



Making biodiversity offsets work in South Africa – A governance perspective



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ABSTRACT

South Africa is increasingly putting itself into an undesirable state of ecological deficit. Regulatory and other interventions are needed to stop and reverse ecosystem degradation. Biodiversity offsets are seen as one possible method of mitigating the current trends in biodiversity and ecosystem services loss in the country. However, for offsetting to succeed in practice, a number of barriers will have to be overcome. This paper discusses concerns raised by South African stakeholders as part of a policy development process implemented by the Department of Environmental Affairs and proposes how the identified barriers may be overcome in the South African setting.

1. Introduction

There is a growing concern among mainstream policy-makers and development planners around the continued loss of biodiversity and associated ecological goods and services (World Economic Forum, 2017; Venter et al., 2016). As a component of the mitigation sequence, biodiversity offsetting is one possible means of slowing the rate of loss, and potentially even reversing the decline where applied as part of a net gain approach (Coralie et al., 2015). However, offsetting is still a relatively novel concept in South Africa and its use is subject to heated debate, even within the community responsible for drafting and shaping offsetting policy (Department of Environmental Affairs, 2015a).

This paper identifies the significant issues that emerged during a national dialogue on environmental offsetting (Department of Environmental Affairs, 2015b). It frames the issues as barriers to the effective rollout of offsetting in the South African setting from a governance perspective. It does not provide an exhaustive review of barriers to offsetting but rather deals with those that appear to be of greatest concern to stakeholders. Hence, this paper does not discuss the merits and demerits of offsets, but assumes that they may have a positive role to play in mitigating ecological impacts.

These barriers are analysed from a policy and governance perspective, and means of addressing them are suggested with a view to further informing the development of offsetting policy internationally.

2. Background and context

Market and policy failures have led to a period of ‘ecological deficit’ where natural capital is being degraded, destroyed, and depleted faster than it is being replenished (National Planning Commission, 2011; Galli, 2012; Gonzalez, 2013). Land, especially agricultural land, is also being severely eroded and key ecosystem services are being compromised (Bateman et al., 2013; Costanza et al., 2014; ELD Initiative, 2015; Global Commission on the Economy and Climate, 2015; Turner et al., 2016).

From a South African perspective, the National Planning Commission is concerned that the ecological deficit may be undermining the Constitutional Right of future generations to ‘an environment that is not harmful to health and well-being’ (Government of South Africa, 1996) and that South Africa’s demand for the goods and services delivered by robust ecological infrastructure is outstripping supply (National Planning Commission, 2011).

In order to address this effectively, both the demand and supply sides must be considered. On the demand side, South Africans must consume in a more sustainable and equitable way. On the supply side, South Africans must replenish their renewable natural capital through interventions that rehabilitate and/or restore their ecological infrastructure (Kubiszewski et al., 2010; Department of Environmental Affairs, 2011a; National Planning Commission, 2011).

Biodiversity offsets are seen as one possible method of slowing and even reversing the current trends in biodiversity and ecosystem services loss in the country. However, for offsets to succeed, a number of barriers will have to be overcome. This paper discusses the barriers

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to establishing biodiversity offsets identified by the South African Department of Environmental Affairs and proposes how to overcome them in the South African setting. Although many of the identified barriers may be broadly analogous to those that have been identified in other countries, it is likely that they may align far closer to those in countries with a similar economic development and natural environment status.

3. Status of offsetting in South Africa

Currently, South Africa does not have a national policy for biodiversity offsetting, nor an explicit offsetting provision in the law. Despite this, there is an implicit legal provision for the use of offsets in the national environmental impact regulation (Manuel, 2013; Government of South Africa, 2014). Biodiversity offsets also provide a means of implementing the ‘polluter-pays’ principle contained in the National Environment Management Act (NEMA; Act No. 107 of 1998) (Louw, 2014).

In order to address this policy vacuum, a policy framework is being developed to guide the implementation of biodiversity offsets (South African National Biodiversity Institute, 2014). An insight into this national framework is provided in the *Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector* (Department of Environmental Affairs, 2013).

According to South Africa’s Fifth National Report to the Convention on Biological Diversity (South African National Biodiversity Institute, 2014), the evolving framework outlines an approach to biodiversity offsets that involves compensating for the loss of biodiversity in one area by securing additional equivalent biodiversity in another area. This includes financial provision for the appropriate management of the area secured. This approach is underpinned by ecosystem-level biodiversity targets and the identification of spatial biodiversity priorities through systematic biodiversity planning. Although South Africa does not have a formal register of biodiversity offsets, the Fifth National Report estimated that there were less than fifty biodiversity offsets implemented in South Africa.

Due to the lack of national policy, a number of South African provinces have developed their own biodiversity offsetting frameworks. The Western Cape Province was the first to develop biodiversity offset governance (Manuel, 2013). Their Provincial Guideline on Biodiversity Offsets (Department of Environmental Affairs and Development Planning, 2007) is often used to inform offsetting governance discussions. The KwaZulu-Natal and Gauteng provinces soon followed in developing their own biodiversity offsetting strategies and associated guidelines (Ezemvelo KZN Wildlife, 2009, 2013; Manuel, 2013). Other departments, such as the Department of Water Affairs and South African National Biodiversity Institute (2013), have also developed related guidelines, including the *Wetlands offsets: a best-practice guideline for South Africa*. Notwithstanding this evolving governance framework, the administration of biodiversity offsets is generally still weak (South African National Biodiversity Institute, 2014).

A number of important policy positions appear to be emerging from on-going discussions. Firstly, there appears to be increasing support for the position of a ‘net gain’ from biodiversity offsets rather than just ‘no net loss’ (Department of Environmental Affairs, 2015a). Secondly, there is a call to clearly delineate the concepts of offsetting and compensation or trade-off. Thirdly, the concept of ‘offset banking’ is being favourably considered. Finally, ‘trading up’ as an alternative to ‘like-for-like’ is also favourably considered for certain offset instances.

4. The discussion document development process and findings

South Africa’s National Environmental Management Act (Act No. 107 of 1998, NEMA) contains a principle that requires the promotion of participation of all interested and affected parties in environmental

governance and that all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, especially the participation by vulnerable and disadvantaged persons (NEMA section 2(4)(f)). In late 2014, guided by this principle, and with a view to a possible environmental offsetting policy development process, the South African national Department of Environmental Affairs initiated the Environmental Offsetting Discussion Document project. The overall project objective was that by project completion, all interested and affected parties had access to basic information around the concept of environmental offsetting in a South African context that has been informed by various key environmental offsetting actors and role players. To this end, the project produced, among others: a review of local and international literature; a stakeholder analysis and associated database; and a discussion document. The compilation of the discussion document was an attempt to utilise what Von der Heyden et al. (2016) refer to as a co-creation approach to policy development. To this end, an initial stakeholder workshop was held where the draft literature review and stakeholder analysis was presented for comment and input after which stakeholders were encouraged to suggest the discussion document content, including structure, focus and issues to be covered. Informed by these workshop discussions, an initial draft discussion document was compiled which was then used to focus discussions in a second stakeholder workshop. Stakeholders were also given various opportunities to submit written input for consideration in the final discussion document. The proceedings of this second workshop and the few written comments received informed the published discussion document (Department of Environmental Affairs, 2015b) and provided an insight into stakeholder concerns.

