

¹ Is there really such a thing as *Tropical Biology*?¹

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⁸ Received: _____; Revised: _____; Accepted: _____.

¹ Inspired by the provocative title of M. H. Robinson's 1978 essay in the journal *Tropical Ecology*.

9

Abstract

10 The ecosystems of The Tropics comprise a majority of the planet's biodiversity,
11 approximately 40% of its terrestrial surface area, and half the human population. Despite
12 this, Tropical Biology has historically been conceptualized as a specialized subdiscipline of
13 the Biological Sciences. I assessed the validity of this assumption, and conclude that it
14 depends on the framework and evidence used to evaluate it. I suggest that the way forward
15 as a discipline is not for Tropical Biologists to drop the geographic adjective that unites
16 them, but to recenter The Tropics as the foundation of ecology and evolutionary biology.

17 *Keywords:* bibliometrics, collaboration, colonialism, Global South, scholarly societies,
18 scientometrics, temperate, text-mining

19 1. INTRODUCTION

“This is an interesting and useful study, but I feel the manuscript is better suited to a specialized journal focusing on tropical ecosystems.”

This provincial view of research done in the tropics is not new. In 1963, P. W. Richards felt it necessary to use his Presidential Address to the British Ecological Society to explain “what the Tropics can contribute to ecology”, advocate for financial investment in tropical research and field stations, and encourage students to visit and dedicate study “the most [biologically] exciting part of the world” (Richards 1963). His justification for this topic was self-deprecating but pointed — he was concerned that a talk summarizing recent advances in tropical ecology, including his studies of forest structure and diversity in Borneo and Guyana, “would probably bore the large part of my audience who have never been to the tropics and never intend to do so” (Richards 1963). That he felt this advocacy was still necessary despite decades of effort (Richards 1946, 1964) must have been extremely frustrating.

43 Sixty years on many of us find ourselves similarly frustrated. Tropical field stations
44 continue to be underfunded (Chapman *et al.* 1945, Corner 1946, Eppley *et al.* 2024).
45 Financial support for research in the tropics is relatively low and declining (Chapman *et al.*

46 1945, Sohmer 1980, Stegmann *et al.* 2024). And while tropical ecosystems comprise the
47 majority of the planet's biodiversity (Gaston 2000), approximately 40% of its terrestrial
48 surface area, and are home to half the human population (Hoornweg & Pope 2017), their
49 study is still considered by many to be a scientific subdiscipline. My objective here is not to
50 review the biological validity (Robinson 1978, Moles & Ollerton 2016) or scientific
51 implications (Zuk 2016) of this generalization, nor to summarize the history, status, and
52 direction of tropical research (*e.g.*, Buechner & Fosberg 1967, Janzen 1972, Janzen 1986,
53 Chazdon & Whitmore 2001, Bawa *et al.* 2004). Instead, I will attempt to assess the
54 fundamental assumption behind the Editor's summary that motivated this essay: Is there
55 really such a thing as *Tropical Biology*?²

56 **1. Why the answer is ‘No’:**

57 “...in the case of biology, a major part of the accumulated biological knowledge is
58 concerned with a rather minor part of the world’s fauna and flora, because of the
59 chance development of biology in the temperate zones.”

60 S. D. Ripley (1967)

61 One means of assessing if *Tropical Biology* is a distinct academic discipline is by considering
62 the communities into which scientists self-organize. Scholarly societies are one such
63 community; their establishment requires both an intellectual pursuit with which individuals
64 identify and a critical mass of like-minded individuals in search of community. Some of these
65 communities coalesce around broad conceptual domains (*e.g.*, *Evolutionary Biology*,
66 *Conservation Biology*, *Integrative Biology*; Figure 1A). Still others bring together individuals
67 from different conceptual domains that share an interest in a particular system (*e.g.*, *Avian*
68 *Biology*, *Island Biology*; Figure 1B). Finally, some scholarly societies comprise individuals
69 using a common methodological framework to study disparate systems or address questions
70 from distinct conceptual domains (*e.g.*, *Molecular Biology*, *Mathematical Biology*,

² Biology *sensu lato*: the study of living organisms, including their morphology and physiology, behavior, ecology, evolution, and conservation.

71 *Experimental Biology*; Figure 1C).

72 *Tropical Biology* fails to align with any of these constructs. Its practitioners investigate
73 fundamental questions across conceptual domains with a broad range of methodological
74 approaches and study systems. This intellectual diversity was cogently summarized by the
75 historian Megan Raby: “The work that tropical biologists do is nearly as diverse as the
76 ecosystems they study” (Raby 2017, p.5). Moreover, the “geographic pigeonhole” (*sensu*
77 Raby 2017) that presumably unites this community of scientists — the adjective ‘tropical’ —
78 is itself challenging to operationalize. Formally, *The Tropics* are the band of the Earth’s
79 surface receiving at least one day of direct overhead sunlight per year; this region is
80 delineated by the Tropics of Capricorn and Cancer ($23^{\circ}26'10.4''$ S and N, respectively).
81 However, the ranges of many ‘tropical’ species and ecosystems extend far beyond these
82 boundaries³, which is in part why Feeley and Stroud (2018) identified no less than eight
83 distinct criteria by which authors to define ‘tropical’ systems. How then is it that *Tropical*
84 *Biology* - whose practitioners conduct research in habitats ranging from rain forests to
85 savannas - came to be seen as a specialized subdiscipline despite the lack the sharp
86 boundaries around which scientific groups typically coalesce?

87 This contemporary perception of ‘The Tropics’ as distant and special is the result of
88 centuries of historical and cultural reinforcement (Arnold 1996, Driver & Yeoh 2000, Stepan
89 2001, Miller & Reill 2011). The first Europeans to visit the tropics returned with vivid,
90 captivating, and frequently pejorative descriptions of the places and people they encountered
91 (Putz & Holbrook 1988). Their stories and images established and inculcated several
92 persistent and often contradictory tropes about tropical regions and people that were then
93 repeated and reinterpreted by subsequent visitors (Smith 1950, Stepan 2001). The historian
94 David Arnold (1996) has argued that these narratives of “Tropicality” (*sensu* Gourou 1947)
95 allowed Europeans to justify colonial expansion by defining the region as environmentally

³ Perhaps the most extreme examples are migratory birds such as the northern wheatear (*Oenanthe oenanthe*), which fly over 14,000 km from sub-Saharan Africa to their breeding grounds in the Arctic (Bairlein *et al.* 2012)

96 and culturally distinct while simultaneously superimposing on its remarkable diversity a
97 generic and simplified identity: *The Tropics*.

98 The narratives of naturalists such as von Humboldt, Darwin, and Wallace were both
99 informed by and reinforced these conceptions of the tropics as ‘distant’ and ‘other’ (Raby
100 2017). Their writing and ideas then inspired many of the scientists central to the coalescing
101 sciences of ecology and evolutionary biology, who were themselves immersed in a cultural
102 milieu that viewed *The Tropics* as ‘distant’ and ‘exotic’. However, as Raby (2017) elegantly
103 demonstrates, the scientific frameworks these disciplinary pioneers put forward, including the
104 unique status of *Tropical Biology*, were not simply distillations of prevailing cultural and
105 environmental tropes. Instead they emerged from the complex interplay of European
106 colonialism, the expansion of US hegemony in Latin America and the Caribbean at the turn
107 of the twentieth century, and the construction of tropical field stations for use by North
108 American scientists that accompanied this expansion. The role of this scientific colonialism
109 at such a pivotal moment of scientific consolidation cannot be overstated. As Richards (1963)
110 explains, “the science of ecology developed first in central Europe, Scandinavia and Britain
111 and very slightly later in the United States. The ideas and concepts with which it started
112 were therefore inevitably based on the conditions in a temperate climate” (see also Webb
113 1960, Buechner & Fosberg 1967, Ripley 1967). The same would be true of subsequent studies
114 testing and refining these fundamental concepts, further reinforcing the “temperate bias”
115 (*sensu* Zuk 2016) in the leading journals of the day. While engagement with the burgeoning
116 community of field biologists in tropical countries could have expanded the prevailing
117 theories to make them more general, these scientists were rarely to work at the new US-run
118 field stations (Raby 2017). Their exclusion from the scientific discourse and literature,
119 coupled with the temperate-centered focus of the early theory, suggests that the distinction
120 between Biology and *Tropical Biology* is a historical legacy and largely artificial.

121 **2. Why the answer is ‘*Maybe*’.**

122 “... to this day ecology is biased by concepts and ideas appropriate mainly to the
123 study of vegetation in temperate climate and areas where a very large proportion
124 of the land has long been modified by agriculture and other more or less intensive
125 forms of land usage.”

126 P. W. Richards (1963)

127 Even if *The Tropics* are a historical construct, *Tropical Biology* could still be conceptually
128 distinct field of study if the scientific community has identified or converged on a suite of
129 topics that are either unique to or best studied in tropical systems. To assess this possibility,
130 I used a text-mining approach to compare the research foci of N = 11,327 studies conducted
131 in the tropics with those of N = 26,419 studies conducted in other parts of the world.
132 Specifically, I extracted and summarized the information from two structural components
133 used by authors to describe the subject of their articles: the title and keywords. These
134 provide distinct but complementary information, and so they are often analyzed both
135 independently and in unison. For simplicity I present here results based on pooling each
136 article’s title and keywords, which were qualitatively similar to those for analyzing titles and
137 keywords independently. The results for all analyses can be found in the *Supporting*
138 *Information*, where one can also find a complete description of the methods used to gather
139 and process the data.

