Biodiversity offsetting in the United States:

Lesson learned on maximizing their ecological contribution

Rebecca Kormos, Deborah Mead & Brook Vinnedge 2015

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Florida panther on the Florida Panther Conservation Bank (Photo by Ben Alderman)
Gopher tortoise on the Tiger Creek Conservation Bank (Photo by Rebecca Kormos)
Mining in Florida panther habitat (Photo by Rebecca Kormos)

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Introduction

Biodiversity offsets have been used to compensate for the residual negative impacts of development on endangered and threatened species and their habitats in the United States for almost three decades. Biodiversity offsets have not always met the ecological goal of no net loss (NNL) in the US, but considerable strides have been made towards improving their effectiveness. The Interior Department's US Fish and Wildlife Service (USFWS), the agency held responsible for administering the Endangered Species Act (ESA) for most terrestrial and freshwater organisms, has encountered challenges in maximizing the ecological potential of biodiversity offsets but has met these head on by implementing policy changes that encourage offsets for unavoidable impacts, providing species-specific mitigation guidance for targeted species, and improving monitoring and management practices. As the use of offsets expands globally (Madsen *et al.* 2011) it is of paramount importance to examine those systems that have been in place long enough to assess their effectiveness and learn from these experiences. The following is therefore a summary of some of the lessons learned in the US. We focus on those experiences that can have broader application, especially to those range-states where biodiversity offsets are being considered for the impacts of industry and development on great apes in Africa. Because great apes are large bodied, wide-ranging mammals, we concentrate especially on how biodiversity offsets have been implemented for two mammals in the US: the Florida panther (*Puma concolor coryi*), and the San Joaquin kit fox (*Vulpes macrotis mutica*), as well as other listed species facing similar threats to their survival.

Background

In the US, where the concept of biodiversity offsets was first established, the goal has been to mitigate (or minimize) impacts of development on endangered species and their habitat through a regulatory process that requires compensation for loss of acres or individuals. In the US it is the Endangered Species Act of 1973, as amended (ESA), that is the main policy driver for the existence of biodiversity offsets for species listed as either Endangered[1] or Threatened[2]. Similarly the US Army Corps of Engineers regulates loss of wetlands through the Clean Water Act (CWA) which is the main driver for biodiversity offsets for wetlands and streams (Bayon *et al*. 2008, Mead 2008).

The ESA prohibits "take" of endangered or threatened (listed) species, where "take" means to harass[3], harm[4], pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." However, the ESA does allow for take that is incidental[5] to an otherwise lawful action through two separate regulatory processes. *Federal* agencies may apply for incidental take through consultation with the USFWS under section 7 of the ESA. If the USFWS deems that a federal agency

[1] The term ''endangered species'' means "any species which is in danger of extinction throughout all or a significant portion of its range" (ESA).

[2] The term ''threatened species'' refers to any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (ESA).

[3] "Harass "as defined by the USFWS in regulation, means "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering."

[4] "Harm," as defined by the USFWS in regulation, means "an act which actually kills or injures wildlife. Such acts may include significant habitat modification or degradation when it actually kills or injures wildlife by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering."

[5] "Incidental take" refers to a take of a listed species that is incidental to, and not the purpose of, carrying out an otherwise lawful activity" (ESA).

action is not likely to "jeopardize[6] the continued existence of any listed species" or "result in the destruction or adverse modification of designated critical habitat[7]," the USFWS will provide the federal agency with what is known as a "non-jeopardy" Biological Opinion (BO). If unavoidable take is likely to occur as a result of the action, the BO will include an "Incidental Take Statement" (ITS) that authorizes the incidental take." The ITS specifies the amount of take allowed and what measures, if any, are required, in addition those conservation measures included as part of the proposed action, to minimize the impact of the "taking" on the species. "Take" is usually stated as the number of individual animals or the number of acres of habitat (used as a surrogate for the individuals) to be impacted. Federal agency actions include projects conducted by federal agencies as well as non-federal projects that are funded or permitted by federal agencies. The incidental take authorization provided to the federal agency though the ITS is then extended to the non-federal permit applicant.

Non-federal project proponents that do not have a federal nexus (e.g., require a permit or license from a federal agency to proceed with their action) but have a proposed action that may impact listed species may obtain an Incidental Take Permit (ITP) from the USFWS through section 10 of the ESA regulatory process. This process requires the permit applicant to develop a Habitat Conservation Plan (HCP) and apply directly to the USFWS for an ITP. Although this regulatory process has a different legal standard (i.e., it requires that the permit applicant minimize and mitigate any unavoidable take to the maximum extent practicable and that the taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild) than the section 7 consultation process for federal agencies, the outcome regarding the use of compensatory mitigation for permitted projects is usually the same where offset programs exist. In areas without offset programs the use of compensatory mitigation to offset adverse impacts of development is often applied inconsistently both within and between sections 7 and 10 of the ESA.

The influence of the ESA in the use of biodiversity offsets for unavoidable take has grown due to the fact that the number of listed species throughout the US has increased dramatically from 78 species listed under the predecessor of the ESA: the Endangered Species Preservation Act of 1966, to more than 1,600 listed species under the ESA by the beginning of 2015 (http://ecos.fws.gov/tess_public/reports/species-listings-count-by-year-report) (Figure 1). The number of listing decisions made by the USFWS each year has largely been driven by Congress and litigation in the last two decades. By 2016, the USFWS will reach a decision on the federal listing status of 250 more species. One consequence of this increase in the number of listed species is that the frequency with which proposed development will overlap listed species' habitats will increase, further intensifying the need to find ways to compensate for negative impacts on those species.

