Building a Roadmap for Successful Regional Mitigation

A Report Prepared for the Sonoran Institute

Version 1.0

Courtesy Charles Sale

Version 1.0 / July 2015

Defenders of Wildlife is a national, nonprofit, membership organization dedicated to the protection of all native animals and plants in their natural communities.

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Suggested citation: Cava, E. and N. Dubois. 2015. Building a Roadmap for Successful Regional Mitigation. Defenders of Wildlife, Washington, DC.

Version 1.0 / July 2015

Building a Roadmap for Successful Regional Mitigation

Document Background and Purpose

This paper presents a model process for developing meaningful regional mitigation goals and objectives for utility-scale solar energy in Arizona, with a focus on compensatory mitigation. Our process builds upon the Bureau of Land Management's (BLM) Solar Regional Mitigation Strategies (SRMS), The Nature Conservancy's (TNC) Conservation Action Planning framework and the Open Standards for the Practice of Conservation,[1] a results-based adaptive management framework developed by the Conservation Measures Partnership.[2] A primary difference between results-based management and other approaches is the emphasis on describing desired results in terms of management outcomes rather than the implementation of actions. Each step in the process of regional mitigation must be connected to the ones before and after, to ensure that mitigation actions connect back to mitigation objectives to successfully and measurably offset impacts—i.e., provide mitigation *results*.

The purpose of this paper is to build on the work done to date by the BLM in developing regional mitigation strategies for solar energy zones and present opportunities for refinement and improvement using a results-based approach.

Introduction

Secretarial Order No. 3330 directed the Department of the Interior (DOI or Interior Department) to establish a department-wide, science-based strategy to strengthen mitigation practices so as to effectively offset impacts of large development projects of all types. The Secretarial Order addressed several of the key issues we have been promoting: (1) the use of a landscape-scale approach, (2) early integration of the full mitigation hierarchy in project planning and design, (3) ensuring the durability of mitigation measures, (4) ensuring transparency and consistency in mitigation decisions, and (5) a focus on mitigation efforts that improve the resilience of our nation's resources in the face of climate change.[3]

Critical to a successful landscape approach is ensuring that renewable energy project planning is informed by both energy development *and* conservation goals for a particular landscape. Adopting a landscape approach allows public land agencies, energy developers, and other stakeholders to identify up-front strategies to (1) avoid development in priority areas including crucial wildlife habitats and corridors; (2) direct development to areas with the lowest possible conflicts to conservation values; (3) identify opportunities to minimize impacts; and (4) when necessary, effectively mitigate impacts from renewable energy development on important natural resource values (wildlife, wilderness, recreation, etc.) associated with the particular landscape. By establishing development and conservation goals and objectives upfront, land management and wildlife agencies can strategically determine whether and how development can be effectively mitigated such that the landscape can sustain its ecological systems, functions, and values. Such an approach avoids the redundancies and expense of administering a project-by-project analysis and provides greater certainty that critical conservation and renewable energy objectives can be met.

Through Order No. 3330 DOI affirmatively adopted the full mitigation hierarchy. The mitigation hierarchy is a widely accepted process that consists of identifying, avoiding, minimizing and mitigating impacts of development projects. To fully realize the conservation potential of compensatory offsite mitigation, however, the existing DOI mitigation framework must be augmented with an additional step that must take first priority in the hierarchy, over and above avoidance: **quantifiable conservation goals and objectives.**

In our model we use concepts from the Open Standards for the Practice of Conservation, a set of widely-used methods for designing, managing, and monitoring conservation projects for success. In this paper we show how an Open–Standards-type approach can be used to set appropriate conservation and mitigation goals and objectives, and to plan off-site mitigation so it can successfully reach those goals and objectives. We believe the best practices recommended in this report can be used by any agency or planner to develop successful mitigation, not only the BLM.

Defenders' goal is to ensure that "diverse wildlife populations in North America are secure and thriving." To achieve this goal, we support policies and on–the-ground efforts to increase species abundance—particularly imperiled and sensitive species. We believe that using a results-based approach to mitigation will help managers increase species abundance while simultaneously planning and permitting responsible development.

To illustrate how this approach can be applied, we focused on a small set of ecological and wildlife resources—two vegetative communities and two wildlife species of conservation interest—in the Sonoran Desert, and on potential impacts to these resources from solar energy development following efforts to avoid and minimize impacts via the siting process. We based these examples on information drawn from existing literature and not from full implementation of a stakeholder-driven planning process. We encourage readers to consider our illustrative examples as samples of the type of outputs that would be produced by a results-based management approach to mitigation. This approach can be applied to the development of any regional mitigation strategy.

Background: BLM's Solar Energy Program and Regional Mitigation

The BLM's Solar Energy Program, established through the Solar Programmatic Environmental Impact Statement, is the leading example of how the BLM and the Interior Department are applying the mitigation hierarchy. The Solar Energy Program:

> employs a mitigation hierarchy to address impacts –avoidance, minimization, and offset of unavoidable impacts. Avoidance will be achieved through siting decisions and the identification of exclusions and priority development areas (i.e., Solar Energy Zones). Minimization will also be achieved through siting decisions as well as through the application of programmatic and SEZ-specific design features. For those impacts that cannot be avoided or minimized, the BLM will seek effective measures to offset (or mitigate) negative impacts.[4]

For those impacts in Solar Energy Zones (SEZ) that cannot be avoided and must be offset, the BLM is developing Solar Regional Mitigation Strategies (SRMS) to "identify any unavoidable impacts from solar energy development in an SEZ that may warrant regional mitigation and [] identify potentially appropriate regional mitigation locations and actions"[5] and develop "a more systematic approach for identifying and addressing requirements for off-site mitigation actions."[6] As envisioned, each SRMS will "enhance the ability of state and federal agencies to invest in larger scale conservation and mitigation efforts through the pooling of financial resources and prioritization of investments."[7]

As described by the BLM, Regional Mitigation is:

> a landscape-scale approach to mitigating impacts to resources and values managed by the BLM in order to provide for sustained yield of resources on the Public Lands. To achieve and sustain BLM resource and value objectives, it may be appropriate to compensate for the direct and indirect impacts of a BLM authorization by conditioning that authorization on the performance of mitigation outside the area of impact (i.e., offsite or compensatory mitigation).[8]

Missing from the description is a definition of "regional."

Mitigation Roadmap: Steps in a Successful Regional Mitigation Strategy

A. Overview of Roadmap Steps

Pre-step 1: Identify resources likely to be affected by development. Use a regional conservation plan to guide selection of resources (**targets**) that represent a diversity of species and issues on the landscape, including habitat generalists and specialists, in order to capture a wide range of conservation targets and values. Particular attention should be paid to species that have regulatory or policy requirements for mitigation, such as endangered and threatened species, BLM or state-listed sensitive species. Requirements for mitigation in law and policy are described in more detail in Appendix E.

Step 1: Develop or identify regional conservation goals and objectives. Regional conservation goals and objectives are quantifiable statements of the desired outcomes for biological targets, generally at ecoregional or other ecologically relevant scales and over relatively long time frames. They may already exist in a regional conservation plan developed by a management agency, wildlife agency, conservation organization, or other entity, or a mitigation planner may need to consider such information in order to develop appropriate regional conservation goals and objectives suitable for the project at hand. Collectively, regional conservation objectives contribute to achievement of a regional conservation goal.

A **goal** is defined as "a formal statement detailing a desired impact of a project such as the desired future status of a target."[9] An **objective** is "a formal statement detailing a desired outcome of a project."[10] Objectives should be results-oriented, be measurable, have a defined time frame, be specific, and be practical.

Step 2: Characterize anticipated impacts resulting from development. After using principles of avoidance and minimization to determine the lowest-impact places to develop, assess likely residual impacts that will result from development. Impact assessments must be tied to regional conservation goals and objectives. Impact assessment should focus on aspects of the biology or ecology of the target/resource that would lead to the loss of a resource over time if missing or altered. An impact is comprised of both a **threat** (a human activity) and the **stress** (loss of functions and values) it causes to the resource.

A **conceptual model** is a tool that visually portrays the main cause and effect relationships assumed to exist among threats, stresses, and biological targets. These conceptual models provide the starting point by which to identify intervention points for mitigation **actions** and generate **sets of results-based mitigation objectives** that link these actions to intermediate outcomes in support of broader **conservation goals**.

Appendix C includes an example conceptual model for creosote-bursage desert scrub and the threat of utility-scale solar development.

Step 3: Develop mitigation objectives for each impact. Mitigation objectives are quantitative statements that define desired outcomes to offset anticipated impacts from development. For purposes of this report we focus on compensatory mitigation, but mitigation objectives can be developed for any step of the hierarchy and at any scale—for example, avoidance of Areas of Critical Environmental Concern can be an avoidance mitigation objective during the overall process of directing development away from sensitive areas, while avoidance of riparian vegetation within the development site or zone can be an avoidance objective during the site planning process.

Compensatory mitigation objectives are the heart of a regional mitigation strategy; they connect the dots between impacts, offsets, and conservation. Mitigation objectives contribute to and are linked to conservation objectives in that a planner chooses which attributes of a target resource to mitigate for based on their importance in the conservation plan. A good mitigation objective is results-oriented. It describes what is needed to accomplish to avoid, minimize, or compensate for an impact. Consequently, a mitigation objective must be linked to one or more impacts. Mitigation objectives should be measurable and describe quantitative indicators that can be used to assess whether they have been achieved by quantifying both impacts and mitigation actions.

Step 4: Identify mitigation actions for each objective. Mitigation actions are conservation actions that are tailored to address mitigation objectives.

Step 5: Identify mitigation sites to implement actions. We recommend identifying mitigation sites after identifying mitigation actions that will meet objectives. It may be much harder to achieve objectives if the sites are chosen first, before deciding on the best mitigation actions, as actions will then be dictated by what is possible on site rather than tailored to what is most likely to meet mitigation objectives. In some cases, a property of the site itself is the most important factor in meeting mitigation objectives—for example, when the mitigation objective is to restore lost connectivity or a riparian buffer, only those locations that connect key habitats or that are situated along a riparian corridor will be appropriate for achieving mitigation actions—and in these cases, it may be appropriate to switch Steps 4 and 5 for particular mitigation targets and objectives.

Step 6: Identify mitigation site objectives. These targeted sub-objectives are based on the compensatory mitigation objectives and resultant actions developed in steps 3 and 4, but focused on the particular mitigation site. As managers implement and measure mitigation site objectives they should be able to "roll up" measurement and track achievement of the broader regional mitigation objectives.

Step 7: Identify monitoring objectives. Planners need to decide how, when, and what to monitor in order to measure indicators and results.

Step 8: Implement actions and monitoring. After developing the strategy, as development planning gets underway, planners should begin to implement mitigation actions and monitor both development impacts and mitigation progress.

Step 9: Analyze, use, adapt. Planners and managers are familiar with the concept of adaptive management, which requires analysis of data (i.e. indicator measurements) in order to evaluate progress towards achieving objectives and then changing course. A results-based approach such as the one we propose provides a strong foundation for adaptive management, as planners can continuously check implementation against objectives to see if results are being achieved and if not, change actions as needed.

Step 10: Capture and share learning. Any management process is iterative, as it must be sustained and adapt through time while individuals come and go and conditions change. Capturing and sharing learning is essential, and the Open Standards, Conservation Action Planning, and other such efforts provide extensive trainings and guidance on how to ensure that learning is retained in the management system to ensure long-term success.

B. Discussion of Roadmap Steps 1–6

Step 1: Regional Conservation Goals and Objectives

For the purpose of developing a regional mitigation strategy, a region should be a defined ecological area such as a watershed, Level III or IV ecoregion, or ecological scale appropriate to the resources impacted.

Regional conservation goals are overarching outcomes that are supported by quantifiable regional conservation objectives. Regional conservation objectives are defined in terms of the Key Ecological Attributes that make up the status of the conservation target, and are measured by the use of appropriate indicators. Each of these terms is defined and discussed below.

- **Conservation goals:** In Open Standards, a **goal** is defined as "a formal statement detailing a desired impact of a project such as the desired future status of a target."[11] Conservation goals need to be "clear, explicit, and defensible" in order to give credibility to regional conservation plans,[12] and typically contain two components: **representation**, or how much of the target is enough; and **quality**, or the "level of viability or ecological integrity of individual target occurrences."[13*] For example, in our illustrative example we developed the following regional conservation goal for Southwestern Willow Flycatcher, drawing on the species' Recovery Plan and criteria for de-listing off the endangered species list (described in more detail in Appendix A):

  > *SP_Goal_2: By 2020, the total known population of Southwestern Willow Flycatcher in the Sonoran ecoregion will have increased to 1,950 territories, with each management unit meeting and holding at least 80% of the minimum population target and each Recovery Unit meeting 100% of the minimum population target identified in the Recovery Plan (Criteria Set A).*

* All of these criteria for conservation goals are similar to the frequently used concept of a SMART goal (Specific, Measurable, Achievable, Realistic, and Timely), but we note that the concept of SMART alone is not enough to guide natural resource manager. The SMART approach does not provide substantive guidance on how to link goals to conservation targets and development impacts.

- **Conservation objectives:** An **objective** is a formal statement detailing a desired outcome or change that planners believe is necessary to achieve the goal.[14] Objectives should be results-oriented, be measurable, have a defined time frame, be specific, and be practical.
In conservation planning, objectives should be defined in terms of the ecological attributes that are needed to ensure the health and viability of the target. These are often referred to as "Key Ecological Attributes" or KEAs. In Open Standards and TNC's Conservation Action Planning framework, there are three categories of KEAs that planners should consider using to define conservation objectives:
    1. "**Size:** Measure of the area of the conservation target's occurrence (for an ecosystem target) or abundance of the target's occurrence (for a species or population target)
    2. **Condition:** Measure of the biological composition, structure and biotic interactions that characterize the space in which the target occurs
    3. **Landscape context:** Assessment of the target's environment including: a) ecological processes and regimes that maintain the target occurrence (e.g., flooding, fire regimes and other kinds of natural disturbance); and b) connectivity that allows species targets to access habitats and resources or allows them to respond to environmental change through dispersal or migration."[15]

The following is one of our example regional conservation objectives for Southwestern Willow Flycatcher (described in more detail in Appendix A). Note that we have framed our example conservation objective for Southwestern Willow Flycatcher using placeholders ("xx") to stand in for the numerical targets that would ideally be determined by a stakeholder-driven process, informed by experts and management agencies:

SP_Obj_2.1 (habitat size): By 20xx, at least xx acres of suitable habitat, meeting minimum thresholds for stream length (xx miles) and proximity to surface water ("good" (25-50 m) or "very good" (0-25 m) as established in the Sonoran REA[16]) will be established in the Sonoran Desert in Arizona.

