Biodiversity in Times of COVID-19 and its Relationship with the Socio-Economic and Health Context: A Look from the Digital Media

Angie C. Montenegro-Hoyos [1,2,3] · Eduardo A. Muñoz-Carvajal [1,4] · Britt N. Wallberg [1,3] · Mylene E. Seguel [5] ·
Sergio A. Rosales [5] · Natalia A. Viña-Trillos [6,7] · Denisse S. Torres-Avilés [5,8] · Alejandro E. Villarroel [1,9] ·
Carlos F. Gaymer [4,5,10] · Francisco A. Squeo [1,3,4]

Abstract

The COVID-19 pandemic has caused a pause in people's activities and a socio-economic crisis worldwide due to confinement. This situation is an unprecedented opportunity to understand how these changes may impact biodiversity and its conservation, as well as to study human-nature interaction. Biodiversity plays an essential role in conservation and economic activities, and in countries with greater inequality and low gross domestic product (GDP), biodiversity could have a low priority. Moreover, how biodiversity is prioritized in a society impacts how the citizens view it, and digital news tends to shape biodiversity narratives. The aim of this work was to determine the main trends in biodiversity-related news categories during the COVID-19 pandemic in countries with terrestrial and marine hotspots and relate them to the socioeconomic and public health context of each country. For this, we searched for news on biodiversity and Covid-19 in the first 6 months of the pandemic and related them to GDP, Gini-index, deaths, and infections by Covid-19. Results showed that conservation, public policies, and use of natural resources stood out as the main news categories across countries, with a positive narrative and mostly related to terrestrial rather than marine environments. On the other hand, the socio-economic and public health characteristics of each country had an influence on which aspect of the biodiversity was reflected in the media. For example, countries with greater inequality were associated with tourism news, additionally, countries with low GDP, high cases, and deaths by Covid-19 were associated with news about cultural diversity. In contrast, countries with high GDP and low inequality were associated with news about zoonosis, research and development, public policies, and alien and invasive species.

Keywords GDP · News · Hotspots · Coronavirus · Pandemic · Gini index

✉ Angie C. Montenegro-Hoyos
   angie.carol@userena.cl

1 Departamento de Biología, Facultad de Ciencias, Universidad de La Serena, La Serena, Chile

2 División de Ecología Vegetal—Centro de Ornitología y Biodiversidad (CORBIDI), Lima, Perú

3 Instituto de Ecología y Biodiversidad (IEB), La Serena, Chile

4 Centro de Estudios Avanzados en Zonas Áridas (CEAZA), La Serena, Chile

5 Departamento de Biología Marina, Facultad de Ciencias del Mar, Universidad Católica del Norte, Coquimbo, Chile

6 Departamento de Ecología, Facultad de Ciencias, Universidad

   Católica de la Santísima Concepción. Casilla 297, Concepción, Chile

7 Programa de Doctorado en Ciencias Mención Biodiversidad y Biorecursos, Universidad Católica de la Santísima Concepción, Concepción, Chile

8 Departamento de Repoblación y Cultivo, Instituto de Fomento Pesquero, Valparaíso, Chile

9 Instituto de Conservación, Biodiversidad y Territorio, Facultad de Ciencias Forestales y Recursos Naturales, Universidad Austral de Chile, Valdivia, Chile

10 Millennium Nucleus for Ecology and Sustainable Management of Oceanic Islands (ESMOI), Coquimbo, Chile

Introduction

The current pandemic caused by the Sars-Cov-2 virus (COVID-19), which started in December 2019 in Wuhan (China), was characterized by its rapid spread on a global scale, having repercussions on people's daily lives and public health systems (Baloch et al. 2020; Kraemer et al. 2020; Pitlik 2020). Most nations in the world are being challenged by this virus (Manenti et al. 2020) so, during the first quarter of 2020, most of the world's governments (Hale et al. 2020), declared national emergencies and created more or less strict quarantines (e.g., depending on the number of cases and deaths) to encourage social distancing and slow the advance of COVID-19 (Karnon 2020). These quarantines have meant changes in human activity on a global scale, so some authors have referred to this period as a "great human pause" (Rutz et al. 2020), having strong social, economic (Manenti et al. 2020), and, environmental (Corlett et al. 2020) consequences.

Furthermore, this situation is an unprecedented opportunity to understand how these changes may impact biodiversity and its conservation, as well as to study human-nature interactions (Bates et al. 2020; Corlett et al. 2020; Rutz et al. 2020). The consequences of lockdown have been positively, negatively, or neutrally related to biodiversity or the environment, but its true impacts remain opaque (Manenti et al. 2020; Corlett et al. 2020). For example, different effects have been reported on terrestrial and marine environments (Manenti et al. 2020; Corlett et al. 2020; Rutz et al. 2020), wildlife (Silva-Rodríguez et al. 2020; Gilby et al. 2021), alien and invasive species (Nuñez et al. 2020), cultural diversity (Cupertino et al. 2020; Meneses-Navarro et al. 2020), as well as biodiversity-related activities such as tourism (Bakar and Rosbi 2020), agriculture and rural economy (Rawal et al. 2020), forest fires (Amador-Jiménez et al. 2020), and pollution (Dutheil et al. 2020; Patrício Silva et al. 2021). Although it is still too early to make categorical statements about the consequences, the scientific knowledge gained during the pandemic will allow us to observe the unsustainable aspects of the pre-Covid-19 economic model, to facilitate the rebuilding and transformation of the political and economic structures that lead to biodiversity loss (Sandbrook et al. 2020).