140 Briefly, I download the bibliographic record from SCOPUS or the Web of Science ‘Core
141 Collection’ for every article published from 1990-2022 in one of N = 10 journals (*Journal of*
142 *Evolutionary Biology*, *Ecology*, *Journal of Applied Ecology*, *Evolution*, *Biotropica*, *Journal of*
143 *Ecology*, *Tropical Conservation Science*, *American Naturalist*, *Tropical Ecology*, *Journal of*
144 *Tropical Ecology*). I then used the `refsplitr` package (Fournier *et al.* 2020) and code
145 written in the R programming language (R Core Team 2023) to process the records, extract,
146 process, combine the terms extracted from each article’s title and keywords, and assign the
147 article to its respective geographic category. Collectively this resulted in N = 141,009 terms,

¹⁴⁸ of which I identified and ranked the 50 terms most frequently used in articles from each
¹⁴⁹ geographic category.

¹⁵⁰ Two major patterns emerge from this analysis. The first is that 26% of the most
¹⁵¹ frequently used terms from ‘tropical’ articles reflected geographic locations (e.g., *Costa Rica*,
¹⁵² *Amazon*, *Panama*, *tropical*). In contrast, all of the top-50 terms from non-tropical articles
¹⁵³ were conceptual (e.g., *phenotypic plasticity*, *food web*, *sexual selection*; Table 1). The second
¹⁵⁴ is that after removing the system- and location-specific terms, there is ample conceptual
¹⁵⁵ overlap between tropical and non-tropical studies (Table 2) and that the topics studied are
¹⁵⁶ broadly consistent with disciplinary trends (Carmel *et al.* 2013, McCallen *et al.* 2019,
¹⁵⁷ Anderson *et al.* 2021). That said, the most common research topics within each article
¹⁵⁸ category often differ dramatically in their relative rankings (Figure S2), and there are
¹⁵⁹ notable areas of topical divergence (Table 2).

¹⁶⁰ One interpretation of these results is that Tropical Biology is in fact a subdiscipline
¹⁶¹ focused on problems and topics of particular relevance in tropical locations. While there are
¹⁶² subjects for which this is undoubtedly true, the observed differences could also indicate that
¹⁶³ some topics are extensively studied in over-represented research sites (Stocks *et al.* 2008) or
¹⁶⁴ the historical relegation of certain subjects to the tropics (Zuk 2016). While preliminary,
¹⁶⁵ these results are consistent with those of Castro Torres and Alburez-Gutierrez (2022), who
¹⁶⁶ analyzed of over half a million articles from the social sciences. They found a far greater
¹⁶⁷ prevalence of geographic markers in the titles of articles by authors in the Global South,
¹⁶⁸ which they argue both indicates and perpetuates “an unwarranted claim on universality” by
¹⁶⁹ scholars from North America and Europe. This parallel evidence from a different field is
¹⁷⁰ compelling, and biases in the types of research conducted in the tropics – regardless of the
¹⁷¹ underlying mechanism – could shape the development of theory and determine what data are
¹⁷² used to test it (Raby 2017). Without more (and more sophisticated) tests of alternative
¹⁷³ hypotheses for the patterns presented here, it seems premature to conclude that Tropical
¹⁷⁴ Biology is a conceptually distinct field.

¹⁷⁵ **3. Why the answer is ‘Yes’**

¹⁷⁶ “*No education is complete without a trip to the Tropics.*”

¹⁷⁷ J. E. Webb (1960)

¹⁷⁸ Finally, I believe an argument can be made for treating *Tropical* Biology as a unique
¹⁷⁹ discipline, but not one based on the reasons typically put forward by others. What sets the
¹⁸⁰ field apart is not the biology *per se* (*sensu* Robinson 1978). Rather, what Tropical Biologists
¹⁸¹ have in common is the broader context in which their scholarship is embedded and carried
¹⁸² out. Research anywhere is challenging, but for tropical biologists the precarious
¹⁸³ infrastructure, economic volatility, limited resources, and political instability can make the
¹⁸⁴ challenges feel insurmountable. These struggles can be compounded by having to
¹⁸⁵ communicate one’s results in a foreign language (Amano *et al.* 2016) to the potentially
¹⁸⁶ biased reviewers and readers (Smith *et al.* 2023) of journals that are increasingly charging
¹⁸⁷ publications fees equivalent to several months salary (Smith *et al.* 2021). When added to the
¹⁸⁸ physical and emotional toll of disease, crime, working in isolation, the destruction of their
¹⁸⁹ field sites, and the potential for professional retribution or physical violence (Clancy *et al.*
¹⁹⁰ 2014, Ellwanger *et al.* 2020, Palinkas & Wong 2020), research in the tropics can be uniquely
¹⁹¹ stressful, dangerous — even deadly. Lamentably, this is also true for the heroic
¹⁹² conservationists, indigenous leaders, and journalists with whom we work (Cavalcanti *et al.*
¹⁹³ 2023).

¹⁹⁴ **4. The Future of (Tropical) Biology**

¹⁹⁵ “*There are few things more presumptuous than a US scientist holding forth on the*
¹⁹⁶ *future of tropical ecology”*

¹⁹⁷ D. H. Janzen (1972)

¹⁹⁸ In 1945 the President of the Ecological Society of America (ESA), Orlando Park, encouraged
¹⁹⁹ its members to establish a “full scale program in tropical ecology”, including “a new
²⁰⁰ journal... dealing with tropical biology in its broadest aspects” (Park 1945). How would the

201 field be different if the ESA had done so? What if the scientific community had paid heed to
202 Richards (1946) and properly centered the tropics when drawing biological generalizations?
203 Or if UNESCO's International Hylean Amazon Institute, the ambitious international
204 consortium proposed in 1946 by Brazilian biochemist and diplomat Paulo Carneiro (Dresser
205 1948, Maio & Sá 2000), had come to fruition? Perhaps universities in Europe and North
206 America would offer elective courses in *Temperate Biology*. The instructors of these courses
207 might present their research at the annual meeting of the *Association for Temperate Biology*
208 & *Conservation* (Figure 2) and publish papers in specialized journals, with article titles that
209 — in contrast to the broader conceptual advances from the tropics — emphasize the specific
210 temperate systems or locations the work was done (Figure 3).

211 I prefer instead to consider what the ambiguity of my conclusions implies for how we
212 should move forward. I suggest that the future lies in neither dropping the geographic
213 adjective that motivates so many of us, nor keeping it and accepting status as as
214 specialization. Instead, I call on ATBC members to continue taking pride in and elevating
215 what makes biology in the tropics distinct and important — the places and context in which
216 we work — while working to recenter tropical ecosystems as the biological foundation and
217 conceptual focus of Ecology and Evolutionary Biology. Below are six actions with which I
218 propose anyone can help us *reclaim and reshape the Tropical Narrative*.

219 **Cite with purpose.** Citation is a powerful and political act; it conveys legitimacy on
220 the scholarship in the article being cited as well as its author, helps elevate the profile of the
221 author and study system, and those reading your work will cite these articles when writing
222 their own. For many scientists it also plays an important role in their professional
223 advancement. Be mindful of this impact and the opportunity it presents when choosing
224 whom to cite. Cite scientists whose work or approach you feel is undervalued or overlooked.
225 Cite scientists from countries or institutions that have been ignored by the broader scientific
226 community. Cite scientists whose approach to research you feel others should emulate. Cite
227 studies conducted in the tropics.

228 ***Teach with Purpose.*** All tropical biologists are teachers, whether it be in a
229 classroom or in a meeting with policy makers, and teaching also provides an opportunity to
230 elevate the scholarship of others. Be mindful of whose papers are assigned as readings, the
231 studies and systems used to illustrate concepts, and the scientists highlighted in
232 presentations. Use your syllabus as a tool to recast the narrative about the tropics and the
233 scientific community that studies them. Train students in the skills needed when working in
234 tropical systems — collaboration, facilitation, conflict resolution, and communication to
235 diverse audiences (Kainer *et al.* 2006). Teach collaboratively and cross-nationally (Russell *et*
236 *al.* 2022).

237 ***Collaborate with Purpose.*** International collaboration can be challenging, but
238 personally and professionally rewarding (Smith *et al.* 2014). Be mindful of global scientific
239 inequities, laws, and ‘parachute science’ (Gómez-Pompa 2004, Asase *et al.* 2022,
240 Ramírez-Castañeda *et al.* 2022). Partner with communities to identify research priorities and
241 return the results of research to them (Duchelle *et al.* 2009, Kainer *et al.* 2009). Push for
242 organizations and universities to strengthen collaborations with — and especially within —
243 the Global South (Kainer *et al.* 2006, Ocampo-Ariza *et al.* 2023). Treat the parataxonomists,
244 field technicians, and station staff that make our work possible with the respect they deserve
245 (Basset *et al.* 2004); that includes recognizing their contributions with coauthorship the way
246 one would other essential contributors (e.g., Bruna *et al.* 2004). Review submissions for and
247 submit articles to national journals. Make an effort to learn the local language.

248 ***Engage the Public.*** Public fascination with the tropics and their charismatic species
249 (Albert *et al.* 2018) provides unparalleled opportunities for outreach and education (Moreira
250 & Robles 2017). Take advantage of global sporting events (Melo *et al.* 2014), teams with
251 tropical species as mascots (Sartore-Baldwin & McCullough 2019), movies set in the tropics
252 (Yong *et al.* 2011), tropical images in fashion (Kutesko 2014), or other connections between
253 people’s interests and tropical biodiversity. Leverage this universal appeal into support for
254 tropical research and conservation (but beware of philanthropic paternalism and the risk of

255 perpetuating stereotypes).

