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ESSAY

TO BE OR NOT TO BE SOCIAL IN TROPICAL ECOLOGY IS THE QUESTION AFTER THE COVID-19 PANDEMIC

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Many difficulties arise when comparing tropical organisms and ecosystems within and between continents and countries with different ecological and geological histories. However, there are also variable anthropogenic influences reflecting other cultures, economies, and political systems. Still, such among- and across-continental comparisons are invariably needed for a better understanding of the evolution and the maintenance of the diversity of flora and fauna especially in highly endangered forest habitats (Corlett and Primack 2006). There are many difficulties in studying and analyzing these forests comparatively. Long-term experience and observations, such as those carried out by French scientists in the 1960s in the rainforests of French Guiana and Gabon (Dubost 1968; MNHN 1986) are particularly needed today. Nevertheless, they will never act as perfect, independent replicates, with very little chance to repeat studies during the relatively short period of a scientific career. Constraints are numerous with some being particularly limiting in the long term. The recent COVID-19 episode has not been helpful in this respect. Three of these constraints stand out as being most important: career time length, the number of scientists, and the overall concern of decision-makers for environments.

First, time is limited for all of us: at best, we may have 30-40 years of research activity to reach our scientific objectives. It's better not to set goals excessively high. Let's consider a student starting his/her Master's or Ph.D. courses. Depending on the country and educational system, it will take between 5 and 10 years to reach an internationally competitive level by passing through the filters represented by peer-reviewed journals and granting agencies. Meanwhile, s/he will establish working relationships with other well-established scientists during international meetings when s/he is lucky and rich enough to attend them. After these first-phase achievements, another decade will pass, moving from one post-doc to another before obtaining tenure for the rest of the career. From that moment on, s/he will be able to raise grants and, perhaps, launch some large-scale research programs across continents, with international counterparts progressed through periodic international meetings. Of course, these meetings may be delayed by, perhaps, two to four years, or even more. Making progress on such international projects is a question of time but also of support and human relationships. Not everyone is willing to work with others as a team. By nature, we may be either solitary or social, but both qualities are needed in science as a whole. Field work often implies solitude, especially when carrying out animal studies that require being silent in the forest, yet socialization is a second key element of science, especially during conferences, workshops, and international meetings.

Second, the number of colleagues in the same field with whom one may share research questions and conceive replicated observations and experiments is limited across all continents. Potential colleagues from some continents or countries may remain unknown because they do not publish often and/or only in regional journals, rarely attending international meetings.

Finally, at that point, decision-making politicians have an important role to play, not only in financing and promoting international conferences but also by favoring the visits of scientists to foreign countries and making visa procedures as easy as possible to promote international scientific exchanges. Transportation logistics and time are two other major constraints involved in such among- and across-continental comparisons. Let us take a non-random example: consider that I want to replicate exactly a study on seed removal of a tree species that, ideally, is the same species that grows in two continents and different countries. An example might be a species found for instance, in South America, in French Guiana, Suriname, and Guyana, as well as in Central Africa

in Gabon, Cameroon, and Central African Republic. Ideally, each experiment should start during the same year, the same 'fruiting season,' at about the same 'ecological time,' i.e., at the beginning of the rainy season, at it's the peak, or during the dry season. Even with the best of intentions it quickly becomes apparent that this is logistically impossible. Instead, I may travel at speed from one country to another in one year and repeat the process in the second year for the other continent. But, then, as a consequence, I may face a strong year effect. If I cannot provide background data on fruit and seed availability, all results will likely be questioned by referees and ultimately rejected by the journal. Eventually, the paper might be accepted through a less strict review process. Still, if this journal is not listed in the citation index, it's almost as if the study had never existed. The alternative is cooperating with colleagues, one counterpart for each country on both continents. How many scientists do we then need? Frequently, there will not be enough on the scene from appropriate disciplines. Even when the peoplepower does exist, they may be far too occupied by other more profitable or pressing duties, such as education, training, or management of resources, unable to dedicate themselves to some costly ecological and not immediately applicable studies. It is certainly idealistic to carry out cross-continental comparisons when we face a lack of human resources in countries of both the northern and southern hemispheres. How much of the tropical forests will have disappeared by the time such comparisons can be carried out? Is this a reason to lay down arms, to abandon such a beautiful though romantic idea: that is, to unite scientists across different continents? I don't think so. I subscribe to and applaud Corlett and Primack's (2006) suggestion and call for international collaboration and comparisons, but I am also wondering and questioning how to achieve this. The book written by Primack and Corlett (2005) and their additional paper (Corlett and Primack 2006) is a kind of 'scientific-diplomatic' 'open sesame' call to visit all tropical countries and habitats and to perform comparative work. No passports or visas are implied! Few of us can follow such a busy agenda in the field. As mentioned, I don't think this is feasible within the second half of our career lifetime, which is often occupied by administrative work and organizational commitments. As scientists do the major part of their fieldwork during the first half of their careers and won't have much time during the other half, cross-continental comparisons should start as early as possible. We need to increase communication and collaboration among institutions, scientists, and the 'South'. Still, I don't believe that Ph.D. students should dilute their energy and spend time traveling across countries and continents unless the specific subject requires this. They should seek their scientific equivalents, their 'ecological' counterpart in other countries when possible. As between convergent animals in Paleo- and Neotropical rainforests, there is never an exact match between interests. Everyone is unique and has a personal approach complementary to someone else's. I strongly believe that international meetings are the appropriate tool we have to use as often as possible to promote such exchanges and networking among students and early-career scientists. Otherwise, potential partners and collaborators will continue searching for each other with no hints as to where to look. The Association for Tropical Biology and Conservation (ATBC), which was originally founded in the United States, has started some time ago to move outside the Central and North American regions, going first to India in 2001, Brazil in 2005 and 2012, China in 2006, Mexico in 2007 and 2017, Tanzania in 2011, Madagascar in 2019, Colombia in 2022, and is back to India in 2023. Other organizations, such as the British Ecological Society (especially the Tropical Ecological Group, BESTEG), met with the ATBC in Aberdeen in 2003 and the Society for Tropical Ecology (GTÖ) in Edinburgh in 2019. Europe also brings together scientists with a long history of research in all parts of the world. GTÖ has become a European society whose meetings attract researchers from countries in the southern hemisphere. Together, these three major associations and societies committed to tropical biology and ecology cover and maintain many contacts with colleagues across the continents. During three years of COVID-19, we witnessed and contributed to the rocketing development of virtual meetings, webinars, and conferences using on-line tools. We also experienced the limitation of these asocial screen-mediated interactions. For all the reasons mentioned above, I strongly believe that maintaining a scientific, in-person, social life during international seminars, meetings, and conferences is key in continuing to develop our science. Our aim is a better knowledge of biodiversity and the conservation of habitats in the tropics, more than ever essential for the future livelihood of all humans and organisms on the planet. To reach that goal, tropical biologists and ecologists need to disperse across the continents, to meet and to collaborate with their counterparts.

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