Biodiversity offsets in South Africa – challenges and potential solutions

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ABSTRACT
South Africa has a decade of experience designing and implementing biodiversity offsets. In the absence of explicit national policy on biodiversity offsets, the country has relied on existing legal provisions in environmental law as the basis for offset requirements, supported by provincial guidelines. South Africa’s periodic national biodiversity surveys provide scientifically rigorous quantification and mapping for individual ecosystems and finer scale surveys identify biodiversity priority areas, primed as ‘offset receiving areas’. Yet despite enabling factors the use of offsets has frequently been inadequate to deliver intended biodiversity outcomes. Challenges include: (a) the absence of national policy to drive and shape offset implementation; (b) insufficient capacity to evaluate, design and implement offsets; (c) inconsistent decision-making; (d) problems establishing sustainable financing mechanisms; and (e) inadequate enforcement and monitoring, linked to poor drafting of licencing conditions and/or insufficient capacity to monitor implementation. South Africa’s experience provides valuable insights into the challenges and potential solutions for making offsets work for biodiversity conservation and offers important lessons for the development and implementation of biodiversity offsetting in other developing countries.

Introduction
In recent years, the uptake of biodiversity offsets, applied within the context of the mitigation hierarchy, has rapidly increased, with many countries exploring offsets as a mechanism to counteract the residual impacts of project development on biodiversity. Whilst good practice guidance for biodiversity offsets has been developed (e.g. BBOP 2012) and their conceptual basis debated from various perspectives (e.g. Apostolopoulou & Adams 2017; von Hase & ten Kate 2017), it is widely recognised that offsets face technical and methodological challenges (e.g. Pilgrim & Ekstrom 2014) and have proved inconsistent in achieving conservation objectives (Bull et al. 2013). More practical experience and lesson sharing on offset application in diverse contexts is needed (ICMM & IUCN 2012) and must overcome constraints posed by issues of corporate confidentiality and concerns over the public sharing of offset challenges and failures.

South Africa is the third most biologically diverse country in the world (Cadman et al. 2010) and an emerging economy with ambitious development plans. Biodiversity offsets were first considered in South Africa more than a decade ago as a mechanism to remedy the residual adverse impacts of project development. South Africa has since gained considerable experience in the development of offset policy and guidelines (e.g. Brownlie & Botha 2009), and in offset planning; generating important lessons that can inform development of robust biodiversity offsetting elsewhere. Here we describe key elements of South Africa’s approach to biodiversity offsets and discuss challenges and potential solutions for designing and implementing offsets.

Methodology
Thirteen expert practitioners completed semi-structured interviews regarding their experiences in the practical design and implementation of biodiversity offsets, and the development of offset policies, guidelines and protocols. Four interviewees were independent consultants, three were employed by extractives operations, and six were members of public sector or non-governmental organisations. Each had between five and 10 years of practical biodiversity offset experience; six were key participants in the development of South Africa’s regional and national offsets policies. The majority were involved in the ongoing global, scientific debate on the impact of biodiversity offsets.

A semi-structured anonymous interview design, guided by a list of open-ended questions, was selected for this study. The interviews lasted between 30 and 90 minutes, and were conducted between December 2016 and February 2017. The interviewees were asked to reflect on their experiences designing and implementing biodiversity offsets, including how they addressed challenges and potential solutions identified in the literature. This paper presents a summary of the key findings from these interviews.

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based on the following considerations (e.g. Creswell 2013):

- A semi-structured design provides participants scope to express diverse views and allows the interviewer to follow-up on emerging themes.
- A degree of comparability between participants is enabled through use of consistent interview themes.
- Semi-structured interviews allow for the elicitation of narratives concerning personal experiences.
- Open-ended questions reduce the influence of the interviewer’s personal opinions.
- Anonymity allows participants to freely express their views and contribute personal case studies.

Several interviewees contributed case studies to illustrate and evidence key elements of their experiences and opinions. Case study information that could be corroborated through supporting documentation and evidence is referred to in this paper.

To set the interviewees’ practical experience in a broader context, verify information gathered through interview and substantiate case studies, an extensive review was conducted of published literature and other publicly available information (e.g. EIA reports, environmental authorisations, offset feasibility studies, offset agreements, policy documents, government publications, non-governmental organisation reports, in-country workshop and conference proceedings).

