Critical review of Biodiversity Offset track record

For the purposes of IEEP in their review of 'Policy Options for a potential EU No Net Loss Initiative

Summary: A review of biodiversity offset case studies shows that biodiversity offsets face a number of problems: 1) technical (not being able to effectively measure what is lost and gained), 2) governance (not enforcing the mitigation hierarchy or adequate standards and measurements, nor penalising failed projects) 3) socio-geographical perspective (the local and wider cultural value of nature) 4) financial (fundamental errors in the market logic of using 'price' to regulate destruction 5) Legal (evidence to show that biodiversity offsetting interefers in the interpretation of environmentala nd planning laws and due legal process).

A lack of longitudinal studies and the failure to show conclusive evidence of widespread successful offsetting, this should lead policy makers to adopt the precautionary principle.

Summary of findings

This critical review is based on exchanges with academics in the science of restoration ecology, environmental officers in countries that already offset nature as well as local conservation groups that face biodiversity offset pilots. This has guided us towards key academic texts but also grey literature produced by local communities faced by biodiversity offsetting (Annex A and B). At the end of this document is a brief summary of all large-scale studies of offsetting projects at the local, regional, national and international scale and what the problems are. These exchanges and literature review – while limited due to the dearth of independent information regarding the outcome (positive or negative) of biodiversity offsets – lead us to make a number of observations:

Technical issues: Impossibility of accurately measuring net loss and restoration/avoided impact

1. There are problems regarding the calculation of 'what is lost': often, it appears that the calculation of 'what is lost' lacks detail. This is a pragmatic choice related to the difficulty of measuring biodiversity and the pressure on offset providers to provide cheap and accessible offsets. One example in the North West of France (see Annex A) and one example in South-West of England (See Annex B) show that this 'pragmatism' has led to inferior assessments being made that undervalue the biodiversity on site.[1] This makes it hard to know if offsets have achieved 'no net loss'.
2. There is evidence of underreporting 'what is gained' in offsets, which makes the task of assessing offset outcomes more difficult. This means it is hard to know if offsets have really achieved 'no net loss.' Anecdotal evidence in Germany reveals that extremely little information is produced on the results of offsets over time.

[1] One academic, Martine Maron from the University of Queensland, highlighted to us that "*A major issue in establishing whether the target condition has been met is that while the overarching policy objectives may state replacement of a specific biodiversity value, the onsite targets set in a particular case were never going to be enough to replace the lost biodiversity even if achieved. This has been the case for a long time for the south-eastern Red-tailed Black-Cockatoo, for which offsets initially involved planting of tree species that are not habitat for the cockatoo, and then moved on to protecting already-protected trees. While the proponents may have achieved the site-level outcome required of them (although they did not always) the outcome required could never have benefited the cockatoo.*"

3. It appears that many biodiversity offset programmes specify 'actions to take' rather than 'condition outcomes'. This means that offsets are not liable for achieving specific outcomes. In the event that offsets do not achieve equivalence to 'what is lost' (which we believe is a strong possibility due to flaws in restoration ecology), offsets will result in an increased loss of biodiversity.

4. There is evidence within the restoration ecology literature that shows that the science of restoration is still in its infancy and demonstrates mixed to poor outcomes. This means that offsets that are based on restoration work risk the same flaws.

5. Offsets that are based on 'avoided impact' also face a number of flaws, such as problems related to setting baselines. These are problems that can be observed from biodiversity offsets, but also other types of offsets such as carbon offsets, that face similar problems.[2]

Governance issues: mitigation hierarchy, enforcement and policy landscape

6. There is evidence to show that despite the existence of the 'mitigation hierarchy', most jurisdictions do not properly implement an avoidance hierarchy. Furthermore, studies show the difficulty of proving whether projects have properly consulted alternative options. Studies show that it is extremely rare that projects have ever been refused due to the difficulty of offsetting biodiversity. Since the 'mitigation hierarchy' is key in ensuring the environmental integrity of compensation activities, this is undoubtedly concerning.