Biodiversity is not only important from the point of view of the conservation of natural heritage, but also because of the economic activities associated with it. Thus, biodiversity may be related to socioeconomic indices (Fisher and Christopher 2007) such as gross domestic product (GDP) (Amano and Sutherland 2013) and the Gini coefficient, which is used to measure inequality (Holland et al. 2009). This may lead countries with low GDP and high Gini coefficient to concentrate efforts on public health and the economic and social strife brought on by the pandemic, to

the detriment of biodiversity protection (McElwee et al. 2020). Considering the above, this study addresses biodiversity in a broad sense, while also integrating human activities related to biodiversity in the current context of the pandemic, based on the information available in different digital media.

We live in a digital age (Livingstone 2004), characterized by an increasing volume of freely available data available in real-time (Castells 2010), for free and on a global scale (Soriano-Redondo et al. 2017). This information provides new avenues for research in several fields of science (Ruths and Pfeffer 2014) and thus, the potential of obtaining data from the internet to study conservation problems has been recognized (Di Minin et al. 2015; Ford et al. 2016). Furthermore, the role of the media in the public perception of biodiversity has been described as critical (Chevallier et al. 2019), thus news from each country is a reflection of its interests and social, economic, political, and cultural context (Lee and Basnyat 2013; Cooper et al. 2019). The lockdowns that have occurred around the world have somewhat limited the possibility of researchers developing comprehensive research and recording quantitative data, so information in digital media can play a fundamental role in observing the impacts of the pandemic on biodiversity (Manenti et al. 2020).

The effect that the pandemic could have on the environment and wildlife is a novel and understudied topic (Manenti et al. 2020), so it represents a unique experiment to assess the effects of human activity on biodiversity (Corlett et al. 2020). In this work, we analyzed, through the information available in digital media on COVID-19, biodiversity, lockdown effects, and socioeconomic characteristics, in countries with terrestrial and marine hotspots, an aspect that has yet to be evaluated by researchers. Consequently, this study aims to determine the main trends in biodiversity-related news categories during the COVID-19 pandemic in countries with terrestrial and marine hotspots and relate them to the socioeconomic and public health context of each country. Specifically, we address the following questions: What have been the main categories of biodiversity-related news stories during the COVID-19 pandemic in countries with terrestrial and marine hotspots? What has been the focus of these news stories? And finally: How do socioeconomic and pandemic severity indicators correspond to these news categories?

Methods

To relate the available information to the countries under study, we considered only those that had hotspots to study the effect of this great human pause on biodiversity. Given the great richness of species concentrated in hotspots, as

well as high rates of population growth (Cincotta et al. 2000) associated, they serve as excellent laboratories for observing the effects of the human footprint (Weinzettel et al. 2018). Furthermore, two European countries (France and Spain) were considered in the study as examples of developed countries (Chevallier et al. 2019). Further, we determined trends and approaches in biodiversity-related news during the COVID-19 pandemic in various countries and how these trends related to socioeconomic and pandemic severity indicators. We initially selected the study countries and searched for digital news. Then we classified each news item according to a particular theme. Finally, each theme per country was related to the different indicators through PCA analysis, clustering, and correlations.

Trends in Biodiversity News During the Pandemic

Fourteen different countries spanning five continents were selected (Fig. 1). The following criteria were used for this selection: (i) those countries with terrestrial and/or marine biodiversity hotspots (Myers et al. 2000; Ramírez et al. 2017), or areas of high conservation value (Micheli et al. 2013; Selig et al. 2014), (ii) those countries with data on the Gini Index, and Gross Domestic Product (GDP) (The World Bank 2020a, b), Constraint Index (Hale et al. 2020) and records of cases and deaths per million inhabitants product of COVID-19 (John Hopkins University 2020). In addition, other filters were in place, including countries that have their domain in Google; availability of the counties' official

languages in Google translator; being a model country in terms of socioeconomic and environmental standards and having been strongly affected by the pandemic, such as France and Spain (Ceylan 2020); countries that have successfully implemented conservation policies for decades (Chevallier et al. 2019); countries that have a president who has publicly expressed COVID-19 denial, like Brazil (Pereira et al. 2020); and finally, being leaders in conservation, environmental care and, environmental education, like Costa Rica (Jiménez et al. 2017). We should highlight that we overrepresented Latin America because its countries were strongly affected by the pandemic, are rich in biodiversity, and have high inequality, in addition to the fact that most of the studies on Covid effects already conducted have focused on other continents.

