Title: Preventing perverse outcomes from global protected area policy. *Shifting the focus from quantity to quality to avoid perverse outcomes.*

Running title: Beyond Area Based Targets

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Abstract

Aichi Target 11 focuses on protected areas. While it has galvanized expansion of the global protected area (PA) network, we highlight a lack of evidence that enlarging systems of PAs alone is associated with real biodiversity gains. We examine how prioritizing more area risks unintended perverse consequences. We consider the incentives underpinning this misguided focus on PA extent and suggest a new paradigm for PA target development: shifting the focus from quantity to quality to achieve improved biodiversity outcomes.

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Global policy goals catalyze global action

Global biodiversity conservation goals are catalytic, shaping behaviors of individuals, governments and non-governmental organizations. The Aichi Targets set the current framework for The Convention on Biological Diversity (CBD). At first glance, Target 11 on protected areas (PAs) might appear "on track" to be achieved by 2020[1] (Supplementary Figure 1). Yet, this characterization focuses solely on PA expansion, neglecting other elements of the target critical to halting biodiversity decline.

Global policy targets (e.g., Target 11) define policy norms and shape behavior at multiple scales[2]. Consequently, it is critical policy targets actively direct efforts toward desired outcomes, in this case, biodiversity conservation. Target 11 requires extensive PA networks to be 'equitably and effectively managed', 'ecologically representative', and 'well connected', and to ensure PAs halt biodiversity loss. However, action under Target 11 has focused on PA expansion, to achieve numeric PA extent targets. At least 40% of nations have designated at least 17% of their terrestrial area as PAs, and 13% have exceeded 10% protection in marine environments[3]. Yet much of this expansion has been 'inadequately targeted'[3] (Box 1, Figure 1).

In the past decade, ecological representation of the global PA estate has improved only slightly, and no more than if PAs were established at random[4]. More than a quarter of terrestrial and half of marine ecoregions have under 5% of area protected[5]. Over 85% of threatened vertebrates are unrepresented in PAs, a depressing 4% more species than a

decade earlier[6]. Connectivity is rarely assessed. Management effectiveness is slowly increasing[7], but chronic capacity shortfalls constrain effectiveness of the global PA estate[7] - only 30% of MPAs have sufficient capacity to conduct effective management[8]. Funding shortfalls of ~US $50 billion per annum are at least an order of magnitude greater than existing PA budgets[8]. Poor attention to equity and PA governance also commonly undermine conservation outcomes[9].

Risks of perverse outcomes

These shortfalls highlight the disconnect between PA quantity, PA quality (e.g., equitable and effective management, representative and connected systems), and conservation outcomes (e.g., change in ecological condition), posing a substantive challenge to ensuring current targets catalyze appropriate policy action. Drawing an analogy, it would be inconceivable to monitor healthcare provision based on available beds (quantity) irrespective of the presence of trained medical staff (quality), or whether patients live or die (outcome)[10]. Yet, this is exactly what occurs when we *de facto* rely on extent as the benchmark of success in PA policy

When global policy targets are superimposed on underlying political and economic dynamics, they modify the psychological rewards reaped for specific actions[11]. Under Target 11, the existing indicators for extent (17/10%) and representation (a more specific area-based target)[12] reward PA network expansion. When superimposed on variable opportunity costs of protection, the pursuit of PA coverage incentivizes the

establishment of large PAs with low opportunity costs, rather than maximizing the marginal gain for biodiversity.

This phenomenon is predicted by Goodhart's Law,[11] which warns that once an indicator transitions to a *de facto* policy target (due to its measurability relative to the overall target) its power is undermined. Effort shifts to improving the indicator itself (i.e., PA extent), becoming divorced from the underlying values that the Target seeks (i.e., biodiversity conservation). Once embedded in institutions, the actions promoted by an indicator are perceived as the 'right' policy solution, silencing equally or more effective alternatives and perpetuating tradeoffs which are rarely acknowledged.

Consequently, the transition of the PA extent component of Target 11 to *de facto* policy risks an array of perverse outcomes that constrain and undermine conservation end-goals[13,14] (Figure 1). These include 'under-achievement' (i.e., misdirection of conservation action to areas of low impact) [12], 'overstatement'[12] (i.e., exaggerated perceptions of progress due to paper parks[6,15], and chronic capacity shortfalls[2]) and reduced social licence for conservation (i.e., PA fatigue), among others (Figure 1).

