Evolutionary history is a powerful means to evince significant levels of plant services for humankind

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Content

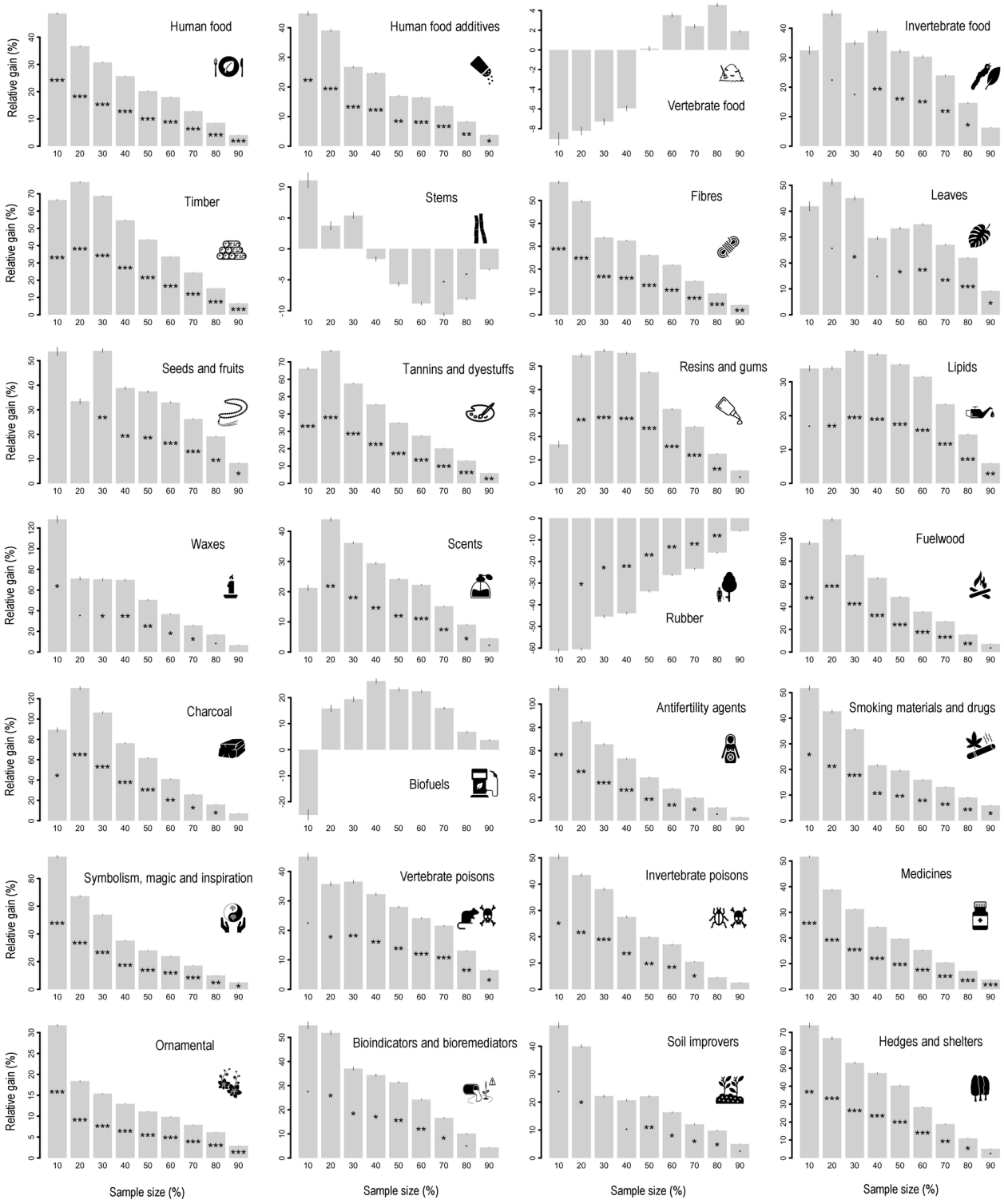

Fig. S1. Relative gains in plant-use records with PD_{max} across use categories and sample sizes. The symbols indicate significant gains (based of SES scores) for a nominal alpha of 10% "·", 5% "*", 1% "**" and 0.1% "***", respectively (two-tailed tests), and the vertical thin bars at the center of the percentage bars represent confidence intervals at 95%.

