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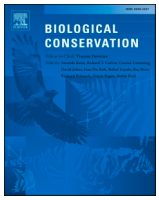

First, do no harm? Dark logic models, social injustice, and the prevention of iatrogenic conservation outcomes

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ABSTRACT

In medicine and public health, the Hippocratic injunction to 'first do no harm' has inspired a longstanding tradition of research and practice seeking to mitigate *iatrogenic* (doctor or practitioner-created) risks. Aiming to anticipate and prevent iatrogenic outcomes, dark logic models challenge practitioners to explicitly consider mechanisms through which harms may arise from the implementation of proposed interventions. Placing recent literatures on conservation (in)justice in closer dialogue with debates about the utility of dark logic models in the health sciences, this article explores how such approaches may or may not be useful for avoiding negative social impacts or injustices in conservation governance. Particularly considering resurgent spatial ambitions in global biodiversity conservation – as evidenced by the Half Earth and 30 × 30 conservation targets – we suggest that dark logic models may ultimately prove to be a worthwhile component of conservation practice vis-à-vis the UN Convention on Biological Diversity's Kunming-Montreal Global Biodiversity Framework. In this context, dark logic models constitute an additional tool – which can be used in complementary fashion, alongside others – to better anticipate and prevent conservation harms, as well as to avoid further burdening those who have done the least to cause the biodiversity crisis with conservation's negative socioeconomic impacts.

1. Introduction

"As to diseases, make a habit of two things", wrote Hippocrates of Kos (2015: 85) in *Epidemics*: "to help, or at least to do no harm." In medicine and public health, the Hippocratic injunction to 'first do no harm' has inspired a longstanding tradition of research addressing possibilities for *iatrogenic* outcomes to result from medical interventions. Here, specific 'iatrogenies' are understood as diseases, conditions, or other adverse outcomes that inadvertently ensue from medical treatment itself, rather than its absence (Labetoulle, 2009). Such outcomes can arise from conventional malpractice, medical accident, or simple human error. Yet thornier questions have also emerged concerning interventions that were (un)knowingly misconceived at the time of implementation, or which were otherwise generative of adverse outcomes unanticipated or disavowed by relevant practitioners (Lorenc and Oliver, 2014). In this sense, iatrogenic consequences are – importantly – not necessarily limited only to indicators of human health. For instance, Meessen et al. (2003) have proposed the term "iatrogenic poverty" in reference to the loss of assets and livelihoods as an unintended consequence of health or welfare interventions, pointing to the potential for broader social or economic 'iatrogenies' to arise. In the social sciences, scholars such as Ivan Illich (1976: 13) have also notably engaged the term in reference to a perceived "medicalization of life" that was thought to be intensifying in the late twentieth century, producing, in turn, a counter-intuitively broad range of iatrogenic consequences in settings often far removed from clinics and hospitals.

In short, this article places recent literatures on the management of iatrogenic risk in the health sciences in closer dialogue with ongoing debates concerning the social justice implications of conservation governance. Particularly as conservation interventions become increasingly enmeshed with efforts both to address emergent health risks and to bolster human livelihoods or wellbeing outside of conventionally-defined protected areas (e.g. Hopkins et al., 2021), Illich's (1976) admonition to consider the correspondingly broad potential for iatrogenic risk across a wide range of empirical settings seems worth revisiting. Indeed, this is especially the case given that conservation interventions are now often explicitly framed as earnestly pursuing 'win-win' outcomes for both biodiversity and human livelihoods

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(Büscher, 2014; Svarstad and Benjaminsen, 2017), if not even more ambitious "triple win" or "quadruple win" outcomes across a growing range of other objectives, including climate change mitigation, human health, gender equality, peacebuilding, and so forth (Ortiz et al., 2021). Not least in the aftermath of the COVID-19 pandemic – which many analysts now frame as an escalating *polycrisis* across several socio-ecological risk vectors – global conservation is increasingly perceived as an important leverage point through which multifaceted health, wellbeing, and sustainability objectives can be pursued through the adoption of a corresponding "nexus approach" (Estoque, 2023; IPBES, 2023a). Simply put, however, this broadening of conservation's formally stated 'good intentions' does not, in itself, preclude associated interventions from catalysing unintended or tacitly intended harms, thus underscoring the necessity of simultaneous measures for reducing iatrogenic risk.

Conversely, this is not to say that the adoption of multiple win aspirations by conservation organizations is somehow universally unwarranted per se. As Massarella et al. (2018: 375, emphasis added) note, conservation and development initiatives frequently necessitate the enrolment of diverse stakeholders into a "community of *promise*". Here, it is simply often the case that stakeholder expectations must be sufficiently raised from the outset of intervention planning activities so as to enable the investment of necessary volumes of political or financial capital. However, as a result of heightened "multiple win" expectations throughout this process, it may appear – to some stakeholders at least, and not unlike in the context of public health (Bonell et al., 2015) – that ostensibly 'new and improved' conservation models entail relatively limited potential for iatrogenic impacts upon livelihoods or human wellbeing (Mbaria and Ogada, 2016; Nel, 2021; Fletcher, 2023). This is particularly so as many conservation organizations are increasingly at pains to distance themselves from the injustices associated with past and present forms of exclusionary 'fortress conservation'. Such tendencies increasingly result in initiatives – to take just one example – like the WWF's (2023) "inclusive conservation" campaign, wherein the public is assured that "WWF is working with them [indigenous peoples] to secure formal restitution and recognition of their rights to lands, waters and natural resources, and to strengthen indigenous governance delivered on their own terms."

