

# Darlington's Theory Quotes

Paul Merrell - 5/22/26

A list of quotations related to my YouTube video about the idea that areas that can support larger populations are more competitive and more dominant and that dominant species arise in the Old World tropics.

## Darlington, 1957, Zoogeography.

“Dominant land and fresh-water vertebrates seem mostly to have risen in the great favorable area of the Old World tropics”

“Of two otherwise identical populations, one with twice as many individuals as the other, the larger is twice as likely to originate any single mutation, and in evolutionary progressions that depend on sequences of mutation that statistical advantage of large populations is great... It follows that adaptation should be most rapid in environments that are extensive and more or less continuous.”

“The chance of superior species appearing in an area is probably proportional to number of species in the area, just as the chance of superior individuals appearing by mutation is proportional to number of individuals.”

“The idea of evolution of dominant animals in great, densely populated areas is not new. It goes back to Darwin. I have merely restated the idea in terms of modern genetics...”

## Darlington, 1959, Area, Climate, and Evolution.

“Vertebrates have moved back and forth over the world in very complex ways, but the sum of the movement has been from larger to smaller land masses. Evidence of this comes from many sources.... More movement of vertebrates from Asia to Australia than the reverse, more from the Old World to North America... more from North to South America... Movements of vertebrates from continents to island have been even more strongly directional”

“The more individuals, the more the mutations, and the more rapid adaptation should be... If adaptation proceeds partly by selection of superior species... it should be most rapid where populations are numerous as well as where they are large...”

## Darwin, 1859, On the Origin of the Species.

“I suspect that this preponderant migration from north to south is due to the greater extent of land in the north, and to the northern forms having existed in their own homes in greater numbers, and having consequently been advanced through natural selection and competition to a higher stage of perfection or dominating power, than the southern forms... the northern forms were enabled to beat the less powerful southern forms.”

“From the extraordinary manner in which European productions have recently spread over New Zealand... we may believe, if all the animals and plants of Great Britain were set free in New Zealand, that in the course of time a multitude of British forms would become thoroughly naturalized there, and would exterminate many of the natives. On the other hand... hardly a single inhabitant of the southern hemisphere having become wild in any part of Europe... Under this point of view, the productions of Great Britain may be said to be higher than those of New Zealand.”

## Fristoe et al., 2023. Evolutionary imbalance, climate and human history jointly shape the global biogeography of alien plants. Nature Ecology & Evolution.

Successful aliens tend to originate from large, biodiverse regions that support abundant populations and where species evolve against a diverse backdrop of competitors and enemies

Our results also show that biogeographic syndromes defined by combinations of the ‘Old World’ continents of Africa, Europe, and temperate and tropical Asia have been particularly successful at donating naturalized alien species.

Species originating from large, biodiverse regions have been more successful at naturalizing beyond their native ranges. This is in line with large areas facilitating effective selection, as proposed by the [Evolutionary Imbalance Hypothesis]...

## Fridley and Sax, 2014, The imbalance of nature: revisiting a Darwinian framework for invasion biology.

Richer biotas of more potential competitors and those that have experienced a similar set of environmental conditions for a longer period should be more likely to have produced better environmental solutions (adaptations) to any given environmental challenge.

## Vermeij, 2005. Invasion as Expectation: A historical fact of life

...biotic interchange has often been highly one-sided, with one biota acting as donor and the other as recipient for invaders. Donor biotas tend to be larger in extent, richer in species, and better endowed with species of high competitive, defensive, and reproductive performance than recipient biotas.

Biotic interchange is almost always a highly asymmetrical process. When two biotas come into contact, the predominant direction of invasion is from the larger, more diverse biota, in which antipredator and competition-related adaptations have evolved to absolutely higher performance standards, to the smaller, less diverse biota, in which maximal levels of performance are lower (Darwin 1859; Darlington 1959; Briggs 1966, 1967a,b, 1999, 2003; Vermeij 1978, 1991a). Moreover, the donor biota has suffered less extinction of species than the biota receiving the bulk of invaders (Vermeij 1991a).

## Jablonski, Roy, and Valentine, 2006, Out of the tropics.

“...a global analysis of genera and subgenera of marine bivalves over the past 11 million years supports an "out of the tropics" model, in which taxa preferentially originate in the tropics and expand toward the poles without losing their tropical presence.”

## Di Castri, 1989, History of biological invasions with special emphasis on the Old World.

“While keeping the pitfalls of generalization in mind, there are numerous facts in favour of a higher invasion potential—as an average—of Old World organisms as compared with the floras and faunas of other continents. Crawley’s question (1985) on ‘why has the trans-Atlantic “trade” in aliens been so one-sided?’ is just one of many similar statements found in literature.

