BIOGEOGRAFIA HISTÓRICA

ENFOQUES FUNDAMENTAIS

Dispersialismo – Darwin 1859, Wallace 1876

Biogeografia filogenética – Hennig 1966, Brundin 1966

Áreas ancestrais – Bremer 1992, Ronquist 1994

Panbiogeografia – Croizat 1958, Craw 1988, Page 1987

Biogeografia cladística – Nelson 1974, D. Rosen 1976, Nelson & Platnick 1981

Análise de parcimônia de endemismos (PAE) - B. Rosen 1988, Craw 1988, Morrone 1988

Métodos baseados em eventos – Page 1994, Ronquist 1997

Filogeografia – Avise *et al.* 1987

Biogeografia experimental – Haydon, Tadtkey & Pianka 1994

Biogeografia Integrativa – Donoghue & Moore 2003

Panbiogeografia

Representa um rompimento com a tradição dispersialista

Prioriza cenários de VICARIÂNCIA

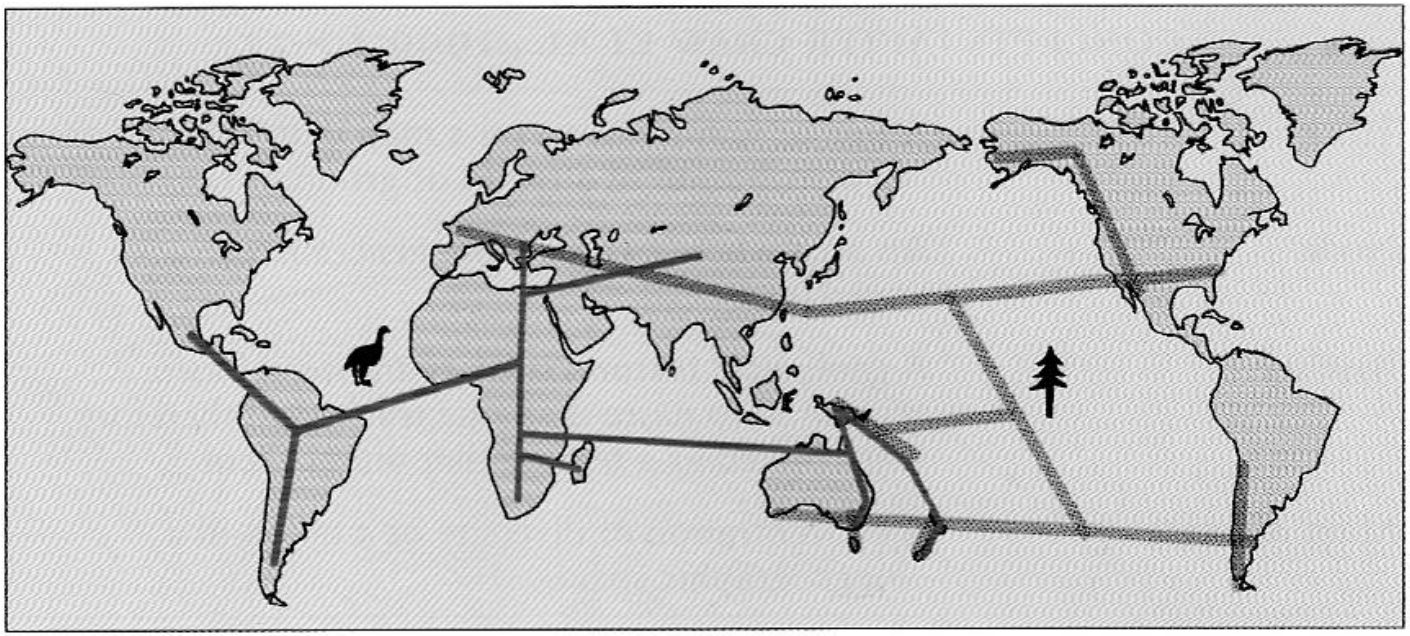


Figure 6.1b. Biogeographic map. Panbiogeographic tracks (from Page, 1989: Figure 10) demonstrating that ratite birds (solid lines) and southern beeches (hatched lines) have different baselines and are not panbiogeographic homologs (following Craw, 1985). [Modified map reproduced with permission of Carolyn King.]

Parenti & Ebach 2009

Primeiras ideias de VICARIÂNCIA

GRUNDRISS

DER

KRÄUTERKUNDE

ZU VORLESUNGEN

ENTWORFEN

VON

D. CARL LUDWIG WILLDENOW,

Ritter des grofsen rothen Adler Ordens dritter Klasse, Professor der Botanik, Vorsteher d botanischen Gartens, der Academie der Wissenschaften zu Berlin, Stockholm und München Mitglied, des Instituts zu Amsterdam Correspondent, der Academie nützlicher Wissenschaften zu Erfurt, der italiänischen Academie zu Siena, der Societät zu Nancy, der freien ökonomischen Societät zu St. Petersburg, der physiographischen Societät zu Lund, der Gesellschaft naturforschender Freunde zu Berlin, der physikalisch-medicinischen Societät zu Moskau, der naturhistorischen ebendaselbst, der phytographischen zu Gorinki, der sächsischen ökonomischen Societät zu Leipzig, der naturforschenden Gesellschaft in Zürich, Jena und Halle, der meklenburgischen naturhistorischen Gesellschaft, der wetterauischen Gesellschaft, der phytographischen Societät in Göttingen, der botanischen Gesellschaft in Regensburg, der physicalischen Privat - Societät zu Göttingen und der westphälischen correspondirenden Gesellschaft der Pharmacie und ärztlichen Naturkunde Mitglied.

Fünfte verbesserte und vermehrte Auflage.

Mit zehn Kupfertafeln und einer Farbentabelle.

BERLIN, 1810.

BEI HAUDE UND SPENER.

Karl Willdenow (1765–1812)

German botanist, provided a major treatise on plant geography. He described the floristic provinces of Europe and offered a novel interpretation for their origin as well as others in the southern hemisphere.

"Lands now separated by oceans may, in former epochs, have been united. . . . Thus, the northern part of America may have been connected with Europe, New Netherlands [Australia] with the foothills of the Cape of Good Hope"

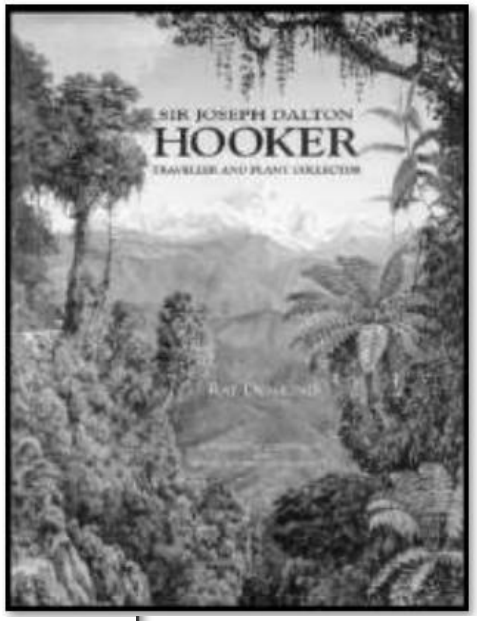
Willdenow (1798)

Primeiras ideias de VICARIÂNCIA

Joseph Dalton Hooker (1817–1911)

Director of the Kew Royal Botanic Garden and good friend of Darwin (the only acknowledged person in the "*Origin of Species*") . . .

. . . but he strongly disagreed with the Darwin-Wallace dispersalist tradition



Hooker was an expert on southern hemisphere floras and believed that they represented evidence for a once more widespread flora that was subsequently broken up by geological and climatic causes.

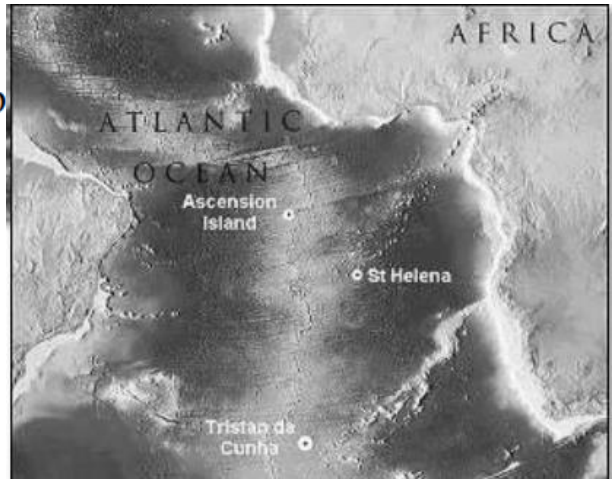
"*. . . many of the peculiarities of the three great areas of land in the southern latitudes are representative ones, effecting a botanical relationship as strong as that which prevails throughout the lands within the Arctic and Northern Temperate zones, and which is not to be accounted for by any theory of transport or variation, but which is agreeable to the hypothesis of all being members of a once more extensive flora, which has been broken up by geological and climatic causes.*"

(Hooker, 1853)

http://courses.botany.wisc.edu/botany_422

Hooker had postulated a southern continental bridge involving South America, New Zealand, Antarctica, and the Tristan de Cunha Island group

Tree ferns and other typical "Antarctic" floristic elements on Tristan de Cunha



"Pontes de terra" pretéritas

Land Bridges — attempt to explain "vicariant" distributions of many taxa (related but disjunct biota) by presence of *former* land bridges that are now subsided; rejects long distance dispersal implied by Darwin-Wallace tradition and assumes original migration over land features subsequently disappeared.