The news search for each country followed the methodology of Chevallier et al. (2019) with modifications. Google's advanced search engine was used, with the following constraints: (i) keywords "Covid + biodiversity" (in the official language of each country); (ii) country name; and (iii) official language of the country (in the case of Madagascar and South Africa, French and English were used, respectively). Subsequently, the "news" section was chosen and sorted by importance, and finally, a customized search time interval was created. For this purpose, the first value greater than zero of the Restriction Index was used as the start date, and the end date was 6 months later (Fig. 1). Up to 100 news items were then selected from each country and then translated into Spanish using Google Translator.
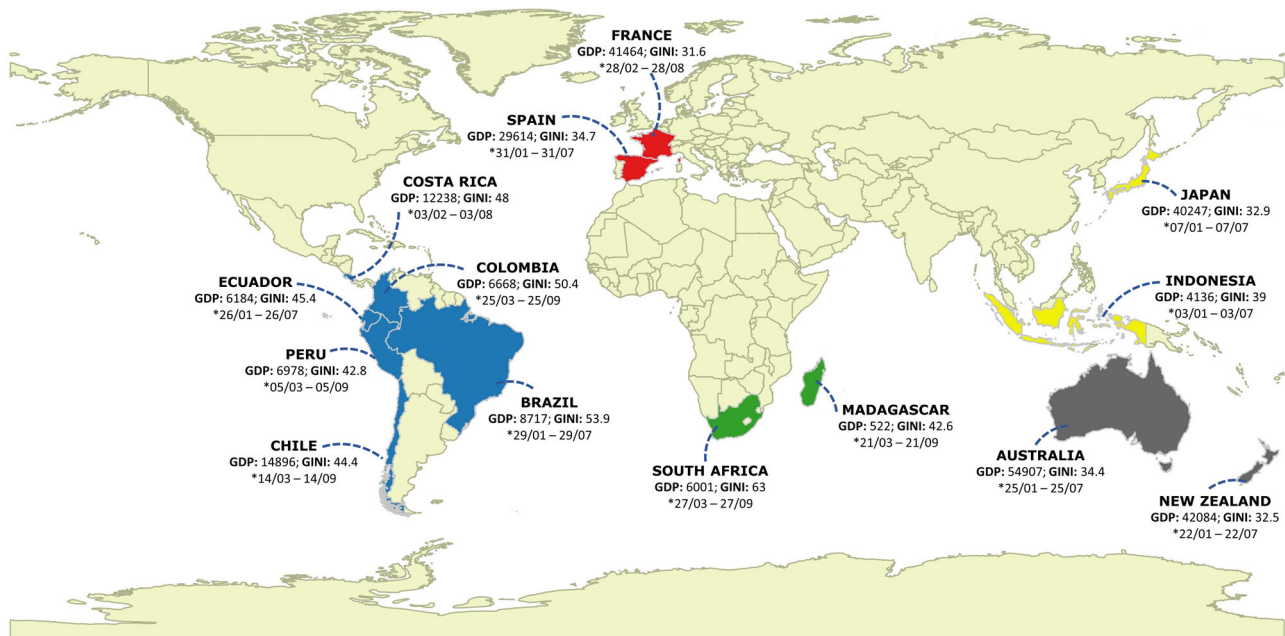

Fig. 1 Gross domestic product, Gini index (source: World Bank) and (*) period of the study considering the change in the stringency index (source: Hale et al. 2020) up to 6 months, for the selected countries (blue: Latin American countries; green: African countries; red: European countries; yellow: Asian countries; grey: Oceania countries)

The news items were classified according to their main theme across 11 categories: Conservation; Public Policy; Natural Resource Use (NRU); Zoonosis; Economics; Research and Development (R&D); Pollution; Tourism; Cultural Diversity; Wildlife Sightings (FFS) and Invasive and Exotic Species (IES) (see description in Table S1). Additionally, it was identified whether the news item had a focus: (i) on marine, terrestrial, or both environments (Global Biodiversity) (see description in Table S2) and (ii) positive, negative, or neutral (see description in Table S3). Finally, the frequencies of the news items by country, category, and the combinations of country v/s category and country v/s focus were calculated.

Relationship between News Trends and Socio-Economic and Pandemic Severity Indicators

The following socio-economic and pandemic severity indices were used: (i) Gini Index, as an economic indicator that measures income inequality among citizens of a country (Sitthiyot and Holasut 2020); (ii) Gross Domestic Product (GDP), as an economic measure that calculates the total production of goods and services in a given period and the economic income per capita in the country (Fernandez 2019); (iii) COVID-19 stringency index, which measures the relationship between the number of COVID-19 cases and the response of each government to the pandemic (Hale et al. 2020), the average value of which was used for the analysis of the period of study, and (iv) mortality and total COVID-19 infections per million inhabitants, on the date of the end of the news search.

To analyze the relationships between the news categories with the indices in the different countries, a principal component analysis (PCA) was performed using the Vegan: Community Ecology Package (Oksanen et al. 2019), following the methodology proposed by Borcard et al. (2018) and Legendre and Legendre (2012). Further, Pearson correlations and their significance levels (p-value) were determined, using the Rstudio program (RStudio Team 2020). Finally, a WPGMA cluster analysis was included to better define the groupings.

Results

News Classification

A total of 1176 digital news articles related to COVID-19 and Biodiversity were found. The distribution of news items was not uniform across the 14 countries studied. The countries with the lowest number of news items were Japan and Madagascar, while the rest of the countries registered more than 70 news items (Fig. S1). Of the total sample of news categories studied, the most representative were Conservation (24.57%), followed by Public Policies (18.20%), Use of Natural Resources (11.56%), Zoonosis (10.46%), and Economy (9.18%) (Fig. 2).

