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I. Overview of the Nevada Workshop Process

In 2008, the Heinz Center, the Nevada Department of Wildlife (NDOW), and the University of Nevada – Reno convened a workshop on performance measures for the Nevada Wildlife Action Plan. Participating in the workshop were 27 representatives from state and federal agencies, NGOs, and the academic sector.

During the first day, attendees from each organization described the species and ecosystems that they would be focusing on during the next 1-5 years. From this larger list of priorities, the group voted on three highest-priority conservation targets from lists of species, groups of species, ecosystems, and vegetation types. They selected sagebrush, Mojave Desert, and desert springs and springbrooks.

Break-out groups were organized for each of the targets. Each group identified desired condition, threats, opportunities, and priority actions for their respective target. The group also reviewed the State Wildlife Action Plan for species lists for the target ecosystems.

During the second day of the workshop, participants used the desired condition statements and species lists to identify potential status indicators for the top three priority ecosystems. For each ecosystem, the group also developed a conceptual model showing links between the desired condition and threats, opportunities, and actions.

To conclude the workshop, facilitators demonstrated how the conceptual models can be used to construct logic chains that link actions to targets and help identify specific management indicators.

Following the workshop, participants formed an ongoing monitoring collaborative and received additional funding from the Bureau of Land Management to conduct fieldwork. In the summer of 2010, Nevada partners began collecting data that will be reviewed in fall 2010.

NDOW, the University and other partners continue to work together in an ongoing monitoring collaborative.

Funding for the Nevada Pilot Project was provided the by the Doris Duke Charitable Foundation, through a grant from the Wildlife Habitat Policy Research Program of the National Council for Science and the Environment.

II. The Nevada Pilot and The Pioneering Performance Measures Project

The Nevada Workshop was a pilot process that helped launched a larger effort, now known as "Pioneering Performance Measures." The project began in 2006 by investigating approaches for monitoring and measuring the performance of wildlife conservation activities, especially activities described in the new State Wildlife Action Plans.

At the outset, an advisory committee of national experts was formed to guide the effort. Under their direction, the first phase of the project succeeded in:

- Completing the **pilot project in the state of Nevada**
- Facilitating two workshops on performance measurement that were attended by wildlife managers from 38 U. S. states and territories
- Conducting a literature review on the most up-to-date wildlife and conservation management strategies
- Holding briefings to discuss our findings with numerous government agencies and NGO's
- Publishing two resources for wildlife and natural resource managers: Measuring the Results of Wildlife Conservation Activities (2009) and Strategies for Managing the Effects of Climate Change on Wildlife and Ecosystems (2008)

The resource reports were produced with input from practitioners and experts from all four sectors – academia, business and industry, government. They contain "best practice" methods that wildlife managers can use to track and measure the progress of their conservation activities, including sample outcome measures that could be used to track the status of wildlife species and habitats at a state or regional level.

Funding for the Nevada Pilot Project was provided the by the **Doris Duke Charitable Foundation**, through a grant from the **Wildlife Habitat Policy Research Program** of the **National Council for Science and the Environment**.

With funding from the Bureau of Land Management, the project has expanded to work with additional states and tribes in the Western U.S.

For more information, including publications and state resources, visit the project website at www.heinzcenter.org/wildlife.

III. Workshop Memo

Performance Measures for the Nevada Wildlife Action Plan
A Workshop Sponsored by
The Nevada Department of Wildlife and The Heinz Center
March 2008

1 February 2008

To: Workshop Participants

From: Laura Richards and Larry Neel, Nevada Department of Wildlife
Robin O'Malley, Program Director, The Heinz Center
Dennis Murphy, University of Nevada-Reno

Re: Workshop Purpose

On behalf of the Nevada Department of Wildlife, The Heinz Center, and the University of Nevada, Reno, we would like to thank you for participating in this workshop.

Context and challenge

This workshop is intended to inform the Nevada Department of Wildlife's evolving Wildlife Action Plan and is part of a larger project at The Heinz Center that is focused on identifying practical strategies for measuring and reporting on the progress of wildlife conservation activities across the nation. The motivation for the project is the need to meet a specific combination of performance measurement challenges that are associated with the new State Wildlife Action Plans. The Heinz Center and its stakeholder partners are assembling guidance documents describing the tools and techniques that state wildlife agencies and others can use to develop straightforward, meaningful, and workable performance measures for wildlife conservation activities. Through this workshop and future collaborative activities, Nevada's Department of Wildlife is joining the Heinz effort to produce a pilot performance measures program that may serve as a model for other state plans.

