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Social media's potential to promote conservation at the local level: an assessment in eleven primate range countries

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¹¹ **Abstract** – Historically, Internet access has been linked to a country’s wealth. However, starting a decade
¹² ago, this situation changed dramatically and Internet access became increasingly available in primate range
¹³ countries. The rapid growth of smartphone use in developing nations has created new avenues to communicate
¹⁴ conservation. Here we assess the potential of social media to promote primate conservation at the local level
¹⁵ within primate range countries. We interviewed 381 people in communities associated with 18 conservation
¹⁶ projects from 11 countries to assess their use of social media. We found that 91% of the people had at least one
¹⁷ social media account and 95% of these people checked their accounts daily. The median number of contacts
¹⁸ per person across all platforms was 453 and 300 considering only each person’s most used platform. We also
¹⁹ documented that local conservation projects had a diversity of information they wanted to relay to the local
²⁰ community through social media. Our research highlights the potential for social media to be an extremely
²¹ useful communication tool for tropical conservation scientists. Thus, we encourage more conservation groups
²² to explore using social media to communicate to local communities and to report on the impact it has on
²³ conservation.

²⁴ **Keywords** – conservation education, conservation outreach, digital communication, environmental awareness,
²⁵ Internet access, primate conservation.

²⁶ **Introduction**

²⁹ The widespread adoption of social media
³⁰ globally was hard to anticipate just a decade
³¹ ago. Social media now includes a huge number
³² of websites and applications that allow users
³³ to create and share content or to participate
³⁴ in social networking. There are now 3.6 billion
³⁵ people using social media – almost half
³⁶ of the people on the planet – with 2.7 billion
³⁷ people alone having Facebook accounts (Wu
³⁸ *et al.*, 2018; Statista, 2020). Academics are no
³⁹ exception to this trend and social media use by
⁴⁰ scientists is growing rapidly. For example, the
⁴¹ ResearchGate social network site has over 15
⁴² million users and is visited more than 150 million
⁴³ times a month (ResearchGate, 2020). Also,
⁴⁴ 13% of scientists use Twitter on a regular basis
⁴⁵ (Van Noorden, 2014).

⁴⁷ The use of social media by scientists is particularly
⁴⁸ evident in conservation. Social media
⁴⁹ is used today as a tool for gathering data to
⁵⁰ address conservation issues, raise funding, and

⁵¹ communicate with the public and policy makers
⁵² to influence their actions to protect biodiversity
⁵³ (Vercammen *et al.*, 2020; Veríssimo *et al.*, 2020).
⁵⁴ Social media can be an effective way to collect
⁵⁵ digital data for conservation (Levin *et al.*, 2015;
⁵⁶ Forrester *et al.*, 2017). For example, Van Hamme
⁵⁷ *et al.* (2021) screened over 850 Instagram pictures
⁵⁸ associated with mountain gorilla (*Gorilla beringei beringei*)
⁵⁹ ‘eco-tourism’, on which at least one human and one
⁶⁰ mountain gorilla were visible. They found that
⁶¹ in only 3% of the pictures, tourists respected the
⁶² 7+ m distance rule (Macfie and Williamson,
⁶³ 2010). In another study, Levin *et al.* (2015)
⁶⁴ used data from the Flickr photo-sharing website
⁶⁵ to identify natural areas that were not protected
⁶⁶ where a large number of photographs had been
⁶⁷ taken, such as the Pantanal of Brazil. The
⁶⁸ researchers suggested that such areas would
⁶⁹ have the public’s support if they were to be
⁷⁰ suggested for protected area status. Musing *et al.*
⁷¹ (2015) obtained online videos of slow lorises
⁷² (*Nycticebus* spp.), which they supplemented
⁷³ with data from pet shops and informants, to
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document the extent of this illegal trade and to propose way of curbing it. Researchers used Instagram posts of endangered Hawaiian monk seals (*Neomonachus schauinslandi*) to not only supplement traditional population monitoring, but also to assess the frequency of human-seal interactions and animal disturbances (Sullivan *et al.*, 2019). Google search trends have been use to map changes in the spatial distribution of invasive plants to aid in their control (Proulx *et al.*, 2014). By mining data from Instagram, researchers demonstrated that characteristics of the protected area (e.g., accessibility) determined social media usage and not charismatic species richness (Hausmann *et al.*, 2017). These examples clearly illustrate the potential for social media data to be used to advance conservation efforts.