7. Studies show that in the USA, the implementing body almost never takes action when offsets are found not to be in compliance with the agreed standards.

8. Biodiversity offset test cases in the EU show that the permission to offset has weakened legislation that currently prevents damage (see Annex A). This means that rather than preventing damage through the price of offsets, biodiversity offsetting may increase levels of biodiversity destruction and undermines the EU's targets to reduce biodiversity loss.

Socio-geographical considerations

9. By definition, most biodiversity offsets do not take into consideration the social impact of development and land-use change. This impact can be a loss of quality of life, loss of spiritual, cultural or community role that nature plays, loss of recreation, loss of 'natural engineering' values such as storm water drainage, water purification & pollination (etc.), loss of economic value of housing (etc.)

10. Biodiversity Offsetting does not take into consideration the impact of development and land-use change on landscapes. The Council of Europe recognises the importance of

[2] On academic, Sian Sullivan, from the University of Birkbeck, highlighted to us that *"There is a lot of scope for playing with figures in the ways in which they are assessed. For example, the Rio Tinto offsets associated with the Ambatovy ilmenite mining projects in Madagascar rely on counterfactual assumptions that assume high levels of forest degradation by locals, thus acting to justify displacement of them and their resource use practices. They also do not take into account historical deforestation practices caused through commercial and colonial exploitation of timber, the establishment of commercial eucalyptus plantations."*

landscapes to communities, formally defining them as *"an area , as perceived by people, whose character is the result of the action and interaction of natural and/or human factors."* Landscapes have significant cultural heritage and this highlights an important principle in landscape protection and that is that they are 'site specific' meaning that they have meaning not only in what they are but *where* they are.

Financial considerations

11. The premise of biodiversity offsetting is that it replaces the need for regulation that prevents destruction since the price put on ecosystems is a sufficient regulator. The theory is that putting a price on ecosystems loss will regulate its destruction, since precious ecosystems would, in theory, be more expensive to offset, their destruction would therefore be avoided. Proponents of biodiversity offsetting suggest that price will act as a form of regulation, since developers will look for the cheapest land to build on. If offsets are sold on a market, it will be impossible to 'ensure' that price is prohibitive enough to dissuade destruction, since price depends on demand and supply. As previous environmental markets (such as for carbon) have shown, weak design and political intent means that prices never reach the required level to be prohibitive. Furthermore, experience in countries that have well-established offsetting requirements show that businesses factor in the cost of offsetting into their business plan, meaning that it no longer plays a dissuasive role.

Legal considerations

12. There is concern that biodiversity offsetting interferes in the ability of laws to prevent damage. Biodiversity offsetting relies on a market price for habitat restoration being high enough to encourage development in places that are easier to find a similar substitute, and therefore cheaper, rather than on laws that are democratically decided. There is also concern that biodiversity offsetting (see Annex A and B) has undermined the democratic voice of local communities who challenge unwanted land use change.

<u>Findings</u>

1. **Lack of monitoring & underreporting:** A number of articles show that very little monitoring of the outcome of restoration activities is done. These articles also show that there is an underreporting of failed projects.
    - *Bernhardt, E.S., Palmer, M.A., Allan, J.D., Alexander, G., Barnas, K., Brooks, S., Carr, J., Clayton, S., Dahm, C., Follstad-Shah, J., Galat, D., Gloss, S., Goodwin, P., Hart, D., Hassett, B., Jenkinson, R., Katz, S., Kondolf, G.M., Lake, P.S., Lave, R., Meyer, J.L., O'Donnell, T.K., Pagano, L., Powell, B., Sudduth, E., 2005. Synthesizing US river restoration efforts. Science 308, 636–637.*