- **Indicators:** Goals and objectives are defined in terms of measurable **indicators**. Indicators are variables that managers measure to determine whether conservation or mitigation objectives are being reached and actions are effective. The Conservation Measures Partnership defines indicators as "[a] measurable entity related to a specific information need such as the status of a target/factor, change in a threat, or progress toward an objective. A good indicator meets the criteria of being: *measurable*, *precise*, *consistent*, and *sensitive*" (emphasis original).[17] Some indicators measure directly whether a *mitigation objective* is being reached. For example, if a mitigation objective is to reestablish a population of 1,000 tortoises, then regular surveys of tortoise abundance will let the managers know whether the objective is being attained. Indicators may also be used to determine whether *mitigation actions* are being effective. For example, if managers are trying to decrease tortoise mortality by reducing road kill, they might conduct regular surveys of how many tortoises are found dead on the road.

Furthermore, conservation objectives should contribute towards ecosystem **resilience** by planning to increase the size, extent, and connectivity of habitat across the landscape. Resilience is traditionally defined as "a measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables."[18] In conservation planning, resilience commonly refers to the simpler concept of "ensuring that [all species and communities native to a region] can persist and evolve for long periods of time,"[19] whether because they can tolerate disturbance and still maintain their ecological functions and values (a property also called "**resistance**") or because they are able to return to equilibrium post-disturbance.[20]

Many managers and scientists recommend managing for resilience in order to help ecosystems and resources adapt to the new and intensified stresses expected from climate change.[21,22] These stresses will affect different species differently, depending on such factors as how common they are, how specialized their habitat needs are, how mobile they are, how many habitat types they depend on to fulfill their life cycle, and numerous other factors. Due to the broad suite of species, habitats, and resources involved, planning for climate resilience goes beyond the scale of mitigation and should be part of setting broader regional conservation goals in order to account for these many and varying factors.

Step 2: Assessing Impacts

Impact* assessments of residual impacts should be performed on the same target resources and their attributes (KEAs) that were identified as conservation objectives. Impact assessment measures the change in the attribute (stress) as a result of development (threat). Below are some example stresses that might occur to attributes of a vegetative community/habitat or species/population target resulting from a threat such as development:

Size: Measure of the area of the conservation target's occurrence (for an ecosystem target) or abundance of the target's occurrence (for a species or population target).

- e.g., for a vegetative community/habitat target: habitat loss or conversion
- e.g., for a species/population target: loss of occupied habitat; direct mortality or displacement

Condition: Measure of the biological composition, structure and biotic interactions that characterize the space in which the target occurs.

- e.g., for a vegetative community/habitat target: undesirable change in species composition or abundance; decreased "intactness"
- e.g., for a species/population target: loss of key resources (food, water, breeding sites, etc.)

Landscape context: Assessment of the target's environment including: a) ecological processes and regimes that maintain the target occurrence (e.g., flooding, fire regimes and other kinds of natural disturbance); and b) connectivity that allows species targets to access habitats and resources or allows them to respond to environmental change through dispersal or migration."[23]

- e.g., for a vegetative community/habitat target: undesirable change in landscape pattern in vicinity of development site(e.g., reduced connectivity, increased fragmentation); undesirable change in key ecological processes within the development site's "functional unit"
- e.g., for a species/population target: reduced genetic connectivity; disruption of movement corridors

Step 3: Mitigation Objectives

A mitigation objective defines what needs to be done to achieve mitigation. Achieving mitigation means offsetting the impacts of development. Impacts are defined in terms of Key Ecological Attributes (KEAs) (Step 2). As previously described, KEAs are derived from the regional conservation objectives (Step 1) and measured using indicators. Thus, a good mitigation objective is linked to both the regional conservation objectives and development impacts through the KEAs that were previously established.

It is important that any mitigation strategy clearly and correctly define and distinguish between regional conservation goals and objectives and mitigation objectives. Compensatory mitigation objectives, described throughout this report as "mitigation objectives" (see Appendix C for examples of avoidance, minimization, and compensatory mitigation objectives for creosote-bursage vegetation) define the results needed to offset development impacts. The offset of these impacts contribute to achievement of broader regional conservation goals and objectives described in Step 1.

* BLM and many stakeholders in the region refer to the combination of "stresses" and "threats" collectively as "impacts."

Step 4: Mitigation Actions

Mitigation actions are conservation actions tailored to achieve mitigation objectives by improving the status of the target resource in a location other than at the development site. An action must provide a mitigation benefit (i.e., contribute towards a mitigation objective). An action that provides conservation benefits but not mitigation benefits is not, by definition, a mitigation action.

Mitigation actions should be chosen **prior** to the selection of mitigation sites, with few exceptions, and **must** be tied to mitigation objectives. If mitigation actions are chosen before mitigation objectives are established and finalized, actions will be conservation, not mitigation.

A good mitigation action must provide a mitigation **benefit**. To provide a mitigation benefit, the action should:

- Achieve **equivalency** in that there is correspondence between the outcome of the mitigation action and the impact(s) requiring compensation, as defined in the conservation goals and objectives. For example, since Sonoran desert tortoise are a BLM Special Status Species and a candidate species for listing as threatened or endangered, they require "like-for-like" compensation such that if development kills desert tortoises, then mitigation must improve desert tortoise population numbers, likely by reducing another source of mortality.

  Methodologies exist for calculating functional equivalency using habitat size and condition as the "currency" for equating impacts and compensation; these methods are commonly used in evaluating restoration projects. Determining equivalency may be more challenging when the proposed mitigation is something other than restoration, such as changing designations or undertaking management activities such as building fences, where there may be a longer time lag or a less clear causal connection between the action and the species or habitat that benefits.

- Create **additional benefit** by ensuring that actions add to existing management. In other words, actions must be more than existing management obligations to remove threats.* In particular, agencies must be able to demonstrate that actions taken in already protected areas meet mitigation objectives and are not used solely for the benefit of existing protected area management goals (although meeting these existing goals may be a valuable side benefit of mitigation actions). Agencies must also uphold accountability by maintaining a ledger of mitigation actions undertaken and completed additional to existing conservation obligations.

  For example, protecting relatively high-value habitat that is *not* under threat within some defined time frame is unlikely to contribute an additional mitigation benefit that can be used to offset impacts. The planner must ultimately assess the offset available from protecting a site threatened by future activities at the site-specific level. However, landscape-scale threat assessments such as models of near-term future Terrestrial Intactness, near-term and long-term development, and long-term climate change impacts (all of which are data products of the Sonoran REA) may be useful in an initial identification of potentially threatened sites that might benefit from protection.

- Achieve **durability**. To be durable, mitigation actions must be "effective for the duration of the development's impacts on the affected resource values and functions."[24] For example, in the desert southwest solar development will likely disturb creosote bush, a plant species with some individuals known to be among the oldest living organisms on earth, and creosote bush in general is susceptible to disturbance and has low germination success outside of a narrow precipitation band.[25] Any mitigation must account for the temporal nature of these

* We recognize that in practice, while agencies are obligated to enforce existing laws and policies they often lack the resources to do so and therefore threats to resources continue unabated, and in such cases managers may be tempted to use mitigation funds to pay for needed law enforcement. We caution that any agency seeking to use mitigation funds to pay for existing law enforcement obligations may confront a slippery slope that does not, in fact, result in the desired outcome of both permitting development and leaving resources better off than they were before.

types of impacts. Durability, in this context, has three tenets:

- Durability as to designation – i.e., conservation designations will endure over time;
- Durability as to management – i.e., the authority and the obligation to actively manage for conservation over time; and
- Durability as to funding— i.e., ongoing funding for conservation management actions is assured over the requisite time period.

- **Be feasible,** meaning that the action can surpass the political, technical, and financial hurdles to getting done. With adequate information, projects can be rated on their feasibility before implementation, although conducting such a rating may require specialized knowledge not possessed by all stakeholders. An example of an action with a potentially low technical feasibility rating would be a vegetative restoration project in the arid Mojave Desert. The political feasibility of actions that require changes in regulations will vary depending on the political climate both within and outside the planner's organization. As an organization or agency gains more experience in particular mitigation techniques, the planner will be better able to judge their feasibility.
- As described above, **resilience** is an important factor to keep in mind when developing conservation objectives. In the context of mitigation, we recommend asking two questions about the resilience of any given mitigation project: 1) whether the project contributes to the targets' overall ability to persist and evolve (i.e. its conservation objectives), rather than creating an isolated pocket of mitigation that does not contribute to overall long-term conservation, and 2) whether a chosen combination of actions and sites represent viable long-term investments when viewed from a perspective of changing threats and species' long-term needs (i.e., the mitigation project and its achievement of mitigation objectives will persist for a long period of time).

Step 5: Mitigation Sites

Mitigation sites should be selected where there is a high likelihood of achieving the desired mitigation objectives. In turn, whether or not these objectives are reached depends on the effectiveness of the mitigation actions taken at the site (using the aforementioned criteria). It is best to first identify mitigation actions that have a high likelihood of success and then to find sites where these actions can be successfully carried out. It may be much harder to achieve objectives if the sites are chosen first, before deciding on the best mitigation actions, as actions will then be dictated by what is possible on site rather than tailored to what is most likely to meet mitigation objectives.

It is important to note that in certain circumstances, it may not be feasible to mitigate for all impacts to a particular resource at a single mitigation site. Consider, for example, a situation in which development in a particular area causes two different impacts to the local desert tortoise population, direct mortality from crushing and lost genetic connectivity by disturbance in a dispersal corridor. A mitigation site chosen because actions there could increase the long-term survival rate for desert tortoise may not mitigate the loss in genetic connectivity. An additional site where it is possible to meet mitigation objectives for connectivity would be required in this case.

Potential mitigation sites should be screened to ensure they meet the following minimum criteria:

1. Candidate compensatory off-site mitigation sites must be located within the **same ecoregion** (e.g., EPA Level III ecoregion) as the development site(s).
2. Candidate compensatory off-site mitigation sites must be located within the **same ecological subregion** (e.g., EPA Level IV ecoregion, watershed, or other appropriate ecological boundary delineator) as the development site(s). In addition, impacts on a threatened or endangered species must be mitigated in the same recovery unit, and impacts from groundwater pumping must

usually be mitigated in the same or a hydrologically connected groundwater basin.

3. To avoid complications arising from multi-state, multi-agency coordination and implementation, candidate compensatory off-site mitigation sites should ordinarily be located within the **same state** as the development site(s), except, for example, where compensation for groundwater pumping from a bi-state basin may extend to the adjoining state or where all regulatory agencies with authority over mitigation approvals determine that the best place to achieve the goals and objectives of the mitigation occurs in a neighboring state.

4. To the extent possible, the location of the candidate compensatory off-site mitigation sites should be based on the **geographic distribution of the species or feature impacted**. For example, the least common/most restricted feature could be:

    a. A rare plant,

    b. The Mohave ground squirrel,

    c. A riparian corridor or spring,

    d. Non-biological resources such as lands with wilderness characteristics.

    If the least common and most geographically restricted feature limits regional mitigation candidate areas to places that do not meet all mitigation needs, it may be necessary to mitigate for the least common and most geographically restricted feature separately and in addition to the regional mitigation obligations.

5. Candidate sites should also provide or be **adjacent to sites that provide heterogeneity** in biota, climate factors, or physical gradients that will accommodate the long and short-term movement and life cycle needs of species, including over time in response to climate change.

6. Candidate sites should occur in areas where **surrounding land uses are likely to preserve and enhance mitigation benefits over time** and not provide additional sources of threat, such as human trespass, invasive vegetation, dust deposition, light pollution, etc.

7. Finally, the candidate compensatory off-site mitigation site must have the **same biological values that require compensatory off-site mitigation as well as similar species, habitat types, and natural features** as the development site(s), including topography, hydrology (e.g. wetlands, seeps and springs, playas, and riparian habitat), geology, plant communities (both the impacted major habitat types found in the development site(s) and any unusual plant assemblages identified), wildlife linkages and corridors, areas important for ecological processes such as sand or sediment transport, and groundwater infiltration zones and aquifer linkages to surface water expressions.

8. Ideally, mitigation sites would be chosen to be **of adequate size to fulfill mitigation objectives**. However, to allow for flexibility in selecting final actions and in case impacts are not precisely estimated, candidate mitigation **site acreage must be of comparable or greater contiguous size than the development site(s)**, and/or include lands contiguous to or within much larger protected areas (e.g. inholdings in National Park/National Preserve). Acquisition of scattered, isolated, smaller parcels for mitigation of development within a development site(s) is not acceptable, absent unusual circumstances such as the need to mitigate for the damage or loss of several rare plant species with restricted and disjunct populations.

Sites meeting the above criteria represent good mitigation candidate sites and can be identified using GIS or other landscape-scale screening tools or data such as resource inventories. **These sites should be further assessed to see if mitigation actions can be successfully implemented and mitigation objectives met.** In some cases, stakeholders or planners may have already identified suites of actions needed on the site, some of which may align with mitigation actions and therefore the assessment as to whether mitigation objectives can be met can be made at the same time as the candidate site screening process.

In other cases additional site-specific assessment must follow to determine if mitigation actions are appropriate and if mitigation objectives can be achieved. To determine whether a proposed site is suitable for mitigation, a mitigation strategy must as much as possible quantify: (1) unavoidable impacts likely to occur as a result of development and requiring compensatory offsite mitigation and (2) value of potential sites for compensatory offsite mitigation. Mitigation value is dependent on the particular actions implemented at the site, which includes the site's ability to support an action—e.g. restoration of connectivity habitat.

