Who is Writing the Science behind the Management of Protected Areas

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ABSTRACT

While protected areas are one of the most important strategies for the conservation of nature, their management is challenging, because they form part of a complex socio-ecological system. One constraining factor for their effective management is incomplete knowledge of the dynamics of the protected areas' systems. The lack of knowledge is not universal, but site specific. Our research shows that while male scholars affiliated to highly developed countries in the temperate and sub-tropical zones produced most of the scientific work related to protected areas, most of the biodiversity exists within the tropics and in less developed countries. We propose that, to improve the effectiveness of protected areas, it is essential to better distribute research efforts so that the knowledge that supports management of protected areas is rooted in the contexts of the more bio diverse environments.

Keywords: science, protected areas, bias, knowledge.

INTRODUCTION

In 1992, during the United Nations Conference on Environment and Development, 168 countries voluntarily ratified the Biological Convention, which in Target 11 established that 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas should be secured in protected areas (Convention on Biological Diversity, 2018).With that, protected areas became the most important strategy for the *in situ* conservation of nature (Le Saout et al., 2013). Despite their importance, management effectiveness varies greatly around the globe, while some protected areas are well-governed, well-designed and well-managed (International Union for the Conservation of Nature, 2017), others have been called 'paper parks' as they exist solely in law and do not fulfil their conservation targets (Di Minin and Toivonen, 2015, Bonham et al., 2008).

Though factors such as size, shape and budget influence the effectiveness of protected areas (Le Saout et al., 2013), three others factors seem to predominate: political interests (Kati et al., 2015, Gullison and Hardner, 2018), tourism (Job et al., 2017, Sinay 2002 and 2008, Sinay et al 2019a and 2019b) and science (Watson et al., 2016). While political interests define the economic resources available for the management of protected areas, science explains how management should take place, and tourism, if well implemented, influences visitors' attitudes towards conservation, which, in turn, have the potential to influence political interests. Therefore, science, tourism and political will are directly related to the effectiveness of protected areas and their management.

The science used to support protected areas management, however, is not always universal in its applicability, because its validity is affected by cultural, biological, economic, geographic, and political contexts. Therefore, knowledge developed, for example, for the management of the Auyuittuq National Park, which protects part of Canada's artic, is unlikely to be useful for managing the Amazon, which is affected by specific threats such as cocaine plantations, processing labs and related criminal activity (James, 2014). Knowledge and strategies locally produced are likely to be more effective than those developed elsewhere are.

Moreover, the transposition of protected areas management knowledge may have unexpected negative effects. This can be exemplified by the 'parks without people' approach, as proposed by the USA, which forced the expulsion of traditional custodians of many protected areas within the tropics, causing the extinction of indigenous cultures and the consequent creation of 'empty' ecosystems, which were quickly invaded by drug and agribusinesses that caused loss of the 'protected' resources (Amend and Amend, 1995, Sinay, 2008).
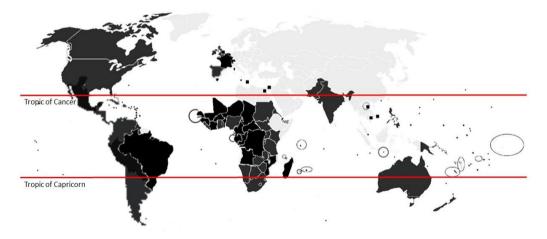
While the science behind the management of protected areas is largely site specific, there is evidence to suggest that science is generally being developed by male scholars (Ovseiko et al., 2016, Heidari et al., 2016, Roberts and Verhoef, 2016, Commission, 2012, Shen, 2013, Sinay et al, 2019), who are affiliated with institutions located in countries ranked as having very high human development level (Analytics, 2018a, Sinay et al, 2019), and where English is the official language (Analytics, 2018b, Sinay et al, 2019).

As most countries classified as having very high human development level are located in non-tropical zones (United Nations Development Programme, 2018) and most of the biodiversity is located within the tropics (Mannion et al., 2013), this research investigates if the same tendency is also the case for the science related to protected areas. That is, who are the scholars writing the science behind the management of Protected Areas?

METHODS AND MATERIALS

This investigation was based on two of the most used and most comprehensive scientific databases (Baneyx, 2008, Brown, 2014): Scopus, "the largest abstract and citation database of peer-reviewed literature: scientific journals, books and conference proceedings" and which encompasses only peer-review literature (Elsevier, 2018); and Google Scholar, which is not limited by the peer-reviewed restriction, instead it claims to cover all academic contributions from 'sensible' websites (Google, 2018) including 'grey' literature.

Figure1. *Countries were English, Spanish, Portuguese or French are spoken. Red lines indicate the tropics within which most of the biodiversity is locate*d

Source Adapted from Wikipedia, 2018, Wikipedia, argento, 2018

The research was performed in four languages: English, (protected areas), Spanish + Portuguese[1] (*areas protegidas*) and French (*aires protégées*).