- *Hobbs, R., 2009. Looking for the silver lining: making the most of failure. Restoration Ecology 17, 1–3.*
- *Government Accountability Office report "Wetlands Protection: Corps of Engineers Does Not Have an Effective Oversight Approach to Ensure that Compensatory Mitigation is Occurring."* [3]According to this report, though the Corps can take a variety of enforcement actions (such as issuing penalties, suspending or revoking a permit, recommending legal etc) in the year 2003, the Corps took no enforcement actions to obtain compliance with issues permitted. They include that Corps guidance for oversight of compensatory mitigation is sometimes vague or internally inconsistent. They perform limited oversight of compensatory mitigation.
- *NRC (2001) Compensating for Wetland Losses under the Clean Water Act. National Academy Press, Washington, D.C. According to this article, 63% of the banks were inadequately monitored. Lack of centralised information about banks and their credits, hence the difficulties in monitoring them, high transaction costs, and the risk of credits being sold twice.*

2. **Restoration ecology has produced weak results:** Studies point towards both technical difficulties (difficulties of measuring biodiversity and implementation difficulties such as time-lags) but also 'administrative improbabilities'. This latter point is important: articles question whether governance will ever be strong enough to enforce offsetting rules properly to achieve 'no net loss.' A number of articles suggest that restoration ecology is a relatively young and inexperienced discipline with a still-embryonic and patchy evidence base. Given the complexity and variability of natural systems, the ecological community is increasingly recognizing that recreating or restoring ecosystems to some specified former state is often unlikely to be feasible, especially within reasonable time frames. Success is dependent on geographical and historical context. Between a third and half of restoration offsets are successful and even less than that in recreation offsets. Studies also show that it is often not easy to evaluate the effectiveness of offsets in achieving their environmental objectives. It requires knowing what has been lost, what the baseline of the offset site is, what the result of the offset is after a defined time. It also requires making a decision about what is being measured. Studies show that for reasons of pragmatism, assessments are simplified and tend to lack enough detail (See Annex A and Annex B).
    - *Robertson, M. 2006, The nature that capital can see, Environment and Planning D.*
    - *Hobbs, R.J., Hallett, L.M., Ehrlich, P.R., Mooney, H.A., 2011. Intervention ecology: applying ecological science in the twenty-first century. Bioscience 61, 442–450.*
    - *Palmer, M.A., Filoso, S., 2009. Restoration of ecosystem services for environmental markets. Science 325, 575–576.*
    - *Stokstad, E., 2008. Environmental regulation: new rules on saving wetlands push the limits of the science. Science 320, 162–16*
    - *Mack, JJ, and M. Micacchion. 2006. An ecological assessment of Ohio mitigation banks: vegetation, amphibians, hydrology and soils. Ohio EPA technical report WET/2006-1.* Scientists looked at the 12 oldest of the state's 25 wetland mitigation banks. Although these had been studied and monitored by the Army Corps and EPA

[3] As the academic Morgan Robertson, formerly part of the Army Corps of Engineers, has related to us: *"The Government Accountability Office is a part of the government, not a watchdog group, and this is just one of many reports they've done over the years on the failures of the compensation program."*

[Environmental Protection Agency], the study found that many were not up to standard when checked against stringent scientific criteria. Indeed, against these measurements only three banks scored in the "successful category," while five passed in some areas and failed in others. The remaining four failed nearly every assessment, functioning more like shallow dead pools than wetlands. More disturbing, none of the government agencies charged with oversight were taking the bank managers to task for this fact. The study states that "No Ohio mitigation bank has created anything other than very poor quality amphibian communities when compared to results from natural shrub or forest wetlands. Not one bank site provided habitat for wood frogs or spotted salamanders, two species indicative of high quality sites."

