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# Achieving Conservation And Development

## 10 PRINCIPLES FOR APPLYING THE MITIGATION HIERARCHY

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April 2015

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*McKenney, Bruce and Jessica Wilkinson. April 2015. "Achieving Conservation and Development: 10 Principles for Applying the Mitigation Hierarchy." The Nature Conservancy.*

The authors are responsible for the content and views set out in this publication. We would like to acknowledge the significant contributions of many colleagues in the The Nature Conservancy: Ana Cristina Barros, Len Barson, Bob Bendick, Matt Brown, Laura Crane, Gala Davaa, Juan Carlos Gonzalez, Nels Johnson, Joe Kiesecker, Mark Kramer, Linda Krueger, Michael Looker, Sara Mascola, Cathy Norlie, Liz O'Donoghue, Christy Plummer, Nikkie Rovner, Lynn Scarlett, Mark P. Smith, Bill Stanley, Jerry Touval, and Mark Weisshaar.


*Photo Credits:*

*Cover (Top): Early morning light illuminate a black gum pond in The Nature Conservancy's Old Fort Bayou Mitigation Bank in Jackson County, Mississippi. Situated only a few miles inland from the Gulf of Mexico, this unique area was Mississippi's first coastal wetland mitigation bank. The Conservancy is working to restore longleaf pine savanna habitat and natural hydrology in the area. Photo credit: © 2011 Erika Nortemann/The Nature Conservancy.*

*Cover (Bottom): A Nature Conservancy biologist releases a red-cockaded woodpecker she caught to band and measure at the Conservancy's Disney Wilderness Preserve as part of her research to help restore the woodpecker to this longleaf pine forest. The Conservancy established the Preserve as a wetland and stream mitigation project to restore and protect over 11,500 acres, addressing offset requirements for development by The Walt Disney Company and the greater Orlando Aviation Authority. Photo credit: © Carlton Ward, Jr.*

*Rattlesnake master in restored mesic prairie at Kankakee Sands Preserve in Indiana. The Nature Conservancy and partners established a wetland mitigation bank on the preserve. Photo Credit: © Chis Helzer/The Nature Conservancy.*

# Introduction

Improving mitigation policy and practice – how we avoid, minimize, and offset environmental impacts to lands and waters – is one of the best opportunities for achieving sustainable development and conservation goals. This will be essential as we face a major global challenge: how to meet the demand for energy, food, water, minerals, and infrastructure of a growing population with expanding consumption levels *and* ensure the health of lands and waters for future generations. While investments to meet this demand will help fuel economic growth, improve quality of life, and lift people out of poverty, they can also bring large, negative environmental impacts. As these impacts expand to new frontiers, governments, companies, and concerned communities are increasingly taking action to improve mitigation policy and practice. This is evidenced by the fact that:

- 56 countries have or are developing national mitigation policies that require offsets or enable the use of offsets, with most of these policies developed over the past decade.[1]
- Multi-lateral and private sector financial institutions are requiring the projects they finance to avoid, minimize, and compensate for biodiversity impacts in accordance with new performance standards.[2] This includes requirements for project developers to avoid impacts to "critical habitat" and achieve "net gains" for biodiversity.[3]
- At least 32 companies have established no net loss or net positive impact goals for biodiversity to guide their corporate practices.[4]

Spearheaded by the Development by Design program, The Nature Conservancy is working to transform mitigation based on our decades of experience in conservation and landscape-level planning, global reach and policy expertise, and solution-oriented approach. Over 250 Conservancy staff work on advancing the science, policy, and practice of mitigation. This work spans a dozen countries and over 40 U.S. states. In the past decade, the Conservancy has engaged in more than 150 mitigation projects in the U.S. alone, helping direct over $500 million of mitigation funding towards conservation priorities and directly contributing to conservation outcomes on over 1.5 million acres.

Given the breadth of the Conservancy's mitigation work, it is critical for the Conservancy to operate by and promote a core set of principles for mitigation. This paper summarizes 10 key principles for applying the mitigation hierarchy – avoid, minimize, and offset (Figure 1) – and is intended to guide the Conservancy's approach to and engagements on mitigation.

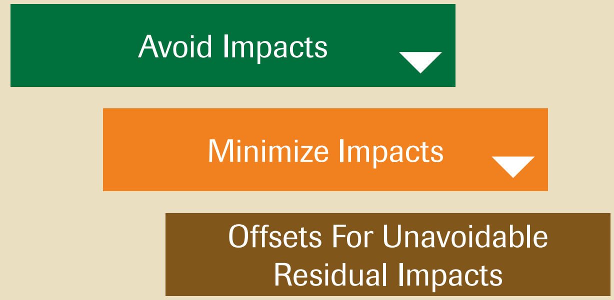



**FIGURE 1:** THE MITIGATION HIERARCHY

The three-step process of the mitigation hierarchy – avoid impacts, minimize impacts (including restoration on-site and other actions), and provide offsets for remaining unavoidable impacts (also often referred to as compensatory mitigation) – may be applied to achieve policy goals for biodiversity, ecosystem services, or other resources and values.

This includes the Conservancy's role in:

- Fostering the development of new and revised mitigation policies and programs;
- Developing and/or providing input on regional and site-level mitigation plans;
- Preparing comments during public review processes;
- Designing and implementing mitigation activities and offset projects;
- Developing and conducting the Conservancy's own mitigation programs, projects, and corporate engagements; and
- Reviewing risks of the Conservancy's mitigation engagements.

In developing this set of 10 principles – 6 principles for applying the mitigation hierarchy and 4 principles specific to offsets – we drew on several key publications including the *Standard on Biodiversity Offsets* (2012)[5] developed by the Business and Biodiversity Offsets Programme (BBOP),[6] and *Biodiversity Offsets Technical Study Paper* (2014),[7] developed by the IUCN Technical Study Group on Biodiversity Offsets.[8] The Conservancy played a strong role in the development of both documents and we continue to support and participate in the efforts of these groups to advance best practices for offsets. It is important to note that the BBOP and IUCN documents focus on principles and best practices for *biodiversity offsets* – the third and last step in the mitigation hierarchy. Because the mission of The Nature Conservancy is to "protect the lands and waters on which all life depends," we believe the central focus of our engagement on mitigation must be on application of the *full* mitigation hierarchy, which includes offsets as a last step but starts with avoiding and minimizing impacts.

# Principles for Applying the Mitigation Hierarchy

## PRINCIPLE 1. LANDSCAPE CONTEXT

### The Mitigation Hierarchy Should Be Applied In A Landscape Context

Traditional mitigation approaches too often focus only on direct project impacts at the *site-level* without considering the bigger landscape-level picture – how the direct, indirect, and cumulative impacts (see Box 1) can affect a landscape's ecological values and functions, making it more difficult to achieve overarching conservation goals. As a result, multiple "isolated" project impacts may go forward when some should have been avoided. This is especially true when development comes as part of a boom of activity in a single geographic area, as for example often occurs with energy and mining.

> *"Landscape-level assessments are essential for applying the mitigation hierarchy because they pro-actively identify potential conflicts, risks, and trade-offs between conservation goals and development scenarios."*

The term "landscape" generally corresponds to an ecoregion or other ecologically significant large area of land and water that contains geographically distinct assemblages of natural communities.[9] Planning at this ecological scale (landscape, watershed, seascape) helps ensure that conservation priorities incorporate values such as habitat functionality, minimum critical size, and connectivity. It promotes the avoidance of impacts to important places and values (e.g., unique, irreplaceable, or high value habitat), guides offsets so they contribute to landscape conservation goals, and supports the health and maintenance of large, resilient ecosystems. There are now unprecedented land surface data and modeling capabilities for conducting landscape-level assessments – both to identify conservation priorities and project future development scenarios.

Landscape-level assessments are essential for applying the mitigation hierarchy because they pro-actively identify potential conflicts, risks, and trade-offs between conservation goals and development scenarios. Such planning provides many distinct advantages over what can be achieved with traditional project-level mitigation assessments,[10] including: (1) incorporating consideration of past and future cumulative impacts; (2) informing what step in the mitigation hierarchy is appropriate (e.g., avoidance versus offsets) for the viability of the species, habitats, and natural features that are under consideration; (3) supporting the selection of offsets that maximize regional ecological outcomes; and (4) promoting greater predictability and transparency for the regulated community, with potential cost- and time-savings.[11] For more information on applying the mitigation hierarchy within a landscape context, see Appendix A: Development by Design Publications.