**South Africa’s approach to biodiversity offsets**

South Africa’s Constitution (Act 108 of 1996) allocates management of South Africa’s biodiversity to the national Department of Environmental Affairs; at the provincial scale, biodiversity management devolves to provincial departments. Environmental management at provincial level must be consistent with national policy.

A draft national policy on offsets was produced in 2012 and revised in 2016, though it is yet to be formally endorsed. Guidelines have been published for two of South Africa’s nine provinces, the Western Cape (DEA&DP 2011) and KwaZulu-Natal (EKZNW 2013), and drafted but not released for Gauteng Province. Formalisation of the provincial guidelines is on hold, pending clarity on the national position. National guidance for wetland offsets (MacFarlane et al. 2016) has also been published. All incorporate robust offset principles that broadly reflect international standards (e.g. BBOP 2012).

Offset or compensation requirements are not explicit in South Africa’s environmental law. However, environmental management principles in the National Environment Management Act of 1998 (NEMA), which apply to all authorities whose decisions affect the environment and to private and public sector developers, enable the inclusion of biodiversity offsetting as a condition of authorisation. They include the ‘polluter pays’ principle, and the need to remedy adverse effects on biodiversity and ecosystems after avoidance and minimisation.

The NEMA Environmental Impact Assessment (EIA) regulations’ list activities across development sectors that are subject to environmental assessment. The significance of residual impacts triggers the need for offsets, which are required to address impacts on biodiversity predicted to be of ‘medium’ to ‘high’ significance. Impacts of ‘very high’ significance that may result in loss of irre- placeable biodiversity are considered unacceptable.

Other laws influence and support biodiversity conservation and the use of offsets, including the Protected Areas Act (2003) and Biodiversity Act (2004). Biodiversity stewardship programmes (see SANBI 2014) encourage conservation on private land; with associated tax incentives and rates relief mechanisms.

The South African National Biodiversity Institute (SANBI) periodically evaluates and maps the threat and protection status of biodiversity in a scientifically-robust manner through a national biodiversity assessment (e.g. Driver et al. 2012). Systematic biodiversity plans have been drawn up for most of the country. They map ‘Critical Biodiversity Areas’ (CBAs), which represent the most efficient configuration in the landscape to protect a region’s biodiversity. Their purpose is to inform biodiversity-inclusive land-use planning, improve decision-making (Brownlie et al. 2005) and support protected area expansion. They ‘red flag’ priority conservation areas and indicate ‘offset receiving areas’.

Biodiversity offsets in South Africa aim for no net loss in relation to conservation targets so as to retain and protect enough of each ecosystem to prevent declines below ‘endangered’ status (Figure 1) and, in wetland ecosystems, to achieve no net loss of water resources (MacFarlane et al. 2016). Targets are science-based measures of what must be conserved to meet biodi- versity representation and persistence goals. They are the basis for calculating initial offset requirements using a ‘basic offset ratio’ linked to the threat status of the affected ecosystem (Figure 2). The offset is then adjusted according to additional considerations including habitat condition, effects on threatened species or special habitats, ecologically or evolutionarily-important processes or areas, and valued ecosystem services. For wetland offsets, multipliers also address functional hydrological aspects.

Offsets comprise statutory protection and manage- ment of biodiversity in good condition and are preferably located in ‘offset receiving areas’. With the exception of wetlands, restoration is generally not feasible in South Africa’s ecosystems, thus ‘averted loss’ or ‘protection’ offsets dominate. In accordance with best practice, offsets must generally comprise ‘like’ biodiversity, although ‘trading up’ exchanges that secure biodiversity with a higher threat status may be acceptable under certain conditions.
Main challenges

The principal challenges that have been associated with introducing biodiversity offsets into South Africa’s regulatory and environmental management systems are discussed below.

Absence of clear policy on biodiversity offsets

The lack of explicit national policy, embedded in an effective enabling framework, has resulted in frequently inconsistent, ad hoc and varied offset requirements and approaches. Uncertainty has rendered offset conditions vulnerable to legal challenge and retarded the provinces’ application of offsets and finalisation of guidelines. Debate over parameters has contributed to unnecessarily protracted EIAs, offset development and authorisation processes.