256 ***Get in the Game.*** Help make the process of publishing fairer by serving as a
257 reviewer or subject editor for *Biotropica* (Powers *et al.* 2024). Contribute to capacity
258 building efforts by reviewing student seed grants proposals or serving as a judge for student
259 presentations at the ATBC’s Annual Meeting. Join a committee or chapter and organize a
260 webinar, workshop, hackathon, or reading group. What should the ATBC be doing
261 differently? Communicate your ideas to the leadership or stand for election and push for
262 change as a Councilor or Chapter Officer.

263 ***Support and celebrate one another.*** Finally, remember that the work done by
264 tropical biologists addresses the “neglected problems that afflict most of the world’s people”
265 (Annan 2003). Conducting research — regardless of the subject — advances the
266 socioeconomic condition of the country in which it’s conducted. It is difficult, frustrating,
267 and not without risk. Take a moment to thank, congratulate, and support each other
268 (Rudzki *et al.* 2022, Nordseth *et al.* 2023) for your contributions and the effort and resilience
269 that they required. There is no more important a time to be a *Tropical Biologist*.

Table 1

The top $N = 50$ terms used in keywords and titles of tropical articles, non-tropical articles, and the terms that the two categories have in common. The term's rank in a category is in parentheses. Terms in bold refer to geographic locations.

Tropical: Unique Top Terms (rank)	Non-Tropical: Unique Top Terms (rank)	Shared Top Terms (rank in Tropical, Non-Tropical)
tropical forest (1)	sexual selection (1)	diversity (4, 8)
tropical rainforest (2)	phenotypic plasticity (5)	fragmentation (5, 46)
seed dispersal (3)	natural selection (9)	climate change (6, 3)
tree species (8)	tradeoff (12)	species richness (7, 18)
costa rica (10)	adaptation (13)	herbivory (9, 14)
atlantic forest (11)	local adaptation (15)	disturbance (13, 38)
brazil (12)	gene flow (17)	life history (17, 2)
conservation (14)	quantitative genetic (20)	competition (21, 4)
rainforest (15)	drosophila melanogaster (21)	community structure (29, 44)
seed germination (16)	food web (22)	speciation (30, 7)
panama (18)	reproductive isolation (23)	predation (31, 19)
dry forest (19)	sex ratio (24)	body size (34, 10)
seed predation (20)	fitness (25)	population dynamic (36, 6)
tropical tree (22)	coevolution (26)	dispersal (40, 11)
functional trait (23)	experimental evolution (27)	density dependence (50, 16)
savanna (24)	genetic variation (28)	
mexico (25)	inbreeding depression (29)	
species diversity (26)	maternal effect (30)	
puerto rico (27)	evolution (31)	
frugivory (28)	mate choice (32)	
phenology (32)	phylogeny (33)	
neotropic (33)	ecosystem function (34)	
tropical dry (35)	sexual conflict (35)	
cloud forest (37)	mating system (36)	
pollination (38)	heritability (37)	
tropical dryforest (39)	sperm competition (39)	
nitrogen (41)	coexistence (40)	
amazon (42)	hybridization (41)	
seasonality (43)	plant community (42)	
secondary forest (44)	reproductive success (43)	
mutualism (45)	sexual dimorphism (45)	
phosphorus (46)	selection (47)	
beta diversity (47)	metaanalysis (48)	
fire (48)	genetic correlation (49)	
succession (49)	community assembly (50)	

Table 2

The top $N = 50$ terms used in the keywords and titles of tropical and non-tropical articles that are unique to each of these categories once system-specific terms have been excluded. This is followed by the top terms from each category that they have in common.

Tropical: Unique Top Terms (rank)	Non-Tropical: Unique Top Terms (rank)	Shared Top Terms (rank in Tropical, Non-Tropical)
seed dispersal (1)	natural selection (1)	diversity (2,8)
tree species (6)	tradeoff (6)	fragmentation (3,46)
conservation (9)	adaptation (9)	climate change (4,3)
rainforest (10)	local adaptation (10)	species richness (5,18)
seed germination (11)	gene flow (11)	herbivory (7,14)
dry forest (13)	quantitative genetic (13)	disturbance (8,38)
seed predation (14)	drosophila melanogaster (14)	life history (12,2)
functional trait (16)	food web (16)	competition (15,4)
species diversity (17)	reproductive isolation (17)	community structure (20,44)
savanna (18)	sex ratio (18)	speciation (21,7)
frugivory (19)	fitness (19)	predation (22,19)
phenology (23)	coevolution (23)	body size (24,10)
cloud forest (26)	experimental evolution (26)	population dynamic (25,6)
pollination (27)	genetic variation (27)	dispersal (28,11)
nitrogen (29)	inbreeding depression (29)	density dependence (37,16)
seasonality (30)	maternal effect (30)	community assembly (42,50)
secondary forest (31)	evolution (31)	sexual selection (43,1)
mutualism (32)	mate choice (32)	phenotypic plasticity (47,5)
phosphorus (33)	phylogeny (33)	
fire (34)	ecosystem function (34)	
beta diversity (35)	sexual conflict (35)	
succession (36)	mating system (36)	
bird (38)	heritability (38)	
biomass (39)	sperm competition (39)	
montane forest (40)	coexistence (40)	
biogeography (41)	hybridization (41)	
regeneration (44)	plant community (44)	
species composition (45)	reproductive success (45)	
remote sensing (46)	sexual dimorphism (46)	
litter (48)	selection (48)	
temperature (49)	metaanalysis (49)	
forest structure (50)	genetic correlation (50)	

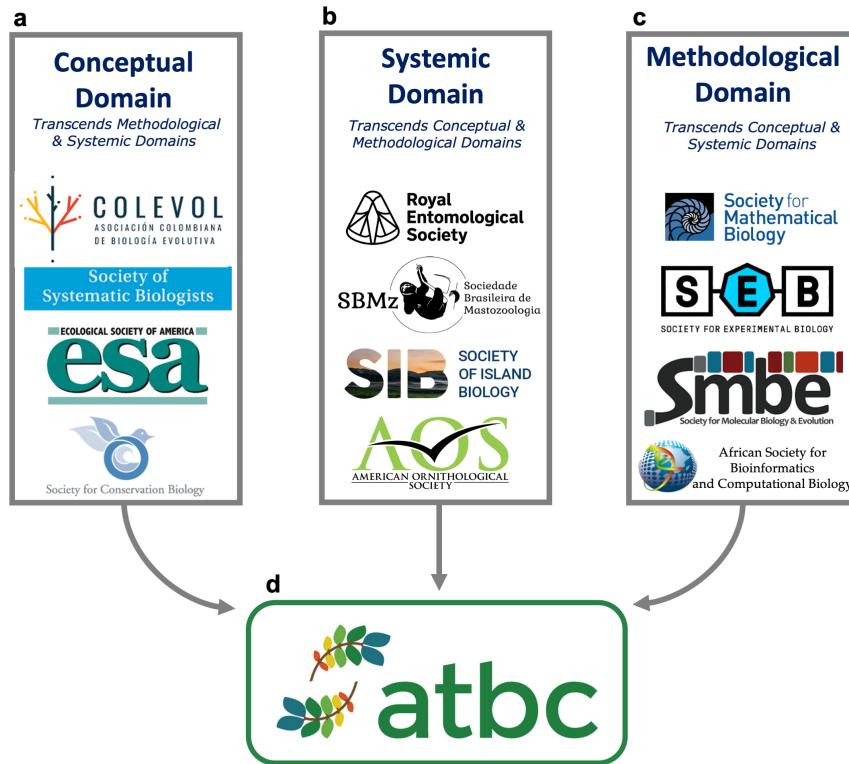


Figure 1. Alternative ways in which researchers self-organize in scholarly societies: (a) Conceptual Domain, (b) Systemic Domain, or (c) Methodological Domain. The Association for Tropical Biology & Conservation (i.e., ATBC) is unique in that transcends the three domains: its members use a broad diversity of species, ecosystems, and methods to address questions grounded in – or even transcending – multiple distinct conceptual domains.



Figure 2. The logo for a proposed new scholarly society for researchers specializing on temperate ecosystems and species.