Major project activities to date include the preparation of a literature review and meetings with diverse, multi-sector expert panels to discuss possible performance measures for the new State Wildlife Action Plans. More information about the project and copies of the literature review and meeting summaries can be found on the Centers' website, http://www.heinzctr.org/wildlife/ Funding for this work has been provided by the Doris

Duke Charitable Foundation through the Wildlife Habitat Policy Research Program of the National Council for Science and the Environment.

Nevada's plan is among 56 State Wildlife Action Plans that together represent a significant milestone for biodiversity conservation in the United States. For the first time, the wildlife agencies in each state and territory have identified species of greatest conservation need, priority ecosystems and habitats, significant threats to biodiversity, key conservation actions, and potential monitoring and evaluation activities.

The states and territories will soon find themselves under pressure from Congress and others to demonstrate that the actions described in these plans can actually achieve meaningful improvements in wildlife populations. At the same time, resources for implementing the plans (including the monitoring and evaluation components) remain quite limited; funding for the federal State Wildlife Grants program has remained level in FY-06 and FY-07 at $67.5 million, or only slightly more than $1.2 million on average for each state and territory.

With such limited resources, the state wildlife agencies need to identify creative strategies for monitoring and evaluation. Ideally, in Nevada these strategies should be relatively inexpensive and take advantage of existing monitoring programs, yet can still provide meaningful feedback on plan implementation.

Key Findings To Date

In June and August, 2007, The Heinz Center convened two expert panels to discuss approaches to project and program evaluation that might be relevant for the specific context of the State Wildlife Action Plans. The panels included a broad spectrum of managers and evaluation professionals from state and federal resource agencies, business, academia, and the non-profit sector.

Observations from the workshops and the associated literature review include:

> 1) There is general agreement in the literature and among evaluation practitioners regarding the sequence of steps that need to be taken in order to developing a performance measurement system;
>
> 2) Simple conceptual models such as "logic frameworks" or "results chains" can help to identify performance measures, especially in cases where results might not be immediately observable. These tools require managers and planners to be as explicit as possible about how proposed actions will contribute towards conservation of specific resources, what intermediate results can be expected, and what milestones or indicators might be employed to measure progress;
>
> 3) Simple conceptual models can also be helpful in identifying links between activities such as education, outreach, and coordination, and the types of conservation activities that more directly affect species and their habitats;

4) Simple metrics of species status and habitat quantity are available and can be used to answer the question "how are species and habitats doing" in a particular state; and

5) Sample measures for many common conservation activities (habitat restoration, direct species management) have already been described in the literature, hence are already available.

More information about the workshops, including meeting summaries, a draft literature review, and a summary PowerPoint presentation, are available on The Heinz Center's website http://www.heinzctr.org/wildlife/

Focus of This Workshop

Nevada's well-developed, comprehensive Wildlife Action Plan, its rich wildlife and fishes diversity, its history of resources stewardship, and experience in assessment and monitoring combine to provide a near perfect template for developing an model performance measures approach. This workshop will attempt to cover five key initial steps that are necessary to develop a fully operational performance measurement strategy for the Nevada Wildlife Action Plan. Given the limited amount of time that we will have together, we do not anticipate that we will develop a complete, comprehensive monitoring strategy for the Nevada Wildlife Action Plan in this one workshop. Rather, our goal is to illustrate a comprehensive suite of tools and techniques for performance measurement and demonstrate how each of these tools can be applied to real-world problems.

1) Select Targets for Management and Monitoring

The Nevada Wildlife Action Plan includes detailed descriptions of numerous priority ecosystems and species within the state of Nevada. Given that there are limited resources for implementation, and even more limited resources for monitoring and evaluation, it makes sense to identify a modest suite of targets for management and monitoring. In evaluation practice, "targets" are specific environmental conditions or variables that managers are attempting to influence through project activities (Margoluis and Salafsky 1998). Through a group exercise, we will identify a suite of a dozen or so "conservation targets" (communities/ ecosystems/ species) that, taken together, do a reasonable job of characterizing fish and wildlife resources in the state of Nevada.

2) For selected targets, identify goals and objectives for management

We want to be clear on the management goals and objectives for each of the targets identified in the first exercise. Different goals or objectives can very easily translate into different management activities and different performance measures. We will start with the list of targets selected in the previous exercise and, through a group brainstorming exercise, identify specific goals and objectives for each of these targets.