In South Africa numerous projects (e.g. mining, public infrastructure) have been authorised with an offset requirement despite impacts on irreplaceable biodiversity (which should render the project unacceptable) and/or where project alternatives could have avoided impacts. Without explicit requirements set out in national policy, including limits to what can be offset, offsets risk becoming political negotiating tools associated with inappropriate developments. For example, a
colliery located next to a World Heritage Site in Limpopo Province was closed temporarily for non-compliance with environmental and water regulations. The operation was permitted to resume operations subject to weak conditions which included a requirement for retrospective compensation of impacts and an offset agreement (CER 2014). Offset conditions that bear little relationship to residual negative impacts and/or reflect poor application of the mitigation hierarchy threaten to undermine integrity of the concept and outcomes for biodiversity.

**Poor impact assessment**

Transparent offset design depends on rigorous baseline studies and impact assessment, and on a reliable measure of residual negative impacts (BBOP 2012). Alternatives analysis in EIAs enables sequential consideration of mitigation measures as required in South African law. In practice, biodiversity is often poorly addressed in EIAs (Brownlie et al. 2006), baseline information inadequate and significance ratings questionable. Ecosystem services are frequently disregarded, since biophysical and social specialists work in silos within the EIA process. Offsets have been overlooked or considered too late in the EIA process to influence project design or invite stakeholder input into their planning, thereby missing opportunities for offset requirements to drive impact avoidance and minimisation.

South Africa’s 2014 EIA regulations dictate tight timeframes for the EIA process, underlining the need for early and due consideration of offsets.

**Inconsistent decision-making and enforcement**

Robust, auditable and enforceable conditions of authorisation are crucial where offsets are concerned (e.g. Brown et al. 2014). Without them, the most basic form of security for an offset is missing and offsets have little chance of succeeding.

In South Africa, the need for offsets often first appears in the conditions of environmental authorisation. The late introduction of offset requirements presents numerous challenges: availability of suitable offset sites has not been investigated; budgets exclude offset costs; and time and other resource implications have not been considered. As a result, conditions of authorisations may be weak and unenforceable. Examples have included poorly defined offset requirements, failure to allocate responsibility for implementation, and a lack of explicit offset parameters (e.g. offset size, essential biodiversity components, location, deadlines for implementation, site protection mechanisms). Financial requirements for the establishment and long-term management of the offset have been omitted or linked to company profits and/or continued operations of the project, giving companies a financial escape clause if profits fall. Explicit penalties and consequences for failed offset delivery are rarely included.

Weak and unenforceable conditions of environmental authorisations are contributing to offset delay or failure. In 2009 in KwaZulu-Natal a condition of environmental authorisation for a dam required a ‘detailed plan of action to establish offset areas.’ No timelines, required outcomes or specifics about financial provision were given. Inundation of the dam basin started in 2013. Although preliminary planning for suitable offsets has been completed, there is no clarity on when and how offsets will be implemented and financed.

**Insufficient capacity to deal with offsets**

South Africa’s environmental sector has recognised capacity constraints (DEA 2014). A lack of understanding about offsets in government and frustration by developers at lack of clarity from competent authorities and specialists is a challenge (De Witt 2015).

Inadequate resourcing of government agencies hinders conservation management, performance monitoring and enforcement. Although developers must make financial provision for protecting and managing offset areas, it can be difficult for public agencies to receive funds from outside parties: mechanisms for channelling money to, and/or building capacity within, the respective agency are limited or cumbersome. Independent service providers can assist in undertaking offset-related functions (e.g. management, monitoring, auditing); however, some activities (including protected area declaration and stewardship programme support) can only be conducted by the responsible conservation agencies. The additional burden presented by a growing number of offsets is substantial.

To date no offset register has been established and no systematic performance review of offsets has been undertaken. Necessary capacity building and training on offsets has been limited and sporadic. Consequently, there are inadequate data and uneven capacity across government authorities, EIA practitioners, specialists and civil society organisations to design, implement and monitor offsets effectively. To be effective, education and training on offsets is urgently needed to build understanding and expertise in all these groups. Authority resources must be increased to meet the additional requirements for registering, monitoring and evaluating offset performance.

**Financial and institutional arrangements**

Optimum vehicles for financing offsets over time and the allocation of responsibility for managing the funds present a big challenge. Trust funds have been used to finance offsets in the Northern and Western Cape provinces. However, their use has proved difficult:
government agencies are often unable or unwilling to hold these trusts; securing funds specifically for offsets may not always be possible; fears that holding substantial funds could lead to substitution and budget cuts by central government; and barriers to government bodies utilising the interest on capital for managing offsets. Conservation NGOs may also be reluctant to hold trust funds, fearing increased audit scrutiny and a lack of clarity on limits of the liability.