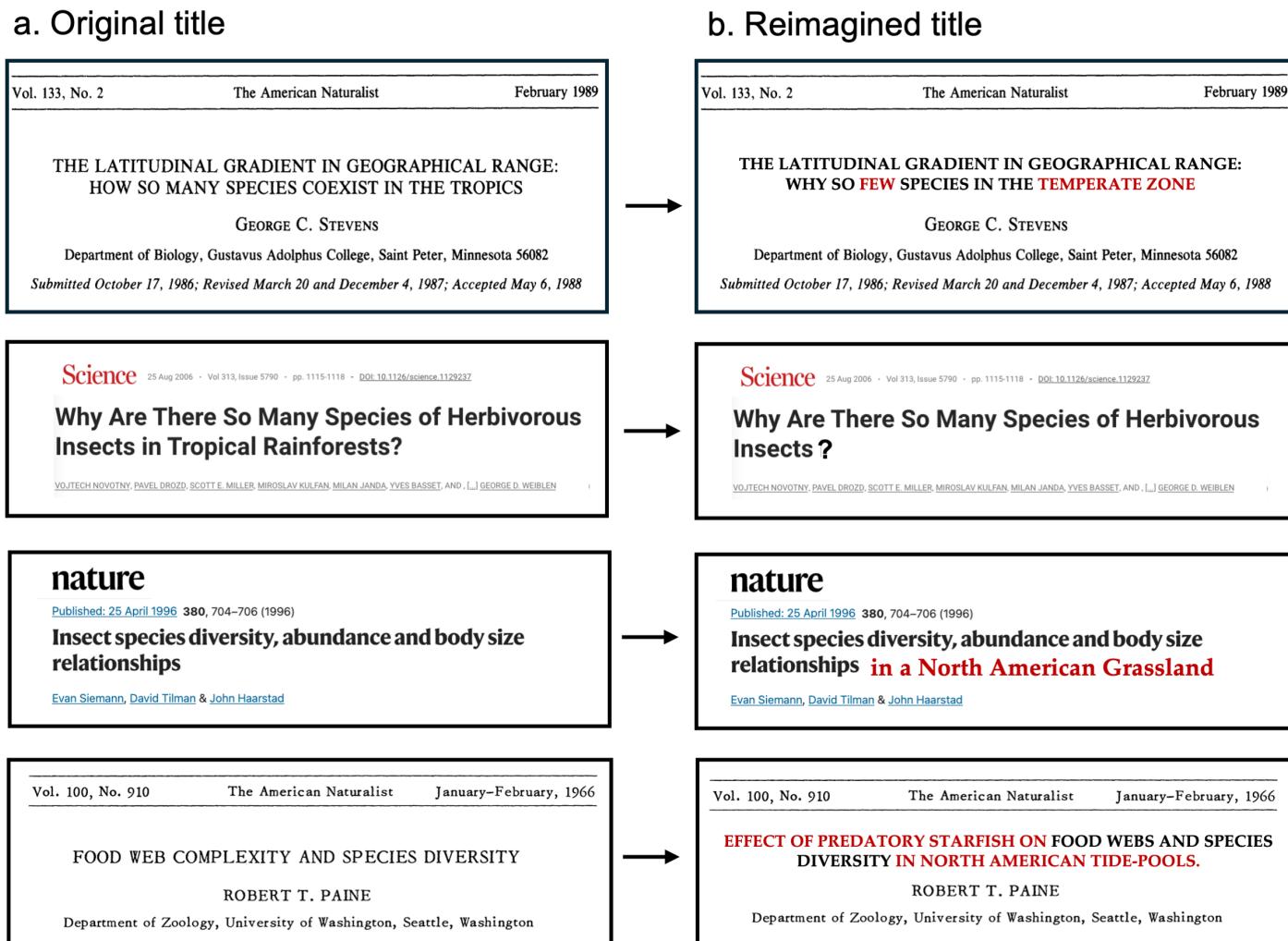


Figure 3. The (a) original and (b) reimagined titles of four high-profile research articles. Comparing these emphasizes how the original titles reflect and reinforce the idea that 'reference' or 'default ecosystems are found in the Temperate Zone.

270 ACKNOWLEDGEMENTS

271 I am grateful to the organizers of the 2022 Meeting of the ATBC for encouraging the
272 Presidential Plenary on which this essay is based, to J. Powers for her outstanding editorial
273 work, and to P. Delamônica for her unending support and insights. I am also grateful to M.
274 Raby and N. Stepan, whose outstanding books shaped many of the ideas expressed here.
275 This essay is dedicated to the memory of Emilio Bruna Jr.

276 DATA AVAILABILITY STATEMENT

277 The data used in this publication, the code used to import, organize, and analyze these
278 data, and the code used to prepare the manuscript are available at Zenodo
279 <https://doi.org/10.5281/zenodo.13821266> and Github
280 https://github.com/BrunaLab/bruna_biotropica_plenary_ms.

281 The data used in this paper are part of a larger dataset collected for a longitudinal
282 study of research in the tropics; those data, and the code used to harvest, clean, and
283 organize them, are available at Github https://github.com/BrunaLab/tropical_bibliometrics.
284 Questions regarding the data or code, or suggestions for improvement should be posted as
285 Issues on that repository or referred to E. M. Bruna.

286 DISCLOSURE STATEMENT

287 The author confirms that there have been no involvements that might raise the
288 question of bias in the work reported or in the conclusions, implications, or opinions stated.

289 AUTHOR CONTRIBUTION STATEMENT

290 E.M.B conceived the study and is responsible for the methodology, data collection,
291 data curation, formal analysis, validation, visualization, software, and writing.

292

REFERENCES

- 293 ALBERT, C., G. M. LUQUE, and F. COURCHAMP. 2018. The twenty most charismatic
294 species. PLOS ONE 13: e0199149. 10.1371/journal.pone.0199149.
- 295 AMANO, T., J. P. GONZÁLEZ-VARO, and W. J. SUTHERLAND. 2016. Languages are still a
296 major barrier to global science. PLoS Biology 14: e2000933.
297 10.1371/journal.pbio.2000933.
- 298 ANDERSON, S. C., P. R. ELSEN, B. B. HUGHES, R. K. TONIETTO, M. C. BLETZ, D. A.
299 GILL, M. A. HOLGERSON, S. E. KUEBBING, C. McDONOUGH MACKENZIE, M. H.
300 MEEK, and D. VERÍSSIMO. 2021. Trends in ecology and conservation over eight decades.
301 Frontiers in Ecology and the Environment 19: 274–282. 10.1002/fee.2320.
- 302 ANNAN, K. 2003. A challenge to the world's scientists. Science 299: 1485–1485.
303 10.1126/science.299.5612.1485.
- 304 ARNOLD, D. 1996. The problem of nature: Environment, culture and European expansion.
305 Blackwell.
- 306 ASASE, A., T. I. MZUMARA-GAWA, J. O. OWINO, A. T. PETERSON, and E. SAUPE.
307 2022. Replacing “parachute science” with “global science” in ecology and conservation
308 biology. Conservation Science and Practice 4: e517. 10.1111/csp.2.517.
- 309 BAIRLEIN, F., D. R. NORRIS, R. NAGEL, M. BULTE, C. C. VOIGT, J. W. FOX, D. J. T.
310 HUSSELL, and H. SCHMALJOHANN. 2012. Cross-hemisphere migration of a 25 g
311 songbird. Biology Letters 8: 505–507. 10.1098/rsbl.2011.1223.

- 312 BASSET, Y., V. NOVOTNY, S. E. MILLER, G. D. WEIBLEN, O. MISSA, and A. J. A.
313 STEWART. 2004. Conservation and biological monitoring of tropical forests: The role of
314 parataxonomists. *Journal of Applied Ecology* 41: 163–174.
- 315 BAWA, K. S., W. J. KRESS, N. M. NADKARNI, and S. LELE. 2004. Beyond paradise:
316 Meeting the challenges in tropical biology in the 21st century. *Biotropica* 36: 437–446.
317 10.1111/j.1744-7429.2004.tb00341.x.
- 318 BENOIT, K., D. MUHR, and K. WATANABE. 2021. Stopwords: Multilingual stopword lists.
319 [Https://CRAN.R-project.org/package=stopwords](https://CRAN.R-project.org/package=stopwords).
- 320 BRUNA, E. M., W. J. KRESS, F. MARQUES, and O. F. DA SILVA. 2004. *Heliconia*
321 *acuminata* reproductive success is independent of local floral density. *Acta Amazonica* 34:
322 467–471. 10.1590/S0044-59672004000300012.
- 323 BUECHNER, H. K., and F. R. FOSBERG. 1967. A contribution toward a world program in
324 tropical biology. *BioScience* 17: 532–538. 10.2307/1294010.
- 325 CARMEL, Y., R. KENT, A. BAR-MASSADA, L. BLANK, J. LIBERZON, O. NEZER, G.
326 SAPIR, and R. FEDERMAN. 2013. Trends in ecological research during the last three
327 decades: A systematic review. *PLoS ONE* 8: e59813. 10.1371/journal.pone.0059813.
- 328 CASTRO TORRES, A. F., and D. ALBUREZ-GUTIERREZ. 2022. North and South: Naming
329 practices and the hidden dimension of global disparities in knowledge production.
330 Proceedings of the National Academy of Sciences 119: e2119373119.
331 10.1073/pnas.2119373119.

- 332 CAVALCANTI, R. P., G. F. BENZAQUEN, S. DA S. R. GOMES, and V. P. ALMEIDA. 2023.
333 Political violence and mobilisation in Brazil's Amazonian region during Bolsonaro's
334 government (2019–2022). *Justice, Power and Resistance* 6: 152–170. 10.1332/SONH8866.
- 335 CHAPMAN, V. J., C. O. FLEMMICH, A. L. GRIFFITH, J. L. HARLEY, R. HOBBINS, C. H.
336 HOLMES, C. DE ROSAYRO, and J. WYATT-SMITH. 1945. Need for development of
337 tropical ecological studies. *Nature* 156: 627–628. 10.1038/156627a0.
- 338 CHAZDON, R. L., and T. C. WHITMORE eds. 2001. *Foundations of Tropical Forest
339 Biology: Classic Papers with Commentaries*. University of Chicago Press, Chicago, IL.
- 340 CLANCY, K. B. H., R. G. NELSON, J. N. RUTHERFORD, and K. HINDE. 2014. Survey of
341 academic field experiences (SAFE): Trainees report harassment and assault. *PLoS ONE*
342 9: e102172. 10.1371/journal.pone.0102172.
- 343 CORNER, E. J. H. 1946. Need for the development of tropical ecological stations. *Nature*
344 157: 377–377. 10.1038/157377b0.
- 345 DRESSER, P. VAN. 1948. The Future of the Amazon. *Scientific American* 178: 11–15.
- 346 DRIVER, F., and B. S. A. YEOH. 2000. Constructing the tropics: introduction. Singapore
347 *Journal of Tropical Geography* 21: 1–5. 10.1111/1467-9493.00059.
- 348 DUCHELLE, A. E., K. BIEDENWEG, C. LUCAS, A. VIRAPONGSE, J. RADACHOWSKY, D.
349 J. WOJCIK, M. LONDRES, W.-L. BARTELS, D. ALVIRA, and K. A. KAINER. 2009.
350 Graduate students and knowledge exchange with local stakeholders: Possibilities and
351 preparation. *Biotropica* 41: 578–585. 10.1111/j.1744-7429.2009.00563.x.