**BOX 1:** DIRECT, INDIRECT, AND CUMULATIVE IMPACTS

Definitions of direct, indirect, and cumulative impacts offered here draw from regulations guiding implementation of the U.S. National Environmental Policy Act. **Direct impacts** are those that are caused by the action and occur at the same time and place as the impact (40 C.F.R. §1508.8(a)). **Indirect impacts** are those caused by the action but are either later in time or farther removed in distance (40 C.F.R. §1508.8(b)). **Cumulative impacts** are impacts that result from the incremental impact of the action when considered in light of other past, present, and reasonably foreseeable actions (40 C.F.R. §1508.7). Consideration of cumulative impacts allows for mitigation programs to take into account those impacts that individually may be minor but over time and in concert with other activities, may be significant.

*Workers clean solar panels for maximum efficiency at the power solar facility in Lancaster, California. The Conservancy has worked extensively on renewable energy siting and mitigation, supporting the growth of solar energy by steering development on public lands to areas of least ecological conflict. Photo credit: © Dave Lauridsen/The Nature Conservancy.*

## PRINCIPLE 2. GOAL

### Mitigation Policy Goals Should Support Conservation Objectives And Drive Accountability In Applying The Mitigation Hierarchy

Mitigation policy goals at the national, regional, and/or local level help ensure the mitigation hierarchy is applied to meet conservation objectives. Such goals provide a clear driver for avoiding and minimizing impacts, and in the case of offsets they support assessing the equivalency of offsets to impacts, how much offset is enough, and which actions are most important to take to achieve the goal. Mitigation policy goals may be specific to a category of resources or values of concern (e.g., wetland acres or functions, native vegetation, contribution to species recovery), to a context (e.g., public land management objectives), or to applicable regulatory and management authorities (e.g., biodiversity, at-risk species, ecosystem services). Wherever possible, goals should be uniform across agencies and measurable.

Mitigation policy goals also support a more structured and transparent framework for accountability in applying the mitigation hierarchy, so that compensatory measures are more than simply a collection of actions. For example, many policies set a goal for offsets to fully address a project's residual impacts, achieving at a minimum a "no net loss" outcome for conservation, or achieving a higher goal such as net conservation gain or net positive impact.[12] Such goals can be found across many of the 56 countries that have or are developing national mitigation policies requiring or enabling the use of offsets.[13] For instance, the U.S. wetland and stream protection program is guided by a national goal of achieving no overall net loss of wetland acreage and function.[14] Also in the U.S., the national Fish and Wildlife Service issued a mitigation framework for sage-grouse in 2014 that states that mitigation programs for the species should be designed to result in net overall positive outcomes for sage-grouse.[15] The National Environmental Offsets Policy for Australia (2012) states that offsets must "deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action."[16] Both Colombia and Peru have set no net loss of biodiversity goals in their national frameworks for compensatory mitigation.[17] In the European Union, a biodiversity strategy was adopted in 2012 – Biodiversity Strategy to 2020 – that seeks to "ensure no net loss of biodiversity and ecosystem services."[18]

> *Many policies set a goal for offsets to fully address a project's residual impacts, achieving at a minimum a "no net loss" outcome for conservation, or achieving a higher goal such as net conservation gain or net positive impact.*

Many types of actions may be compensatory in some manner, but they are not "offsets" unless they fully address a project's unavoidable residual impacts (see Figure 2). Having a clear goal helps regulatory agencies articulate why offset investments are necessary and how much compensation should be required. Where there is no clear goal, offsets may become part of a negotiated decision between the regulatory agencies and the project proponent rather than determined through a science-based approach that identifies actions for achieving a goal. Such negotiated approaches can lead to project delays and leave regulatory agencies vulnerable to claims that offset requirements are arbitrary.

Figure 2 below depicts how the mitigation hierarchy is carried out to meet both no net loss and net positive contributions for biodiversity.

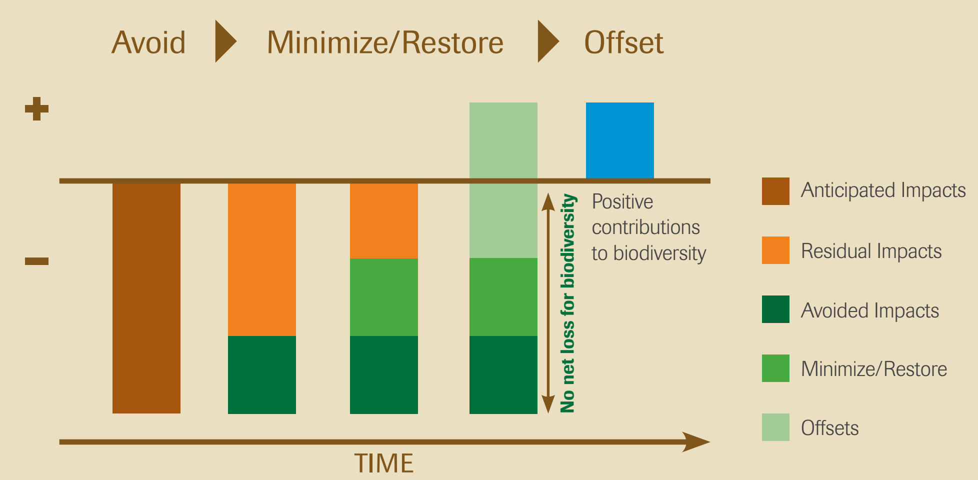



**FIGURE 2:** APPLYING THE MITIGATION HIERARCHY FOR A NO NET LOSS OR NET POSITIVE GOALS

**Source:** Kiesecker *et al.* 2009

## PRINCIPLE 3. MITIGATION HIERARCHY STEPS

### The Mitigation Hierarchy Should Be Followed Sequentially – Avoid, Minimize, And Then Offset Impacts

When applying the mitigation hierarchy, it is essential to avoid and minimize impacts before offsets are considered (see Box 2). Considering all three components simultaneously may create the temptation to skip over the avoidance and minimization steps, allowing project proponents to jump directly to offsets. Doing so opens mitigation programs to criticism that the availability of an offset mechanism makes it easier to approve project impacts in important habitat (this criticism is sometimes referred to colloquially as a "license to trash"). For this and other reasons, we stress that avoidance should be the first and most important step in the mitigation hierarchy.

Avoidance is also critical because it is the best way to ensure target resources are not harmed, whereas minimization and compensatory actions carry with them the risk they will fail either to be carried out or to meet conservation objectives. As such, mitigation policy should explicitly state that offsets will not be considered at the same time as avoidance and minimization measures, but rather only after the first two steps have been satisfied. The strict sequence of the mitigation hierarchy is recognized in many existing mitigation policies, including in U.S. wetland and stream mitigation policy[19] and several Australian polices, including the national Environmental Offsets Policy[20] and that of Western Australia.[21]

Mitigation policies should provide guidance on how to follow the mitigation hierarchy. For example, U.S. wetland and stream policy calls for impacts to be avoided and minimized "to the maximum extent practicable."[22] The terminology in this case – "practicable" – can then be defined to take into account considerations such as existing technology, available science, costs relative to ecological benefits, the likelihood of success, and long-term sustainability.

Lastly, implementation rules and guidance should promote rigorous science-based approaches for addressing each step of the mitigation hierarchy. This will support more objective decision-making about when avoidance and minimization are necessary, when an offset is an appropriate compensatory action, and what type and how much of an offset is necessary to address impacts. Science-based approaches can make implementation of the hierarchy more systematic, reducing subjectivity and project review times, and support better outcomes for development and conservation.