The project engaged 159 individuals who had been identified as people who had shown an interest in offsetting or the offsetting debate. As can be seen from Table 1, a broad range of stakeholders with very different interests were engaged. The notable absence of NGOs from the first stakeholder workshop was due to a boycott of the event because government had not provided a draft document which NGOs could engage with. This is indicative of the suspicion that many South African NGOs have for offsetting and especially government’s intentions in this regard.

Unfortunately the process was also complicated by an attempt to deal with all forms of environmental offsetting currently being debated in South Africa, including carbon, air quality, water, wetlands, and biodiversity offsets. However, each of these forms were dealt with separately to a large extent.

Given the more balanced participation in the second workshop and the fact that discussions in the second workshop were more focussed because of the availability of a draft discussion document, this workshop was used as the basis for identifying the key issues associated with the offsetting concept.

A total of 52 issues specifically related to biodiversity offsetting

Table 1
Stakeholder engagement and participation.

	Total	DEV	NGO	RES	REG	PRS	EAP
Total stakeholders engaged	159	60	29	16	42	1	11
Workshop 1 participants	49	19	4	5	15	0	6
Workshop 2 participants	60	18	11	10	15	0	6
Participants that attended both workshops	23	3	3	4	10	0	3

Where: DEV A developer – a person representing an entity that may be required to implement an offset

NGO A non-government organisation with an environmental focus or specific interest

RES A researcher or academic

REG A regulator – a government official that may require a developer to implement an offset

PRS A journalist

EAP An environmental assessment practitioner that may be required to design an offset.

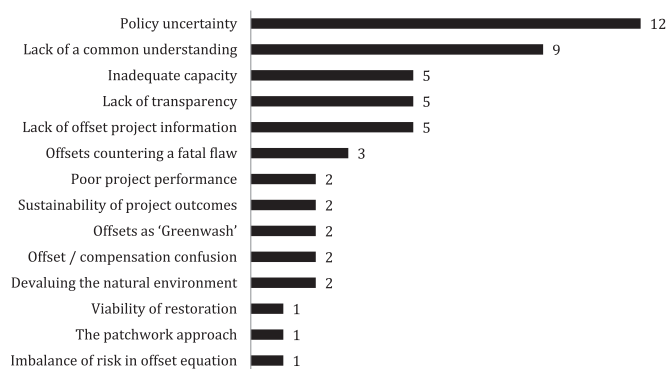


Fig. 1. The number of issues raised per identified barrier during the 2nd stakeholder workshop.

were raised during the second workshop with most of them being raised by NGOs (32 comments –62%) followed by researchers and environmental assessment practitioners (8 each) and then developers and regulators (2 each). Although the low level of engagement by regulators is not surprising as they “were there to listen”, the relative silence from developers was apparently due to them feeling intimidated by the often vitriolic nature of some of the NGO inputs.

Following an analysis of the 52 issues, 14 specific barriers were identified. As illustrated in Fig. 1, it is clear that some of the barriers appear to concern stakeholders much more than others.

5. The barriers

5.1. The three types of barriers

From a further analysis of the identified barriers and the literature, three discernible types of barriers to the efficient and effective implementation of biodiversity offsetting in South Africa were identified. These include:

- (1) **Theory-related barriers** – These barriers are similar to what Bull et al. (2013) refer to as the ‘theoretical problems for biodiversity offsets’ and what Maron et al. (2016) refer to as ‘ethical challenges’ and ‘social challenges’. They include barriers associated with philosophical and ethical argument, theoretical debate, perceptions, misconceptions, misunderstandings or differing understanding, and suspicion and distrust of the intent of offsetting.
- (2) **Governance barriers** – These barriers include what Bull et al. (2013) refer to as the ‘practical challenges for biodiversity offsets’ and what Maron et al. (2016) refer to as ‘technical challenges’ and ‘governance challenges’. They include barriers associated with the practical implementation of offsetting and especially the capacity to efficiently and effectively implement, what the 2007 National Framework for Air Quality Management in the Republic Of South Africa (Government of South Africa, 2007) refers to as ‘the environmental governance cycle for continued improvements in environmental quality’.
- (3) **Environmental improvement barriers** – This third category, although a barrier to offsetting implementation, does not relate to the offsetting mechanism specifically, but rather to the interventions resulting from offsetting requirements, agreements, or voluntary commitments, namely, barriers associated with the efficacy and sustainability of the actual ecological infrastructure restoration, rehabilitation, and creation interventions themselves.

Fig. 2 provides a sense of the relative importance the stakeholders groups appear to assign to the three barrier types based on the issues raised.

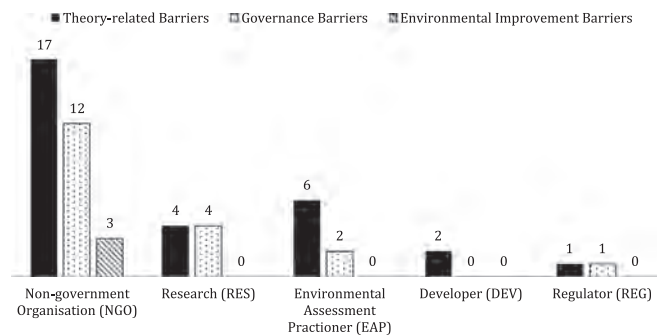


Fig. 2. The number of issues per barrier type and stakeholder group.

Although many of the identified barriers have characteristics that may be associated with the other barrier types, the following sections identify and briefly describe the barriers in the groups that most closely fit the barrier type – the principal barrier type – drawing from the discussion document and, especially, the second workshop discussions.

5.2. Theory-related barriers

5.2.1. Lack of a common understanding of the concept

As noted above, offsetting is already practiced in a range of forms in South Africa especially in respect of environmental authorisations that are informed by environmental impact assessments (EIAs). Despite this, the offsetting community in South Africa is relatively small. It is made up of the officials that are including offset provisions in authorisations, and a small group of consultants, academics, and biodiversity focused non-governmental organisations dealing directly with offsetting as an environmental impact management option. In addition, there are interested parties which tend to be organisations that are less than supportive of the concept for many of the reasons outlined in this paper.

