Relationships of Floras (& Faunas)

Knowledge of earth and organism histories now permit closer examination of relationships of disjunct floras and faunas.

• Southern Hemisphere temperate
• Southern Hemisphere tropics
• the Wallace Line
• Eastern Asian - Eastern North American temperate

The Wallace Line

Alfred Wallace, one of the premier zoobiogeographers, wrote the definitive treatise "Distributions of Animals" in 1876 where he summarized the known distributions and causes of their biogeographical patterns.

Alfred Wallace’s main interest was in the vertebrate fauna of the Indo-Malay Archipelago from Asia to Australia where he clearly saw a sharp faunistic break.

Wallace’s 1854 – 1862 expedition in Indo-Malay (1848-1852 South America with Henry Bates)

Sclater’s & Wallace’s faunistic regions

“...there are two distinct faunas rigidly circumscribed, which differ as much as those of South America and Africa, and more than those of Europe and North America” [Letter to Henry Bates in London (1858)]

Probably his most important trip he ever made was a 6 km ferry ride from Bali to Lombok.
The Wallace Line

“In the archipelago . . . there are two distinct faunas rigidly circumscribed, which differ as much as those of South America and Africa, and more than those of Europe and North America” [Letter to Henry Bates in London (1858)]

“The boundary line often passes between islands closer than others in the same group. I believe the western part to be a separated portion of continental Asia, the eastern the fragmentary prolongation of a former Pacific continent”

Looking east from Bali across 6 km Lombok Straits

The Wallace Line

- Wallace Line — the imaginary line separating the Oriental and Australian biotas — extends between Bali and Lombok and between Borneo/Philippines and Sulawesi
- Several other lines have been proposed in the region based on particular groups of animals or plants.
- Main issue with most lines is what do with Sulawesi (Celebes)

The Wallace Line

Wallace graphically depicts what has since been termed the "Wallace Line" in his book by showing birds and mammals that are found in the Oriental (Borneo, left) and Australian (New Guinea, right) sides

Cover plate from Distributions of Animals

The Wallace Line

Sulawesi, with its mixture of Oriental and Australian fauna, was so perplexing to Wallace, that he vacillated back and forth on where to place the island

Backbone of Sulawesi
The "Wallace Line" biogeographical riddle was elegantly solved with the continental drift theory of Alfred Wegener and the more recent plate tectonic basis as a mechanism for Earth evolution.

Earth and Life Evolve Together

Collision of the Australian plate with the Asian plate occurred between 15-5 mya.

Note the origins of Bali and Lombok, forming the Wallace Line.

Sulawesi is a hybrid island from both plates!
The Wallace Line – is it real?

Tree shrews (family Tupaiaidae) were indicated by Wallace as honoring this biogeographical line. An Asian group whose entire range gets as far east as Bali and Borneo but not to Lombok or Sulawesi.

Tree shrew family & individual species distributions

A Biogeographical and Phylogenetic Analysis of Dipterocarpaceae: Do They Honor the Wallace Line?

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Materials and Methods

- Surveying local populations from all over the world
- Using a combination of morphological and molecular data

Results and Discussion

Dipterocarpaceae chronogram

3 genera and 8 species make it to New Guinea on Sahul Shelf . . .

. . . and within last 10 myr – so dipterocarps do honor Wallace’s Line!

The Wallace Line – is it real?

Do plants honor the Wallace Line?

All but 3 of the genera of Dipterocarpaceae honor the Wallace Line – to New Guinea

Surprising considering the winged fruit in the family is designed for (limited?) dispersal

Borneo dipterocarp

Distribution of genera of Dipterocarpaceae

Dipterocarp Distribution (with Wallace Line added)

March 1, 2019
The Wallace Line – is it real?

Do palms honor the Wallace Line?

Greatest center of diversity of palms is in the IndoMalay archipelago — how do they respond to the Wallace Line?

The Wallace Line – is it real?

Rattan palms are essentially Asian with all but 3 genera restricted west of Lombok and Sulawesi

For the 3 genera east of Wallace Line, only 1 species each crosses the line

but timing of these dispersals east are not known

Distribution of different genera of rattan palms

The Wallace Line – is it real?

The genus Caryota (fishtail palms) is widespread across the IndoMalay - New Guinea region

Does it NOT support the Wallace Line?

The Wallace Line – is it real?

Although fishtail palms appear not to honor the Wallace Line as a genus, only the most recent speciation events in each clade have generated species crossing the line.

Perhaps these occurred after plate contact occurred? – no dates are available yet

Species relationships within two different groups of fishtail palms and their biogeographical distributions

Bill Hahn
The Wallace Line – is it real?

_Eucalyptus_ (Myrtaceae) is an Australian genus and basically honors the Wallace Line from the east.

Date of 4 species in Wallacea not known.

Distribution of _Eucalyptus_