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Van Steenis 1962
The land-bridge theory in botany with particular reference to tropical plants. **Blumea 11.**

“Pontes de terra” pretéritas

Land Bridges — subsequently criticized by biogeographers (wrong answer for the correct question) as “bridge building” to address any disjunct pattern.

Some, like *Beringia*, will be validated later; other floristic patterns will have other explanations besides land bridges or dispersal.

http://courses.botany.wisc.edu/botany_422

Léon Croizat 1894 - 1982

Pai da Biogeografia Moderna

"Terra e vida evoluem conjuntamente"
"a vida é a última camada geológica"
(1964)

Box 1.2 Léon Croizat (1894–1982)

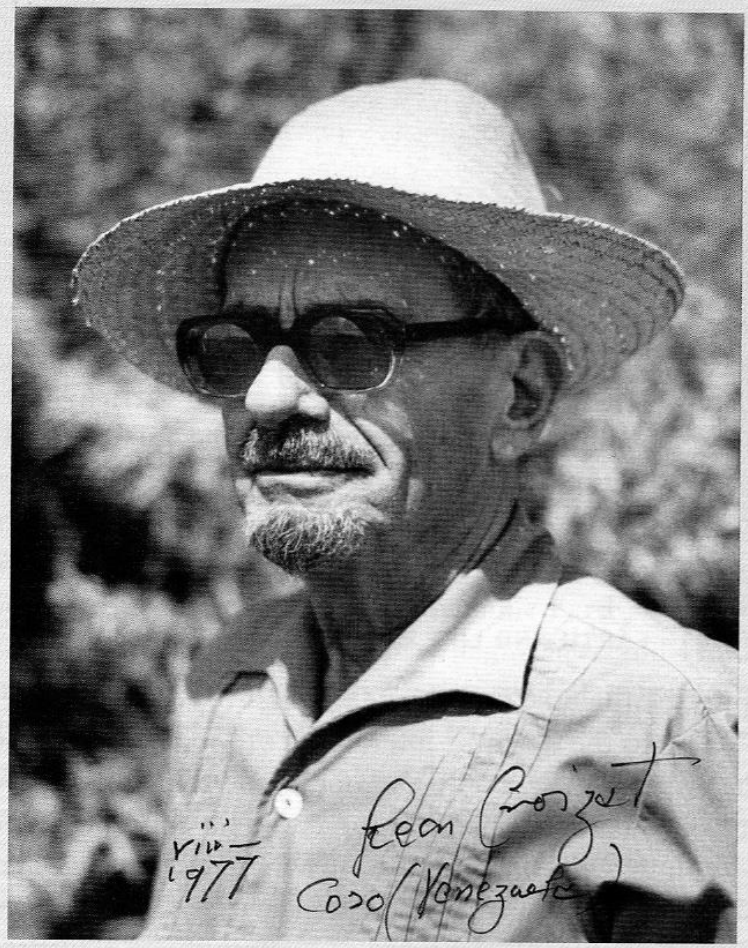
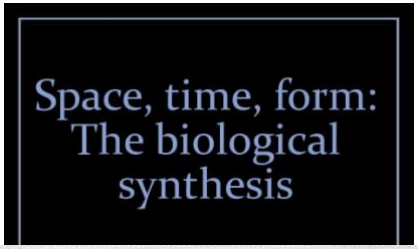
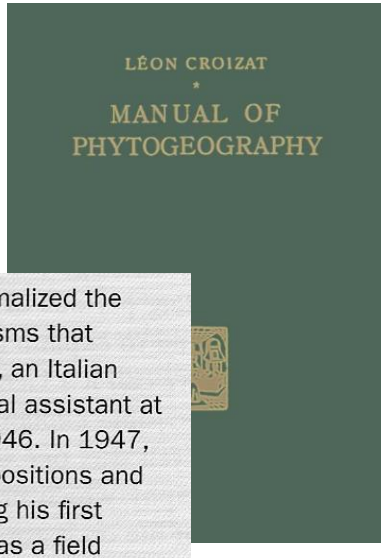


Figure 1.1. Léon Croizat in Coro, Venezuela, August 1977. [Photograph courtesy of Ricardo Callejas and Beatriz Rivera.]





Léon Croizat is the father of modern biogeography. He formalized the concept of a dynamic Earth evolving along with the organisms that inhabit it, now sometimes called panbiogeography. Croizat, an Italian emigrant to the United States, was employed as a technical assistant at the Arnold Arboretum, Harvard University, from 1937 to 1946. In 1947, he moved to Venezuela, where he held several academic positions and worked on various field expeditions as a botanist, including his first exploration of the upper Orinoco. His experience and skill as a field botanist and scholar led him to write several groundbreaking works: *Manual of Phytogeography* (1952), *Panbiogeography* (1958), *Principia Botanica* (1961), and *Space, Time, Form: The Biological Synthesis* (1964) (see Craw, 1984). *(continued)*

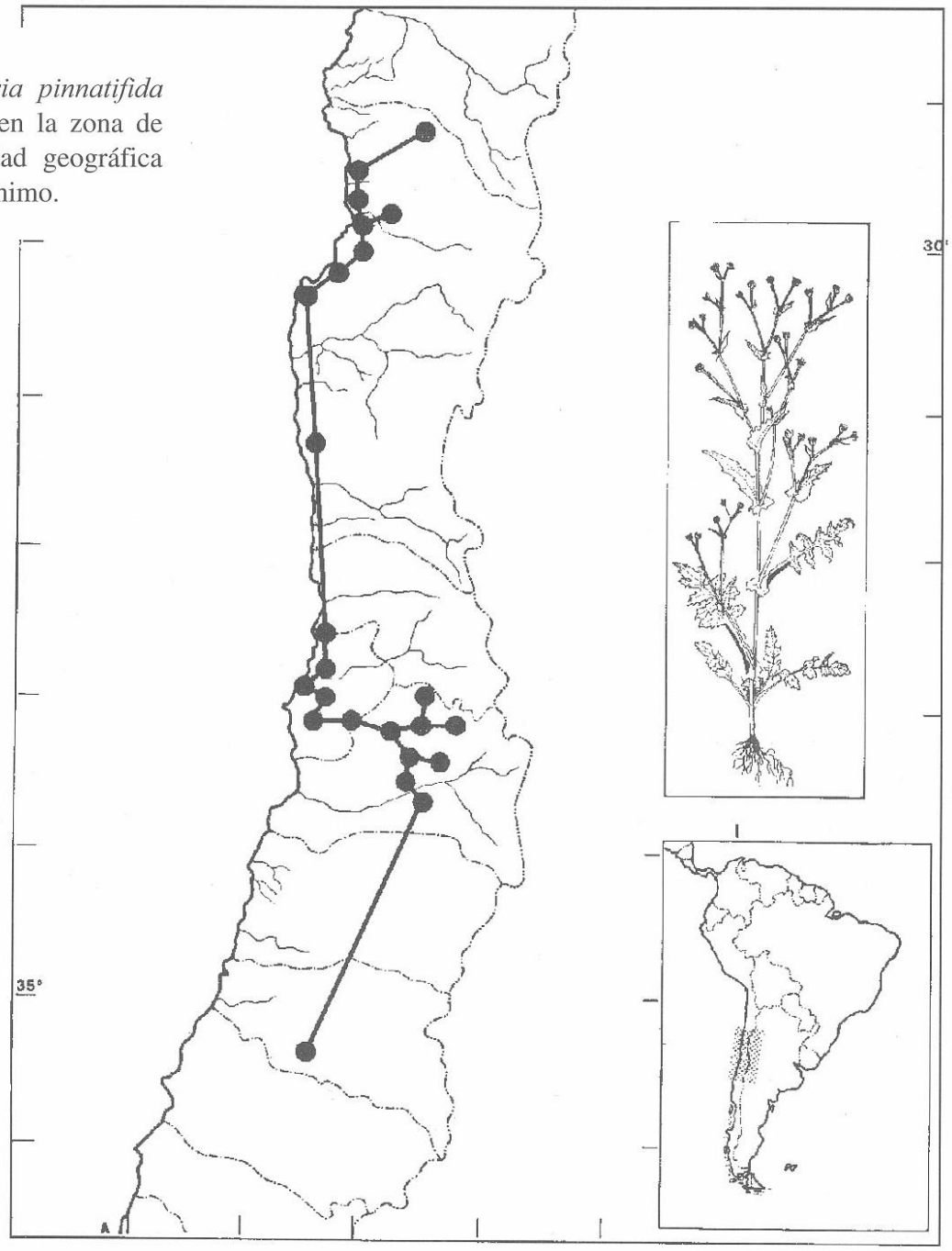
PANBIOGEOGRAFIA

Croizat 1952, 1958, 1964, 1981

Análise de traços – método original, essencialmente gráfico:

1. Traço individual = coordenadas de um táxon no espaço.
orientação do traço:
- linha de base = barreiras geográficas ou geológicas atravessadas pelo traço individual.
- centro de massa = área de distribuição que possui a maior diversidade dentro da distribuição do táxon
- filogenia
2. Traço generalizado = superposição de vários traços individuais de táxons
3. Nó = área onde 2 ou mais traços generalizados se cruzam ou superpõem.