Once mitigation sites have been identified for all impacted resources, sites should be given higher priority based on factors such as whether they have (1) high mitigation value for multiple impacts and/or resources (2) high mitigation value for impacts and/or resources that cannot be addressed at other sites, and (3) in the case of sites that provide equivalent mitigation values, also provide additional conservation values beyond the mitigation value. The final portfolio of mitigation sites should be based on maximizing the greatest number of mitigation objectives for the greatest number of resources.

Step 6: Mitigation Site Objectives

The mitigation strategy must include **mitigation site objectives** that detail the desired results for each mitigation action on each mitigation site. Mitigation site objectives should be specific and measurable, and linked to mitigation and conservation objectives via a clear conceptual model, such that staff implementing a mitigation strategy can monitor results and if the mitigation objective is not being met, adapt management accordingly.

Steps 7 – 10: Monitoring, Implementing, Adapting, Learning

This paper does not detail the remaining steps (7 – 10) of the Roadmap. Steps 7 – 9 include: identify monitoring objectives, implement actions and monitoring, and analyze monitoring data in order to adapt management accordingly. To assess mitigation effectiveness, project managers monitor the right indicators, namely the objectives—the results—themselves. A common mistake is to monitor the mitigation activities, such as number of desert tortoises translocated, rather than monitoring the mitigation objective, which might be that translocation results in a new, viable population of desert tortoises at the translocation site. In instances where the mitigation hypothesis was incorrect (i.e. the mitigation action, even when successfully implemented, did not result in achievement of mitigation objectives) or implementation failed and must be improved, monitoring the right information will allow the manager to assess results and adapt strategies, where necessary. Lastly, the longevity of a mitigation strategy centers in stakeholders' ability to capture and share learning. Step 10, capturing and sharing learning, is essential, and the Open Standards, Conservation Action Planning, and other such efforts provide extensive trainings and guidance on how to ensure that learning is retained in the management system to ensure long-term success.

<u>Table 1: Definitions of key terms adapted from the Open Standards</u>	
Target (biological)	A target is an element of biodiversity like a species, habitat, or ecological system that is the focus of the mitigation planning effort. Examples of targets used in this report include populations of desert tortoises and riparian vegetation. In the BLM SRMSs targets are commonly referred to as "resources," and occasionally as "conservation elements."
Threat	A human activity that directly or indirectly degrades one or more targets. For example, ground clearing for utility-scale solar development is a threat to desert tortoise.
Stress	The direct effect that a threat has on the target species or habitat. It is described in terms of which attribute of the target is affected (e.g. size, condition, or landscape context). For example, the threat of ground clearing for utility-scale solar development may cause stresses on desert tortoise including direct mortality due to crushing (a stress to the species' size or abundance attribute), loss of breeding habitat (a threat to the species' condition attribute), or loss of connectivity habitat (a threat to the species' landscape context attribute). The BLM does not distinguish between threats and stresses, instead grouping them under the term "impacts." Distinguishing between the two is helpful because it forces managers to focus their attention on individual stresses, which are likely to need different types of mitigation.
Goal	A formal statement detailing a desired impact of a project such as the desired future status of a target. Goals should be directly associated with one or more conservation targets, represent the desired future status of the target over the long term, be measurable, have a defined time frame, and be specific. For example, below is a regional conservation goal for Southwestern Willow Flycatcher, drawing on the species' Recovery Plan and criteria for de-listing off the endangered species list: *SP_Goal_2: By 2020, the total known population of Southwestern Willow Flycatcher in the Sonoran ecoregion will have increased to 1,950 territories, with each management unit meeting and holding at least 80% of the minimum population target and each Recovery Unit meeting 100% of the minimum population target identified in the Recovery Plan (Criteria Set A).*
Objective	A formal statement detailing a desired outcome or change that planners believe is necessary to achieve the goal. Objectives should be results-oriented, measurable, have a defined time frame, be specific, and be practical. For example, below is a regional conservation objective for Southwestern Willow Flycatcher (with placeholders ("xx") standing in for numerical targets that would ideally be determined by a stakeholder-driven process, informed by experts and management agencies: *SP_Obj_2.1 (habitat size): By 20xx, at least xx acres of suitable habitat, meeting minimum thresholds for stream length (xx miles) and proximity to surface water ("good" (25-50 m) or "very good" (0-25 m) as established in the Sonoran REA[26]) will be established in the Sonoran Desert in Arizona.*
Conservation or Management Action	A specific intervention undertaken to reach one or more objectives. In the case of reaching mitigation objectives, actions are referred to as mitigation actions. Examples of mitigation actions include habitat restoration or enhancement, closing degraded areas to other human uses, acquiring high-value habitat at risk of future degradation, etc.

Using the Roadmap: Applying our Results-Based Approach to a Regional Mitigation Strategy

As discussed above, we developed a case study of illustrative examples using the principles embodied in the Open Standards and described above in this report. The Open Standards and other results-based management approaches provide a basis for monitoring and evaluating the effectiveness of management actions. Results-based management approaches emphasize understanding the causal connections between management interventions and the desired outcomes that these activities produce in terms of reducing **threats** and **stresses** affecting biological **targets**. A primary difference between results-based management and other approaches is the emphasis on describing desired results in terms of management outcomes rather than the implementation of actions.

The case study of illustrative examples is contained in Appendix A. This Appendix details the process and results of developing our example regional conservation goals and objectives, mitigation objectives, impacts assessment, mitigation actions, and mitigation sites for utility-scale solar development in the Sonoran Desert. Below we describe the steps we undertook to develop the case study.

Pre-step 1: To illustrate the relationship and application of the proposed mitigation approach, we selected four resources **likely to be affected by solar development**: (1) creosote-bursage vegetation, (2) riparian vegetation, (3) Sonoran desert tortoise, and (4) Southwestern willow flycatcher. These resources were chosen because they represent both generalist and specialist species and habitat types, are iconic components of the Sonoran Desert ecosystem, and in the case of riparian habitat and the two species, represent declining and/or imperiled resources that warrant in-kind compensatory mitigation.

After selecting the four resources, we developed simplified **conceptual models** for each one, as described in the box on p 3. As used here, a conceptual model is a tool that visually portrays the main cause and effect relationships assumed to exist among threats, stresses, and biological targets (resources). For this project, we focused our conceptual models on threats and stresses representing direct and indirect impacts of utility-scale solar development. We based these conceptual models on existing assessments, including the BLM Rapid Ecoregional Assessment (REA), The Nature Conservancy's Sonoran Desert Ecoregional Conservation Assessment Report (TNC Ecoregional Assessment), and the work of the BLM Arizona office on developing a SRMS for three Arizona SEZs. Appendix C to this memo demonstrates and details how we used a conceptual model to develop example regional conservation goals and objectives and mitigation objectives.*

Step 1: Our first step was to select conservation goals and objectives for both species and vegetative communities at a regional scale, using goals and objectives drawn from the management plans and associated literature from BLM, AZGFD, FWS, TNC, and their technical teams and advisory boards. For the purposes of this project, we identified regional goals and objectives at the scale of the Sonoran Desert in Arizona.

The example regional conservation goals for this project meet the SMART elements discussed above, and are linked to specific targets. In addition, the regional conservation goals are written in terms of desired future status of the target in terms of both representation and quality (e.g. amount of habitat rated "good" or "very good" for Terrestrial Intactness) and the regional conservation objectives are written in terms of desired intermediary results (e.g. ability of actions to influence specific measures of connectivity, habitat condition, or mortality).

Both our goals and objectives were identified in terms of measurable indicators at different scales. For example, we used Terrestrial Intactness to define regional conservation objectives for the creosote-bursage vegetation type. Terrestrial Intactness is a landscape-scale indicator available through the Sonoran REA, but both its relatively coarse resolution (1 km is the finest available) and its synthetic nature (the fact that it is created by

* Note that while the focus of this project is on compensatory mitigation, a results-based approach can be used to make assumptions and hypotheses explicit and measurable for any type of conservation or mitigation intervention. Appendix C describes the use of conceptual models to show not only how to develop compensatory mitigation objectives but also how to develop example avoidance and minimization objectives as well.

combining several submodels) mean that it is a "lagging" indicator, where measurable results may only be detected once numerous actions at a variety of scales are complete. It is therefore appropriate to use it as a regional indicator for measuring progress towards an overall long-term goal, as we have done with creosote-bursage vegetation. Conversely, the submodels of Terrestrial Intactness can be considered "leading" indicators that are predictive of the final Intactness score, and therefore they may be more appropriately used at smaller scales, shorter timelines, or to measure more specific things such as individual conservation or mitigation objectives.

One thing that no component of the Sonoran REA Terrestrial Intactness indicator can model is the presence or absence of particular species, species richness, or species rarity. Instead, the Sonoran REA, like many similar assessments, relies upon species richness data based upon state Natural Heritage programs that track species occurrences (produced by NatureServe) and individual species distribution models produced by USGS or the state wildlife agency. A wide variety of approaches are used to develop these models, which are often based on vegetation, topography, and soil characteristics, with known species occurrences used to define the parameters of the model. These indicators can tell you where a species is likely to be found, but not how many there are (size/extent), what their reproductive success rates are (condition), or how well connected they are genetically to neighboring populations (context)—some of the attributes of a species conservation target that contribute to its overall success and viability.

To measure these attributes, a finer scale of indicator is required, often measured in the field at sites of impact and conservation/mitigation action. The Sonoran REA developed indicators and a rating system from Poor to Very Good for multiple attributes for each of its species-specific Conservation Elements, based on a literature review.[27] We used these indicators in setting our example conservation objectives for the Sonoran desert tortoise and Southwestern willow flycatcher.

Step 2: We used our conceptual models to identify stresses caused by utility-scale solar development to Key Ecological Attributes of our target resources. Impacts in the illustrative model are described only by the type of impact that is likely to occur, and are not quantified.

Step 3: We developed example compensatory mitigation objectives that connect stresses from a particular threat (losses of particular values or functions, as described in Table 1 above) to broader regional conservation objectives that describe the acceptable status of that particular value or function at a landscape scale.

Step 4: We identified a suite of example actions to achieve compensatory mitigation objectives for utility-scale solar energy (and associated road) development on our four conservation targets in the Sonoran desert. Planners considering implementing these actions would need to take into account the principles for mitigation actions described above (equivalency, additionality, durability, feasibility, and resilience) and attempt to maximize as many principles as possible in order to optimally achieve mitigation objectives.

Step 5: In order to model the identification of mitigation sites, we chose to return to the real-world example of the BLM's Arizona SRMS process and several candidate mitigation sites nominated by TNC, rather than continue with our illustrative examples. Using real-world data and information helped us ground our site assessment case study in actual places on the landscape rather than in theoretical locations.

How does our framework differ from BLM's approach?

As described in the beginning of this report, the BLM is using SRMSs to "identify any unavoidable impacts from solar energy development in an SEZ that may warrant regional mitigation and [] identify potentially appropriate regional mitigation locations and actions"[28] and develop "a more systematic approach for identifying and addressing requirements for off-site mitigation actions."[29] SRMSs are being conducted under two forms of guidance: the Draft Procedural Guidance for Developing Solar Regional Mitigation Strategies (hereinafter "Draft SRMS Guidance") and

BLM Interim Policy, Draft-Regional Mitigation Manual Section-1794.

The Draft SRMS Guidance outlines seven elements as the basis for an SRMS, as shown in Table 2 below and compared to the steps of our proposed results-based approach to regional mitigation. While the approaches share a significant amount of similarities, the most glaring difference is the relationship in our proposed approach that nests ***mitigation as a subset of conservation—meaning that all mitigation actions contribute towards conservation in some way, but not all conservation actions contribute towards mitigating the impacts of development.***

The Draft SRMS Guidance provides information on what each of the seven elements should include. However, the BLM has struggled to consistently connect the various elements to one another. In the absence of clear linkages between mitigation actions and anticipated outcomes, it is not possible to demonstrate effectiveness, learn across projects, and ultimately to determine the extent to which mitigation funds are well spent. Furthermore, these outcomes must directly address anticipated or unavoidable impacts resulting from development, even as they contribute to broader conservation goals. Ultimately, the mitigation strategy must provide a way to evaluate the effectiveness of actions in terms of their ability to achieve both mitigation and broader conservation outcomes, rather than simply track the implementation of actions that may or may not achieve desired outcomes.[30]

Goals, Objectives, and Impacts Assessments: The BLM's regional conservation goals and objectives lack the specificity of quantitative desired results for Key Ecological Attributes. Instead, they provide only limited guidance for developing regional mitigation objectives. Without such detailed guidance, BLM mitigation planners and other stakeholders engaged in the SRMS process must posit their own regional conservation goals and objectives, relying on their own assumptions and perspectives. Due to the lack of useful underlying regional conservation goals and objectives, the impact assessments have been disconnected from the development of regional mitigation objectives.

The Colorado SRMS draft impact tables improved upon this approach, including a Rationale table for each SEZ that identified not only whether there was expected residual impact to a resource, but also how certain it is that residual impacts will occur, how significant those impacts are onsite and in the region, what the resource's role is in the ecosystem, and other considerations, all adding up to a justification for why or why not regional mitigation is warranted for each impacted resource on each SEZ. The Rationale tables also provided quantitative estimates of impacts in a number of places, as well as substantial clarifications and justifications for decisions and assessments in detailed endnotes to each table. This approach provides a stronger foundation for developing regional mitigation objectives based on clear and transparent connections to impacts.

Even with these improvements, however, we have seen relatively few cases where BLM has described measurable mitigation objectives and incorporated indicators. For example, Objective 2 for Goal 8 of the Colorado SRMS is to "enhance groundwater recharge and protection through creation of additional wetlands within 1-5 years of SEZ development."[31] While this would no doubt be a valuable conservation action, it is not tied to an indicator that measures SEZ impacts and therefore can ensure that it provides mitigation. Without that information, stakeholders have no way to hold the BLM accountable for how many acres of wetlands are created or enhanced or where they should be, nor do BLM implementing staff have much guidance for how to go about creating such projects.