Such virtuous objectives notwithstanding, a vibrant and still-growing literature on the social impacts of conservation implicitly demonstrates that there is, to put it lightly, a significant degree of iatrogenic risk remaining in the sector (Adams and Hutton, 2007; Holmes and Cavanagh, 2016; Oldekop et al., 2016; Cavanagh and Benjaminsen, 2022). Here, numerous assessments of the negative social impacts of specific conservation interventions continue to precipitate associated calls for redressing perceived conservation injustices (e.g. Martin, 2017; Weldemichel, 2022; The Oakland Institute, 2023). Whilst this crucial work of identifying, documenting, and seeking redress for conservation injustices is unquestionably important, we cannot help but note that comparatively few frameworks have emerged at the research-practice interface that seek to anticipate and prevent such outcomes from arising in the first instance – and to do so precisely *regardless* of the specific conservation model or suite of institutional arrangements being proposed for implementation. Indeed, this is notwithstanding the fact that several important conservation alternatives are once again (re) emerging in response to the perceived injustices of exclusionary 'fortress conservation' models. These include important approaches rooted in "convivial conservation" (Büscher and Fletcher, 2019), "just conservation" (Martin, 2017), and related frameworks, often coupled with equally important calls for broader forms of transformative socio-economic or socio-ecological change (Büscher et al., 2017; IPBES, 2023a, 2023b). In aggregate, it might be said that these new frameworks and alternatives are now shaping a conjuncture that is in some ways not unlike the initial rise of "community based conservation" (CBC) and collaborative natural resource management (CBNRM) approaches in the late 1980s and 1990s (Hulme and Murphree, 2001), which was in turn superseded by a "back to the barriers" movement in favour of strict 'fortress conservation' (Hutton et al., 2005). Whilst this is generally both laudable and warranted, we simply note here that these alternatives may *also* benefit from explicitly considering how they will mitigate unintended iatrogenic risks. Indeed, this is particularly so given that both conventional "multiple win" approaches to conservation and their more radical alternatives will ultimately be implemented in baseline contexts that are often characterized by significant inequalities, conflicts, and rapid processes of social, economic, or ecological change.

Seeking to contribute to the literature in this regard, this article foregrounds the concept of a "dark logic model", inspired by related debates in medicine and public health (Pawson, 2013; Lorenc and Oliver, 2014; Bonell et al., 2015). In short, dark logic models complement existing logical frameworks ("logframes") and theory of change-based programme designs by challenging intervention designers and implementers "to anticipate the most plausible and most harmful unintended impacts and associated mechanisms" that may arise from their activities (Bonell et al., 2015: 97). Certainly, professional standards mandated by most bilateral and multilateral donors already require implementing organizations to harness logframe models in articulating a "theory of change" with respect to how requisitioned finances and inputs will achieve desired outcomes and impacts. Quite often, however, such requirements result in a "tyranny of the logframe" (Sunderland et al., 2020: 208), which forces practitioners to focus more-or-less exclusively on the desirous nature of a given initiative's intended outcomes or impacts, and the mechanisms through which the latter will be achieved. More seriously, the articulation of logframe models with pressures to secure donor resources in the highly-competitive landscape of conservation practice may yield a form of "beneficence inflation", in which desirable (intended) impacts of conservation interventions are simultaneously both overstated and marginally devalued, and wherein associated risks are underestimated, understated, or neglected outright. Indeed, such beneficence inflation may already help to explain the prevalence of escalating win-win, triple-win, or "quadruple win" rhetoric in conservation policy and practice (Svarstad and Benjaminsen, 2017; Chambers et al., 2022). Further, to the extent that some quarters of the global conservation industry have been successful in asserting a "right to fail" in this regard (Chambers et al., 2022) – that is, "failing forward" (Fletcher, 2023) via the continual reformulation of 'multiple win' conservation interventions in spite of scandals, controversies, and claims of social or environmental injustice – it is thus now more imperative than ever to develop robust systems for the avoidance of iatrogenic conservation outcomes.

Extending debates about the utility of dark logic models from medicine and public health to conservation governance, this article illuminates how related approaches to project design, implementation, and evaluation may (or may not) assist in avoiding negative social impacts or broader conservation injustices. Ultimately, we suggest that the uptake of dark logic models may be especially worthy of consideration in the context of the emerging UN Convention on Biological Diversity's (UNCBD) 'Kunming-Montreal Global Biodiversity Framework' (hereafter: GBF), as well as related 30 × 30 or other targets for protected, conserved, and 'sustainably managed' area expansions. Though warranted in terms of mitigating ongoing processes of global biodiversity loss (e.g. Pörtner et al., 2023), such rapid rates of conservation area expansion and/or land use change raise clear and pressing risks for justice and equity. To elucidate the nature of these risks – as well as the potential for dark logic models to anticipate and pre-empt them – this article proceeds as follows. Firstly, we review recent debates about the social impacts and justice implications of conservation, highlighting how the resurgent spatial ambition of the GBF once again underscores the salience of related concerns. Secondly, we illuminate how dark logic models have been developed in the health sciences to mitigate iatrogenic risks, and relatedly highlight three ideal-type 'approaches' to dark logic modelling in conservation contexts. Lastly, we explore both opportunities for implementation and likely barriers or disincentives for

engagement with dark logic models amongst conservation organizations at present. We conclude by emphasising the potential of dark logic models to identify, pre-empt, or otherwise mitigate the negative socio-economic impacts of conservation amidst emerging global attempts to meet increasingly ambitious "30 × 30" and other conservation targets.