Even within this small group, no common understanding of the theory and practice of offsetting exists. As a result, debates around the utility or efficacy of the concept are frequently confounded by differing and, often, conflicting understandings. This finding confirms the South African National Biodiversity Institute (2012) contention that “[t]here is currently little understanding, clarity or agreement amongst role-players involved in development, planning and EIA processes on what appropriate biodiversity offsets are, when they should be considered, the best approaches to designing and implementing offsets, and the responsibilities for securing and managing them.”

Although the Department of Environmental Affairs’ participatory process to develop the Environmental Offsetting discussion document was, in itself, also meant to encourage discussion and debate and consensus-building where possible, stakeholder positions remained relatively unmoved. As a result, rather than discussion and debate, the process often became a platform to reiterate entrenched positions and sometimes descended into personal attacks and recrimination (Department of Environmental Affairs, 2015a). Hence, the process had limited impact on the positions that the Discussion Document (Department of Environmental Affairs, 2015b) described as “...highly polarised with some people regarding offsetting as ‘the missing link in sustainable development’ and others regarding offsets as ‘a license to trash the environment’.”

5.2.2. The fear of devaluing the natural environment through commodification and/or monetisation

Many stakeholders have a philosophical and/or ethical opposition to offsetting based on the belief that offsets, by their nature, quantify, commodify or monetise the natural environment by making it fungible and turning potentially irreplaceable habitats and species into tradable and exchangeable items dictated by market principles (Spash, 2015; Ives et al., 2015). As Monbiot (2014) puts it “[with offsetting] ...

everything will be fungible, nothing will be valued for its own sake, place and past and love and enchantment will have no meaning. The natural world will be reduced to a column of figures.”

5.2.3. Offsets countering a fatal flaw or offsetting the ‘unoffsettable’

In its biodiversity offsetting guideline, the Western Cape defines a fatal flaw as “a major defect or deficiency in a project proposal that should result in its being rejected” (own emphasis) and, from a biodiversity perspective, regards impacts on biodiversity “...that would in all likelihood be irreversible or lead to irreplaceable loss of resources, would jeopardize ecological integrity and therefore could not be compensated” as fatal flaws (Department of Environmental Affairs and Development Planning, 2007). This notwithstanding, there is a concern that offsetting may be used as a means of ‘compensating’ for fatal flaws in a project thereby allowing such projects to proceed. Indeed, although the Western Cape’s offsetting guidelines specifically exclude fatal flaws from their stated objective for biodiversity offsets, the guideline also notes that offsets may be considered for fatally flawed projects in ‘exceptional circumstances’ and, in their definition they note that a fatally flawed project ‘should’ be rejected and not ‘must’ be rejected (Department of Environmental Affairs and Development Planning, 2007). In fact, some practitioners believe that offsetting is specifically about countering fatal flaws. For example, Thornton-Dibb and Costas (2015) suggest that the presence of a protected species at a site that would be regarded as a fatal flaw for a site that would otherwise be suitable in all other respects could be offset by the developer acquiring additional land of a similar ecological value which it must actively rehabilitate and conserve for the lifetime of the project.

However, this concern may often be less about the possible abuse of offsetting to allow highly destructive projects to proceed than it is about the lack of formal protection for areas of high conservation importance.

5.2.4. Policy uncertainty – offsetting as a ‘last resort’

This barrier deals with government’s own apparent ambivalence to the offsetting concept as evidenced by official offsetting guidelines which often appear to be extremely guarded about offsetting.

For example, Ezemvelo KZN Wildlife’s guidelines (2013) describe offsets as “the last resort in the mitigation hierarchy” and again that “offsets should only be considered as a ‘last resort’”. This ‘last-resort’ description of offsetting is repeated in almost all of the official guidelines, including the wetland offsetting guidelines (Department of Water Affairs and South African National Biodiversity Institute, 2013) and appears to come directly from South Africa’s conception of the environmental impact mitigation sequence.

In comparison to, for example, the PricewaterhouseCoopers description of the mitigation sequence that includes the following mitigation options in order of priority: Avoid – impact avoidance being the first priority; Reduce, moderate, minimise; Rescue (relocation, translocation); Repair, reinstate, restore; Offset and; Compensate – the option of lowest priority (PricewaterhouseCoopers, 2010), the South African mitigation sequence is described as a mitigation hierarchy and has fewer mitigation ‘options’ (Department of Environmental Affairs, 2013). Importantly, the South African hierarchy combines the “offset” and “compensate” options by regarding the offset option as “...measures over and above rehabilitation to compensate for the residual negative effects on biodiversity, after every effort has been made to minimise and then rehabilitate impacts” (Department of Environmental Affairs, 2013).

Perhaps due to the fact that all types of offsets were being discussed at the stakeholder workshops, some stakeholders, especially those involved in pollution rather than biodiversity issues, consciously or unconsciously, compared the typical representation of the mitigation hierarchy to the, far more publicly familiar, ‘waste management hierarchy’ of: Waste avoidance and reduction; Re-use; Recycling; Recovery and finally; Treatment and disposal (Department of Environmental Affairs, 2011b). Land-filling has been, and remains,

South Africa’s most utilised waste disposal method with, what is often considered to be, an extremely poor environmental performance track-record. Thus, associating offsetting with landfill as the last step in the hierarchy may be one of the reasons why some stakeholder believe that offsetting is, at best, environmentally undesirable, and, at worst, even environmentally destructive.

Indeed, even among biodiversity stakeholders, offsetting as the ‘last-resort’ in the mitigation hierarchy is often considered to mean ‘undesirable’,¹ as opposed to ‘least desirable’ and the use of the ‘last resort’ term is seen by some as an indication of government’s own ambivalence to offsetting.

In practice, given that thousands of EIAs are processed every year in South Africa² and the fact that very few offsets have been required despite offsetting being included in the mitigation sequence for many years, it may be reasonably concluded that authorities appear to be more comfortable accepting residual impacts than they are in attempting to offset them.

5.2.5. Confusing offsetting with compensating

As noted above, unlike some international descriptions of the mitigation sequence that separate offsetting and compensation (PricewaterhouseCoopers, 2010), the South African ‘hierarchy’ actually defines offsetting as a form of compensation. Although this is certainly not a specific South African peculiarity, there appears to be a possible shift to regarding offsetting and compensating as quite distinct and different concepts.