The frequency of news categories by country showed variations in terms of their relevance. Specifically, in Latin American countries, the most relevant categories associated with COVID-19 and Biodiversity were Conservation (20.82%), Use of Natural Resources (15.99%), and Public Policies (15.24%); in addition, news on Cultural Diversity was present in all countries, with greater emphasis on Brazil, Peru and Ecuador; and the least relevant category was Exotic and Invasive Species (0.56%) represented only in Chile (Fig. 2). In African countries, the most relevant categories were Conservation (31.11%), Public Policies (17.88%) and Tourism (11.92%) and the least relevant categories were Pollution and Cultural Diversity, both with 1.32%. In the European countries, news related to Conservation (26.02%), Public policies (25%), and Zoonosis (16.84%) stood out, with the least relevant category being Tourism (0.51%). In Asian countries, news related to Conservation (30.08%), Zoonosis (21.05%), Public Policies (16.54%), and Research and Development (15.79%) stood out, and the least relevant were Tourism and Wildlife Sightings, both with 0.75%. Finally, in the countries of Oceania, news related to Conservation (22.78%), Public Policies (21.52%), Economy (17.09%), and Pollution (11.39%) predominated, with the least relevant category being Tourism (1.90%; Table S4), and news on Alien and Invasive Species appeared in both countries of this continent.

Although all the countries stood out in the conservation theme with a percentage higher than 14%, Madagascar (39.6%) and Japan (42.2%) presented values much higher than the rest. In the public policy category, Australia (32.1%) and Spain (32.0%) stood out, followed in third place by Chile (21.1%). News on zoonosis reached a percentage close to 20% in Asian countries, surpassing the other countries studied. New Zealand had the highest percentage in Economics and pollution (17.5%); although this last category was not very well represented in other countries. Indonesia stood out in Research and development, Brazil in cultural diversity, and Peru, South Africa, Colombia, Ecuador, and Costa Rica stood out in the use of natural resources with an average percentage of 20%. Despite the low total of news items in the category of invasive and alien species, this category was represented in Australia, Japan, New Zealand, and Chile. On the other hand, in Ecuador and South Africa, the categories of Tourism and Wildlife Sightings stood out.

The categorized news items had a greater focus on terrestrial ecosystems (44.81%) and global biodiversity (51.79%) compared to marine ecosystems (3.40%)
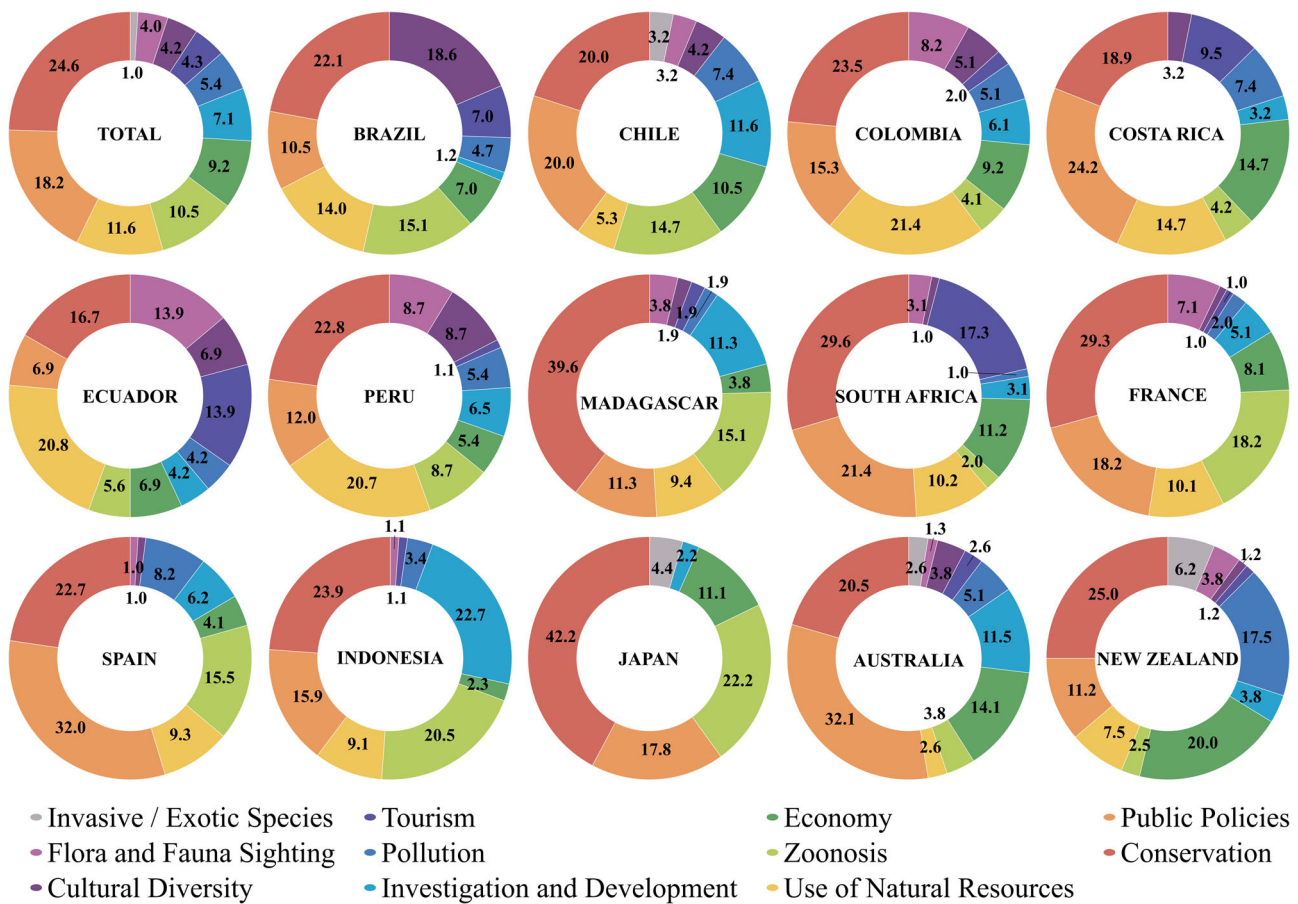
Fig. 2 Relative frequencies of news items classified in each category as total and for individual countries