Barriers to new perspectives

The area-based component of Target 11 is a powerful motivator. Unlike the other elements of Target 11, 17/10% extent target is numeric, discrete, simple, objective, comparable and inexpensive to measure (Figure 1). Numeric targets engender trust,

provide sufficient abstraction to be broadly applicable, creating a comparable standard, to facilitate trend analysis by reducing complex phenomena to a single dimension[16]. Simplification and abstraction are core to the power of numeric goals[2], but this power belies their weakness in obscuring local context and complexity. As a policy goal, numbers can create incentives that motivate and align the priorities of diverse actors[17,18], but also distort national priorities, feasibility, resources and trade-offs[11]. While the architects of goals frequently acknowledge these flaws, they are glossed over by other actors.

Yet, scientific, political and practical barriers impede transitions to outcomes-based targets, making implementing protected area policy that results in effective protected areas a wicked problem. Barriers include time lags (ecological and social) between policy action and detectable response, misalignment of incentives, motivations and objectives (such as attempting to conserve wilderness only through protected areas) the ability to sell action as achievement, and limited low-cost, practicable methods to monitor outcomes (Figure 1). Given these barriers, it is perhaps unsurprising (though disappointing) that ongoing discussions on post-2020 PA targets remain centered on extent (e.g., natureneedshalf.org, and Hawaii Commitments (https://portals.iucn.org/congress/hawaii-commitments). However, only by letting go of area-based targets and simultaneously refusing to recognize greater coverage as progress, despite its past utility, will we redirect progress toward greater conservation impact (Box 2).

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120 **Moving beyond area-based targets**

121 It is time to move beyond area-based targets. A new paradigm that explicitly connects
122 targets and indicators with desired conservation outcomes is needed. This requires a
123 monitoring and reporting framework directly linked to conservation objectives that is
124 locally relevant, globally scalable, and realistic given the financial and data constraints
125 many PA agencies face. This challenge is shared by those developing the Sustainable
126 Development Goals (SDGs) indicator framework, and requires immediate attention to
127 put forward a new approach for Target 11's successor in 2020. While there is no short-
128 term panacea to this problem, we propose steps to change the incentive structure of
129 conservation targets, and realign how conservation actors think, feel and act to achieve
130 conservation goals (Box 1, Box 2).

131

132 Shifting toward outcomes-based indicators of conservation action requires a clear
133 conceptual foundation for outcomes-based PA monitoring. Existing efforts (e.g., SMART
134 2015, The Green List of Protected Areas) document the attributes of 'fully-conserved'
135 PAs. Shifting focus from PA extent toward these functional attributes, by setting
136 numeric targets for them would represent a positive interim measure, as we transition
137 toward outcome-focused conservation targets in future. However, any use of proxies
138 must avoid the potential pitfalls of the current Target 11. Adopting appropriate
139 theoretical frameworks that explicitly connect policy targets and indicators with
140 patterns of expected behavior[12,14] and incorporate counterfactual thinking, can enable

progress to subsequently be evaluated.

More critically, we must refocus PA targets towards end-goals, learning from other indicators and efforts. For instance, Aichi Target 12 ("By 2020, the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained") which directly embeds outcomes in the target, and adopts metrics (e.g., Planet Index and Red List Index) which examine the fundamental objective of reducing extinction.

To do so for PAs requires the creation of a feasible, scalable indicator of PA conservation outcomes that normalizes and aggregates already existing low-precision routine PA monitoring data (that meet a minimum quality threshold), with high-precision datasets designed for causal inference. Developing methods to aggregate locally relevant metrics to a globally relevant PA outcomes indicator will set a foundation for 'translating' and communicating the likely continuum of PA outcomes in a way that incentivizes progress.

PAs have highly diverse means of effecting conservation impact. The large variety of local PA objectives make explicit proscription of local scale-metrics to monitor conservation progress for a composite PA outcomes indicator inappropriate. However, adopting standardized suite of recommended indicators and methods, such as estimated avoided deforestation (ideally via quasi- experimental matching techniques [19]) for all forest PAs is a feasible and useful first step. Given disparities in data availability

and quality among PAs, an evidence hierarchy, that describes the uncertainty associated with different data sources, similar to the IUCN Red List, will be required to ensure coarse estimates are interpreted with an appropriate level of caution. Providing a clear path linking currently feasible approaches and ideal methods will catalyze gradual evolution towards more robust local measures, especially if combined with technical capacity building efforts and partnerships for PA managers.