VIII-1. Trazo individual, hábito y distribución de *Moscharia pinnatifida* (Asteraceae). Las localidades de *M. pinnatifida*, distribuida en la zona de Chile Central, están conectadas de acuerdo a su proximidad geográfica logrando un trazo individual equivalente a un árbol valuado mínimo.



Moscharia pinnatifida

Crisci et al. 2000

Rhea americana
ema

Zanella
in Carvalho & Almeida 2010

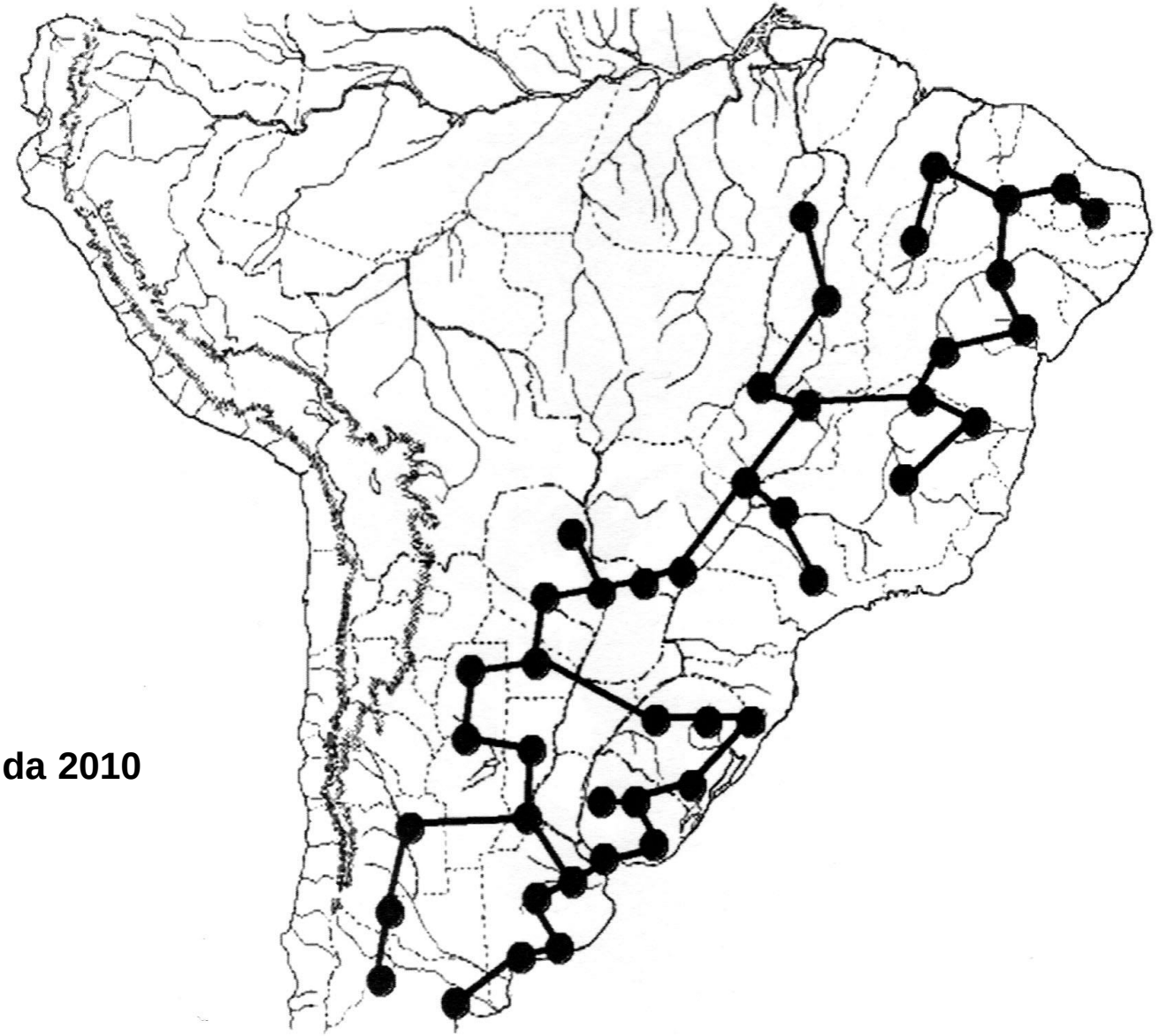


Figura 13.2 – Traço biogeográfico da ema, *Rhea americana*. Modificado de Morrone[3].

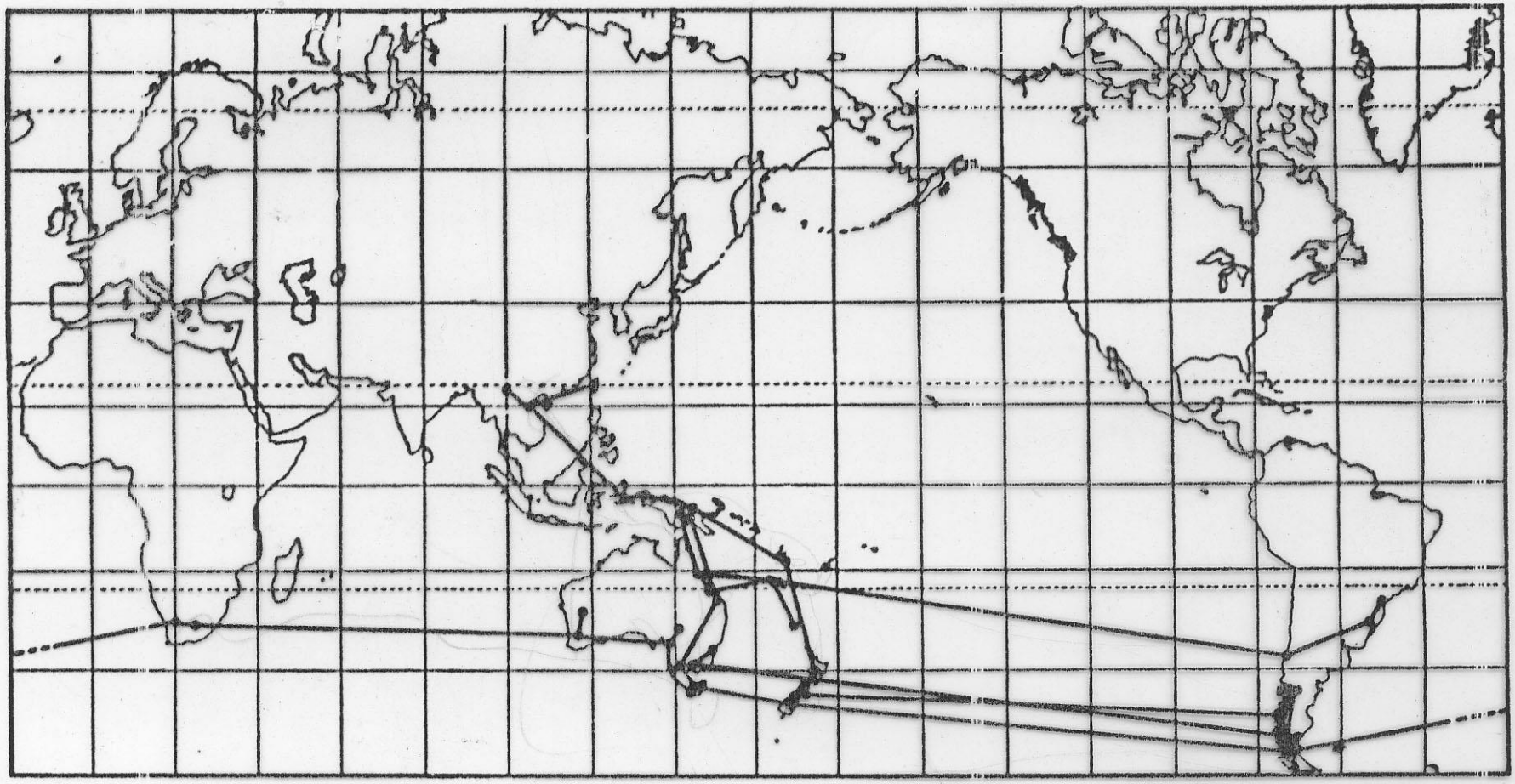


Fig. 1.10. Some generalized tracks for the southern hemisphere and S.E. Asian tropics; Chironomid midges; *Nothofagus*; *Restionaceae*, *Araucaria*, *Libocedrus*.