Public enthusiasm to participate in conservation through social media is high, as demonstrated by the over 1.9 million registered volunteers in Zooniverse and over 1 million users of iNaturalist, two online citizen science platforms (Arts *et al.*, 2015). On these platforms, people in 2020 are particularly drawn to projects addressing conservation and biodiversity – 51 of the 56 projects tagged as “Most popular” on Zooniverse (accessed 16 March 2020) fit these categories. Building on this enthusiasm, researchers have started to use social media data to document trends in public interest in conservation issues (Ficetola, 2013; Soriano-Redondo *et al.*, 2017) and to monitor ecosystem services and trade (Galaz *et al.*, 2010). However, effective use of social media to drum up support for conservation is not always achieved. For example, Acerbi *et al.* (2020) obtained online interest data to evaluate the attention given to the publication of the “World’s 25 Most Endangered Primates”, finding that the release had only limited effect on the public.

Of course, social media is not just a data collection tool. The use of social media to communicate conservation messages has grown in popularity and takes many forms. For decades now large conservation groups have engaged in extensive and costly social media campaigns to raise awareness and to connect to potential donors. Recently, small conservation

groups and individual researchers have also taken to social media to communicate messages about wildlife exploitation, their conservation activities, and to raise donations (e.g., <https://www.sadabe.org>, <https://www.himaninautiyal.com>, <https://www.tce-programme.org/>). However, most conservation communication efforts using social media are targeted to the public in high-income countries, particularly tailored towards raising awareness (Nekaris *et al.*, 2013) (e.g., <https://www.facebook.com/ThePrimateCast/>) and marketing (Harrington *et al.*, 2018; Thomas-Walters *et al.*, 2020) (e.g., <https://kibalechimpanzees.wordpress.com/2018/06/12/get-your-kcp-t-shirt-for-world-chimpanzee-day/>).

Communicating globally and using social media for fundraising in high-income countries is clearly valuable for conservation. However, given the proportion of the world’s population on social media, one might expect that social media platforms could also be used to relay conservation messages to rural and often remote communities living next to and in primate habitats, as it has been done in the United States where 58% of rural people used social media in 2015 (Perrin, 2015). In their daily lives, these communities engage in activities that positively (e.g., wildlife monitoring, self-policing, environmental education) or negatively (e.g., bushmeat hunting, mining, logging) impact primate populations. Their behavior can be nudged towards positive actions through the social media they receive.

In this study, we assess the potential of using social media to promote primate conservation at the local level within primate range countries. Such efforts could target, for example, people living adjacent to protected areas with specific conservation messages. We explore a) the number of local people who could receive the message sent from the conservation group and b) the diversity of issues that could be targeted to specific communities, through the collection of two datasets. First, we asked people that our conservation programs interacted with (e.g., field assistants, cooks, village leaders), if they had social media accounts, and if so, what platforms they used and how many contacts they

1 had in their social media network (e.g., the number of Facebook Friends, TikTok followers, or WhatsApp contacts). The type, frequency, and nature of the use of social media platforms vary substantially among cultures and regions (Wang and Liu, 2019; Sheldon *et al.*, 2020). For example, the most widely known difference in the use of social media deals with the ban of Facebook and Twitter in China (Leetaru *et al.*, 2013; Mao and Qian, 2015). As a result, to ensure a diversity of perspectives and experiences in our evaluation, we gathered a team of academics from around the world who were from or had worked extensively with local communities in 11 primate-range countries. Second, we detailed the types of information that the local conservation projects wanted to provide the local community.

21 Methods

22 We targeted 18 conservation efforts where an academic was associated with a group that worked extensively with local communities in primate-range countries. To obtain a global perspective we included projects from Brazil, China, Colombia, Democratic Republic of the Congo, Ethiopia, India, Indonesia, Madagascar, Mexico, Rwanda, and Uganda. All of the communities had reliable access to the internet, which was typically used with smart phones. For none of the communities would it have been difficult to buy or repair a cell phone. The conservation groups were engaged in a diversity of activities including, education and outreach, conservation festivals, advance degree training, mobile health clinics, tourism, mitigating human-wildlife conflict (particularly crop raiding), reforestation, habitat restoration, teaching sustainable agriculture, park revenue sharing, and patrolling for illegal hunting, logging, or mining. Therefore, their local counterparts included a diverse array of players. While this between-study site diversity does not allow to treat the studies as replicas, their very heterogeneity meets our goal of characterizing the variety of scenarios in which social media can play a significant role in promoting biodiversity conservation.