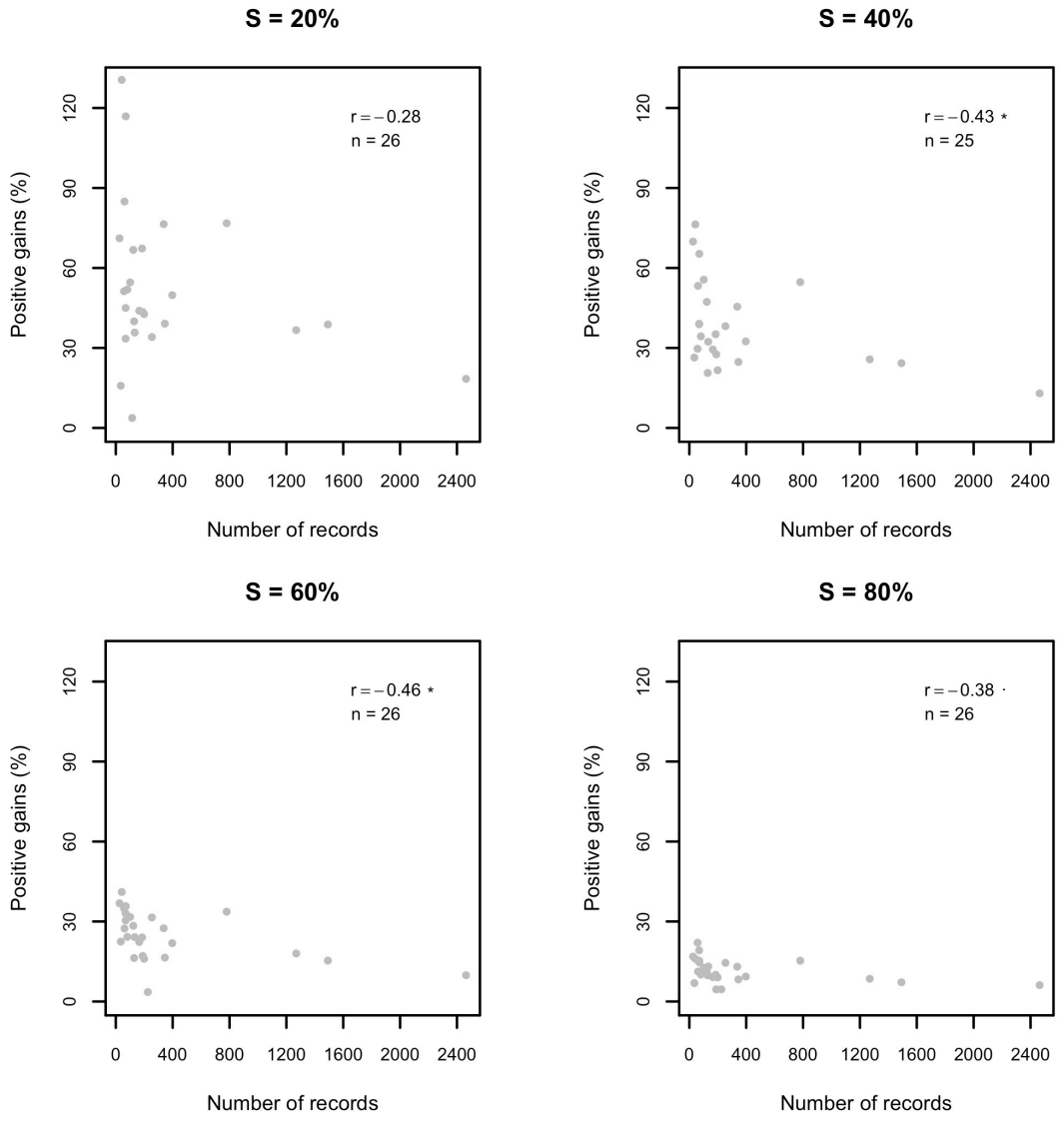

Fig. S2. Pearson correlations between the number of plant-use records in the categories that showed positive gains with PD_{max} relative to random selection (x-axis) and relative gains (y-axis) across sample sizes (S = 20, 40, 60 and 80% of the total pool). Statistical significance was assessed with SES scores via permutations of the response variable (n = 1000 times). The symbols close to the Pearson's r scores indicate statistical significance for a nominal alpha of 10% "·" and 5% "*", respectively (two-tailed tests).

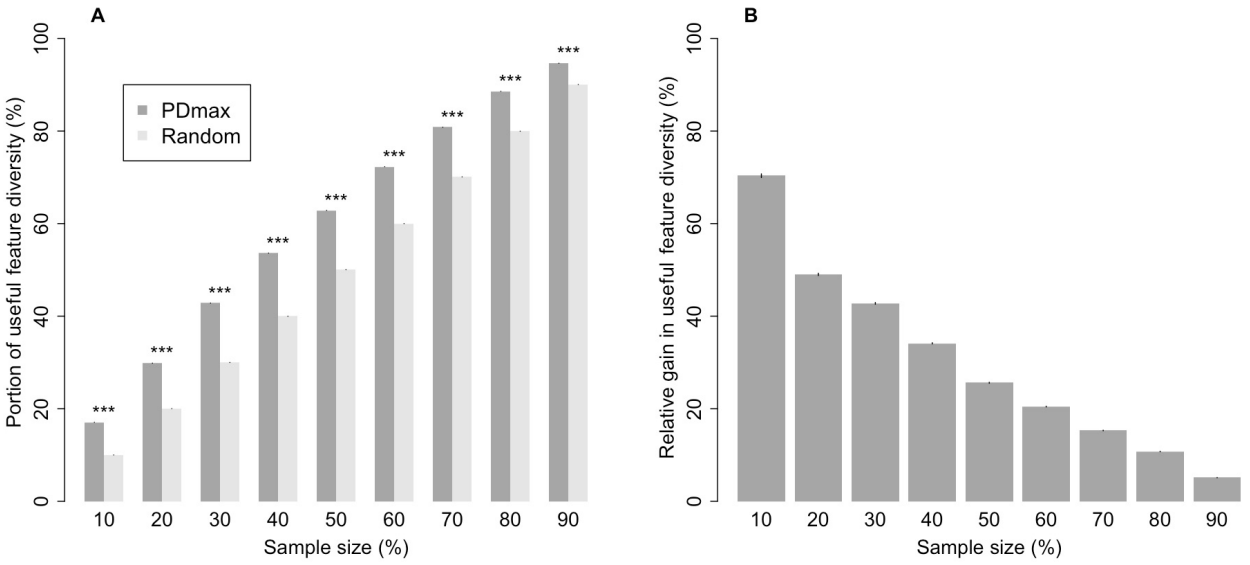

Fig. S3. (A) Portion of useful feature diversity (all use categories combined) retrieved with the PD_{max} and random selection strategies across sample sizes after downweighting plant-use records (genus-level observations) in direct proportion to species richness per genus. (B) Gain in useful feature diversity obtained with PD_{max} relative to random selection across sample sizes. The symbols "***" indicate statistical significance (based on SES scores) for a nominal alpha of 0.1% (two-tailed tests), and the vertical thin bars at the center of the percentage bars represent confidence intervals at 95%.