Contemporary evaluation practice defines a goal as a general summary of the desired state that a project is working to achieve. A good goal meets the criteria of being visionary, relatively general, brief, and measurable.

An objective is a specific statement detailing the desired accomplishments or outcomes of a project. A good objective meets the criteria of being impact oriented, measurable, time-limited, specific, and practical (Margoluis and Salafsky 1998).

3) For selected targets, identify threats and other factors that could influence the target

The Nevada WAP identifies numerous potential threats to wildlife and habitat areas. Financial constraints mean that not all of these threats can be addressed immediately. This means that NDOW and its partners will need to establish some set of priorities among these threats. One way to establish priorities is to ask a series of questions, including: Which threats are most urgent? Which are most likely to affect the greatest number of acres? Which are likely to affect the greatest number of species of conservation need? Which are most tractable (meaning that funding, knowledge, and personnel are available to address them)? Which ones can NDOW/partners address directly? Which ones can others address?

4) Develop Conceptual Model for one or more targets

Conceptual models are an important part of the process of developing performance measurement systems. Such models range from simple box-and-arrow diagrams to sophisticated computer models that allow quantitative predictions.

Together, we will walk through the process of constructing a simple conceptual model that characterizes the relationships between threats and targets, and describes how specific actions described in the NWAP might lead to improvements in the condition or status of a particular target. Once we complete this model, we can then identify key management indicators that tell us whether or not a particular management intervention is having the desired effect. As a group, we will identify a suite of potential indicators for a particular real-world example, and discuss how we might actually measure these indicators (which indicators are measureable short-term versus long-term, which ones are currently being tracked by someone, which ones represent "data gaps" where key information is lacking).

5) Review Existing Data Sources and Identify Data Gaps

This session will serve as an opportunity for information-sharing between NDOW, federal agencies, non-profit organizations, academics, and other "data providers." The purpose of the session is to identify what existing sources of monitoring data are available for tracking wildlife populations and key habitat areas in Nevada. We also need to understand the limitations of these data sets, and identify "data gaps" where we clearly need more or better information that is simply not being collected at the present time.

For each of the existing data sources, we will discuss the appropriateness of using that particular data source to answer "status" questions (how are wildlife populations and key habitats doing?) as well as "effectiveness" questions (do management interventions achieve the desired outcomes?).

Anticipated Outcomes

While the completed task of identifying explicit performance measures will require additional technical meetings to select and quantify indicator measures, identify thresholds or triggers for management responses, and resolve the specifics of anticipated management actions, we expect that this workshop will produce several essential outcomes:

1) A reasonably comprehensive list of conservation targets for at least the first phase of implementation work under the Nevada Wildlife Action Plan.

2) For one or more of these targets, a fairly complete statement of goals and objectives for management.

3) For one or more targets, a comprehensive analysis of threats.

4) For one or more targets, a completed conceptual model that links threats, potential management actions, and management indicators.

5) A reasonably comprehensive list of monitoring programs and data sources that can be used in support of performance measurement activities related to Nevada's Wildlife Action Plan.

6) A better understanding of the methods and tools available for developing performance measures, on the part of NDOW and its partners, and on the part of Heinz Center staff participating in the workshop.

How to prepare?

In support of the planned activities above, we are asking participants to consider and be prepared to discuss informally you answers to a short list of questions. In addition to the two homework questions described in the meeting agenda, participants should come prepared to discuss the following topics:

1.) What's important – what are the highest priority conservation targets (species, communities, ecosystems) that matter to you?

2.) What are the goals and objectives that you/your organization has for each of these targets?

3.) What stressors affect your priority targets?

4.) What types of management activities are you planning for your targets, and why did you choose those management approaches?

5.) How will you judge the success of your work? What measurements/data/information are you planning to collect that will demonstrate the successful nature of your work? What data would you like to have?

