frontiers in Ecology and Evolution

PERSPECTIVE
published: 19 January 2018
doi: 10.3389/fevo.2017.00175

Our House Is Burning: Discrepancy in Climate Change vs. Biodiversity Coverage in the Media as Compared to Scientific Literature

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Scientists, policy makers, and journalists are three key, interconnected players involved in prioritizing and implementing solutions to mitigate the consequences of anthropogenic pressures on the environment. The way in which information is framed and expertise is communicated by the media is crucial for political decisions and for the integrated management of environmental issues. Here we present a comparative study of scientific literature and press articles addressing climate change and biodiversity. We extensively scrutinized the scientific literature, research funding, and press articles from the USA, Canada, and United Kingdom addressing climate change and biodiversity issues between 1991 and 2016. We found that media coverage of climate change was up to eight times higher compared to biodiversity. This discrepancy could not be explained by different scientific output between the two issues. Moreover, climate change media coverage was often related to specific events whereas no such indication of a connection was found in the case of biodiversity. An international communication strategy is urgently required to raise public awareness on biodiversity issues. We discussed several initiatives that scientists could undertake to better communicate major discoveries to the public and policy makers.

Keywords: science communication, biodiversity loss, research funding, public awareness, media coverage, climate change

OPEN ACCESS

Edited by:
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Specialty section:
This article was submitted to Interdisciplinary Climate Studies, a section of the journal Frontiers in Ecology and Evolution

Received: *27 July 2017*
Accepted: *22 December 2017*
Published: *19 January 2018*

Citation:
Legagneux P, Casajus N, Cazelles K, Chevallier C, Chevrinais M, Guéry L, Jacquet C, Jaffré M, Naud M-J, Noisette F, Ropars P, Vissault S, Archambault P, Bêty J, Berteaux D and Gravel D (2018) Our House Is Burning: Discrepancy in Climate Change vs. Biodiversity Coverage in the Media as Compared to Scientific Literature. Front. Ecol. Evol. 5:175. doi: 10.3389/fevo.2017.00175

INTRODUCTION

Loss of Biodiversity and Climate Change, Two Irreversible Environmental Issues

Recent changes in biodiversity (BD) and climate (CC) threaten planet Earth's integrity (Millennium Ecosystem Assessment, 2005; Cardinale et al., 2012; IPCC, 2014) with both issues having already surpassed safe limits (Rockström et al., 2009). Scientific contributions are communicated through peer-reviewed scientific journals, but they are also popularized for stakeholders, policy makers, and the public. The political and scientific spheres interact; funding agencies orient academic research program priorities, and discoveries in turn affect political decisions.

Intergovernmental environmental initiatives, such as the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), already exist in order to bridge the communication gap between the scientific community and stakeholders. Indeed, they produce syntheses based on the primary scientific literature directly usable by policymakers. IPCC and IPBES link scientific and political agendas (Brooks et al., 2014) and can thereby attract substential interest from the media, such as COP21 held in Paris in 2016 (Depoux et al., 2017).

However, because it does not encompass public awareness, the science-policy bond seems insufficient to resolve CC and BD societal issues. The role of the media is therefore of major importance in popularizing scientific research (Allan, 2002) and educating the public regarding environmental issues, because political decisions are tightly related to public perception of such threats (McCombs and Shaw, 1972). As mass media cannot relay all the scientific information and perspectives, they must select the topics that they cover, thus influencing and orientating the popularization of some issues (Carvalho and Burgess, 2005) over others.

Considering that (i) mitigating the impact of CC and BD are major priorities for human well-being and (ii) scientific literature is used in both fields to orient political decisions interplaying with the media, we formulated two main working (or null) hypotheses. First, scientific funding, scientific production, and media coverage should follow the same long-term trends. Second, short-term media coverage should mirror specific events such as major discoveries, international conferences, climatic, or environmental catastrophes that can lead to cascading effects involving political decisions, scientific expertise, and public awareness.

