Title: "Prevent perverse outcomes from global protected area policy".

Running title: Beyond Area Based Targets

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Abstract

Aichi Target 11 has galvanized expansion of the global protected area network, but there is little evidence that this enlargement brings real biodiversity gains. We argue that area-based prioritization risks unintended perverse consequences and that the focus of protected-area target development should shift from quantity to quality.

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, with sufficient capacity to conduct management), 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, the 17/10% extent target is numeric, discrete, simple, objective,

96 comparable and inexpensive to measure (Figure 1). Numeric targets engender trust,
97 provide sufficient abstraction to be broadly applicable, creating a comparable standard,
98 to facilitate trend analysis by reducing complex phenomena to a single dimension[16].
99 Simplification and abstraction are core to the power of numeric goals[2], but this power
100 belies their weakness in obscuring local context and complexity. As a policy goal,
101 numbers can create incentives that motivate and align the priorities of diverse
102 actors[17,18], but also distort national priorities, feasibility, resources and trade-offs[11].
103 While the architects of goals frequently acknowledge these flaws, they are glossed over
104 by other actors.
105
106 Yet, scientific, political and practical barriers impede transitions to outcomes-based
107 targets, making implementing protected area policy that results in effective protected
108 areas a wicked problem. Barriers include time lags (ecological and social) between policy
109 action and detectable response, misalignment of incentives, motivations and objectives
110 (such as attempting to conserve wilderness only through protected areas) the ability to
111 sell action as achievement, and limited low-cost, practicable methods to monitor
112 outcomes (Figure 1). Given these barriers, it is perhaps unsurprising (though
113 disappointing) that ongoing discussions on post-2020 PA targets remain centered on
114 extent (e.g., natureneedshalf.org, and Hawaii Commitments:
115 https://portals.iucn.org/congress/hawaii-commitments). However, only by letting go of
116 area-based targets and simultaneously refusing to recognize greater coverage as
117 progress, despite its past utility, will we redirect progress toward greater conservation

118 impact (Box 2).

119

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

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., Living 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 a 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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Competing Interests

The authors are not aware of any conflicts of interest affecting this manuscript.

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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.

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

Change how we THINK ABOUT success

- Policy makers, governments, and NGOs publically acknowledge perverse outcomes from an area-focused agenda
- Editors and journals commit to rejecting evaluations of PA success that focus on area

Change how we DESIGN global policy targets

- Develop new targets utilizing expertise from other disciplines (e.g., behavioral psychology, economics, evaluation) to motivate progress towards conservation goals

Change OBJECTIVES and MOTIVATIONS by modifying language of global PA targets

- Report ecologically and social meaningful numeric targets
  - Representation: Quantify how much is enough and for what?
  - Management Effectiveness: area under protection meeting green list criteria[20]
  - Quantify proportion of network adequately funded

- *Commit* to a RATE of progress rather than *only* a THRESHOLD
- Include numeric and impact focused clauses or sub-clauses, such as:
  - At least 50% of which exceed minimum standards for management effectiveness
  - Halt deforestation within protected area boundaries

- Specifically reference conservation end-goals:
  - Reference conservation **impacts** in the target language
    e.g. "targeted to maximize conservation impacts"
  - Incorporate an avoiding clause: "Avoiding residual protected areas"
  - Reduce conflation of objectives by adding an independent wilderness target.

ACT: Change 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: Change how we MONITOR global policy targets

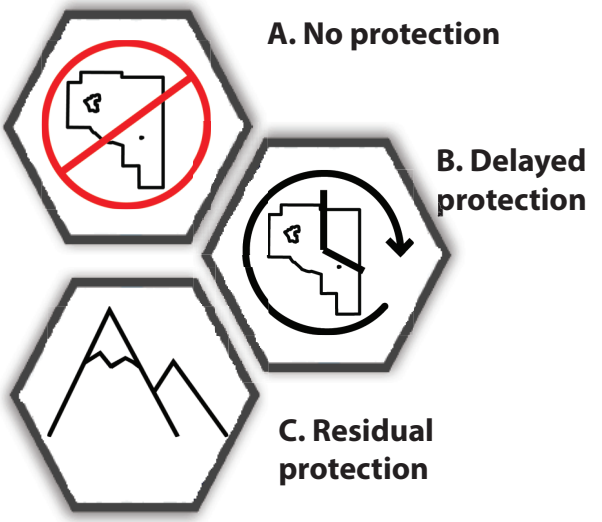
- *Quantify* Perverse outcomes: Paper Parks, Residual Areas
- Transition to global policy target indicators to focus on **impact and outcomes**
- Design a reporting framework that captures progress other than area
- Invest in research to identify how to best motivate progress (i.e. behavior change driven by institutions & individuals)
- Develop an evidence hierarchy that facilitates evolution of more robust local-scale monitoring