**BOX 2:** STEPS IN THE MITIGATION HIERARCHY

Although the steps of the mitigation hierarchy are expressed differently in existing policies, the core three steps are: avoid, minimize, and offset. In the U.S., the original formulation appears in regulations governing the country's environmental impact statement law. These regulations define mitigation to include five steps: avoid, minimize, rectify, reduce or eliminate, and compensate. The federal U.S. wetlands program defines the hierarchy as avoid, minimize, and compensate for unavoidable impacts. The International Finance Corporation (IFC), which has developed performance standards that guide the world's largest lending institutions, defines the mitigation hierarchy as the three-step process – avoid, minimize, and compensate. IFC groups other steps, "abate, rectify, repair, and/or restore," under the minimization umbrella. The Business and Biodiversity Offsets Programme (BBOP) defines the hierarchy as avoidance, minimization, rehabilitation/restoration, and offset. (See Appendix B for references.)


*A greater sage-grouse in Wyoming. Conservancy scientists collaborated with the National Audubon Society and the University of Montana to forecast how potential energy development could affect the greater sage-grouse. Agencies can use the study's findings to determine how best to pursue energy development while maintaining quality habitat for wildlife. Photo credit: © Joe Kiesecker.*

## PRINCIPLE 4. LIMITS TO OFFSETS

### There Are Limits To What Can Be Offset

Offsets can be an important tool for conservation, but they also bring risks. The offset concept suggests that biodiversity values and ecosystem services can be easily traded and replaced, which is far from the case. There are many limits and challenges to the use of offsets.[23] Most natural ecosystems have evolved over thousands of years, with animal and plant communities that reflect precise relationships. It is difficult to determine how fully these complex ecosystems can be reestablished or replicated through offsets. Likewise, offsets may not be in close proximity to where project impacts have occurred, making it difficult for offsets to provide similar functions and values to those lost to impacts. Overall, there remains considerable uncertainty regarding the effectiveness of mitigation measures for many types of ecosystems.[24]

In applying the mitigation hierarchy, it must be recognized that there are limits to what can be offset. Impacts that cannot be offset should be avoided, as this may be the only means to prevent irreplaceable loss (see Box 3). Among the many reasons for choosing avoidance over offsets are concerns over impacts to unique or highly valued habitat (e.g., irreplaceable and vulnerable conservation values and functions), the difficulty and uncertainty of offsetting impacts to specific habitat types, the lack of offset opportunities, and the high risk of failure of some types of offset measures.

*“Among the many reasons for choosing avoidance over offsets are concerns over impacts to unique or highly valued habitat, the difficulty and uncertainty of offsetting impacts to specific habitat types, the lack of offset opportunities, and the high risk of failure of some types of offset measures.”*

**BOX 3:** LIMITS TO OFFSETS – “TOO SPECIAL TO DEVELOP”

On October 31, 2013, Secretary of the Department of the Interior, Sally Jewell, issued the first Secretarial Order of her Administration. In her remarks announcing its release she noted what some see as the fundamental issue for her Department as a land manager: how the Department balances “the inherent tensions that can exist with development and conservation. Part of the answer is encouraging development in the right ways and in the right places. Part of the answer is recognizing that there are some places that are too special to develop.”

*Remarks at the National Press Club. Secretary of the Interior Sally Jewell. October 31, 2013. Washington, DC.*

## PRINCIPLE 5. SUSTAINABLE OUTCOMES

### Mitigation Should Support Long-Term, Durable Outcomes

Mitigation actions should be outcome-based and designed to be sustainable and durable. In order to ensure that minimization and offset actions yield the intended ecological outcomes, they should be held to science-based performance standards (i.e., success criteria). Performance standards should be based on the goals of the mitigation plan, best available science, and measurable, objective and verifiable indicators and attributes, which may include measures of functional capacity or comparisons to reference sites.[25]

*“To support long-term outcomes, mitigation plans should require monitoring of progress toward meeting performance standards, and adaptive measures for addressing unforeseen outcomes.”*

To support long-term outcomes, mitigation plans should require monitoring of progress toward meeting performance standards, and adaptive measures for addressing unforeseen outcomes.[26] In addition, there should be clear enforcement measures that will be taken should monitoring and oversight reveal non-compliance (e.g., failure to meet outcome-based measures), including a requirement that if performance standards are not met, the mitigation provider will provide replacement compensation through other means. Finally, there must be sufficient regulatory agency resources committed to oversight of mitigation agreements, to work with mitigation providers on adaptive management, and enforce mitigation agreements.

To the maximum extent possible, offsets should be sited and designed to be self-sustaining.[27] Even if well-designed and sited, offsets may often require a moderate degree of on-going maintenance and management after performance standards are met to retain the desired functions of target resources. To ensure the persistence of offset measures, offset agreements should include a long-term management plan that outlines necessary management measures. As a condition of project approval, funds should also be set aside to support long-term site management activities.

Finally, offsets should be durable. Durable offsets are those that provide a high level of confidence that the offset investment will yield the intended ecological outcomes for the intended duration of the project. If offsets are carried out on publicly owned lands, there are particular challenges to ensuring durable offsets. In either case – on private or public lands - offset durability is best achieved through a combination of means, focused on three important components of durability:

- DESIGNATION: Protection through the provision of real estate instruments or comparable designation mechanisms in the context of public lands.
- MANAGEMENT: Commitments to restrict incompatible uses and allow affirmative management activities.
- FUNDING: The provision of both contingency funds to support remedial actions and long-term management funding.

## PRINCIPLE 6. STAKEHOLDER ENGAGEMENT PRACTICES

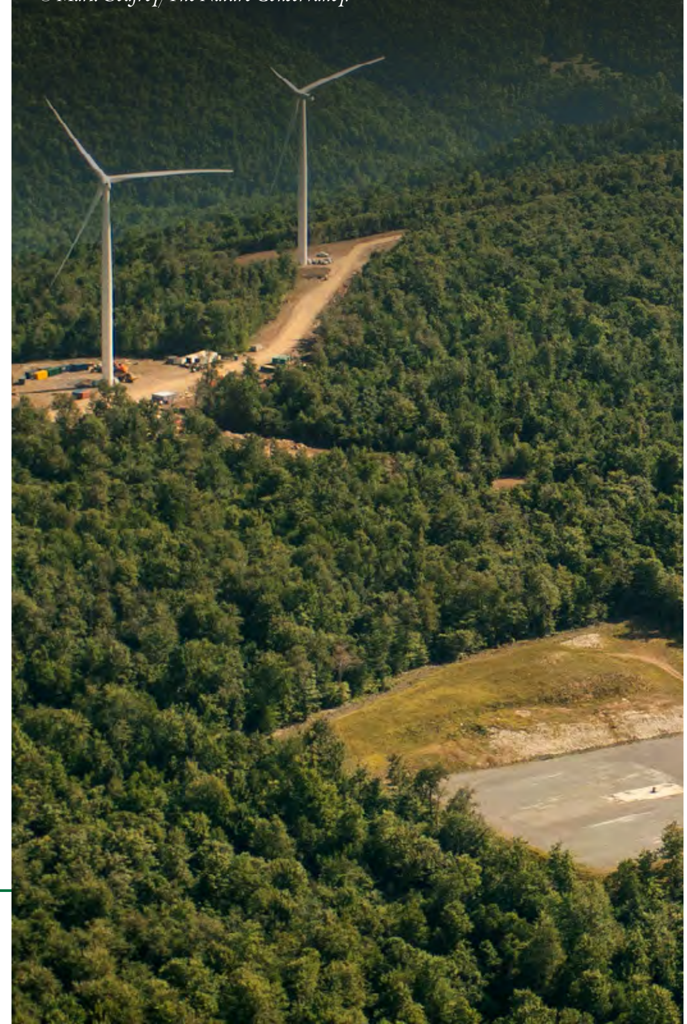
### Mitigation Should Follow Best Practices For Stakeholder Engagement

Mitigation policy and practice should be guided by generally accepted best principles for meaningful and inclusive stakeholder engagement, including the importance of transparency, rights-based approaches, and the use of science and traditional knowledge, as defined below.

- INCLUSIVENESS: Full and inclusive range of people and interests engaged in the review of proposed projects, mitigation planning and actions, and review of outcomes.
- TRANSPARENCY: Communicating information regarding proposed projects, mitigation planning, actions, and results in a public, transparent, timely, and culturally appropriate manner.
- RIGHTS-BASED APPROACHES: Respect for stakeholders' rights and legal and customary arrangements, and promotion of free, prior, and informed consent regarding projects and mitigation plans and actions.
- SCIENCE AND TRADITIONAL KNOWLEDGE: Ensuring sound science and traditional knowledge informs project decision-making and mitigation planning and actions.

