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VIEWPOINT

Adopt digital tools to monitor social dimensions of the global biodiversity framework

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1 | INTRODUCTION

The Kunming-Montreal Global Biodiversity Framework (GBF) envisions harmonious coexistence with nature. Realizing this vision depends on effectively monitoring progress toward the GBF's goals and targets. However, the GBF's current monitoring framework (Convention on Biological Diversity, 2022) has fundamental gaps. Of its 27 goals and targets, only nine have a complete set of headline indicators, while most goals either have no indicators to track their achievement or have at least one indicator that is only conceptual.

2 | ROLE OF SOCIAL INDICATORS

Of particular concern is the lack of indicators to track human attitudes toward species, biomes, and biodiversity more broadly. Monitoring human attitudes and behavior is critical to achieve several key GBF targets. For example, Targets 4 and 6 aim to resolve human–wildlife conflict and manage invasive species, respectively (Convention on Biological Diversity, 2022). These threat processes are inherently linked to human dimensions, so any monitoring focused solely on ecological measurement—and ignoring human behaviors and attitudes—will be at best incomplete. In the context of human–wildlife conflict, large-scale assessments have predicted conflict zones for species across continental scales using data on species ranges as well as human population densities, assuming an overlap in species range and human population leads to increased conflict risk. This assumption may hold at global scales, but conservation policy often unfolds at national-local scales, where highly heterogenous human behaviors and attitudes are the key factor influencing conflict risk. For instance, conflicts do not always correlate with physical damage or loss, with some societies and cultures being more tolerant to the presence of substantial damage and others retaining a high level of conflict even when species cause only negligible loss. Ultimately, our ability to understand and predict human-mediated threats such as human–wildlife conflict is contingent upon capturing this heterogeneity in behaviors and attitudes.

The same is true for threats such as biological invasion. In this context, our ability to successfully conserve species will depend not only on our ability to detect and map threats such as biological invasions but also on understanding public attitudes toward these threats. This

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approach of integrating social indicators into ecological indicators offers unprecedented insight and conservation potential. For instance, social indicators may reveal an increased interest in people purchasing invasive tropical plants for their garden, which could be used as an early-warning signal to assess and forecast the ecological risk of the impact. Under high risk, we should mobilize to promote behavioral change and awareness of impacts to mitigate risks. This approach shifts conservation from reactive to proactive, halting declines in their tracks. Such approaches are already being researched with online digital data (Jarić et al., 2021).

Improved monitoring of people's attitudes and behaviors can also help capture the willingness of societies to mobilize support for biodiversity conservation. In many contexts, political actors as well as businesses will take into account potential reputational damage when making a decision, so demonstrating public support can be a way to influence decision-making.

These indicators can also help to engage the public in conservation practice and questions pertaining to conservation ethics. For instance, conservationists can employ and endorse a controversial array of conservation approaches from lethal control to rewilding. These approaches can often be defended on conservation grounds but can evoke strong reactions from the public. Social indicators can track this public awareness of conservation topics and ideally engage an informed public in conservation decision-making.

Ultimately, readily available and up-to-date social indicators can help design conservation practices that are not only effective but also just, equitable, and ethically permissible—key criteria of GBF target 22.

3 | INTEGRATING DIGITAL INDICATORS INTO GBF

When the previous GBF targets were established in Aichi, Japan, collecting data on global-scale human–nature interactions in a cost-effective manner was largely unattainable. Consequently, only about 10 countries had comparative data available to evaluate progress toward Aichi Target 1, which focused on awareness of the value of biodiversity and steps to conserve it (Secretariat of the Convention on Biological Diversity, 2020). Arguably, this target was most directly linked with human dimensions.

With increased access to the internet, now at 66% globally (International Telecommunication Union, 2022), alongside greater access to data sources such as social media platforms, and advances in machine learning, cloud computing, and natural language processing, new kinds of social science analyses are now available (Fink et al., 2020). It is now possible to understand how attitudes and behaviors toward different elements of biodiversity vary in real time at local, national, and global scales (Fink et al., 2020; Johnson et al., 2023)—a key requirement of the GBF. Such insights can in turn inform policy in a more responsive and cost-effective manner (Caetano et al., 2023).

For example, using sentiment analysis and named entity recognition, it is possible to use digital mass media websites to map human–wildlife conflict between elephants and humans across time and space in near real-time. It is also possible to leverage computer vision alongside photos posted on social media to detect when an invasive species is documented in a new location, which can highlight the need for conservation action early on, making eradication easier.

Despite the promising potential of expanding internet access at the global scale, it is important to highlight that significant disparities still exist in various areas. These disparities are evident when considering factors such as gender, income, and urban or rural settings (International Telecommunication Union, 2022). While these gaps have been gradually shrinking (International Telecommunication Union, 2022), it is apparent that in many cases, obtaining insights relevant to the current decade will require a combination of online and offline data collection methods to ensure the creation of nationally representative datasets. Other challenges to reaching a truly global representation include the challenges in translating content across multiple languages, a process that can lead to loss of meaning. This process has recently become easier with the aid of Artificial Intelligence and Large Language models. However, these methods have their own challenges, namely, around their embedded cultural and social biases, since they mostly originate from Western languages with their particular linguistic features.

There is much to be done in developing the current GBF monitoring framework. Integrating social indicators is a critical next step. Social indicators can offer unprecedented insight into how attitudes and behaviors drive threats, reveal early-warning signals of biodiversity declines, and promote a transformation in conservation practice. Ultimately, social indicators offer the potential to avert declines and bend the biodiversity curve toward recovery.

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