We collected two types of data. First, to evaluate the potential reach that a social media post could have, we asked each project to communicate to people they worked with (e.g., farmers, herders, field assistants, local teachers, local village leaders, rangers, and residents living next to protected areas) and asked them to tell us all of the social media platform they used, if any. We then asked how many social contacts they had on each platform, and how often they checked social media. When doing this we informed the person of the purpose of the study, told them they should in no way feel pressured to participate, and told them we would not associate their name with the information. This was viewed as culturally acceptable and none of the local members of the 18 conservation groups could envision any risk associated with providing us this information (Villamar *et al.*, 2018). We asked each conservation group to interview all people they would want to communicate with, regardless of whether they thought the person would use social media. As some social media platforms notify members immediately if a message is received, often with audible and visual signals, we report the frequency of social media use (i.e., accessing the platform) as either daily or less than once a day. No one refused to answer our questions.

Second, to understand how the conservation projects might use social media, we asked each group to provide a short list of the type of information that they would envision relaying to the community. We emphasized that this list was not to be what their group had relayed, but simply the type of information they might want to share with the community.

We report social media use considering the whole sample and on a country-by-country basis. When comparing countries, interpretations should be made with caution as we have no assessment of within country variation in social media use. For example, a particular site in a country with high social media use could be remote with poor Internet access; thus, the single site would not represent the country as a whole. To assess the potential reach that a message could have if it was forwarded, we provide the average number of contacts across

all platforms and each person's most used platform. Considering the contacts across all platforms would represent the greatest reach a message could have, but assumes that the contact list on the different platforms are independent, which is unlikely to be the case. In contrast, considering the number of contacts on each person's most used platform is more conservative, but assumes that people will only forward messages from the one platform. To describe contact information we report the range, mean, and median. When considering the potential of a message that is reposted to reach an audience, the high values in a skewed distribution are meaningful, thus the range and average are meaningful.

Results

Eighteen conservation projects from 11 countries participated in our assessment of the potential of communicating conservation messages via social media to their local communities (table 1, fig. 1). In total, 381 individuals provided the requested information. Of this total, only 36 of these 381 individuals (9.5%) did not have a social media account. Of the 344 people with social media accounts, 327 (90.1%) check their accounts at least daily and only 17 (4.9%) did not. More than half (55.2%) of these

individuals used more than one platform (1 platform = 44.8%, 2 = 26.5%, 3 = 21.2%, 4 = 6.4%, 5 = 1.2%).

As is common with social media data (Chapman *et al.*, in press), the number of contacts people had was highly skewed. Considering all platforms, 271 people had less than 1000 contacts, 95 people had more than 1000 contacts, other 10 had 5000 contacts and other 4 people had over 10 000 contacts. One person, a feeder of giant pandas in China, had 2 754 201 TikTok followers. The people with the second and third most contacts (168 031 and 40 200) were tour operators. The median number of contacts per person across all platforms was 453 and 300 considering only each person's most used platform.

Facebook (59.6% of those interviewed), WhatsApp (40.9%), and Instagram (24.9%) were the most used platforms in our sample. However, there were differences in the types of platforms available or preferred from region to region. In China for instance, only 2% of participants used Facebook (this site was banned in 2009), while 100% used WeChat, a platform no other participants in the study used. Furthermore, 51.2% of participants in China used TikTok and Kuaishou, platforms that participants from other countries did not use.

Table 1. Description of the use of social media of local community members neighboring conservation projects in 11 primate range countries. N = number interviewed. Note: These values should be interpreted with caution as we have no assessment of within country variation in social media use.

Country	# Interviewed	% Not using social media	Median all contacts	Median highest single platform
Brazil	32	9	457	275
China	41	0	309	309
Colombia	23	13	296	195
DR Congo	20	0	546	373
Ethiopia	16	38	393	163
India	25	0	782	782
Madagascar	20	35	568	342
Mexico	80	0	717	440
Rwanda	52	21	1432	308
Sulawesi	12	0	2035	1526
Uganda	60	0	50	50



Figure 1. The location the 18 conservation sites in the 11 countries that interviews were conducted concerning social media use.