For example, although the Latin America and Caribbean Network of Environmental Funds (RedLAC) believe that both compensation and offsets are measures taken to compensate for any residual significant adverse impacts that cannot be avoided, minimised and/or rehabilitated or restored, they regard these activities as being quite different. Firstly, RedLAC regard offsets as measures to achieve no net loss or a net gain of biodiversity for at least as long as the project’s impacts persist. Secondly, RedLAC regards compensation as measures that address residual impacts but are not quantified to achieve no net loss or that are not secured for the long term (ten Kate et al., 2011). What this means is that, in effect, compensation may have no direct environmental benefits at all and the compensation may have no relation to the nature of the impact it is compensating.

With this, confusing a concept that aims to deliver, at least, no net environmental loss with one that may have no direct environmental benefits at all appears to be very disturbing for many stakeholders who, in some cases, seem to view this lack of clarity as a deliberate governance loophole.

5.2.6. The imbalance of risk in the offset equation

In the offset equation of: residual environmental impact being offset by an intervention that counterbalances this impact, it is highly likely that the predicted residual environmental impact will be realised. In contrast, there is a high risk that the counterbalancing intervention will never take place or that it may not adequately counterbalance the associated impact resulting in the continued decline in overall environmental quality.

It is this imbalance of risk that appears to be at the heart of many of the concerns around offsetting. As Bull et al. (2013) put it, the popularity of offsets lies in their potential to meet the objectives of biodiversity conservation and of economic development in tandem; the

¹ In this context, ‘undesirable’ means that offsets are considered to render little, if any benefits and, indeed there may be a risk of the offset resulting in further negative environmental impacts. Were-as ‘least desirable’ means that offsetting is considered the least desirable mitigation option as it renders less mitigation benefit than any of the other options in the mitigation sequence.

² According to the Presidency’s 2015/16 3rd Quarter Outcome 10 Progress Report (Department of Planning, Monitoring and Evaluation, 2016), from 1 July 2014 to 31 December 2015, 2596 EIA applications were finalised.

controversy lies in the need to accept ecological losses in return for uncertain gains. Maron et al. (2012) sum up this risk succinctly; “offsets exchange certain losses for uncertain gains”.

Offset banking, the practice of an offset providing the funding for biodiversity already secured in advance, may provide a solution to reducing this risk. While there are as many if not more challenges to offset banking as there are to offsets, a well-designed offset banking system may be able to avoid these challenges and provide for an effective offsets programme with reduced risk.

5.2.7. The patchwork approach

There is a concern that ad hoc, small-scale, stand-alone offset-supported interventions pose a number of challenges including, among others: the high risk of failure if upstream or bordering degradation is not addressed in some way; increased demands on already limited enforcement and compliance monitoring capacity; the potentially limited environmental value of small, unconnected pockets of restored ecological infrastructure; and; reduced opportunities for maximising the benefits that could be accrued by integrated, landscape-scale interventions.

Although common sense may suggest that integrated landscape-scale interventions are more likely to yield far greater, and more sustained, environmental benefits at less cost and reduced administrative burden than a number of small-scale, stand-alone interventions, there is often a requirement or a desire for an offset-supported intervention to take place as close as possible to the impact it is counterbalancing (Bull et al., 2013). Often this is due to the ‘like-for-like’ offsetting requirement that is the current practice in South Africa. This requirement or desire for offset localisation is probably the principle driver for the patchwork approach that is the current practice.

5.3. Governance barriers

5.3.1. Offsets as ‘Greenwash’

With the lack of a common understanding of what an offset is, philosophical concerns around the impacts of offsetting ‘valuing the invaluable’ or ‘pricing the priceless’, coupled with the lack of information on the extent and efficacy of offsetting interventions to date, it is hardly surprising that some interested parties have extremely negative perceptions of offsetting. Although these perceptions may be rooted in the many examples³ of companies making unsubstantiated or misleading claims about the environmental benefits of their products, services, technologies or company practices (so-called ‘greenwash’), offsetting is often viewed as a governance loophole through which irresponsible developers can avoid expensive avoidance or mitigation interventions. Unfortunately, this latter perception is nearly always associated with the belief that government is in collusion with destructive and/or polluting industries for whatever reason (see, for example, Anon, 2000, quoted in Japan International Cooperation Agency, 2005).

Indeed, as discussed in the next section, without the evidence to prove that offsetting is having the desired positive impacts envisaged by the National Development Plan 2030 (National Planning Commission, 2011), it is very difficult, if not impossible, to challenge these negative perceptions.

5.3.2. Lack of offset project information

As noted above, there is little formal recording of the environmental authorisations which have been issued that require or imply a biodiversity offset, apart from a few anecdotal accounts. Without a record of formal offsetting requirements, there is no record of the type of offsets, the impact mitigated, their extent, their net impact, their

success or otherwise and, most importantly, whether the positive outcomes of the environmental improvement or protection intervention implemented through the offset has been sustained or not.

Without this basic information, there is no way of measuring the efficacy of offsetting, nor is there any way of knowing whether offsetting is making the positive impacts envisaged by the National Development Plan 2030 (National Planning Commission, 2011).

5.3.3. Sustainability of project outcomes

Notwithstanding the concerns around poor project design and implementation or the viability of restoration or rehabilitation discussed below, there is a concern that even if interventions result in an adequate counterbalancing of the impacts that are being offset, it is unlikely that these positive outcomes can provide a net positive environmental benefit that is sustained in perpetuity. Indeed, there is a concern that unless the restored or rehabilitated offset-supported ecological infrastructure is maintained or protected, there is a high level of risk that the offset will fail and that the impacts will not be counterbalanced for the duration of the impact.

5.3.4. Lack of transparency and/or lack of public participation

South Africa's environmental impact assessment (EIA) process is relatively well-regarded in terms of its public participation requirements.⁴ In fact, the EIA process is sometimes held up as a victim of its own success from a public participation perspective as it is often the only platform the public has to effectively challenge less participatory policy decisions (e.g. road tolling).

In the absence of any national guidance on how offsetting should be considered in the EIA process, there has been a tendency to include offsetting requirements in environmental authorisations that have not been subjected to the rigorous participatory process. In such cases, as the exact offset requirements have not been developed as part of the EIA process, the authorisation often simply makes provision for a required process to develop an ‘acceptable’ offset. Thus, the offset is then ‘negotiated’ between the regulator and the applicant outside the formal participatory process.

This lack of transparency in the design and approval of such offsets is considered to be an important factor that contributes to suspicion and distrust of offsetting in some circles. Indeed, given that the EIA participatory process is specifically aimed at promoting participatory environmental governance and, through this, better informed decisions that improve the common good, there is an argument to be made that the lack of transparency in the design and approval of offsets is resulting in less than optimal outcomes or even perverse impacts.