IV. AGENDA

Nevada Wildlife Action Plan
Workshop on Performance Measures
Agenda

Thursday, March 6, 2007

8:30 AM	Welcome – *Laura Richards, NDOW*
8:45 AM	Introductions, logistics, etc. – *Robin O'Malley, The Heinz Center*
9:00 AM	Overview of Project – *Robin O'Malley, The Heinz Center*
9:45 AM	Introducing Performance Indicators – *Barry Noon, Colorado State Univ.*
10:15 AM	Break
10:30 AM	Targets and Priorities For NWAP Implementation- *Group*
12:00 PM	Lunch
1:00 PM	Objectives (desired conditions) for Targets – *Group, Break-outs*
3:00 PM	Break
3:15 PM	Obstacles/Opportunities and Actions for Targets – *Break-outs*
4:30 PM	Report Back from Break-outs - *Group*
5:00 PM	Adjourn for Evening

Friday, March 7, 2008

9:00 AM	Introduction to Logic Models – *Jonathan Mawdsley, The Heinz Center*

9:20 AM	A Nevada Example of a Logic Model – *Susan Abele, TNC, Larry Neel, NDOW*
9:40 AM	Constructing Logic Models For NWAP Targets - *Group*
10:30 AM	Break
10:45 AM	Using Logic Models to Identify Indicators for NWAP Targets – *Group*
12:00 PM	Lunch
1:00 PM	Review/Recap, Next Steps - *Group*
3:00 PM	Adjourn

V. WORKSHOP FLOW

Nevada Wildlife Action Plan Performance Indicators Workshop

Thursday, March 6

Welcome – Laura Richards

Background – Why are we here? – Dennis Murphy

Introduction of Participants – Facilitator

Workshop Agenda – Facilitator – Step-by-step walkthrough of the workshop process with brief descriptions of each task and proposed group approach (e.g. discussions expected to be "full group", anticipated "breakout" discussions, etc.)

Selecting Performance Indicators/Adaptive Management – Barry Noon

Inventory of Participant Priorities – each participant takes five minutes or less to present their agency/organization's wildlife conservation priorities as worked out in their "homework assignment". These priorities go on the flip chart for aggregation.

Group "processes" the various organizational priorities into a set of "least common denominator" categories; categories are ranked as to level of importance; critical subset of categories selected as "the" priority topics to focus on for the rest of the workshop.

Breakout groups are selected by expertise/stewardship responsibility to discuss each (or the top three or four) of the priority topics. These breakout groups would develop the following:

- Relative importance to wildlife – "Why is this habitat type important to wildlife conservation in Nevada?"

- Key attributes that supports that critically important wildlife contribution
- From the two discussions above, develop a "desired condition" (will later transmute into the "goal" for this priority)

Full group check-in. Breakout groups contribute their "desired conditions" to a common list (community bin).

Breakout again.

- Discuss "barriers" to achieving "desired condition". What processes prevent us from producing and maintaining "desired condition"?
- Develop a "list of required actions" – real-world steps needed to address the barriers and move toward "desired condition". These actions do not necessarily rest at the "project-by-project" level, but rather at the "conservation approach" level. What are the programmatic things that need to be done to reduce barriers and promote desired condition?
- Process the "list of required actions" into "objectives" stopping short of the classic definition of objectives in terms of "how much by when". The actual quantification of the objectives will be saved for a follow-up workshop more likely to involve the technical experts.

Group check-in – breakout groups again contribute their list of barriers and required actions/objectives to the community bin.

Group discussion about process – what worked? What posed problems? Were creative solutions devised to get past challenges and on toward success?

First day adjourned

Friday, March 7

Building a Conceptual Model to Inform Adaptive Management – Barry Noon

"Straw Dog Conceptual Model (s)" – Susan Abele, Dennis Murphy, Larry Neel – roll out a representative conceptual model for one of the priority topics and demonstrate how it was developed and how its different elements relate to one another.

Group discussion or breakout discussion (merits and drawbacks to both) – look for the key elements of the model that could be monitored, measured, and expected to provide a "report" on progress toward "desired condition"

Next Steps – group or breakout session outlining the process for the development of conceptual models for all the priority topics. Inventory of talent and resources:

- Who are the 'experts' that need to get together for the identification and quantification of the measurement indicators?
- What data sources currently exist that can inform this process?

- What data do not currently exist that is critical to the development of success measures?
- What plan of action would be required to coalesce existing data as well as collect the critical absent data? Where are the funding resources available to implement a performance measurement strategy?

Summary of Workshop; What to expect next; Thank You Participants!

VI. PROCESS OVERVIEW

Monitoring and Evaluation Programs for State Wildlife Action Plans

The State Wildlife Action Plans represent a significant advance in biodiversity conservation planning for the United States. Each of these plans includes information that will be necessary in order to implement conservation strategies for specific targets -- individual species, suites of species, or vegetation or ecosystem types. Here we describe how the information contained in the individual plans can be linked together into detailed management, evaluation, and monitoring strategies for specific conservation targets.