2. Conservation (in)justice and resurgent spatial ambition in the Kunming-Montreal Global Biodiversity Framework

Over the last several decades, a vibrant debate has emerged at the interface of several academic disciplines examining the impacts of conservation measures on human wellbeing and addressing related implications for social (in)justice. Importantly, several contributions to this literature illuminate how conservation interventions – whilst oriented toward the protection of biodiversity, ecosystems, landscapes, and so forth – are ultimately also 'social' in that they are shaped both by the actions of implementing organizations and the responses of impacted human communities (Sandbrook, 2015). Given this necessary role of human agency in conservation, it is perhaps unsurprising that related interventions may entail unintended – or in some unfortunate cases, tacitly *intended* – negative social impacts (e.g. Brockington, 2004; West and Brockington, 2006; Ojeda, 2012).

Though rarely framed explicitly or formally as intending to harm people, conservation measures often necessarily involve restrictions on human access to lands and natural resources. Whilst such restrictions are often an inevitable aspect of conservation practice – at times demanded by local land or resource users themselves – they can also entail variable degrees of risk for negative impacts upon livelihoods and wellbeing, as well as potential for violating indigenous and/or human rights enshrined in (inter)national law (Newing and Perram, 2019). Moreover, as dynamic literatures on "green militarization", "green violence", and related issues make clear, conservation interventions do not occur in a social or political vacuum (Lunstrum, 2014; Büscher and Ramutsindela, 2016). Particularly in conflict or 'insurgency'-affected regions – which encompass a quantitatively substantial range of jurisdictions in which conservation organizations now operate – conservation activities can, in practice, overlap with the dynamics of organized violence in ways that complicate formally stated 'multiple win' objectives (Ojeda, 2012; Canavire-Bacarreza et al., 2018; Marijnen et al., 2021). Beyond overt conflicts or insurgencies, recent studies also show that conservation activities are often more widely embedded in multifaceted socio-political contestations and struggles over either financial or natural resources (e.g. Milne, 2022). This can be the case both at large scales (highlighting the significance of "conservation geopolitics", see Hodgetts et al., 2019; Ramutsindela et al., 2020), and at smaller scales, involving for instance gender, class, or generation-related contestations within local communities themselves (Pas and Cavanagh, 2022).

As a result of both the broadly social nature of conservation practice and the embeddedness of conservation activities in wider social and political contexts, the negative social impacts or 'harms' that may arise from conservation interventions are several. Such 'harms' can be – inter alia – *physical and direct* (involving violence or damage to both people and property associated with conservation law enforcement, forced migration, anti-poaching operations, etc.); *economic* (involving lost incomes, livelihoods or assets, uncompensated costs or damages); *psychological* (in the form of depression, PTSD, etc., arising in the aftermath of direct impacts); or *cultural* (entailing lost access to meaningful sites or territories that enable the reproduction of longstanding social, religious, or other cultural practices) (Martin et al., 2015; Holmes and Cavanagh, 2016; Oldekop et al., 2016).

On one hand, some scholars have suggested that these negative social impacts can, in the long-term, result in conservation failures, or 'lose-lose' rather than 'win-win' outcomes for both biodiversity and livelihoods (see, for instance, Martin, 2017; Robbins, 2020). Accordingly, "the principle of local support" has often been emphasized as a key factor in determining positive conservation outcomes (Holmes, 2013). On the other hand, the historical record is replete with examples where local resistance to conservation has simply been overridden by states and law enforcement agencies – often with significant financial support from bilateral donors, multilateral donors, and/or conservation NGOs – resulting in biological conservation objectives being achieved precisely in spite of local resistance and widespread grievances about perceived conservation injustices (Brockington, 2004).

Simply put, the ongoing potential for conservation interventions to result in social harm sits awkwardly alongside key tenets of contemporary conservation policy. Over the last several decades, the sentiment that conservation should be doing no harm to people has been well captured in global conservation treaties and governance frameworks (Adams et al., 2004; Roe, 2008). Selected examples include the IUCN's Kinshasa Resolution in 1975, which called on governments not to displace people from protected areas (PAs); the 1984 World Bank guidelines for PAs, which ruled out the resettlement of indigenous people (Adams and Hutton, 2007); the World Parks Congress' Durban Accord in 2003, which emphasized that PAs must not contribute to or exacerbate poverty (IUCN, 2005); as well as more recent support from conservation organizations for the "Conservation Initiative on Human Rights", which aims to promote the more substantive integration of human rights protection into conservation policy and practice.

At the time of writing, multilateral aspirations to reconcile conservation and poverty reduction objectives are once again underscored by the UNCBD's Kunming-Montreal Global Biodiversity Framework (hereafter: GBF). Importantly, the GBF's "Global targets for 2030" include the following text under Target 3:

> "Ensure and enable that by 2030 at least 30 per cent of terrestrial and inland water areas, and of marine and coastal areas, especially areas of particular importance for biodiversity and ecosystem functions and services, are effectively conserved and managed through ecologically representative, well-connected and equitably governed systems of protected areas and other effective area-based conservation measures, recognizing indigenous and traditional territories, where applicable, and integrated into wider landscapes, seascapes and the ocean, while ensuring that any sustainable use, where appropriate in such areas, is fully consistent with conservation outcomes, recognizing and respecting the rights of indigenous peoples and local communities, including over their traditional territories". (UNCBD, 2022: 9)

Here, it should be noted that the implementation of Target 3 will not necessarily or inevitably entail the expansion of strict protected areas (e.g. IUCN categories I or II). In practice, the social impacts of Target 3 will significantly depend upon the specific implementation plans developed by national parties to the UNCBD, and the extent to which these plans incorporate a substantive role for other effective area-based conservation measures (OECMs and related 'sustainable use' initiatives) in addition to conventional protected areas. Conversely, however, an emerging literature on the actual socioeconomic impacts of OECMs and other non-state conservation or 'sustainable use' measures implemented outside of protected areas demonstrates that – not unlike formally-designated protected areas themselves – these initiatives can often entail highly unequal distributions of negative as well as positive impacts for some community strata (Holmes and Cavanagh, 2016; Cavanagh et al., 2020; Pas and Cavanagh, 2022). Consequently, it should not simply be assumed, a priori, that OECMs and related measures are socially or economically more benign than traditional protected areas. This is particularly so in the absence of a more extensive and empirically fine-grained knowledge base on differentiated or diverse OECM impacts across world regions (Sandbrook et al., 2023).