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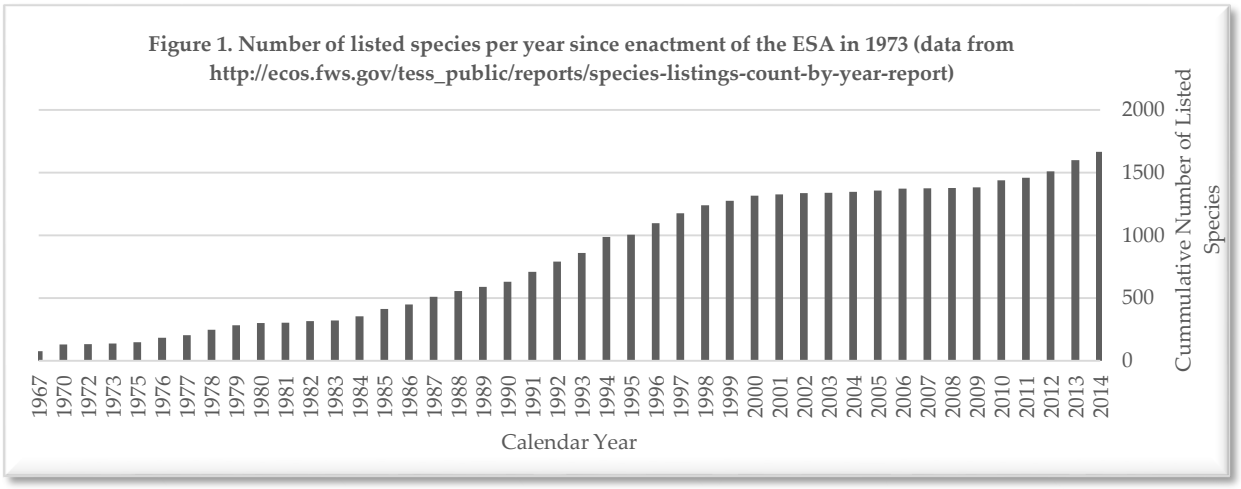
[6] Jeopardy "occurs when an action is reasonably expected, directly or indirectly, to diminish a species' numbers, reproduction, or distribution so that the likelihood of survival and recovery in the wild is appreciably reduced" (http://www.fws.gov/midwest/Endangered/section7/section7.html).

[7] When a species is proposed for listing as endangered or threatened under the Endangered Species Act (Act), the USFWS is obligated to consider whether there are areas of habitat they believe to be essential to the species' conservation and to propose those areas as designation as "critical habitat" (ESA 1973) defined as: "a specific geographic area(s) that contains features essential for the conservation of a threatened or endangered species and that may require special management and protection. Critical habitat may include an area that is not currently occupied by the species but that will be needed for its recovery" (http://www.fws.gov/midwest/endangered/saving/CriticalHabitatFactSheet.html). Once an area is designated as critical habitat, Federal agencies are required to consult with the USFWS on actions they carry out, fund, or authorize in critical habitat areas, to ensure that their actions will not destroy or adversely modify those areas.

Figure 1. Number of listed species per year since enactment of the ESA in 1973 (data from http://ecos.fws.gov/tess_public/reports/species-listings-count-by-year-report)



Lessons Learned

1. Provide clear authority for the regulating agency to request compensation

The goal of biodiversity offsets generally accepted by the international community is to achieve "No Net Loss" (NNL) and preferably a "net gain" of biodiversity. The Business and Biodiversity Offsets Programme (BBOP) – an international partnership of companies, government agencies, scientists and non-governmental organizations (NGOs) (ten Kate & Inbar 2008) that focuses on developing and providing guidance for the design of biodiversity offsets – specifies that this NNL is "with respect to species composition, habitat structure, ecosystem function and people's use and cultural values associated with biodiversity" (BBOP 2013).

Until recently, biodiversity offsets in the US have generally not resulted in NNL of listed species or habitat over time (Kormos *et al. in prep*). One of the main reasons the US has not achieved NNL for many species is that historically the USFWS has not always sought compensation for impacts, partly because it was not clear whether they had the authority to do so. As a result, compensation for listed species has varied over time and from state to state. For example, no compensation was requested for "take" of Florida Panther habitat until the 1990s, thus contributing to the fact that there has been a net loss of habitat from development projects since 1984[8] (Kormos *et al. in prep*). For the gopher tortoise, early on, individuals were simply moved out of harm's way, a procedure later found to result in a very high mortality rate. In California however, where environmental regulations have historically been stricter than in many states, compensation for the San Joaquin kit fox was requested from the 1980s, resulting in an overall net gain of habitat since 1987.

Sections 7 and 10 of the ESA gives the USFWS the authority to recommend or require mitigation under certain conditions and thus the power to include compensation as part of the mitigation request (Gardner 2008). Therefore a growing number of regional or field offices have increasingly made it their policy to strongly encourage or require compensation, as appropriate, for proposed projects with adverse

[8] In addition to habitat loss, hunting was one of the primary reasons for the panther's plummeting numbers. Before 1949, hunting panthers was allowed in Florida and by the early 1970s the panther population had almost been extirpated, with only an estimated 12-20 (excluding kittens) remaining in the wild.

impacts to listed species, and to approve compensatory mitigation programs such as conservation banking and in lieu fee programs to assist project proponents with ESA compliance. This has made a dramatic difference for many species, such as the Florida Panther, for whom there has now been a net gain in habitat over the last ten years as a result of stricter enforcement of regulations. Unfortunately, for many species compensation is still not requested or offered when there are impacts to ESA listed species.