Elements of the state wildlife plans that are relevant to this discussion include: lists of species and habitats, descriptions of threats, and other factors that could influence species or their habitats, descriptions of conservation actions, and descriptions of monitoring and evaluation strategies.

1) Start with a target (species or vegetation-cover type)

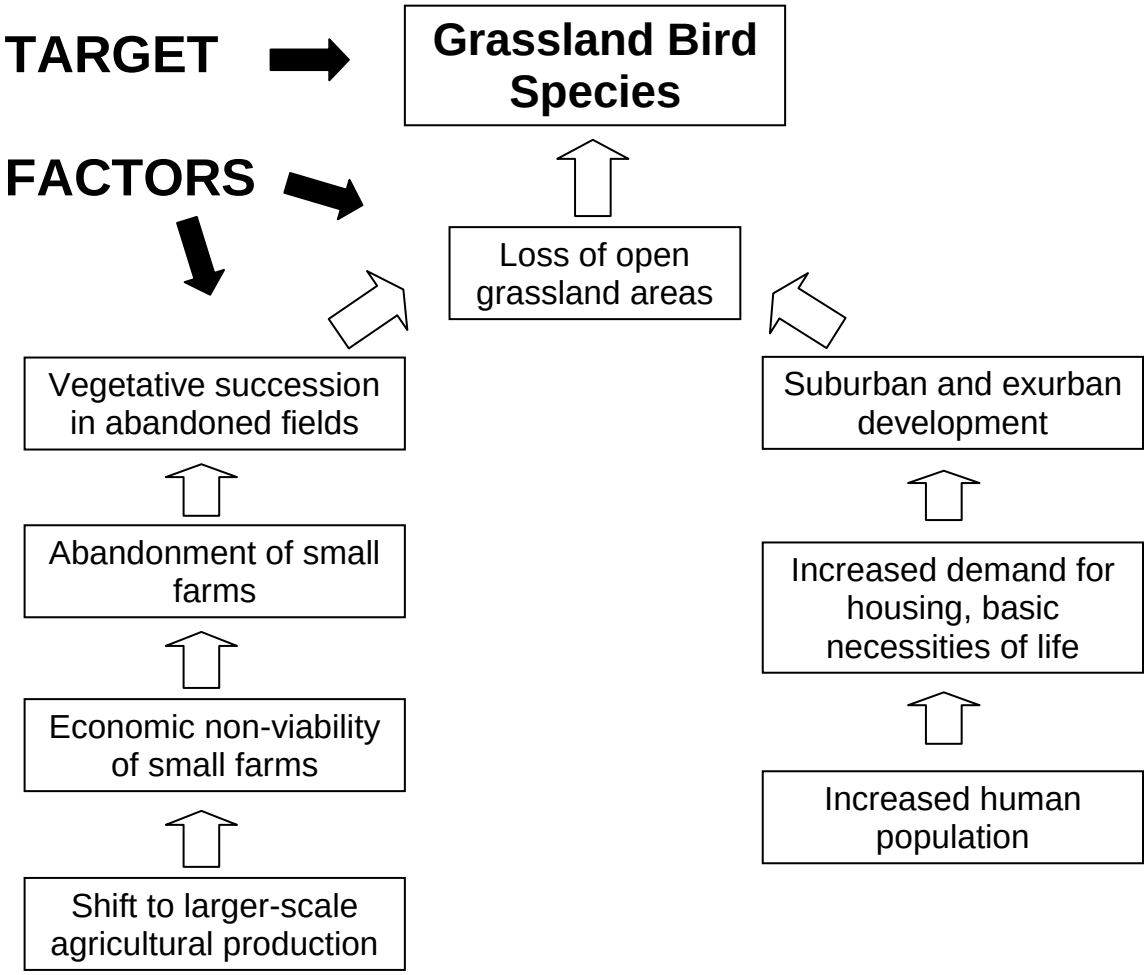
Given the breadth of the plans and the relatively modest resources available for implementation and monitoring, states may find it helpful at first to focus implementation work on a few target species or vegetation cover (or habitat) types where conservation success can be easily defined and measured.