Mitigation Actions and Sites: Throughout the SRMS process, the BLM has relied upon stakeholders to submit mitigation actions alongside of, or after, submitting candidate mitigation sites. The BLM has generally asked for these submissions prior to finalizing, and in some cases prior to even presenting draft versions of, regional mitigation objectives. Although actions proposed by stakeholders and selected by BLM may indeed be related to the impacts and may represent valuable conservation investments on the proposed sites—without having articulated mitigation objectives first, there is little certainty that successfully implementing the proposed actions will actually result in offsetting the impacts of utility-scale solar energy development.

Table 2: Comparing the steps in our proposed results-based approach to regional mitigation with the BLM's elements of a Solar Regional Mitigation Strategy	
Steps in the proposed results-based approach	**BLM Draft SRMS Guidance - Elements of a SRMS**
Pre-Step 1: Identify conservation targets/resources likely to be identified by development	
Step 1: Develop regional conservation goals and objectives.	
Step 2: Characterize anticipated impacts resulting from development.	Element 1: A description of the SEZ and regional baseline conditions against which unavoidable impacts are assessed.
	Element 2: A preliminary assessment of the degree of impacts to resources and identification of which potential unavoidable impacts may warrant regional mitigation.
Step 3: Develop mitigation objectives for each impact.	Element 3: The identification of regional mitigation goals based on the goals and objectives identified in approved resource management and/or land use plans.
Step 4: Identify mitigation actions for each objective. Step 5: Identify mitigation sites to implement actions. Step 6: Identify mitigation site objectives.	Element 4: The evaluation and recommendation of appropriate mitigation investment locations, objectives, and actions.
	Element 5: The preliminary identification and recommendation of a method for calculating mitigation compensation for unavoidable adverse impacts that potentially warrant mitigation.
	Element 6: The preliminary identification and recommendation of a management structure to hold and apply mitigation investment funds.
Step 7: Identify monitoring objectives. Step 8: Implement actions and monitoring. Step 9: Analyze, use, adapt. Step 10: Capture and share learning.	Element 7: Planning for mitigation implementation and the development of long-term monitoring and adaptive management recommendations to evaluate and maximize the effectiveness of regional mitigation actions.

Regional Mitigation in Arizona: Moving Beyond the BLM's Solar Energy Program

The BLM occupies a unique position in its ability to develop a regional mitigation strategy, as it controls decision-making on the public lands. Even with this advantage, however, it has been struggling to connect objectives and planned actions and sites back to impacts to ensure measurable mitigation *results*. Following our process, or incorporating its principles into the SRMS process, can help the BLM move towards a framework whereby managers, the public, and developers all have certainty that renewable energy development on public lands genuinely contributes to improved conservation outcomes.

In Arizona, a number of other regional planning projects are underway, including the Interstate 11 Corridor project managed by the Arizona Department of Transportation, and future anticipated transmission development on public and private lands, including a review of designated West-wide Energy Corridors. These planning initiatives offer an opportunity to develop consistent region-wide approaches to mitigation, addressing a range of development-related impacts on public lands.

Any form of development can benefit from our approach as long as managers stay focused on the process. However, agencies or organizations that are not land managers may find that they have additional considerations, such as actions that are more expensive on private than on public lands, or challenges finding willing sellers or partners, or different regulatory issues, than the BLM does. These other agencies may be able to use conservation or mitigation banks, which are common in the private sector. They may also find that the impacts they address are unique: for example, highways may present particular impacts to connectivity in addition to habitat loss, while transmission lines may not cause much loss of habitat but may cause direct mortality impacts to species via collision or increased predation by corvids that perch on the lines.

Role of Stakeholders

Stakeholders can and should be engaged throughout every step of developing the regional mitigation strategy. Content and local experts should be brought in early on, when identifying conservation targets, goals, and objectives, and even when defining the regional scope of the plan. The Conservation Measures Partnership recommends identifying a project team, which may change in size and composition at different stages of the project. For example, an initial visioning session might benefit from the involvement of a third-party facilitator as well as representatives from a wide variety of local, regional, and national conservation organizations, wildlife and natural resource management agencies, researchers and scientists, and interested citizens. Later, this initiating project team might transition to a smaller number of people who work closely together to design and manage the plan. An essential element to ensuring successful stakeholder engagement is that project teams "explicitly identify the assumptions under which they are operating and then systematically test each assumption to see if it holds in their project context. This explicit and systematic testing of assumptions is a key facet that helps project teams uncover the *why* behind their project successes and setbacks."[32]

Below we address examples of opportunities for stakeholder involvement in steps 1 – 5 of developing a successful regional mitigation strategy.

Pre step-1 in our framework, identifying conservation targets, is an early opportunity for stakeholder engagement. The project team must define the region of interest using maps and other geographic resources, generate a statement of overall vision for the project, and identify conservation targets. Stakeholders and their knowledge of the system will be invaluable in developing conceptual models that define the relationships between the conservation targets, threats and stresses, and other elements of the ecosystem, which can often be done qualitatively.

In step 1, setting conservation goals and objectives, stakeholders, planners, and scientists must come together to use all available information to develop measurable objectives that support clear goals. It is important that stakeholders separate science from feasibility and policy. While policy makers and other stakeholders might identify the goal for a species as a minimum viable population, ecologically viable population, recreationally viable population, or commercially viable population (or other goals), scientists and researchers must conduct a viability assessment to define the population numbers that would make up a measurable objective.[33] If during the conservation planning process, policy makers and other stakeholders find the actions that would be required to meet objectives infeasible given existing scientific information, it is their choice to revisit and modify conservation goals accordingly.[34]

Stakeholders can also play a key role in Step 2, identifying impacts, by sharing their knowledge of the places in the region where development is expected to occur. GIS datasets, conservation inventories, species models, and other tools that stakeholders and external advisors can provide may all prove valuable during the impacts identification process.

Steps 3 and 4, developing mitigation objectives and actions, rely heavily on planners to build upon the existing conservation plan, conceptual models, and impacts assessments to propose mitigation objectives and actions. Stakeholders can and should assess planners' work and contribute to the development of these steps.

Step 5, identifying mitigation sites, is a particularly valuable place for stakeholder involvement as local stakeholders, in particular, may have knowledge of particular parcels of land that would represent good opportunities to undertake mitigation actions. As with impacts identification, stakeholder resources including maps, models, and inventories can all contribute to identifying sites where mitigation actions can occur to meet mitigation objectives.

Conclusion

By following the roadmap, mitigation outcomes will offset development impacts and contribute to regional conservation goals. A successful regional mitigation strategy connects each step in the process to the steps that follow.

Pre-step 1: Identify resources likely to be affected by development.
Step 1: Develop or identify regional conservation goals and objectives.
Step 2: Characterize anticipated impacts resulting from development.
Step 3: Develop mitigation objectives for each impact.
Step 4: Identify mitigation actions for each objective.
Step 5: Identify mitigation sites to implement actions.
Step 6: Identify mitigation site objectives.
Step 7: Identify monitoring objectives.
Step 8: Implement actions and monitoring.
Step 9: Analyze, use, adapt.
Step 10: Capture and share learning.

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Appendix A: Illustrative Examples of the Steps of a Regional Mitigation Strategy for Solar Development in the Sonoran Desert

As described above in the report, we applied the steps in our results-based approach to regional mitigation to the illustrative example of solar development in Arizona's Sonoran Desert. Our general process is described above; what follows are the examples we developed.

Step 1: Illustrative regional conservation goals and objectives for conservation targets

Vegetative community regional goal #1 (target- Creosote-bursage): We started with the example goal that TNC submitted as part of the AZ BLM SRMS process for the creosote-bursage vegetative target as part of our first vegetative community goal.* This goal is a broad statement representing the desired status of the biological target over the longer term. It uses the concept of "intactness" to define condition, similar to the BLM's measure of "Terrestrial Intactness" as defined in the Sonoran Rapid Ecoregional Assessment (which incorporates metrics of habitat fragmentation, development disturbance, invasive vegetation, and increased fire regime).[1] Each of these metrics occurred as threats or stresses in our conceptual model (Appendix C), contributing to the overall status of the target. We have framed our example goal and objectives for creosote-bursage using placeholders ("xx") to stand in for the numerical targets that would ideally be determined by a stakeholder-driven process, informed by experts and management agencies, and have used Terrestrial Intactness as a placeholder indicator for condition as well.

The "Terrestrial Intactness" potential indicator for VEG_Goal_1 combines influences on size of the vegetative community (i.e. development disturbance), habitat condition (i.e. invasives), and landscape context that include ecological processes (i.e. fire regime) and connectivity (i.e. fragmentation).We also identified specific regional conservation objectives (in placeholder format) for three attributes that can be used to define the status of the target. Ultimately, mitigation objectives should link directly to attainment of one or more of these regional conservation objectives. Ideally, regional conservation objectives will each reflect one of those influences to ensure that they collectively contribute to achieving the conservation goal.

> *VEG_Goal_1: By 20XX, creosote-bursage desert scrub habitat will meet or exceed xx acres within the Sonoran ecoregion, of which xx% meets "established" criteria for adequate condition and connectivity as measured by ["Terrestrial Intactness."]*
>
> *VEG_Obj_1.1 (habitat size): By 20XX, xx acres of creosote-bursage desert scrub habitat will be established within the ecoregion.*
>
> *VEG_Obj_1.2 (habitat condition): By 20XX, xx% of established creosote-bursage desert scrub habitat in the ecoregion will achieve at least xx% native vegetation cover [or other measure of habitat condition, such as vegetation departure from historic conditions].*
>
> *VEG_Obj_1.3 (landscape context/ habitat connectivity): By 20XX, xx% of established creosote-bursage desert scrub habitat in the ecoregion will achieve greater than [xx score on a measure of connectivity, for example the "Low Natural Habitat Fragmentation" submodel of the Sonoran REA Terrestrial Intactness model[2]]. An alternate way to consider this goal might be in terms of desired condition within known connectivity corridors, such as "By 20XX, historic creosote-bursage vegetation overlapping with Arizona wildlife zones will achieve at least xx% native vegetation cover."*

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* TNC provided the following example goal for Creosote-Bursage Desert Scrub: "Maintain or restore Sonoran-Mojave Creosotebush-White Bursage Desert Scrub in moderately-high to very-high intactness across 80% of its current distribution in the Sonoran Desert in Arizona."

Species regional goal #1 (target- Sonoran desert tortoise): The desert tortoise is a key species of the Sonoran desert, and is closely associated with creosote-bursage scrub habitat. It is a candidate for listing under the Endangered Species Act and is actively managed both by the BLM and by AZGFD (see Appendix D). While BLM's management policy does not require mitigation for this species outside of designated category I - III habitat defined in the 1988 Rangewide Plan,[3] the BLM's overall goal is to "maintain habitat in order to ensure the existence of viable populations and thus reduce the need for listing the species."[4] While goals and objectives for Category I – III habitat are measurable, these objectives do not provide guidance for the overall population and suitable habitat outside of those three priority habitat designations. The SEZs were sited to avoid Category I – III habitat but development may impact low density populations of tortoise or may impact Category I – III habitat indirectly, so the lack of measurable objectives for overall Sonoran desert tortoise populations and densities makes it challenging to plan mitigation for residual impacts.

The related Mojave desert tortoise is listed as threatened and has an extensive recovery plan that includes population and habitat viability assessments;[5] however the Sonoran desert tortoise does not have a recovery plan and its management falls under several plans developed by the Arizona Interagency Desert Tortoise Team (AIDTT). The BLM follows the AIDTT's 1996 Rangewide Management Plan[6] in addition to its own guidance, and has long had a "no net loss" policy.[7] In the words of AZGFD, "the 1996 plan included management recommendations and options, but listed no goals and objectives nor agency commitments."[8]

We chose to use the recent Sonoran REA as the basis for the attributes and indicators we used to develop example Sonoran desert tortoise regional conservation goals and objectives. The Sonoran REA developed models estimating the current and near-term future status of Sonoran desert tortoise habitat based on "habitat intactness"[9] as well as a set of attributes and indicators to assess species status.[10] However, while these attributes and indicators are helpful for assessing status, as described above there is limited information available to determine desired population sizes and conditions to maintain "viable" populations overall (this could change if the species were listed as threatened or endangered and a Recovery Plan were produced; it was identified as a candidate for listing in 2010[*]). We have therefore framed regional conservation goals and objectives for the Sonoran desert tortoise in terms of meeting or exceeding no net loss, and have included placeholders using habitat objectives as a proxy for species objectives. In other words, while the regional conservation goal captures aspects of population size (abundance), the first two regional conservation objectives identify habitat characteristics that are assumed necessary to support the desired population size. The third regional objective addresses mortality rates, an aspect of the population condition component of the goals.

Given the 2010 ESA Candidate designation, a forthcoming IADTT Candidate Conservation Agreement, and continual ongoing research into the species, new information is and will be available all the time. Stakeholders or planners using our approach and seeking to develop regional conservation goals and objectives for Sonoran desert tortoise may choose to use our example goals and objectives and fill in the placeholders using desired management goals and additional scientific information, or they may choose to define conservation objectives that act on different KEAs supported by other sources of data besides the Sonoran REA. What is important is that stakeholders document their data sources, assumptions, and decisions so that managers can later assess progress towards those objectives or choose to modify them as new information comes to light.

> *SP_Goal_1: By 20XX, Sonoran desert tortoise populations will meet or exceed their current abundance and be stable or increasing in xx% of their range in the Sonoran ecoregion.*

* Note that the AIDTT has developed a Candidate Conservation Agreement with the FWS, signed in 2014, but this document was not available for review at the time of publication.

