POLICY PERSPECTIVE

The biodiversity bank cannot be a lending bank

Sarah A. Bekessy[1], Brendan A. Wintle[2], David B. Lindenmayer[3], Michael A. Mccarthy[2], Mark Colyvan[4], Mark A. Burgman[2], & Hugh P. Possingham[5]

[1] School of Global Studies, Social Science and Planning, RMIT University, GPO Box 2476, Melbourne 3001, Australia
[2] School of Botany, The University of Melbourne 3010, Australia
[3] Fenner School of Environment and Society, The Australian National University, 2000, Australia
[4] School of Philosophical and Historical Inquiry, University of Sydney, 2006, Australia
[5] The Ecology Centre, The University of Queensland, St Lucia, QLD 4072, Australia

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Correspondence
Brendan A. Wintle, School of Botany, University of Melbourne, 3010, Victoria, Australia. Tel: +61-3-8344-3306; fax: +61-3-9347-5460.
E-mail: brendanw@unimelb.edu.au

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Abstract

"Offsetting" habitat destruction has widespread appeal as an instrument for balancing economic growth with biodiversity conservation. Requiring proponents to pay the nontrivial costs of habitat loss encourages sensitive planning approaches. Offsetting, biobanking, and biodiverse carbon sequestration schemes will play an important role in conserving biodiversity under increasing human pressures. However, untenable assumptions in existing schemes are undermining their benefits. Policies that allow habitat destruction to be offset by the protection of existing habitat are guaranteed to result in further loss of biodiversity. Similarly, schemes that allow trading the immediate loss of existing habitat for restoration projects that promise future habitat will, at best, result in time lags in the availability of habitat that increases extinction risks, or at worst, fail to achieve the offset at all. We detail concerns about existing approaches and describe how offsetting and trading policies can be improved to provide genuine benefits for biodiversity. Due to uncertainties about the way in which restored vegetation matures, we propose that the biodiversity bank should be a savings bank. Accrued biodiversity values should be demonstrated before they can be used to offset biodiversity losses. We provide recommendations about how this could be achieved in practice.

Introduction

Biobanking and vegetation offset approaches are now widely applied in an attempt to halt ongoing reduction in vegetation cover in already heavily altered landscapes (Fox & Nino-Murcia 2005). Offsetting approaches have been developed that aim to incorporate ecological principles, though policy and technical issues are yet to be resolved. The use of offsets to mitigate damage to biodiversity through vegetation clearance (ten Kate *et al.* 2004; Blundell 2006) is flawed if it allows clearance to be offset by protection of existing ecological assets. This will reduce the amount of habitat in a landscape, rather than lead to "net gain" or "no net loss" that is the objective of such schemes (e.g., Wetland trading in USA [Reppert 1992]; Biobanking [Department of Environment and Conservation 2005]; and Net-gain [Victorian Government 2002] policies in Australia). Furthermore, the way that ecological concepts are incorporated into such policies will be crucial if they are to succeed in maintaining and improving biodiversity throughout the landscape (e.g., the role of habitat connectivity, area and quality in mediating metapopulation persistence (Hodgson *et al.* 2009), the need for ecological redundancy to maintain ecosystem processes (Peterson *et al.* 1998), and the manner in which species richness scales with habitat area (Rosenzweig 1995)).

Under "biobanking" or "vegetation offset" approaches, proponents of a development involving clearance or alteration to vegetation are required to identify an offset of an equivalent or better biodiversity value, assessed using a biodiversity value metric (see discussion of metrics

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below). Two types of offsets are commonly identified under such schemes: the regeneration of vegetation in areas that are currently highly degraded, and the securing (often through tenure change) of vegetation in equivalent or better condition (compared to the liquidated asset). An assumption of such schema is that improved management and security of existing vegetation is an acceptable offset for permanent loss of existing habitat because it may provide future improvements to net biodiversity value or avoid future losses. While we agree in principle with the use of offsetting and biobanking as instruments to conserve biodiversity, most offsetting schemes that use these two approaches are resulting in net losses of biodiversity. We recommend instead policies that are likely to provide net benefits for biodiversity.

Using existing assets as offsets will deplete biodiversity

Trading schemes that allow vegetation clearance to be offset by protection of existing vegetation will result in a net loss of habitat (Figure 1). In the best-case scenario, when the offset is protected in perpetuity and maintained so that its habitat value improves over time (i.e., its species composition and structure is closer to some reference state or condition; Gibbons *et al.* 2008), there is still a net loss of habitat. In the worst-case scenario, the protection is inadequate to prevent the further loss of vegetation through degradation or future development of offsets, leading to even greater losses of habitat in the landscape.