That said, if Target 3 *were* to be achieved primarily via protected area expansion, it would entail nearly doubling the existing extent of terrestrial PA coverage and nearly quadrupling the marine PA estate by the end of the present decade (Cavanagh and Benjaminsen, 2022). In

such a scenario, projected rates of expansion would follow an already quite rapid rate of PA establishment over the course of the last several decades, in which the terrestrial protected area estate has grown to encompass approximately 21.5 million km^2 of land area as of 2023 (IUCN and UNEP-WCMC, 2023). In essence, this denotes that the terrestrial PA estate now exceeds the land area of the continent of South America in aggregate size (ca. 17.8 million km^2), and is approaching the land area of North America (ca. 24.7 million km^2). Despite this already quite rapid historical growth, achieving GBF Target 3 via protected areas would necessitate an additional expansion of roughly 20 million km^2 by the end of the decade, amounting to an average annual rate of more than 3 million km^2 per year, 2024–2030. Again, the precise social impacts of the latter expansion in grounded local contexts would be mediated by a range of important variables, including – inter alia – the exact type of newly established or expanded PAs (i.e. strict IUCN categories I-II versus "sustainable use"-oriented IUCN categories V-VI), and the question of whether effective benefit-sharing and human rights protection measures are implemented in practice. Yet, whilst these and similar factors *can* moderate the negative social impacts of conservation, it cannot simply be assumed that they *will*.

Indeed, achieving the GBF's Target 3 whilst simultaneously and universally "recognizing and respecting the rights of indigenous peoples and local communities, including over their traditional territories" (UNCBD, 2022: 9) will demand a marked break with the kinds of human rights abuses and other excesses of conservation governance that have been identified in some contexts (e.g. Adams and Hutton, 2007). That said, the GBF text laudably contextualizes its pursuit of Target 3 alongside a number of other important targets and measures intended – in whole or in part – to protect the rights of indigenous peoples and local communities (IPLCs). These include GBF Target 1, which aims to:

> "Ensure that all areas are under participatory, integrated and biodiversity inclusive spatial planning and/or effective management processes addressing land- and sea-use change, to bring the loss of areas of high biodiversity importance, including ecosystems of high ecological integrity, close to zero by 2030, while respecting the rights of indigenous peoples and local communities".
>
> (UNCBD, 2022: 9)

In short, here, we emphasize that there is considerable potential to integrate dark logic models into the implementation of GBF Target 1 on land and spatial planning, as well as into related measures to protect the rights of IPLCs and other stakeholders in conservation. Not least, this would provide a complementary tool – alongside existing approaches for "social impact assessment" and the protection of human rights in conservation practice – for better anticipating and potentially avoiding the 'harms' or negative social impacts that have been identified in past debates concerning conservation injustices (e.g. Martin, 2017). Before unpacking precisely how dark logic models and associated methods can be integrated into the above approaches to spatial and land use planning, however, the following section illuminates how and why dark logic models have emerged in the fields of medicine and public health. A penultimate section then highlights both opportunities for implementation and likely barriers or disincentives for engagement amongst conservation organizations.

3. Understanding the emergence and utility of dark logic models

Importantly, dark logic models were first proposed for use in the health sciences. Aside from a longstanding tradition of medical research and practice oriented toward the avoidance of 'iatrogenic' outcomes (e.g. Meessen et al., 2003), dark logic approaches emerge from both researcher and practitioner efforts to better understand counter-intuitive or "paradoxical" results arising from seemingly well-intentioned public health or welfare interventions. Here, seminal examples in the literature include interventions to reduce rates of teenage pregnancy that were found to actually increase these rates (Bonell et al., 2015), or initiatives to address substance abuse that appeared – likewise, counter-intuitively – to provide new opportunities for certain stakeholders to continue or even intensify harmful behaviours (e.g. Werch and Owen, 2002, see also Biallas et al., 2022).

In these and similar settings, dark logic models have been developed to better conceptualize key *mechanisms* through which malign outcomes can arise from the implementation of formally well-intentioned interventions. This might entail, for instance, understanding that group-oriented methods of treating substance use disorders may inadvertently provide troubled youths with additional contacts and networks for accessing illicit substances, thereby exacerbating rather than ameliorating harmful practices. In turn, such insights can be harnessed in (re)designing interventions in ways that avoid such 'iatrogenic' outcomes. Differently put, a dark logic model is, in essence, a tool for better anticipating *how* the most harmful unintended impacts of a health or welfare intervention may occur, and for restructuring interventions to circumvent mechanisms that can plausibly lead to these harmful impacts.

In this sense, the emergence of dark logic models can be understood in relation to the broader "realist" evaluation paradigm in the health sciences (Pawson, 2013). In short, realist evaluation is premised on an inherent scepticism with regard to both the internal and the external validity of conventional randomized control trials (RCTs) (e.g. Pawson and Tilley, 1997: 30–31). Whilst not rejecting the importance of RCTs outright for assessing "what works" in an intervention context – indeed, some proponents have proposed alternative models for conducting "realist RCTs" (Bonell et al., 2012) – realist evaluations instead ask the inherently more nuanced question of "what works, for whom, and under what circumstances?" (Fletcher et al., 2016, see also Deaton, 2020). In doing so, realist evaluations aim to uncover empirical mechanisms that may be overlooked by conventional RCTs, but which nonetheless explain the empirical occurrence of unexpected and/or unintended (harmful) outcomes. Particularly when combined with dark logic modelling approaches, realist evaluations can complement RCT-based methods by generating *ex post* explanations of observed impacts that are "complexity consistent" (Westhorp, 2013) in the sense that they can describe factors and mechanisms that may not have been legible within a given intervention's *ex ante* logical framework.