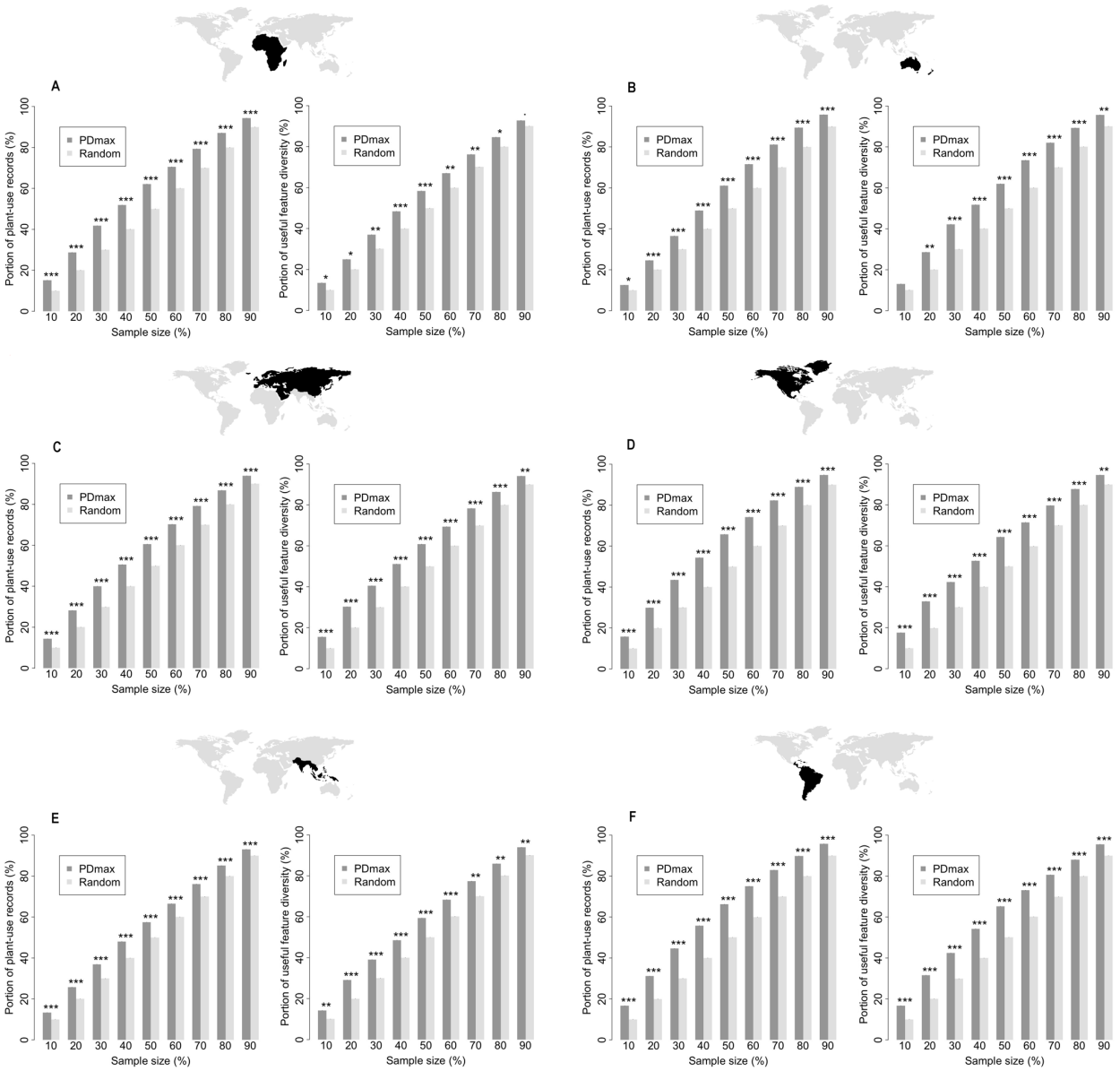

Fig. S4. Results of the PD_{max} analysis across continental regions (A) Africa, (B) Australasia, (C) Europe + Asia-Temperate, (D) North America, (E) Asia-Tropical, (F) South America. The left figures show the portion of the total pool of plant-use records (all use categories combined) retrieved with the PD_{max} and random selection strategies across sample sizes, and the right figures show the portion of useful feature diversity retrieved with the PD_{max} and random selection strategies after downweighting plant-use records (genus-level observations) in direct proportion to species richness per genus. The symbols indicate statistical significance (based on SES scores) for a nominal alpha 10% "·", 5% "*", 1% "**" and 0.1% "***", respectively (two-tailed tests), and the vertical thin bars at the center of the percentage bars represent confidence intervals at 95%.