These principles are necessary for meaningful participation of potentially affected stakeholders in decision-making processes for proposed projects, including mitigation planning and implementation. Because these principles are applied in many contexts beyond mitigation, and there are many supporting references to guide best practices,[28] we do not discuss them in detail here.

*Aerial photograph showing a gas well site (pad) in front of a new wind farm being constructed on a ridge above the Marcellus Shale formation in northeastern Pennsylvania. The Conservancy and Appalachian Landscape Conservation Cooperative (LCC) completed a study assessing potential energy development of wind, shale gas, and coal in the Appalachians to identify possible overlaps with important forest areas and natural resources and developed an online mapping tool to help inform development, conservation, and mitigation planning. Photo credit: © Mark Godfrey/The Nature Conservancy.*



# Principles Specific To Offsets

## PRINCIPLE 7. ADDITIONALITY

### Offsets Should Provide A New Contribution To Conservation, Additional To What Would Have Occurred Without The Offset

Additionality is a core principle of offsets. Offsets must provide a new contribution to conservation values and functions above and beyond what would have occurred without the offsets.[29] Offsets may lack additionality if, for example, proposed offsets are already a current or planned government action or requirement, there is existing public or private funding designated for the offset actions, or the area for the proposed offset is presently under a level of protection that will guarantee the maintenance of its conservation values.[30]

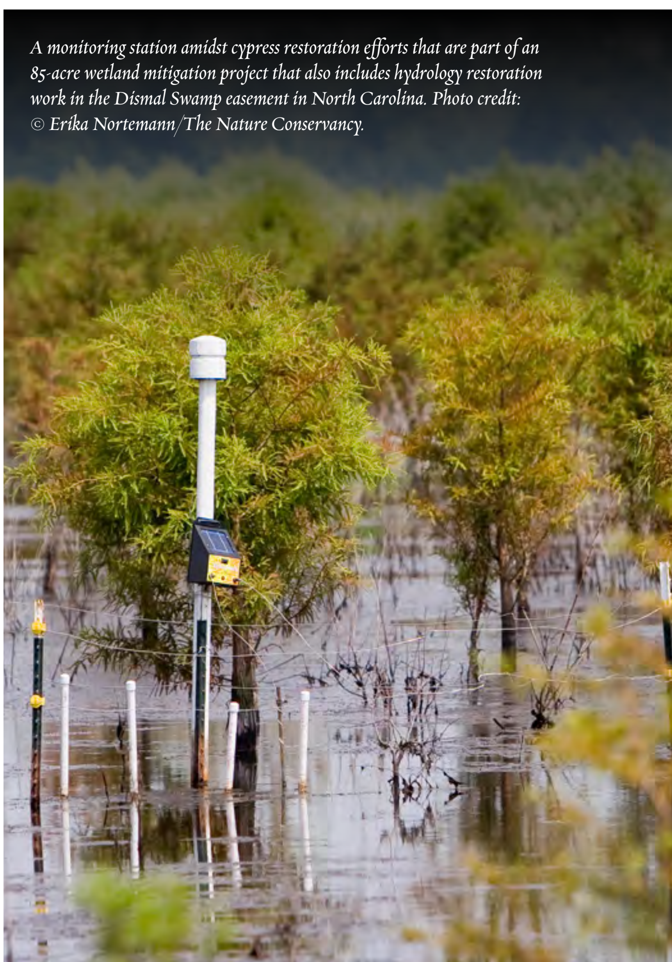
In assessing an offset's additionality, it is important to consider the offset's contribution toward achieving the mitigation policy goal and the likelihood of successful conservation outcomes given risks, uncertainty, and other factors.[31] Actions that restore, enhance, improve management for, and/or increase the protection of resources can provide a new contribution to conservation and therefore support additionality. These actions can be measured against project impacts to assess progress toward a mitigation policy goal, such as no net loss or net gain. For example, restoration actions taken to improve degraded ecosystems can be evaluated for their "ecological lift" and associated conservation gains over time. Likewise, offsets that preserve or improve management of habitat deliver conservation value when, taking into account real-world conditions and threats, these actions protect against an expected background rate of loss.

*"Offsets must provide a new contribution to conservation values and functions above and beyond what would have occurred without the offsets. Actions that restore, enhance, improve management for, and/or increase the protection of resources can provide a new contribution."*

Whether conservation actions will successfully provide conservation uplift varies depending on the ecosystem, restoration and management techniques, and other factors. For example, in some cases restoration approaches are known to be effective and likely to deliver the intended additionality. The success of other restoration techniques is less certain; they may not have been well tested or have a less consistently successful track record.

Lastly, the additionality of an offset may be affected by "leakage." This refers to the situation in which an offset displaces negative impacts that would have occurred at the offset location to another ecologically sensitive location. For example, there is leakage if an offset protects one forest area from future deforestation only to have the threat to that forest move to another and cause deforestation there. While leakage remains a difficult challenge to measure, especially at a global scale, it is important to assess and reduce leakage risks where possible in the design and implementation of offsets.

The amount and type of offsets required should be measured against project impacts to assess progress toward a mitigation policy goal, such as no net loss or net gain. Credit (and debit) accounting systems should be used to evaluate the amount of uplift that offset actions provide. In applying offset accounting systems, the desire for scientific rigor should be balanced with the need for a practical and implementable approach. As such, accounting systems should strive to achieve a reasonable degree of precision.[32]



*A monitoring station amidst cypress restoration efforts that are part of an 85-acre wetland mitigation project that also includes hydrology restoration work in the Dismal Swamp easement in North Carolina. Photo credit: © Erika Nortemann/The Nature Conservancy.*


*The grasslands of Mongolia's Eastern Steppe at sunset. The Nature Conservancy is supporting the development of a mitigation framework in Mongolia to address mining and infrastructure impacts. This will support avoidance of impacts to key habitats, including the largest remaining temperate grasslands on the planet, and support offsets for unavoidable, residual impacts. Photo credit: © Nick Hall.*

## PRINCIPLE 8. EQUIVALENCE

### Offsets Should Provide Ecologically Equivalent Values As Those Lost To Project Impacts

Equivalence is the principle that offsets should provide habitat, functions, values, and other attributes that are similar in type ("in-kind") and proportionate to those affected by the project.[33] There may be some instances where it is appropriate to support "out-of-kind" offsets, such as when offsets can benefit a habitat type or conservation values that are of higher significance than those affected by the project – a concept known as "trading up." Compared to in-kind offset options, out-of-kind offsets should demonstrably provide a greater contribution to landscape-level conservation goals (e.g., should better address the past disproportional losses to specific habitat types).[34] Finally, under most circumstances, a no net loss or better outcome can best be achieved through offset actions that provide ecologically proportionate values through on-the-ground conservation outcomes rather than, for example, through research, education, and training programs.

## PRINCIPLE 9. LOCATION

### Offset Benefits Should Accrue In The Project-Affected Landscape

This principle establishes a preference for offset benefits to accrue within the landscape affected by the project.[35] On the one hand, requiring offsets to be adjacent or close to project sites may encourage offsets that do not have a high likelihood of success because they are surrounded by incompatible land uses, or are in areas likely to be developed in the near future. Such projects may have higher failure rates and provide less conservation benefit than alternative offset opportunities in the region.

> *"Requiring offsets to be sited in the same ecoregion or watershed as project impacts ensures that benefits accrue in proximity to the project-affected area."*

On the other hand, siting offsets too far from the project-affected area can also be problematic in some situations. For example, locating an offset in a different ecoregion may make it more difficult for the offset to provide ecologically equivalent values and functions as those lost to project impacts. In addition, such offsets may be opposed on equity grounds as they can create conservation "winners and losers" (e.g., the region benefiting from offsets is different from that experiencing losses).

Requiring offsets to be sited in the same ecoregion or watershed as project impacts ensures that benefits accrue in proximity to the project-affected area, and also provides flexibility for selecting offsets that can most successfully contribute to conservation goals at the landscape level (e.g., ecoregion or watershed).