Following Bonell et al. (2015: 97), we can identify at least three different stylized or "ideal-type" approaches to dark logic modelling that may be useful in anticipating or avoiding such harmful outcomes, each of which is further elaborated in Table 1 below with reference to conservation contexts. These approaches can be applied alone or in combination, as appropriate, or alongside additional iterations of a dark logic modelling methodology tailored to the specific historical and geographical characteristics of a unique conservation context and stakeholder population.

A first approach begins by inviting both conservation practitioners and other stakeholders to develop a conventional logic model describing how an intervention is meant to function, specifying key inputs, processes, and mechanisms for achieving desired positive outcomes. Once this conventional logical framework ("logframe") and its corresponding theory of change is produced, its assumptions are scrutinized, and complemented with a "dark logic" model that challenges practitioners and other stakeholders to hypothesize how these same inputs and mechanisms can plausibly instead result in iatrogenic outcomes or unintended harms. Importantly, the latter should reflect on how the progression of the logic model might change as a result of contextual interactions in the intervention area, thereby yielding a clear description of pathways and mechanisms through which conservation activities may precipitate (especially) 'worst-case' outcomes. Whilst minor (reversible) harms should of course also be anticipated and avoided, here we emphasize the pre-emption of worst-case outcomes (understood as severely harmful and/or irreversibly harmful outcomes for individuals or groups), given that 'mixed' outcomes or partially successful implementation is often simply a reality of conservation practice. That said,

Table 1
Three 'ideal type' approaches to dark logic modelling in conservation contexts. Adapted from Bonell et al. (2015) with allusions to aspects of empirical cases discussed in Cavanagh and Benjaminsen (2014), Cavanagh et al. (2020), and Cavanagh et al. (2021).

Dark logic modelling approach	Illustrative application in a conservation context
Approach 1: Hypothesize mechanisms leading to severely harmful or 'worst-case' outcomes	Approach 1 seeks to hypothesize how a specific intervention design might inadvertently result in 'worst case' or severely harmful outcomes. For instance, in the case of a payments for ecosystem services initiative to incentivize a state conservation agency to restore an apparently 'degraded' IUCN Category II protected area, this would first entail developing a conventional logical framework explaining how requisitioned inputs will achieve desired outcomes (e.g. providing otherwise unavailable finances to achieve 'additional' restoration and carbon sequestration that would not have occurred in a baseline scenario). In addition, a "dark logic" model of how this same intervention structure could plausibly yield severe adverse impacts or harms instead is also hypothesised. Importantly, the latter should account for the agency of diverse actors affected by the intervention, as well as latent mechanisms and contextual interactions in the intervention context that may trigger negative outcomes in terms of both harmful social impacts and unachieved conservation objectives. These could include – for instance – unresolved land claims, a legacy of historical injustices, or protected area occupation by agrarian communities, potentially leading to severe harms such as uncompensated dispossession and associated damage to persons and property.
Approach 2: *Ex post* comparison with similarly structured interventions	Approach 2 begins by developing a conventional logical framework and theory of change for achieving desired conservation outcomes. For instance, harnessing a leaseholder model of community conservation in dryland areas to form new conservancies by pooling together privately owned rangelands under the management of a conservation organization. Once completed, this logical framework is compared and contrasted with the findings of *ex post* evaluations of similarly structured interventions that identified both positive and negative outcomes. In particular, evaluations of 'failed' or 'unsuccessful' interventions are harnessed to identify mechanisms that may plausibly derail the envisioned progression of an *ex ante* logical framework. These could include difficulties in excluding baseline land uses; grievances about the provenance of land/property rights; inequalities of wealth that translate into asymmetrical negotiations between landowners and conservation lessees, and so on.
Approach 3: Stakeholder validation grounded in intervention context	Approach 3 entails mooting a stakeholder-formulated logical framework for a conservation intervention – for instance, an agroforestry scheme on smallholder farms intended to reduce consumptive pressure on forested protected areas – for further validation amongst different actor groups within the stakeholder population (e.g. women, youths, socioeconomic strata, ethnic or cultural minorities, etc.) who will be impacted by it and/or involved in its implementation. This ensures that stakeholders who have "skin in the game" – in the sense that they may conceivably be exposed to potential intervention risks in a personal capacity – retain meaningful input into dark logic modelling and intervention design processes. Such inputs may illuminate key mechanisms previously unidentified by intervention designers, including: space and water constraints on the uptake of certain tree species; labour requirements for some stakeholder groups, particularly women and youths; trade-offs between uses of available fuelwood, fodder, and/or crop residues, and so forth. Both the latter and similar factors can result in either harmful iatrogenic impacts or underperformance on desired intervention objectives.

severely harmful, irreversibly harmful, and/or catastrophic outcomes for individuals or groups (e.g. violent death, uncompensated dispossession, etc.) are always fundamentally avoidable, yet reportedly occur with non-zero frequency in contemporary conservation contexts (e.g. The Oakland Institute, 2023). In effect, explicit consideration of how severely harmful outcomes can be avoided may help to counterbalance tendencies to overstate the likelihood or beneficial impact of desired outcomes and to overlook or disavow iatrogenic risks.