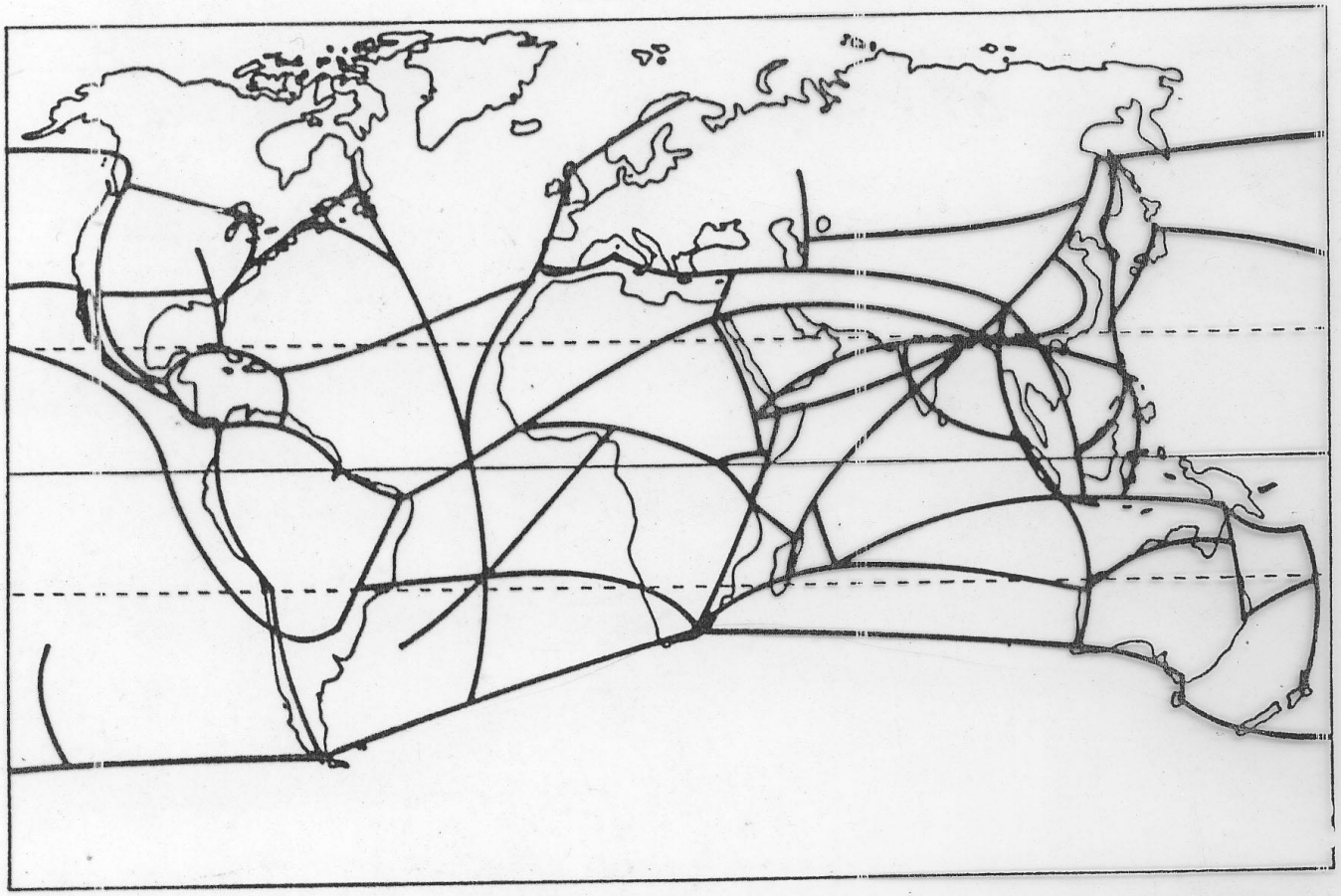


Figure 9.8
Composite drawing of the major and many moderately important "tracks" hypothesized by Croizat (1952, 1958, 1960, 1964) to show hypothesized distributions of ancestral land biotas connecting distant regions. These tracks are derived by plotting distributions of endemic species in several taxa and then drawing lines to connect regions that share disjunct endemics in different groups. For example, tracks radiating out from Madagascar show that its endemics are most closely related to other endemic taxa in South America, tropical eastern Africa, tropical India, Melanesia, and western Australia. Some of the tracks mimic known land connections, such as the Bering Land Bridge and the Mesozoic connection between Africa and South America, whereas others connect continents with islands and islands with each other. In general, the tracks avoid desert regions and open oceans, and instead follow the backbones of principal mountain ranges and island arcs.

Brown & Gibson 1986

Table 1.1

Distribution of endemic taxa in South America (SA), Africa (Af), Madagascar (M), Tasmania (Tas), Australia (Aus), New Zealand (NZ), New Guinea (NG), and New Caledonia (NC)

	Areas								
Family/genus	*Af*	*M*	*SA*	*Aus*	*Tas*	*NZ*	*NG*	*NC*	*Others*
Chironomid midges	+		+	+		+			1, 2
Winteraceae		+	+	+	+		+	+	3, 5
Coriaria			+			+	+	+	1, 2, 3, 4
Proteaceae (Gevuina; Lomatia; Oreocallis and Orites combined)			+	+	+		+		
Acaena	+		+	+	+	+	+	+	3
Osteoglosine fishes			+	+			+		
Ratite birds			+	+			+		2
Stylidiaceae			+	+	+	+			
Nicotiana			+	+				+	1
Hylid frogs and Chaleosyrphus (Syrphid flies)			+	+			+		1, 2
Marsupials (Recent)			+	+			+		1
Nothofagus			+	+	+	+	+	+	

Other areas; 1, N. America; 2, Europe; 3, Central America; 4, China/Japan; 5, Malaysia.