[1] *As the term of search – areas protegidas - is the same for Spanish and Portuguese these languages were analysed together.*

These languages cover the American continent, most of Africa, a significant part of Oceania, some countries in Europe and Asia, and most of the countries within the tropical zone (Figure 1 and Table 1). No time limit was specified in the search; therefore, results encompass all publications

available in the Scopus and Google Scholar databases. Search on these databases was done

between October and November of 2018.

Table1. *List of Tropical countries*

NORTH AMERICA	CENTRAL AFRICA	SOUTHEAST ASIA
Mexico	Angola	Brunei
CENTRAL AMERICA	Cameroon	Burma (Myanmar)
Belize	Central African Republic	Cambodia
Costa Rica	Chad	East Timor
El Salvador	Congo	Indonesia
Guatemala	Democratic Republic of Congo (Zaire)	Laos
Honduras	Equatorial Guinea	Malaysia
Nicaragua	Gabon	Philippines
Panama	Sudan	Singapore
SOUTH AMERICA	Zambia	Thailand
Bolivia	**EAST AFRICA**	Vietnam
Brazil	Burundi	India
Colombia	Comoros	**OCEANIA**
Ecuador	Djibouti	Australia
French Guiana	Eritrea	
Guyana	Ethiopia	
Paraguay	Kenya	
Peru	Madagascar	
Suriname	Malawi	
Venezuela	Mauritius	
CARIBBEAN	Mayotte	
Anguilla	Mozambique	
Antigua and Barbuda	Reunion	
Aruba	Rwanda	
Bahamas	Seychelles	
Barbados	Somalia	
British Virgin Islands	Tanzania	
Cayman Islands	Uganda	
Cuba	**WEST AFRICA**	
Dominican Republic	Benin	
Grenada	Burkina Faso	
Guadeloupe	Côte d'Ivoire (Ivory Coast)	
Haiti	The Gambia	
Jamaica	Ghana	
Martinique	Guinea	
Montserrat	Guinea-Bissau	
Netherlands Antilles	Liberia	
Puerto Rico	Mali	
Saint Barthélemy	Mauritania	
Saint Kits and Nevis	Niger	
Saint Lucia	Nigeria	
Saint Martin (France)	Saint Helena	
Saint Vincent and the Grenadines	São Tomé and Principe	
Trinidad and Tobago	Senegal	
Turks and Cacaos Islands	Sierra Leone	
United States Virgin Islands	Togo	

Source. Produced by the authors

These databases were used in conjunct with two tools: SciVal – Scopus[2], which allowed identification of the number of publications per country, and Profile - Google Scholar[3], which was used to identify the most cited scholars and the number of times their works were cited. The data collected with Google Scholar were analyzed with Google to discover the institution of primary affiliation and the country; with Google Photos to find out the gender of the scholars; and with Wikipedia to learn the language spoken in each country, as well as the level of development.

RESULTS

The Scopus database in English, Spanish + Portuguese and French returned 178,266 works related to protected areas; 178,171 (99%) of these appeared in the English search, 80 (0.04%) in the Portuguese + Spanish search, and 15 (0.009%) in the French search (Table 2).

Table2. *SciVal Scopus retrieval for the search on Protected Areas in English, Spanish, Portuguese, and French*

	Protected areas
Number of publications total	178,266
Number of publications English search	178,171
Number of countries contributing	216
Number of publications Spanish + Portuguese search	80
Number of countries contributing	27
Number of publications French search	15
Number of countries contributing	7

Source. Produced by the authors

The works in the English database were written by scholars from 225 countries. Yet, five countries (USA, China, UK, Germany, and Italy) wrote nearly half of the total number of publications (87,121). Of these five countries, only China is not classified as having a very high human development level and is partly located within the tropics. The USA published alone 20 per cent of the works accessible in the Scopus database. The number of publications of the 196 countries least represented in the database nearly equals those of the USA (35,307 and 35,502 respectively). Similarly, the number of publications of the 210 countries least represented in the database nearly equals the combined total of the USA, China and UK (64,800 and 65,060 respectively). The 100 countries within the tropics published nearly 30,000 works (17% of the total number of publications); fewer than the number from the USA alone. Within the scholars primarily affiliated to countries located within the tropics, those affiliated to Australia, Brazil and India wrote about half of the works.

The 80 works returned from the Portuguese + Spanish database were written by scholars affiliated with 27 countries. Despite the language, 15 per cent of the publications were done by scholars affiliated with the USA. The number of publications of the 12 countries that published the least equals the number of publications of the USA. Less than 25 per cent of these 80 publications were by scholars affiliated with countries that have Spanish or Portuguese as the official language, while half of the publications were by scholars affiliated with countries where English is the official language. About a quarter of the publications were written by scholars affiliated with institutions within the tropics.

The 15-works encompassed in the French database were written by scholars affiliated to seven countries. Seven were published by USA and Canadian affiliated authors, and a third by scholars affiliated with institutions within the tropics.