METHODS

We restricted our analyses to English-speaking countries to avoid potential biases in the number of newspaper articles available in databases. We also selected countries with long-term data available regarding research funding. We focused media coverage on three countries: USA, Canada (newspapers in French were excluded), and the United Kingdom (UK). We are confident that the choice of the newspapers included in the present study is representative of broader media coverage at least for CC. Similar analyses conducted only for CC in the media on eight countries from 2000 to 2017 (including 38 newspapers) revealed same global patterns regardless of the newspaper or country considered (McNatt et al., 2017). We compiled information from databases to extract the number of published scientific articles (Web of Science), the amount of public funding granted to CC and BD-related projects (http://www.nserc-crsng.gc.ca/ase-oro/index_eng.asp, https://www.nsf.gov/awardsearch, http://gotw.nerc.ac.uk/) and newspaper articles (Factiva; https://www.dowjones.com/products/factiva/) from 1991 to 2016. Because most of scientific production result from international collaboration, we compiled all (worldwide) published scientific manuscripts regardless of their country of origin. The top 50 scientific journals retained from our queries are listed in Tables S1 and S2 (Supplementary Material). All queries were done using the same keywords: we used "climate change," "global warming," and "IPCC" to assess the media coverage of CC, and "biodiversity," "ecosystem services," "endangered species," and "IPBES" for the coverage of BD. We acknowledge that the choice of keywords is crucial. The choice of CC keywords was easier than the choice of BD keywords. The main reason was that BD issues in the media can be addressed with global and very specific terms. It was virtually impossible for us to tackle all themes, species, or environmental issues linked to BD. To circumvent this possible bias in our study, we ran a preliminary analysis with other BD keywords ("biodiversity loss," "species extinction," "mass extinction," "Anthropocene," "ecosystem services," "invasive species," "alien species") to investigate media coverage and found similar results (not shown). We decided not to include keywords such as "environment" or "nature" because they were not specific enough to BD or CC issues. To assess media coverage of both CC and BD, we queried the Factiva database based on the methodology developed by the International Collective on Environment, Culture, and Politics (ICECaPs, Boulder University; McNatt et al., 2017). We gathered every article published between January 1, 1991, and December 31, 2016, in one of these 12 major newspapers: The Globe and Mail (Canada), National Post (Canada), The Toronto Star (Canada), Winnipeg Free Press (Canada), The New York Times (USA), USA Today (USA), The Wall Street Journal (USA), The Washington Post (USA), Financial Times (UK), The Guardian (UK), The Independent (UK), The Times (UK). All duplicates (funding grants, newspaper articles, or scientific papers) that were retrieved both from BD or CC queries were removed to avoid any study tangling biodiversity and climate change topics together. Research funding for UK was only available for 2001–2016. Although an increase of research funding over time was detected in the UK for both CC and BD, we decided not to include UK research funding in the analyses to cover the full (1991–2016) period. Research funding was expressed in $US and currency rates for $CA were adjusted for each year (1991–2016). We then pooled information monthly. We listed *a priori* CC and BD major events (Table S3, Supplementary Material). We used the *peakwindow* function (R Cardidates package, Rolinski et al., 2007) with the following parameterization (min peak = 0.1 and min. cut = 0.6) for both CC and BD. We used the *segmented* function (Segmented package, Muggeo, 2008) to determine the breakpoints in time series with the default parameterization. All results are presented as mean ± s.e.m.

RESULTS AND DISCUSSION

How Are Biodiversity and Climate Change Issues Reported in the Media?