- *Zedler, J. 'Ecological Issues with wetland mitigation', Ecological Applications (1996).*
- *Moreno-Mateos, D.Power, M. Comı´n, F Yockteng, R.,(2012) 'Structural and Functional Loss in Restored Wetland Ecosystems' Plos Biology 10(1): e1001247.doi:10.1371/journal.pbio.1001247* The study states that: "Ecological restoration to recover critical ecosystem services has been widely attempted, but the degree of actual recovery of ecosystem functioning and structure from these efforts remains uncertain. Our results from a meta-analysis of 621 wetland sites from throughout the world show that even a century after restoration efforts, biological structure (driven mostly by plant assemblages), and biogeochemical functioning (driven primarily by the storage of carbon in wetland soils), remained on average 26% and 23% lower, respectively, than in reference sites. Restoration performance is limited: current restoration practice fails to recover original levels of wetland ecosystem functions, even after many decades**. If markets for ecosystems services and mitigation offsets from restored or created wetlands is used to justify further degradation, global loss of wetland ecosystem function and structure will continue and likely increase**… Abundance, species richness, and diversity of native animals and plants in wetlands were severely reduced following degradation."
- Hilderbrand, R. H., A. C. Watts, and A. M. Randle 2005. The myths of restoration ecology. Ecology and Society 10(1): 19. [online] URL: http://www.ecologyandsociety.org/vol10/iss1/art19/ This paper argues that due to flaws in restoration ecology science, "Conservation measures alone will not suffice to protect ecosystem functions, services and habitat for a large number of species in the future". "Policies such an no let loss continue to exceed gains…and gains are often not functionally equivalent to losses…**Many restorations are not successful either in structure or function….such results underscore the need to evaluate our underlying beliefs and expectations in restoration**…"The myth of the carbon copy maintains that we can restore or create an ecosystem that is a copy of previous or ideal state…the belief is that these systems will return to their previous state after disturbance. The belief in this ability is promoted by those backing the extraction industries. This is resurging in the form of the 'no net loss' paradigm of environmental protection…Few created or restored wetlands have achieved structure or function equivalent to existing wetlands…The myths of the Bionic world is a belief that science and technology will solve the pressing issues of human population growth, finite resources and altered ecosystems…**If we follow thislogic;**

we have no tough choices to make about how we view and treat surroundings, and decisions can be put off until the economic markets demand or justify a solution. Let's hope they're right but until supporting evidence emerges, we must maintain what we have."

- Why bartering biodiversity fails – Susan Walker, Ann Brower, Theo Stephens, William Lee: Weak technical design and lax enforcement are predictable features of regulatory biodiversity trading. Biodiversity is non-interchangeable in terms of type, space and time. Unavoidably simple biodiversity currencies are inadequate; the facilitate nominal biodiversity accounting, but omit, obscure or conceal biodiversity features and noninterchangeabilities. The biodiversity data needed to inform exchange restrictions usually exceed those that governments, developers or habitat bankers have been willing to fund. Less comprehensive data bring greater uncertainty about biodiversity characteristics and hence increase potential for biodiversity loss. The basis for multipliers seems unsound: providing several times something different cannot replace a lost species or unique ecosystem. Political and administrative causes of inadequate review…classic theories of politics predict this tilt, and that biodiversity's poor measurability and non-interchangeability exacerbate it. Together, political and ecological factors create two fundamental problems for public administration of biodiversity barter. Problem of thin markets: thin markets (for a viable trading program to operate in practice, currencies must be simple…but to protect biodiversity, high-quality data must inform precautionary exchange restrictions. Such restrictions create transaction costs and allow few exchanges)
- *BenDor, T., 2009. A dynamic analysis of the wetland mitigation process and its effects on no net loss policy. Landscape Urban Plan. 89, 17–27.* This article highlights the problem of time lags: some habitats take longer than others, and some can never be restored. Ecological indicators such as plant biomass and species richness recover quite quickly, but species composition, soil physical and chemical properties and ecosystem functions such as nutrient cycling take longer.
- *Hossler, K., Bouchard, V., 2010. Soil development and establishment of carbon based properties in created freshwater marshes. Ecol. Appl. 20, 539–553.*
- *Hossler, K., Bouchard, V., Fennessy, M.S., Frey, S.D., Anemaet, E., Herbert, E., 2011. No-net-loss not met for nutrient function in freshwater marshes. Ecosphere 2, art82.*
- *Hilderbrand, R. H., A. C. Watts, and A. M. Randle 2005. The myths of restoration ecology. Ecology and Society 10(1): 19. [online] URL: http://www.ecologyandsociety.org/vol10/iss1/art19/* "Ecological restoration is trying to do in a matter of years what takes decades or centuries under natural conditions. Expecting complete restoration on human time scales is unreasonable"