A second approach is essentially comparative in nature. Here, intervention designers and other stakeholders engage in dark logic modelling by comparing and contrasting the *ex ante* logical framework for a proposed intervention with *ex post* evaluations of similarly structured interventions that were found to yield both positive – and, perhaps more importantly – negative effects. On one hand, comparison with "successful" interventions may reaffirm the structure of the logical framework, but may also uncover mechanisms that were crucial for initiative success elsewhere that are not thought to characterize the intervention context at hand. Conversely, comparison with similarly structured interventions that were found to be "unsuccessful" – or which "failed" in the sense that they produced unexpected social or other harms – may be even more important, insofar as this can assist in uncovering mechanisms that may cause the progression of proposed logical frameworks to become derailed or to result in unanticipated negative outcomes. Over time, these practices yield an improved knowledge base on how specific interventions can avoid social harm(s), thereby gradually building a 'higher-resolution' understanding of the diverse ways that even similarly structured interventions can unfold in practice.

Finally, a third approach to dark logic modelling involves an even more radically participatory process for intervention design, focusing on stakeholders "who have particular insight into local contexts and how interventions might operate within these" (Bonell et al., 2015: 97). Though not always feasible within settings that involve donor or NGO "blueprint projects" (Mosse, 2005: 24) with strict implementation, appraisal, and/or evaluation constraints, this approach begins by inviting intervention participants or stakeholders themselves to, in effect, inform donors or financiers how conservation activities should be implemented. In turn, a logical framework is formulated on the basis of these solicited perspectives, which connects intervention inputs to desired positive outcomes, and which serves as a basis for hypothesizing how undesirable or unanticipated negative outcomes may inadvertently arise. Subsequent concerns about the log-frame and its theory of change are then triangulated across different categories of stakeholders, with particular attention to identified risks and mechanisms that may not have been identified in (counter-factual) log-frames developed by

"external" consultants or conservation professionals elsewhere, thereby increasing the likelihood that unanticipated negative outcomes can be avoided. Importantly, here, stakeholder groups should reflect a representative cross-section of known socioeconomic categories in the intervention area (e.g. gender, ethnicity, income status, generation, etc.), allowing for the balanced triangulation of perspectives on the logical framework across these groups. Moreover – to an even greater extent than the two approaches outlined above – sufficient resources will need to be available to facilitate participation without causing additional pressures on stakeholder time and resources, thereby avoiding a "tyranny of participation" (Cooke and Kothari, 2001) scenario in which unacceptable livelihood or income trade-offs accrue to stakeholders – or wherein existing socioeconomic inequalities are simply reproduced – as a result of these important contributions to the process of intervention design.

In summary, each of these three approaches to dark logic modelling – whether employed alone or in combination, as available resources permit – can assist in identifying and mitigating key mechanisms that may catalyse unintended harms. Even if implemented *ex post* or 'post-intervention', the results of dark logic modelling can inform the design and conduct of subsequent interventions and contribute to an evolving knowledge base on underlying mechanisms that have been found to influence intervention effects. That said, establishing that a particular intervention *could* cause harm does not necessarily mean that its theory of change or means of delivery *should* be totally abandoned. However, by identifying plausible harms and their underlying mechanisms, implementors, evaluators, and other stakeholders will improve their understanding of both key intervention risks and corresponding opportunities to refine or significantly alter the intervention's structure. In the following section, we extend this discussion of dark logic modelling approaches by illuminating key opportunities for their uptake in conservation practice, as well as by assessing structural barriers that may need to be overcome in order to do so.

4. Dark logic and its discontents: opportunities and barriers to uptake in conservation practice

Many conservationists identify as members of a "crisis discipline", one whose "relation to biology, particularly ecology, is analogous to that of surgery to physiology and war to political science" (Soulé, 1985: 727). It is perhaps unsurprising, therefore, that conservation researchers and practitioners often seek guidance from standards of evidence, evaluation, and intervention design that prevail in medicine and the broader health sciences. Not least, medicine's "effectiveness revolution" has inspired Pullin and Knight (2001, 2009) to call for a more explicitly "evidence-based conservation", which has since been widely embraced in many conservation organizations and research communities (Sutherland et al., 2012). Whilst this orientation is generally laudable, we note how the related focus on ensuring that conservation is "doing more good than harm" (Pullin and Knight, 2009: 931) may at times risk departing from the substance of medicine's Hippocratic imperative. Traditionally understood, the Hippocratic imperative demands that we *first do no harm*. It does not suggest that we establish, on balance – much less 'on the balance of probabilities' – that we have *hopefully done less harm than good*.

Granted, the de facto status of conservation initiatives as complex interventions into complex socio-ecological systems denotes that these efforts will often be accompanied by a significant degree of uncertainty with respect to both their intended and their unintended impacts. In this regard, it may ultimately not be possible to somehow conclusively establish, from an *ex ante* perspective, that a given intervention absolutely *will not* result in some degree of iatrogenic harm. Simply put, however, dark logic models can assist conservation practitioners in deepening their ethical, as well as their scientific, engagements with the health sciences in relation to this predicament. Firstly, concerning ongoing discussions about "evidence-based conservation", we emphasize that dark logic models emerged in the health sciences precisely due to a perceived need for critical nuance and reflection vis-à-vis enthusiasm for the presumed "gold standard" of evaluations based upon randomized control trials (RCTs) (e.g. Bonell et al., 2012). Yet just as these critical perspectives were emerging in public health, many discussions of "evidence-based" interventions in conservation practice and (sustainable) development economics were moving largely in the opposite direction, precipitating a new wave of enthusiasm for RCT-based approaches in particular (Asquith, 2020; Wiik et al., 2020). Whilst support for RCT-based research and evaluation perhaps reached its zenith following the receipt of the 2019 Nobel Prize in Economic Sciences by Abhijit Banerjee, Esther Duflo, and Michael Kremer (Kapur, 2020), the much longer history of control trials and related forms of experimental evaluation in the health sciences has arguably yielded a somewhat more nuanced or multipolar intellectual landscape in the most recent generation of literature, and particularly so in the field of public health (e.g. Bonell et al., 2012; Marchal et al., 2013; Fletcher et al., 2016; Deaton, 2020). Our attention to dark logic models, here, thus seeks to encourage a similarly nuanced and multifaceted discussion in conservation governance regarding the nature and implications of apparently more "evidence-based" forms of conservation practice.