(Fig. S2a). On the other hand, news stories had a predominantly positive focus in all countries and accounted for 61.05% of the total (Fig. S2b).

Relationship between News Categories, Socioeconomic Indices, and Pandemic Indicators

The PCA results show that the first eigenvector (PCA1) had an eigenvalue of 4.49 and explained 28.05% of the variance of the data and the second vector (PCA2) had a value of 2.79, explaining 17.45% of the variance. Together these two axes explained 45.5% of the total variance (Table S5, Fig. 3). PCA1 is explained by the GDP, Gini Index, measures of government restrictiveness, number of cases and deaths, and the following news categories: Invasive and Exotic Species, Natural Resource Use, Wildlife Sightings (FFS), and Cultural Diversity. PCA2 is explained by the number of cases and deaths, the restriction measures and Gini Index, and the following news categories: Zoonosis, Research and Development, Tourism, and Economy (Fig. 3). These results were consistent with those obtained in the cluster analysis in which four groups were generated, the first of which corresponded to New Zealand, Australia,

and Japan grouped by presenting high values of GDP and news associated with Invasive and Exotic Species. The second group was composed of Latin American countries and South Africa that presented high Gini values and news associated with Tourism. The third group corresponded to Chile and Peru due to the high numbers of cases and deaths. The last group was composed of European countries for having high numbers of cases and deaths, as well as a higher GDP, a lower Gini Index, and the zoonosis category.

Significant correlations between indices and news categories (Table S6, Fig. 4) explained the grouping of countries in the different clusters. For the first cluster, there is a positive correlation between GDP and Invasive and Alien Species (IAS), Pollution and Economy, IAS and Economy, and IAS with Pollution. In the second cluster, we can observe a positive correlation between the Gini Index and Tourism and FFS and Natural Resource Use (UNR) and a negative correlation between the number of Cases and Cultural Diversity and GDP with Natural Resource Use. In the third cluster, the correlation between the number of cases and deaths was positive. Finally, in the fourth cluster, we observed that the variables Economy and Zoonosis were negatively correlated.
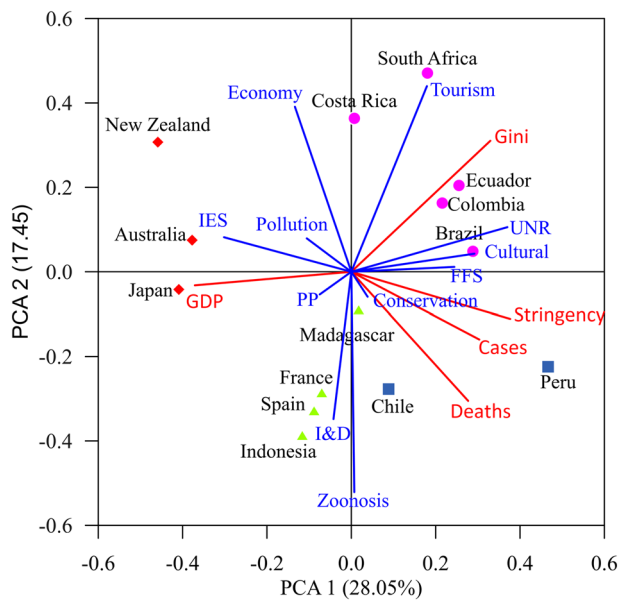
Fig. 3 Principal component analysis where variable scores are represented by blue lines (indices) and red lines (news categories). Countries are categorized into 4 groups (differentiated by colored symbols) obtained via WPGMA cluster analysis. IES Invasive/Exotic Species, R&D Research and Development: FFS Flora and Fauna Sighting, UNR Use of Natural Resources; AFW Agriculture, Food and Water; GDP Gross domestic product; Gini, Gini index

Discussion

Our results revealed three important findings: (1) Most news stories focused on conservation, public policies, and the use of natural resources; (2) News stories had a predominating positive focus and were related more to the terrestrial environment and global biodiversity than to the marine environment; and (3) Countries with greater inequality in income distribution were associated with tourism news, additionally, countries with low GDP, high number of deaths and infections by Covid-19 were associated with news about cultural diversity. In contrast, countries with high GDP and low inequality, were associated with news about zoonosis, research and development, public policies and alien and invasive species.