In summary, clear designation of those Endangered and Threatened species for which impacts must be mitigated is critical, as well as clear laws or policies that provide authority for regulators to require compensation for those species is important for NNL to be achieved. In addition, a deeper understanding of those laws and their interpretation/application is also essential for no net loss to occur over time.

2. Define no go zones, thresholds and ensure that jeopardy or non-jeopardy opinions are based on science and free from political will

One of the greatest criticisms of biodiversity offsets is that they provide a green light for development. Although there are exceptions (e.g. Bonnie and Wilcove 2008), in the US this does not seem to be true for species since permits were not being made contingent upon offset. Small projects and projects with small impacts on listed species often don't reach the threshold for "jeopardy" under section 7 of the ESA and incidental take must be authorized regardless of whether federal agencies or applicants include offsets in their project proposals. For the most part in the US, the data suggest that projects are being permitted regardless of whether or not biodiversity offsets exist as a mitigation option (Kormos *et al. in prep*). The loss of species and their habitats would thus be far greater if biodiversity offsets were not used to compensate for damages. To ensure the continued survival of all species and the recovery of listed species, what is needed are improvements in defining of "no-go zones" for development, thresholds for how much total natural habitat the US is willing to accept as a loss, and how much compensation is needed. Clearer standards in law, regulation, and policy that require compensation for all actions that negatively impact listed species, as well as other resources of concern, would better enable the USFWS to make consistent decisions regarding authorization or permitting of incidental take of listed species and losses of other important resources. These procedures however can only be successful if they exist within an atmosphere that allows "jeopardy" and "non-jeopardy" findings and decisions free of political pressure and based on the best science available.

"No go zones" should be delineated as part of a larger plan for the conservation of the species (see below). Each individual project for which "incidental take" of a listed species is permitted slowly chips away at the habitat of the species, and cumulatively can result in significant habitat loss and fragmentation over decades. Articulating thresholds for how much habitat of a species can ultimately be "taken" and still ensure species survival in the long term is an important component of a conservation plan for that species. . The term "no go zones" is likely to be interpreted in the US as infringing on private landowners rights, often referred to as a "taking" under the 5th amendment of the US Constitution (not to be confused with "take" of listed species under the ESA), but this term is useful when applied to many countries where the government owns or controls much of the land.

Political pressure unquestionably exists on USFWS to issue "non-jeopardy" opinions and issuance of jeopardy opinions is extremely rare (e.g. see Pittmann 2010 for the Florida Panther). In some states, many of these non-jeopardy opinions still include no compensation or inadequate compensation for negative impacts. As the use of biodiversity offsets expands, ensuring the existence of no-go zones for development, thresholds for impacts to species, and the ability to enforce these limits is of great concern. If such restrictions are not defined and respected, there will be little hope of species long term survival.

3. Ensure mitigation ratios accurately represent the multiple values of habitat to species survival in the long-term

Another reason that NNL was not initially being achieved for some species in the US is that historically, mitigation ratios have not always truly reflected the value of the land lost and gained for the species. In 2005, a 1:1 ratio (for every one acre of habitat lost, one acre of habitat is protected in perpetuity) was still the most common mitigation ratio in the US (Fox & Nino-Murcia 2005).

There are multiple factors that can affect the value of any given plot of land for a species, and the USFWS has come a long way in incorporating many of these factors into mitigation ratios - turning the table for the species long-term survival potential and achieving a net-gain in habitat in some cases. The San Joaquin kit fox mitigation ratio for example, is now based on whether impacts are temporary or permanent and depends on the habitat type. Mitigation calculations for the Florida panther uses "Panther Habitat Units" that take into account habitat type as well as where the land is situated within the priority zones for the species.

An in-depth understanding of the biology of the species being impacted is obviously essential for designing mitigation in a meaningful way, but this does not always happen. For example, the amount of compensation for the Florida panther was underestimated throughout most of the 1990s due to the fact the Florida panther was considered a forest-obligate species. Therefore, loss of habitats other than forest were not mitigated through offsets. This error emphasizes that ratios should always be based on the best science possible.

Another challenge has been that mitigation ratios have not always fully considered the indirect or cumulative impacts. Cumulative impacts are defined by the USFWS in the context of the "environmental baseline" which includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early ESA section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process. A system that better tracks and considers collective negative effects over time on species is needed to allow the USFWS to make better informed and documented decisions on whether or not a project is likely to jeopardize the continued existence of a listed species and to calculate the amount of compensation required.

Although there have been improvements in mitigation ratios in the US, there are still many additional important factors that can affect the land value from the point of view of the species that are not yet incorporated. Factoring in elements such as the size and shape of a parcel of land lost or gained, and that considers the net amount of edge habitat or parcel location relative to other protected lands could increase the accuracy of mitigation ratios. Accelerated climate change may further complicate the calculation of the changing values of the land since the ecological functions and values of offsets will shift over time as a result of factors such as drought. Researchers are currently tackling these issues and increasingly suggesting use of models that can allow input of many factors (e.g. Bruggeman 2009, Bunn 2013) and can be used to develop crediting methodologies, more appropriate mitigation ratios, and better locate biodiversity offsets in the landscape to achieve more effective compensatory mitigation and better ecological outcomes for the species.

4. Articulate how biodiversity offsets are nested within a larger landscape plan for species recovery

Numerous studies have stressed the need for locating offsets within a broader conservation plan for a given species (e.g. BBOP 2013, Kormos *et al.* 2014). In the past most permittee responsible mitigation sites were not particularly interconnected nor part of a larger plan for any given species conservation. Thus although they may have compensated one acre in protection for one acre impacted, offset sites were not necessarily contributing to the conservation of viable populations of species in the long-term.