SP_Obj_1.1 (patch size): By 20XX, xx% of current Sonoran desert tortoise habitat in the Sonoran ecoregion will meet the size criteria for "good" (500-1,000 sq mi) or "very good" (>1,000 sq mi) as established in the Sonoran REA.[11]

SP_Obj_1.2 (habitat condition): By 20XX, xx% of current Sonoran desert tortoise habitat in the Sonoran ecoregion will meet the criteria for "good" (scarce and patchy presence of exotic ephemerals) or "very good" (no presence of exotic ephemerals) habitat degradation as established in the Sonoran REA.[12]

SP_Obj_1.3 (population condition): By 20XX, mortality rates will have stabilized at "Good" or "Very Good" levels (common raven predation rare or absent, as defined in the Sonoran REA[13]*) in xx% of the species range in the Sonoran ecoregion.*

SP_Obj_1.4 (landscape context / population connectivity): Retain functional habitat linkages between all Sonoran Desert Management Areas.[14]

Vegetative community regional goal #2 (target- Riparian areas): In the Sonoran Desert, riparian and xeroriparian communities are a highly valued and scarce resource that have experienced tremendous declines over time. Many of the streams in the Sonoran Desert are ephemeral and therefore it seems more appropriate to use a measure of terrestrial, rather than aquatic, intactness (the Sonoran REA developed models for both). However, "Because of the cumulative impacts of factors such as human water consumption and channel dewatering, climate change, or simple mapping error, >70% of stream length in arid and semi-arid regions in the western U.S. that was historically mapped as permanent is now intermittent or ephemeral"[15]—meaning essentially that there used to be vastly more riparian habitat than there is today.

The Sonoran REA found it challenging to map and identify riparian habitat along the narrow, often ephemeral corridors, in which it exists in the ecoregion. However given known limitations of data availability and refinement, the REA determined that approximately 58% of the existing riparian vegetation (of approximately 1.6 million total acres, according to NatureServe land cover data) in the ecoregion falls into Terrestrial Intactness category Moderately High or above. As this metric only applies to current vegetation, it does not account for riparian habitat previously lost to development or hydrologic change. Given these uncertainties, we developed draft regional conservation goal and objectives for riparian habitat parallel to those for creosote-bursage habitat.

We also note that for the purposes of this project, we are including both xeroriparian and riparian habitat together under the "riparian areas" target. The Sonoran REA similarly combined the two vegetative classes in its coarse-filter conceptual model.[16] However, "xeroriparian habitats are just as important in arid ecosystems; in the lower Colorado River Basin, dry washes occupy <5% of the area, but support 90% of its bird species."[17] In any regional conservation or mitigation planning exercise, stakeholders and managers should consider whether to treat riparian and xeroriparian areas together or separately.

VEG_Goal_2: By 20XX, the extent of riparian habitat will meet or exceed xx acres within the Sonoran ecoregion, of which xx% meets "established" criteria for adequate condition and connectivity as measured by ["Terrestrial Intactness."]

VEG_Obj_2.1 (habitat size): By 20XX, xx additional acres of riparian habitat will be established within the ecoregion.

VEG_Obj_2.2 (habitat condition): By 20XX, xx% of established riparian habitat will meet "good" or "very good" criteria for native vegetation cover [this could be described as a maximum % cover of tamarisk or other invasive riparian vegetation; or measured using vegetation departure from historic conditions].

VEG_Obj_2.3 (landscape context / habitat connectivity): By 20XX, xx% of riparian corridors meet "good" or "very good" criteria for connectivity [for example, this could be described using the "Low Natural Habitat Fragmentation" submodel of the Sonoran REA Terrestrial Intactness model, or a metric such as connected stream miles].

Species regional goal #2 (target- Southwestern Willow Flycatcher): Southwestern willow flycatcher is an endangered species whose historic range encompassed all of Arizona. In the Southwestern deserts they are riparian obligates, particularly for breeding, for which they require dense stands of vegetation in mesic riparian landscapes, usually associated with wetlands and/or at least some surface water present in wet or non-drought years. The species' 2002 Recovery Plan states that:

> "The overall recovery objective for the flycatcher is to attain a population level and an amount and distribution of habitat sufficient to provide for the long-term persistence of metapopulations, even in the face of local losses (e.g., extirpation). This requires that the threats that led to listing the flycatcher as an endangered species are ameliorated. The specific objectives are to recover the southwestern willow flycatcher to the point that it warrants reclassification to "threatened" status, and then further to the point where it is removed from the list of threatened and endangered species. The estimated date for downlisting is 2020. The estimated date for delisting is 2030."[18]

While this particular Recovery Plan goal does not provide measurable indicators of the desired population size and amount and distribution of habitat needed to provide for long-term persistence, the Recovery Plan does include two alternate sets of criteria for meeting the goal of down-listing from endangered to threatened across the species range both in terms of total population and the distribution of territories across recovery units and management units.* A regional conservation goal in this case would need to identify these desired outcomes within the Sonoran ecoregion.

Since habitat loss and degradation is a primary determinant of population size, we focused the regional conservation objectives on specific habitat conditions necessary to support the species' population goal. According to the Sonoran REA, over 70% of the current distribution of potential habitat was classified as Moderately Low to Very Low in terms of landscape intactness (p. 71). Note that the first objective focuses on the size of "suitable habitat" as defined by specific attributes necessary to support the species, rather than on the extent of the vegetative community.

SP_Goal_2: By 2020, the total known population of Southwestern Willow Flycatcher in the Sonoran ecoregion will have increased to 1,950 territories, with each management unit meeting and holding at least 80% of the minimum population target and each Recovery Unit meeting 100% of the minimum population target identified in the Recovery Plan (Criteria set A).

SP_Obj_2.1 (habitat size): By 20xx, at least xx acres of suitable habitat, meeting minimum thresholds for stream length (xx miles) and proximity to surface water ("good" (25-50 m) or "very good" (0-25 m) as established in the Sonoran REA[19]) will be established in the Sonoran Desert in Arizona.

SP_Obj_2.2 (population connectivity): By 20xx, xx% of suitable habitat patches in the Sonoran ecoregion will meet "good" (2-15 km) or "very good" (<2 km) criteria for connectivity based on the distance between occupied sites established in the Sonoran REA.[20]

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* Criteria set A: 1,950 territories/approximately 3,900 individuals across the range, with a specific distribution across Management and Recovery Units that accounts for connectivity and metapopulation dispersal (Recovery Plan pp 77-78). Criteria set A, which is more stringent than B, is also the baseline population level required for de-listing off the endangered species list with the addition of other threat-reduction and habitat-protection requirements and therefore we have chosen it as the basis for SP_Goal_2.

<u>Step 2: Modeling impact identification for utility-scale solar in the Sonoran Desert</u>

Appendix C includes a set of conceptual models that we used to map out the relationships between threats associated with solar development and stresses on Key Ecological Attributes for each of our example conservation targets. **<u>Table 1</u>** below shows a set of selected threats and stresses drawn from the conceptual models. Many of these impacts are applicable to other forms of energy and infrastructure development, such as the access roads and ground impacts associated with powerline construction. For illustrative purposes we have also included two examples associated with road construction and loss of connectivity.

As we were developing illustrative examples only, we could not quantify impacts, only identify the types of impacts (both threats linked to solar development and threats resulting from those stresses). In developing a regional mitigation strategy, it is essential that planners estimate the amount of impacts expected prior to development, in order to ensure that compensatory mitigation is actually likely to be an appropriate strategy for offsetting residual impacts and to help identify appropriate mitigation actions and sites. However, planners do not necessarily need to precisely quantify impacts at the time of developing a regional mitigation strategy—but they *do* need to define the mitigation objectives (Step 3, below) in terms of indicators that will allow measurement of both impacts and compensatory mitigation as development and mitigation proceed.

<table>
<tr><th colspan="4"><u>Table 1: Selected example threats/stresses (collectively referred to as “impacts” by the BLM) from solar development to size, condition, and context attributes of conservation targets</u></th></tr>
<tr><th>Resource</th><th>Size/extent</th><th>Condition</th><th>Landscape context</th></tr>
<tr><td>Creosote-bursage vegetation</td><td colspan="2">Threat: Ground clearing for utility- scale solar development
Stresses: Habitat loss and degradation</td><td>Threat: Ground clearing for utility-scale solar development
Stress: Habitat fragmentation</td></tr>
<tr><td>Riparian vegetation</td><td colspan="2">Threat: Groundwater extraction for utility-scale solar development, driven by demand for cooling and cleaning
Stresses: Lower groundwater tables, leading to reduced expressions of surface water and altered species composition</td><td>Threat: Road crossings across riparian corridors.
Stress: Loss of connected habitat for species’ dispersal along riparian corridors.</td></tr>
<tr><td>Sonoran desert tortoise</td><td>Threat: Ground clearing for utility-scale solar development
Stress: Direct mortality</td><td>Threat: Downwind dust deposition from utility-scale solar development
Stress: Reduced habitat carrying capacity</td><td>Threat: New highway construction
Stress: Loss of genetic connectivity</td></tr>
<tr><td>Southwestern willow flycatcher</td><td>Threat: Groundwater extraction for utility-scale solar development, driven by demand for cooling and cleaning
Stress: Loss of suitable riparian habitat in ecoregion</td><td></td><td></td></tr>
</table>

Step 3: Modeling mitigation objectives for utility-scale solar in the Sonoran Desert

We developed example compensatory mitigation objectives that connect stresses from a particular threat (losses of particular values or functions, as described in Table 1 above) to broader regional conservation objectives that describe the acceptable status of that particular value or function at a landscape scale. Our example compensatory mitigation objectives do the following:

1. Connect to an important KEA as defined in a conservation objective and described in Step 1,
2. Are relevant to the impacts expected from utility-scale solar development as described in Step 2,
3. Are defined in terms of measurable indicators (often as placeholders or potential indicators, as these would need to be defined by the planner or via a stakeholder-driven process), and
4. Are defined in terms of quantitative desired results that can be achieved via one or more actions as described in Table 2 below (we have also generally defined these as "xx" placeholders or, in the case of compensatory mitigation, as achieving a net gain relative to the impacted resource).

Table 2 below shows our example compensatory mitigation objectives and how they connect to regional conservation objectives, impacts affecting Key Ecological Attributes of the conservation targets, and actions to achieve the mitigation objectives.

The sets of mitigation objectives below are not intended to be comprehensive in terms of addressing all of the threats and stresses facing each conservation target, but rather to demonstrate examples of different impacts on different KEAs and how compensatory mitigation might be used to offset each one.

Step 4: Modeling mitigation actions for utility-scale solar in the Sonoran Desert

We identified a suite of example actions to achieve compensatory mitigation objectives for utility-scale solar energy (and associated road) development on our four conservation targets in the Sonoran desert. Planners considering implementing these actions would need to take into account the principles for mitigation actions described above (equivalency, additionality, durability, feasibility, and resilience) and attempt to maximize as many principles as possible in order to optimally achieve mitigation objectives. Example mitigation actions are shown in Table 2 for the mitigation objectives they can contribute to.

Table 2: Example actions to fulfill compensatory mitigation objectives for example stresses affecting attributes of conservation targets

Resource	Stresses affecting attributes	Example Compensatory Mitigation Objective	Example Action(s)
Target scale: Community/habitat			
Creosote-bursage vegetation	1. Reduction in size/extent - loss of community/ habitat on development site	Achievement of a net gain in Sonoran Desert creosote-bursage acres, at an equivalent level of condition (as measured by an indicator at the appropriate scale) relative to those lost to development. *[Connected to: VEG_Obj_1.1 (size) and VEG_Obj_1.2 (condition)]*	● Protect sites with high likelihood of future conversion/loss ● Restore sites with high uplift potential
Creosote-bursage vegetation	2. Degraded/reduced condition - undesirable change in species composition/ abundance on development site - undesirable change in "intactness" on development site	Achievement of a net gain in Sonoran Desert creosote-bursage acres, at an equivalent level of condition (as measured by an indicator at the appropriate scale) relative to those lost to development. *[Connected to: VEG_Obj_1.1 (size) and VEG_Obj_1.2 (condition)]*	
Riparian vegetation	3. Adverse changes to landscape context - undesirable change in landscape pattern in vicinity of development site (e.g., reduced connectivity, increased fragmentation) -undesirable change to key ecological processes within the development site's "functional unit"	Achievement of a net gain in connected riparian corridors in the development site's watershed relative to the [acres, distance, proportion, or other measure of corridor size] of connected riparian habitat lost to development. *[Connected to: VEG_Obj_2.3 (context/connectivity)]*	● Protect sites that provide connectivity and have a high likelihood of future conversion/loss ● Restore sites that provide connectivity and have high uplift potential ● Remove barriers in sites that would otherwise provide connectivity ● Alter management prescriptions/reduce threats that negatively affect same ecological process in sites within the "functional unit" ● Protect sites with a high likelihood of future fragmentation ● Restore fragmented sites

Target scale: Species/population			
Sonoran desert tortoise	1. Reduction in size/extent -loss of occupied habitat -direct mortality (decreased population size)	Achievement of a net reduction in desert tortoise mortality from known sources (e.g. roads) in the ecoregion, relative to direct mortality on-site and post-translocation *[Connected to: SP_Obj_2.3 (population condition)]*	● Establish crossing structures and fences at other roads in the region with known mortality impacts ● Enforce speed limits on roads in areas with known mortality impacts ● Reduce OHV use (that crushes tortoises) in otherwise high-quality desert tortoise habitat
Southwestern willow flycatcher*	2. Degraded/reduced condition -loss of key resources (food, water, breeding sites, etc.)	Achievement of a net gain in each development area's groundwater table levels relative to the groundwater extracted due to development and operations. *[Connected to: VEG_Obj_2.1 (habitat size)—indirect, in ecoregion]*	● Purchase and retire groundwater rights in the aquifer where the development site is located ● Improve runoff/drainage patterns so that modelled water infiltration into the aquifer is increased
Sonoran desert tortoise	3. Adverse changes to landscape/metapopulation context -reduced genetic connectivity -disruption of movement corridors	Achievement of a net gain in habitat quality and protection in key connectivity corridors between Sonoran Desert Management Areas relative to lost connectivity habitat. *[Connected to: SP_Obj_2.1 (size), SP_Obj_2.2 (habitat condition), and SP_Obj_2.4 (context/connectivity)]*	● Restore degraded connectivity habitat associated with one or more (ideally between) the populations where connectivity was impacted.