One could argue that offsets based on the protection of existing habitat do benefit biodiversity conservation as they "protect" this habitat from future loss. This is based on the assumption that the habitat used as the offset is under some real threat of clearance either now or in the future. This may be true in some instances, although basing offset policy on the premise that existing vegetation (and therefore offsets themselves) cannot be truly secured effectively admits defeat from the outset. An effective net-gain policy would ensure that future losses, if unavoidable, would themselves be offset, making the concept of tenure security as an offset redundant. If the objective of a vegetation management policy is to achieve no net loss, then actions that merely place offsets into a different tenure or security arrangement should not be permitted.

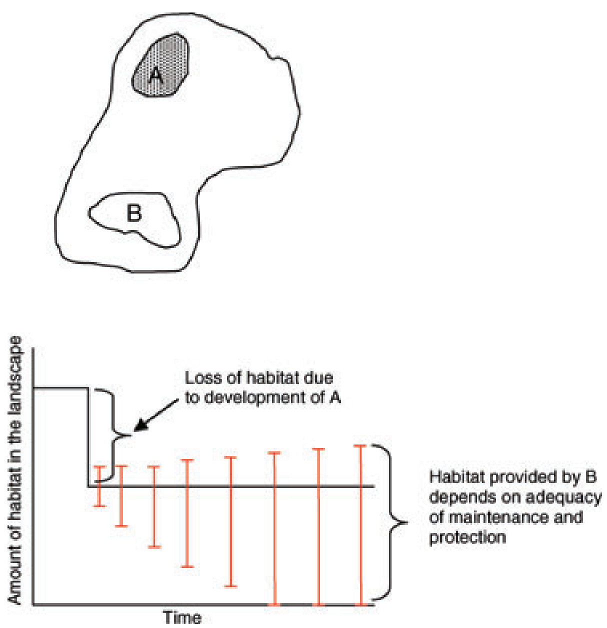

Figure 1 Trading existing ecological assets: B is selected as an offset to the development of A. In the best-case scenario, B is maintained well and improves slightly over time, but there is still a net loss of habitat. In the worst-case scenario, the protection provided is inadequate over time to prevent the loss of B through degradation or future development. Increasing error bars over time result from increasing uncertainty about the state of patch B at future time periods due to uncertainty about future environmental and political conditions.

Uncertainty precludes lending as a net-gain option

Many habitat trading schemes assume that we are capable of recreating habitat and that it will automatically be used by biodiversity, while others penalize future offsets arising from restoration based on the premise that they are unlikely ever to substitute fully the character and function of the lost vegetation (Victorian Government 2002; Moilanen *et al.* 2008). Unlike a building that can be retrofitted for sustainability, once habitat is destroyed it might be impossible to reconstruct. Revegetation and restoration can increase tree cover and create habitat for some species. However, to date recreation of ecosystems with all component species and functions has proved prohibitively expensive or impossible (Wilkins *et al.* 2003). Assessments of revegetation success point to the fact that it is difficult to create habitat for some key elements of biodiversity (Hynes *et al.* 2004; Cunningham *et al.* 2007), making it critical that areas of rare ecosystems are not destroyed.

Furthermore, the population dynamics of species must be incorporated into decision making, particularly for those species sensitive to time lags between vegetation clearance and restoration (Gibbons & Lindenmayer 2007). Figure 2 demonstrates the potential loss of habitat given uncertainty in restoration success. In the best-case

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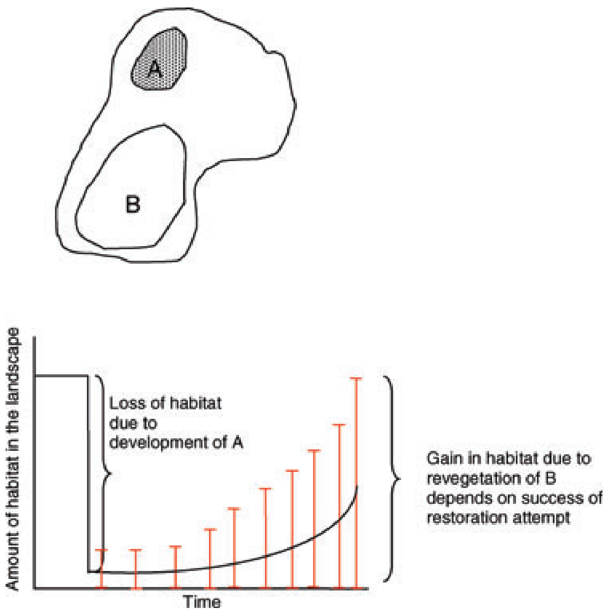