Differently put, engagement with literatures on dark logic modelling and the prevention of iatrogenic outcomes can help move debates about evidence-based conservation beyond discussions of "what works" and toward a deeper understanding – inspired by the realist evaluation paradigm in the health sciences – of "what works, for whom, and under what circumstances" (Fletcher et al., 2016, see also Deaton, 2020). Again, we concur here with health and social wellbeing scholars that conceptualize interventions as "events in systems" (Hawe et al., 2009; Moore et al., 2019) – or in a conservation context, as events in complex *socio-ecological* systems (Ostrom, 2007). Once interventions are understood as events that shape, and are shaped by, the dynamics of socio-ecological systems, one is better placed to appreciate why dark logic modelling approaches emphasize not only: i) the *context* in which an intervention is implemented, but also ii) the *mechanisms* through which interventions articulate with the latter contexts and iii) the implications that these articulations entail for the *agency* of actors and organizations in conservation practice.

That said, by elucidating the above three 'ideal type' approaches to dark logic modelling (see Table 1), we do not mean to suggest that these methods should displace or substitute other, well-established mechanisms for risk management and conservation harm reduction. As will be well-known to conservation practitioners, other approaches to avoiding harm certainly exist. Aside from conventional social or environmental impact assessments – conducted, for instance, via normal project or programme implementation routines for several bilateral and multilateral donor-financed initiatives (e.g. Jones et al., 2017) – a number of alternative frameworks have also been developed. These include the 'Bardach Eightfold Path', which requires intervention planners to construct alternative implementation options, project the outcomes of these options, and confront trade-offs, respectively. However, Bardach (2000: 12) defines these alternatives as "alternative strategies of intervention to solve or mitigate the problem" (for instance, in a conservation context, biodiversity loss or ecosystem degradation) that initially prompted an intervention to be formulated in the first instance. In other words, even in the Bardach Eightfold Path, there is no explicit obligation for intervention designers to conceptualize how an intervention may go awry, or to substantively involve relevant stakeholders in identifying such risks. Rather, the focus is instead on conceiving of even more optimal implementation options for the intervention in question.

Likewise, in conventional forms of social impact assessment (SIA) it is commonplace for both intended and unintended social consequences – both positive and negative – of planned interventions to be analysed (Schreckenberg et al., 2010; Vanclay and Esteves, 2011; Franks and Small, 2016). Yet although SIAs are often conducted as part of regulatory approval processes for some conservation initiatives – as well as

infrastructure development and resource extraction projects – even their proponents occasionally express reservations about whether these assessments adequately address human rights protections (Esteves et al., 2012). In part, this may be related to the fact that prevailing SIA methodologies often do not explicitly theorize *mechanisms* leading to iatrogenic or otherwise "paradoxical" impacts (Bonell et al., 2015: 95). In addition to SIAs, improved monitoring and evaluation programs can also play an important *ex post* role in identifying harms that have already accrued, but by definition these practices cannot assist in the crucial work of harm prevention. Ultimately prevention is better than cure, and we can only prevent conservation harms when we understand the mechanisms through which these harms may arise. It is precisely in this regard that a dark logic framework can help to document and understand paradoxical effects, harmful externalities, and crucially, the mechanisms which might underlie these.

Importantly, the potential findings of dark logic modelling approaches raise questions not only about improved practices for social impact assessment, but also for measures to ensure Free, Prior, and Informed Consent (FPIC) in conservation contexts. Particularly given that FPIC constitutes a key facet of achieving both recognition and broader "procedural justice" in conservation governance (Massarella et al., 2020; Ruano-Chamorro et al., 2022), pressing concerns arise as to whether – or to precisely what extent – conservation organizations are responsible for informing stakeholder populations about the risk of *unintended* or potentially harmful impacts resulting from conservation interventions. Such considerations are particularly important in the context of the GBF's stipulation, in its Target 1, that land and spatial planning processes in conservation should be carried out "while respecting the rights of indigenous peoples and local communities" (UNCBD, 2022: 9). Notably, key international legal institutions requiring FPIC to accompany conservation or other sustainable development interventions include the UN Declaration on the Rights of Indigenous Peoples (UNDRIP). The UNDRIP is explicitly recognized by the GBF, which notes that "nothing in this framework may be construed as diminishing or extinguishing the rights that indigenous peoples currently have or may acquire in the future" (see UNCBD, 2022: 5). In turn, this ambition needs to be considered in the context of – inter alia – UNDRIP Article 19, which demands that "[s]tates shall consult and cooperate in good faith with the indigenous peoples concerned through their own representative institutions in order to obtain their free, prior and informed consent before adopting and implementing legislative or administrative measures that may affect them" (UN, 2007: 16). As such, a deeper or more substantive interpretation of consent requirements in FPIC processes may plausibly also require a more rigorous *ex ante* theorization of potential iatrogenic impacts from conservation interventions. Again, this may warrant wider uptake of dark logic models to complement existing social impact assessment protocols in conservation governance.