The developer’s responsibility for offsets should last for at least the duration of residual negative impacts on biodiversity (BBOP 2012). In South Africa there is currently no clarity on institutional and financial arrangements for offset sites when that responsibility ends.

**Timing and delays**

The time required to design and implement an offset is often underestimated by the competent authorities and developers. The planning steps and agreements required prior to implementation can be complex: securing protected area status for an offset site can take years. While over 70% of all land in South Africa is in private hands it is often difficult – and time-consuming – to locate sites that meet offset criteria and objectives. Offsets are required mainly for threatened ecosystems which are, by definition, fragmented and severely reduced in extent. Moreover, finding willing landowners can be difficult and involve lengthy negotiations. For example, protracted disagreements over where the trust fund for an offset should be held and which organisations should be responsible for its management delayed a Western Cape road offset for several years. Delays can result in significant time lags between impacts of project development occurring and offset delivery. In some cases the offset may not be delivered at all.

**Potential solutions**

We summarise here some of the factors that have supported improvements in offsetting in South Africa to date and potential solutions to overcoming the main challenges (Figure 3).

**National policy and oversight on biodiversity offsets**

Biodiversity offsets in South Africa are unlikely to succeed without an explicit regulatory driver, embedded in a sound enabling framework. National policy should introduce predictability to offset requirements. To do so it needs to set out clear principles, defensible methodologies, realistic standards (ten Kate & Crowe 2014) and requirements in relation to steps and constraints within the EIA process and challenges noted above; these components are included in the draft national policy.

A register of biodiversity offsets must be established to improve transparency, track and evaluate offset performance, aid compliance monitoring and enable emerging trends to inform policy adjustments over time (see also Brown et al. 2014; Gordon et al. 2015).

**Capacity building**

Levels of understanding and application of the mitigation hierarchy, including biodiversity offsets, require

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**Figure 3.** Challenges and potential solutions for good practice biodiversity offsets in South Africa.
urgent improvement across all sectors. Capacity building needs to be targeted, coordinated and supported by government.

Increased human and financial resources within the competent authorities responsible for authorisations that may be conditional on biodiversity offsets, and within conservation agencies responsible for offset implementation, are needed: offsets must be monitored, evaluated and compliance with offset conditions enforced – these elements are essential if offsets are to deliver requisite biodiversity outcomes and make intended contributions to conservation (e.g. Villarroya et al. 2014). Expertise and understanding of offsets, specifically the legal, financial and management requirements for delivering biodiversity outcomes, is essential in the formulation of practical, measurable, auditable and enforceable offset conditions.

The establishment of an ‘offsets think-tank’, involving offsets practitioners from different provinces in South Africa, has provided a useful forum to exchange ideas and share lessons learned. This forum should be expanded or adapted, as appropriate, in future as offset practice grows.

**Improving EIA practice and integrating offset considerations**

The core components of good practice EIA in South Africa need to be improved to provide a reliable basis for considering biodiversity offsets. In a sense, the sound use of offsets has the potential to force better EIA practice. To give assurance of quality work, biodiversity specialists involved in EIAs should be professionally registered; peer review of specialist studies in complex or controversial cases is desirable.

In South Africa progress is being made towards the definition and application of good practice. For example, inconsistencies in the assessment and evaluation of impact significance have prompted provincial offset guidelines to prescribe protocols for determining impact significance based on four criteria: considerations relating to pattern (threat status of species, ecosystems and special habitats); process (watercourses, habitat corridors and connectivity); ecosystem services, and interactions between these, as reflected in systematic biodiversity plans. This approach is incorporated into ‘minimum requirements’ for addressing biodiversity in EIAs that are being finalised by the national environmental authority.

Consideration of offsets as a final step in the mitigation hierarchy and inclusion of offset design into the EIA process are essential (e.g. BBOP 2012; Bull et al. 2013). In South Africa, competent authorities are, in some cases, requiring developers to demonstrate this approach during the EIA process. For example, the environmental authorisation for a cement project in the Western Cape was initially rejected due to significant predicted botanical impacts; the developer was required to demonstrate application of the mitigation hierarchy and offset feasibility. Independent offset specialists were commissioned to undertake an offset study that ‘raised the bar’; improving the rigour of baseline studies, quantifying residual botanical impacts, exploring alternatives, and investigating the feasibility of developing suitable and appropriate offset/s, in consultation with selected stakeholders, to compensate for residual impacts. Involvement of independent offset specialists in the EIA process has been demonstrated to be crucial for determining offset feasibility and improving the quality of offset design.