ACT: No more area-based targets

Figure Captions

Figure 1. Perverse Outcomes of Pursuing Percentage Targets. **A. No protection:** Failure to protect highly threatened, diverse, connected but small areas; **B. Delayed protection:** Expansion results in delayed protection in areas where PA establishment could have much higher biodiversity benefits, resulting in greater risks to biodiversity; **C. Residual protection:** Protection of low threat, unrepresentative areas, generating limited protective effect; **D. Paper Parks:** No, or insufficient resources allocated to PA management, resulting in chronic shortfalls of staff, resources and equipment; **E. False Advertising:** Biodiversity losses in a PA remain undetected, but area celebrated as 'protected'; **F. Misallocated protection:** Poorly-targeted expansions result in protected area networks that capture common taxa, low risk and abundant in places where threats are low. This results in actions where biodiversity does not benefit, and limiting opportunities for conservation. In some cases, efforts to allocate action in areas of low conflict results in minimising conservation impacts; **G. Resource Dilution:** PA expansion without associated increases in budget or staff capacity reduces management capacity in situ and across entire PA network; **H. PA fatigue:** Political and social goodwill for PAs is finite, and due to resource competition, PA establishment is frequently contested. PA expansion may induce apathy or resistance towards establishing new PAs; **I. Goodhart's Law:** The real underlying values and objectives of halting biodiversity decline are subsumed by the metric, resulting in the pursuit of percentage gain even when it has no advantage; **J. Threshold alleviation:** Since existing PA targets are thresholds, perceptions of success are binary. Pressure to achieve the target is wholly released subsequent to passing threshold values, regardless of biodiversity benefits, potentially resulting in lower overall impact. **K. Lost Conservation Benefits**.

POOR PLACEMENT

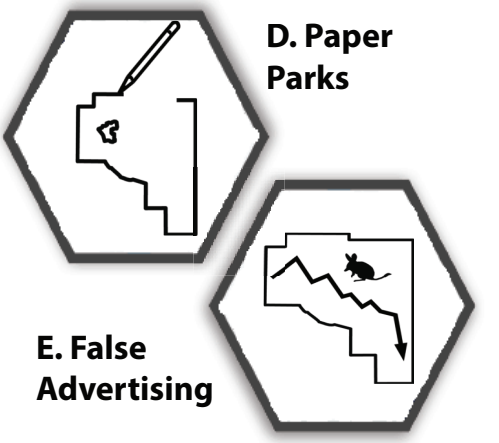


A. No protection

B. Delayed protection

C. Residual protection

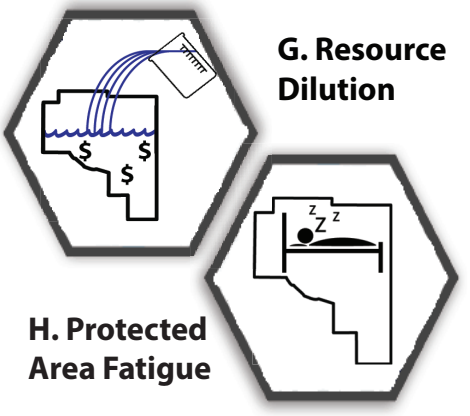
OVERSTATEMENT



D. Paper Parks

E. False Advertising

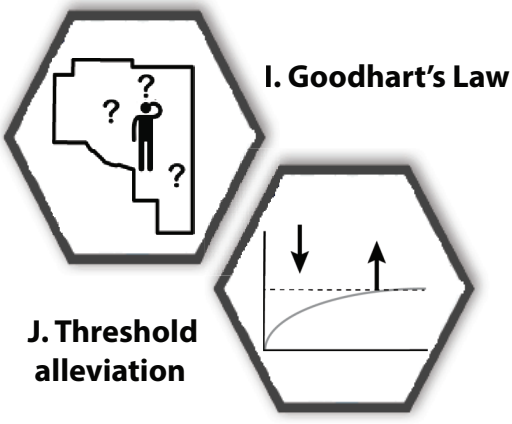
UNDER ACHIEVEMENT



G. Resource Dilution

H. Protected Area Fatigue

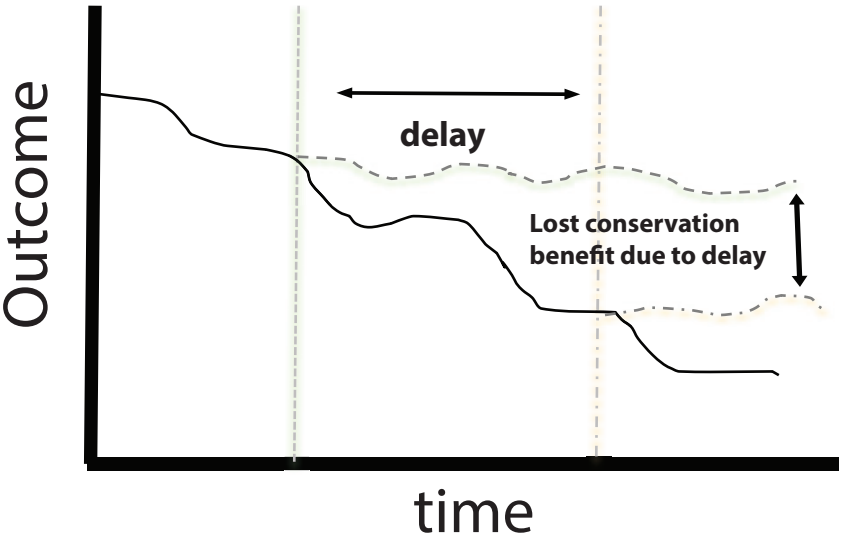
WARPED VALUES



I. Goodhart's Law

J. Threshold alleviation

F. Misallocated protection



K. Lost Conservation Benefits Against a background of ongoing biodiversity decline, any delay or misallocation of limited resources causes long-term harm that may not be reversible at human time scales.