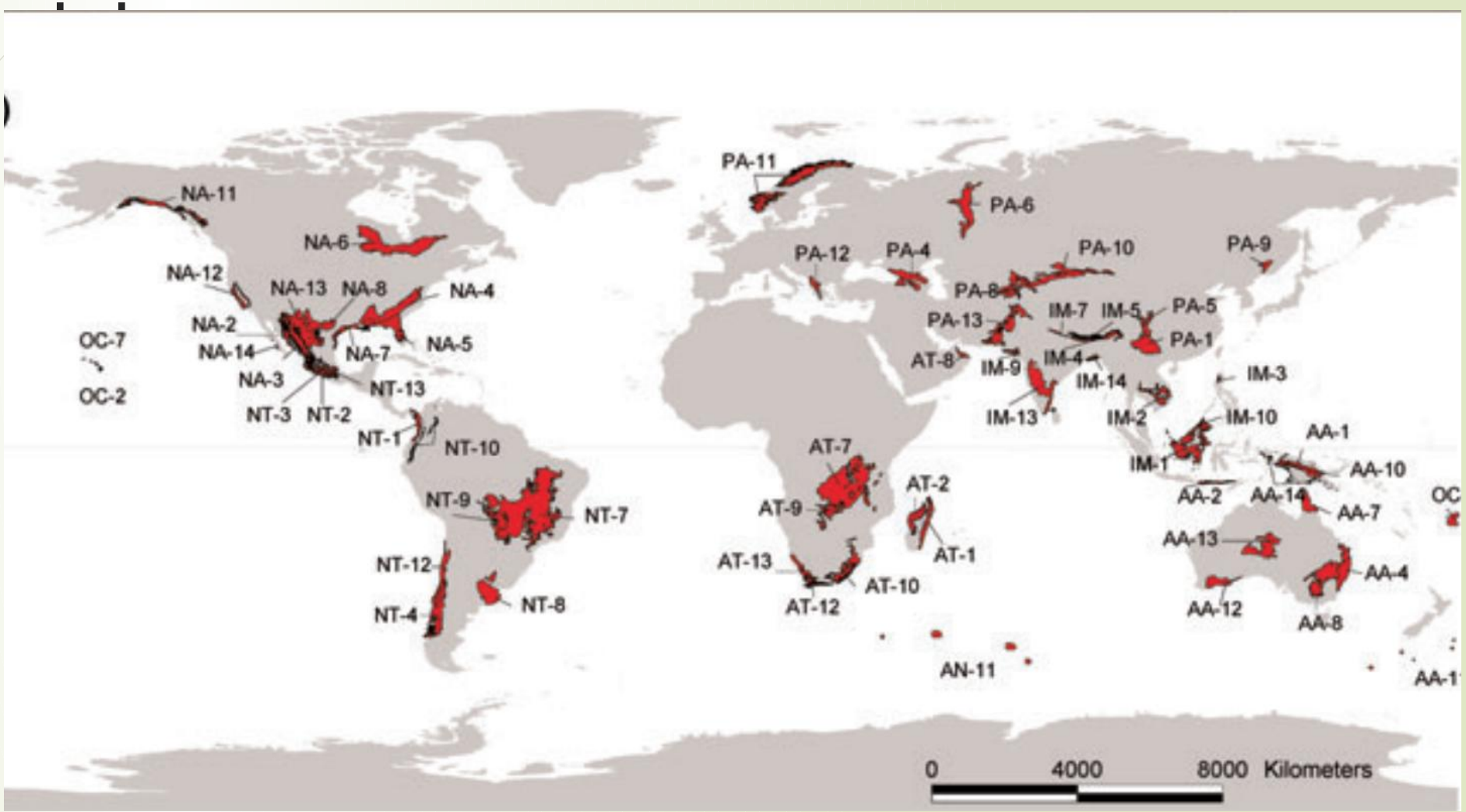
Borneo Lowlands



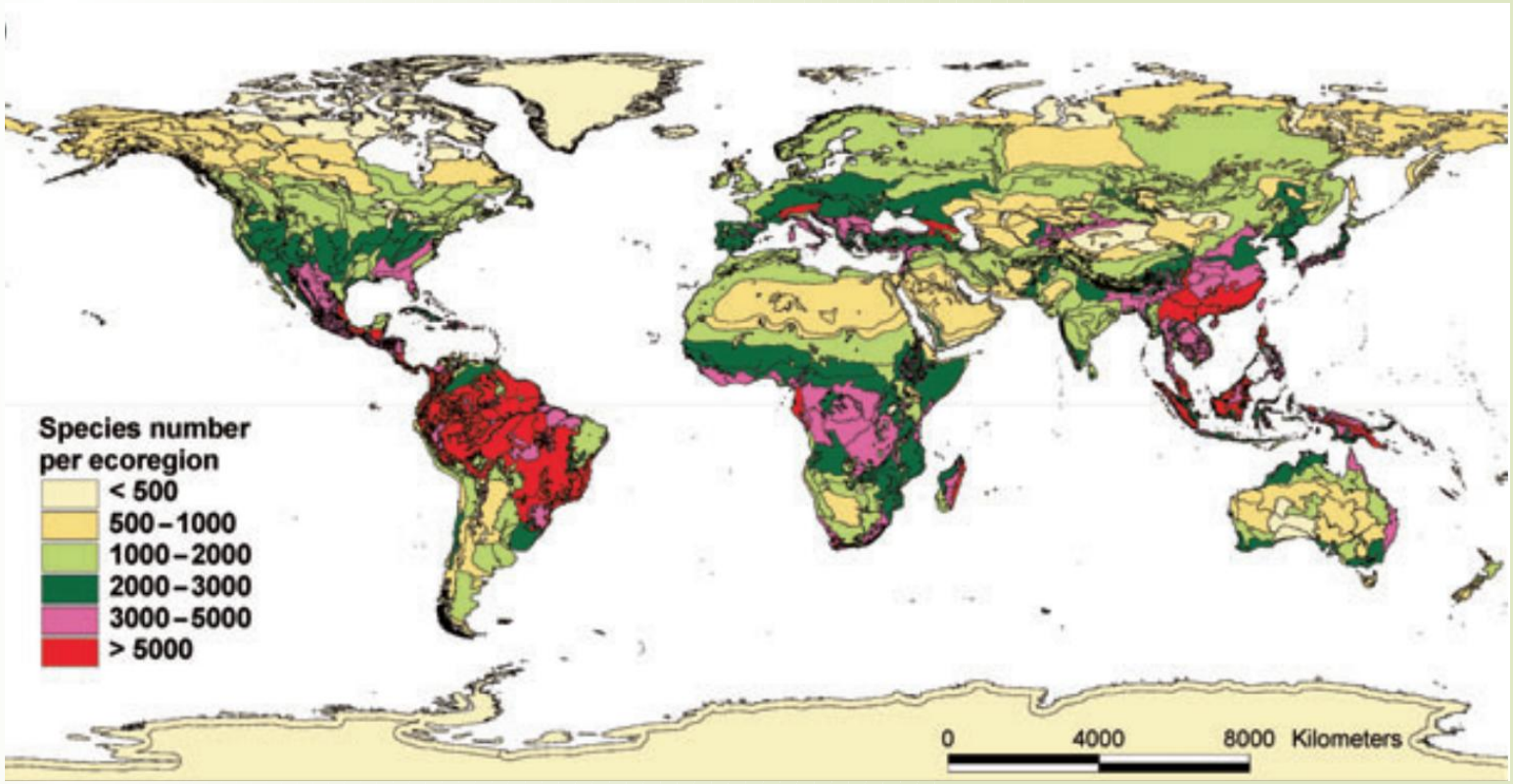
Suitability and quality of underlying data by ecoregion



Ecoregions highest in species



Species of vascular plants by ecoregion



Data quality (1=good, 4=very bad)

No.	Biome	*z*	Mean plant species richness	Mean of data quality index
1	Tropical and subtropical moist broadleaf forests	0.24–0.33*	3161	2.6
2	Tropical and subtropical dry broadleaf forests	0.21	1440	2.8
3	Tropical and subtropical coniferous forests	0.19	2225	2.9
4	Temperate broadleaf and mixed forests	0.17	1909	2.3
5	Temperate coniferous forests	0.14	1570	1.9
6	Boreal forests/taiga	0.16	822	1.5
7	Tropical and subtropical grasslands, savannas and shrublands	0.18	1731	2.6
8	Temperate grasslands, savannas and shrublands	0.12	1372	2.1
9	Flooded grasslands and savannas	0.12	767	3.5
10	Montane grasslands and shrublands	0.17	1397	2.9
11	Tundra	0.13	438	1.6
12	Mediterranean forests, woodlands and scrub	0.20	2294	2.7
13	Deserts and xeric shrublands	0.11	1078	2.7
14	Mangroves	†	205	3.9