One is understandably impressed by the invasion ability of species such as the European rabbit (*Oryctolagus cuniculus*) in Australia (Myers, 1986) and Chile, *Rattus rattus* ... and *Mus musculus* everywhere, *Rubus* in Chile, and *Pinus pinaster* in South Africa. Whole floras have also been virtually replaced. For example, the native species of the grazing lands of California, Chile, Argentina, South Africa, Australia, have been replaced by Old World species, particularly Mediterranean Basin annuals and herbs. A similar phenomenon has been the massive invasion of African plants into South American savannas.

At least when vascular plants are considered (e.g. Allan, 1937; Frenkel, 1970; Raven, 1977), it appears that:(a) the proportion of alien species is lower in Europe and in the Mediterranean Basin than in most of the other regions of the world; and (b) most aliens in the other continents

have a Eurasians origin, nearly 80% of the total adventive flora; annuals constitute the dominant group, followed by biennials and perennials, shrubs, and trees.

Taking as an example a comparison between the Mediterranean Basin and California—and admitting that the criteria followed for recording the nature and the origin of plant species may differ to a certain extent—Quezel et al. (1989) recognize over a total Mediterranean flora of about 20,000 species, no more than 400 ‘important’ alien species, that is to say, some 5% (more likely 6-7% not considering the criterion of ‘importance’). In California, more than 1000, introduced species (about 75% of Eurasian origin) were recognized in 1968 (certainly many more at present) as against about 5200 native species (see also Howell, 1972 and Spicher and Josselyn, 1985). The proportion of aliens would be therefore about three times greater in California than in the Mediterranean Basin.”

## Marshall, 1988, The Great American Interchange.

“The Great American Interchange represents the best-documented example in the fossil record of the intermingling of two long-separated continental faunas... the North American land mammal fauna was part of the vast Holarctic realm... [they] were thus the survivors of many earlier exchanges, tested repeatedly by immigrations and attempted immigrations from the Old World.”

“Nearly half of the families and genera now on the South American continent belong to groups that emigrated from North America during the last 3 million years.”

## Gillespie, 2004, Population Genetics

Molecular Evolution. The rate of substitution of neutral alleles,  $\rho$ , for advantageous additive mutations is

$$\rho = 2Nus$$

where  $N$  is population size,  $u$  is mutation rate, and  $s$  is the strength of selection.

## Loope, 1989.

There is some evidence that the more endemic (native) a taxon is the more vulnerable to extinction it is (McDowall, 1969; Loope, 1989; Pyle 1983). Among flowering plants a taxon in an endemic Hawaiian genus is 1.3 times as likely to be endangered or extinct as one that is

endemic at the species level, 4 times more likely as one at the intraspecific level, and 10 times as likely as a native taxon not endemic at any level (Loope, 1989).

Jablonski, Sepkoski, Bottjer, Sheehan, 1983.

“major ecological innovations appeared in nearshore environments and then expanded outward across the shelf at the expense of older community types.”

Wilson, 1961, Taxon Cycle.

“Retreating taxa can shift their headquarters from larger to smaller land masses, but not in the opposite direction”

Wilson, 1959, Adaptive Shift and Dispersal in a Tropical Ant Fauna.

“(1) Most groups seem to invade New Guinea from southeastern Asia... (2) From New Guinea a fraction of the invading stock presses on to outer Melanesia ... no concrete evidence indicating any reverse movement of these precinctive species back toward New Guinea”

Wilson, 1992. The Diversity of Life

“The mammals of North American origin proved dominant as a whole over the South American mammals... The fauna of North American was not insular and discrete like that of South America. It was and remains part of the World Continent fauna, which extends beyond the New World to Asia, Europe, and even Africa. The World Continent ... has tested more evolutionary lines, built tougher competitors, and perfected more defenses against predators and disease. This advantage has allowed its species to win by confrontation.”

Briggs, 1999, Coincident Biogeographic Patterns: Indo-West Pacific Ocean

“[Veron (1995)] concluded that the Indonesia/Philippines Archipelago and other regions extending west to the central Red Sea probably act as long-term net sources of species diversity. He added that more peripheral regions are probably always net sinks. Species diversity (but not individual species) is thus continually exported from central sources to peripheral sinks.”

“It seems evident that these six biogeographic patterns provide support for the hypothesis that the East Indies has been operating as a center of evolutionary radiation.”

“There appears to be few documented cases where species arising from small, isolated populations have been able to invade and replace a large parent population. If a barrier separating a peripheral group from its larger parent population is removed, it is usually the former that becomes extinct.”

“Because successful evolution evidently occurs in high diversity centers of origin, dominant species that have been able to spread over large geographic areas probably arose in such places.”

“Successful species that are produced in the center must be able to dominate peripheral relatives that are less fit in a genetic sense.”