The major reason that the conservation groups gave for using social media was categorized into six classes. The most common reason (34.0%) conservation groups gave for using social media was that they wanted to announce and advertise meetings or events. The nature of the events varied from social gatherings (e.g., party to celebrate Lemur Day or the showing of a nature film), to educational talks (e.g., how to improve local health), to organizational meeting (e.g., plans to dig a trench to deter elephant crop raiding). The second most common reason (20.8%) was to educate the community. The education messages were diverse, including improved farming methods, the risk of primate diseases, proper disposal of plastic bottles, and simply conveying the wonders of nature. Conservation groups also wanted to use social media to request help from the community (18.9%), such as asking for volunteer to plant seedlings, or gathering information about aspects of community life such as the frequency of crop raiding. The fourth most frequently given major reason to use social media (13.2%) was to inform the community about planned research or to present the findings of completed

research. Fifth, conservation groups sometimes wanted to present news (9.4%). For example, to tell the community that another chimpanzee had been injured by a snare or that the project had planted some number of seedlings. Finally, conservation projects sometimes (3.8%) wanted to share good news about the community itself (e.g., a specific community member just graduated from nursing school, or which team won a football match).

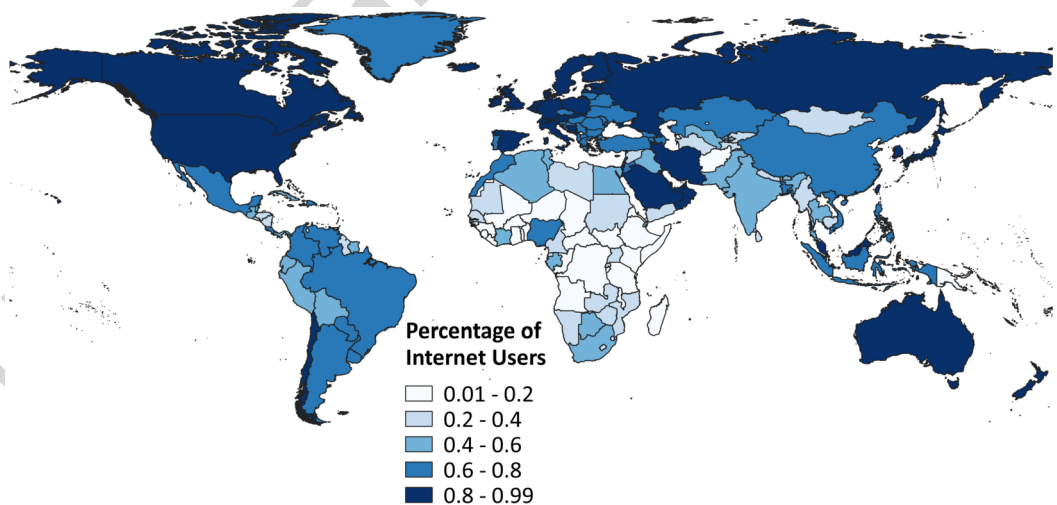
Discussion

Our assessment of select conservation projects around the world demonstrates that most people in the communities neighboring primate conservation projects use one or more social media platforms and check their feeds daily. This suggests that conservation projects can use social media as an effective tool to communicate locally. Each of the 18 projects considered had information or news that they wanted to disseminate to these communities. For instance, frequently, foreign scientists are criticized for not conveying the research findings to the local communities and thus not being inclusive in

1 their research approach (Blair, 2019; Erondu *et*
 2 *al.*, 2021; Massey *et al.*, 2021). The local use of
 3 social media provides an effective way to com-
 4 municate research findings. Often researchers
 5 only fully understand their data after they have
 6 left the field site and have returned to their
 7 universities and performed detailed analysis.
 8 Returning to the field site where the research
 9 was conducted can be difficult and expensive,
 10 particularly for international students. But once
 11 systems are established to convey informa-
 12 tion through social media, these difficulties are
 13 largely removed. Such systems can be as sim-
 14 ple as a list of WhatsApp contacts or a Face-
 15 book group. It will be important that these sys-
 16 tems involve local leaders moderating posts, and
 17 when researchers post, they would need appro-
 18 priate ethical clearance.