5.3.5. Inadequate compliance and enforcement capacity

One of the greatest concerns around the South African environmental impact management regime is the belief that poor environmental authorisation compliance monitoring and enforcement may be undermining the potential benefits of the rigorous EIA process. With this, there is the concern that offset provisions will simply complicate environmental authorisations and put a further strain on, already stretched, compliance monitoring and enforcement capacity.

This is analogous to international concerns where non-compliance with offset requirements is considered to be a significant challenge that takes many forms including offsets not being implemented at all, or only being partially implemented (Bull et al., 2013).

According to the Centre for Environmental Rights (2015), there is a trend of diminishing budgets for South African environment authorities’ compliance and enforcement units and this is resulting in fewer

³ Nosizo (2014) found that 94% of green-advertised products in a sample of six South African magazines were greenwash and that amongst the ‘sins of greenwashing’, ‘vagueness’ and ‘no proof’ had the highest percentages and were evident in all product categories.

⁴ For example, a nationally significant nuclear power station environmental authorisation was successfully overturned due to a relatively minor shortfall in the participatory process meant to inform the authorisation decision (Earthlife Africa (Cape Town) v Director General Department of Environmental Affairs and Tourism and Another (7653/03) [2005] ZAWCHC 7; 2005 (3) SA 156 (C) [2006] 2 All SA 44 (C) (26 January 2005)).

Table 2
Barriers to biodiversity offsetting in South Africa and examples of interventions to address the barrier.

Barrier		Potential means of addressing barrier		
Issue	Summary description	Principle type	Policy intervention	Capacity development and maintenance
Lack of a common understanding of the concept	Limited offset policy development or implementation as debates around the utility or efficacy of the concept are frequently confounded by differing and often, conflicting understandings and suspicion	Theory-related	Although this barrier is unlikely to be fully overcome, clear and unambiguous policy will contribute to more constructive and focussed debate.	Offset governance training, standard operating procedures and implementation guidelines will foster a common understanding amongst officials
The fear of devaluing the natural environment through commodification and/or monetisation	Philosophical or ethical resistance to offset policy development or implementation	Theory-related	Although this barrier is unlikely to be overcome, clear and unambiguous policy will contribute to more constructive and focussed debate.	Offset implementation guidelines that ensure that offset design is based on environmental function not estimated monetary value
Offsets countering a fatal flaw or offsetting the 'unoffsettable'	Resistance to offset policy development or implementation due to concerns that everything will be regarded as 'offsettable'	Theory-related	Unambiguous policy that makes it clear that certain landscapes, ecosystems or elements of ecological infrastructure are irreplaceable, and cannot be offset and must be protected and maintained – the 'no-go' option	Rolling out the protected area expansion plan and using offsets to protect and maintain certain irreplaceable landscapes, ecosystems or elements of ecological infrastructure
Policy uncertainty	Resistance to offset implementation due to an apparent policy ambivalence	Theory-related	Unambiguous policy that regards offsetting as one of the useful regulatory tools needed to address the undesirable state of ecological deficit	Offset governance training, standard operating procedures and implementation guidelines will promote the efficient and effective implementation of policy
Confusing offsetting with compensating	Resistance to offset policy development or implementation due to concerns that compensating does not necessarily result in environmental improvement	Theory-related	Unambiguous policy that makes it clear that offsetting counterbalances rather than compensates for residual biodiversity impacts – the 'net gain' objective	The development and implementation of norms and standards aimed at maximising the potential environmental benefits of offset interventions
6.4 The imbalance of risk in the offset equation	The concern that offsets exchange certain losses for uncertain gains (Maron et al., 2012).	Theory-related	Unambiguous policy that provides for risk-averse multipliers and offset banking	Offset governance training, standard operating procedures and implementation guidelines will promote more effective offset design
6.5 The patchwork approach	The concern that the current ad hoc, small-scale, stand-alone offset-supported interventions are inefficient, ineffective and reduce opportunities for maximising the benefits that could be accrued by integrated, landscape-scale interventions.	Theory-related	Unambiguous policy on 'like for like' offsetting and 'trading up'	Using high positive impact offset receiving areas for appropriate 'trading up' offsets, especially where such areas contribute to the rehabilitation, restoration, protection and maintenance of key or irreplaceable landscapes, ecosystems or elements of ecological infrastructure
6.6 Offsets as 'Greenwash'	Resistance to offset policy development or implementation due to concerns that offsets provide an effective governance loophole for unethical developers	Governance	Clear policy on: offset information requirements; access to information; offset monitoring and reporting.	The development and implementation of norms and standards aimed at maximising the potential environmental benefits of offset interventions
Lack of offset project information	Limited offset policy development or implementation due to the lack of evidence around the efficacy of offsetting	Governance	Clear policy on: offset information requirements; access to information; offset monitoring and reporting.	Necessary offset governance capacity: structures – offset knowledge and information management section; systems – offset database, webpage and web-based monitoring and reporting system; skills – staff skilled in the use of the systems.
Sustainability of project outcomes	The concern that even if interventions result in an adequate counterbalancing of the impacts that are being offset, it is unlikely that these positive outcomes can provide a net positive environmental benefit that is sustained for the period of impact that is	Governance	Clear policy on how offsets must be sustained for, at least, the impact period.	Best practice guidelines on funds, trusts, cooperatives, stewardship agreements, etc.

(continued on next page)

Table 2 (continued)

Barrier		Potential means of addressing barrier		
Issue	Summary description	Principle type	Policy intervention	Capacity development and maintenance
Lack of transparency and/or lack of public participation	being counterbalanced The concern that the lack of transparency in the design and approval of offsets is resulting in less than optimal outcomes or even perverse impacts.	Governance	Clear policy on: offsetting as an inclusive component of EIA not an 'add-on' to an environmental authorisation	The mainstreaming of offset calculation, design, evaluation, authorisation, monitoring and enforcement into the standard EIA governance regime
Inadequate compliance and enforcement capacity	The concern that offset provisions will simply complicate environmental authorisations and put a further strain on, already stretched, EIA evaluation and compliance monitoring and enforcement capacity.	Governance		The mainstreaming of offset governance as part of the standard environmental impact governance – ensuring that residual impact identification, the design of adequate residual impact mitigation through offsets, the capture of the offset design as an authorisation condition, the monitoring of compliance with offset requirements and the enforcement of offset conditions
Poor project performance tainting the concept of offsetting	Poorly designed, implemented and/or maintained environmental improvement or protection interventions that yield poor environmental outcomes are often considered to be failures of the offsetting concept.	Environmental Improvement		Up-scaled research on environmental improvement interventions and especially monitoring and evaluation
Concerns around the viability of restoration	Limited offset policy development or implementation due to the belief that restored or recreated ecosystems can never contain equivalent biodiversity values to those that are lost	Environmental Improvement		Up-scaled research on environmental improvement interventions

inspections, inspection reports are taking longer to finalise, fewer compliance notices and directives are being issued and fewer criminal convictions are being secured.