## PRINCIPLE 10. TEMPORAL CONSIDERATIONS

### Offsets Should Protect Against Temporal Losses

This principle addresses several temporal considerations. The first is an issue of timing. Offsets should take into account the loss of conservation values for any time lag between when project impacts occur and offset benefits are established.[36] Project impacts often cause certain and immediate losses, whereas offset outcomes may be uncertain and require many years to be fully realized. Restoration of some habitat features and systems can take decades or more to develop and mature (e.g., forested wetlands, fragile desert ecosystems), and carry the risk that they may never provide an equivalent conservation value to what was lost. For offsets focused on preserving habitat, the conservation benefits begin at the moment of implementation but the level of benefit depends on what the expected background rate of loss had been for the site (i.e., threat abated by the offset). Where the timing or type of mitigation may result in temporal loss, it is important that the amount of required mitigation should be adjusted upwards to account for the expected to account for that loss.

Second, it is important that the duration of the impacts is matched with the duration of the offset. There should be a presumption that impacts are permanent, as they are often directly or in effect permanent. For example, when an impact causes even temporary disturbance to some species, the population effects of such a disturbance may have permanent consequences for the species. Although there should be a strong preference for permanent offsets, at a minimum offsets should be effective for at least the duration of the direct, indirect, and cumulative impacts caused by the project.

> *“Offsets should take into account the loss of conservation values for any time lag between when project impacts occur and offset benefits are established.”*

*A Conservancy staff member on a monitoring visit at the Old Fort Bayou Mitigation Bank. This mitigation bank helps bridge a critical gap in the Mississippi Sandhill Crane Refuge and provides quality mitigation for growing Mississippi coastal communities. Restoration practices such as prescribed burns, hydrologic improvements and removal of non-native species help return the area to a more natural state. Photo credit: © Erika Nortemann/The Nature Conservancy.*

# Summary Of Principles

| Principles | Why is this principle important? |
|---|---|
| **Principle 1.** Landscape Context<br>**The mitigation hierarchy should be applied in a landscape context.** Landscape-level assessments of conservation priorities and development scenarios should inform application of the mitigation hierarchy. They should be conducted as far in advance of project decisions and investments as possible and should identify important conservation values and potential direct, indirect, and cumulative impacts to these values. | • Mitigation is informed by an understanding of conservation priorities and potential direct, indirect, and cumulative impacts.<br>• Potential conflicts, risks, and trade-offs between conservation and development goals are identified in advance of decisions and investments.<br>• Important places and values for meeting landscape conservation goals, including areas where impacts should be avoided altogether, are clearly identified.<br>• Offset actions are designed and implemented to make a meaningful contribution to landscape conservation goals. |
| **Principle 2.** Goals<br>**Mitigation policy goals should support conservation objectives and drive accountability in applying the mitigation hierarchy.** Mitigation policy goals should provide a clear driver for avoiding and minimizing impacts, and guide offset requirements. Offsets should fully address residual project impacts to achieve, at a minimum, a "no net loss" outcome for conservation. | • The mitigation hierarchy is applied with a focus on supporting broader conservation objectives.<br>• Application of the mitigation hierarchy is supported by a structured, transparent, and science-based foundation that drives impact avoidance and minimization and guides offset requirements.<br>• Accountability is strengthened so that, at minimum, offsets fully address a project's unavoidable residual impacts. |
| **Principle 3.** Mitigation Hierarchy Steps<br>**The mitigation hierarchy should be followed sequentially - avoid, minimize, and then offset impacts.** Avoidance is the first and most important step for supporting landscape-level conservation goals. Efforts to avoid and minimize impacts should be made to the maximum extent practicable – taking into account existing technology, available science, costs relative to ecological benefits, and the likelihood of success for offset actions – before offsets are considered. Offsets are then applied to address residual impacts. | • Options for impact avoidance and minimization are fully considered, including avoiding projects altogether, before offsets are considered.<br>• Offsets are applied for residual impacts only, not used as a justification to approve projects where impacts should have been avoided or minimized. |
| **Principle 4.** Limits to Offsets<br>**There are limits to what can be offset.** The mitigation hierarchy should be applied with clear recognition that many impacts to biodiversity, ecosystem services, and other resources and values cannot be offset. These impacts need to be avoided, as this may be the only means to prevent irreplaceable loss. | • When it is not possible to offset the impacts (e.g., due to the rarity of the resources, lack of offset opportunities, poor likelihood of offset success, etc.), project impacts are not approved, precluding the need for offsets. |
| **Principle 5.** Sustainable Outcomes<br>**Mitigation should support long-term, durable outcomes.** Minimization and offset actions should be required to meet ecological performance standards and adhere to provisions for adaptive management, monitoring, and enforcement measures to ensure long-term and sustainable outcomes for conservation. Durability of offsets should be secured through designation mechanisms, management, and funding. | • Mitigation actions focus on maintaining key ecological functions and meeting ecological targets rather than only administrative standards.<br>• Requirements for meeting performance standards, monitoring, and adaptive management, with regulatory oversight and enforcement, support the sustainability of minimization and offset actions.<br>• Offset agreements include a long-term management plan that outlines necessary management measures and funding for the measures.<br>• Offsets are sited and designed to be self-sustaining and durable. |

| Principles | Why is this principle important? |
|---|---|
| **Principle 6.** Stakeholder Engagement Practices<br>**Mitigation should follow best practices for stakeholder engagement.** Principles for meaningful stakeholder engagement in the decision making process, including transparency, rights-based approaches, and use of science and traditional knowledge, are essential in applying the mitigation hierarchy. | • Application of the mitigation hierarchy meets generally accepted best practices for stakeholder engagement.<br>• Meaningful stakeholder participation in decision-making processes supports better, more sustainable outcomes. |
| **Principle 7.** Additionality<br>**Offsets should provide a new contribution to conservation, additional to what would have occurred without the offset.** Offset actions that restore, enhance, manage, and/or protect values and functions should be a genuinely new contribution to conservation with a strong probability of success. The amount and types of offsets required should be measured against project impacts to assess progress toward the mitigation policy goal. | • Offsets contribute a measurable new benefit to conservation values and functions; they do not take the place of existing or mandated conservation actions that would have been implemented without the offset.<br>• Offsets take into account risks, uncertainties, and other factors in design and implementation in order to deliver additional conservation benefits consistent with the mitigation policy goal. |
| **Principle 8.** Equivalence<br>**Offsets should provide ecologically equivalent values as those lost to project impacts.** Offsets should preferably be "in kind" in terms of habitat type, functions, values, and other attributes. "Out-of-kind" offsets may be appropriate in some cases where they better meet landscape-level conservation priorities and/or address past disproportional losses to other habitat types. | • Offsets either provide conservation benefits similar to those lost due to the project, or are a "trade up" to provide benefits that better meet conservation priorities. |
| **Principle 9.** Location<br>**Offset benefits should accrue in the project-affected landscape.** Offsets should be implemented to maximize conservation benefits within a defined spatial extent or unit (e.g., watershed, ecoregion), supporting the accrual of offset benefits in the same landscape as project impacts. | • Offsets are located in the project-affected ecoregion, increasing opportunities for ecological equivalence and reducing the potential for conservation "winners and losers" (i.e., benefits not accruing to those affected).<br>• Important ecosystem functions (e.g., flood control benefits) remain supported within the project-affected region. |
| **Principle 10.** Temporal Considerations<br>**Offsets should protect against temporal losses.** Offsets should be designed and implemented to safeguard against temporal losses of conservation values that can occur due to the different timing of project impacts and offset benefits. At a minimum, offsets should provide a high level of confidence of protection for at least as long as the direct, indirect, and cumulative project impacts. | • Offsets are implemented in advance or concurrent with project impacts where possible and appropriate.<br>• Temporal losses (e.g., years before offset conservation values reach maturity) are compensated for in the design and/or size of the offset.<br>• Offsets are maintained and effective for the duration of a project's direct, indirect, and cumulative impacts on the species and ecological communities. |

# Appendix A: Development By Design Publications

## PEER REVIEWED PUBLICATIONS


Kiesecker, J.M, H. Copeland, A. Pocewicz, N. Nibbelink, B. McKenney J. Dahlke, M. Holloran, and D. Stroud. 2009. A Framework for Implementing Biodiversity Offsets: Selecting Sites and Determining Scale. BioScience 59:77-84.