19 Internet access and social media use are
 20 widespread, particularly in middle income
 21 countries, such as Brazil and Mexico (Poushter,
 22 2016). Even in low-income countries 20-30%
 23 of the population are often connected to the
 24 Internet (fig. 2). In primate range countries
 25 the average percentage of the population that
 26 were Internet users in 2020 was 39% (fig. 2).
 27 This represents 3.4 billion people. Internet users
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are defined as people who accessed the Inter-
 net in the last 12 months from any device,
 including mobile phones. This level of social
 media usage offers an important and relevant
 channel to disseminate and maintain conserva-
 tion efforts near protected areas. While low-
 income countries have a smaller percentage of
 Internet users, using social media to commu-
 nicate with key actors presents the possibility
 to spread important information through tradi-
 tional word of mouth networks. Furthermore,
 the percentage of internet users will increase as
 Internet penetration rate is typically high. We
 were able to obtain data from 89 primate range
 countries on the proportion of their population
 that had internet coverable <https://ourworldindata.org/grapher/3g-mobile-network-coverage-of-population>, Accessed November 22, 2021). We found that for 36% of the countries, 90% of their populations were in areas accessible to the Internet. Over half (51%) of the countries had 80% of their people in Internet accessible areas and for only 24% of the countries were less than 50% of the people covered. Unfortunately, social media will not be an effective communication tool in some key primate conservation areas, such as the Amazon and Congo basin, that have poor Internet coverage and may have



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47 **Figure 2.** A global map of the intensity of Internet users in for 2020. Internet users are defined as people who
 48 accessed the Internet in the last 12 months from any device, including mobile phones. The estimates are derived
 49 either from household surveys or from Internet subscription data and the raw data and sources can be found at
 50 https://en.wikipedia.org/wiki/List_of_countries_by_number_of_Internet_users.

1 for some time. For example, there are only 29
2 towns larger than 25 000 people in the state of
3 Amazonas (~ 1.6 million $\text{km}^2 = 19\%$ of Brazil's
4 territory), and Internet access usually terminates
5 a few kilometers from the town (Carlos Peres,
6 pers. comm., November 22, 2021).

7 Examples of the use of social media to com-
8 municate to the local level in primate range
9 countries are rare. However, in Morocco, Face-
10 book proved to be an effective way to engage
11 the public (Waters and El-Harrad, 2013). It was
12 used to provide the public with information and
13 to anonymously report the illegal wildlife trade
14 of Barbary macaques (*Macaca sylvanus*) and
15 animals being illegally used for tourist pictures.
16 Facebook was also part of a campaign launched
17 to inform the lay public and the mass media
18 about the actual role played by howler monkeys
19 (*Alouatta* spp.) as sentinels of the arrival of the
20 yellow fever in a region in Brazil ([https://www.
21 facebook.com/Campanha-Proteja-seu-Anjo-da-
22 Guarda-243621236063810/](https://www.facebook.com/Campanha-Proteja-seu-Anjo-da-Guarda-243621236063810/); Bicca-Marques,
23 2018). The conservation efforts with slow lo-
24 rises (*Nycticebus* spp.) represents an example
25 of taking social media from the local to global
26 scale to promote primate conservation efforts
27 (Nekaris and Campbell, 2012; Nekaris *et al.*,
28 2013; Nekaris *et al.*, 2015). The scarcity of pub-
29 lished examples at the local level, suggests that
30 the use of social media as a tool to commu-
31 nicate conservation messages at this level in
32 primate range countries is underappreciated or
33 under documented.

34 It would be unfair of us not to provide
35 a few words of caution to academics seek-
36 ing to promote conservation through social
37 media. Academia is a very competitive profes-
38 sion (Chapman *et al.*, 2019). Using social media
39 for scientific or conservation purposes demands
40 considerable time commitments. Several online
41 sites suggest that effective participation in social
42 media aimed at an academic audience involves
43 a full suite of activities, including having one's
44 own blog, writing lay summaries to papers pub-
45 lished, uploading data, images, PowerPoint pre-
46 sentations, and posters, reaching out to key
47 bloggers in the field, working with the univer-
48 sity's press office, and using a variety of social
49 media outlets (Sugimoto *et al.*, 2017). Just the

work to write a blog entry is estimated to take
51 about 3.5 hours per week (Strong, 2018). This
52 is a significant time commitment; thus, conser-
53 vation scientists should consider when in their
54 career they invest this time and likely invest in
55 getting the training to be both effective and effi-
56 cient.

57 At present, practicing conservation activi-
58 ties, such as holding community workshops,
59 doing abundance surveys, or communicating to
60 local communities over social media, is typi-
61 cally viewed as, at best, only nominally con-
62 tributing to academic advancement (Chapman
63 and Peres, 2021). Many of these endeavors are
64 undervalued in the tenure and promotion pro-
65 cess (Alperin *et al.*, 2019). This needs to be
66 changed by academics established in the sys-
67 tem. However, until it does, early career sci-
68 entists wishing to most effectively promote con-
69 servation may wish to make a long-term career
70 plan. This would involve deciding at what stage
71 of their career it is best to invest in what activi-
72 ties to ensure the greatest conservation impact.