However, there is also broad acknowledgement that with the establishment of the, so-called, Green Scorpions in 2005, there has been a dramatic and significant improvement in general environmental compliance and enforcement in South Africa (Centre for Environmental Rights, 2015; Endangered Wildlife Trust, 2012).

Associated with these concerns and the, often, post-EIA process offset requirement provisions in environmental authorisations discussed above, is a general concern around government's capacity to ensure that offsetting is implemented efficiently and effectively.

5.4. Environmental improvement barriers

5.4.1. Poor project performance tainting the concept of offsetting

Poorly designed, implemented and/or maintained environmental improvement or protection interventions are likely to yield poor environmental outcomes no matter how they are funded. Indeed, there are probably countless instances of failed environmental improvement or protection interventions implemented and/or paid for by the most well-intentioned organisations or individuals. However, although offsetting may be regarded as being merely a means of funding environmental improvement or protection interventions, offset-related interventions that fail due to poor design, implementation and/or maintenance are often considered to be failures of the offsetting concept.

Despite this, poor project performance will continue to taint the offsetting concept until such time as there is clear evidence that, in the main, offset-supported interventions can, and do, provide an overall net positive environmental benefit.

5.4.2. Concerns around the viability of restoration

Policy objectives such as 'no net loss' or 'net gain' imply the belief that humanity is able to restore or recreate ecosystems that contain equivalent biodiversity values to those that are lost (Maron et al., 2016; Bull et al., 2015; Mandley, 2015), yet restoration ecology is a relatively young and inexperienced discipline with a still-embryonic and patchy evidence base (Hilderbrand et al., 2005).

With reference to wetlands, Clare et al. (2011) argue that "[t]he premise of compensatory offset wetland policies is that habitat loss can be mitigated through the creation or restoration of habitat that is equivalent to that which was lost. The challenges associated with measuring, let alone reproducing, the full suite of ecological, social, and economic values and functions of a natural wetland makes the reliance on this policy approach untenable in all cases, and highlights the need to give greater consideration to avoidance in the mitigation sequence."

Concerns around the viability of restoration, rehabilitation and, especially 'built' or 'created' ecological infrastructure (for example, constructed wetlands in places where wetlands did not previously exist), were also raised during the offset discussion document development process. Indeed, restoration to a previous (pristine) state was regarded as being scientifically challenging and poorly understood and was therefore considered to be risky as an offset target. Indeed, there was a general consensus that, within practical timeframes, it may actually be impossible to restore some ecosystems (Department of Environmental Affairs, 2015b).

However, the important concept of 'practical timeframes', or what Kentula (1994) refers to as ecologically mature projects, may be crucial to these concerns as, although a restoration initiative may not reproduce the full suite of ecological, social, and economic values and functions of a natural wetland immediately following its conclusion, this may be a very different picture 100, 50 or even 20 years later. As Maron et al. (2012) put it, achieving different types of restoration or rehabilitation goals can often be a question of timescale. Indeed, given the resilience of the natural environment to the impact of human activity over the last couple of centuries (Levis et al., 2017), the concept

of a pristine environmental state may itself be questionable.

6. Overcoming the barriers

The following sections describe the three principle interventions required to address each of the barrier types. Table 2 summarises the barriers and provides some examples of possible interventions to address each barrier.

6.1. Policy interventions to address the theory-related barriers

Theory-related barriers are unlikely to be removed through interventions that hope to build consensus. Hence the failure of the offset discussion document development process in this regard. Indeed, Maron et al. (2016) consider many of these issues to be 'fundamentally intractable'.

However, the suspicion, distrust and general discomfort with offsetting that result from philosophical, ethical and theoretical differences, conflicting perceptions, misconceptions, misunderstandings or differing understanding could be greatly reduced through clear and unambiguous government policy that specifically references these issues.

For this reason, the national policy on biodiversity offsetting must be concluded as quickly as possible in order to reduce policy uncertainty and make government's position on, and approach to, offsetting as clear and unambiguous as possible.

To this end, policies must, as a minimum: contextualise offsetting within the broader South African development policy context; clearly articulate the offsetting objective in terms of addressing ecological deficit; clarify definitions, especially around the offset-compensation issue; reiterate the importance of the mitigation sequence, but placing offsetting as a legitimate and supported option in the mitigation sequence. Policies must also make it clear that certain landscapes, ecosystems or elements of ecological infrastructure are irreplaceable, and cannot be offset and must be protected and maintained. Furthermore, policies should make it clear that offsets may be used to protect and maintain these irreplaceable elements.

The policy must clearly define offsetting as a means of counterbalancing residual impacts through net gains in biodiversity and with this, provide clear guidance on: risk reduction through offset ratios, weighting, and banking; appropriate trading-up options; and the use of offsets to support the protected area expansion strategy. The policy must also provide guidance on sustaining the net gains.

6.2. Capacity building and maintenance interventions to address the governance barriers

Governance barriers must be dealt with through the building and maintenance of the required organisational capacity to efficiently and effectively implement the policy contemplated above. This typically requires the building and maintenance of offset governance structures, systems, skills, incentives, strategies and interrelationships (Hjöllund, 2000).

According to Hjöllund's (2000) '6S' model of organisational capacity, structure refers to the division of labour amongst staff and the lines of command and communication within the organisation. By mainstreaming offsetting into the current work of the competent authorities, as it being part of the recognised mitigation sequence it should already be, this element of capacity is already largely in place.

Systems refer to the tools of the organisation including hardware (machines) as well as software (operational procedures). These should allow for organisational resilience - the ability to adapt, adjust, and eventually even drop certain tools and activities, according to the changing institutional context. Other than the provinces that are already implementing their own offsetting guidelines, this area of capacity is likely to require the most attention. Although the current

legislation and EIA regulations may provide sufficient mandate for offsetting, it is possible that some amendment may be required to bring this into full alignment with policy. However, for the efficient and effective implementation of offsetting, competent authorities must develop and implement standard operating procedures and systems for the design, evaluation, monitoring and reporting of offsets.

Skills refer to the ability of the staff to apply the systems referred to above. As for organisational structure capacity, existing EIA staff should already have the necessary knowledge, experience and expertise to ensure that offsetting objectives are met and should also have access to specialised expertise. Thus, existing EIA staff will be adequately skilled given proper training in the use of the systems described above.

Incentives are the individual and collective staff motivations. As above, this element of capacity should already be in place. However, the recognition that offsetting will deliver a net benefit if efficiently and effectively implemented should provide a further incentive.