For wide-ranging species such as the Florida panther, the San Joaquin Kit Fox and all species of apes in Africa, connectivity between suitable habitat areas is of vital importance for the species' survival in the long-term. Without opportunities for dispersal and exchange of genetic information, small, isolated populations are at higher risk of extirpation in the US. The average offset size for the Florida panther has only been about 387 acres since the early 1990s. Their home range is about 38,548 acres for female, and about 103,042 acres for male panthers (Kautz *et al.* 2006). The average size of individual permittee responsible mitigation sites for the San Joaquin Kit Fox have been an average about 161 acres onsite and 136 acres offsite, whereas their home range size is about 1,344 acres (Cypher 2013). Thus the offset size is much smaller than the habitat requirements for these species. This highlights the need to nest these sites within a larger plan for them to be biologically meaningful and sustainable.

It is important to note that there may be some instances when connectivity is not always desirable, especially when a species is susceptible to disease outbreaks. This is true for great apes in Africa (Ebola), and for the Utah prairie dog (plague) in the US. Although these species still require large areas, it may be beneficial for a landscape plan to have several large areas that are not connected in addition to large contiguous areas as well. The point is that a larger species-specific strategic plan is needed within which to situate the offset sites, and this plan should in turn be aligned with other landscape conservation goals and plans.

In the US, there are several ways in which important habitat can be defined for a species. The USFWS is required to create and implement Species Recovery Plans for each listed species under section 4(f) of the ESA. These offer excellent potential for articulating how offsets could be used in conjunction with other conservation tools and positioned adjacent to other projected areas. Unfortunately explicit suggestions for placement of biodiversity offsets sites (i.e., compensatory mitigation such as conservation banks) are not yet frequently included within these plans. In addition, plans are often only issued many years after species first become listed, whereas it would be most useful if recovery plans and listing could occur simultaneously.

The designation of Critical Habitat could be another source of information that could aid in defining "no-go zones" or the location of biodiversity offsets. In reality however, there are numerous challenges and the designation of critical habitat remains one of the most controversial aspects of the ESA (http://www.fws.gov/verobeach/MammalsPDFs/CriticalHabitatFactSheet.pdf). One problem is that there is disagreement over the value of designating critical habitat. Many conservation groups argue that those species who have benefited from critical habitat designations for two or more years are more than twice as likely to have population numbers that are improving and less than half as likely to have populations that are declining (Taylor *et al*. 2005). They also argue that critical habitat affords listed species more substantial protection than that which is available through listing and endangered status alone in that not only must federal agencies ensure that actions that they authorize, carry out, or fund do not jeopardize the continued existence of the species but that they must also not destroy or adversely modify its critical habitat. They argue that this "prohibition on destruction or adverse modification of critical habitat goes further and can serve to limit actions that diminish the value of critical habitat for the recovery of a listed species" (Los Padres Forestwatch and Center for Biological Diversity 2010).

The USFWS however, argue that a critical habitat designation does not provide significant added protection to a species. Defining critical habitat takes a huge amount of time and resources and the USFWS argues that these resources could be better spent elsewhere. They also argue that designation of critical habitat can also have negative consequences to species as a result of misunderstandings and misconceptions about the definition both by the public and developers (https://www.fws.gov/midwest/endangered/saving/CriticalHabitatFactSheet.html). As a result, as of January 2015, critical habitat has only been designated for less than half of all listed species in the US (https://www.fws.gov/endangered/what-we-do/critical-habitats-faq.html).

There are additional ways in which the US is trying to take a broader landscape approach to biodiversity offsets. In 1982 the ESA was amended to include HCPs which allowed project proponents with no federal nexus a legal means of incidental take of listed species regardless of the size of the project. The first HCP (San Bruno Mountain) was a large conservation strategy for several species in California. The State of California now also uses a process called the Natural Community Conservation Planning (NCCP) program, which is similar to the federal HCP program but only applicable to large regional planning efforts within the state. Most large conservation plans in California are joint HCP-NCCPs with several private and public partners working together to develop large comprehensive multi-species conservation plans that take "a broad-based ecosystem approach to planning for the protection and perpetuation of biological diversity." An NCCP is supposed to identify and provide "for the regional or area wide protection of plants, animals, and their habitats, while allowing compatible and appropriate economic activity" (https://www.wildlife.ca.gov/Conservation/Planning/NCCP). There are currently 23 active NCCPs covering more than 11 million acres (https://www.wildlife.ca.gov/Conservation/Planning/NCCP).

In addition, throughout the US, innovative trading programs called Habitat Credit Exchange programs are currently being proposed as compensatory mitigation mechanisms for listed and at-risk species. Exchanges use a clearinghouse or broker to facilitate credit trades between developers and compensatory mitigation providers, in contrast to conservation banks and in lieu fee programs in which credit trades are made directly between the developer and the bank or in lieu fee sponsor. Habitat Credit Exchange programs may better facilitate participation of land owners as compensatory mitigation providers through streamlined enrollment. Such programs are being piloted for a few species such as the Utah prairie dog and the greater sage grouse. The ecological outcome should be similar to conservation banks if the same ecological standards are applied, but the method of trading credits may better reflect a true market approach.

Finally, to guide offset site selection as part of a larger landscape plan, several researchers are increasingly suggesting specific metrics for ranking choice of sites (e.g. Bruggeman 2009, Bunn 2013). New and revised USFWS and other Department of the Interior agency mitigation policies are expected to be issued in 2015 and 2016 that include this emphasis on siting conservation banks and other offset sites within the context of a broader landscape approach to conservation (Clement *et al.* 2014).