Humphries & Parenti 1986

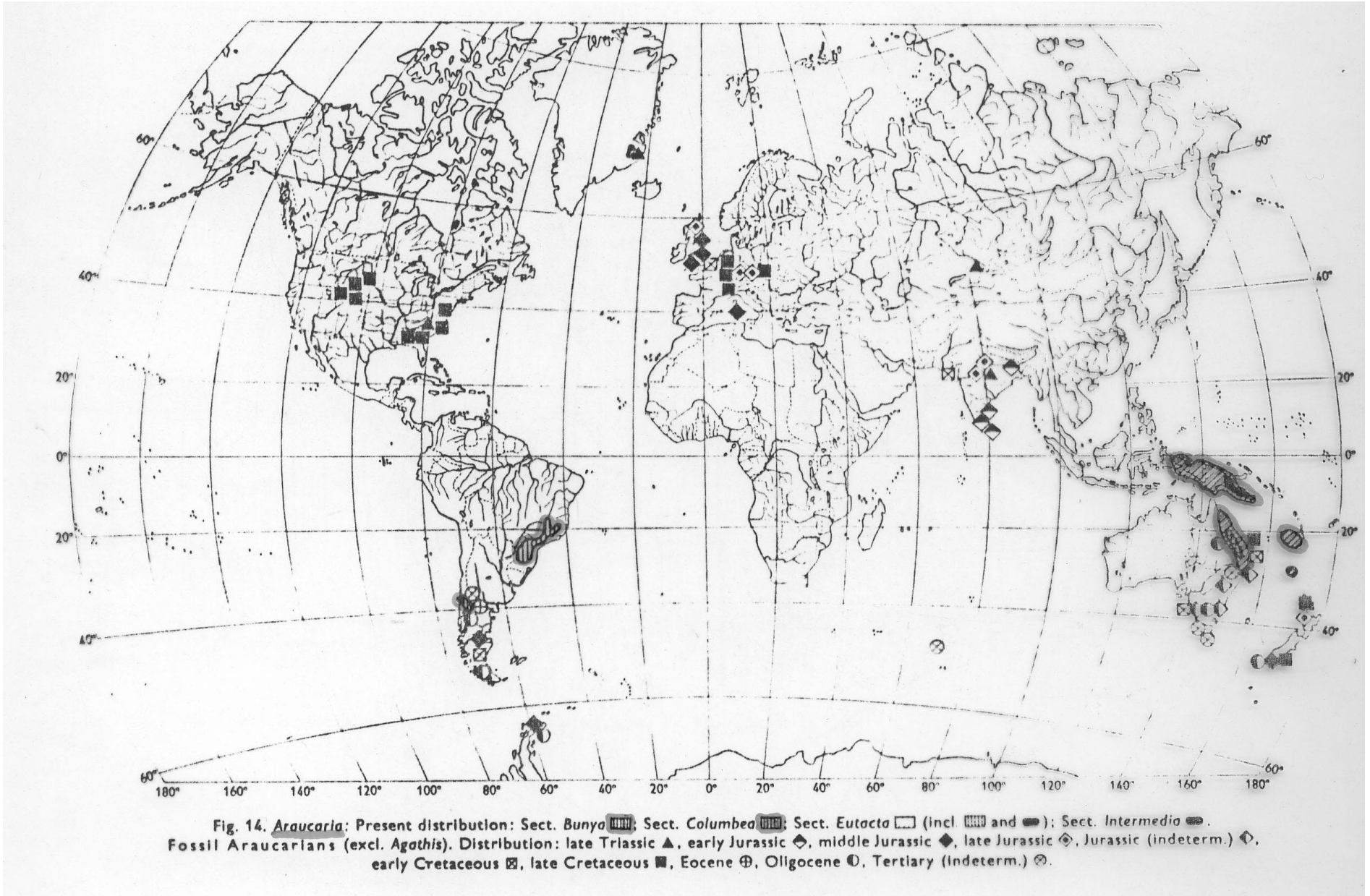


Fig. 14. *Araucaria*: Present distribution: Sect. *Bunya*; Sect. *Columbea*; Sect. *Eutacta* (incl. and); Sect. *Intermedia* .
Fossil Araucarians (excl. *Agathis*). Distribution: late Triassic ▲, early Jurassic ◆, middle Jurassic ◆, late Jurassic ◈, Jurassic (indeterm.) ◈, early Cretaceous ⊠, late Cretaceous ■, Eocene ⊕, Oligocene ◐, Tertiary (indeterm.) ⊗.

Araucaria **- Florin 1963**

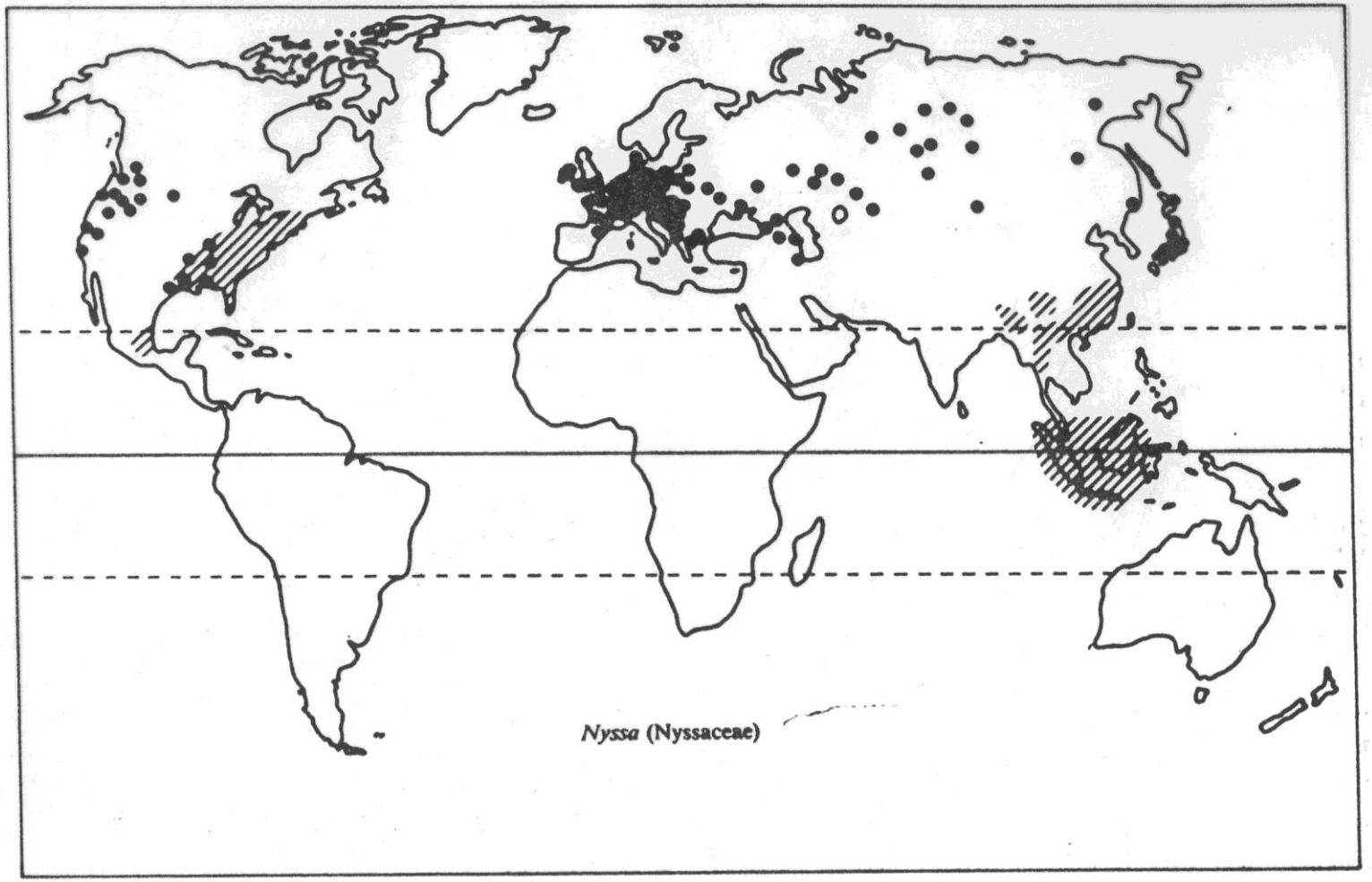


Figure 8.11
Distribution of extant *(shaded)* and extinct *(dots)* populations of the sourgums or blackgums, the tree genus *Nyssa* (Nyssaceae). Fossils show that this taxon was widely distributed across Europe, Asia, and North America during the Tertiary, but it is now confined to eastern North America (including Mexico and Guatemala) and southeast Asia (including the islands of the East Indies out to Wallace's Line). (After Wood, 1972.)