- 352 ELLWANGER, J. H., B. KULMANN-LEAL, V. L. KAMINSKI, J. M. VALVERDE-VILLEGRAS,
353 A. B. G. D. VEIGA, F. R. SPILKI, P. M. FEARNSIDE, L. CAESAR, L. L. GIATTI, G.
354 L. WALLAU, S. E. M. ALMEIDA, M. R. BORBA, V. P. D. HORA, and J. A. B.
355 CHIES. 2020. Beyond diversity loss and climate change: Impacts of Amazon
356 deforestation on infectious diseases and public health. Anais da Academia Brasileira de
357 Ciências 92: e20191375. 10.1590/0001-3765202020191375.
- 358 EPPELEY, T. M. et al. 2024. Tropical field stations yield high conservation return on
359 investment. Conservation Letters e13007. 10.1111/conl.13007.
- 360 FEELEY, K. J., and J. T. STROUD. 2018. Where on Earth are the “tropics”? Frontiers of
361 Biogeography 10. 10.21425/F5FBG38649.
- 362 FOURNIER, A. M. V., M. E. BOONE, F. R. STEVENS, and E. M. BRUNA. 2020.
363 Refsplitr: Author name disambiguation, author georeferencing, and mapping of
364 coauthorship networks with Web of Science data. Journal of Open Source Software 5:
365 2028. 10.21105/joss.02028.
- 366 GASTON, K. J. 2000. Global patterns in biodiversity. Nature 405: 220–227.
367 10.1038/35012228.
- 368 GÓMEZ-POMPA, A. 2004. The role of biodiversity scientists in a troubled world. BioScience
369 54: 217–225. 10.1641/0006-3568(2004)054[0217:TROBSI]2.0.CO;2.
- 370 GOUROU, P. 1947. Les pays tropicaux, principes d'une géographie humaine et économique.
371 [1. éd.]. Presses Universitaires de France, Paris.

372 HOORNWEG, D., and K. POPE. 2017. Population predictions for the world's largest cities
373 in the 21st century. *Environment and Urbanization* 29: 195–216.
374 10.1177/0956247816663557.

375 JANZEN, D. 1972. Whither Tropical Ecology. In J. A. Behnke (Ed.) Challenging Biological
376 Problems: Directions Toward Their Solution. pp. 281–296, Oxford University Press, New
377 York.

378 JANZEN, D. H. 1986. The future of tropical ecology. *Annual Review of Ecology and
379 Systematics* 17: 305–324.

380 KAINER, K. A., M. L. DiGIANO, A. E. DUCHELLE, L. H. O. WADT, E. M. BRUNA, and
381 J. L. DAIN. 2009. Partnering for greater success: Local stakeholders and research in
382 tropical biology and conservation. *Biotropica* 41: 555–562.
383 10.1111/j.1744-7429.2009.00560.x.

384 KAINER, K. A., M. SCHMINK, H. COVERT, J. R. STEPP, E. M. BRUNA, J. L. DAIN, S.
385 ESPINOSA, and S. HUMPHRIES. 2006. A graduate education framework for tropical
386 conservation and development. *Conservation Biology* 20: 3–13.
387 10.1111/j.1523-1739.2006.00356.x.

388 KUTESKO, E. 2014. Adidas shows the changing face of Brazil with tropical collection. The
389 Conversation (available at <http://theconversation.com/adidas-shows-the-changing-face-of-brazil-with-tropical-collection-26546>).
390

391 MAIO, M. C., and M. R. SÁ. 2000. Ciência na periferia: A Unesco, a proposta de criação
392 do Instituto Internacional da Hidroárea Amazônica e as origens do Inpa. *História, Ciências,*

- 393 Saúde-Manguinhos 6: 975–1017. 10.1590/S0104-59702000000500011.
- 394 MCCALLEN, E., J. KNOTT, G. NUNEZ-MIR, B. TAYLOR, I. JO, and S. FEI. 2019. Trends
395 in ecology: Shifts in ecological research themes over the past four decades. *Frontiers in*
396 Ecology and the Environment
- 397 MELO, F. P., J. A. SIQUEIRA, B. A. SANTOS, O. ÁLVARES-DA-SILVA, G. CEBALLOS,
398 and E. BERNARD. 2014. Football and biodiversity conservation: FIFA and Brazil can
399 still hit a green goal. *Biotropica* 46: 257–259. 10.1111/btp.12114.
- 400 MILLER, D. P., and P. H. REILL eds. 2011. *Visions of empire: Voyages, botany, and*
401 *representations of nature.* Cambridge University Press.
- 402 MOLES, A. T., and J. OLLERTON. 2016. Is the notion that species interactions are stronger
403 and more specialized in the tropics a zombie idea? *Biotropica* 48: 141–145.
404 10.1111/btp.12281.
- 405 MOREIRA, J. C., and R. A. ROBLES. 2017. Tamar Project: Conservation and education in
406 ecotourism activities related to turtles in Fernando de Noronha Archipelago, Brazil. *In* I.
407 Borges de Lima and R. J. Green (Eds.) *Wildlife Tourism, Environmental Learning and*
408 *Ethical Encounters: Ecological and Conservation Aspects. Geoheritage, Geoparks and*
409 *Geotourism.* pp. 169–181, Springer International Publishing, Cham.
410 10.1007/978-3-319-55574-4_10.
- 411 NORDSETH, A. E., J. R. GERSON, L. K. AGUILAR, A. E. DUNHAM, A. GENTLES, Z.
412 NEALE, and E. REBOL. 2023. The Fieldwork Wellness Framework: A new approach to
413 field research in ecology. *Frontiers in Ecology and the Environment* 21: 297–303.

414 10.1002/fee.2649.

415 OCAMPO-ARIZA, C. et al. 2023. Global South leadership towards inclusive tropical ecology
416 and conservation. *Perspectives in Ecology and Conservation* 21: 17–24.
417 10.1016/j.pecon.2023.01.002.

418 PALINKAS, L. A., and M. WONG. 2020. Global climate change and mental health. *Current
419 Opinion in Psychology* 32: 12–16. 10.1016/j.copsyc.2019.06.023.

420 PARK, O. 1945. Observations concerning the future of ecology. *Ecology* 26: 1–9.
421 10.2307/1931910.

422 POWERS, J. S., J. RATNAM, and E. SLADE. 2024. *Biotropica* 's first open call for editorial
423 service. *Biotropica* 56: e13339. 10.1111/btp.13339.

424 PUTZ, F. E., and N. M. HOLBROOK. 1988. Tropical rain-forest images. In J. S. Denslow
425 and C. Padoch (Eds.) *People of the Tropical Rain Forest*. pp. 37–52, University of
426 California Press, Berkeley.

427 R CORE TEAM. 2023. R: A language and environment for statistical computing. R
428 Foundation for Statistical Computing, Vienna, Austria <https://www.R-project.org/>.

429 RABY, M. 2017. American tropics: The Caribbean roots of biodiversity science. UNC Press
430 Books.

431 RAMÍREZ-CASTAÑEDA, V. et al. 2022. A set of principles and practical suggestions for
432 equitable fieldwork in biology. *Proceedings of the National Academy of Sciences* 119:

433 e2122667119. 10.1073/pnas.2122667119.

434 RICHARDS, P. W. 1946. Need for the development of tropical ecological stations. *Nature*
435 157: 377–377. 10.1038/157377a0.

436 RICHARDS, P. W. 1963. What the tropics can contribute to ecology. *Journal of Ecology* 51:
437 231–241. 10.2307/2257682.

438 RICHARDS, P. W. 1964. Towards a programme for tropical biology. *Bulletin of the*
439 *Association for Tropical Biology* 8–15.

440 RIPLEY, S. D. 1967. Perspectives in tropical biology. *BioScience* 17: 538–540.
441 10.2307/1294011.

442 ROBINSON, M. H. 1978. Is tropical biology real. *Tropical Ecology* 19: 30–52.

443 RUDZKI, E. N., S. E. KUEBBING, D. R. CLARK, B. GHARAIBEH, M. J. JANECKA, R.
444 KRAMP, K. D. KOHL, T. MASTALSKI, M. E. B. OHMER, M. M. TURCOTTE, and C.
445 L. RICHARDS-ZAWACKI. 2022. A guide for developing a field research safety manual that
446 explicitly considers risks for marginalized identities in the sciences. *Methods in Ecology*
447 and Evolution 13: 2318–2330. 10.1111/2041-210X.13970.

448 RUSSELL, A. E., T. M. AIDE, E. BRAKER, C. N. GANONG, R. D. HARDIN, K. D. HOLL,
449 S. C. HOTCHKISS, J. A. KLEMENS, E. K. KUPREWICZ, D. McCLEARN, G.
450 MIDDENDORF, R. OSTERTAG, J. S. POWERS, S. E. RUSSO, J. L. STYNOSKI, U.
451 VALDEZ, and C. G. WILLIS. 2022. Integrating tropical research into biology education is
452 urgently needed. *PLoS Biology* 20: e3001674. 10.1371/journal.pbio.3001674.