Those countries considering the use of biodiversity offsets as a conservation tool, have the opportunity to locate offsets strategically within broader landscape plans from the beginning thus avoiding piecemeal conservation and fragmentation of the species habitats that later needs to be adjusted to make ecological sense as part of a larger plan. Strategically situating biodiversity offsets as part of a larger conservation plan from the beginning ensures that their contribution to species recovery is maximized.

5. Ecosystem planning is essential - but don't forget the needs of the individual species

While it is important to strategize at the ecosystem level, planning this broadly can sometimes be too broad to adequately address the needs of individual species. Although developers may prefer to "stack[9]" their offsetting needs so that they only need invest in one site, this is not always what is preferable for the long-term survival of the species of concern. For example, an offset site designed to compensate for impacts to ecosystem services, or the cultural values of biodiversity, may be the same site that compensates for impacts to species, but not always. Compensation for impacts to chimpanzee habitat for example, may be increased protection and corridor development in another part of the country. However, compensation for the decreased access for local communities to fresh drinking water, may need to be addressed adjacent to the development instead. Similarly, credits for wetlands and panthers may occur at the same place in some circumstances, but not in others where panther habitat being protected is not wetland. In other words, the location and management practices of one offsetting site may not be ideal for all species that require mitigation, nor compensation for all biodiversity values. Companies should therefore be prepared to unbundle their offsetting needs and invest in separate locations when necessary.

In the US, there have been concerns that HCPs fail to account for ecosystem-scale conservation, focusing on a single species and single parcels of land in isolation from the species' habitat and other surrounding land uses. A large percent of conservation banks in the US sell credits and manage for only one species. Critics of this single-species approach argue that conservation banks often focus only on benefiting a few species rather than protecting ecosystems as part of regional habitat conservation plans and that the result of this could be that they are less likely to support high biodiversity or contribute to regional connectivity (Fleischer & Fox 2008; Bunn *et al.* 2013). "Multiple species HCPs" (MSHCPs) have been encouraged in an effort to overcome this problem and are strongly supported by agencies since they are believed to increase the biological value of the plans by "providing for ecosystem planning."

While MSHCPs have their benefits, Rahn *et al.* (2006) found that they carry a "risk that the needs of particular species may be over-looked" and that these plans are often "overbroad, covering species for which they provide no localized scientific information." They also found that this "lack of information makes it difficult to predict the effectiveness of a plan when an incidental take permit is issued, or to evaluate it during the permit terms." Similarly, Harding *et al.* (2001) found that for 42% of the species they examined there was insufficient data and analysis to determine clearly how predicted take might affect the populations" (Harding *et al.* 2001). Taylor *et al.* (2005) found that 40 to 50 percent of listed species in multispecies plans showed declining trends. Ideally therefore, plans should outline specific species conservation actions for each covered species as well as an overall ecosystem approach. Thus while this landscape multispecies approach is critical for a more comprehensive plan for the larger ecosystem, at the same time it must be ensured that the needs of individual listed species are being met.

[9] "Stacking" is defined as "Acquiring credits under multiple market-based strategies on a single acres of property, where all credits can be sold independently" such as "managing a single acre for conservation banking credits, carbon credits, wetland credits and water quality credits" (Fox 2008).

6. Conservation banks are the state of the art of biodiversity offsetting in the US

There are three main types of compensatory mitigation for "residual impacts[10]" to species from development projects in the US: 1) permitee responsible mitigation (PMR), 2) paying in lieu fees, or 3) buying credits from a conservation bank. PRM is the most common form of compensation in the US. Prior to the creation of the first conservation bank in 1992, this and in lieu fees were the only choices available. With PRM, the permittee implements their own mitigation projects, either on-site or offsite and the liability for success remains with the permittee (DOI 2013). For in lieu fees, "permittees pay a fee to an USFWS-approved compensation fund in lieu of implementing their own mitigation" (DOI 2013). With in lieu fees therefore, it is the in lieu fee fund sponsor who is responsible for the compensation project and thus has liability for the success of the compensation project (DOI 2013).

Conservation banks are "permanently protected lands that contain natural resource values, which are conserved and permanently managed for species that are endangered, threatened, candidates for listing, or are otherwise species-at-risk" (http://www.fws.gov/endangered/landowners/conservation-banking.html) as well as provide habitat and protection for the many other species that live on the property that are not listed. To qualify as a conservation bank, the bank owner must permanently protect a plot of land through a conservation easement, or other equivalent real estate protection instrument, and then manage the property for a given species or even several species. A long term management plan and a trust fund or endowment is required to cover the costs of permanent management and monitoring of the conservation bank. The USFWS approves a specified number of habitat or species credits, called "conservation credits that may be species or habitat-based that the bank owner may sell to developers who are impacting that species and/or species habitat elsewhere. The number of conservation banks has grown from the first bank being approved in the early 1990s to 130 approved banks by the end of 2014 (Figure 2).

Conservation banks have many advantages over PRM. Certainly one of the advantages to a developer for choosing to buy credits from a bank rather than PRM is that developers often do not have in-house expertise on mitigation and offsetting and therefore the ability to pass the responsibility of managing an offset site for species conservation to a third party can be attractive (White 2008). This transfer of responsibility also allows passing the liability for the success of the mitigation from the developer to the conservation bank sponsor (Mead 2008). Another attraction is that the permitting time is often reduced and mitigation costs can be more predictable, and often less than PRM (White 2008).