Brown & Gibson 1986

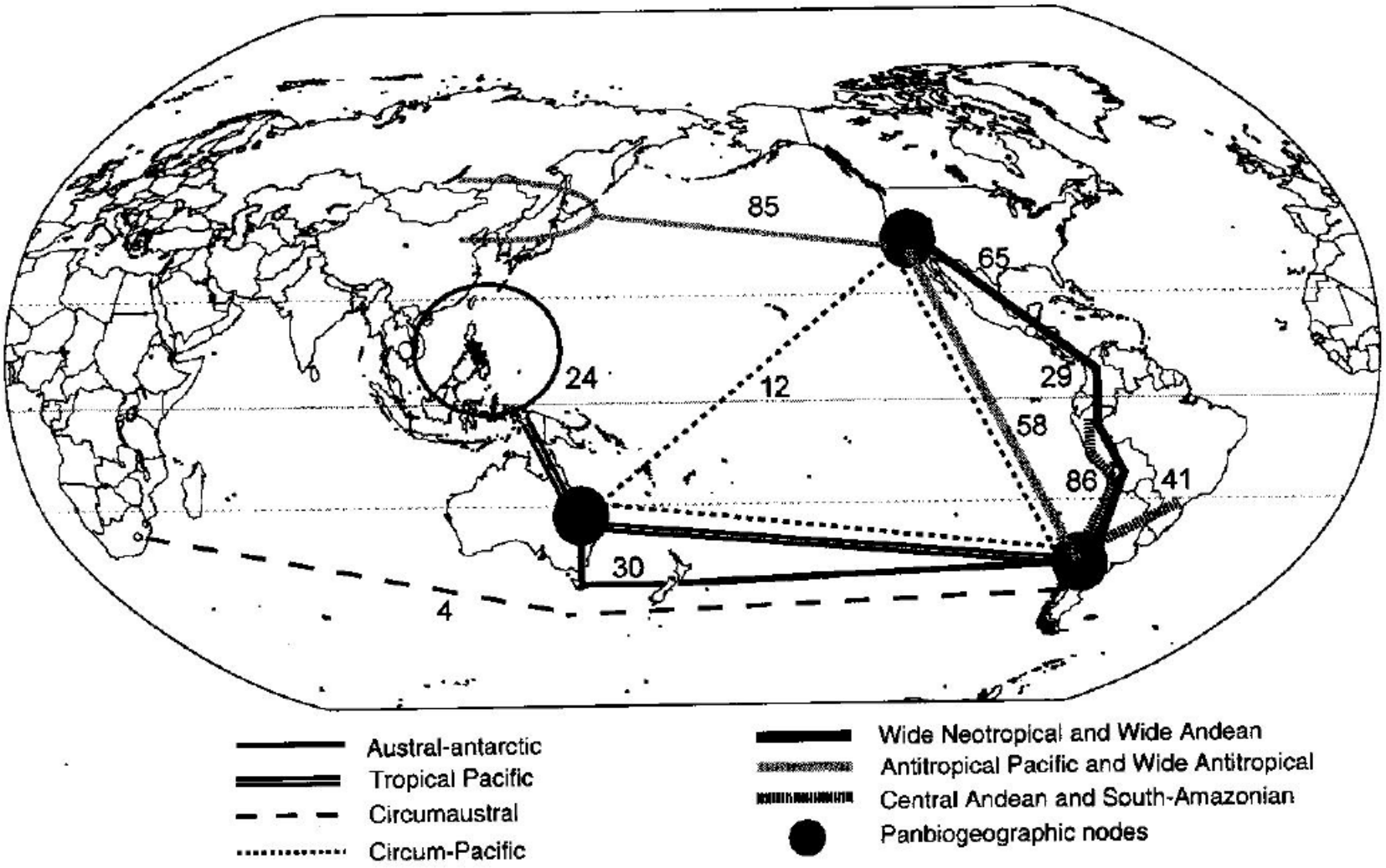


Fig. 3.17 Generalized tracks representing disjunct Chilean plant distributions. The zone of confluence of different tracks can be interpreted as a composite biogeographic zone or a panbiogeographic node (Heads 2004)

Moreira-Muñoz 2011

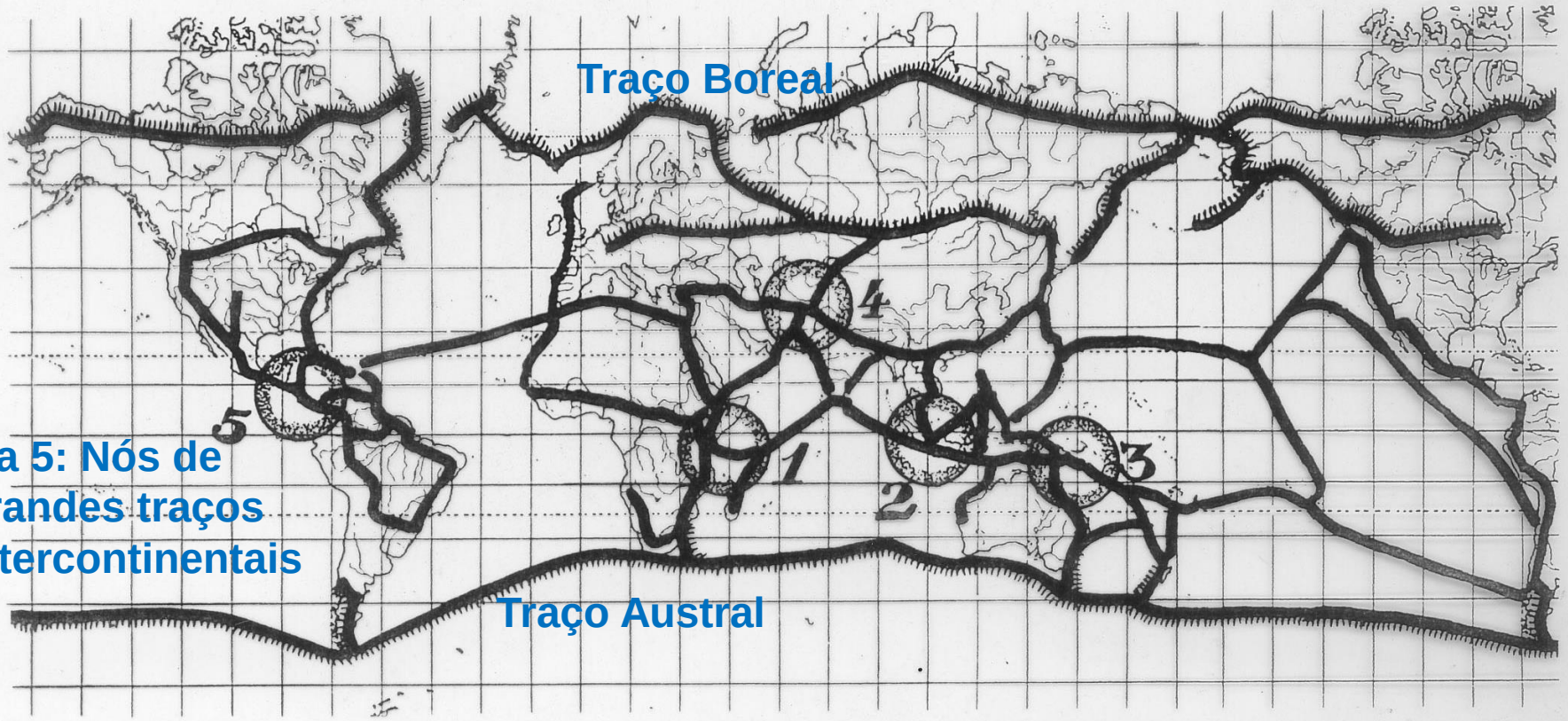


FIGURE 4.2 Paths of spatial distribution of the modern biota, depicted by Croizat as generalized "tracks." Hatched lines depict the "boreal" (Nearctic and Palearctic) and "austral" (Antarctic and Oceanic) tracks. The circles numbered 1–5 are main "nodes" on important intercontinental tracks. Tracks show connections between areas, but are non-directional: there are neither points of origin nor centers of origin. (From Croizat 1958, v. 2b, p. 1018, Figure 259.)

Lomolino & Heaney 2004

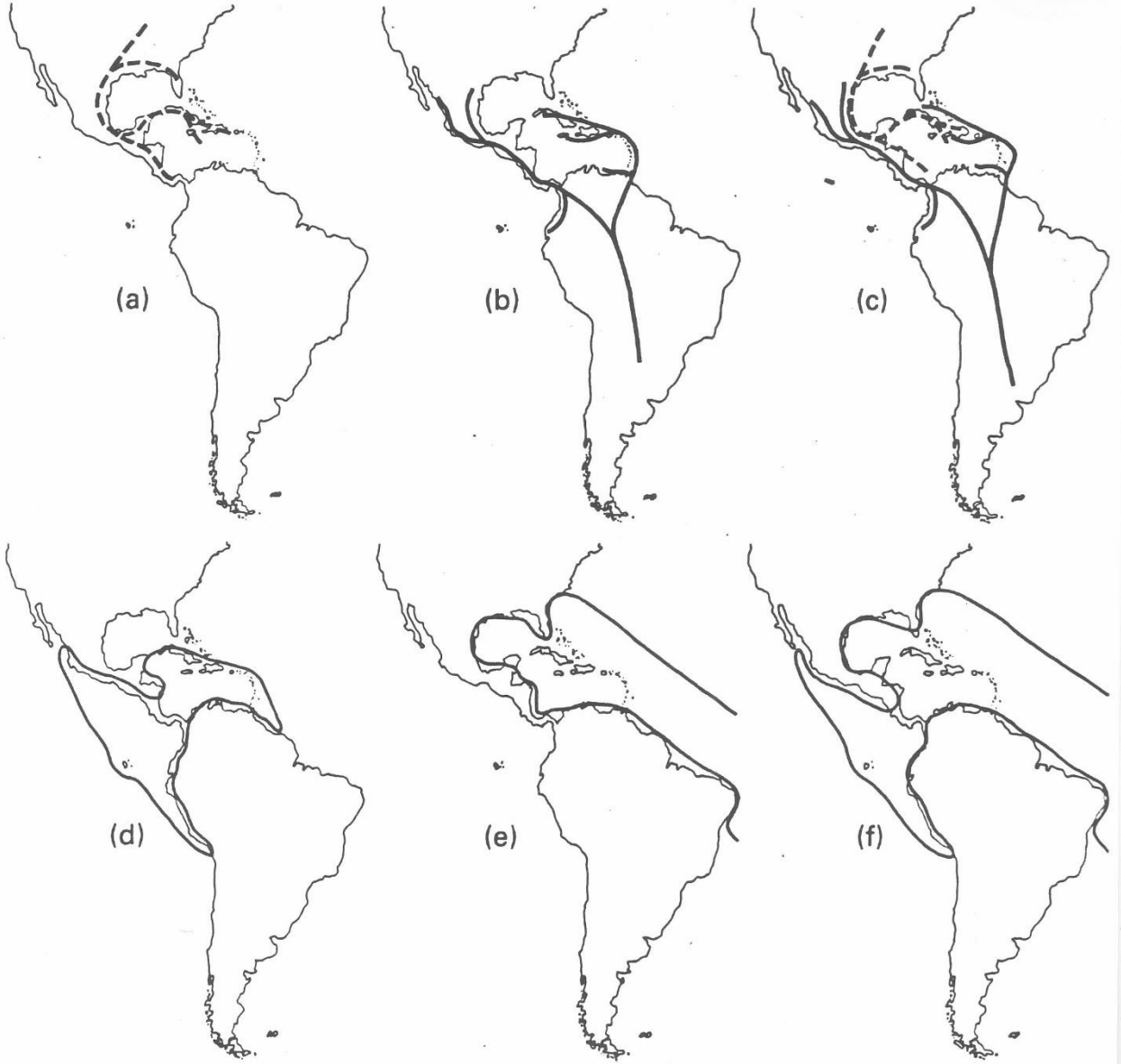
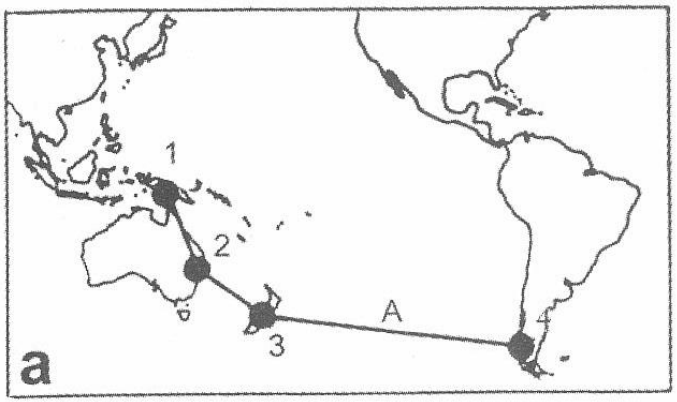