Elsewhere, offset planning has been undertaken concurrently with the EIA, enabling strict application of the mitigation hierarchy. This was the case for a zinc mine in the Northern Cape, where early consideration of likely offset requirements helped make the business case for impact avoidance and minimisation, achieved primarily through mine redesign (Hughes et al. 2015). It ensured that interdependencies between biodiversity and water resources could be identified through interdisciplinary workshops and facilitated engagement of principle conservation stakeholders to obtain their input on the offset outcome. It also allowed the developer to plan appropriately, taking into account the practical, time and financial/ budget implications of offsets. This can facilitate the design of appropriate and robust offsets, support identification of essential implementation factors, reduce resistance from project proponents and enhance eventual compliance (e.g. BBOP 2009; Brown et al. 2013).

**Improving decision-making and conditions of authorisation**

Reliable, quantified information on residual negative impacts should be required from the EIA prior to decision-making to enable inclusion of clearly defined offset conditions in the authorisation (see also Brown et al. 2013, 2014; Commonwealth of Australia 2014). These conditions must include crucial elements of offset design and implementation that give assurance of successful outcomes. Reasonable, realistic time limits for securing offsets must be set and conditions should stipulate that no regulated activities can commence until specified measures are in place. For a zinc mine in the Northern Cape a legal agreement had to be signed with the provincial conservation authority setting out the details and financial guarantees of the offsetting plan before they were permitted to start work on site (DENC NCP 2013).

In South Africa, drafting of explicit offset-related conditions of authorisation by independent offset specialists is proving constructive given current capacity constraints and short timeframes for decision-making. Where different authorities are responsible for different authorisations, which may require offsets as conditions of development (e.g. water use licence, environmental authorisation, forestry permit), effective mechanisms for coordination and cooperation are essential. Although South Africa has introduced the ‘one environmental
system, alignment of different authorisation processes remains problematic. Proposals in provincial offset guidelines for an independent and impartial body to be established to advise on offsets (their appropriateness, adequacy of offset proposals and provision for implementation) have merit.

Financial and institutional arrangements

A successful offsetting framework depends on the establishment of financing vehicles that are transparent and securely governed. Guidance on suitable vehicles for holding funds to support the long-term management of offset sites, and responsibility for fund management, is urgently needed. Owing to policy uncertainty and public finance management challenges this remains a major unresolved issue in South Africa.

Adequate funds to implement the offset, in an appropriate vehicle or a financial guarantee, should be required before the impact is allowed to occur. Without this safeguard there is significant risk that the offset will never be realised, whilst the impacts proceed. Additional performance bonds or other forms of security should be provided where there are likely to be risks. In the case of the Northern Cape zinc mine, the developer must give surety to protect against the mine refusing to pay the required annual instalments; if land purchase for offsets were to fail, penalties would be payable to government and that money would be used to buy the required land.

Clarity on institutional and financial arrangements once the developer's responsibility for offsets has ceased is required. Substantive demands on State resources could accrue in future unless prudent provisions are made.

Up-to-date biodiversity information

The status of biodiversity and biodiversity plans must be regularly updated to ensure reliable baseline data to inform offset design (see also Gordon et al. 2015). Plans act as an ‘early warning’ system driving impact avoidance of CBAs, particularly since offset requirements are linked to ecosystem threat status: the greater the threat the larger and generally more costly the offset.

For the Saldanha Bay region in the Western Cape, an Industrial Development Zone strategically positioned to serve the African oil and gas sector, a fine-scale systematic biodiversity plan with clearly mapped CBAs (Maree & Vromans 2010) supported by guidance on biodiversity management has been pivotal in supporting application of the mitigation hierarchy, principally through impact avoidance and minimisation. This plan facilitated assessment of the acceptability and feasibility of offsets for several projects in the area, supplemented by specialist studies to inform detailed mitigation measures, and offset design and location.