A General View of the Main Categories and Focus of Biodiversity-Related News

The various new items have highlighted that human activities and poor biodiversity conservation have exacerbated the Covid-19 pandemic. The scientific evidence suggests that where biodiversity has been lost, humans have found themselves in greater contact with animal species, which are
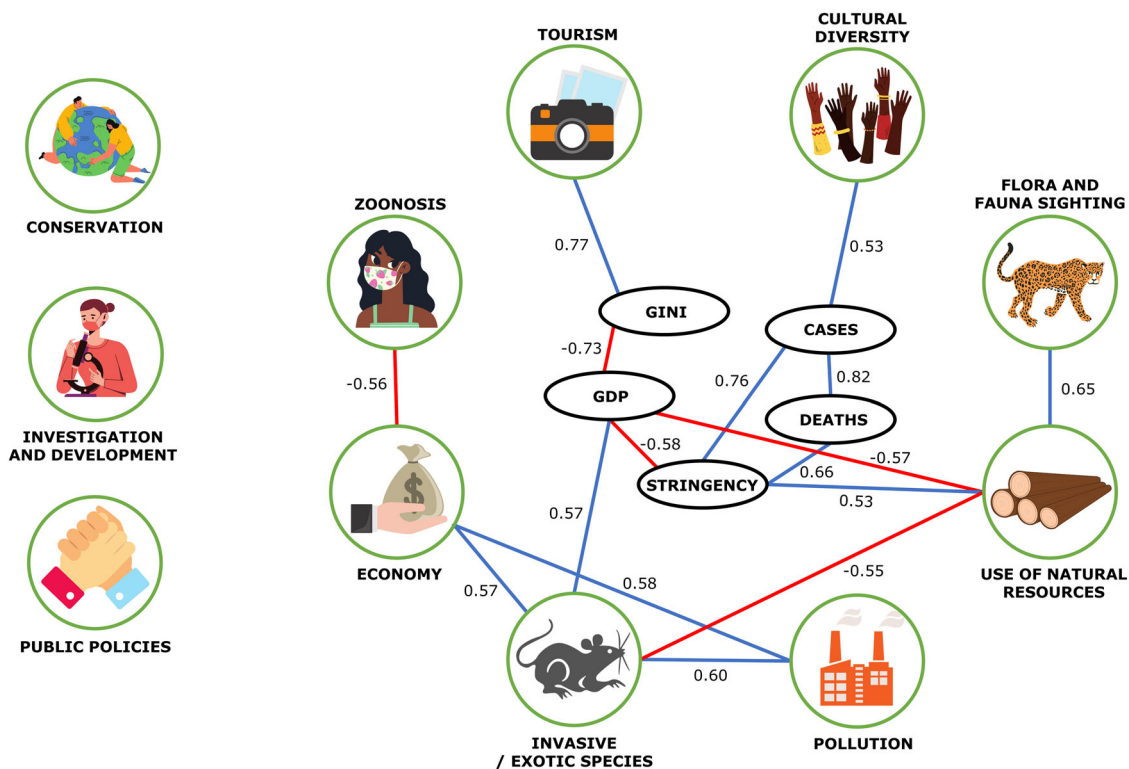

Fig. 4 Significant correlations between indices and news categories extracted from the Pearson matrix (Table S6). Red line: negative correlations; blue line: positive correlations; green circles: news categories; black circles: socioeconomic and pandemic severity indicators

the reservoir of new human pathogens (Keesing and Ostfeld 2021). Also typical of these news items is the narrative promoting greater rational and emotional engagement in people in favor of wildlife conservation (Shreedhar and Mourato 2020). On the other hand, immediately after the pandemic began, the media documented situations where human lockdown generated a decrease in environmental pollution, wildlife sightings in cities and, the emergence of flora in places where the usual traffic of people was reduced (Coll 2020). These may be the arguments as to why the Conservation category had a greater appearance in the digital media.

In the second place, public policies were highlighted because the Covid-19 pandemic not only produced a health crisis, but also generated a social and economic crisis, for which a discussion on the development of public policies to address the crisis considering the possible consequences on biological and cultural conservation (Kline and Moretti 2014), where the news highlighted the concern for protecting biodiversity through policies in pursuit of sustainable development (Heggen et al. 2020; Mejia et al. 2020). Following on from this, the next category highlighted was that of natural resources which was a function of how the services provided by ecosystems are to be used in economic reactivation, having a relationship with the dependence of Latin American and African countries on the use of their natural resources (Veltmeyer 2012; Long et al. 2017). Similarly, with the decrease in the global movement of the export and import sector in European countries, there are problems in the supply of raw materials due to the decrease in primary activities due to mobility restrictions presented in the countries as a sanitary measure (Shreedhar and Mourato 2020). In addition, this group of news highlights a concern about food security issues, highlighting the great dependence of Latin American countries on their resources, whose extraction is of great importance for their economy (Veltmeyer 2012; Long et al. 2017). Another reason why this category stood out during the pandemic is that there was a decrease in the extraction of natural resources (e.g., timber and fisheries) and an improvement in air and water quality (Muhammad et al. 2020; Zambrano-Monserrate et al. 2020).