* Southwestern willow flycatchers are riparian obligate species. Because their populations are drastically reduced from historic numbers, they are unlikely to experience direct impacts from solar development, even where suitable habitat occurs on or near the SEZ (such as at Gillespie SEZ in the BLM AZ SRMS). However, as an endangered species reliant upon stabilization and reversal of long-term trends in riparian habitat loss, they can be considered a "groundwater dependent species," as described in the 6/30/2014 SRMS impacts table (Gillespie, p 9, available at http://www.blm.gov/style/medialib/blm/az/pdfs/energy/solar-mitigate/impact-tables.Par.35711.File.dat/GillespieSEZResourceImpacts63014.pdf). The table also states that "impacts could range from small to large depending on groundwater use for development." Therefore, the mitigation objectives for flycatcher are the same as those for riparian habitat, neither of which will experience direct size (ie acreage loss or mortality) impacts from SEZ development, but both of which could experience indirect impacts mediated by groundwater extraction.

Step 5: Case study: assessing nominated candidate sites for mitigation in the BLM Arizona SRMS

In order to model the identification of mitigation sites, we chose to return to the real-world example of the BLM's Arizona SRMS process and several candidate mitigation sites nominated by TNC (Rainbow Valley, La Posa Plain, Sears Point, and Cactus Plain), rather than continue with an illustrative example. Therefore Table 3 below shows BLM's creosote-bursage mitigation objective (ECO1) developed for the three Arizona SEZs as of February 2015, potential indicators that we propose for measuring impacts and mitigation objective results, and known/estimated impacts where possible or commentary on potential methods for assessing impacts. Note that ECO1 for creosote-bursage vegetation does not include a landscape context attribute.

Table 3: BLM's SRMS mitigation objectives, potential indicators, and unavoidable impacts from solar development requiring off-site compensatory mitigation

Attribute category	Attribute / Value	Mitigation Objective	Potential Indicator	Gillespie[b] (2,600 acres)	Agua Caliente[c] (2,500 acres)	Brenda[b] (3,400 acres)
1. Size/ extent	Extent of resource lost (acres of vegetative cover)	"ECO 1: Create, restore, and/or acquire equivalent acreage of creosote-bursage and desert scrub ecosystem habitat community lost through development on SEZ to 80% of existing vegetative cover (acres) and composition of primary plant species within 5 years of initiation of land disturbing development in the SEZ."[a]	# Acres lost (direct impacts)	2,500 acres in SEZ	2,400 acres in SEZ	3,400 acres in SEZ
2. Condition	Condition of lost resource (composition of primary plant species)		"Vegetation intactness" score of lost or degraded acres (a sub-component of REA terrestrial landscape intactness model)	Could be assessed using REA data, e.g., calculate # acres of medium-high Vegetation Intactness affected in SEZ and buffer zone (consider employing a discount rate for indirectly impacted acres)		

[a] Mitigation objective from AZ BLM "DRAFT Goals and Objectives Crosswalk Table," February 2015. Note that ECO1 was described by the BLM as a "regional objective" and not as a mitigation objective. We here classify it according to our system as a mitigation objective.
[b] Solar Program EIS identifies the number of acres that would be lost through development of SEZ (direct) and those affected within 5 mile buffer of SEZ (indirect impacts), 57,800 acres for Gillespie and 59,100 for Brenda.
[c] AZ RDEP only identifies the numbers of acres that would be lost through development of SEZ, not indirect impacts.

Table 4 shows potential generic actions that could link to compensatory mitigation objectives:

Table 4: Mitigation objectives link to impacts and actions link to objectives

Attribute category	Attribute / Value	Compensatory objective (s)	Potential actions
1. Size/extent	Extent of resource lost	Achieve minimum net gain of xx acres of creosote bursage desert scrub	Acquisition/protection Restoration/enhancement
2. Condition	Condition of lost resource	Added or existing acres must achieve a net gain in condition relative to that lost	Acquisition/protection Restoration/enhancement

Tables 5 – 6 screen TNC's candidate sites for their ability to potentially achieve the creosote-bursage mitigation objectives described above. As described elsewhere in this paper, substantial information is missing from BLM's AZ SRMS to date to completely define and evaluate indicators, mitigation objectives, actions, and therefore sites. We relied on TNC's analysis of its candidate sites as much as possible[21] and used GIS analyses to assess such factors as size of nominated sites compared to SEZs, geographic distribution of resource, and other site screening factors.

Where we are not able to quantify objectives, propose indicators, or fully assess a site's suitability, we offer considerations for planners in conducting such assessments themselves.

Applying basic screening criteria to candidate mitigation sites

A. Geographic context:

1. Select areas in same ecoregion as development site(s)
2. Select areas in same ecological subregion as development site(s)
3. Select areas in same state as development site(s)

Table 5: Assessing candidate mitigation sites' geographic context

TNC candidate site	Same ecoregion	Same subregion	Same state
Rainbow Valley	Yes	Yes	Yes
La Posa Plain	Yes	Yes	Yes
Sears Point	Yes	Yes	Yes
Cactus Plain	Yes	Yes	Yes

B. Geographic extent:

4. Select areas within the geographic distribution of the resource being impacted (creosote-bursage vegetation)
5. Select areas of comparable or greater contiguous size than the development site(s)

Table 6: Assessing candidate mitigation sites' geographic extent

TNC candidate site	Same geographic distribution as resource	Adequate extent
Rainbow Valley	Yes	Yes (24,400 acres)
La Posa Plain	Yes	Yes (64,800 acres)
Sears Point	Yes	Yes (28,400 acres)
Cactus Plain	Yes	Yes (58,900 acres)

Assessing whether sites meet mitigation objectives

We began with a basic screening process (relying on GIS analyses provided by TNC during the AZ SRMS process) to determine whether or not the sites were likely to contribute to meeting mitigation objectives for size and condition, as shown in Table 7.

- For size, combined area must exceed direct losses identified in Step 1, note that these areas may be inclusive of those identified to meet condition and connectivity objectives below.
- For condition, these would be areas with moderate-high existing integrity where additional land protections would prevent likely future loss or degradation OR areas with moderate existing integrity with high uplift potential (can be restored or enhanced with changes to land use/management). To achieve net gain, combined area must exceed losses identified in Step 1.
    - Existing integrity can be assessed using GIS datasets such as the Sonoran REA Terrestrial Intactness model.
    - In order to provide mitigation via threat reduction, areas of moderate-high existing integrity would need to be intersected with models representing future threats such as development, degradation due to climate change, reduced future terrestrial intactness, etc. in order to determine where areas with existing moderate-high integrity are threatened with future loss of integrity *and* are available for purchase/acquisition/management changes. One source for models which may be appropriate for identifying future threats is the Sonoran REA.
    - In order to provide mitigation via uplift, areas of moderate or lower existing integrity would need to be able to benefit from feasible restoration actions.

Table 7: Assessing candidate sites' mitigation value

TNC candidate site	Acres of mod-high integrity[d]	Actions available to improve resource size?[e]	Actions available to improve resource condition?[e]
Rainbow Valley	17,900	Yes – restore 780 acres old agricultural fields ($7.8M) Yes – 2,795 acres private land acquisition ($1.4M)	
La Posa Plain	44,000	Yes – 807 acres private land acquisition ($0.4M)	
Sears Point	8,700	Yes – 8,638 acres private land acquisition ($4.3M) and 6,154 acres Arizona State Trust land acquisition ($3.1M)	Yes – close and restore unneeded roads (amount available and cost unknown but likely lower)
Cactus Plain	16,400	No	No

[d] According to TNC's letter dated Sept. 26, 2014, these are the number of acres of creosote-bursage vegetation with "moderate to high intactness" in each site based on REA data.

[e] TNC provided these estimates in their letter dated April 20, 2015, relying upon their own and BLM's GIS analyses and cost estimates provided by the BLM in a March 25, 2015 AZ SRMS webinar.

The planner would need to use GIS or other analyses to quantify the size (acres) and condition (existing or available uplift to integrity value) in order to determine which combination of actions on which sites would most efficiently achieve creosote-bursage mitigation objectives. A planner would also need to identify mitigation sites for other impacted resources in addition to creosote-bursage vegetation in order to develop a portfolio of mitigation sites maximizing the greatest number of mitigation objectives for the greatest number of resources at an affordable cost.

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[1] Sonoran REA, Appendix E, p. 158.
[2] Sonoran REA, Appendix E, p. 158.
[3] Spang, E.F., G.W. Lamb, F. Rowley, W.H. Radtkey, R.R. Olendorff, E.A. Dahlem, and S. Slone. (1988). Desert tortoise habitat management on the public lands: A rangewide plan. Report prepared for Bureau of Land Management, Division of Wildlife and Fisheries, 903 Premier Building, l8th and C Streets, N. W., Washington, D.C. 20240. 23 pp.
[4] BLM IM-AZ-2012-031 – Desert Tortoise Mitigation Policy.
[5] U.S. Fish and Wildlife Service. (1994). Desert tortoise (Mojave population) recovery plan. U.S. Fish and Wildlife Service, Portland, OR.
[6] Arizona Interagency Desert Tortoise Team. (1996). Management plan for the Sonoran Desert population of the desert tortoise in Arizona. R.C. Murray and V. Dickinson, eds. Arizona Game and Fish Department and U.S. Fish and Wildlife Service, Phoenix. *Available at* https://www.fws.gov/southwest/es/arizona/Documents/SpeciesDocs/DesertTortoise/Management_Plan_Sonoran_Desert_Tortoise.PDF.
[7] Arizona Interagency Desert Tortoise Team. (2000). Averill-Murray, R.C., ed. Status of the Sonoran population of the desert tortoise in Arizona: an update. Arizona Interagency Desert Tortoise Team and Arizona Game and Fish Department, Phoenix. 48 pp. *Available at* http://www.azgfd.gov/pdfs/w_c/tortoise/2000%20Status%20Report.pdf.
[8] Arizona Game and Fish Department. (date unknown). "Arizona Interagency Desert Tortoise Team." Available at http://www.azgfd.gov/w_c/desert_tortoise_aidtt.shtml [accessed 5/19/2015].
[9] Sonoran REA, Case Study No. 1.
[10] Sonoran REA, Appendix C, p. 90.
[11] Sonoran REA, Appendix D, p. 149.
[12] Sonoran REA, Appendix D, p. 149.
[13] Sonoran REA, Appendix D, p. 149.
[14] Arizona Interagency Desert Tortoise Team (1996).
[15] Sonoran REA, p. 51.
[16] Sonoran REA, p. 46.
[17] Sonoran REA, p. 55 (internal citations omitted).
[18] U.S. Fish and Wildlife Service. (2002). Southwestern Willow Flycatcher Recovery Plan. Albuquerque, New Mexico. i-ix+ 210 pp., Appendices A-O, p. 77.
[19] Sonoran REA, Appendix D, p. 152.
[20] Sonoran REA, Appendix D, p. 152.
[21] Marshall, Rob (2015, Apr. 20). Comment letter to Arizona BLM Re: Mitigation objectives, candidate sites matrix. Submitted by The Nature Conservancy Arizona, Center for Science and Public Policy.

Appendix B: Terms and concepts: translating across different institutional languages

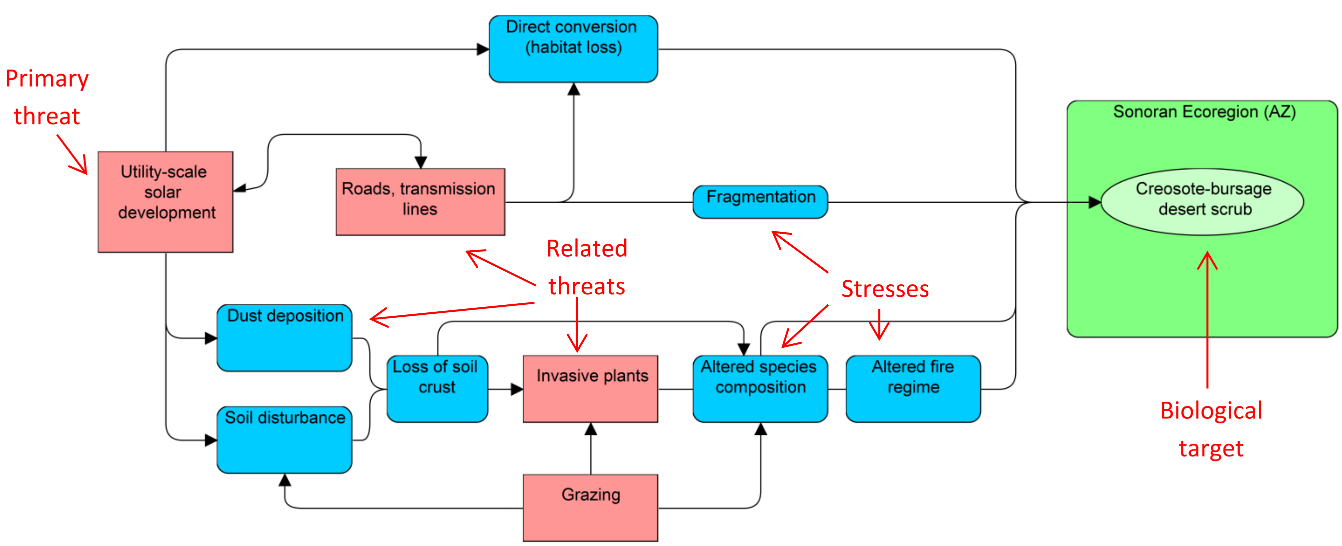
<table>
<tr><td colspan="6"><u>Terminology Crosswalk</u></td></tr>
<tr><td>Defenders' Adaptation of Open Standards</td><td>BLM SRMS Draft Procedural Guidance</td><td>Sonoran REA</td><td>California Desert Renewable Energy Conservation Plan</td><td>AZGFD State Wildlife Action Plan</td><td>TNC Sonoran Ecoregional Assessment</td></tr>
<tr><td>Biological Target</td><td>Resource</td><td>Conservation Element</td><td>Resource</td><td>Species of Greatest Conservation Need</td><td>Biodiversity Conservation Target</td></tr>
<tr><td>Threat</td><td rowspan="2">Impact</td><td>Change Agent</td><td>Stressor</td><td>Stressor</td><td>Stressor</td></tr>
<tr><td>Stress</td><td></td><td></td><td>Stress</td><td></td></tr>
<tr><td>Mitigation Action</td><td>Mitigation Action</td><td></td><td>Conservation and Management Actions[a]</td><td>Conservation Action[a]</td><td></td></tr>
<tr><td>Regional Conservation Goal</td><td>Resource Management Plan / Land Use Plan Goals and Objectives</td><td></td><td>Plan-wide biological goal (typically qualitative)</td><td rowspan="2">[refers to species-specific plans]</td><td rowspan="2">Conservation Criteria (numeric goals for each target)</td></tr>
<tr><td>Regional Conservation Objective</td><td>Regional Mitigation Goal</td><td></td><td>Plan-wide biological objective (measurable and quantitative)</td></tr>
<tr><td>Mitigation Objective</td><td></td><td></td><td>Step-down biological objective[a] (express how implementation of DRECP would contribute towards meeting the Plan-wide biological goals & objectives)</td><td></td><td></td></tr>
<tr><td>Mitigation Site Objective</td><td>Measurable Objective for each Location and Action</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="6">[a]Note that Arizona's SWAP and the California DRECP are not mitigation strategies per se, but rather conservation plans. As such their actions encompass both mitigation and conservation, and the DRECP's Step-down biological objectives represent a smaller scale or a more specific issue than the overall plan-wide objectives and are therefore similar to mitigation objectives in terms of scale. They are included in the table for comparison purposes but are not directly parallel to "mitigation actions."</td></tr>
</table>

Appendix C: Using a conceptual model to identify threats, stresses, and intervention points for mitigation

A strong and logical conceptual model for each biological target is an essential first step to identifying the specific threats and stresses acting upon the target, and also informs development of regional conservation goals and objectives if that has not been done previously. Once the stresses have been identified, the model can be used to identify intervention points—opportunities for mitigation objectives and actions to avoid, minimize, and compensate for the stresses or threats.