[10] "Residual Impacts" are defined as "the remaining adverse impact on biodiversity after appropriate avoidance, minimisation and rehabilitation measures have been taken according to the mitigation hierarchy" (BBOP 2012b).

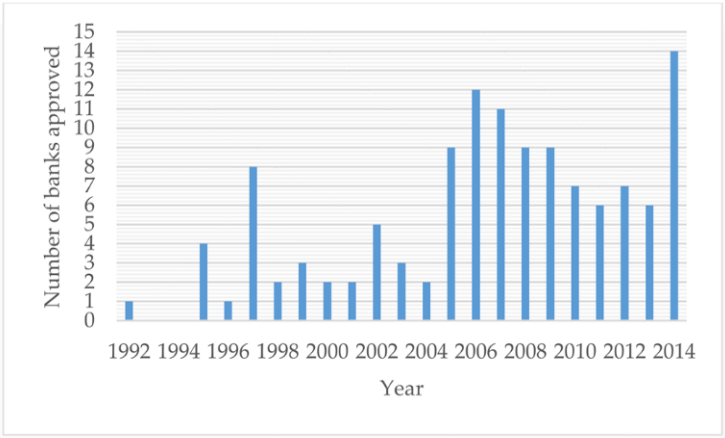


Figure 2. Number of conservation banks approved each year

From the point of view of the regulatory agency – in this case the USFWS – there are several advantages of conservation banks. Monitoring many small plots as is the case for PMR is a tremendous challenge. Fewer, large bank agreements are easier to monitor, and require fewer resources to follow-up.

These are the administrative advantages, but is conservation banking a superior method ecologically as well? The evidence suggests that it is. For one, conservation banks are generally much larger than PRM sites. For example, the 12 conservation banks for the San Joaquin Kit Fox have an average area of 1,485 acres, while individual permittee responsible mitigation sites are on average about 161 acres onsite and 136 acres offsite. The three approved conservation banks for the panther are 4,009, 1,930 and 472 acres. These banks are adjacent to other protected areas that collectively provide the panther with large areas of contiguous habitat. The average offset required per project for the panther is 387 acres. This trend generally remains true nationwide as well, where the overall average size of a conservation bank in the US is 1,278 acres.

Not only do conservation banks protect larger areas by aggregating offsets into one area, they are usually strategically sited to contribute to the overall conservation of the species. Most USFWS approved conservation banks have been sited to conserve parcels within identified core conservation areas and reduce fragmentation within the landscape, as is the case with Florida panther and most San Joaquin kit fox banks (Kormos *et al. in prep*). For example, one of the reasons for the siting of the Florida Panther Conservation II site, was that it sits in the middle of over 5,000 acres that preserved and protected.

The other huge advantage of conservation banks is that these larger areas of land are protected in advance of development since the bank owner is required to put a conservation easement on the land, and to have an endowment fund for management of the bank even before credits can be sold for that property. With PRM, protection occurs at the same time as impacts. With in lieu fees, the protection generally occurs after the impacts since sufficient funding must be accrued before an offset site can be achieved on the landscape.

Although in the context of the US, the aggregation of well protected offset sites within an overall strategic plan for the species is the state of the art for how compensation projects can be most effective in protecting species in the long-term, conservation banks should be used as only one of many conservation tools available for habitat protection. Even conservation banks can end up being isolated islands in a sea of development if not placed adjacent to other protected areas or as stepping stones in a landscape of compatible uses. In addition, there can only be as many conservation banks as the market allows. During the economic downturn in the US for example, there was less demand for buying credits from banks,

since there was less development occurring. In addition, if too many conservation banks are created, the market will be flooded with credits, and it will no longer be profitable for banks. Not all states yet have conservation banks and their distribution is uneven throughout the country (Figure 3) have been used for less than 5 percent of the listed species.

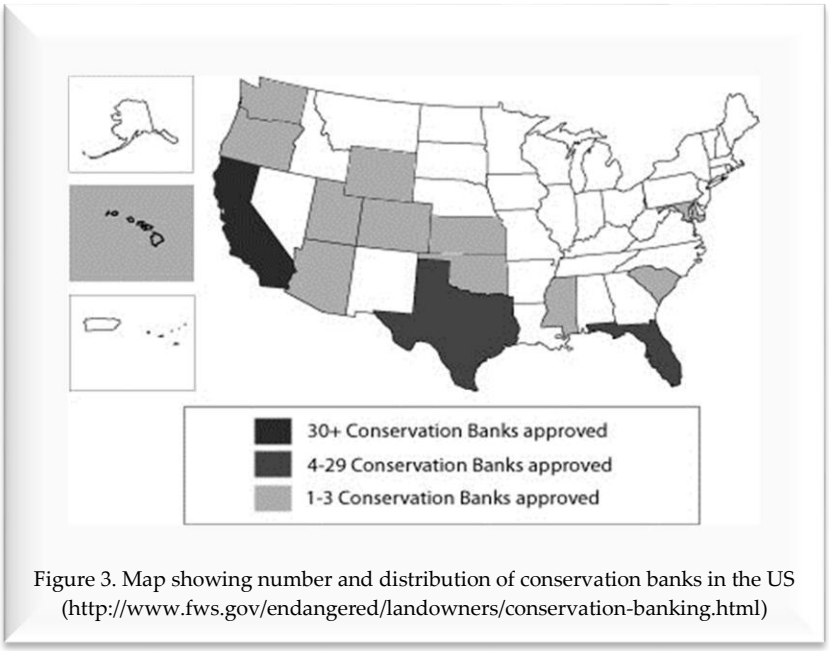


Figure 3. Map showing number and distribution of conservation banks in the US (http://www.fws.gov/endangered/landowners/conservation-banking.html)