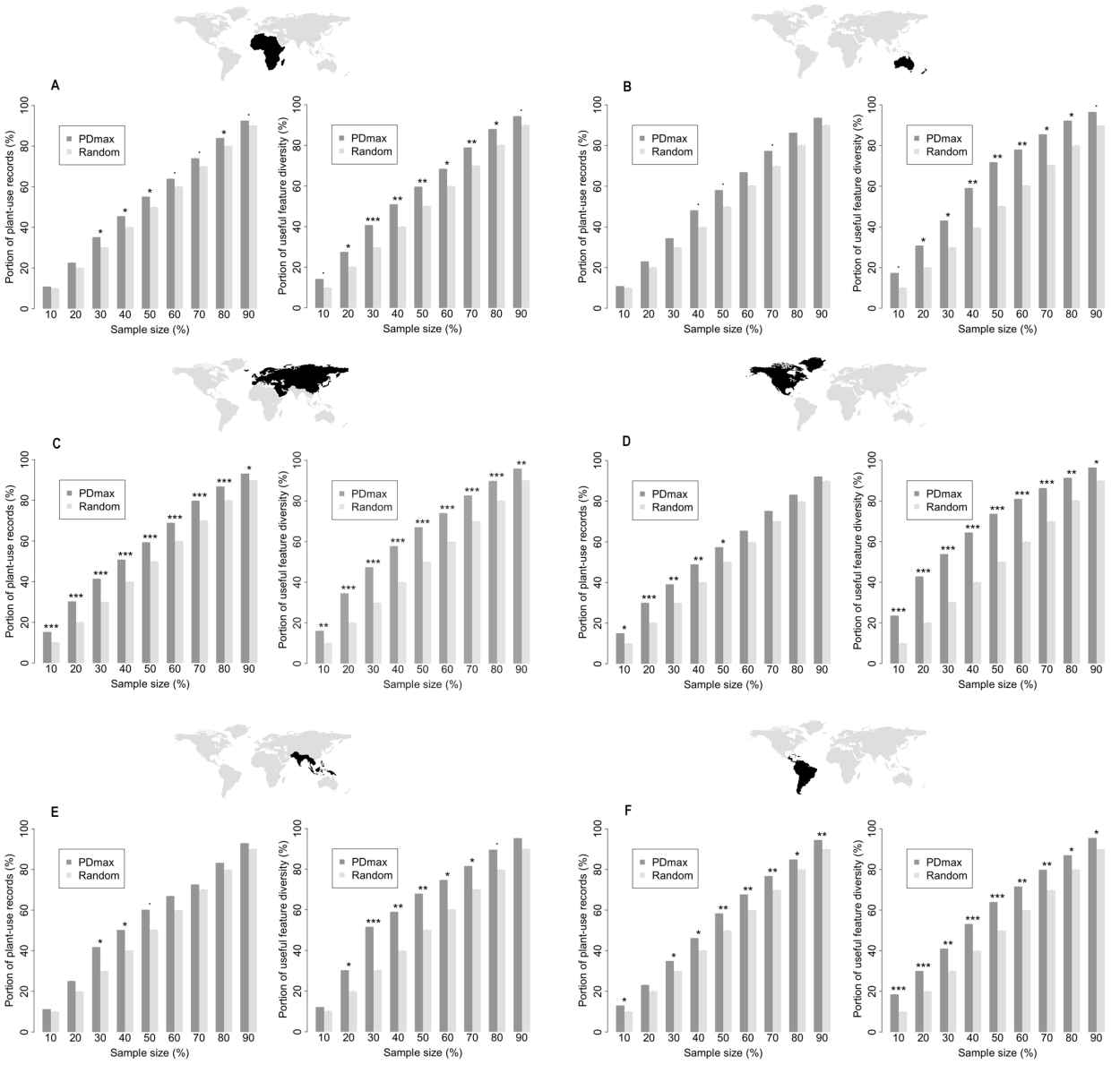

Fig. S5. Results of the PD_{max} analysis using the endemic flora of the continental regions (A) Africa, (B) Australasia, (C) Europe + Asia-Temperate, (D) North America, (E) Asia-Tropical, (F) South America. The left figures show the portion of the total pool of plant-use records (all use categories combined) retrieved with the PD_{max} and random selection strategies across sample sizes, and the right figures show the portion of useful feature diversity retrieved with the PD_{max} and random selection strategies after downweighting plant-use records (genus-level observations) in direct proportion to species richness per genus. The symbols indicate statistical significance (based on SES scores) for a nominal alpha 10% "·", 5% "*", 1% "**" and 0.1% "***", respectively (two-tailed tests), and the vertical thin bars at the center of the percentage bars represent confidence intervals at 95%.

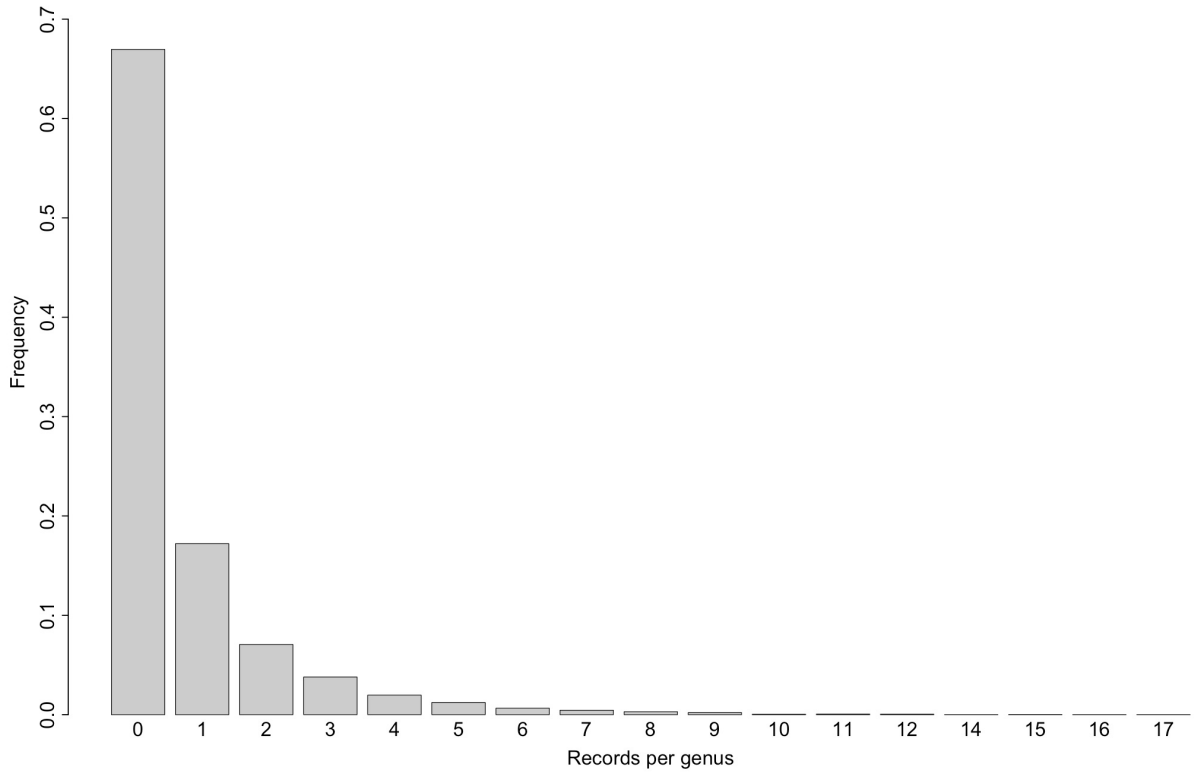

Fig. S6. Frequency of plant-use records per genus in the dataset.

