

EDITORIAL



EDUARDO HUGO RAPOPORT (1927-2017): ARGENTINA'S SPECIAL GIFT TO ECOLOGY AND BIOGEOGRAPHY

Eduardo Hugo Rapoport died in his beloved Bariloche last spring. With his passing, biogeography and ecology lost an exceptionally creative scientist, Argentina lost one of its most distinguished citizens, and those of us who knew him—and called him Eddy—lost a treasured friend. This is not an obituary. I did not know Eddy well enough to my chagrin I never took him up on his repeated invitations to visit him in Bariloche. I did, however, have some wonderful times with him and I was a great admirer of his work. So what follows is a very personal account of Eddy's scientific contributions and how they affected me and my own work.

My acquaintance with Eddy began with a telephone call. I think it was in the late 1970s. He was traveling in the U.S. visiting friends and colleagues. He had discovered some of my papers on biogeography and wanted to come to Tucson to meet and talk with me. When he arrived and asked about inexpensive lodging, Astrid and I invited him to stay with us. There ensued three memorable days. We spent hours in deep scientific discussions, punctuated by informal times with Astrid and our kids. After he returned to Mexico, where he was working at the time, Eddy sent me the Spanish version of his book, Areografía (Rapoport 1975). In 1982 he sent me the English language version, Areography: geographical strategies of species (Rapoport 1982). A couple years later, after he had returned to Argentina and established himself at Bariloche, he visited again and stayed with us. He brought us a beautiful ceramic bowl inscribed “Cerámica Bariloche Argentina S.N.” that we have treasured ever since. This visit was again marked by long discussions with Astrid and me about life, books, philosophy, art, and politics, and with me about ecology and biogeography. Over the succeeding years we stayed in touch, first by letter and then by email, although the frequency of communication decreased over time.

Despite enormous challenges, Eddy led a rich, joyful life and enjoyed a very influential career. His entry in Wikipedia (<https://en.wikipedia.org/wiki/Eduardo_H._Rapoport>) contains a summary of his interests, career history, and major publications. For those whose Spanish is better than my own, I refer you to his delightfully idiosyncratic autobiography: Aventuras y desventuras de un biólogo latinoamericano (Rapoport 2015). It is vintage Eddy, witty and self-deprecating. Most of the book consists of detailed descriptions of his scientific work, but it also contains fascinating personal history and philosophical reflections.

Eddy is best known to me and most scientists for his contributions to biogeography, most of which are contained in his book, *Areografía* (1975) and the English version *Areography* (1982). When it was published, Eddy had been doing ecological research in ecology, mostly in freshwater and soil ecosystems, for more than 20 years. These field and laboratory studies, several published in important international journals, were substantial contributions to good basic and applied ecology. But it was *Areografía/Areography* that drew most attention and caused “Rapoport’s Rule” to be enshrined in the lexicon of biogeography.

The book focuses on geographic ranges: their size, shape, location, and internal structure. Thirteen years after its publication, Brown et al. (1996) wrote “Primary credit for stimulating interest in quantitative studies of geographic ranges, however, must go largely to Rapoport, whose creative and insightful monograph *Aerography* ... not only anticipated nearly all of the ideas in the present review article, (but) also investigated many of them by collecting data and performing elegantly simple analyses.” Now more than twenty years after its publication, the book still stands as a treasure trove of biogeographic ideas and information. The book showcases Eddy’s exceptional creativity. It shows how an inquiring intellect, working in relative isolation and with minimal support, can do transformative science. It is an example of the best inductive science: documenting general patterns in nature and erecting hypotheses to explain them.

One of my favorite examples is how Eddy quantified the distribution of individuals within the range. He chose a palm species whose distinctive morphology allowed every individual to be identified on aerial photographs. A transect through the range from center to edge revealed a pattern: the average density of individuals decreased and their distribution became more clumped. Subsequent studies suggest that this pattern, although not universal, is very general. Eddy likened the range to a slice of Swiss cheese. The center of the range may be densely and relatively continuously inhabited, but toward the edges density decreases and increasingly large holes appear until they coalesce to leave islands around the periphery.

Most of *Areografía/Areography* is based on Eddy’s extraction and analysis of data from Hall & Kelson’s (1959) *The Mammals of North America*. The two volumes and 1162 pages of this monographic treatise contained 500 maps plotting detailed geographic ranges of the 3679 then-recognized species and subspecies of mammals inhabiting the continent north of Panama. Eddy used a simple mechanical planimeter to measure the boundaries and enclosed areas of the ranges, and performed elegantly simple analyses of these and associated data. One of his most intriguing findings was that the ratio of perimeter to area was approximately 10 and did not seem to vary much with range size, taxon, and environmental conditions.

Another pervasive pattern was a correlation between area of the range and latitude. This pattern was picked up by George Stevens (1989), who noted that “Rapoport ... made passing reference to the correlation while describing the degree of geographical overlap between the distributions of subspecies.” Stevens coined the term “Rapoport’s rule” and documented many such correlations along geographic gradients not only of latitude, but also of elevation on land and depth in the ocean. Stevens should be credited

with recognizing the importance of these patterns as one of the phenomena associated with the pervasive geographic gradients in species richness. There are more species in the tropics in part because larger numbers of small geographic ranges with greater overlaps are packed into the lower latitudes. Rapoport's rule is now well enshrined in the lexicon of biogeography. It is the subject of literally thousands of papers; most are generally supportive, but some are highly critical, questioning the occurrence of the pattern in some regions and taxa. My assessment is that the rule has been well-supported as a generalization. Like most ecographic rules, however, it is not a law and there are well-documented exceptions.

If Eddy Rapoport's only legacy were the biogeographic pattern that he discovered and is named in his honor, he will long be recognized for this seminal contribution to biogeography. But the totality of Eddy's work and life have left a much broader, deeper, and longer-lasting legacy on those of us who were privileged to know him. We will miss him.

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