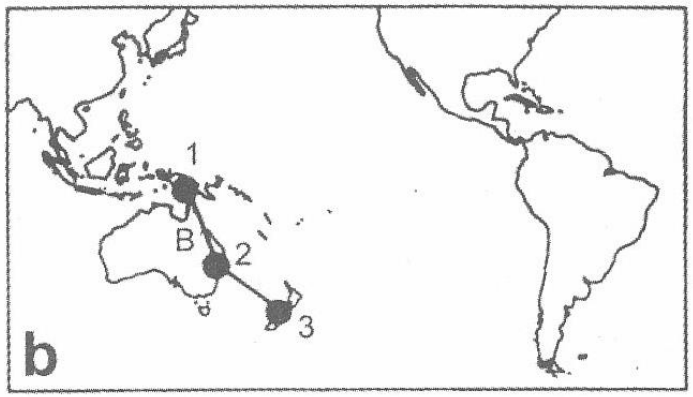
Fig. 9.7 Summary of the generalized tracks representing different elements in the historical biogeography of the Caribbean biota. (a) North American–Caribbean track. (b) South American–Caribbean track. (c) Overlapping of (a) and (b), to enclose the Caribbean Sea. (d) Eastern Pacific–Caribbean track. (e) Western Atlantic–eastern Atlantic track. (f) Eastern Pacific–eastern Atlantic track. From Rosen [10].

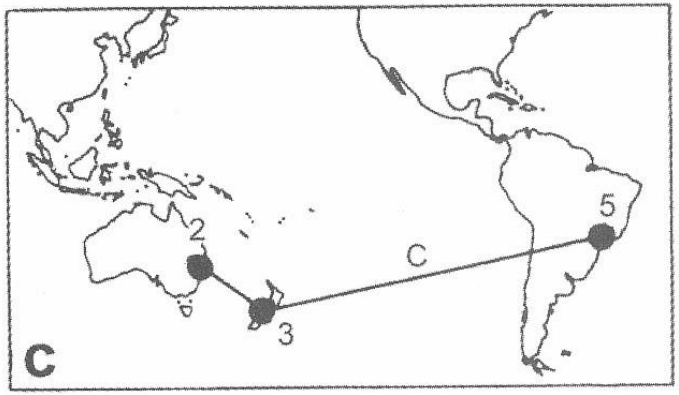
Compatibilidade de traços (Craw 1988, 1989):

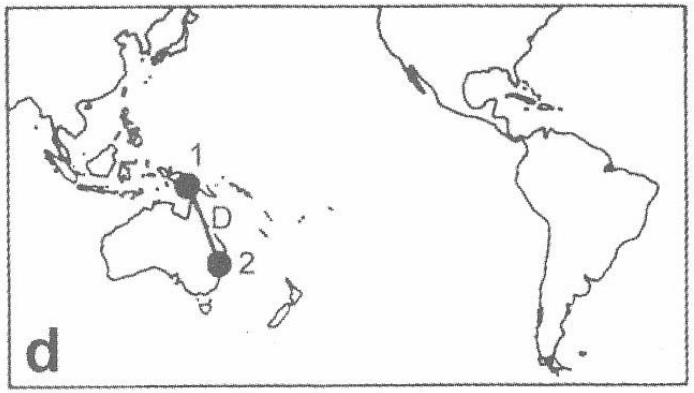
Método panbiogeográfico quantitativo que trata traços como caracteres das áreas analisadas – eles são codificados e colocados em matriz de áreas x traços, analisada em busca de compatibilidades entre traços (opção CLIQUE do programa PHYLIP (Felsenstein 1993)