PAs, once established, are near permanent. Without action, we risk 'locking-in' a global PA estate designed to maximize area, not impact. The upcoming re-negotiation of the CBD Targets in 2020 provides a rare window of opportunity to ensure future PA establishment is appropriately targeted and the current PA estate is managed to maximize conservation impact. To take advantage of this window, we need to radically reframe the current PA debate to focus on outcomes, and rapidly develop the framework, data collection and analytical techniques needed to make global PA outcomes monitoring feasible.

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Box 1. Immediate Actions to shift the focus from quantity to quality

A transition to outcomes-based PA targets and monitoring will take time. Meanwhile, immediate actions can be taken under the existing formulation of Target 11 to avoid perverse outcomes, and maximize the contribution of PAs to global biodiversity conservation.

- *Avoid making area the headline:* Report outcomes, not area. New PA announcements should focus on the likely biodiversity gains, not the square kilometers protected. Even when based on patchy or incomplete data, reporting progress under Aichi Target 11 should focus on equitable and effective management and outcomes, and tell compelling stories about individual examples of PA success.

- *Celebrate representation, connectivity and outcomes:* Provide vocal, public recognition to nations whose actions contribute to representation, connectivity, equitable and effective management and outcomes.

- *Build the evidence base for PA outcomes:* Examine the factors that influence PA outcomes, and how to best manage the current PA estate to deliver maximum gains.
    - Establish a reporting framework like the Red list, with rules and guidelines for their application so as to incorporate different data types and qualities.
    - Publish the cost of management interventions.
    - Embed counterfactual thinking and evaluation deliberately in protected area management and evaluation.

- *Focus ongoing or proposed actions under Aichi Target 11 on outcomes:* Focus action on where we can achieve most conservation gain, and embed forecasts of likely PA impacts into core decision-making processes.

265 Figure 1. Perverse Outcomes of Pursuing Percentage Targets
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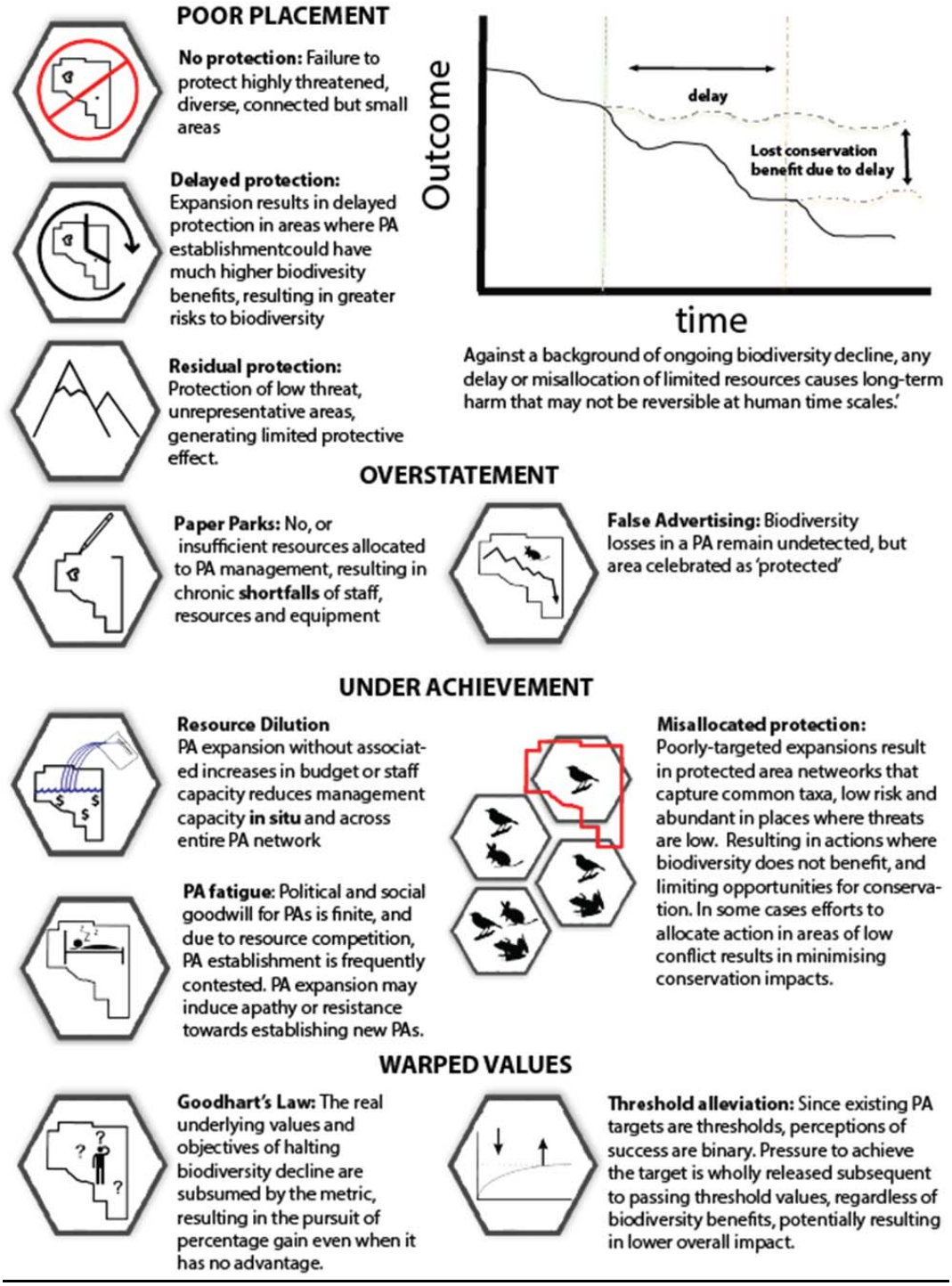