Very few significant correlations(all are positive)

	r^2 of data quality vs. richness	r^2 of footprint vs. richness
Global	n.s.	0.09***
Tropical and subtropical moist broadleaf forests	0.06**	n.s.
Tropical and subtropical dry broadleaf forests	n.s.	n.s.
Tropical and subtropical coniferous forests	n.s.	n.s.
Temperate broadleaf and mixed forests	n.s.	n.s.
Temperate coniferous forests	n.s.	n.s.
Boreal forests/taiga	n.s.	0.18*
Tropical and subtropical grasslands, savannas and shrublands	0.21**	n.s.
Temperate grasslands, savannas and shrublands	n.s.	0.14*
Flooded grasslands and savannas	n.s.	n.s.
Montane grasslands and shrublands	0.10*	0.25***
Tundra	n.s.	0.14*
Mediterranean forests, woodlands and scrub	n.s.	n.s.
Deserts and xeric shrublands	0.06*	0.09**

*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$; n.s., not significant.

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Dr. Shipunov

BIOL 330

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Biogeography presentation script

Paper 1: 1526 Fernandez de Oviedo's: first European accounts of New World plants: huge trees and first reports of tobacco, chili pepper, and corn. Inspired botanists to explore and collect specimens. Difficult to name and classify species because huge diversity of plants in tropics and few floristic accounts. 1970s began new collection and documentation of plants in America by in-country institutions. Large number of plants, much time to complete flora in places where land clearing and human activities lead to extinction, botanists utilize online and printed checklists. Country-based checklists made in 1990s made by Missouri Botanical Garden. Checklists based on herbarium specimens, published literature, and expert knowledge of plant specialists. A lot of data so some took decades. Used to identify plants, estimate number of threatened species, resource for decision makers in some countries. 1993 to 2016, checklists completed for Mexico, West Indies, and South America. Ongoing projects plus completed ones make initial overview of plants possible. This paper merged all projects into a single checklist to present initial account of native vascular plant species known in the Americas. Used Missouri Botanical Garden Tropicos database for this compilation. 124,993 species, 6227 genera, and 355 families (33% of known vascular plants worldwide. Three diverse families are Orchidaceae, Asteraceae, Fabaceae. West Indies, most diverse is Rubiaceae, Orchidaceae and Asteraceae. 52 Families are endemic (largest in Bromeliaceae). 70% of species in Americas are restricted in distribution to one of the

countries or regions. West Indies, 67% of vascular flora restricted to that region, North America (69%) Southern Cone (45%). Country level, Brazil (55%) and Mexico (53%). Geographically close places share most species (Mexico and United States) (Southern Cone, Brazil, and Bolivia). Only 122 species occur in all countries and regions. Number of species expected to increase. Average 744 species described per year. 152,000 total species by 2050. This checklist is made but still no official attempt to catalog plant diversity of the Americas when this was published. Database can be readily updated but there can be difficult because new discoveries and taxonomic and nomenclature changes.

Paper 2: Ecoregions are relatively large unites of land delineated to reflect boundaries of natural communities of plant and animal species in their natural state. Goal of paper is to present first global map of vascular plant species richness by ecoregion and compare with published literature on global priorities for plant conservation, pinpoint geographical gaps in understanding of the global vascular plant flora, and explore the relationships between plant species richness by ecoregion and knowledge of the flora, and between plant richness and the human footprint (measure of the loss and degradation of natural habitats and ecosystems as a result of human activities). Few studies of global patterns of plant species richness. Limits use of maps to set rigorous global biodiversity priorities. 10 times as many plants as all terrestrial vertebrates combined. Vascular plants often given less consideration in evaluating global networks of protected areas and in guiding efforts to improve those networks than are vertebrates. Comprehensive studies of vascular plant diversity are essential. Natural boundaries better than grids or political borders. Inform biogeographical and conservation work (many ways but three mentioned here). Evaluate previous priority-setting efforts, help prioritize future surveys and data collection, and used for a wide set of analyses relating biodiversity patterns to

anthropogenic threats or to abiotic drivers of species richness. Used four methods to asses richness 1.collation and interpretation of published data, 2.use of species–area curves to extrapolate richness, 3.use of taxon-based data, 4.estimates derived from other ecoregions within the same biome. The highest estimate of plant species richness is in the Borneo lowlands ecoregion (10,000 species). Followed by 9 ecoregions in South and Central America (>=8,000 species). Lack adequate data for flooded grasslands and flooded savannas. Found significant correlation between species richness and data quality for only a few biomes (species-rich regions are better studied than those poor in vascular plants). Found positive and significant correlations between species richness and the human footprint only in a few biomes. Limitations: Poor quality of some places (like Australia, Colombia, and Amazon basin), can be attributed to limited access to data on plant species richness at ecoregion scale.