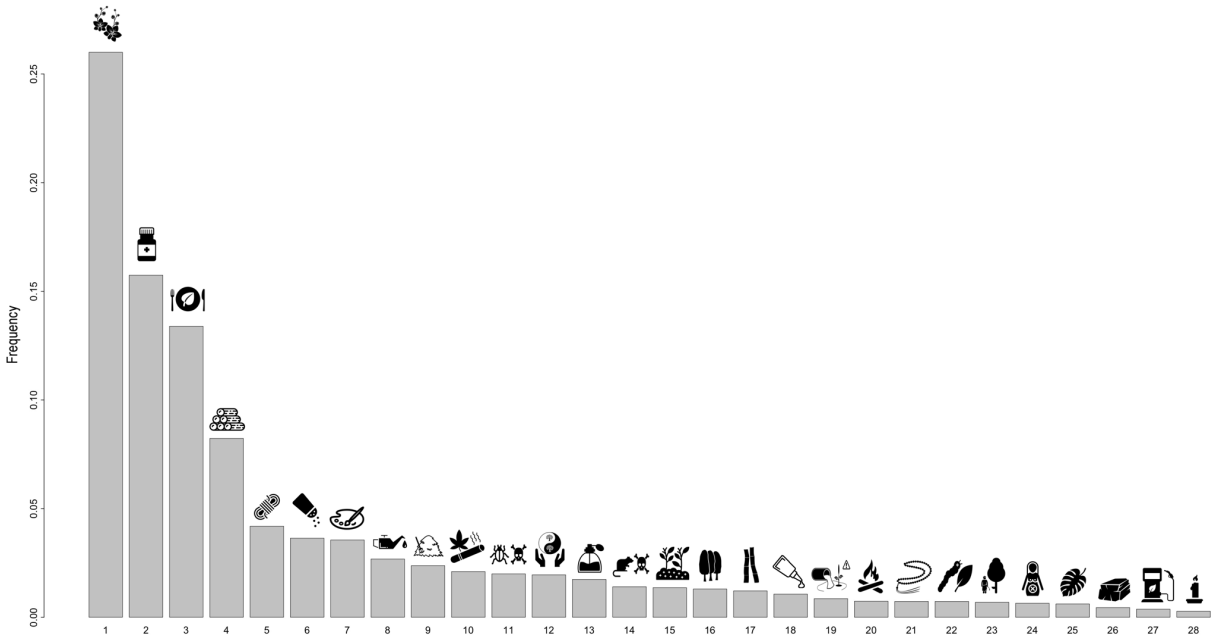

Fig. S7. Frequency of plant-use records across categories in the dataset. From left to right: (1) ornamental, (2) medicines, (3) human food, (4) timber, (5) fibres, (6) human food additives, (7) tannins and dyestuffs, (8) lipids, (9) vertebrate food, (10) smoking materials and drugs, (11) invertebrate poisons, (12) symbolism, magic and inspiration, (13) scents, (14) vertebrate poisons, (15) soil improvers, (16) hedges and shelters, (17) stems, (18) resins and gums, (19) bioindicators and bioremediators, (20) fuelwood, (21) seeds and fruits, (22) invertebrate food, (23) rubber, (24) antifertility agents, (25) leaves, (26) charcoal, (27) biofuels, (28) waxes.