In summary, conservation banks are a specific form of compensatory mitigation that can support and connect other protected areas and can contribute to an overall plan for species recovery, but they should not be viewed as a panacea for the future survival of every species. In countries with unclear land tenure systems or where most of the land is owned by the government, it is less clear who would retain ownership and responsibility of the conservation bank, how the easement and endowment fund would work. In those countries with governance challenges, how permanence would be secured is also a large question. These are issues that need to be discussed, however conservation banking systems can provide an important point of reference to inform investigations into the viability of a similar approaches to offsetting in other countries. Countries will obviously need to formulate their own approaches to incorporate the political, social, institutional and governance landscape context of their country while ensuring that the system is still based on the ecologically sound principles at the root of conservation banking including; aggregating offset sites, protecting the land in advance of impacts, protecting the land in perpetuity, securing a supporting endowment fund, and locating sites within species recovery plans.

Dutchman Creek Conservation Bank in California. Credits sold at this bank for the Burrowing Owl (*Athene cunicularia hypugea*), California Tiger Salamander (*Ambystoma californiense*), Conservancy Fairy Shrimp (*Branchinecta conservation*), San Joaquin Kit Fox (*Vulpes macrotis mutica*), Swainson's hawk (*Buteo swainsonii*), Vernal Pool Fairy Shrimp (*Branchinecta lynchi*), Vernal Pool Tadpole Shrimp (*Lepidurus packardi*), and the Western spadefoot toad (*Scaphiopus hammondii*)(Rebecca Kormos)

Tiger Creek Conservation Bank in Florida. Credits are sold at this bank for the Bluetail mole skink (*Eumeces egregius lividus*) and the Sand skink Sand skink (*Neoseps reynoldsi*) (Rebecca Kormos)

Florida Panther Conservation Bank II in Florida. Credits are sold at this bank for the Florida Panther Puma (*Felis concolor coryi* (Rebecca Kormos)

7. Monitor biodiversity offsets to ensure effectiveness and compliance

How can anyone know whether a method has been successful if accurate records have not been kept of the loss and gain in habitat, where the losses and gains have been, or whether those plots of lands meant to be an offset are continuing to be managed and protected? As mentioned above, the two main documents containing information on the extent of "take" and the expected compensation for any given project are the Biological Opinion (BO) and the Habitat Conservation Plan (HCP). Unfortunately, in the US, record-keeping of the BO and the HCP documents have not always been good. Documents are not always centralized and are often distributed amongst many regional offices, and sometimes cannot even be located at all. When documents are available, they are not necessarily available to the public. BOs and HCPs do not always include the information in a consistent way. For example, for certain species such as the San Joaquin Kit Fox, "take" can be listed as "temporary," "permanent," or both. Information about compensation required is sometimes not included. Even more serious is the fact that, given the large number of permittee responsible mitigation offset sites, the USFWS has been unable to make visits to monitor whether the sites continue to provide the habitat for which they were created. These shortfalls are primarily due to shortages in staff and funding. Critically, the location of most offset sites are not even known.

Conservation banks are the exception. Most banks are well monitored and tracked. Annual reports, information on the site, size, and location of conservation banks is available through the "Regulatory In lieu fee and Bank Information Tracking System" (RIBITS) - a clearinghouse of information on conservation banking programs across the country (https://ribits.usace.army.mil/ribits_apex/f?p=107:158:11542525023458::NO:RP). Developed by the U.S. Army Corps of Engineers with support from the Environmental Protection Agency, the U.S. Fish and Wildlife Service, the Federal Highway Administration, and NOAA Fisheries this database provides information on location, size, owner of each conservation bank, as well as the number of credits sold and a shape file for most conservation banks.

Unfortunately, such a database does not exist for PRM sites. The consequences of this lack of monitoring and tracking for PRM sites are twofold. The loss of habitat may be far greater than appears in

theory since some sites may no longer be protected or managed for the species conservation. In addition, when ILF and PRM sites are not held to the same standards as conservation banks, this drives business away from conservation banking, the preferred method from an ecological standpoint, because lower standards mean lower costs which are attractive to developers and others seeking compensatory mitigation.

Accurate monitoring of biodiversity offsets is of the utmost importance to determine if the overall loss of habitat is being appropriately mitigated. Only with this kind of information for all authorized impacts and offsets are we going to eventually have a better idea of the biological success of biodiversity offsets as a conservation tool and only with appropriate follow-up are those who impact the environment truly held responsible for mitigating those impacts in the long-term. Keeping such a database from the beginning would be a wise investment for those countries now considering wider use of biodiversity offsets in their country.

8. Keep your eye on the goal and beware of "cookie cutter" formulas and jargon

With regards to individual Endangered or Threatened species, the goal of biodiversity offsets should be the species conservation and eventual recovery. Therefore choices about where to offset, mitigation ratios and the way in which the mitigation hierarchy is applied should all keep this focus in mind. International best practices for biodiversity offset (e.g. BBOP 2013) are of critical importance for baseline basic standards, yet if always followed to the word, application of these standards might not necessarily result in a better conservation outcome for the species in the long-term. Each situation is unique and must be regarded as such. More practical guidance to support the application of these standards and high level principles, and how to accommodate the flexibility that is required in approach would be hugely beneficial.