Figure 2 Uncertainty in restoration: B is revegetated as an offset to the development of A. In the best-case scenario, assuming perfect restoration success, there is a time lag in the availability of habitat. In the worst-case scenario, vegetation is never restored to the same condition as A, and there is a net loss of habitat in the landscape. Error bars increase over time due to uncertainty about future environmental and political conditions.

scenario, assuming perfect restoration success, there is still a time lag in the availability of habitat during which populations can drop below a minimum viable population size (Shaffer 1981). In the worst-case scenario, habitat is never fully restored; there is a net loss of habitat in the landscape, and the probability that dependent species persist in the landscape is likely to decline (Morris *et al.* 2006; Gibbons & Lindenmayer 2007).

Uncertainty penalties have been proposed (Moilanen *et al.* 2008), whereby trading systems allow for ecological uncertainties by offsetting loss of a given area with a much greater area of vegetation restored/conserved. This is equivalent in economics, to applying a discount rate to calculate net present value. However, the uncertainties associated with biodiversity value of restored sites is such that the multipliers applied to offsets are difficult to compute and are likely to be unworkably large (Moilanen *et al.* 2008). Uncertainty multiplier systems are at best complicated and unworkable in the eyes of proponents and are at worst token and not commensurate with the inherent uncertainty about restoration success. We contend that the inherent difficulties in the use of uncertainty multipliers adds to the weight of our arguments for abandoning lending bank practices in favor of a savings bank approach. This means that the biodiversity value of offsets should be realized before assets are liquidated.

The future of biodiversity banking: the biodiversity savings bank

Biodiversity banking and offsetting of habitat loss are good ideas that should not be abandoned. However, we propose that the only workable and equitable system is one in which assets are banked for the future and trading is only possible once it can be demonstrated that assets have matured (reached ecological equivalence with whatever losses they are being traded against). The value of biodiversity assets (savings) should be demonstrated before they can be used to offset loss of biodiversity elsewhere. New investments could be sold to a party interested in liquidating an equivalent amount and quality of vegetation. Alternatively, banked biodiversity (i.e., habitat created above and beyond "duty of care" (Bryan *et al.* 2005)), could be bought or sold on an established market. The definition of duty of care in this instance would include the land management actions required of landholders under national, state and local laws, such as eradication of proclaimed weeds and pests. To ensure that on average the environment is better off after each trade, uncertainties would be estimated, and trade allowed when the evidence for the expected environmental benefits is beyond reasonable doubt.

Figure 3 shows how a biodiversity savings bank would operate. Habitat would be restored at a site and trade would be allowed when the destruction of vegetation (A) had only a small chance of taking the environment below the original amount of habitat in the landscape. Care would need to be taken to ensure that credit is only assigned to actions that are above and beyond duty of care or existing legislative requirements. An auditing system would need to be established to ensure that genuine restoration projects receive due recognition and appropriate accrual of biodiversity credits.

Offsetting policies should be transparent in their objectives by identifying a set of ecological attributes that habitat trading aims to maintain or improve. The use of objectives such as "net gain" would need to be defined and assessed in terms of these ecological attributes, for example "net gain in the persistence of species in the landscape and the extent and condition of their habitat." For the sake of accountability, monitoring systems would need to be established to measure whether objectives are being met. The burden of demonstrating the ongoing success of restoration projects should be borne by the proponent of the trade. The advantage of the savings bank approach is that the equity of a trade or offset can be known (within