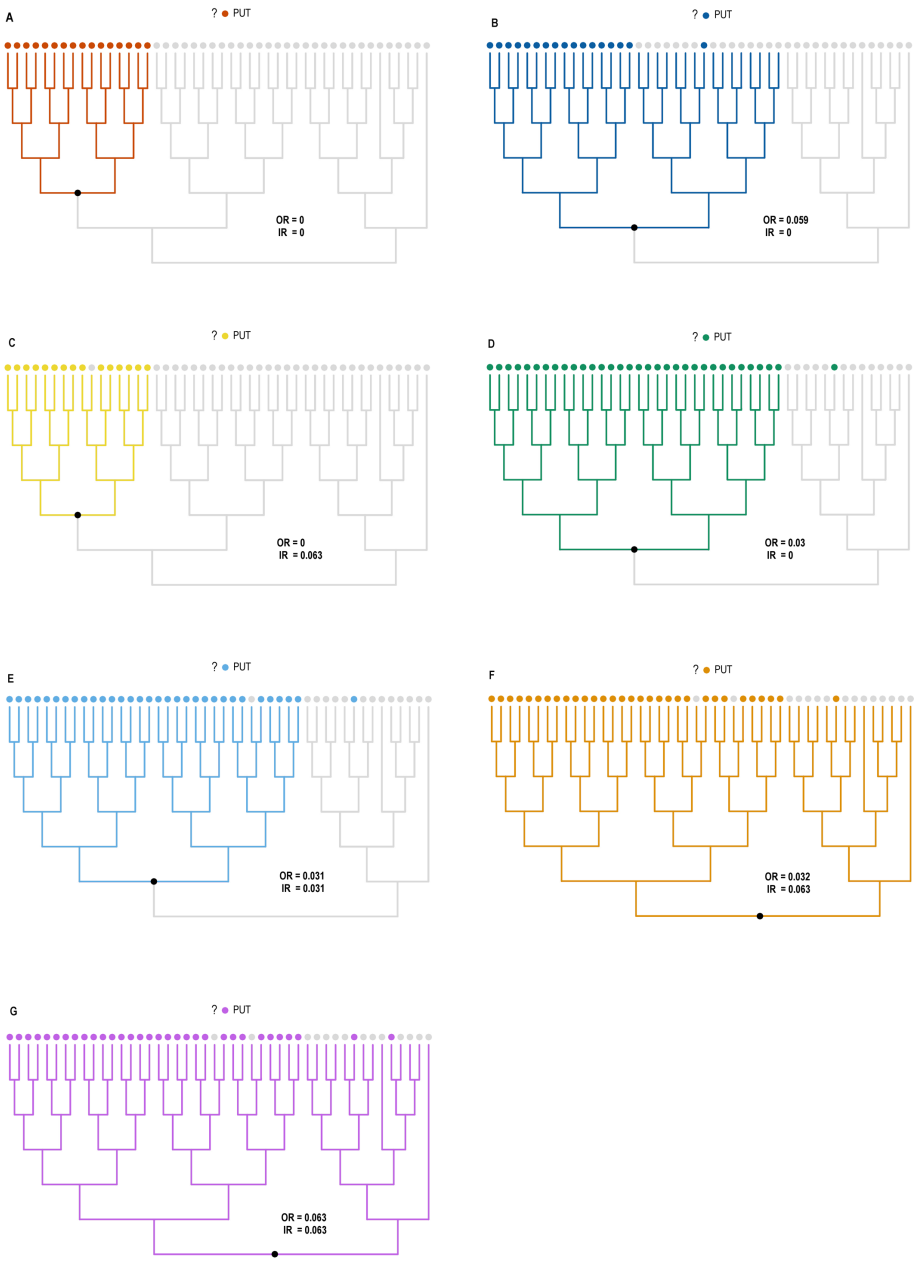

Fig. S8. Different scenarios for the assignation of phylogenetically uncertain taxa (PUTs) to their most derived consensus clades (MDCCs), which can be either monophyletic or polyphyletic depending on the outlier (OR) and intruder (IR) ratios (see Fig. S9 for analogous scenarios with paraphyletic clades). The nodes of the MDCCs are marked with a black dot in each case, and their corresponding branches (i.e. the candidate branches for the PUTs to be inserted) are highlighted in color. The circle symbols on the phylogenetic tips represent the taxa that are included in the molecular phylogeny, and those that share the same taxonomic rank as the target PUT (hereafter "sharing taxa") are highlighted in color. Each scenario refers to a different PUT, and the phylogenies represent different subtrees of the whole molecular tree. (A) The sharing taxa represent a monophyletic MDCC (OR and IR = 0). (B) The presence of one outlier defines a polyphyletic MDCC (OR > 0.05). (C) The MDCC cannot be considered as purely monophyletic (IR > 0.05). Note that in this particular case, the identity of root node of the MDCC would not change even if the MDCC would be purely monophyletic, as the node represents the most recent common ancestor (i.e. the smallest clade) that includes all the sharing taxa of the PUT in the tree. (D) The sharing taxa define a monophyletic MDCC because the outlier is disregarded (OR < 0.05). (E) Both the outlier and the intruder are disregarded because OR and IR are lower than 0.05, and thus the MDCC is considered as monophyletic. (F) The presence of two intruders results in a polyphyletic MDCC (IR > 0.05) despite the outlier could be disregarded (OR < 0.05). (G) Both the intruders and the outliers force the MDCC to be polyphyletic (OR and IR > 0.05).

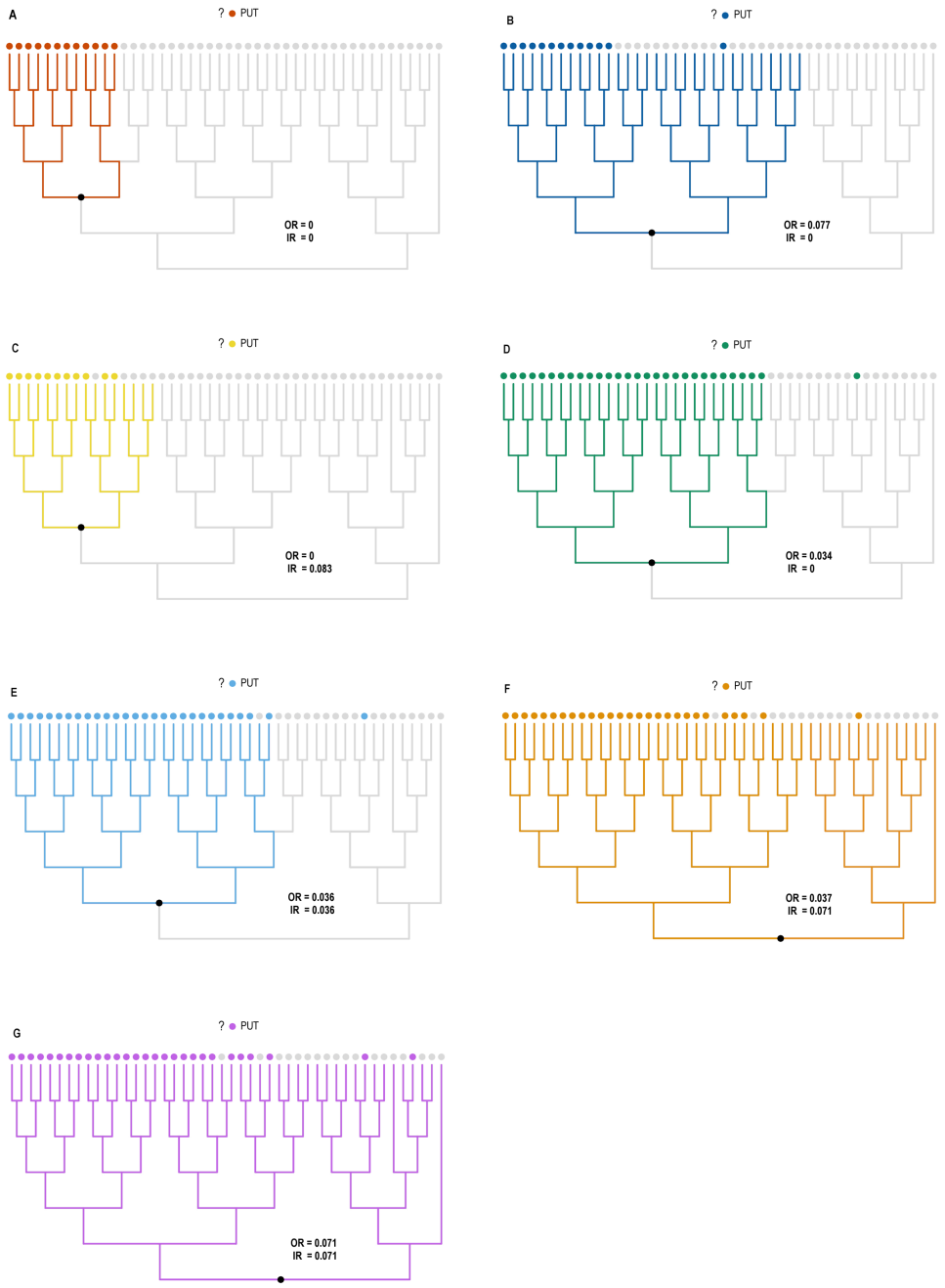

Fig. S9. Different scenarios for the assignation of phylogenetically uncertain taxa (PUTs) to their most derived consensus clades (MDCCs), which can be either paraphyletic or polyphyletic depending on the outlier (OR) and intruder (IR) ratios (see Fig. S8 for analogous scenarios with monophyletic clades). The nodes of the MDCCs are marked with a black dot in each case, and their corresponding branches (i.e. the candidate branches for the PUTs to be inserted) are highlighted in color. The circle symbols on the phylogenetic tips represent the taxa that are included in the molecular phylogeny, and those that share the same taxonomic rank as the target PUT (hereafter "sharing taxa") are highlighted in color. Each scenario refers to a different PUT, and the phylogenies represent different subtrees of the whole molecular tree. (A) The sharing taxa represent a paraphyletic MDCC (OR and IR = 0). (B) The presence of one outlier defines a polyphyletic MDCC (OR > 0.05). (C) The presence of one intruder defines a polyphyletic MDCC (IR > 0.05). (D) The sharing taxa define a paraphyletic MDCC because the outlier is disregarded (OR < 0.05). (E) Both the outlier and the intruder are disregarded because OR and IR are lower than 0.05. As a result, the MDCC is considered as paraphyletic. (F) The presence of two intruders results in a polyphyletic MDCC (IR > 0.05) despite the outlier could be disregarded (OR < 0.05). (G) Both the intruders and the outliers force the MDCC to be polyphyletic (OR and IR > 0.05).