The number of worldwide scientific publications in peer-reviewed journals (hereafter referred to as scientific production) from 1991 to 2016 increased over time for both CC and BD (**Figure 1A**). In 2006, a breakpoint occurred and rate of CC-related publications increased faster than BD scientific

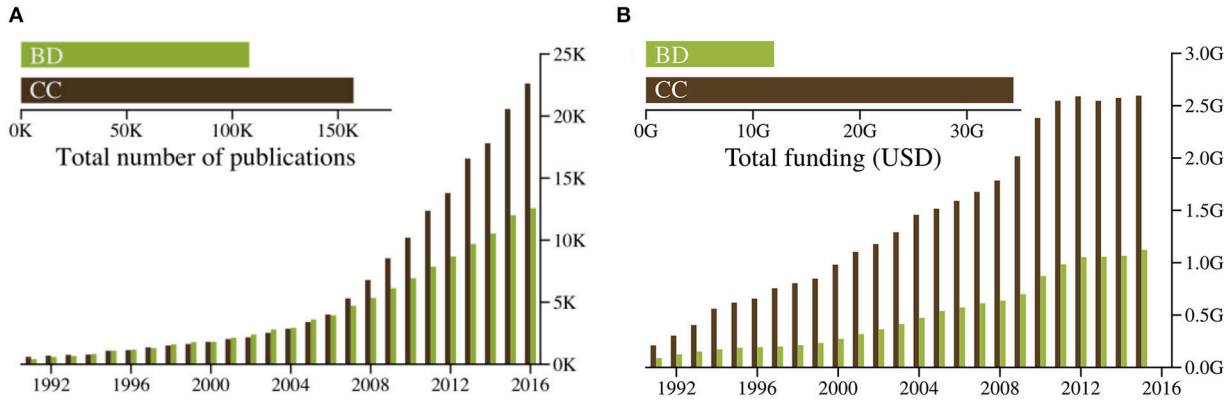

FIGURE 1 | (A) Worldwide scientific papers published in peer-reviewed literature on biodiversity (green) or climate change (brown) topics. **(B)** Public research funding in US and Canada dedicated to biodiversity (green) or climate change (brown) issues.

production (1725 ± 42 and 672 ± 24 publications per year after the breakpoints, for CC and BD respectively; **Figure 1A**). Irrespective of the differences in the net amount of research funding available in each country, we found similar trends in funding directed at CC and BD research over time among the three countries. The rate of research funding in CC science increased faster compared to that of BD (US $107 M ± $3.6 M per year vs. $45 M ± $2.5 M for CC and BD respectively; **Figure 1B**). Because of these trends, we found a significant positive relationship between research funding and scientific production for both BD ($r = 0.98$; $p < 0.001$) and CC ($r = 0.91$; $p < 0.001$). While scientific production and funding were correlated for both topics, media coverage was related to research funding or scientific production for CC (all $r > 0.55$; all $p < 0.01$) but not for BD (all $r < 0.07$; all $p > 0.75$). Overall, CC media coverage was 3.3 times greater compared to BD and reached up to eight times greater in 2016. This discrepancy started in 2000 [same media coverage for CC and BD prior to 2000: $F_{(1, 238)} = 1.64$; $p = 0.20$] and has not stopped increasing since 2003 (**Figure 2**). Similar trends were obtained for all media sources and countries studied (no significant interactions between year and country occurred for media production, all $p > 0.54$). Using peak signal detections (see Methods), peaks in media coverage have been highlighted for each dataset and matched with the dates of 66 *a priori* monthly events linked to both CC (14/17 detected peaks) and BD (5/15 detected peaks). By scrutinizing the content (title and abstract) of the articles for each of those matched months, we confirmed that the *a priori* event was included in the articles.

How Can We Explain a Biodiversity Communication Deficit?

Our comparative analysis of the media coverage of BD issues relative to CC revealed that the science, the challenges and the problems associated with BD issues are not likely reaching the public. BD is covered up to eight times less by the media compared to CC. Media coverage of CC has increased since 2002, and major events such as the United Nations Climate conferences are detailed by media, which contrast with major BD events that cannot be retrieved with our analysis. Interestingly, in 2002, both CC and BD issues were reported in the media (Johannesburg Earth Summit) and similar research funding was dedicated to both issues. At Johannesburg, in his famous discourse "Our house is burning down and we're blind to it," Jacques Chirac was speaking of both issues (www.un.org/events/wssd/statements/franceE.htm). However, since 2002, media attention switched mostly on CC issues compared to BD (**Figure 2**). Since the Johannesburg Earth Summit, our house is still burning and we only have one eye on it.