For example, one principle of biodiversity offsetting (BBOP 2012a) is to achieve additional conservation outcomes, defined as "conservation outcomes above and beyond results that would have occurred if the offset had not taken place." Achieving this "additionality" is an example of a best practice that might not always require the same solution. While additionality is of the utmost importance given the need to achieve a "gain" in habitat to offset the loss, there may be circumstances where protection of a viable subpopulation already thriving in priority habitat is more valuable to that species survival and recovery than enhancing habitat at a site where the species is currently not at carrying capacity or even present. Our ability to effectively restore habitat is growing but has not always been successful due to the complexities of nature and our lack of understanding of it. In some cases, it is not possible to restore habitat, especially within a meaningful timeframe for a species. Therefore protecting an area with known individuals may be a preferable option in some cases to creating an offset on a site that needs to be restored and hoping the species will repopulate. Additionality in these cases may be better achieved by protecting a larger area, rather than by enhancing a site or creating new habitat. On the other hand, protecting a viable population that is not under threat cannot be considered an offset at all, in the sense that it does not achieve additionality even through "averted loss." In other cases, a combination of habitat preservation, restoration and/or creation may be the best choice.

In summary, while international best practices are extremely important, each situation requires careful scrutiny and decisions of placement of biodiversity offsets should always keep the goal of species recovery in mind.

9. Success often depends on committed individuals

More difficult to measure and describe than the above lessons learned, is the role of the individual land steward of a biodiversity offset site, and how their commitment and passion can ultimately be what drives the success of the offset site. Conservation banking in the US is a business that involves a degree of risk, especially in predicting market trends. Historically, the time to have conservation banks approved has been several years. Although this process has been greatly streamlined, permitting a conservation bank still requires patience and perseverance. In the US there are those landowners who have gone above and beyond requirements for the bank site in terms of management and stewardship and the success of the offset is in large part due to their dedication.

In addition, the existence of one of more impassioned individuals within the regulatory agency or oversight entities such as conservation easement holders in the US, can be an important factor in increasing the ecological success of an offset. This combination of land steward and regulator/oversight entity, all committed to the success of the biodiversity offset program, is the best chance for sustainable offsets. And it is helpful to keep in mind that while these roles remain the same, the individuals occupying them change over time and the commitment to the conservation must be passed down to the successors. With unpredictable influences such as climate change, limited funding for regulators to enforce laws and policies, fluctuating economic conditions, and sometimes lack of guidance for conservation bank placement, it is often the commitment of the bank owners and managers and individuals charged with oversight responsibility that defines their success. This is especially important to realize as biodiversity offsets and conservation banking systems are being designed in countries that may suffer from natural disasters, refugee crises, disease pandemics, and civil conflict.

Summary

Countries where biodiversity offset are being planned, designed and implemented throughout the world, stand against incredibly diverse economic, social, legal, political and ecological backdrops. Extrapolating lessons learned from one system could be problematic if the situations are too different. Nevertheless, the US traverses a tremendous cross-section of ecosystems ranging from desert environments, to mountain habitats, to coastal environments. Species being offset range from invertebrates like the fairy shrimp, to large bodied wide-ranging carnivores such as the Florida panther. In addition to species and ecosystem diversity, the US spans a diversity of policy frameworks and regulatory systems. In parallel to the national policies for biodiversity offsets, state-level policies also guide their design and implementation. We therefore hope that these lessons learned on how biodiversity offsets are functioning in the US can have broader application. Primarily we hope that this study will inspire countries to design biodiversity offsets to be nested within a larger conservation plan for the species, where land is protected in perpetuity in advance of development impacts and aggregated into larger areas.

For those countries with poor governance and weak environmental standards, developers and private sector companies are often driven by the environmental standards of those banks that loan them funds for their enterprises instead. The International Finance Corporation (IFC) has issued performance standards that require their clients to follow the mitigation hierarchy and to mitigate residual damages after all mitigation has taken place. These are used as the gold standards by many of the world's largest banks lending to private and development sectors globally. It would be hugely beneficial for national governments, companies impacting the habitat within the nation, and those banks lending funds for those development/private sector projects, to work together to investigate and support the design of systems that draw upon the ecological principles of the US conservation banking system in order to avoid

piecemeal conservation and the eventual decline of species if offset sites are too small and too isolated. It would also be important for individual countries to develop national plans for species and to include in these, sites where biodiversity offsets can complement national parks, World Heritage Sites, community forests and other protected area mechanisms. Such plans already exist for many species of great apes and could easily be adapted to include offset sites.

Finally, national parks can sometimes be viewed negatively by those people living in their vicinity if they limit access of those people to natural resources or income (but see Curran *et al.* 2009). Conservation banking could potentially offer a tremendous opportunity to make protecting endangered species and their habitat economically profitable if the people protecting the land are able to sell credits to development projects elsewhere in the country in exchange for their management of the land. In addition to selling credits, communities can benefit from the enhanced ecological services and increased opportunities for fostering sustainable livelihoods as part of a long-term conservation plan for the sustainable use and conservation of the offset site. In countries where land tenure is unclear and/or where land stewardship is not assigned to a single land owner however, there are potentially complex issues relating to benefit-sharing that may need to be addressed. For example, although conservation banking can produce benefits people at the offset site in terms of ecosystem service provision and sale of credits, it is equally important to understand and address the negative impacts that can occur when biodiversity and ecosystem services are removed or displaced and thus the values that stakeholders' depend upon for basic physical needs, as well as spiritual and cultural fulfilment are impacted or lost (Jenner *pers. comm*.) This underlines that the processes through which local stakeholders participate in decisions on the assessment and selection of potential offset sites and through which those offsets are subsequently designed, implemented, monitored and evaluated is critical.

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