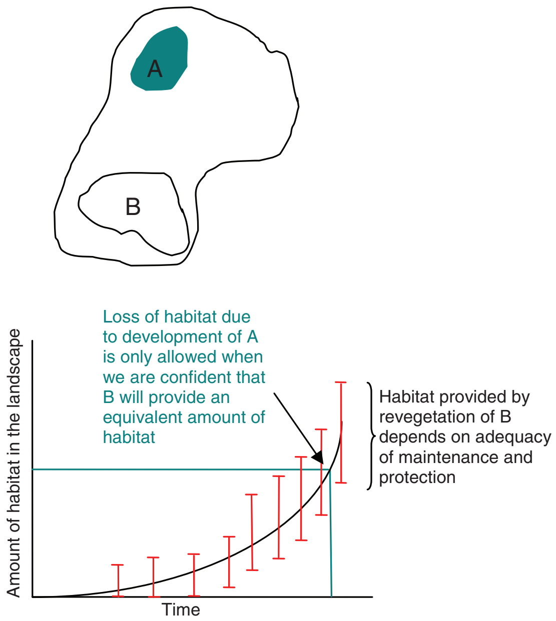

Figure 3 The biodiversity bank as a savings bank: Vegetation is restored at site B and trade is only allowed when we are confident that the destruction of A has only a very small chance of taking us below the original amount of habitat in the landscape. Error bars reflect uncertainty about the whether or not restoration is likely to be successful (from the perspective of someone at time = 0). However, uncertainty at the time of trade under the savings bank model would be much less.

measurement error) at the time of the trade. The ongoing responsibility to demonstrate that the offset is maintaining or improving in quality would sit with the proponent, although a statutory body would be responsible for auditing the monitoring results.

Some things, such as critical habitat for listed threatened species, are not tradeable. Offsetting is not a panacea for unbridled development and must be firmly established as the last and most costly step of the "avoid, mitigate, and compensate" hierarchy from the Convention on Biological Diversity (UNEP 1992). The primacy of avoiding clearance advocated in the convention must be backed up by management systems and strong legislation to prevent clearing of habitat for endangered species. There are many instances in which development has proceeded despite the presence of listed threatened species on a site. Blundell (2006) describes a situation whereby a mining company clears some of the last remaining 3% of Peruvian *Polylepis* forest, home to several endangered bird species, but achieves a "net gain" through protection and restoration of other extant remnants. A similar proposal has been put forward by the Victorian State Government in Australia (Victorian Government 2009), which aims to offset the destruction of several thousand hectares of critically endangered (Environment Protection and Biodiversity Conservation Act 1999) basalt plains grasslands (less than 1% pre-European extent; Barlow & Ross 2001) by assigning a portion of the existing grassland to reserve. Offsetting in these instances cannot be used as a substitute for responsible management; some elements of biodiversity, like whole species and ecosystems, are irreplaceable, hence should be untradeable if the trade adds to an already high risk of extinction or loss.

In the following three sections, we expand on some key aspects of a workable and equitable biodiversity savings bank. We then address some of the likely objections to the savings bank proposal and conclude with a summary of the key argument in favor of such an arrangement.

Currency of trade must reflect ecological realities

Moving from a lending bank to a savings bank approach to biodiversity banking does not obviate the need for metrics to assess biodiversity value because the value of offset sites, once restored, must be demonstrably equivalent to those lost. In order to achieve equity between biodiversity losses and offsets with high confidence, metrics that better reflect the value of vegetation for biodiversity are required. Simple rules of thumb enable quick assessments, but are unlikely to capture the real value for biodiversity (McCarthy *et al.* 2004). Attempting to trade for "ecological equivalence" is an intuitive notion, but the term is not yet defined technically in a way that is appropriate for biodiversity trading.

Metrics must incorporate irreplaceability (Pressey *et al.* 1994) to avoid the trap of allocating low value to degraded habitat even if it is representative of a highly threatened ecological community. Some schemes use a separate overlay or policy mechanism to ensure that the most threatened communities or species habitats are not traded. However, decisions about offsetting that rely on habitat condition metrics alone will jeopardize many of the most threatened ecosystems, as they often exist in a degraded state (Prober & Thiele 1995). Figure 4 represents the problem of decreasing diversity of ecosystems in a landscape resulting from trading vegetation on the basis of quality, without considering irreplaceability. Fragmented and degraded threatened ecosystems are systematically lost over time, and restoration efforts tend to recreate more common ecosystems with a different value to biodiversity (Ryan 2002).