Several hypotheses could explain this discrepancy. First, there might be a temporal effect in media coverage relative to the two issues: the IPCC was created more than 20 years before the IPBES, potentially leading to a better communication strategy in recent years. Attention on CC in the media increased only 10–15 years after the creation of the IPCC, suggesting that media interest on BD could increase in the coming years. The lack of structured platform between scientists and policymakers in the field of BD until 2012 could have hindered the public/media interest (Moser, 2010; Brooks et al., 2014). However, political and public awareness on BD alteration occurred earlier than CC (Millennium Ecosystem Assessment, 2005), the latter being a relatively recent environmental issue (Moser, 2010). Interestingly, a prominent challenge in communicating CC is to convince the public that human activities could alter the global climate and climate skepticism indeed promoted the media uproar regarding CC and global warming (Moser, 2010; Russill, 2011) but in return maintained public confusion (Antilla, 2005). Climate skeptic publications (peer and non-peer) were often followed by press-release promoting the myth of a lack of consensus inside the CC scientific community (Antilla, 2005). There is also a link between weather forecasts and climate change understanding by the public. Catastrophic events such as heat waves or hurricanes might increase concern about climate change, but cool summers (such as 2008 in the USA) can have opposite effects (Li et al., 2011; Weber and

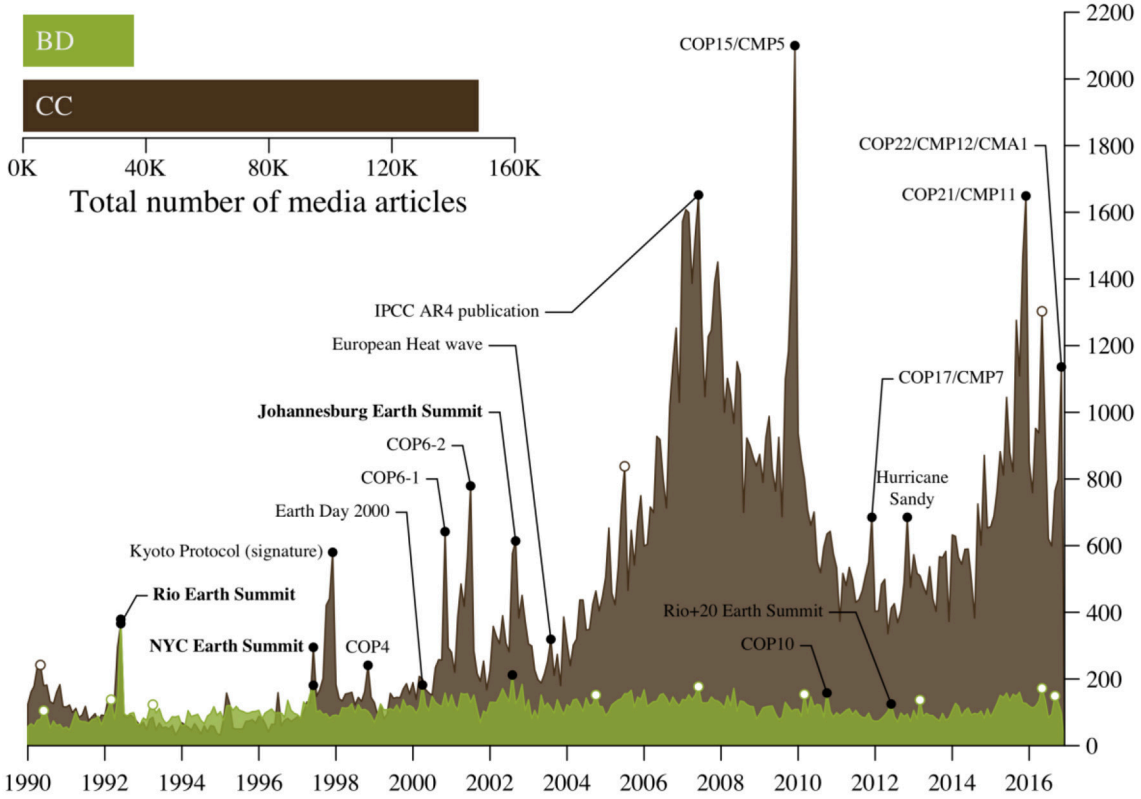

FIGURE 2 | Number of newspaper articles published per month on biodiversity (green) or climate change (brown) issues in US, Canada, and UK. Detected peaks (plain dots) and associated events are shown. Peaks without associated events (empty dots) could not be associated with *a priori* events. Events that embraced both CC and BD issues are written in bold.

Stern, 2011). Beliefs in climate change can thus be affected by local weather conditions but in both ways. The longevity of the media success of CC could thus be partly explained by its similarities with belief systems (Bhagwat et al., 2016) and by the norm of balanced reporting in the prestige's press which presents climate skepticism as a valid opposition to the scientific consensus (Boykoff and Boykoff, 2004; Moser, 2010).