73 Historically, Internet access has been strongly
74 linked to gross national per-capita income
75 (Poushter, 2016). However, starting approxi-
76 mately a decade ago this situation changed
77 rapidly, and Internet access became dramati-
78 cally more available in primate range countries.
79 For example, with the improvement of Inter-
80 net access, social media networking became
81 more popular in Latin America than in Europe
82 or the United States (Poushter, 2016; Hagg
83 *et al.*, 2018). In 2015, one third of the peo-
84 ple in developing nations owned smartphones
85 (Poushter, 2016) and the numbers are growing
86 rapidly. This rapid growth of the use of smart-
87 phone in developing nations, including primate
88 range countries, caught groups seeking to com-
89 municate to rural communities in low-income
90 countries by surprise. In fact, in 2018 Hagg
91 *et al.* stated that “descriptions of, and investiga-
92 tions into, the use of social media for health
93 in low- and middle-income countries emerged
94 only recently in the literature”. Clearly the
95 potential of this form of communication for a
96 variety of endeavors, including primate conser-
97 vation, has not yet been fully appreciated. Our
98 data clearly demonstrates the potential for social
99 100

media to be a useful communication tool for tropical conservation scientists. Given this, and the current threats primates and their habitats face (Estrada *et al.*, 2017; Kalbitzer and Chapman, 2018; Chapman *et al.*, 2020), we encourage more groups to explore using social media to communicate to local communities and to report on the impact it has on conservation.

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Statement of ethics

This study adhered to the Code of Best Practice for Field Primatology.

Conflict of interest statement

The authors have no conflicts of interest to declare.

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Author contributions

Jorge Ramos Luna, Cate Twining-Ward, Juan Carlos Serio-Silva, and Colin Chapman conceived of the project. Janaína Paula Back, Joselyne Barakagwira, Júlio César Bicca-Marques, Mathilde Chavin, Nona Diko, Julia Duboscq, Pengfei Fan, Carmen Galán-Acedo, Songtao Guo, Diana Guzman-Caro, Rong Hou, Beth Kaplin, Addisu Mekonnen, Paulin Mungogo, Himani Nautiyal, Patrick Omeja, Nancia Raelinjanakolona, Veronarindra Ramananjato, Onja Razafindratsima, Cécile Sarabian, Risma Yanti, and Juan Carlos Serio-Silva collected the information. The data was analyzed by Jan F. Gogarten, Urs Kalbitzer, Dipto Sarkar, and Colin Chapman. Colin Chapman led the writing but all authors contributed.

Data availability

All data generated or analyzed during this study are included in this article. Further enquiries can be directed to the corresponding author.

References

- Acerbi A, Kerhoas D, Webber AD, McCabe G, Mittermeier RA, Schwitzer C (2020). The impact of the “World’s 25 Most Endangered Primates” list on scientific publications and media. *Journal for Nature Conservation* 54: 125794.
- Alperin JP, Nieves CM, Schimanski LA, Fischman GE, Niles MT, McKiernan EC (2019). Meta-research: how significant are the public dimensions of faculty work in review, promotion and tenure documents? *eLife* 8: e42254.
- Arts K, van der Wal R, Adams WM (2015). Digital technology and the conservation of nature. *Ambio* 44: 661–673.
- Bicca-Marques JC (2018). Infectious diseases, scientific discourse and the media: challenges to biodiversity conservation. In *Primateology, Bio-Cultural Diversity and Sustainable Development in Tropical Forests: a Global Perspective* (Sanz N, Dennell R, eds.), pp. 226–239. Mexico City, UNESCO.
- Blair ME (2019). Toward more equitable and inclusive spaces for primatology and primate conservation. *International Journal of Primatology* 40: 462–464.
- Chapman CA, Bicca-Marques JC, Calvignac-Spencer S, Fan P, Fashing PJ, Gogarten J, Guo S, Hemingway CA, Leendertz F, Baoguo L, Matsuda I, Hou R, Serio-Silva JC, Stenseth NC (2019). Games academics play and their consequences: how authorship, h-index, and journal impact factors are shaping the future of academia. *Proceedings of the Royal Society B: Biological Sciences* 286(1916): 20192047.
- Chapman CA, Bicca-Marques JC, Dunham AE, Fan P, Fashing PJ, Gogarten JF, Guo S, Huffman MA, Kalbitzer U, Li B, Ma C, Matsuda I, Omeja PA, Sarkar D, Sengupta R, Serio-Silva JC, Tsuji Y, Stenseth NC (2020). Primates can be a rallying symbol to promote tropical forest restoration. *Folia Primatologica* 91: 669–687.
- Chapman CA, Hemingway CA, Sarkar D, Gogarten JF, Stenseth NC (in press). Altmetric scores in conservation science have gender and regional biases. *Conservation & Society*.