Compatibilidade de traços





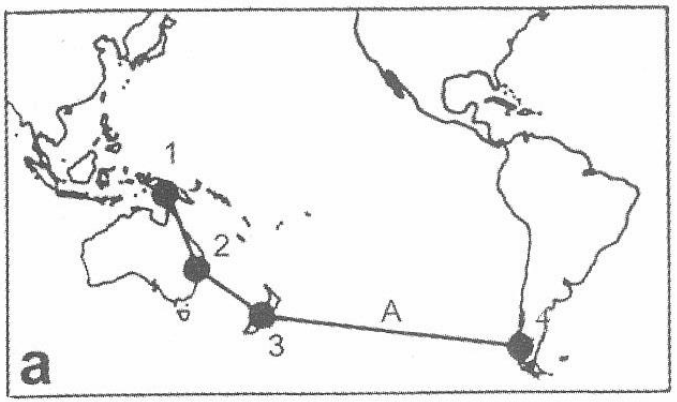




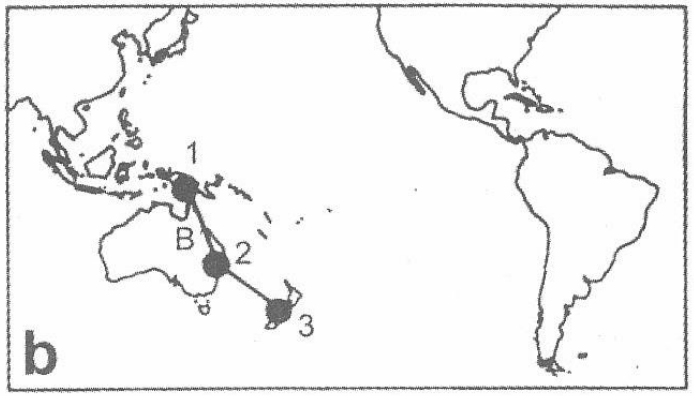
e

		TRAZOS			
		A	B	C	D
ÁREAS	1	1	1	0	1
	2	1	1	1	1
	3	1	1	1	0
	4	1	0	0	0
	5	0	0	1	0

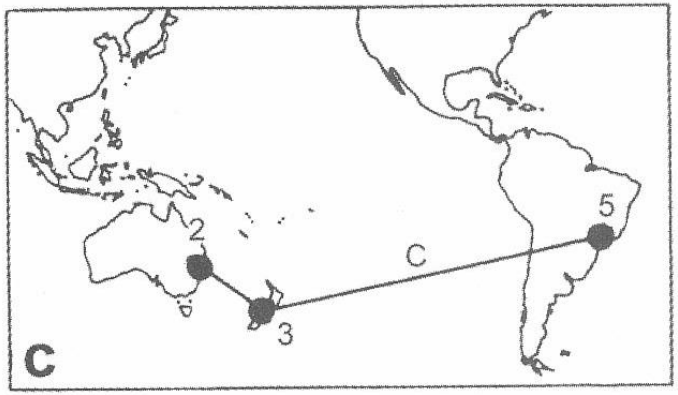
Compatibilidade de traços



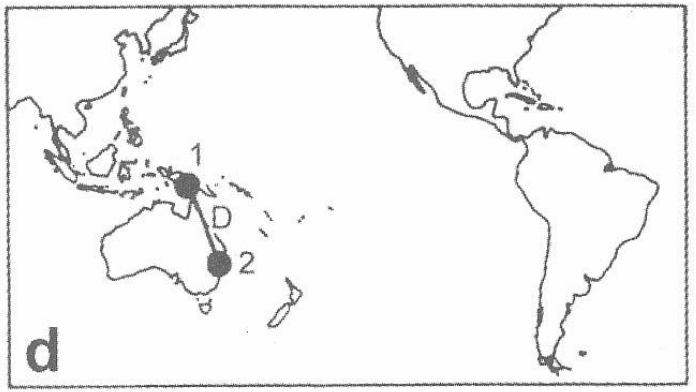
a



b



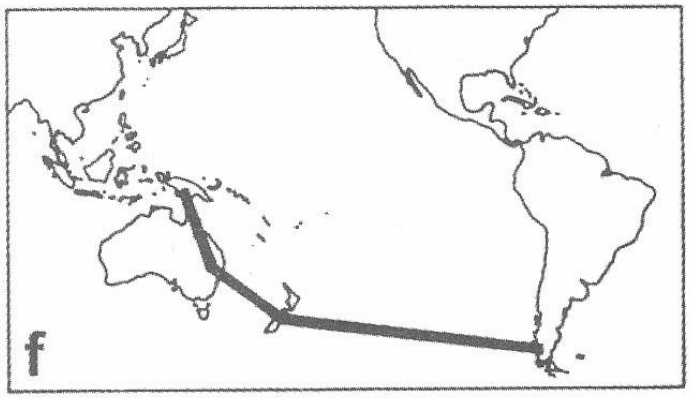
c



d

e

		TRAZOS			
		A	B	C	D
ÁREAS	1	1	1	0	1
	2	1	1	1	1
	3	1	1	1	0
	4	1	0	0	0
	5	0	0	1	0



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Panbiogeografia

Compatibilidade de traços

Exemplo: Katinas et al. 1999: panbiogeografia da subregião andina, com 154 táxons (subfamílias e gêneros): fungos (1), animais (53) e plantas vasculares (100).

Panbiogeografia

Representa um rompimento com a tradição dispersialista

Prioriza cenários de VICARIÂNCIA
Acata a DERIVA CONTINENTAL

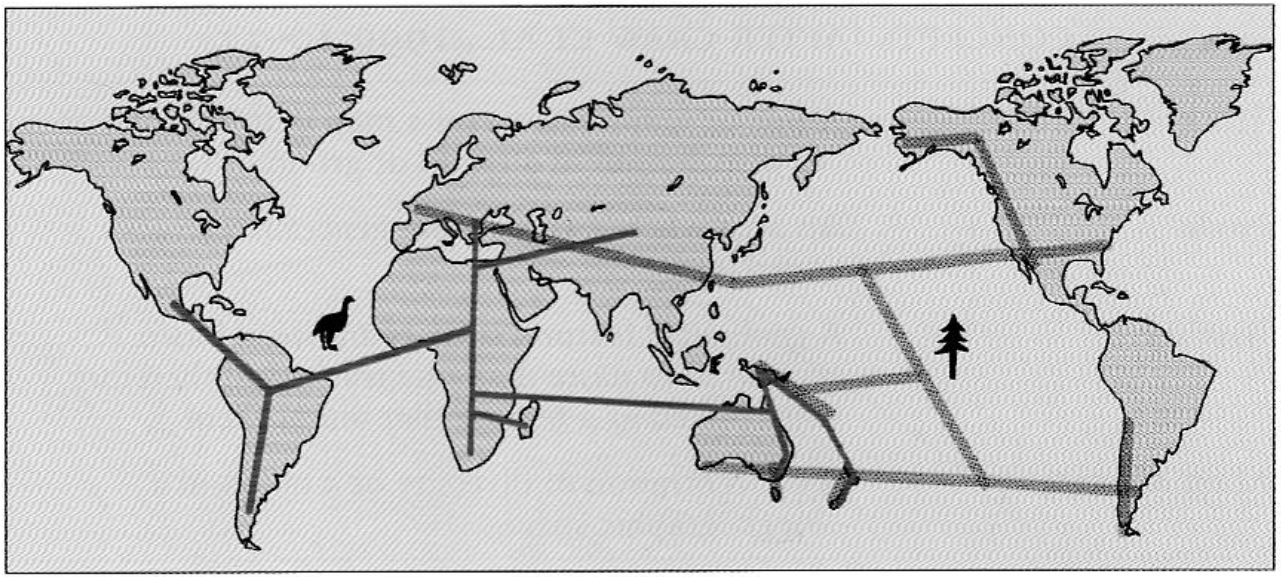

Figure 6.1b. Biogeographic map. Panbiogeographic tracks (from Page, 1989: Figure 10) demonstrating that ratite birds (solid lines) and southern beeches (hatched lines) have different baselines and are not panbiogeographic homologs (following Craw, 1985). [Modified map reproduced with permission of Carolyn King.]

Parenti & Ebach 2009

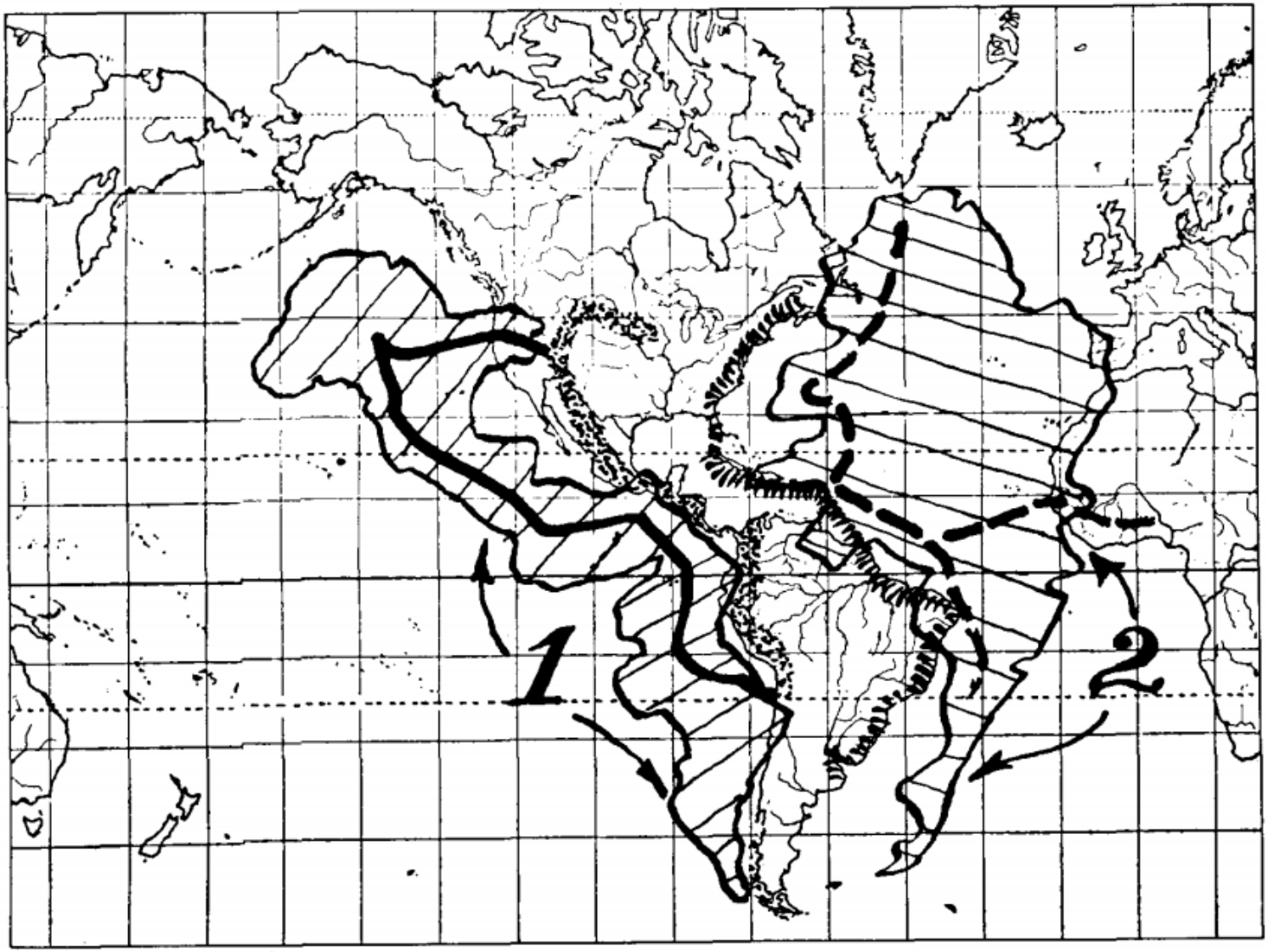

Fig. 4. Croizat's (1960: 79) hypothesis of the composite nature of the North and South American continents. In Croizat's reconstruction both the Atlantic and Pacific Oceans are closed. Croizat's view can be understood as a synthesis of Darwin's early idea of a Pacific continent and Wegener's Pangaea. This novel synthesis was achieved through years of analysis of the distribution records of plants and animals which led Croizat to the realisation that "We may suppose that the New World was originally split into two halves (1 and 2) which later 'floated' to yield the current geography".

Craw 1984