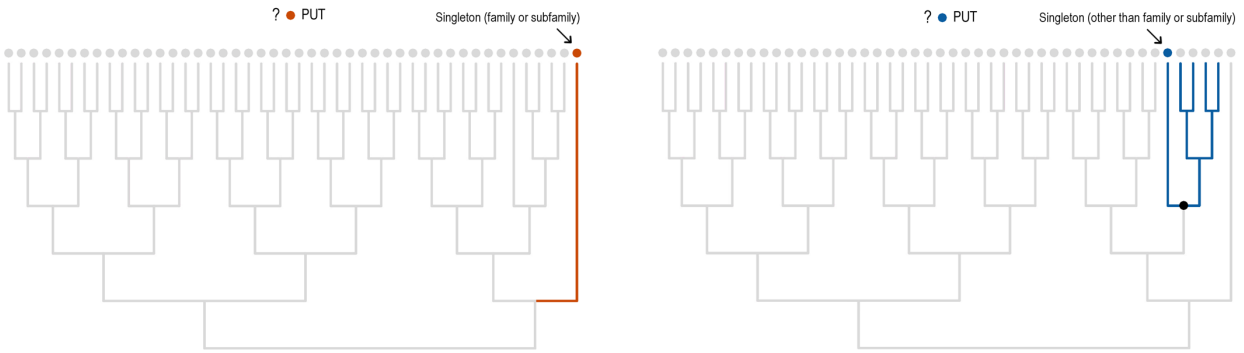

Fig. S10. Two different scenarios for the assignation of phylogenetically uncertain taxa (PUTs) to their most derived consensus clades (MDCCs) when only one taxon shares the same taxonomic rank as the target PUT in the molecular tree. The branches of the corresponding MDCCs (i.e. the candidate branches for the PUTs to be inserted) are highlighted in color. The circle symbols on the phylogenetic tips represent the taxa that are included in the molecular phylogeny, and those that share the same taxonomic rank as the target PUT are highlighted in color. Each scenario refers to a different PUT, and the phylogenies represent different subtrees of the whole molecular tree. In the left scenario, the only taxon sharing the same taxonomic rank as the target PUT is the only representative of a taxonomic family or subfamily in the molecular phylogeny, and thus the terminal node itself is defined as the MDCC of the PUT. In the right scenario, the only taxon sharing the same taxonomic rank as the target PUT is the only representative of a taxonomic rank below the subfamily level (e.g. singleton tribe or subtribe), and thus the parent node of the terminal node (in black) defines the MDCC instead.

Table S1. Description of the plant-use categories used in the study. The categories were stablished following the guidelines in the Economic Botany Data Collection Standard[12].

Group	Category	Explanation	Examples
HUMAN & ANIMAL NUTRITION	Human food	Plants that are eaten by humans because of their nutritional value (including edible oils) or that can be used to make beverages (excluding purely medicinal and/or ritual ones).	• Vegetables • Roots • Edible oils • Spirits • Juices • Edible fruits & seeds
	Human food additives	Plants used as food/beverage condiments, including processing. Unlike food, food additives are not primarily intended to cover nutritional needs but improving flavor, smell, consistency or appearance, and they are consumed in small quantities in relation to the food/beverage to which they are used.	• Sweeteners • Spices • Foaming agents • Food colouring • Food preservatives
	Vertebrate food	Plants used to feed livestock and domestic vertebrate animals in general	• Hay • Fodder • Pasture
	Invertebrate food	Plants used to feed invertebrates that are useful to humans	• Silkworm plants • Bee plants • Lac plants
FUELS	Fuelwood	Wood plants that are used to light and keep fire burning	• Firewood • Kindling • Tinder
	Charcoal	Plants used to produce fuel of high heating value that gives off very little smoke (excluding purely medicinal or drawing charcoal).	• As metallurgical fuel • As cooking fuel • Gunpowder-making
	Biofuels	Plants used for the generation of power (excluding fuelwood and charcoal)	• Ethanol • Biomass • Kerosene substitutes • Fueloil substitutes
MATERIALS	Timber	Plants that yield processable wood (extracted from trunks and large-to-medium branches), typically used to provide structural support in house building, cabinetry, vehicles, tool-making and other facilities	• Beams • Railways • Fences • Poles • Flooring • Furniture • Tools
	Stems	Plants whose stems (excluding trunks, see timber), small branches (typically less than 2 cm of diameter), twigs or culms are directly used as tools and/or building materials	• Broom-heads • Chewing sticks • Thatching • Bamboo construction • Toothpicks
	Fibres	Plants valuable for their fibrous and pliable tissues (high cellulose content), including bast fibres (phloem), hard/leaf fibres (entirety of vascular bundles) or surface fibres (epidermial). Typically intended for weaving work and paper making	• Textiles • Jute • String • Yarn • Mats • Paper-making • Basketry
	Leaves	Plants whose leaves and bracts are directly used as tools and/or building materials	• Wrapping material • Plates • Thatching • Broom-heads • Stuffing