Illustrated example for creostote-bursage desert scrub

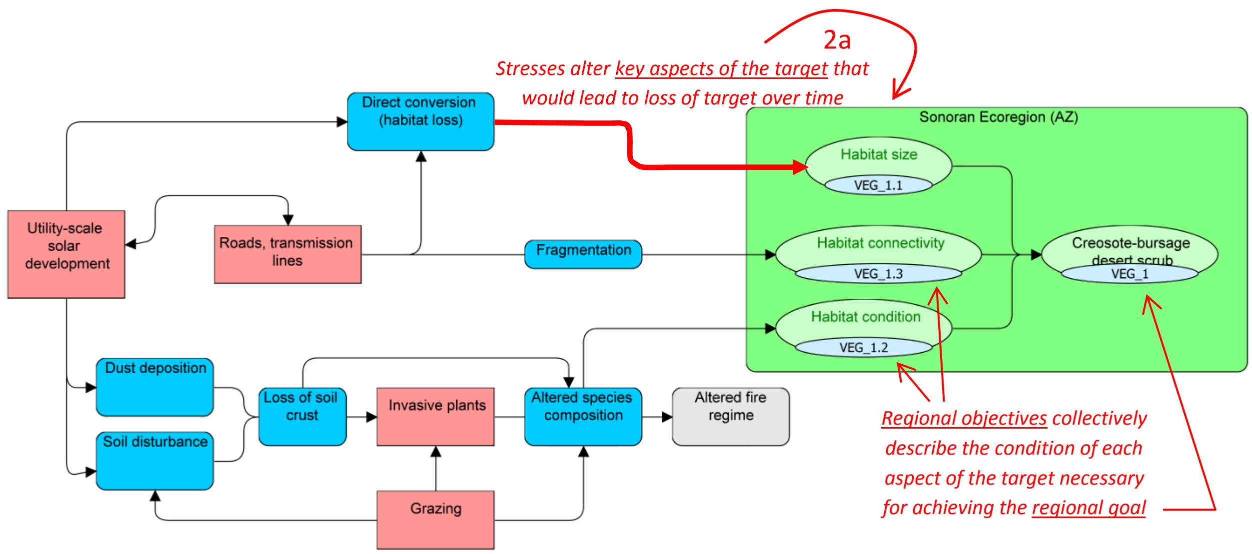
STEP 1: Develop a conceptual model that identifies threats and stresses affecting the status of creosote-bursage desert scrub. In this case, utility-scale solar development is the primary threat, but it encompasses or leads to a number of related threats.



STEP 2 (if not previously done in a regional conservation planning process): Develop regional conservation goals and objectives for creosote-bursage desert scrub.

2a. Identify key aspects of the target that are degraded or negatively affected by stresses

2b. Describe desired outcomes for these aspects and for the biological target in the form of regional conservation objectives and a regional conservation goal respectively.

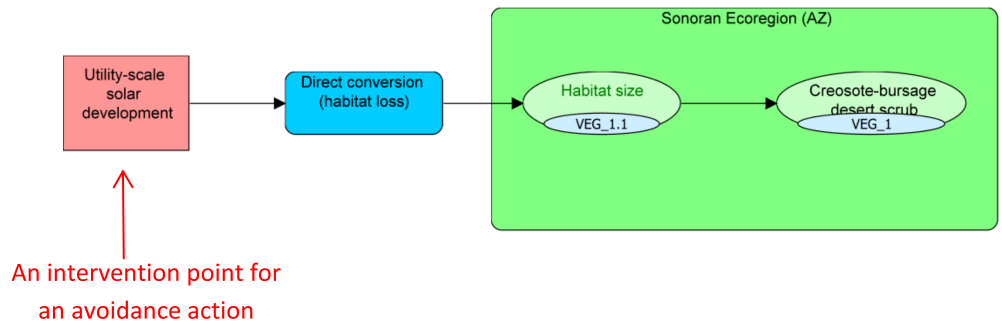


Code	Type	Objective/Goal
VEG_Goal_1	Regional goal	By 20XX, creosote-bursage desert scrub habitat will meet or exceed xx acres within the Sonoran ecoregion, of which xx% meets "established" criteria for adequate condition and connectivity as measured by ["Terrestrial Intactness."]
VEG_Obj_1.1	Regional objective	By 20XX, xx acres of creosote-bursage desert scrub habitat will be established within the ecoregion.
VEG_Obj_1.2	Regional objective	By 20XX, xx% of established creosote-bursage desert scrub habitat in the ecoregion will achieve at least xx% native vegetation cover [or other measure of habitat condition, such as vegetation departure from historic conditions].
VEG_Obj_1.3	Regional objective	By 20XX, xx% of established creosote-bursage desert scrub habitat in the ecoregion will achieve greater than [xx score on a measure of connectivity, for example the "Low Natural Habitat Fragmentation" submodel of the Sonoran REA Terrestrial Intactness model[1]]. An alternate way to consider this goal might be in terms of desired condition within known connectivity corridors, such as "By 20XX, historic creosote-bursage vegetation overlapping with Arizona wildlife zones will achieve at least xx% native vegetation cover."

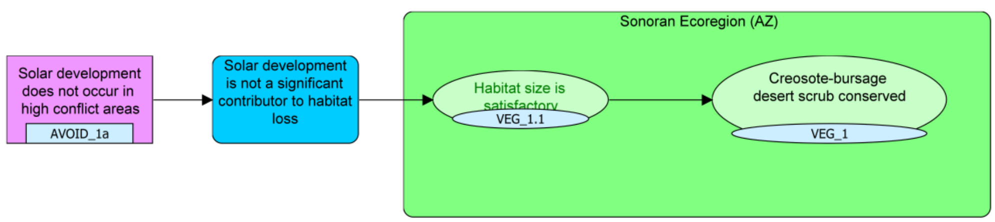
STEP 3: For key threats and stresses related to solar development, identify intervention points and intermediate outcomes (mitigation objectives) needed to achieve the regional goals and objectives.

Avoidance

--> A "thread" extracted from the conceptual model that represents a potential direct impact from solar development affecting the size or extent of creosote-bursage desert scrub, with an intervention point for an avoidance action identified.



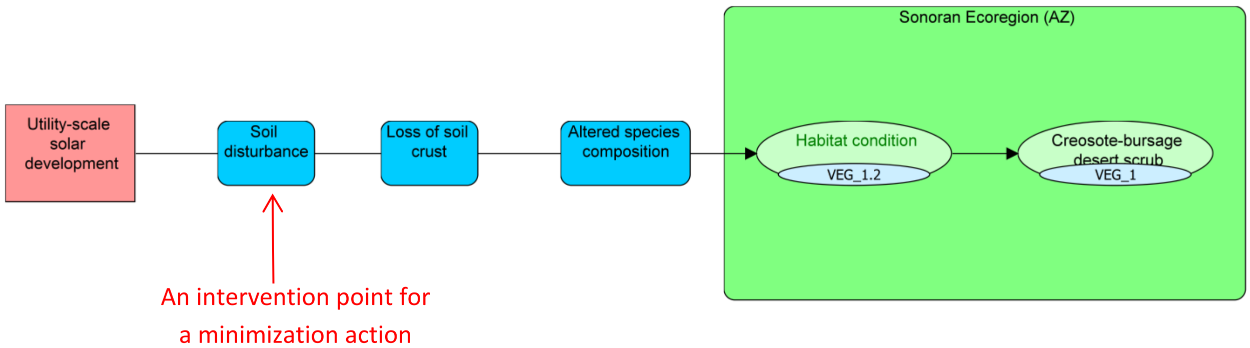
--> A set of results-based objectives describing intermediate outcomes associated with key factors in the thread from the conceptual model. A measurable mitigation objective has been identified for the avoidance outcome in the pink box.



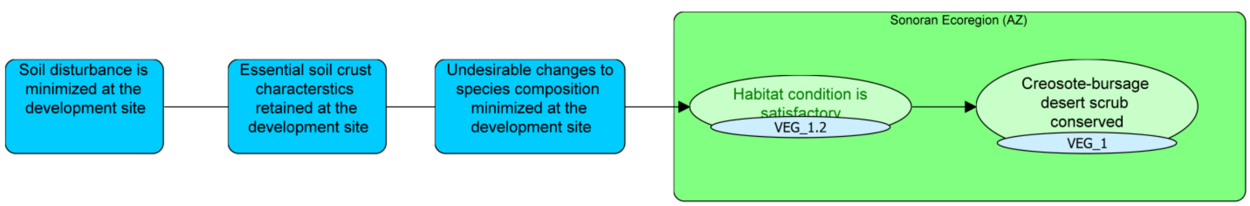
Code	Type	Objective/Goal
AVOID_1a	Mitigation objective	Less than xx% of the acreage designated as developable areas in the solar development area(s) are sited in creosote-bursage habitat of medium-high or greater intactness.
VEG_Obj_1.1	Regional objective	By 20XX, xx acres of creosote-bursage desert scrub habitat will be established within the ecoregion.
VEG_Obj_1.2	Regional objective	By 20XX, xx% of established creosote-bursage desert scrub habitat in the ecoregion will achieve at least xx% native vegetation cover [or other measure of habitat condition, such as vegetation departure from historic conditions]
VEG_Goal_1	Regional goal	By 20XX, creosote-bursage desert scrub habitat will meet or exceed xx acres within the Sonoran ecoregion, of which xx% meets "established" criteria for adequate condition and connectivity as measured by ["Terrestrial Intactness."]

Minimization

--> A "thread" extracted from the conceptual model that represents a potential direct impact from solar development affecting the condition of creosote-bursage desert scrub, with an intervention point for a minimization action identified.



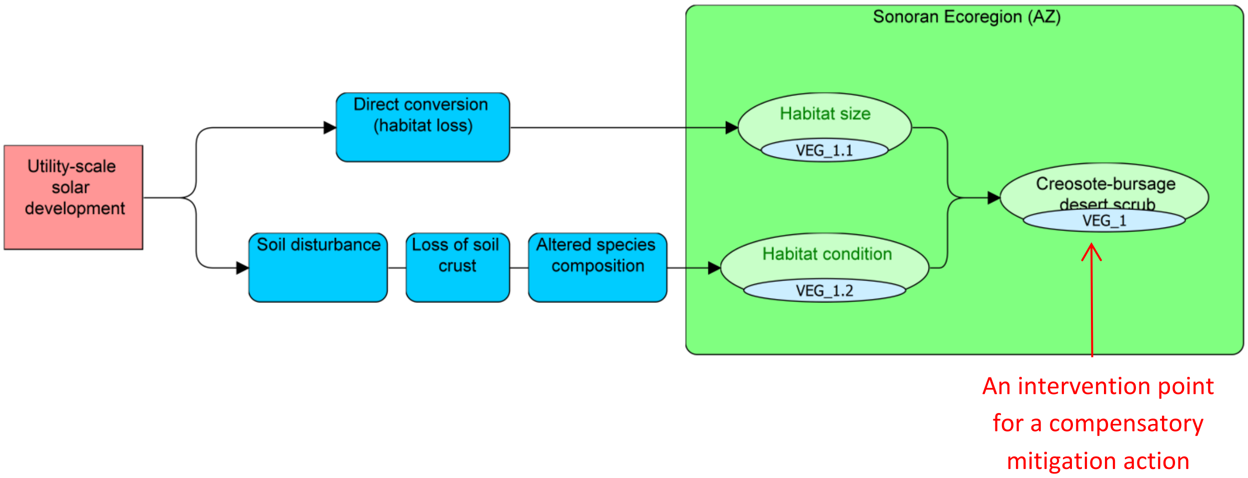
--> A set of results-based objectives describing intermediate outcomes associated with key factors in the thread from the conceptual model. A mitigation objective has been identified for the minimization outcome in the first blue box.



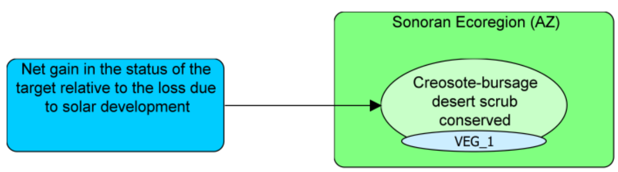
Code	Type	Objective/Goal
MIN_1b	Mitigation objective	A specified on-site impact [e.g. soil disturbance] to creosote-bursage vegetation is reduced by x% within solar development area(s) relative to the anticipated impact in the absence of the minimization measure.
VEG_Obj_1.2	Regional objective	By 20XX, xx% of established creosote-bursage desert scrub habitat in the ecoregion will achieve at least xx% native vegetation cover [or other measure of habitat condition, such as vegetation departure from historic conditions]
VEG_Goal_1	Regional goal	By 20XX, creosote-bursage desert scrub habitat will meet or exceed xx acres within the Sonoran ecoregion, of which xx% meets "established" criteria for adequate condition and connectivity as measured by ["Terrestrial Intactness."]