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Box 2. Long term changes to shift the focus from quantity to quality requires changing how

Changing how we THINK ABOUT success

- Policy makers, governments, and NGOs publically acknowledge that continuing an area-focussed agenda will lead to an underperforming, overly expensive PA system.
- Editors and journals commit to rejecting evaluations of PA success that focus on area alone.

Changing how we DESIGN global policy targets

- Harness expertise from other disciplines (e.g., behavioral psychology, economics, evaluation) to develop new targets that incentivize institutional and national behaviors that motivate outcomes

Changing OBJECTIVES and MOTIVATIONS by modifying language of global PA targets

- Incorporate and report ecologically and social meaningful numeric targets for representation, connectivity and management effectiveness.
    - Representation: Quantify how much is enough and for what?
    - MEE: area under protection meeting green list criteria
    - Quantify proportion of network adequately funded
- *Commit* to a RATE of progress rather than only a THRESHOLD
- *Relocate the Numbers*: Include numeric and impact focused clauses or sub-clauses, such as:
    - At least 50% of which exceed minimum standards for management effectiveness
    - Halt deforestation with protected area boundaries
    - Specifically reference conservation end-goals
        - Reference conservation impacts in the target language, e.g. by adding an impact clause that requires planning and consideration of conservation benefits: "targeted to maximize conservation impacts"
        - Incorporate an avoiding clause: "Avoiding residual protected areas"
- Reduce conflation of objectives under the protected areas target by adding an independent wilderness target.

ACT: Changing how we IMPLEMENT global PA targets

- Pilot novel target wording and explore potential perverse outcomes.
- Commit to providing adequate funding for PA outcomes monitoring
- Introduce incentives for demonstrable PA impact under SDG's, CBD so countries are motivated to increase conservation impacts (Figure 1)

ACT: Changing how we MONITOR global policy targets

- *Quantify* Perverse outcomes: Paper Parks, Residual Areas
- Transition to global policy target indicators to focus on **impact and outcomes**
- Design a reporting framework to allow countries to report progress other than increased area (representation, connectivity, impact)
- Invest in research to identify how to best motivate progress towards actual conservation goals at national & International scales (i.e. behavior change driven by institutions & individuals)
- Develop an evidence hierarchy that facilitates evolution of local-scale monitoring towards more robust standards

ACT: No more area-based targets

Supplementary Material

Supplementary Table 1. Illustrative examples of commitments to national protected area (PA) networks made at plenary sessions and via media releases during the World Parks Congress (WPC) 2014. Column 'A' denotes whether the commitment is for more Area, while 'EEM' denotes whether the announcement is likely to contribute to more effective and/or equitable management. 'Y' indicates positive contribution for conservation (other positive outcomes not explicitly considered); 'N' indicates limited contribution; 'ND' indicates data deficient.