The news had more frequently a positive approach because in times of crisis the language in which events are communicated has a conciliatory tone when incorporating these new concepts such as Covid-19, SARS-COV-2, and, Coronavirus, which can generate concern in the population (Piller et al. 2020). This could also be related to the main themes (conservation, public policies, and use of natural resources) that were presented in the news because the pandemic opens the opportunity to evaluate and generate changes in public and economic policies (Sandbrook et al. 2020). On the other hand, the predominance of the

terrestrial and global approach versus the marine approach could be because most human communities live their lives on land, minimizing their contact with the marine environment (Lotze et al. 2018). This is reflected in the low protection measures and currently low documentation on the effects of the pandemic on marine environments (Laffoley et al. 2020; China et al. 2021; Lovenduski et al. 2021).

Linking Biodiversity with the Socio-Economic and Health Context of Each Country

In addition to the level of closeness that people have with the different ecosystems, the socio-economic situation of the countries influence the activities, the lives of their inhabitants, and how they appreciate their relationship with biodiversity (Pocock et al. 2018). In the health crisis caused by the spread of the Covid-19 virus, it has become evident that depending on the socio-economic situation, the pandemic has affected the population of different countries to different degrees, as has occurred in the Chilean metropolitan region where people with lower resources have a higher prevalence of deaths (Dintrans et al. 2021), and in Colombia where the socioeconomic factor of the population has determined the degree of mortality of the population (Cifuentes et al. 2021). On the other hand, historically, countries with greater social and economic inequality have been the hardest hit by the crisis, especially their ecosystems (Mikkelson et al. 2007).

According to the analysis carried out, tourism news was associated with countries with greater inequality in income distribution, including South Africa, Ecuador, Costa Rica, and Brazil, where tourism plays a key economic role (World Tourism Organization 2013) due to the great diversity of animal and plant species and cultural ecosystem services (WEF 2013; Di Minin et al. 2016). However, this economic activity has been strongly affected by the Covid-19 pandemic (Mooney and Zegarra 2020), due to the impact that the restriction measures had, decreasing the economic growth of different countries whose economies depend on tourism (Gössling et al. 2020; World Tourism Organization 2020; Farzanegan et al. 2020). In these countries, national parks and nature tourism take advantage of aesthetic ecosystem services to obtain resources. However, as visitation decreases, people's interest in these places diminishes, which sounds like an alarm for local communities because their economic livelihood is at risk as long as the health situation does not change (Souza et al. 2021). The resulting decline in tourism can have negative effects on biodiversity by reducing incentives for environmental protection in the short and medium-term (López-Feldman et al. 2020).

Additionally, the health and economic crisis brought about by the Covid-19 pandemic has generated a latent concern about how the economic reconstruction should be

carried out once the health crisis is over. This is a necessary step for countries to foster greater resilience while decreasing their CO_2 footprint as they integrate into a circular economy (Ibn-Mohammed et al. 2021). In countries such as France and Spain, which are characterized by low inequality (lower Gini index) and high GDP, there is greater concern about issues such as zoonosis, research and development, and public policies, which is related to the initiative of European citizens to take measures to reduce their CO_2 footprint (IPSOS 2020), where it is expected that once the health crisis has passed, climate policies can continue to achieve carbon neutrality by 2050 (Dupont et al. 2020).

Countries with low GDP and high Gini Index such as Colombia, Ecuador, Brazil, and Peru have been the most impacted by the pandemic (more cases and deaths), and they are characterized by being multicultural, multiracial, and multiethnic (DANE 2007; BDPI 2020). A positive correlation is observed between the number of cases and cultural diversity, which could be due to the concern of these countries to preserve the indigenous gene pool of their population since this population has often been vulnerable to new infections due to their geographic and genetic isolation (Montenegro and Stephens 2006; Hotez et al. 2008; Ferrante and Fearnside 2020). On the other hand, countries such as Chile, Australia, and New Zealand have significant indigenous populations, but in the analysis, this issue is not a differentiating factor. In the countries of Oceania, there is recognition of the indigenous population, but cultural/genetic assimilation would be one of the reasons why this category is not relevant compared to others (Bodkin-Andrews and Carlson 2016). In Chile this may be because the pluricultural of its population is not recognized, maintaining the idea of a homogeneous population, causing situations of racism and segregation, which recent efforts by the community are trying to reverse (Postero et al. 2018). However, Chilean municipalities with larger indigenous populations exhibited high rates of infection and mortality, and this has not been mentioned by the government in its general reports (Millalen et al. 2020).