Communication and transparency

Communication between developers, offset specialists, competent authorities, the conservation agency(ies), landowners and other stakeholders is important in offset planning and potentially pivotal for offset success. In many offset studies undertaken in the Western Cape and KwaZulu Natal, engagement with relevant stakeholders has informed the design and location of offsets, and workable financial and logistical arrangements. For a KwaZulu-Natal dam, stewardship mechanisms (protected areas or conservation servitudes on private land) were seen to be key to securing and managing offset sites. Gauging landowner willingness to enter into a conservation agreement with the provincial conservation agency was essential.

A public offset register is essential for transparency and accountability (see also Brown et al. 2014) and key offset conditions, objectives and management plans need to be publicly accessible. To date access to this information has been difficult but recent changes (DJCD 2016) make environmental authorisations automatically accessible to the public. South Africa’s EIA regulations also require that audit reports emanating from environmental authorisations, including those with offset conditions, become part of the public record.

A more strategic approach

A ‘project by project’ approach to offsetting is placing strain on competent authorities and conservation agencies. A more strategic approach is needed; one that also improves consistency in offset requirements and delivery. Given that South Africa’s conservation priority areas are known, some form of conservation banking holds promise. A pilot study is underway in a KwaZulu-Natal municipality (Macfarlane et al. 2015) and the City of Cape Town has a type of ‘banking’ scheme. However, these are not fully fledged conservation banking mechanisms and without explicit offset policy or legal requirements there is little incentive to pursue this option at scale.

Minimising administrative demands of offsets on an under-capacitated public service is important. In a growing number of offset projects in South Africa, developers have made financial provision for the costs of management, monitoring and independent performance audits, with responsibility for delivery passed to reputable, appropriately qualified professionals. Monitoring and audit reports are submitted to the relevant authority and/or conservation agency. Compliance is based on specific ecological outcomes rather than activities (e.g. rehabilitation); if an area or approach fails, another option must be pursued to meet targets. In this way, the authorities can direct available resources to follow up and enforcement of offset conditions where there are concerns.
Conclusion

Literature has emphasised theoretical and technical issues (e.g. Pilgrim & Ekstrom 2014 and references therein) and theoretically robust offset methodologies (e.g. Gardner et al. 2013 but see BBOP 2009). Experience from South Africa, however, highlights broader contextual challenges influencing offset outcomes and the crucial role of systems that enable and support offset implementation. Many other countries exploring the use of robust offsets within the mitigation hierarchy are likely to share this experience.

The importance of establishing national policy has been highlighted (ten Kate & Crowe 2014): the absence of clear policy in South Africa has contributed to inconsistency in the use of biodiversity offsets, undermining their potential to deliver the requisite biodiversity outcomes and contribution to conservation. The value of having up-to-date biodiversity plans based on scientific, defensible information has further been demonstrated in South Africa; supporting rigorous application of the mitigation hierarchy (primarily through impact avoidance and minimisation) and guiding offset scoping.

Good practice offsets in South Africa are currently being championed by a small group of consultants and government officials. However, capacity constraints, poor assessment of biodiversity impacts and application of the mitigation hierarchy in the EIA process, and inadequate monitoring and enforcement present significant barriers that must be overcome if offsets are to achieve the requisite biodiversity outcomes.

Capacity building across all sectors and a pragmatic but defensible approach to offset design will be essential for the effective use and implementation of offsets. There is a clear need to establish transparent and securely governed financing vehicles to support offsetting frameworks. A more strategic approach to offsetting, potentially involving conservation banking, could hold promise provided that a national offsets policy is first in place.

The challenges South Africa has faced in introducing and applying biodiversity offsets are likely to resonate with other countries considering biodiversity offsetting as a mechanism to counteract the adverse impacts of development projects on biodiversity. It is hoped that learning generated from the experience of South Africa can inform discussion around, and the development of, robust offset policy and practice elsewhere.

Notes

1. The EIA regulations fall under NEMA. New regulations were promulgated in terms of Chapter 5 of NEMA and were published on 4 December 2014. Notices GN R982-R985 list activities that are subject to environmental assessment.

2. ‘Ecosystems’ are in this context equivalent to vegetation types and are used as the main surrogate for biodiversity overall. Ecosystems are categorised according to their threat status (see DEA 2011; Driver et al. 2012).

3. Department of Environmental Affairs and Tourism, Record of Decision, reference 12/12/20/220, 15 June 2009.

4. http://www.forest-trends.org/documents/files/doc_4586.pdf

5. https://www.environment.gov.za/mediarelease/oneenvironmentalsystem

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