3. **Not replacing the 'same thing': problems of simplification of metrics to make them fungible means they end up not being accurate.**
    - Hilderbrand, R. H., A. C. Watts, and A. M. Randle 2005. The myths of restoration ecology. Ecology and Society 10(1): 19. [online] URL: http://www.ecologyandsociety.org/vol10/iss1/art19/. They argue that in trying to

create stable metrics, we are simplifying nature which is incredible complex: "The incredible complexity of nature forces us to simplify the systems we study in order to develop theory and generalities…in essence, restoration ecology strives to recreate complex systems from simplified guiding principles. Failure to recognize the limitations and tacit assumptions can lead to failures because of the over-application of oversimplified concepts to complex systems"

- See Annex A, case study of a proposed airport in North-West France. This case shows that the offset provider, in this case a company called Biotope, severely undervalued biodiversity that existed on the site, which was an area of wetland habitat.

4. **Focus on compensation rather than avoidance and minimization & weakens existing legislation:** There is evidence that the wetland banking in the US focuses almost predominately on compensation than the other aspects of the mitigation hierarchy such as avoidance and minimization. This means that the offsets can work as an *incentive* to developments that may be ecologically problematic since they offer compensatory measures. This could lead to an increase in biodiversity loss against a projected baseline of loss, albeit hard to measure
    - See Annex A
    - Case in Tyneside, UK: http://saveourwoods.co.uk/articles/nppf/biodiversity-offsetting-permits-previously-rejected-housing-development/.
    - Case in Gloucestershire: http://www.bbc.co.uk/news/uk-england-gloucestershire-23301393?print=true
    - *Hough and Robertson. Mitigation under Section 404 of the Clean Water Act: where it comes from, what it means. Wetlands Ecol Manage (2009) 17:15–33*
    - *Clare, S., N. Krogman, L.Foote, N. Lemphers. 2011. Where is the avoidance in the implementation of wetland law and policy? Wetlands Ecol Manage (pre-publication)*
    - *Why bartering biodiversity fails – Susan Walker, Ann Brower, Theo Stephens, William Lee.* "Barter increases opportunity for officials already motivated to skip lightly past avoidance and minimization and proceed instead directly to compensation."

5. **Displaces biodiversity away from communities**
    - *Ruhl, J. B. and J.E. Salzman. The Effects of Wetland Mitigation Banking on People (January 1, 2006). FSU College of Law, Public Law Research Paper No. 179; FSU College of Law, Public Law Research Paper No. 179. Available at SSRN: http://ssrn.com/abstract=878331*

List of biodiversity offset projects that have failed to achieve 'no net loss'

- Canada – offsetting fish habitat loss: Researchers found that 63% of projects failed to achieve stated target of no net loss: Quigley, J.T., Harper, D.J., 2006. Effectiveness of fish habitat compensation in Canada in achieving no net loss. Environ. Manage. 37, 351–366.
- USA – offsetting forest loss and streambed in Appalachian mountains: researchers found that there was no evidence that any of the approaches considered could replicate the ecological fnctions, such as maintenance of water quality provided by the natural streams:

Bernhardt, E.S., Palmer, M.A., 2011. The environmental costs of mountaintop mining valley fill operations for aquatic ecosystems of the Central Appalachians. In: Ostfeld, R.S., Schlesinger, W.H. (Eds.), Year in Ecology and Conservation Biology, pp. 39–57.