MATERIALS	Seeds & Fruits	Plants whose seeds and/or fruits are used as tools and/or in jewellery	• Buttons • Maracas • Fish-bait • Beads • Bowls
	Tannins & Dyestuffs	Sources of tannins and non-food dyes, either for painting the human body or inert materials	• Dyes for textiles • Tannins for leather • Hair dye • Body painting • Cosmetic dyes
	Resins & gums	Sources of gums, resins and their derivatives. Besides their usefulness as materials, some are also used as medicine and/or in food processing	• Watercolors • Varnishes • Turpentine • Copal • Gum arabic
	Lipids	Mostly sources of vegetable oils. Besides their value as materials, some vegetable oils are also edible (see food)	• Wood finishing • Soap-making • Oil painting • Cosmetics • Illuminant oil
	Waxes	Sources of vegetable wax	• Candles • Shoe polishing • Finishes • Coatings
	Scents	Plants valuable for their aromatic compounds and/or essential oils (excluding food/beverage flavoring)	• Perfume • Toothpaste • Flavoring • Incense • Pot-pourri
	Rubber	Sources of vegetable latex	• Birdlime • Gutta-percha • Chewing-gum making
MEDICINES	Medicines	Plants used for healing and improving human and animal health, including those that are applied to treat skin and/or internal infections. Medicinal plants may not have been necessarily proven as such by modern science, yet their healing properties could be attributable to placebo effects.	• Drugs • Antibiotics • Tonics • Fungal infections • Parasiticides • Antidotes
POISONS	Vertebrate poisons	Plants used to kill, stun or drive away harmful/nuisance vertebrate animals. Also for hunting/fishing and human poisoning	• Rodenticides • Antifeedants • Arrow poison • Fish-poisoning • Ordeals • Suicide
	Invertebrate poisons	Plants used to kill, stun or drive away harmful/nuisance invertebrate organisms (excluding those that are applied to treat skin and/or internal infections, see medicines)	• Insecticides • Molluscicides • Fly-control • Head-lice • Antifeedants
SOCIAL	Antifertility agents	Plants used either to avoid pregnancy or childbirth	• Abortifacients • Male contraceptives • Female contraceptives

SOCIAL	Smoking materials & drugs	Plants used to make cigarettes (including rolling paper and cigarette scents), as stimulants and/or to induce altered states of consciousness, either in ceremonies or for recreational purposes	• Tobacco • Tobacco substitutes • Aphrodisiacs • Opium • Caffeine
	Symbolism, magic & inspiration	Plants with symbolic value and/or to which magical properties are attributed. Also plants as source of inspiration in architecture, science, poetry and mythology	• Emblems • Magic plants • Warding off spirits • Floriography • Architectural motifs • Biomimicry
ENVIRONMENTAL	Ornamental	Plants that are grown mainly for display purposes, this is, for their aesthetic characteristics	• Pot plants • Bonsai subjects • Cut flowers and foliage • Aquarium plants • Gardening • Lawns
	Bioindicators & bioremediators	Indicators of environmental conditions, specially to assess the presence of hazardous contaminants in soils, water and air masses. Many are valuable for their ability to extract toxic metals from the soils of contaminated sites (phytoremediation).	• Hyperaccumulators • Overgrazing indicators • Restoration of saline soils
	Soil improvers	Plants used to increase soil fertility, prevent soil loss and stimulate soil formation	• Erosion control • Agroforestry • Cover crops • Soil stabilizer • Green manure
	Hedges & shelters	Plants that are grown closely spaced to mark the boundary of an area or to form a barrier. Also plants that provide shelter from sun, rain, fire and wind	• Shelter belts • Hedgerows • Property delimitation • Shade trees

Table S2. Phylogenetic structure of plant-use categories. N: number of records per state, SES: Standardized Effect Size (averaged across 100 phylogenetic hypotheses), CI: confidence interval.

Group	Category	N	SES	Lower CI 95%	Upper CI 95%
HUMAN & ANIMAL NUTRITION	Human food	1269	7,846	7,808	7,883
	Human food additives	345	2,062	2,050	2,075
	Vertebrate food	225	-6,914	-6,942	-6,887
	Invertebrate food	69	-1,261	-1,270	-1,252
FUELS	Fuelwood	70	-1,319	-1,328	-1,310
	Charcoal	42	1,572	1,562	1,581
	Biofuels	35	-0,286	-0,293	-0,280
MATERIALS	Timber	780	0,924	0,901	0,948
	Stems	115	-1,978	-1,992	-1,963
	Fibres	397	0,734	0,720	0,747
	Leaves	58	-2,033	-2,043	-2,024
	Seeds & fruits	69	-0,798	-0,806	-0,791
	Tannins & dyestuffs	337	3,603	3,585	3,622
	Resins & gums	101	-2,195	-2,209	-2,181
	Lipids	254	0,330	0,319	0,341
	Waxes	26	-0,477	-0,484	-0,471
	Scents	165	0,345	0,336	0,354
	Rubber	65	-8,304	-8,340	-8,269
MEDICINES	Medicines	1492	9,614	9,562	9,666
POISONS	Vertebrate poisons	133	-1,887	-1,910	-1,863
	Invertebrate poisons	189	0,074	0,062	0,085
SOCIAL	Antifertility agents	61	3,404	3,384	3,424
	Smoking materials & drugs	199	1,758	1,745	1,770
	Symbolism, magic & inspiration	185	3,355	3,340	3,371
ENVIRONMENTAL	Ornamental	2464	3,931	3,902	3,959
	Bioindicators & bioremediators	81	2,690	2,675	2,705
	Soil improvers	129	-1,661	-1,674	-1,648
	Hedges & shelters	123	0,550	0,543	0,558

Table S3. List of genera included in the study (see Excel file attached)

Table S4. Most derived consensus clades (MDCC) for the phylogenetically uncertain taxa (PUT) of the analysis (see Excel file attached)

Table S5. Taxonomic turnover (i.e. β_{sim} distances derived from Sorensen index[46]) among TDWG level-1 standard regions (pairwise comparisons). The higher the β_{sim} between two regions (values ranged between 0 and 1), the lower the portion of shared taxa.

	Europe	Africa	Asia-Temperate	Asia-Tropical	Australasia	North America
Africa	0,31					
Asia-Temperate	0,13	0,55				
Asia-Tropical	0,44	0,62	0,31			
Australasia	0,82	0,64	0,56	0,43		
North America	0,60	0,75	0,70	0,73	0,78	
South America	0,72	0,81	0,80	0,79	0,73	0,34