Strategy on the one hand is the attempted alignment of the four components detailed above in pursuance of the organisation's given objectives with given resources, and on the other, the organisation's own evolution of objectives and revenue base. As above, this element of capacity should already be in place to a large extent.

Finally, interrelationships refer to the extent to which- and how- the organisation relates to other parts of the environmental management system in the country. Having offsetting mainstreamed into the work of the competent authority, as it already should be, means that this element of capacity is also already largely in place. However, the establishment and maintenance of an offsetting community of practice, as discussed below, will greatly enhance this element of organisational capacity.

In summary, by ensuring the implementation of the full mitigation sequence by competent authorities in the EIA process, the organisational capacity to efficiently and effectively implement offsetting should already be largely in place using existing structures, skilled staff, incentives, strategies and interrelationships. The only significant area that needs focussed attention is the development and implementation of offset governance systems including: standard operating procedures; offset calculation, ratio application and weighting methodologies or tools; offset evaluation protocols; offset receiving area databases; offset knowledge and information management systems; and guidelines for environmental assessment practitioners.

6.3. Up-scaled research to address the environmental improvement barriers

These barriers are typical of a relatively new area of research and development and will need to be dealt with through a typical maturation process driven by research, experiment, pilot project implementation, base-line assessment, improved measurement and measurement metrics, long-term monitoring and reporting and environmental improvement practice forums.

Although the South African affiliate of the International Association for Impact Assessment already provides an excellent platform for the discussion of offsetting at its Annual National Conference, especially with respect to the theory-related and governance barriers, there is a need for a more research-focussed forum on environmental rehabilitation and restoration.

Furthermore, it would be safe to conclude that research interest will be increased with the publication of an offsetting policy and the increased use of offsetting as a component of the mitigation sequence.

7. Conclusions

One of the most important conclusions that can be drawn from a governance perspective is that making offsets work in practice is less about the technical details of offsets design and implementation and more about communication, clarity of intent, transparency, capacity

building and creating policy that can be implemented without an enormous investment in governance infrastructure.

In conclusion, as this paper specifically focusses on the concerns raised by South African stakeholders, it ignores the often strong support for offsetting from some quarters. Indeed, many of the most outspoken critics of offsetting support the National Development Plan's concept of natural environment 'replenishment' and consider the efficient and effective implementation of offsetting as being one possible means of doing this.

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References

- Bateman, I.J., Harwood, A.R., Mace, G.M., Watson, R.T., Abson, D.J., Andrews, B., Binner, A., Crowe, A., Day, B.H., Dugdale, S., Fezzi, C., Foden, J., Hadley, D., Haines-Young, R., Hulme, M., Kontoleon, A., Lovett, A.A., Munday, P., Pascual, U., Paterson, J., Perino, G., Sen, A., Siriwardena, G., van Soest, D., Termansen, M., 2013. Bringing ecosystem services into economic decision-making: land use in the United Kingdom. *Science* 341 (6141), 45–50.
- Bull, J.W., Suttle, K.B., Gordon, A., Singh, N.J., Milner-Gulland, E.J., 2013. Biodiversity offsets in theory and practice. *Oryx*, 369–380. <http://dx.doi.org/10.1017/S003060531200172X>.
- Centre for Environmental Rights, 2015. Enforcing the law: the challenges undermining environmental compliance monitoring and enforcement in South Africa. Retrieved from Centre for Environmental Rights: (<http://cer.org.za/full-disclosure>).
- Clare, S., Krogman, N., Foote, L., Lemphers, N., 2011. Where is the avoidance in wetland law and policy? *Wetl. Ecol. Manag.* 19 (2), 165–182.
- Coralie, C., Ollivier, G., Claude Napoléone, C., 2015. Tracking the origins and development of biodiversity offsetting in academic research and its implications for conservation: a review. *Biol. Conserv.* 192, 492–503.
- Costanza, R., de Groot, R., Sutton, P.C., van der Ploeg, S., Anderson, S., Kubiszewski, I., Farber, S., Turner, R.K., 2014. Changes in the global value of ecosystem services. *Glob. Environ. Change* 26, 152–158.
- Department of Environmental Affairs and Development Planning, 2007. Provincial Guideline on Biodiversity Offsets. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town.
- Department of Environmental Affairs/Department of Mineral Resources, Chamber of Mines, South African Mining and Biodiversity Forum & South African National Biodiversity Institute, 2013. Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector. Department of Environmental Affairs, Pretoria. 100 pages.
- Department of Environmental Affairs, 2011a. National Strategy for Sustainable Development and Action Plan (NSSD1) 2011–2014. Department of Environmental Affairs, Pretoria.
- Department of Environmental Affairs, 2011b. National Waste Management Strategy. Department of Environmental Affairs, Pretoria.
- Department of Environmental Affairs, 2015a. Environmental Offsets Discussion Document Workshop: Summary of Proceedings. Department of Environmental Affairs, Pretoria.
- Department of Environmental Affairs, 2015b. Environmental Offsets Discussion Document. Department of Environmental Affairs, Pretoria.
- Department of Planning, Monitoring and Evaluation, 2016. 2015/16 3rd Quarter Outcome 10 Progress Report. Department of Planning, Monitoring and Evaluation, Pretoria.
- Department of Water Affairs and South African National Biodiversity Institute, 2013. Wetlands Offsets: A Best-practice Guideline for South Africa. Pretoria. 100 pages.
- ELD Initiative, 2015. The value of land: Prosperous lands and positive rewards through sustainable land management. Bonn, Germany. (<http://www.eld-initiative.org>).
- Endangered Wildlife Trust, 2012. The status quo of compliance monitoring and enforcement of biodiversity and conservation legislation in South Africa. Retrieved from Conservation Action Trust: (<http://conservationaction.co.za/resources/reports/the-status-quo-of-compliance-monitoring-and-enforcement-of-biodiversity-and-conservation-legislation-in-south-africa/>).
- Ezemvelo KZN Wildlife, 2009. Norms and Standards for Biodiversity Offsets: KwaZulu-Natal Province, South Africa. Ezemvelo KZNWildlife, Pietermaritzburg.
- Ezemvelo KZN Wildlife, 2013. Concise Guideline: Biodiversity Offsets in KwaZulu-Natal, Final Draft, February 2013. Ezemvelo KZNWildlife, Pietermaritzburg.
- Galli, A., Kitzes, J., Niccolucci, V., Wackernagel, M., Wada, Y., Marchettini, N., 2012. Assessing the global environmental consequences of economic growth through the ecological footprint: a focus on China and India. *Ecol. Indic.* 17, 99–107.
- Global Commission on the Economy and Climate, 2015. The 2015 New Climate Economy Report: Seizing the Global Opportunity – Partnerships for Better Growth and a Better Climate. Box 1 “Better Growth, Better Climate – Key Insights”, page 14 of 76.