- New South Wales: Replanted vegetation: supported fundamentally different bird assemblage compared to old growth temperate woodlands: Lindenmayer, D.B., Northrop-Mackie, A.R., Montague-Drake, R., Michael, D., Crane, M., Okada, S., MacGregor, C., Gibbons, P., 2012. Not all kinds of regrowth are created equal: regrowth type influences bird assemblages in threatened Australian woodland ecosystems. PLoS ONE 7 (4), e34527. Also different reptiles. After 10 years of monitoring, it is far from clear whether recovered trajectory would lead to reasonable level of congruence between faunal assempblages or revegetation and original vegetation: Michael, D.R., Cunningham, R.B., Lindenmayer, D.B., 2011. Regrowth and revegetation in temperate Australia presents a conservation challenge for reptile fauna in agricultural landscapes. Biol. Conserv. 144, 407–415.
- Article shows that between a third and half of restoration offsets are successful and even less than that in recreation offsets: Suding, K.N., 2011. Toward an era of restoration in ecology: successes, failures and opportunities ahead. Annu. Rev. Ecol. Evol. Syst. 42, 465–487.
- A survey of 87 restoration projects showed that 17 were unsuccessful, 53 were partially successful and only 17 were successful: Lockwood, J.L., Pimm, S.L., 1999. When does restoration succeed? In: Weiher, E.,Keddy, P. (Eds.), Ecological Assembly Rules: Perspectives, Advances, Retreats. Cambridge University Press, Cambridge
- A survey of 89 published assessments showed that though restoration projects led to an improvement, they did not reach the reference level: Rey Benayas, J.M., Newton, A.C., Diaz, A., Bullock, J.M., 2009. Enhancement of biodiversity and ecosystem services by ecological restoration: a meta-analysis. Science 325, 1121–1124.
- Australia: Restoration of mined coastal sand plains – revegetated areas are on a trajectory towards significantly different species composition: Buckney, R.T., Morrison, D.A., 1995. Temporal trends in plant species composition on mined sand dunes in Myall Lakes National Park, Australia. Aust. J. Ecol. 17, 241–254.
- Restoration plantings on abandoned agricultural land: did not achieve target status: Wilkins, S., Keith, D.A., Adam, P., 2003. Measuring success: evaluating the restoration of a grassy eucalypt woodland on the Cumberland Plain, Sydney, Australia. Restor. Ecol. 11, 489–503.; Lomov, B., Keith, D.A., Hochuli, D.F., 2009. Linking ecological function to species composition in ecological restoration: seed removal by ants in recreated woodland. Austral Ecol. 34, 751–760.
- There are a number of case studies in the 2001 report by the National Research Council that show that in a number of cases, offsetting sites have not reached a satisfactory level of equivalency.

Preliminary conclusions

This preliminary review reveals a number of major problems related to the performance of offsets, that put into doubt their ability to achieve ‘no net loss’.The technical problems related to the difficulty of measuring biodiversity, of restoring and recreating nature and of setting adequate baselines suggest that most biodiversity offsets are little more than a ‘promise in the wind’. Offsets provide no certainty as to their final outcome, and what little rporting is done shows that offsets more often than not provide ‘equivalent biodiversity’ that is grossly inferior top that which was destroyed. This will lead to a net loss of biodiversity.

In addition to ‘technical’ problems, the literature points towards a number of ‘governance’ realities that must be acknowledged. In the past, government agents have failed to penalise or deal with failed offsets and have failed to ensure that the mitigation hierarchy is applied. There appears to be a generalised failure to ensure that offsets are properly implemented, that biodiversity is properly measured and that offset interventions are sufficient and appropriate. Even in countries with ‘strong governance’ such as the USA, Germany and Australia, reports show concerning signs that biodiversity offsetting has contributed to the erosion of the mitigation hierarchy and leads to weakening of existing legislation and protection.

Finally, reports have shown that biodiversity offsets do not take into consideration the impact of developments on local communities, the impact of which cannot be offset. This take a step backwards from the acknowledgement that nature and human society are intimately linked.

It is important that these concerns related to biodiversity offsetting appear in impact assessments of biodiversity offsetting. These concerns highlight the need for attention to be paid first and foremost to actions that avoid and mitigate damage. Given the lack of conclusive, longitudinal data surrounding biodiversity offsetting, policy makers in the EU should adopt the precautionary principle in implementing any policy choices to tackle biodiversity loss.