Notwithstanding the above imperatives and opportunities for engagement with dark logic models in conservation governance, there are also substantial barriers and limitations to such uptake at present. In particular, three main limitations are worthy of discussion here. Firstly, it should be noted that dark logic models are inherently constrained with respect to relevant scales of analysis. Especially when conceived as an element or tool for use in the process of intervention design and implementation, dark logic models must necessarily focus on both the relevant intervention area and the timescales across which conservation activities will be implemented. In itself, this presents challenges, given that even identically structured interventions may yield divergent results when implemented in distinct contexts. Dyngeland et al. (2020), for instance, find that the same anti-hunger intervention in different parts of Brazil resulted in variable both positive and negative outcomes for environmental protection. Similarly, some harms may only emerge or manifest long after a particular intervention has been completed, or may arise so infrequently within single interventions that they are only detectable through *ex post* systematic reviews or meta-analyses (Bonell et al., 2015: 97).

To some extent, the scalar limitations of dark logic models can be mitigated by harnessing "Approach 2" as outlined in Table 1 above – that is, by comparing an *ex ante* dark logic model with the findings of *ex post* evaluations of similarly structured interventions. This highlights a second limitation, however, which is that even identically structured interventions in similar contexts can yield divergent effects when implemented in different historical 'moments' characterized by distinct socio-ecological system dynamics. Here, economic factors such as inflation – particularly the inflation of food prices and/or agricultural inputs – and currency devaluation, as well as political and governance factors – such as property rights and decentralization reforms – can significantly alter the perceptions and behaviours of actors that implement or respond to conservation interventions (Ostrom, 2007, see also Cavanagh and Freeman, 2017). In turn, this highlights the need for engagements with *ex post* evaluations to rigorously examine mechanisms that have been found to precipitate iatrogenic outcomes – as well as to engage relevant bodies of theory in parallel research domains, such as in, inter alia, political ecology, environmental governance, and critical agrarian studies – in order to assess whether these mechanisms remain pertinent within the relevant intervention context.

Lastly – but not unimportantly – a final limitation concerns factors that may impede either the willingness or the capacity of both conservation organizations and other stakeholders to undertake dark logic modelling exercises. We note, here, that prevailing standards for social impact assessment, FPIC, and risk management in the design, appraisal, and evaluation of conservation or development interventions are already time, labour, and resource-intensive to a non-trivial extent. Importantly, this is often the case both for conventionally-defined conservation "professionals", as well as other relevant stakeholders, whose crucial inputs into participatory planning processes are not always recognized or compensated adequately (see, inter alia, Cooke and Kothari, 2001). Moreover, competition for both public and private finances amongst conservation organizations and other stakeholder groups remains intense. It may thus be unrealistic to expect these organizations to voluntarily adopt additional resource-intensive measures – such as dark logic modelling as a mandatory aspect of intervention design – without third-party regulation and willingness to enforce compliance. Such regulation can emerge from consortia of bilateral or multilateral donors, and may also be worthy of consideration in future iterations of the UNCBD framework or related multilateral instruments. If such coordination can be achieved, however, there is significant potential for dark logic models to assist in the avoidance of iatrogenic conservation outcomes, and thus to bolster related initiatives to ensure that the international community's efforts to protect biodiversity are not achieved at the expense of heightened social or environmental injustices.

5. Conclusion

Much more can and should be done to ensure that conservation interventions heed the Hippocratic imperative to 'first, do no harm'. Although rapid action to mitigate the ongoing biodiversity and climate crises is certainly warranted – for some apparently requiring urgent, "triage"-like implementation under conditions of considerable socio-ecological uncertainty (cf. Soulé, 1985) – it would be a grave mistake to allow such urgency to either legitimise or normalize conservation injustices (Martin, 2017). Indeed, as Mbaria and Ogada (2016: 3) put it, we can simply no longer accept that conservation organizations and governance frameworks remain "callously removed from the plight of those who suffer the brunt" of prevailing measures to preserve biodiversity. In many cases, this remains a matter of conservation *effectiveness* as well as ethics, given that unjust conservation impacts have often been shown to precipitate intractable conflicts that, in turn, undermine conservation as well as livelihood objectives (e.g. Mariki et al., 2015; Cavanagh and Benjaminsen, 2022).

Seeking to advance ongoing debates about how such malign conservation outcomes may be avoided, this article has sought to place literatures on dark logic models and the prevention of iatrogenic outcomes in the health sciences in closer dialogue with debates about conservation (in)justice. In doing so, we have highlighted three key 'ideal type' approaches to dark logic modelling, illuminating how these approaches might be applied in conservation contexts. Using "dark logic" models in this way, either before or during an intervention, may help to identify both potential harms and the underlying mechanisms which precipitate them. But even if implemented post-intervention, dark logic approaches can inform the design and conduct of subsequent interventions and result in an improved body of knowledge on often-overlooked mechanisms that risk leading to unintended harms.

That said, dark logic models are not without significant limitations. They are not a panacea for avoiding conservation injustices, and particularly so in the context of resurgent spatial ambitions for protected area or conservation area expansion. Unanticipated harms can still occur, even when a dark logic approach is taken. However, as the number of cases evaluated and studied using dark logic grows, so too will our understanding of underlying mechanisms causing harm. In this sense, the extension of dark logic approaches to the context of conservation governance is not intended to replace, but rather to augment, other methods being used both in conservation practice and in academic research. Moreover, given the focus of the present special issue of this journal on social injustice, we have largely not broached the similarly important issue of iatrogenic conservation impacts *upon biodiversity*, which represents an equally important area for future inquiries (see also Hancock, 1997). Nonetheless – particularly insofar as some actors in the global conservation industry are purportedly successful in asserting a "right to fail" (Chambers et al., 2022) in the face of recurring accusations of conservation injustice – it is now more important than ever to develop robust systems to anticipate and prevent iatrogenic conservation outcomes.

Declaration of competing interest

The authors have no conflicts of interest to declare.

Data availability

No data was used for the research described in the article.

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