McDonald, R, J. Fargione, J. M. Kiesecker, W.M. Miller, J. Powell 2009. Energy sprawl or energy efficiency: climate policy impacts on natural habitat for the United States of America. PLOS One 4:8.

Copeland, H.E., K.E Doherty, D.E Naugle, A. Pocewicz, J. M. Kiesecker. 2009. Mapping Oil and Development Potential in the US Intermountain West and Estimating Impacts to Species. PLoS ONE 4(10): e7400. doi:10.1371/journal.pone.0007400.

Kiesecker, J.M., H. Copeland, A. Pocewicz, and B. McKenney. 2010. Development by Design: Blending Landscape Level Planning with the Mitigation Hierarchy. Frontiers in Ecology and the Environment. 8:261-266.

McKenney, B. and J.M. Kiesecker. 2010. Policy Development for Biodiversity Offsets: A Review of Offset Frameworks. Environmental Management 45:165-176.

Sochi, K., J. Evans, and J.M. Kiesecker. 2010. Conservation in the Wyoming Basins Ecoregion: Planning Today by Assessing Future Scenarios. Gap Analysis Bulletin 17: 23-25.

Doherty KE, Naugle DE, Evans JS et al. 2010. A Currency for Offsetting Energy Development Impacts: Horse-Trading Sage-Grouse on the Open Market. PLoS ONE 5(4): e10339. doi:10.1371/journal.pone.0010339.

Doherty K.E., D.E. Naugle, H. Copeland, A. Pocewicz, and J.M. Kiesecker. 2011. Energy development and conservation tradeoffs: systematic planning for sage-grouse in their eastern range. Studies in Avian Biology 38:505-516.

Kiesecker, J.M., J. Evans, J. Fargione, et al. 2011. Win-Win for Wind and Wildlife: A Vision to Facilitate Sustainable Development. PLoS One. 6 (4):e17566. doi:10.1371/journal.pone.0017566.

Obermeyer, B., R. Manes, J.M. Kiesecker, J. Fargione, and K. Sochi. 2011. Development by Design: Mitigating Wind Development's Impacts on Wildlife in Kansas. PLoS ONE 6(10): e26698. doi:10.1371/journal.pone.0026698.

Cameron D.R., B.S. Cohen, S.A. Morrison. 2012. An Approach to Enhance the Conservation-Compatibility of Solar Energy Development. PLoS ONE 7(6): e38437. doi:10.1371/journal.pone.0038437.

Fargione, J., J.M. Kiesecker, M.J. Slaats, S. Olimb. 2012. Wind and Wildlife in the Northern Great Plains: Identifying Low-Impact Areas for Wind Development. PLoS ONE 7(7): e41468. doi:10.1371/journal.pone.0041468.

Copeland H.E., A. Pocewicz, D.E. Naugle, T. Griffiths, D. Keinath, et al. 2013. Measuring the Effectiveness of Conservation: A Novel Framework to Quantify the Benefits of Sage-Grouse Conservation Policy and Easements in Wyoming. PLoS ONE 8(6): e67261.

Baruch-Mordo S., J.S. Evans, J.P. Severson, D.E. Naugle, J.D. Maestas, J.M. Kiesecker, M.J. Falkowski, C.A. Hagen, and K.P. Reese. 2013. Saving sage-grouse from the trees: A proactive solution to reducing a key threat to a candidate species. Biological Conservation. 167: 233-241.

Oakleaf, J.R., C. Kennedy, T. Boucher, J. M. Kiesecker. 2013. Tailoring Global Data to Guide Corporate Investments in Biodiversity, Environmental Assessments and Sustainability. Sustainability 5, no. 10: 4444-4460.

Saenz, S., T. Walschburger, J.C. González, J. León, B. McKenney, J.M. Kiesecker. 2013. A Framework for Implementing and Valuing Biodiversity Offsets in Colombia: A Landscape Scale Perspective. Sustainability 5, no. 12: 4961-4987.

Saenz, S., T. Walschburger, J.C. González, J. León, B. McKenney, J.M. Kiesecker. 2013. Development by Design in Colombia: Making Mitigation Decisions Consistent with Conservation Outcomes. PLoS ONE 8(12): e81831. doi:10.1371/journal.pone.0081831.

Evans, J. and J.M. Kiesecker. 2014. Shale Gas, Wind and Water: Assessing the Potential Cumulative Impacts of Energy Development on Ecosystem Services within the Marcellus Play. PLoS ONE 9(2): e89210. doi:10.1371/journal.pone.0089210.

Fitzsimons, J., M. Heiner, B. McKenney, K. Sochi, and J. M. Kiesecker. 2014. Development by Design in Western Australia: Overcoming offset obstacles. Land 3: 167-187.

Villarroya, A. Barros, A.C. and J.Kiesecker. 2014. Policy Development for Environmental Licensing and Biodiversity Offsets in Latin America. PLoS ONE. 2014; 9(9): e107144. doi:10.1371/journal.pone.0107144.

Jones, N.F., L. Pejchar, J.M. Kiesecker. 2015. The Energy Footprint: How Oil, Natural Gas, and Wind Energy Impact Land for Biodiversity and the Flow of Ecosystem Services. BioScience.

## BOOK CHAPTERS

Copeland, H.E., A. Pocewicz, and J.M. Kiesecker. 2011. Geography of energy development in Western North America: Potential impacts to terrestrial ecosystems. Pages 7-22 in D. Naugle editor "Energy development and wildlife conservation in Western North America" Island Press.

Copeland, H.E., K.E. Doherty, D.E. Naugle, A. Pocewicz, and J.M. Kiesecker. 2011. Forecasting Development scenarios to aid in conservation design. Pages 183-193 in D. Naugle editor "Energy development and wildlife conservation in Western North America" Island Press.

Kiesecker, J.M., H.E. Copeland, B. McKenney, A. Pocewicz, K.E. Doherty. 2011. Energy by design: Making mitigation work for conservation and development. Pages 157-189 in D. E. Naugle editor "Energy Development and Wildlife Conservation in Western North America" Island Press.

Girvetz, E.H., R. McDonald, M. Heiner, J. Kiesecker, D. Galbadrakh, C. Pague, M. Durnin and O. Enkhtuya. (2012) Eastern Mongolian Grassland Steppe. Chapter 8 in: Climate and Conservation: Landscape and Seascape Science, Planning and Action (Edited by JA Hilty, CC Chester and M Cross), pp 92-103. Island Press/Center for Resource Economics, Washington.

Kiesecker J.M., K. Sochi, M. Heiner, B. McKenney, J.S. Evans, and H.E. Copeland. 2013. Development by Design: Using a Revisionist History to Guide a Sustainable Future. In: Levin S.A. (ed.) Encyclopedia of Biodiversity, second edition, pp. 495-507. Waltham, MA: Academic Press.

Heiner, M., Oakleaf, J.R., Galbadrakh, D., Bayarjargal, Y., and J.M. Kiesecker. Emerging Threats to Snow Leopards from Mining and Energy Development. In: McCarthy, T. and Mallon, D. (Eds.), Snow Leopards of the World: The Science, Politics, and Conservation of *Panthera uncia*. Elsevier Science, Amsterdam. In Press.

## REPORTS

Heiner, M., D. Galbadrakh, J.M. Kiesecker, B. McKenney, J. Evans, E. Tuguldur, D. Zumburelmaa, V. Ulziisaikhan, B. Oyungerel, D. Sanjmyatav, R. Gankhuyag, D. Enkhbat, L. Ocirhuyag, G. Sergelen, E. Girvetz and R. McDonald. (2011) Identifying Conservation Priorities in the Face of Future Development: Applying Development by Design in the Grasslands of Mongolia. The Nature Conservancy. Ulaanbaatar. [Also available in Mongolian]

Heiner, M., Y. Bayarjargal, J.M. Kiesecker, D. Galbadrakh, N. Batsaikhan, M. Ganbaatar, I. Odonchimeg, O. Enkhtuya, D. Enkhbat, H. von Wehrden, R. Reading, K. Olson, R. Jackson, J. Evans, B. McKenney, J. Oakleaf, K. Sochi, E. Oidov. (2013) Identifying Conservation Priorities in the Face of Future Development: Applying Development by Design in the Mongolian Gobi. The Nature Conservancy. Ulaanbaatar. [Also available in Mongolian]

Sochi, K., M. Heiner, H. Copeland, A. Pocewicz, and J.M. Kiesecker. (2013). Systematic Conservation Planning in the Wyoming Basins. The Nature Conservancy. Boulder, CO.