Second, media may not relay information about BD as much as CC because of its perceived local-scale effects (Sadath et al., 2013). CC effects are structurally global and largely due to greenhouse gas emissions, while most of the mechanisms involved in BD alteration are local and only become a global problem by aggregation (Moran and Kanemoto, 2017). Moreover, CC effects are experienced directly by the public (including material loss, health problems, mortality, and emigration) and can easily be translated into economic terms leading to policy makers' decisions. Attempts to reduce global warming can easily be summarized as any action that will limit it to 1.5 or 2°C. However, there is no clear biodiversity benchmark to meet that can easily be translated to policy. The perception of the impacts of biodiversity issues are not only considered as local problems but they are also non-perceived as major threat for ecosystem services. Recent communications about pollination, a service provided by ecosystems (IPBES, 2016), were not associated with a particular boost in our media analysis (**Figure 1A**). However, the loss of pollinators and its consequences for human activities attracted a lot of media attention (Smith and Saunders, 2016) when IPBES pollination assessment report was released in 2015. The fact that such information was not retrieved in this study might reveal some potential limitations associated with our approach. We restricted our requests to mainstream newspapers to have comparable measures of media coverage over 25 years but "new" media such as TV public debates, blogs, social media, etc. were not included which potentially hindered our ability to track recent events. This could also reveal an inherent problem with the choice of keywords and refer to a much more global problem of defining and understanding the concept of biodiversity and its roles for the public.

Third, scientists working on BD may invest less effort in popularizing their results compared to the ones working on CC. From an individual perspective, this is unlikely because scientists working in both research fields are equally contacted by the media (Peters, 2013). However, from a global perspective, fewer resources are devoted to IPBES compared to IPCC (Stokstad, 2017). Despite its strong commitment to assessments, IPBES developed mechanisms to establish strategic partnerships only

very recently, which will improve media coverage that BD receives (Schmeller et al., 2017). Finally, other explanations could also be raised: public and educational outreach are poorly supported by education institutions and are still not rewarded in career advancement of scientists (Andrews et al., 2005); policy responses to mitigate the impact of CC involve all major economic sectors (IPCC, 2014), while BD is (improperly) perceived as more specialized and less accessible compared to CC (Zaccai and Adams, 2012). Whatever the reasons underpinning this BD communication gap, science will not help solve one of the most pressing issues on our planet if it cannot reach the public and/or decision makers. Structural support is therefore needed to overcome the problems facing whistle-blowers.

What Scientists in Biodiversity Could/Should Do?