- 453 SARTORE-BALDWIN, M., and B. MCCULLOUGH. 2019. Examining sport fans and the
454 endangered species who represent their affiliated team mascots. *Society & Animals* 29:
455 268–286. 10.1163/15685306-12341605.
- 456 SILGE, J., and D. ROBINSON. 2016. Tidytext: Text mining and analysis using tidy data
457 principles in R. *Journal of Open Source Software* 1(3). 10.21105/joss.00037.
- 458 SMITH, A. C., L. MERZ, J. B. BORDEN, C. K. GULICK, A. R. KSHIRSAGAR, and E. M.
459 BRUNA. 2021. Assessing the effect of article processing charges on the geographic
460 diversity of authors using Elsevier’s “Mirror Journal” system. *Quantitative Science
461 Studies* 2: 1123–1143. 10.1162/qss_a_00157.
- 462 SMITH, B. 1950. European vision and the South Pacific. *Journal of the Warburg and
463 Courtauld Institutes* 13: 65–100. 10.2307/750143.
- 464 SMITH, M. J., C. WEINBERGER, E. M. BRUNA, and S. ALLESINA. 2014. The scientific
465 impact of nations: Journal placement and citation performance. *PLoS ONE* 9.
466 10.1371/journal.pone.0109195.
- 467 SMITH, O. M., K. L. DAVIS, R. B. PIZZA, R. WATERMAN, K. C. DOBSON, B. FOSTER,
468 J. C. JARVEY, L. N. JONES, W. LEUENBERGER, N. NOURN, E. E. CONWAY, C. M.
469 FISER, Z. A. HANSEN, A. HRISTOVA, C. MACK, A. N. SAUNDERS, O. J. UTLEY, M.
470 L. YOUNG, and C. L. DAVIS. 2023. Peer review perpetuates barriers for historically
471 excluded groups. *Nature Ecology & Evolution* 7: 512–523. 10.1038/s41559-023-01999-w.
- 472 SOHMER, S. H. 1980. NSF support of basic research in tropical biology. *BioScience* 30:
473 412–415. 10.2307/1308006.

- 474 STEGMANN, L. F., F. M. FRANÇA, R. L. CARVALHO, J. BARLOW, E. BERENGUER, L.
475 CASTELLO, L. JUEN, F. B. BACCARO, I. C. G. VIEIRA, C. A. NUNES, R. OLIVEIRA,
476 E. M. VENTICINQUE, J. SCHIETTI, and J. FERREIRA. 2024. Brazilian public funding
477 for biodiversity research in the Amazon. *Perspectives in Ecology and Conservation* 22:
478 1–7. 10.1016/j.pecon.2024.01.003.
- 479 STEPAN, N. 2001. Picturing tropical nature. Cornell University Press, Ithaca.
- 480 STOCKS, G., L. SEALES, F. PANIAGUA, E. MAEHR, and E. M. BRUNA. 2008. The
481 geographical and institutional distribution of ecological research in the tropics.
482 *Biotropica* 40: 397–404. 10.1111/j.1744-7429.2007.00393.x.
- 483 WEBB, J. E. 1960. Biology in the Tropics. *Nature* 188: 617–619. 10.1038/188617a0.
- 484 YONG, D. L., S. D. FAM, and S. LUM. 2011. Reel conservation: Can big screen animations
485 save tropical biodiversity? *Tropical Conservation Science* 4: 244–253.
486 10.1177/194008291100400302.
- 487 ZUK, M. 2016. Temperate assumptions: How where we work influences how we think. *The
488 American Naturalist* 188: S1–S7. 10.1086/687546.

SUPPORTING INFORMATION

Is there really such a thing as *Tropical Biology*?

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¹ **1. Collection, processing, and visualization of bibliometric data**

² To identify the conceptual domains studied by researchers working in ‘Tropical’ and
³ “non-Tropical” locations, I used information extracted from the bibliographic records of
⁴ articles published from 1990-2022 in N = 10 journals (*Journal of Evolutionary Biology*,
⁵ *Ecology*, *Journal of Applied Ecology*, *Evolution*, *Biotropica*, *Journal of Ecology*, *Tropical*
⁶ *Conservation Science*, *American Naturalist*, *Tropical Ecology*, *Journal of Tropical Ecology*).
⁷ Specifically, I extracted and summarized the information from two structural components
⁸ used by authors to describe the subject of their articles: the title and keywords. These
⁹ provide distinct but complementary information, and so they are often analyzed both
¹⁰ independently and in unison. Below I describe how the article records were identified,
¹¹ downloaded, processed, and assigned to the ‘Tropical’ and “non-Tropical” categories using
¹² code written in the R programming language (R Core Team 2023).

¹³ On 8 February 2023, I downloaded all bibliographic data available in SCOPUS and the
¹⁴ Web of Science ‘Core Collection’ for all articles published in the focal journals; both
¹⁵ SCOPUS and the Web of Science were queried because they differ in the years indexed for
¹⁶ each journal. I then used the `refsplitr` package (Fournier *et al.* 2020) to process the
¹⁷ records and remove any duplicates. After removing all stopwords (Benoit *et al.* 2021) from
¹⁸ article titles and keywords, I spell-checked, stemmed, and lemmatized all of the keywords
¹⁹ and title words and extracted the bigrams (i.e., pairs of sequential words, e.g., *seed predation*,
²⁰ *species diversity*) from titles with the `tidytext` library (Silge & Robinson 2016). Finally, I
²¹ identified each article as either ‘Tropical’ or ‘non-Tropical’; all articles published in (*Journal*
²² *of Evolutionary Biology*, *Ecology*, *Journal of Applied Ecology*, *Evolution*, *Biotropica*, *Journal*
²³ *of Ecology*, *Tropical Conservation Science*, *American Naturalist*, *Tropical Ecology*, *Journal of*
²⁴ *Tropical Ecology*) were assigned to the ‘Tropical’ category, while articles published in the
²⁵ other journals were assigned to one of these categories based on a search of the titles,
²⁶ keywords, or abstracts for a list of domain-specific terms (e.g., tropical: *amazon*, *andes*,
²⁷ *congo*, *bci*, *chamela*; non-tropical: *finland*, *boreal*, *eastern decid*, *arctic*, *polar*). These

procedures resulted in $N = 37,807$ total articles published, of which $N = 11,210$ reported research conducted in the tropics and $N = 26,597$ were based on work conducted in other locations. Collectively, the $N = 41,219$ contained a total of $N = 126,713$ bigrams. Not all of the articles included keywords, however; from the the $N = 37,807$ that did I was able to extract a total of $N = 62,883$. There were $N = 37,746$ articles from which I was able to extract both title bigrams and keywords. I used these sets of articles to conduct three geographic comparisons: (1) title bigrams, (2) keywords, and (3) title bigrams + keywords (hereafter, ‘terms’). The number of articles varies widely between journals, as does the number of keywords per article or title length. Comparing counts of keyword, bigram, or term frequency in tropical and non-tropical articles could therefore bias results towards the content published a journals allowing more keywords or journals publishing more articles. To correct for this, I calculated the percentage of articles in each geographic category that used each keyword, title bigram, or term. I then selected the $N = 50$ most frequently used in each geographic category, and identified (a) any keywords, bigrams, or terms that ‘tropical’ and ‘non-tropical’ articles had in common, and (b) any keywords, bigrams, or terms that were unique to each article category.

2. Data and Code

The data used in this publication, the code used to import, organize, and analyze these data, and the code used to prepare the manuscript are available at Zenodo <https://doi.org/10.5281/zenodo.13821266> and Github https://github.com/BrunaLab/bruna_biotropica_plenary_ms.

The data used in this paper are part of a larger dataset collected for a longitudinal study of research in the tropics; those data, and the code used to harvest, clean, and organize them, are available at Github https://github.com/BrunaLab/tropical_bibliometrics. Questions regarding the data or code, or suggestions for improvement should be posted as Issues on that repository or referred to E. M. Bruna.

54 REFERENCES

- 55 BENOIT, K., D. MUHR, and K. WATANABE. 2021. Stopwords: Multilingual stopword
56 lists. <https://CRAN.R-project.org/package=stopwords>
- 57 FOURNIER, A. M. V., M. E. BOONE, F. R. STEVENS, and E. M. BRUNA. 2020.
58 Refsplitr: Author name disambiguation, author georeferencing, and mapping of coauthorship
59 networks with Web of Science data. *Journal of Open Source Software* 5: 2028.
- 60 R CORE TEAM. 2023. R: {A} language and environment for statistical computing. R
61 Foundation for Statistical Computing, Vienna, Austria. <https://www.R-project.org/>
- 62 SILGE, J., and D. ROBINSON. 2016. Tidytext: Text mining and analysis using tidy
63 data principles in R. *Journal of Open Source Software* 1(3).