Metrics must reflect the dynamic nature of landscapes. For example, recently burned patches should not receive an artificially low value because they temporarily lack certain habitat characteristics. Areas that have been recently disturbed can be important for biodiversity (Higgs

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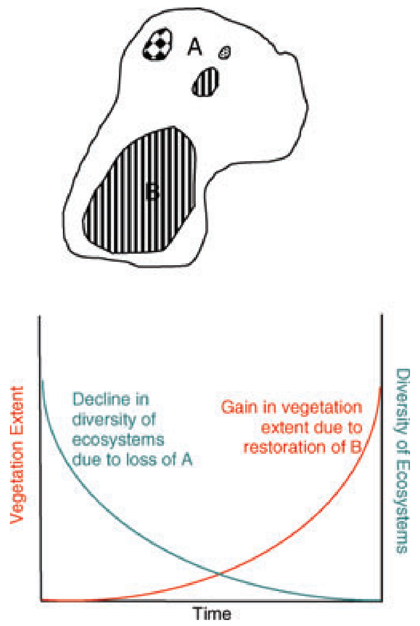

Figure 4 Irreplaceability: When the currency of trade is habitat condition, fragmented and degraded threatened ecosystems (A) are systematically lost over time. Offsetting through restoration (B) tends to recreate more common ecosystems. Over time, even though the amount of vegetation may increase, the diversity of ecosystems in the landscape, and hence the value of the landscape for biodiversity, declines.

& Fox 1993) and these naturally disturbed, early successional habitats can be rare in some landscapes (DellaSala *et al.* 2006). In landscapes where this is the case, the desired reference state (sensu Gibbons *et al.* 2008) need not necessarily be the oldest or most ecological mature version of the ecosystem.

The value of an offset will depend on the value of surrounding vegetation, so spatial context must be considered both in the valuation and planning of offsets (Bruggeman *et al.* 2005). Patches can be important for metapopulation dynamics and retaining landscape connectivity, as well as for their local attributes. For example, planning proposals in urban Sydney, Australia (Growth Centres Commission 2007) suggest that "net gain" in vegetation can be achieved through sacrificing most vegetation within an urban growth corridor so long as vegetation is protected and restored elsewhere in the State of New South Wales. This assumes unrealistically that equivalent vegetation can be found elsewhere, and has further implications in terms of the connectivity of the landscape and the metapopulation dynamics and genetic diversity of species. Furthermore, this approach will lead to an increasing separation between people and nature and a reduction in the provision of local ecosystem services to local communities (Tratalosa *et al.* 2007).

Responsibility for protecting and maintaining offsets must be identified

Responsibilities and funding must be established prior to project approval to ensure that offsets are managed, protected, and monitored. Under the "Net Gain" scheme in Victoria, Australia, security of the offsets is ensured by alteration to the land title that guard against future clearing. However, management contracts to maintain the quality of the vegetation are generally undertaken on relatively short time horizons (e.g., 10 years), making the long-term condition of the offset uncertain. Wetland offsets in the United States are rarely visited to ensure that required mitigation is completed, and monitoring reports are rarely filed (Esty 2007). Without commitments to maintain and protect vegetation offsets through conservation covenants or other such schemes, these policies will result in a net loss of vegetation over time. Alternatively, offsets could be available for future development if a sophisticated landscape accounting scheme was established, but this solution has two potential problems: (1) many criteria would need to be satisfied for a scheme of this kind to achieve benefits for biodiversity, and the sophistication in management that would be required would depend on adequately resourced management agencies with secure long-term funding, and (2) the need for complex government regulation defeats the purpose of establishing market-based approaches to natural resource management (Mansfield 2004).

Implementation of biodiversity offset schemes must be closely regulated and legally enforceable

Many current offsetting initiatives provide guidance as to what constitutes appropriate and inappropriate offsets. For example, guidance for the implementation of offsetting under the "Net-Gain" policy in Victoria, Australia specifies that vegetation types listed as threatened, vulnerable or rare *should not* be offset within the policy framework. However, such values are planned to be liquidated by the Victorian Government itself for housing development and "offset" by increasing tenure security in another area (Victorian Government 2009). This is primarily due to an inconsistent approach to implementing the policy's guiding principles. To avoid these types of inconsistencies, offsetting schemes should be overseen by an independent authority such as the relevant environment protection agencies (e.g., U.S. Environmental Protection Agency) with the power to reject proposals that breach fundamental criteria. In addition, for the principles of even the most ecological defensible offsetting scheme to be respected by proponents of vegetation clearance, they must be attached to a regulatory framework that is legally enforceable and that provides sufficiently serious penalties as a disincentive to noncompliance. Regulatory agencies must ensure that appropriate technical expertise and resources exist so that those bodies responsible for planning, implementing, and overseeing offsetting (e.g., state and local governments) are able to do so in a rigorous and ecologically defensible way.