- 1 Chapman CA, Peres CA (2021). Primate conservation: lessons learned in the last 20 years can guide future efforts. *Evolutionary Anthropology* 30: 345–361.
- 2
3
4
- 5 Erondu NA, Aniebo I, Kyobutungi C, Midega J, Okiro E, Okumu F (2021). Open letter to international funders of science and development in Africa. *Nature Medicine* 27: 742–744.
- 6
7
8
- 9 Estrada A, Garber PA, Rylands AB, Roos C, Fernandez-Duque E, Di Fiore A, Nekaris KAI, Nijman V, Heymann EW, Lambert JE (2017). Impending extinction crisis of the world's primates: why primates matter. *Science Advances* 3: e1600946.
- 10
11
12
13
- 14 Ficetola GF (2013). Is interest toward the environment really declining? The complexity of analysing trends using Internet search data. *Biodiversity and Conservation* 22: 2983–2988.
- 15
16
17
- 18 Forrester TD, Baker M, Costello R, Kays R, Parsons AW, McShea WJ (2017). Creating advocates for mammal conservation through citizen science. *Biological Conservation* 208: 98–105.
- 19
20
21
- 22 Galaz V, Crona B, Daw T, Bodin Ö, Nyström M, Olsson P (2010). Can web crawlers revolutionize ecological monitoring? *Frontiers in Ecology and the Environment* 8: 99–104.
- 23
24
25
- 26 Hagg E, Dahinten VS, Currie LM (2018). The emerging use of social media for health-related purposes in low and middle-income countries: a scoping review. *International Journal of Medical Informatics* 115: 92–105.
- 27
28
29
- 30 Harrington LA, D'Cruze N, Macdonald D (2018). Rise to fame: events, media activity and public interest in pangolins and pangolin trade, 2005–2016. *Nature Conservation* 30: 107–133.
- 31
32
33
- 34 Hausmann A, Toivonen T, Heikinheimo V, Tenkanen H, Slotow R, Di Minin E (2017). Social media reveal that charismatic species are not the main attractor of ecotourists to sub-Saharan protected areas. *Scientific Reports* 7: 1–9.
- 35
36
37
38
- 39 Kalbitzer U, Chapman CA (2018). Primate responses to changing environments in the Anthropocene. In *Primate Life Histories, Sex Roles, and Adaptability – Essays in Honour of Linda M. Fedigan, Developments in Primatology* (Kalbitzer U, Jack KM, eds.). New York, Springer.
- 40
41
42
43
- 44 Leetaru K, Wang S, Cao G, Padmanabhan A, Shook E (2013). Mapping the global Twitter heartbeat: the geography of Twitter. *First Monday* 18.
- 45
46
47
- 48 Levin N, Kark S, Crandall D (2015). Where have all the people gone? Enhancing global conservation using night lights and social media. *Ecological Applications* 25: 2153–2167.
- 49
50
- Macfie EJ, Williamson EA (2010). *Best Practice Guidelines for Great Ape Tourism*, IUCN.
- 51
52
- Mao YY, Qian YY (2015). Facebook use and acculturation: the case of overseas Chinese professionals in Western countries. *International Journal of Communication* 9: 2467–2486.
- 53
54
55
56
- Massey MDB, Arif S, Albury C, Cluney VA (2021). Ecology and evolutionary biology must elevate BIPOC scholars. *Ecology Letters* 24: 913–919.
- 57
58
59
- Musing L, Suzuki K, Nekaris K (2015). Crossing international borders: the trade of slow lorises, *Nycticebus* spp., as pets in Japan. *Asian Primates Journal* 5: 12–24.
- 60
61
62
63
- Nekaris BKA-I, Campbell N, Coggins TG, Rode EJ, Nijman V (2013). Tickled to death: analysing public perceptions of 'cute' videos of threatened species (slow lorises – *Nycticebus* spp.) on Web 2.0 sites. *PLOS One* 8: e69215.
- 64
65
66
67
- Nekaris KAI, Campbell N (2012). Media attention promotes conservation of threatened Asian slow lorises. *Oryx* 46: 169–170.
- 68
69
70
- Nekaris KAI, Musing L, Vazquez AG, Donati G (2015). Is tickling torture? Assessing welfare towards slow lorises (*Nycticebus* spp.) within Web 2.0 videos. *Folia Primatologica* 86: 534–551.
- 71
72
73
74
- Perrin A (2015). Social media usage. *Pew Research Center* 125: 52–68.
- 75
76
- Pouster J (2016). Emerging, developing countries gain ground in tech revolution. Pew Research Center, 2016. (Retrieved from <http://www.pewresearch.org/facttank/2016/02/22/key-takeaways-global-tech/>).
- 77
78
79
80
- Proulx R, Massicotte P, Pepino M (2014). Googling trends in conservation biology. *Conservation Biology* 28: 44–51.
- 81
82
83
- ResearchGate (2020). <https://www.researchgate.net/>, January 20, 2020.
- 84
85
- Sheldon P, Herzfeldt E, Rauschnabel PA (2020). Culture and social media: the relationship between cultural values and hashtagging styles. *Behaviour & Information Technology* 39: 758–770.
- 86
87
88
89
- Soriano-Redondo A, Bearhop S, Lock L, Votier SC, Hilton GM (2017). Internet-based monitoring of public perception of conservation. *Biological Conservation* 206: 304–309.
- 90
91
92
93
- Statista (2020). Number of social network users worldwide from 2017 to 2025 <https://www.statista.com/statistics/278414/number-of-worldwide-social-network-users/>.
- 94
95
96
- Strong F (2018). Study: the perfect blog post length – and how long it should take to write <https://www.ragan.com/study-the-perfect-blog-post-length-and-how-long-it-should-take-to-write-2/>.
- 97
98
99
100