The Google Scholar database in English, Spanish + Portuguese and French returned 141 scholars, 138 appeared in the English search, three in the Portuguese + Spanish search and one in the French search (Table 3).

Table3. *Google Profile retrieval for searches on Protected Areas in English, Spanish, Portuguese and French*

	Protected areas
Number of scholars total	141
Number of scholars English search	138
Number of scholars Spanish + Portuguese search	3
Number of scholars French search	1

The Portuguese + Spanish search retrieved a list with three scholars, two of whom were never cited, despite one having published eight works. These were male scholars from Colombia. The remaining scholar is a woman who was cited 50 times and is affiliated with a Brazilian university. The search of the French database only retrieved one result: a male scholar affiliated with a tropical institution in Benin. His work has been cited five times.

The search in English retrieved a significantly larger number of scholars (138). Of the Top 10 scholars, eight are men, with three affiliated with tropical countries (two from Australia and one from Brazil). Only one is affiliated with a country that is not classified as having very high human development, yet he is a USA scholar temporarily working as a visiting professor in Brazil. The work of these 10 scholars was cited 85,662 times.

The Top 10 male scholars are also primarily affiliated with countries classified as having very high human development; the exception being the scholar previously mentioned,

temporarily working in Brazil. Only this scholar and one from Australia are primarily affiliated with institutions within a tropical country. The work of these 10 scholars was cited 75,770 times. Of the Top 10 female scholars retrieved from identical searches, nine are primarily affiliated with countries classified as having very high human development, the other is from Brazil. This Brazilian scholar is an American citizen with a PhD from an Australian university, country where she is currently working. Four are affiliated with countries in the tropical zone, two are from Australia, and one each from Brazil and Belize. The work of these 10 scholars was cited 24,770 times, slightly more than the number of citations of the most cited scholar (20,396).

The Top 10 scholars not within highly developed countries are affiliated with institutions within the tropics; six men and four women. Their works were cited 5,811 times, which corresponds to nearly a quarter of the number of citations of the most cited scholar and six percent of the number of citations of the 10 Top Scholars.

DISCUSSION

Although the target established in 1992 during the United Nations Conference on Environment and Development of 15 per cent of the world's land surface being protected (Schulze et al., 2018), many studies question their efficacy for protecting biodiversity and other cultural and natural resources (Craigie et al., 2010, Geldmann et al., 2013, Schulze et al., 2018).

While many studies inform the effectiveness of protected areas management (Chape et al., 2005, Hockings, 2006), few critically appraise the science behind management, how science is being conducted, whether it is sufficiently rigorous and replicable, or who is undertaking the studies. Who is developing the science underpinning the effectiveness of protected areas is fundamental, not only due to particularities of different ecosystems, but also because solutions are always embedded in context, especially the cultures of communities of place and interest.

An example to illustrate the importance of the cultural context in which management and conservation take place is the fight of Indigenous people for their right to stay and use their ancestral lands declared as protected areas. In the last decade, while the Federal court of Australia granted land title rights to the But

chula people (Kallee Buchanan, 2014) and the government employed Aboriginal rangers for the management of K'Gari (Fraser Island National Park) (Marie, 2018), the indigenous people of the Amazon were being decimated (Wallace, 2017, Missionário, 2018), while Brazilian politicians running for presidency were raising votes with the promise of terminating indigenous reserves (Gomes, 2018, Rezende, 2018). Such differences and lessons to be shared, despite the similarities of continental dimensions and being situated on the same parallels, make it difficult for an Australian scholar to fully understand the complexity of the political forces influencing the Amazon and protected areas management. This is further confounded by the need for conservation action across over the nine Amazonian countries, each with their own socio-political contexts. It is more likely that a local scholar who speaks the local languages and understands the cultural and political contexts will be more capable of interpreting lessons from their place of origin and reciprocally provide lessons and insights from context-specific cases.

CONCLUSION

Analysis of the Scopus and the Google Scholar databases regarding protected areas indicate the tendency for knowledge to be generated by publications written by male scholars affiliated with countries classified as having very high human development, where English is the official language and located in non-tropical zones. Despite sheltering the vast majority of Earth's biodiversity with more than three-quarters of all species (Barlow et al., 2018), less than 20 per cent of the Scopus database was written by scholars from the tropics. The same applies for the Google Scholar database, which has among the Top 10 scholars only one from the tropics: a male, whose first language is English and who is affiliated with a highly developed country, Australia.

While demographics, cultural, economic, gender and political constraints might explain the underrepresentation of scholars primarily affiliated with tropical countries, practitioners and scholars must translate theories and principles that may not be applicable or appropriate to the realities of the protected areas situated in the most biodiverse regions of the planet. To improve and democratize representation, strategies for distribution of research budgets to address protected areas management need to be rethought to empower those that now have less voice:

scholars, particularly women, of countries in the tropics that do not have 'very high' development levels and do not have English as the official language.

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