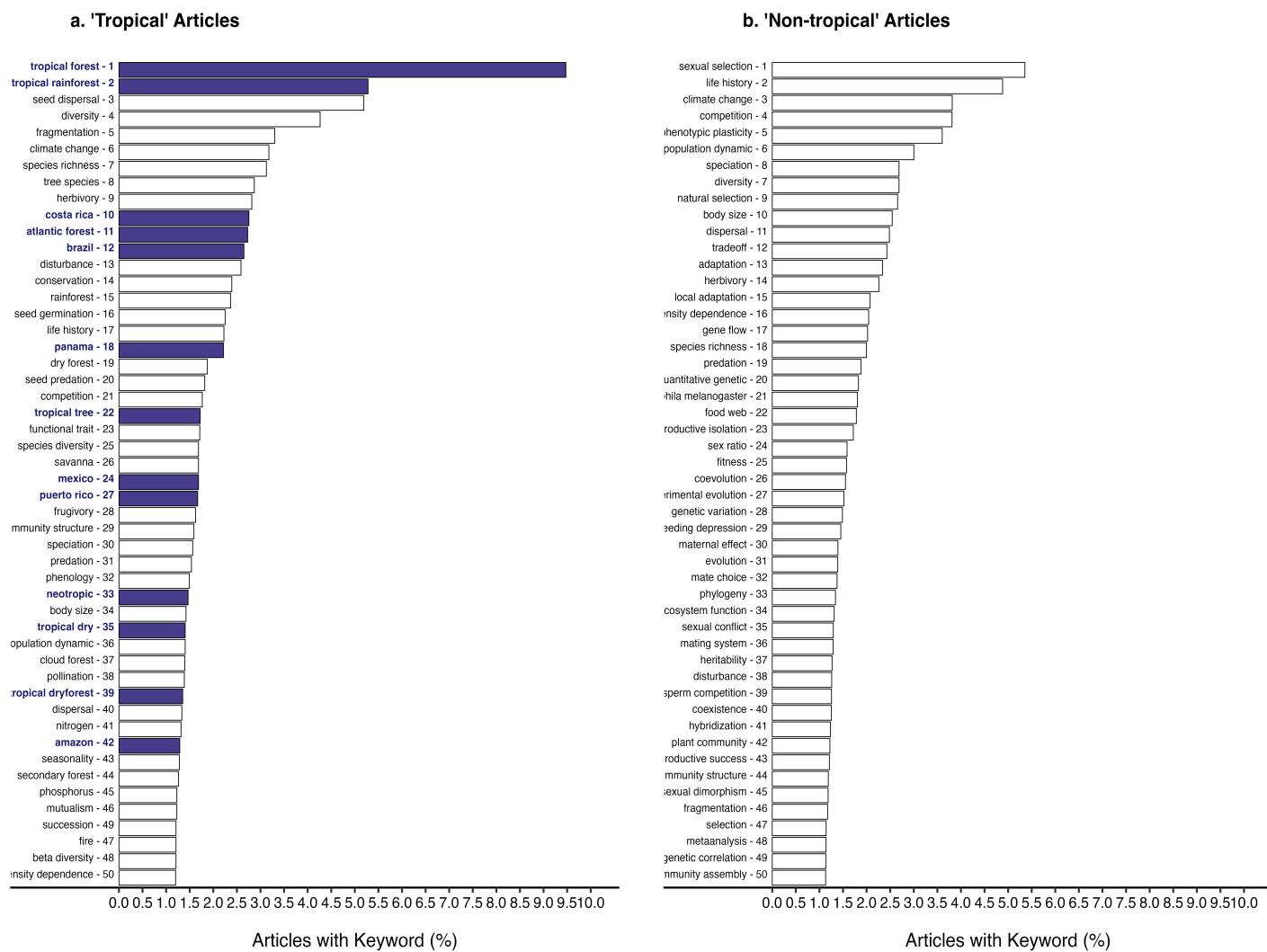


Figure S1. The $N = 50$ most common terms (keywords + title bigrams) from articles based on research conducted in (a) the tropics and (b) non-tropical regions. The rank of these words is based on the percentage of articles in each category that included them. Terms reflecting geography (e.g., *tropics*, *Peru*, *Southern*) are indicated in bold and with filled bars.

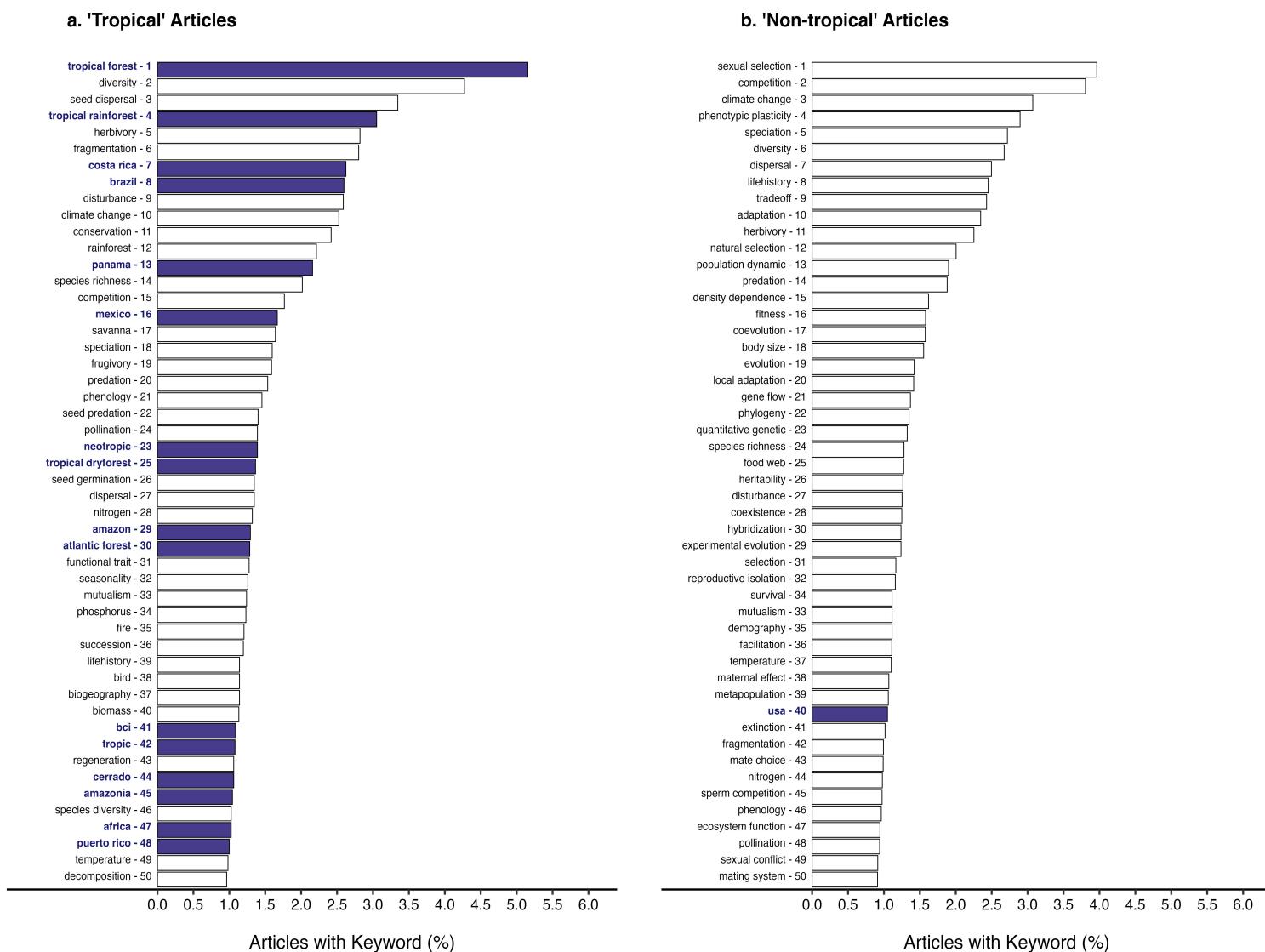


Figure S2. The N = 50 most common keywords from articles based on research conducted in (a) the tropics and (b) non-tropical regions. The rank of these words is based on the percentage of articles in each category that included them. Terms reflecting geography (e.g., *tropics*, *Peru*, *Southern*) are indicated in bold and with filled bars.