We suggest that BD scientists should aim to boost public and media awareness by focusing on two major ideas to: (i) convey accurate and well-structured information on BD and (ii) report on the global issues of BD (e.g., interconnections, ecosystem functions) and the value of BD for human well-being (e.g., ecosystem services). From an individual perspective, scientists in BD should take special care to foster media interest in their own BD-related research. For example, BD scientists could create more media events around major or minor discoveries. The visibility and attractiveness of numerous BD-related conventions and symposiums could also be improved. However, doing outreach for scientists is generally considered as time-consuming and not enough rewarded in term of career advancement by research funding agencies. BD issues would largely benefit from engagement of a public figure that embrace the cause, as Al Gore did for the CC issue (Nisbet and Kotcher, 2009).

Because of the success of CC in the media (**Figure 2**, Figure S1) and its positive feedback on research funding and scientific production (**Figure 1B**), some authors have suggested that BD research should be embedded under CC framework wherever possible (Veríssimo et al., 2014). However, because BD modification is not primarily determined by CC (Maxwell et al., 2016) and because BD is attracting a significant amount of funding, comparable to CC (this study), it questions the communication strategy BD scientists must adopt. Even if a complete embrace of biodiversity issues in CC framework would not be more efficient in raising the media and public interest, a common platform driving knowledge transfer initiative may efficiently boost the awareness of biodiversity issues at an international level. We could also begin to consider the value of an Intergovernmental Platform on Global Change (IPGC), at least for a better and more integrated communication strategy on environmental issues. BD modification is a global issue directly connected to human well-being (Moran and Kanemoto, 2017) but this key message is not yet well-reported by national media. Communications on the challenges related to BD could integrate the tools developed for CC communication: (i) use metaphors for biodiversity loss such as "the burning library of life" (Valiverronen and Hellsten, 2002), (ii) use icons (such as polar bears) to consider the problem through personal values and experiences (O'Neill and Hulme, 2009), (iii) dialogue and reflexive engagement from experts and non-experts instead of one-way, top-down communication (Nerlich et al., 2010), and (iv) although criticized, use claims such as "the million species at risk" (Thomas et al., 2004) to reach the public. Because species extinction arouses more intense emotions (both prospective like fear and retrospective like sadness) than any consequences of global warming (Böhm, 2003), BD communication strategies should consider the emotional component and self-engagement of the public.

One very effective way to engage the public in BD issues is the exposure to the natural world, which influences environmental behaviors (Collado et al., 2013). Citizen Science projects on BD are particularly popular and are not only useful by filling biodiversity data gaps (Theobald et al., 2015) but also by increasing public awareness on nature value and its benefits by reconnecting themselves to the nature (Couvet et al., 2008). The inclusion of scientific research in our societies is essential to better link researchers and policy makers (Funtowicz and Ravetz, 2008) because both environmental issues and solutions should be rooted on scientific knowledge and social acceptance (Naustdalslid, 2011).

DATA ACCESSIBILITY

All the data used in the study as well as R scripts to reproduce the analysis and the figures can be found online at the following doi: 10.5281/zenodo.1134897.

AUTHOR CONTRIBUTIONS

PL, NC, KC, CC, MC, LG, CJ, MJ, M-JN, FN, PR, SV, PA, JB, DB, and DG: conceived the original idea; PL, NC, KC, CC, MC, LG, CJ, MJ, M-JN, FN, PR, SV, PA, JB, DB, and DG: designed the methodology; PL, NC, KC, CC, MC, LG, CJ, MJ, M-JN, FN, PR, and SV: collected data; NC, KC, and PL: analyzed data; NC and KC: produced the figures; PL: led the writing with inputs from all co-authors.

ACKNOWLEDGMENTS

This paper is an initiative from UQAR journal club in ecology and evolution. This work was supported by a UQAR-BORÉAS working group and from resources from the QCBS (Québec Center for Biodiversity Science) and the CEN (Center for Northern Studies). The Factiva and Web of Science databases access was provided by the Université Laval library. Kristen Peck kindly reviewed the English.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fevo.2017.00175/full#supplementary-material

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Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.