Kiesecker, J., M. Heiner, K. Sochi, B. McKenney, and J.Fitzsimons. (2013). Development by Design: Cooperative mitigation planning for Barrick Gold's Kanowna Belle operations in Western Australia. The Nature Conservancy.

Dunscomb, J.K., J.S. Evans, J.M. Strager, M.P. Strager, J.M. Kiesecker. (2014). Assessing Future Energy Development across the Appalachian Landscape Conservation Cooperative. The Nature Conservancy. Charlottesville (VA). Appalachian Landscape Conservation Cooperative Grant #2012-02.

## TOOLS & WEB-BASED GIS APPLICATIONS

Biodiversity and Ecosystem Services Trends and Conditions Assessment Tool (BESTCAT)

Mongolian Gobi Region Ecoregional Assessment GIS Tool

Mongolian Eastern Steppe Ecoregional Assessment GIS Tool

Mitigation Decision Support Tool for Pinedale Anticline & Hiawatha Oil and Gas Developments

## MANUSCRIPTS IN REVIEW

Evans, J., J.M. Kiesecker, J. Fargione, et al. Mapping human disturbance for biodiversity conservation in the contiguous US. Conservation Letters. In Review.

Oakleaf, J., C.M. Kennedy, S. Baruch-Mordo, P.C. West, J.S. Gerber, L. Jarvis, J.M. Kiesecker. A World at Risk: Aggregating Development Trends to Forecast Global Habitat Conversion. PNAS. In Review.

Sochi, K. and J.M Kiesecker. Optimizing regulatory requirements to aid in the implementation of mitigation. Journal of Applied Ecology. In Review.

# Appendix B: Defining Mitigation Steps

Below are several definitions of the mitigation steps from existing policies.

**U.S. Environmental Impact Assessment Policy.** Implementing Regulations for the U.S. National Environmental Policy Act (NEPA)[37] define mitigation as a five-step process wherein "mitigation" includes:

"(a) **Avoiding** the impact altogether by not taking a certain action or parts of an action.

(b) **Minimizing** impacts by limiting the degree or magnitude of the action and its implementation.

(c) **Rectifying** the impact by repairing, rehabilitating, or restoring the affected environment.

(d) **Reducing** or eliminating the impact over time by preservation and maintenance operations during the life of the action.

(e) **Compensating** for the impact by replacing or providing substitute resources or environments."

**U.S. Clean Water Act §404.** Implementing regulations and guidance[38] for the U.S. wetland and stream protection law define a three-step mitigation hierarchy:

1. AVOIDANCE. Permits may only be issued for "the least environmentally damaging practicable alternative." No impacts may be permitted if there is a practicable alternative to the proposed discharge that would have less adverse impact to the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences.

2. MINIMIZATION. "Appropriate and practicable steps" must be taken to minimize the adverse impacts will be required through project modifications and permit conditions.

3. COMPENSATORY MITIGATION. "Appropriate and practicable" compensatory mitigation is required for unavoidable adverse impacts that remain after all appropriate and practicable minimization has been required.

**Business and Biodiversity Offsets Programme Glossary.** BBOP defines the mitigation hierarchy as a four-step process:[39]

1. AVOIDANCE: Measures taken to avoid creating impacts from the outset, such as careful spatial or temporal placement of elements of infrastructure, in order to completely avoid impacts on certain components of biodiversity.

2. MINIMISATION: Measures taken to reduce the duration, intensity and/or extent of impacts (including direct, indirect and cumulative impacts, as appropriate) that cannot be completely avoided, as far as is practically feasible.

3. REHABILITATION/RESTORATION: Measures taken to rehabilitate degraded ecosystems or restore cleared ecosystems following exposure to impacts that cannot be completely avoided and/or minimised.

4. OFFSET: Measures taken to compensate for any residual significant, adverse impacts that cannot be avoided, minimised and/or rehabilitated or restored, in order to achieve no net loss or a net gain of biodiversity. Offsets can take the form of positive management interventions such as restoration of degraded habitat, arrested degradation or averted risk, protecting areas where there is imminent or projected loss of biodiversity.

# Endnotes


1 The Biodiversity Consultancy, Government Policies on Biodiversity Offsets. June 2013, Cambridge: UK; Also see Villarroya A, Barros AC, Kiesecker J. 2014. Policy Development for Environmental Licensing and Biodiversity Offsets in Latin America. PLoS ONE 9(9): e107144.

2 International Finance Corporation (IFC). 2012. Performance Standard 6. Biodiversity Conservation and Sustainable Management of Natural Resources. January 1, 2012. Washington, DC; The Equator Principles. 2013.

3 International Finance Corporation (IFC). IFC Guidance Note 6 Biodiversity Conservation and Sustainable Management of Living Natural Resources. January 1, 2012. Washington, DC.

4 Rainey, Hugo J., Edward H. B. Pollard, Guy Dutson, Jonathan M. M. Ekstrom, Suzanne R. Livingstone, Helen J. Temple, and John D. Pilgrim. 2014. A review of corporate goals of No Net Loss and Net Positive Impact on biodiversity. Oryx.

5 Business and Biodiversity Offsets Programme. 2012. Standard on Biodiversity Offsets. BBOP: Washington, DC.

6 The Business and Biodiversity Offsets Programme (BBOP) is a collaboration of more than 75 organizations and individuals from the private sector, government agencies, and non-governmental organizations (including The Nature Conservancy). Among its publications, BBOP has developed principles, criteria, and indicators that are outlined in the Standard on Biodiversity Offsets.

7 IUCN Technical Study Group. April 14, 2014. "Biodiversity offsets technical study paper." IUCN. Gland, Switzerland.

8 In 2012, at its World Conservation Congress in Jeju, the International Union for Conservation of Nature (IUCN) members adopted a resolution requiring the Director General to establish a working group to develop general policy on biodiversity offsets. That working group, which includes The Nature Conservancy, has completed a technical study paper that outlines broad principles for offsets and identifies unresolved issues that will be addressed in a forthcoming report expected for release in 2016.

9 Dinerstein, E., D. M. Olson, D. H. Graham, A. L. Webster, S. A. Primm, M. P. Bookbinder, G. Ledec. 1995. A conservation assessment of the terrestrial ecoregions of Latin America and the Caribbean. World Wildlife Fund and the World Bank, Washington D. C.; Groves, C. 2003. Drafting a conservation blueprint: A practitioner's guide to planning for biodiversity. Washington, The Nature Conservancy. Island Press.

10 Kiesecker, J.M., Copeland, H., Pocewicz, A., McKenney, B. 2010. Development by Design: Blending Landscape Level Planning with the Mitigation Hierarchy. *Frontiers in Ecology and the Environment* 8: 261-266. See Appendix A for more references.

11 National Cooperative Highway Research Program. October 2010. Optimizing Conservation and Improving Mitigation Cost/Benefit: Task 1 – Literature Review and Interviews. Project 25-25, Task 67. (Prepared by Environmental Law Institute, NatureServe, Institute for Natural Resources-Oregon State University, Resources for the Future.)

12 McKenney, B. and Kiesecker, J.M. 2010. Policy Development for Biodiversity Offsets: A Review of Offset Frameworks. *Environmental Management* 45: 165-176.

13 The Biodiversity Consultancy. June 2013. Government Policies on Biodiversity Offsets. Cambridge: UK; Also see: Villarroya A, Barros AC, Kiesecker J. 2014. Policy Development for Environmental Licensing and Biodiversity Offsets in Latin America. PLoS ONE 9(9): e107144.

14 2008 Compensatory Mitigation Rule, 33 CFR §332, preamble.

15 U.S. Fish and Wildlife Service. 2014. Greater Sage-Grouse Rangewide Mitigation Framework.

16 Australian Government Department of Sustainability, Environment, Water, Population and Communities. 2012. Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy. 6.