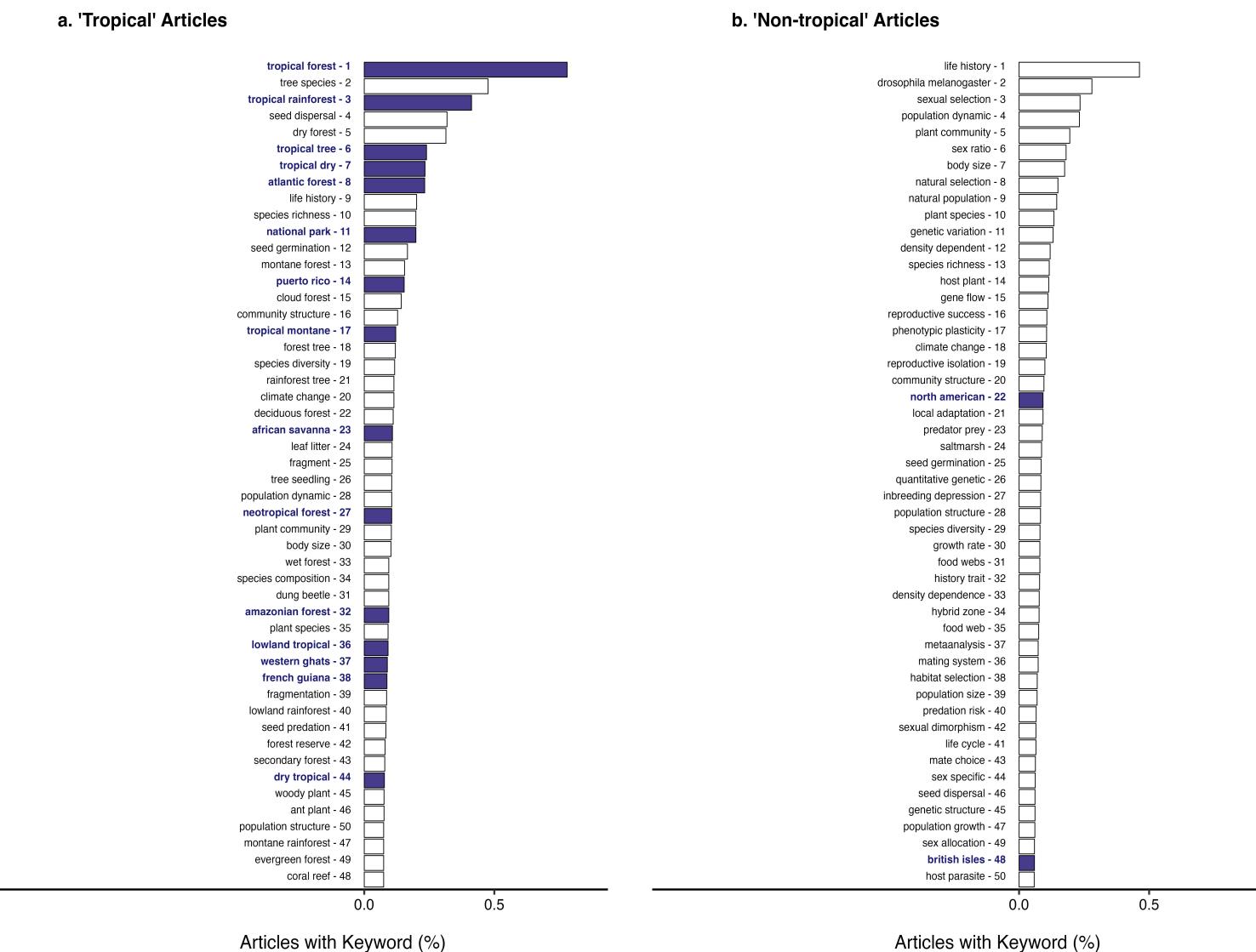


Figure S3. The N = 50 most common bigrams in titles of articles based on research conducted in (a) the tropics and (b) non-tropical regions. The rank of these words is based on the percentage of article titles in each category that included those words. Bigrams reflecting geography (e.g., *tropics*, *Peru*, *Atlantic Forest*) are indicated in bold and with filled bars.

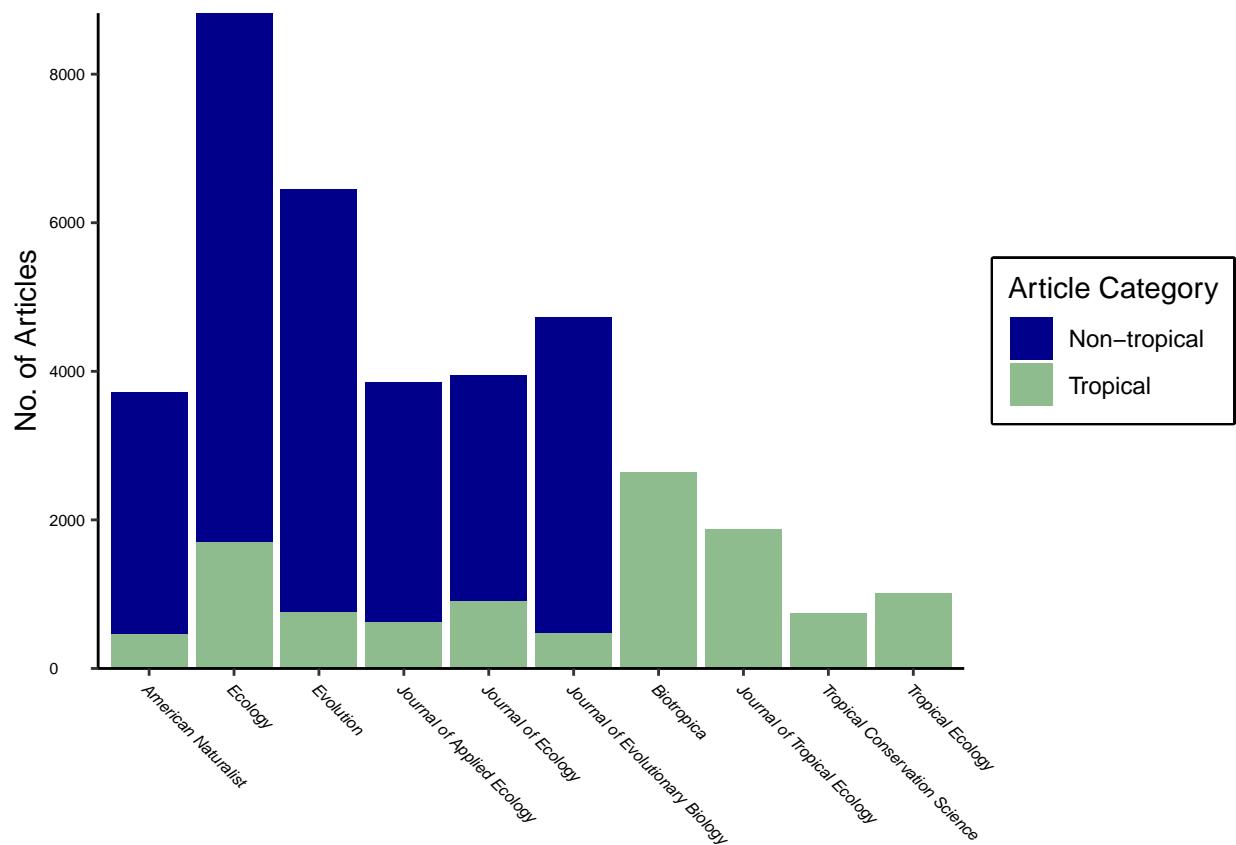


Figure S4. The number of articles from each journal and geographic category that were used in used the analysis of keywords.

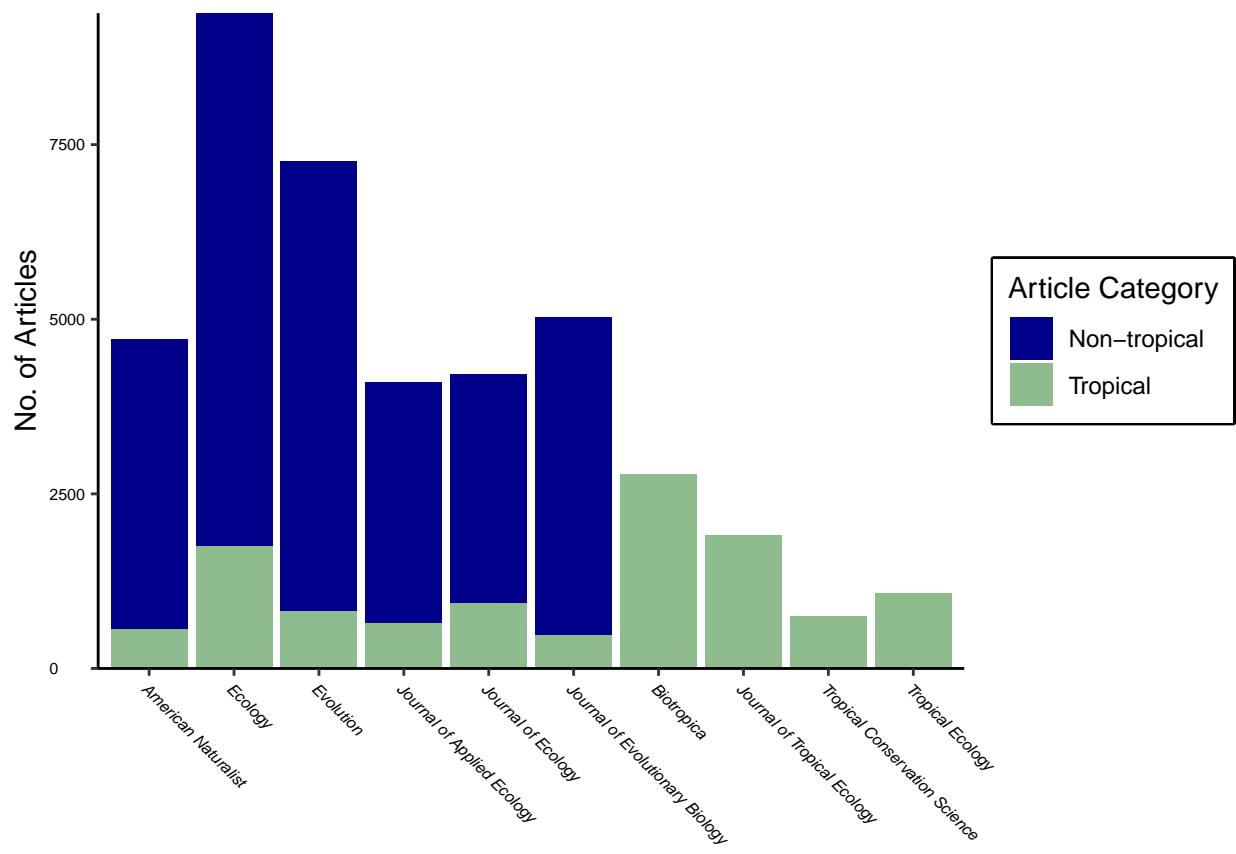


Figure S5. The number of articles from each journal and geographic category that were used in the analysis of title words and title bigrams.