Compensatory Mitigation

--> The two previous threads, with an intervention point for a compensatory mitigation action identified.



--> A set of results-based objectives describing intermediate outcomes associated with key factors in the thread from the conceptual model for direct impacts due to solar development that must be addressed through off-site compensation. Managers can think of this as identifying an intervention point "outside the conceptual model" for understanding impacts from solar development. An objective has been identified for the compensatory mitigation outcome in the first blue box.



Code	Type	Objective/Goal
COMP_1c	Mitigation objective	Achievement of a net gain in Sonoran Desert creosote-bursage acres, at an equivalent level of condition (as measured by an indicator at the appropriate scale) relative to those lost to development.
VEG_Goal_1	Regional goal	By 20XX, creosote-bursage desert scrub habitat will meet or exceed xx acres within the Sonoran ecoregion, of which xx% meets "established" criteria for adequate condition and connectivity as measured by ["Terrestrial Intactness."]

[1] Sonoran REA, Appendix E, p. 158.

Appendix D: Other planning and assessment processes in the region

Comparisons to other planning processes in the region

Other planning and conservation efforts in the region have elements in common with our approach. In particular, most efforts identify conservation goals and objectives for conserving ecological resources (targets). We use the Sonoran desert tortoise as an example to show how each type of planning effort address conservation and mitigation goals and objectives.

Arizona Game and Fish Department (AZGFD) State Wildlife Action Plan (SWAP): The Arizona Game and Fish Department's (AZGFD) State Wildlife Action Plan (SWAP) includes a strong emphasis on desert tortoise.[1] The SWAP describes numerous conservation projects, often in partnership with other agencies, designed to advance broad goals for the species. AZGFD also invests in population monitoring and habitat modeling to support planning efforts. Each of these elements of AZGFD's strategy are valuable contributions towards desert tortoise conservation, but do not address the development of mitigation objectives for the species.

BLM Desert Tortoise Conservation and Mitigation: The BLM in Arizona includes a policy on desert tortoise mitigation based on a three-tiered habitat model roughly analogous to identifying areas where avoidance, minimization, and compensation are the mitigation priorities. [2] The policy includes a ratio-based system for calculating the amount of compensation required for impacts to the three categories, which incorporates such factors as anticipated future human development and adjacent habitat impacts. However, the desert tortoise is a habitat generalist which can be found across the Sonoran Desert, but the BLM's policy does not provide guidance on mitigation for tortoise impacts outside of the three habitat categories.

Arizona Interagency Desert Tortoise Rangewide Plan: The Arizona Interagency Desert Tortoise Team (AIDTT) also adopted the three-category system, originally developed in the late 1980s and early 1990s for public lands management of the tortoise, in 1996.[3] In general, AZGFD and the BLM work closely together in developing management plans, conservation actions, and project mitigation recommendations. The 1996 plan prescribes actions that should be taken to reduce threats but does not link the outcomes of these actions to measurable biological goals and objectives for the species.[*] The Rangewide Plan is used by the BLM in preparing Resource Management Plans in the region, with a focus on the Category I, II, and III habitat management recommendations and on maintaining appropriate vegetative cover. However according to AZGFD, "implementation of the management plan has been spotty at best. In 2002 the AIDTT shifted its focus towards the construction of a proactive State Conservation Agreement (SCA)…In 2014 the SCA morphed into a Candidate Conservation Agreement."[4] The final Candidate Conservation Agreement is not yet available from the AZGFD's website.

Relationship of other assessment processes in the region to a regional mitigation strategy

The Nature Conservancy Sonoran Desert Ecoregional Assessment: TNC's Sonoran Desert Ecoregional Assessment[5] was completed in 2000 and synthesized data from a broad spectrum of governmental, non-governmental, academic, geographic, and expert opinion sources. It followed TNC's standard approach of identifying coarse- and fine-filter Biodiversity Conservation Targets, establishing Conservation Criteria (goals) for each of those targets, and then identifying a network of 100 large landscapes and 79 small, localized Conservation Sites across the Sonoran Desert. The Conservation Sites represent locations where conservation opportunities should be pursued and that contain high concentrations of viable Conservation Targets. The Ecoregional Assessment is not a mitigation strategy and is not designed to help facilitate development. However, its network of Conservation Sites represent excellent potential opportunities for a) determining locations that should be avoided in any regional mitigation strategy and b) identifying potential opportunities for compensatory mitigation investments in areas that would provide important co-benefits to numerous other species and values.

* According to the Rangewide Management Plan, the "BLM's goal is to maintain viable desert tortoise populations in category 1 and 2 habitats and to limit population declines to the extent possible in category 3 habitats" (Arizona Interagency Desert Tortoise Team (1996), p.14).

Sonoran Rapid Ecoregional Assessment (REA): Since 2010, the BLM has launched 14 REAs, which in the continental United States follow the boundaries of EPA Level III Ecoregions.[6] These assessments take 36-48 months, far less time than traditional scientific inventorying of such large areas, and will provide the BLM with information about how their public lands fit into the surrounding landscapes.[7] The Sonoran REA[8] encompasses the Sonoran Desert in southwestern Arizona and southeastern California, and built upon existing geospatial information to ask and answer management questions at the landscape scale, assess current conditions, and project future conditions. The Sonoran REA emphasizes the concept of "intactness," which is a "quantifiable estimate of naturalness measured on a gradient of anthropogenic influence and based on available spatial data."[9] The REA also identified change agents, particularly energy development and climate change, and conservation elements. Similar to TNC's Ecoregional Assessment, the Sonoran REA is not a planning exercise and is not tailored to mitigation, but instead it collects and synthesizes a vast quantity of information for the use of managers and planners. We relied heavily upon the Sonoran REA in generating goals and objectives for this project.

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[1] Arizona Game and Fish Department. (2012). Arizona's State Wildlife Action Plan: 2012-2022. Arizona Game and Fish Department, Phoenix, Arizona. *Available at* http://www.azgfd.gov/w_c/documents/2012-2022_Arizona_State_Wildlife_Action_Plan.pdf.
[2] BLM IM-AZ-2012-031 – Desert Tortoise Mitigation Policy.
[3] Arizona Interagency Desert Tortoise Team (1996).
[4] AZGFD. (n.d.). "Arizona Interagency Desert Tortoise Team." *Available at* http://www.azgfd.gov/w_c/desert_tortoise_aidtt.shtml [accessed 5/19/2015].
[5] Marshall, R.M., S. Anderson, M. Batcher, P. Comer, S. Cornelius, R. Cox, A. Gondor, D. Gori, J. Humke, R. Paredes Aguilar, I.E. Parra, S. Schwartz. (2000). An Ecological Analysis of Conservation Priorities in the Sonoran Desert Ecoregion. Prepared by The Nature Conservancy Arizona Chapter, Sonoran Institute, and Instituto del Medio Ambiente y el Desarrollo Sustentable del Estado de Sonora with support from Department of Defense Legacy Program, Agency and Institutional partners. 146 pp. *Available at* http://azconservation.org/dl/TNCAZ_Ecoregions_Assessment_Sonoran_Desert.zip.
TNC also provided a valuable short summary of Ecoregional Assessment methodologies and results in Arizona to the AZGFD, *available at* http://www.azgfd.gov/w_c/documents/EcoregionalAssessmentResults.pdf.
[6] EPA Western Ecology Division. (2011). Level III and IV Ecoregions of the Continental United States. *Available at* http://www.epa.gov/wed/pages/ecoregions/level_iii_iv.htm [accessed 5/19/2015].
[7] BLM. (2015). "Rapid Ecoregional Assessments (REAs)." *Available at* http://www.blm.gov/wo/st/en/prog/more/Landscape_Approach/reas.html [accessed 5/19/2015].
[8] Sonoran REA.
[9] Sonoran REA, p. viii. The Sonoran REA Terrestrial Intactness model is discussed in more depth elsewhere in this report.

Appendix E: Requirements for mitigation in law and policy

Endangered Species Act

Section 9 of the Endangered Species Act prohibits the "take"[*] or harm of threatened or endangered (listed) species unless such take is authorized pursuant to an Incidental Take Statement or Permit.

Federal agency partners must consult with the Fish and Wildlife Service under Section 7 of the Act to ensure that actions it is authorizing, funding or carrying out are not likely to jeopardize the continued existence of these species or adversely modify or destroy their critical habitat. At the conclusion of consultation, the Service can issue an incidental take statement (ITS) detailing the amount and extent of any anticipated incidental take.[†] The ITS will include additional terms and conditions that the federal agency and any applicant must implement to mitigate the impact of such incidental take.

In the absence of a federal action, FWS can issue Incidental Take Permits under Section 10 of the Act to private entities to take listed species incidental to otherwise lawful activities upon submission of a habitat conservation plan (HCP). HCPs must describe the anticipated effects of the proposed action (e.g., the impacts of development) on endangered species; how those impacts will be minimized, or mitigated; and how the HCP is to be funded. HCPs often identify additional habitat conservation activities and investments that will occur offsite to compensate for the impacts of a development project. These plans are designed to reconcile land use or development with listed species conservation. One way to implement an HCP is by purchasing credits from a species conservation bank approved by the FWS.

Clean Water Act

Section 404 of the Clean Water Act regulates the discharge of "dredge or fill material" into navigable waters and their tributaries, including wetlands, across the United States. 404 fill permits are administered by the Army Corps of Engineers, with veto power granted to the EPA. Since the 1980s the Corps has operated under a "no net loss" policy requiring wetland mitigation (via restoration or construction) equal in land area to any filled wetlands. Over time the wetland mitigation system has grown in size and sophistication, with private wetland mitigation banks providing credits to developers within their "service area" (usually defined as a watershed) and public in-lieu fee programs accepting funds and making investments to generate compensatory mitigation offsite. An extensive body of literature, regulations, guidance documents, and industry participants exist to implement wetland mitigation under the 404 program nationwide.

BLM Policy

While the Sonoran Desert ecoregion contains a mix of private, state trust, tribal, and federal lands, the dominant single land manager is the BLM. As such, any regional mitigation strategy in the area should be consistent with BLM wildlife policy, the purpose of which is to provide guidance to the agency in the conservation of the species, habitat and ecosystems found on BLM lands. In order to be consistent with agency policy, a regional mitigation strategy should conserve habitat and wildlife and result in net conservation benefits to BLM Special Status Species.[‡]

BLM Special Status Species policy, found in Manual 6480, has two broad objectives: to conserve and recover ESA-listed species and their ecosystems; and to proactively reduce or eliminate threats to Bureau sensitive species in order to minimize the likelihood and need of listing these species under the ESA. To achieve net benefits for Special Status Species, the agency should be able to demonstrate, through regional,

[*] Under the statute, "take" is defined broadly to mean "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct."
[†] 50 C.F.R. § 402.14(i)
[‡] These are species which are proposed for listing, officially listed as threatened or endangered, or are candidates for listing as threatened or endangered under the provisions of the Endangered Species Act (ESA); those listed by a State in a category such as threatened or endangered implying potential endangerment or extinction; and those designated by each State Director as sensitive. BLM Manual 6840.01

zone and project analysis and monitoring, that the regional mitigation strategy contributes to the recovery of listed species and improves the conservation status of Bureau sensitive species. Risks to Special Status Species must be evaluated and quantified at appropriate spatial, biological, and temporal scales.*

Manual 6500 establishes BLM wildlife policy "to manage habitat with emphasis on ecosystems to ensure self-sustaining populations and a natural abundance and diversity of wildlife, fish and plant resources on the public lands." Policy objectives call for the agency to "restore, maintain, and improve wildlife habitat conditions" on BLM lands, and to "increase the amount and quality of habitat available" (emphasis added). Wildlife policy is also found within the BLM's Rangeland Health Standards. Agency regulations at 43 CFR, Subpart 4180 state that "[h]abitats are, or are making significant progress towards being, restored or maintained for Federal threatened and endangered species, Federal Proposed, Category 1 and 2 Federal candidate and other special status species."

In addition to BLM policy, under section 7(a)(1) of the ESA, the BLM is explicitly obligated to utilize its existing authorities to affirmatively conserve ESA listed species. Section 7(a)(1) is designed to ensure that federal agencies "conserve" listed species, which means to improve the status of a species to the point where it no longer requires the ESA's protection. BLM policy requires developers to implement mitigation measures for impacted species, and includes species-specific guidance in some cases, such as the Sonoran desert tortoise (described above in Appendix D).

We believe the aforementioned BLM wildlife policy and ESA obligations provide clear guidance for any regional mitigation strategy's conservation objectives. Agency wildlife policy should be used to analyze and develop a regional mitigation strategy which will:

- Conserve and help recover ESA-proposed and listed species as well as candidate and other Special Status Species;
- Reduce or eliminate threats to BLM sensitive species and minimize the likelihood of listing these species under the ESA; and
- Ensure viable (i.e., self-sustaining) populations and a natural abundance and diversity of wildlife, fish, and plant resources on the public lands

These goals are achievable through smart planning and design without slowing the development of a growing solar industry or other energy development on BLM lands. In fact, careful planning that directs development away from the most important and sensitive places for wildlife and clarifies mitigation objectives will create greater certainty for developers and conservationists by providing clarity with regard to what wildlife management standards must be met and what mitigation measures must be implemented to achieve these outcomes. We believe that BLM should apply this standard to zone and project specific decision making. For example, where sensitive, threatened, and endangered species are present, the BLM should demonstrate that development in zones, coupled with necessary mitigation measures (including offsite compensatory mitigation), achieve a net conservation benefit.

With these specific goals in place for BLM Special Status Species, remaining impacts on individual species should be minimized and then offset through compensatory mitigation that creates benefits for wildlife in other appropriate locations.

* Analysis at the population level is consistent with BLM policy. For example, the 6840 manual calls for determining the "population condition" of sensitive species, and monitoring "populations and habitats" to determine whether conservation objectives are being met.