Country	Commitment	A	EE
Madagascar	Madagascar reiterated commitment to triple PA coverage on land, added a commitment to triple marine PA coverage, and promised to bring an end to the illegal rosewood trade and promised to ensure effective management of all PAs.	Y	Y
Comoros	11-fold increase in PAs and entire island of Moheli to be a UNESCO Man and Biosphere Reserve.	Y	N
South Africa	Stated intention to increase the extent of marine PAs ten-fold	Y	N
Russia	Pledged to increase PA coverage by 22%, and an additional 170,000 km^2 in the next 10 years.	Y	N
Australia	Announced that the Marine coverage target had been exceeded.	Y	N

Australia	Announced ban on dumping of dredge spoil in the Great Barrier Reef (an activity already legally prohibited under Australian and Queensland Law (Nature Conservation Act, Qld & EPBC Act, Cth of Australia), but dumping shifted as a consequence to land in Caley Valley wetlands, an ecosystem that hosts tens of thousands of birds from dozens of species at peak times of year.	N	N
Australia	Announced intention to create a Rainforest Recovery Program, increase efforts to curb illegal widlife trade, increased financial support for the Coral Triangle Initiative.	N	Y
Australia	Announced the creation of an Indigenous Peoples Commissioner position, which will have a strong focus on the importance of Indigenous territories for the aboriginal peoples of Australia.	N	N
NSW (State in Australia)	The newest national park in the world, Everlasting Swamp National Park in the State's north-east.	Y	N
Gabon	Committed to designating a network of marine PAs covering 23% of the nation's waters, or roughly 46,000 km^2. Commercial fishing will be off-limits in the network, which is intended to protect whales, sea turtles, and other marine species inhabiting the nation's coastal and offshore ecosystems. The network will include a 27,000-km^2 expansion of Mayumba National Park, extending out to the limit of the nation's EEZ.	Y	Y
Brazil	Committed to protecting 5% of its marine waters by 2020	Y	N

French Polynesia	Committed to creating a large-scale MPA initiative	Y	ND
The Republic of Kiribati and the US	Signed a cooperative agreement to coordinate the respective research and protection of their adjacent MPAs: the Phoenix Islands PA (Kiribati) and the Pacific Remote Islands Marine National Monument (US). The combined area, known as the Phoenix Ocean Arc, covers an ocean space totalling 1,270,000 km^2.	Y	N

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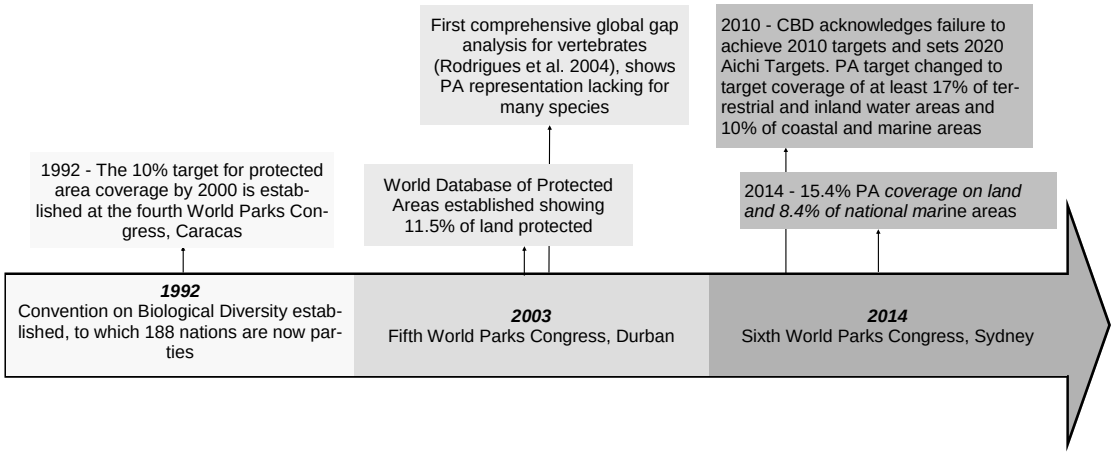

Supplementary Figure 1. Evolution of Aichi Target 11. Aichi Biodiversity Target 11 reads: *"By 2020, at least 17 per cent of terrestrial and inland water areas and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area based conservation measures, and integrated into the wider landscape and seascape*". Since 1992, global protected area (PA) percentage coverage targets have galvanized efforts to establish millions of square kilometers of terrestrial and marine PAs. Under the latest Convention on Biological Diversity (CBD) Strategic Plan, signatories committed to designate 17% and 10% (the '17/10 thresholds') of their terrestrial and marine territory in PAs by 2020. By 2014, global PA coverage had increased to 15.4% of the land and 8.4% of marine areas within national jurisdictions.