17 Villarroya A, Barros AC, Kiesecker J. 2014. Policy Development for Environmental Licensing and Biodiversity Offsets in Latin America. *PLoS ONE* 9(9): e107144. Note that Peru's policy also applies to ecosystem services.

18 European Commission. 2011. The EU Biodiversity Strategy to 2020. European Union, Luxembourg

19 McKenney, B. and Kiesecker, J.M. 2010. Policy Development for Biodiversity Offsets: A Review of Offset Frameworks. *Environmental Management* 45: 165-176. In the Clean Water Act §404 program, the availability of compensation opportunities may not be taken into account during the alternatives analysis and identification of the "least environmentally damaging practical alternative." The 1990 Mitigation MOA states that "[c]ompensatory mitigation may not be used as a method to reduce environmental impacts in the evaluation of the least environmentally damaging practicable alternatives for the purposes of requirements under Section 230.10(a)." Guidance issued by the Corps in 1993 further reinforced this position: "It is not appropriate to consider compensatory mitigation in determining whether a proposed discharge will cause only minor impacts for purposes of the alternatives analysis required by Section 230.10(a)."

20 Australian Government, Department of Sustainability, Environment, Water, Population and Communities. 2012. Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy. "Offsets will not be considered until all reasonable avoidance and mitigation measures are considered, or acceptable reasons are provided as to why avoidance or mitigation of impacts is not reasonably achievable."

21 Government of Western Australia, Department of Environmental Regulation. 2011. Western Australia Environmental Offsets Policy.

22 U.S. Environmental Protection Agency and Department of the Army. 1990. Memorandum of Agreement Between the Environmental Protection Agency and the Department of the Army Concerning the Determination of Mitigation Under the Clean Water Act Section 404(b)(1) Guidelines. § II.C.

23 Gibbons, P., & Lindenmayer, D. B. 2007. Offsets for land clearing: No net loss or the tail wagging the dog? *Ecological Management & Restoration*, 8(1), 26–31; Business and Biodiversity Offsets Programme. 2012. Guidance notes to the standard on biodiversity offsets. BBOP. Washington, DC; Pilgrim, John D., Susie Brownlie, Jonathan M. M. Ekstrom, Toby A. Gardner, Amrei von Hase, Kerry ten Kate, Conrad E. Savy, R. T. Theo Stephens, Helen J. Temple, Jo Treweek, Graham T. Ussher, and Gerri Ward. 2013. A process for assessing the offsetability of biodiversity impacts. *Conservation Letters*. 6(5): 376-384; Gardner, T. A., Hase, von, A., Brownlie, S., Ekstrom, J. M. M., Pilgrim, J. D., Savy, C. E., et al. 2013. Biodiversity Offsets and the Challenge of Achieving No Net Loss. Conservation Biology, 27(6), 1254–1264; Bull, J. W., Suttle, K. B., Gordon, A., Singh, N. J., & Milner-Gulland, E. J. (2013). Biodiversity offsets in theory and practice. *Oryx*, 47(03), 369–380.

24 Wilkinson, Jessica B., Robert Bendick, Bruce A. McKenney, James M. McElfish, Jr., and Rebecca Kihslinger. August 4, 2009. The Next Generation of Mitigation: Linking Current and Future Mitigation Programs with State Wildlife Action Plans and Other State and Regional Plans. Washington, DC: Environmental Law Institute.

25 2008 Compensatory Mitigation Rule, 33 CFR §332.2, definition of "performance standards."

26 Rayment, Matt, Rupert Haines, David McNeil, Mavourneen Conway, Graham Tucker and Evelyn Underwood. 2014. Study on specific design elements of biodiversity offsets: Biodiversity metrics and mechanisms for securing long term conservation benefits. DG ENVIRONMENT. ICF Consulting Ltd.

27 2008 Compensatory Mitigation Rule, 33 CFR §332.7(b).

28 See for example: Global Environment Facility. 2012. Principles and Guidelines for Engagement with Indigenous Peoples; IFC Performance Standards and Guidance Notes. January 1, 2012. Washington, DC; IUCN Policy on Conservation and Human Rights for Sustainable Development. 2012. WCC-2012-Res-099-EN.

29 McKenney, B. and Kiesecker, J.M. 2010. Policy Development for Biodiversity Offsets: A Review of Offset Frameworks. *Environmental Management* 45: 165-176.

30 Pilgrim, John D., and Leon Bennun. 2014. Will Biodiversity Offsets Save or Sink Protected Areas? *Conservation Letters*, September/October 2014, 7(5), 423–424.

31 Moilanen, A., van Teeffelen, A.J.A., Ben-Haim, Y. & Ferrier, S. 2009. How much compensation is enough? A framework for incorporating uncertainty and time discounting when calculating offset ratios for impacted habitat. *Restoration Ecology*, 17, 470–478; Maron, M., Hobbs, R.J., Moilanen, A., Matthews, J.W., Christie, K., Gardner, T.A. et al. 2012. Faustian bargains? Restoration realities in the context of biodiversity offset policies. *Biological Conservation*, 155, 141–148.

32 McKenney, Bruce A. and Joseph M. Kiesecker. 2010. Policy Development for Biodiversity Offsets: A Review of Offset Frameworks. *Environmental Management*. 45: 165-176.

33 Bruggeman, D.J., Jones, M.L., Lupi, F. & Scribner, K.T. 2005. Landscape Equivalency Analysis: methodology for estimating spatially explicit biodiversity credits. *Environmental Management*, 36, 518–534; Gibbons, P., & Lindenmayer, D. B. 2007. Offsets for land clearing: No net loss or the tail wagging the dog? *Ecological Management & Restoration*, 8(1), 26–31. Bruggeman, D.J., Jones, M.L., Scribner, K.T. & Lupi, F. 2009. Relating tradable credits for biodiversity to sustainability criteria in a dynamic landscape. Landscape Ecology, 24, 775–790; McKenney, B. and Kiesecker, J.M. 2010. Policy Development for Biodiversity Offsets: A Review of Offset Frameworks. *Environmental Management* 45: 165-176; Quetier, F. & Lavorel, S. 2012. Assessing ecological equivalence in biodiversity offset schemes: key issues and solutions. *Biological Conservation*, 144, 2991–2999.

34 National Research Council. 2001. *Compensating for Wetland Losses Under the Clean Water Act*. National Academy Press. p. 142.

**35** McKenney, B. and Kiesecker, J.M. 2010. Policy Development for Biodiversity Offsets: A Review of Offset Frameworks. *Environmental Management* 45: 165-176.

**36** Gibbons, P., & Lindenmayer, D. B. 2007. Offsets for land clearing: No net loss or the tail wagging the dog? *Ecological Management & Restoration*, 8(1), 26–31. Burgin, S. 2008. BioBanking: an environmental scientist's view of the role of biodiversity banking offsets in conservation. *Biodiversity and Conservation* 17:807–816; McKenney, B. and Kiesecker, J.M. 2010. Policy Development for Biodiversity Offsets: A Review of Offset Frameworks. *Environmental Management* 45: 165-176. Bekessy, S., Wintle, B., Lindenmayer, D.B., McCarthy, M., Colyvan, M. & Burgman, M. 2010. The biodiversity bank cannot be a lending bank. *Conservation Letters*, 3, 151–158. Maron, M., Hobbs, R.J., Moilanen, A., Matthews, J.W., Christie, K., Gardner, T.A. et al. 2012. Faustian bargains? Restoration realities in the context of biodiversity offset policies. *Biological Conservation*, 155, 141–148.

**37** 40 C.F.R. §1508.20.

**38** U.S. Environmental Protection Agency. 1980. Guidelines for Specification of Disposal Sites for Dredged or Fill Material. 40 CFR Pt. 230; U.S. Environmental Protection Agency and U.S. Department of the Army. February 6, 1990. Memorandum of Agreement Between the Environmental Protection Agency and the Department of the Army Concerning the Determination of Mitigation Under the Clean Water Act Section 404(b)(1) Guidelines.

**39** Business and Biodiversity Offsets Programme (BBOP). 2012. Glossary.

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*McKenney, Bruce and Jessica Wilkinson. April 2015.*
*"Achieving Conservation and Development: 10 Principles for Applying the Mitigation Hierarchy." The Nature Conservancy.*