The category of Alien and Invasive Species (IAS) was presented in countries that are islands (i.e., Australia, New Zealand, Japan) and Chile, the latter considered a biographical island (Villagrán and Hinojosa 2005). However, only Japan, Australia, and New Zealand are grouped by the presence of invasive species and a high gross domestic product, correlating IAS positively with economy and pollution, being countries with stable economies where the incursion of alien species would generate losses in different industries (Hanley and Roberts 2019). In Chile, although invasive species is a problem, it is not a relevant issue in the news, because unlike Japan, Australia, and New Zealand, Chile has a greater number of cases and deaths, and thus the attention of the media and readers has been focused on issues surrounding the public health crisis such as zoonosis.

Digital media showed us a general view of the population on certain issues. The countries selected in this study present biodiversity hotspots except for France and Spain, but the latter in recent years have had policies to remedy climate change (Rupani et al. 2020; Andreoni 2021). The interests of the population, as observed in this study, will have a great influence on the impact of the health crisis such as the number of people infected by the Covid-19 virus and the mortality of its citizens in which they highlighted the zoonotic origin of the pandemic and its relationship with biodiversity (Corlett et al. 2020). The socio-economic characteristics of each population also have an influence, since the most vulnerable people are closely dependent on ecosystem services (Isbell et al. 2017).

Historically, different countries have had different problems such as pollution in Latin American countries, ethnic racism in countries such as Chile, South Africa, Australia, and New Zealand, stable epidemics such as HIV, and global change that affects the whole world. These problems have been made invisible due to the prominence that the humanitarian crisis caused by Covid-19 has gained in government agendas, which could cause efforts in terms of biodiversity to be diverted to alleviate this crisis, diminishing the attention that biodiversity issues received in the population. For these reasons, and with greater emphasis on countries with marine and terrestrial hotspots, actions should be taken to educate the population and protect biodiversity, to maintain the ecosystem services provided by the hotspots, so that sustainable economic development does not come under threat every time there is a crisis of the magnitude of the Covid-19 pandemic.

Conclusions

During the first stage of the pandemic, news stories with a positive narrative and a conciliatory tone predominated, searching for raising awareness of biodiversity conservation. These news stories were mostly related to terrestrial rather than marine environments, making visible our distance from the underexplored marine environment. Furthermore, across countries three main news categories stood out: (1) conservation, showing people's concern about maintaining biodiversity as a barrier to preventing zoonotic diseases; (2) public policies, highlighting the necessity of generating public policies to mitigate multifactor impacts (health, socioeconomic, and politic); and (3) use of natural resources, suggesting the improvement of resources quality due to quarantines and showing our great dependence on natural resources as they mean the continuous supply of raw materials.

On the other hand, the socio-economic characteristics and the health context of each country had an influence on which aspect of biodiversity was reflected in the news. We found a strong link between countries with greater inequality in income distribution and news related to tourism because the media reflected people and government concern on the impact that restrictions had on this activity, which plays a key role in their economy. Additionally, countries with low GDP, greater inequality in income distribution, and where the pandemic was most severe (high number of cases and deaths by covid-19) were linked to cultural diversity news, because in these countries the populations were concerned about the vulnerability of indigenous people and the government inaction. In contrast, countries with high GDP and low inequality were related to news about zoonosis, research and development, public policies, and alien and invasive species, because in these countries the media are concerned with other actual problems such as climate change, and how this is related to the pandemic and biodiversity. Our finding also highlighted how countries with stable economies were more worried about generating long-term solutions to face the pandemic, conversely, countries with socio-economic and sanitary issues were more concerned about solving problems that directly affected their economy and public health.

COVID-19 has patently demonstrated that the human footprint has affected the planet's ecosystems in different ways and magnitudes. It has been said that the lockdowns have been the largest scale experiment to observe the effects of our species on the planet. According to what we observed in the news of all the countries studied, in those periods where lockdowns were enforced, there were decreases in the levels of air pollution, sightings of wildlife in cities and oceans, and the emergence of vegetation in places where human presence was not possible. Unfortunately, as has been suggested in previous studies, when the lockdowns end, probably, the socio-economic systems of the different countries will come back in full force, ensuring that these little incursions made by Mother Nature will be short-lived.

Data availability

Data has been deposited at Figshare and are publicy available (https://doi.org/10.6084/m9.figshare.20103632.v2). All other data used and mentioned in the manuscript are provided as supplementary data.

Code availability

https://doi.org/10.6084/m9.figshare.20103632.v2.

Author Contributions ACM-H: Conceptualization, methodology, formal analysis, investigation, writing - original draft, writing - review & editing, visualization, supervision, project administration. SAR: Conceptualization, methodology, formal analysis, investigation, writing - original draft, writing - review & editing., visualization. EAM-C: Conceptualization, methodology, investigation, writing - original draft, writing - review & editing, visualization, supervision. MES: Conceptualization, methodology, investigation, writing - original draft, writing - review & editing, visualization, supervision. BNW: Conceptualization, methodology, formal analysis, investigation, writing - original draft, writing - review & editing., visualization. denisse torres-áviles: conceptualization, methodology, investigation, writing - review & editing. AEV: Conceptualization, methodology, investigation, writing - original draft. NAV-T: Conceptualization, methodology, investigation, writing - original draft. writing - review & editing. FAS: Conceptualization, methodology, validation, resources, supervision. CFG: Conceptualization, methodology, validation, resources, writing - original draft, writing - review & editing.

Compliance with Ethical Standards

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