- Gonzalez, A., 2013. Biodiversity: the ecological deficit. *Nature* 503 (7475), 206–207.
- Government of South Africa, 1996. The Constitution of the Republic of South Africa, Act No. 108 of 1996. Government Printer, Pretoria.
- Government of South Africa, 2007. 2007 National Framework for Air Quality Management in the Republic of South Africa. Government Gazette No. 30284, Notice No. 1138 of 2007, Government printer, Pretoria.
- Government of South Africa, 2014. National Environmental Management Act (107/1998): Environmental Impact Assessment Regulations, 2014. Government Gazette No. 38282, Notice No. R.982 of 4 December 2014, Government printer, Pretoria.
- Hilderbrand, R.H., Watts, A.C., Randle, A.M., 2005. The myths of restoration ecology. *Ecol. Soc.* 10 (1), 19.
- Hjollund, O.J., 2000. Draft Reference Note: Capacity Analysis. Danish Cooperation for Environment and Development, Copenhagen.
- Ives, C.D., Bekessy, S.A., 2015. The ethics of offsetting nature. *Front. Ecol. Environ.* 13 (10), 568–573.
- Japan International Cooperation Agency, 2005. Japan's Experience in Public Health and Medical Systems – Towards Improving Public Health and Medical Systems in Developing Countries. Research Group, Institute for International Cooperation, Japan International Cooperation Agency (JICA), Tokyo.
- Kentula, M.E., 1994. Restoration, creation, and recovery of wetlands. *U. S. Geol. Surv. Water Supply Pap.*, 2425.
- Kubiszewski, I., Farley, J., Costanza, R., 2010. The production and allocation of information as a good that is enhanced with increased use. *Ecol. Econ.* 69, 1344–1354.
- Kurihara, Akira (Ed.), 2000. Shogen Minamata-byo [Testimony: Minamata Disease] Iwanami Shoten summarized in part.
- Levis, C., Clement, C.R., Steege, H., Bongers, F., Braga Junqueira, A., Pitman, N., Peña-Claros, M., 2017. Forest conservation: humans' handprints. *Science* 355 (6324), 466–467.
- Louw, E.W., 2014. Assessing the effectiveness of current biodiversity offset strategies in South Africa: A case study on current perceptions and views in the mining industry. M.Sc. (Environmental Management) [Unpublished]: University of Johannesburg. Retrieved from: (<https://ujdigispace.uj.ac.za>). (Accessed 20 February 2016).
- Mandle, L., Tallis, H., Sotomayor, L., Vogl, A.L., 2015. Who loses? Tracking eco-system service redistribution from road development and mitigation in the Peruvian Amazon. *Front. Ecol. Environ.* 13, 309–315.
- Manuel, J., 2013. Overview of the South African framework for Biodiversity Offsets - Presentation to the BBOP Community of Practice, 22 May 2013. Available from: (<http://bbop.forest-trends.org/documents/files/jmanuelppt.pdf>), (Accessed 26 February 2016).
- Maron, M., Hobbs, R.J., Moilanen, A., Matthews, J.W., Christie, K., Gardner, T.A., Keith, D.A., Lindenmayer, D.B., McAlpine, C.A., 2012. Faustian bargains? Restoration realities in the context of biodiversity offset policies. *Biol. Conserv.* 155 (2012), 141–148.
- Maron, M., Ives, C.D., Kujala, H., Bull, J.W., Maseyk, F.J.F., Bekessy, S., Gordon, A., Watson, J.E.M., Lentini, P.E., Gibbons, P., Possingham, H.P., Hobbs, R.J., Keith, D.A., Wintle, B.A., Evans, M.C., 2016. Taming a wicked problem: resolving controversies in biodiversity offsetting. *Bioscience* XX, 1–10.
- Monbiot, G., 2014. Reframing the Planet. Published in the Guardian 22nd April 2014. (<http://www.monbiot.com>).
- National Planning Commission, 2011. National Development Plan 2030 – Our future, make it work. Pretoria: Government Printer.
- Nosizo, P., 2014. Exploration of the Extent of Greenwashing in South African Consumer Products (Thesis)(MBA). Stellenbosch University, Stellenbosch.
- PricewaterhouseCoopers, 2010. Biodiversity offsets and the mitigation hierarchy: a review of current application in the banking sector. Business and Biodiversity Offsets Programme (BBOP) and UNEP Finance Initiative (UNEP FI), Geneva.
- South African National Biodiversity Institute, 2012. Draft National Framework for Biodiversity Offsets, May 2012. South African National Biodiversity Institute, Pretoria.
- South African National Biodiversity Institute, 2014. South Africa's Fifth National Report to the Convention on Biological Diversity, March 2014. Department of Environmental Affairs, Pretoria.
- Spash, C.L., 2015. Bulldozing biodiversity: the economics of offsets and trading-in nature. *Biol. Conserv.* 192, 541–551.
- ten Kate, K., von Hase, A., Boucher, J., Cassin, J., Victorine, R., 2011. Opportunities for Environmental Funds in Compensation and Offset Schemes. Latin America and Caribbean Network of Environmental Funds (RedLAC). Rio de Janeiro. 101 pages.
- Thornton-Dibb, M., Costas, T., 2015. Enhancing sustainable development by using biodiversity offsets. Web page posted on 24 November 2015 on Norton Rose Fulbright's Financial Institutions Legal.
- Turner, K.G., Anderson, S., Gonzales-Chang, M., Costanza, R., Courville, S., Dalgaard, T., Dominati, E., Kubiszewski, I., Ogilvy, S., Porfirio, L., Ratna, N., Sandhu, H., Sutton, P.C., Svenning, J.-C., Turner, G.M., Varennes, Y.-D., Voinov, A., Wratten, S., 2016. A review of methods, data, and models to assess changes in the value of ecosystem services from land degradation and restoration. *Ecol. Model.* 319, 190–207.
- Venter, O., Sanderson, E.W., Magrach, A., Allan, J.R., Beher, J., Jones, K.R., Possingham, H.P., Laurance, W.F., Wood, P., Fekete, B.M., Levy, M.A., Watson, J.E.M., 2016. Sixteen years of change in the global terrestrial human footprint and implications for biodiversity conservation. *Nat. Commun.* <http://dx.doi.org/10.1038/ncomms12558>.
- Von der Heyden, S., Lukey, P., Celliers, L., Prochazka, K., Lombard, A.T., 2016. Science to policy – reflections on the South African reality. *S. Afr. J. Sci.* 112 (11/12).
- World Economic Forum, 2017. The Global Risks Report 2017, 12th Edition. World Economic Forum, Geneva.