- 1 Sugimoto CR, Work S, Larivière V, Haustein S
2 (2017). Scholarly use of social media and altmet-
3 rics: a review of the literature. *Journal of the Asso-*
4 *ciation for Information Science and Technology*
5 68: 2037–2062.
- 6 Sullivan M, Robinson S, Littnan C (2019). Social
7 media as a data resource for #monkseal conserva-
8 tion. *PLOS One* 14: e0222627.
- 9 Thomas-Walters L, McNulty C, Veríssimo D (2020).
10 A scoping review into the impact of animal
11 imagery on pro-environmental outcomes. *Ambio*
12 49: 1135–1145.
- 13 Van Hamme G, Svensson MS, Morcatty TQ, Nekaris
14 KAI, Nijman V (2021). Keep your distance: using
15 Instagram posts to evaluate the risk of anthro-
16 ponotic disease transmission in gorilla ecotourism.
17 *People and Nature* 3: 325–334.
- 18 Van Noorden R (2014). Online collaboration: sci-
19 entists and the social network. *Nature News* 512:
20 126–129.
- 21 Vercammen A, Park C, Goddard R, Lyons-White J,
22 Knight A (2020). A reflection on the fair use
23 of unpaid work in conservation. *Conservation &*
24 *Society* 18: 399–404.
- 25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
- Veríssimo D, Pienkowski T, Arias M, Cugnière L,
Doughty H, Hazenbosch M, De Lange E, Moske-
land A, Grace M (2020). Ethical publishing in
biodiversity conservation science. *Conservation &*
Society 18: 220–225.
- Villamar AA, Diago OLS, Contreras EJC, Medi-
naceli A (2018). Código de ética para la investi-
gación etnobiológica en América Latina. *Ethno-*
scientia – Brazilian Journal of Ethnobiology and
Ethnoecology 3.
- Wang X, Liu Z (2019). Online engagement in social
media: a cross-cultural comparison. *Computers in*
Human Behavior 97: 137–150.
- Waters S, El-Harrad A (2013). A note on the effective
use of social media to raise awareness against
the illegal trade in Barbary macaques. *African*
Primates 8: 67–68.
- Wu Y, Xie L, Huang S-L, Li P, Yuan Z, Liu W (2018).
Using social media to strengthen public awareness
of wildlife conservation. *Ocean & Coastal Man-*
agement 153: 76–83.
- 51
52
53
54
55
56
57
58
59
60
61
62
63
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65
66
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