Arguments against the biodiversity savings bank

Some may argue that it is impractical to expect developers or other parties to invest in revegetation now for expected gain once the vegetation has reached an equivalent ecological condition to that which is to be lost. This is in part due to the length of time associated with ecological restoration. However, we believe that there are some mitigating factors. To improve the practicality of the biodiversity savings bank scheme, the rules of the bank could allow credits to be assigned to people who have previously invested in restoration projects that might already be providing some biodiversity benefit that could be immediately tradeable (with the caveat that this restoration must not have been undertaken as part of an existing offset scheme). This would place a premium value on biodiversity restoration investments have already reached a high biodiversity value, rewarding those who have already made an attempt to revegetate.

In order to increase the area of land available for offsetting, other investment initiatives such as carbon trading should be harnessed as a source of funds for investments in biodiversity restoration (Bekessy & Wintle 2008; van Oosterzee *et al.* 2010). Integration of the biodiversity bank with the carbon bank will increase the potential for improved biodiversity outcomes. We believe that allowing investors to double dip (initially, at least) in the carbon and biodiversity banks (i.e., to accrue both carbon and biodiversity credits from one restored parcel of land) will favor biodiverse carbon sequestration investments over biodiversity poor carbon sequestration investments (e.g., monoculture plantations) (see Bekessy & Wintle 2008 for details).

Some vegetation types (e.g., grasslands) will take less time to restore and revegetate than others. This may have the effect of encouraging proponents of vegetation clearance to avoid the destruction of ecosystems that are extremely difficult to regenerate/reconstruct and/or to seek investment in restoration of some vegetation types that are faster to restore. However, it is necessary to ensure that different vegetation types are not substitutable, so that the loss of one vegetation type cannot be offset with credits obtained from the restoration of another. Similarly, metrics that combine different elements of habitat (e.g., tree cover, weeds, coarse woody debris, etc.) should not be constructed in such a way that allows the different elements to be perfectly substitutable (as allowed by additive metrics). Otherwise the elements that are more difficult to conserve or restore will continue to decline, offset by the growth of the cheaper elements (McCarthy *et al.* 2004).

A biodiversity savings bank would be substantially simpler to administer than the current system that allows offsetting with future, uncertain benefits. Under current approach to offsetting, society bears the risk of failure. To ameliorate partly this risk, uncertainty penalties are often applied to offsets whereby the area and condition of the offset is larger than the loss. In ecology, the uncertainties are so large that a consistent and equitable discount rate will make many trades unworkable for proponents (Moilanen *et al.* 2008). Thus, the savings bank that we recommend has considerable value for both proponents of development and for those whose primary motivation is to protect the environment because it simplifies the process, removing the complexity and ambiguity of uncertainty penalties. A savings bank will provide a platform for equitable trades where uncertainty does not unreasonably inflate the expected magnitude and condition of the region that has to be rehabilitated. The value for the environment is that net gain is assured.

Finally, critics of a savings bank approach to biodiversity banking and offsetting need to consider the alternatives. On the one hand, there is maintenance of status quo (offsets based on uncertain future benefits from restoration), which is likely to lead to further biodiversity losses. On the other hand, relying on regulation alone is risky given the continued loss of vegetation in places with apparently strong regulation. While biobanking should not be seen as a substitute for good vegetation management regulations, the biobank will, if handled correctly, bring additive benefits over and above the regulatory minima.

Conclusion

We believe that biodiversity banking and offsetting schemes should be encouraged as an approach to achieving better biodiversity outcomes in the face of increasing human pressure on the environment. However, their purpose is dubious if they fail to deliver real benefits for biodiversity and could in effect reduce pressure on developers to avoid harm (Roberts 1993). In many parts of the world, the loss of habitat below levels necessary

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for viable populations of flora and fauna (also known as "the extinction debt") (Malanson 2008; Hahs *et al.* 2009) means that we need genuine "net gain" outcomes unless we are prepared to accept responsibility for further extinctions. Current implementation of biodiversity offsetting could be considered a *lending* approach, whereby loss of biodiversity assets is offset by possible future gains. This approach is unacceptable because the environment and public own all the risk of failure. We believe that a saving bank approach is the only practical and equitable approach for biobanking.

Implementing a savings bank approach to biobanking will not be easy and will require strong political will and a concerted cooperative effort by scientists, policy makers and managers to get the details right. However, we cannot continue to use current approaches to offsetting to claim that we are adequately mitigating threats to biodiversity, because this is simply an untenable claim. The biobank should be a savings bank, or it should not exist at all.

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