Some criteria that may be helpful in selecting targets for priority implementation work include:

- The target is well defined (taxonomy of species clearly resolved, vegetation cover types well defined).
- For individual species, the basic biology, life history, and habitat requirements are reasonably well understood, geographic distribution within the state is fairly well known, and scientifically sound monitoring protocols are available.
- For vegetation-cover types (or habitats), maps are available that show their distributions in the state.
- Limiting factors or factors causing decline of species or loss of habitat/vegetation type are well understood.
- Actions needed to reverse or stabilize decline are well understood.

2) Build a simple conceptual model for each target that includes factors that could affect the target either positively or negatively

For each target, we recommend building a simple conceptual model that includes lists of the major factors that could influence it, either positively or negatively. Negative factors are described as threats or stressors. Many factors are linked, and it is often helpful to construct a simple diagram that shows linkages between the factors. In the example that follows, we've selected a target – grassland bird species – that has potential conservation concern in many parts of the country. For many grassland bird species, one of the major factors causing population declines is the loss of open grassland habitat where breeding and foraging occur. There are multiple other factors that influence the loss of habitat – changes in farming practices, vegetative succession, and suburban development, to name just a few. The following diagram shows how the targets and factors can be linked. Each arrow indicates a causal link: the item in the box on the blunt end of the arrow is thought to either influence or cause the item in the box at the pointed end of the arrow.



The model does not need to be exhaustive or rigorous at this point, so long as the major factors influencing the target and shown any conceptual linkages that you feel exist between them.

Once the conceptual model seems reasonably complete, it is helpful to look at the list of factors you have identified and ask questions along the following lines:

- Which negative factors are most likely to do harm to the target in the short term? In the long term?
- Which positive factors (if any) are most likely to benefit the target in the short term? In the long term?
- Of the factors most likely to do harm, which of these can we do anything about?
- Of the factors that can benefit the target, which of these can we do anything about?
- Of the factors we can do anything about, which do we have the resources (knowledge, expertise, access, funding) to address in the short term?
- Where could we apply additional resources if they became available, in both the short- and long- term?

Let's apply these criteria to the grassland bird example above using a simple table.

Factor	Type	Short-term?	Long-term?	Can we do something?	Resources Available?
Loss of open grassland areas	Negative	Yes	Yes	Yes	Some
Vegetative Succession	Negative	Yes	Yes	Yes	Some
Farm abandonment	Negative	Yes	Yes	No	No
Loss of small farm economic viability	Negative	No	Yes	No	No
Shift to intensive agriculture	Negative	No	Yes	No	No
Suburban/exurban development	Negative	Yes	Yes	No	No
Increased demand for housing	Negative	No	Yes	No	No
Increased human population	Negative	No	Yes	No	No

Several important points emerge from this exercise. First, the factors that we've identified are entirely negative – there don't seem to be any factors that are currently influencing the system in a positive direction. (No wonder the birds are in trouble!) Second, some of the factors are more immediately relevant to population declines than others. Losses of open grassland areas, vegetation succession, and suburban and exurban development appear to be the most immediate threats. The other factors identified in the initial analysis reflect broader, longer-term societal trends (shifts in agriculture, changes in development and living patterns).

Many of these other factors also fail the test of "can we do something about it." Rural land-use dynamics, human population growth, and suburban sprawl are all likely to be outside the scope of what a wildlife management agency could reasonably be expected to tackle as part of a wildlife conservation project. Certainly resources are generally not available to wildlife managers to address these types of broader societal trends.

So where does that leave us? We have identified two factors – loss of open grassland areas and vegetation succession – that we could reasonably be expected to be able to respond to in the short term using available resources.

3) For targets, identify goals, and for factors, identify objectives

The next step is to identify explicit programmatic goals for each of the targets -- a goal being an overall statement of the desired condition for the target. For the grassland bird example above, the goal might be "to increase breeding populations of grassland birds in the state."

Then you will want to identify specific objectives for each of the factors that meet the criteria in the bulleted list above. Is the factor something that is most likely to harm or help in either short or long terms? Can we do something about it? Is it something we have the resources to affect? The objectives should help you reach the goal for the target.

For the grassland bird example a specific objective for the factor "loss of grassland areas" might be to increase the area in open grassland cover types on state wildlife areas where grassland birds breed. A specific objective for the factor "vegetation succession" might be to decrease the cover and density of tree saplings in open grassland sites.

4) For each objective, list actions that could be taken to implement it

For each objective, you can then list specific conservation actions which would help you achieve the objective and bring you closer to your goal.

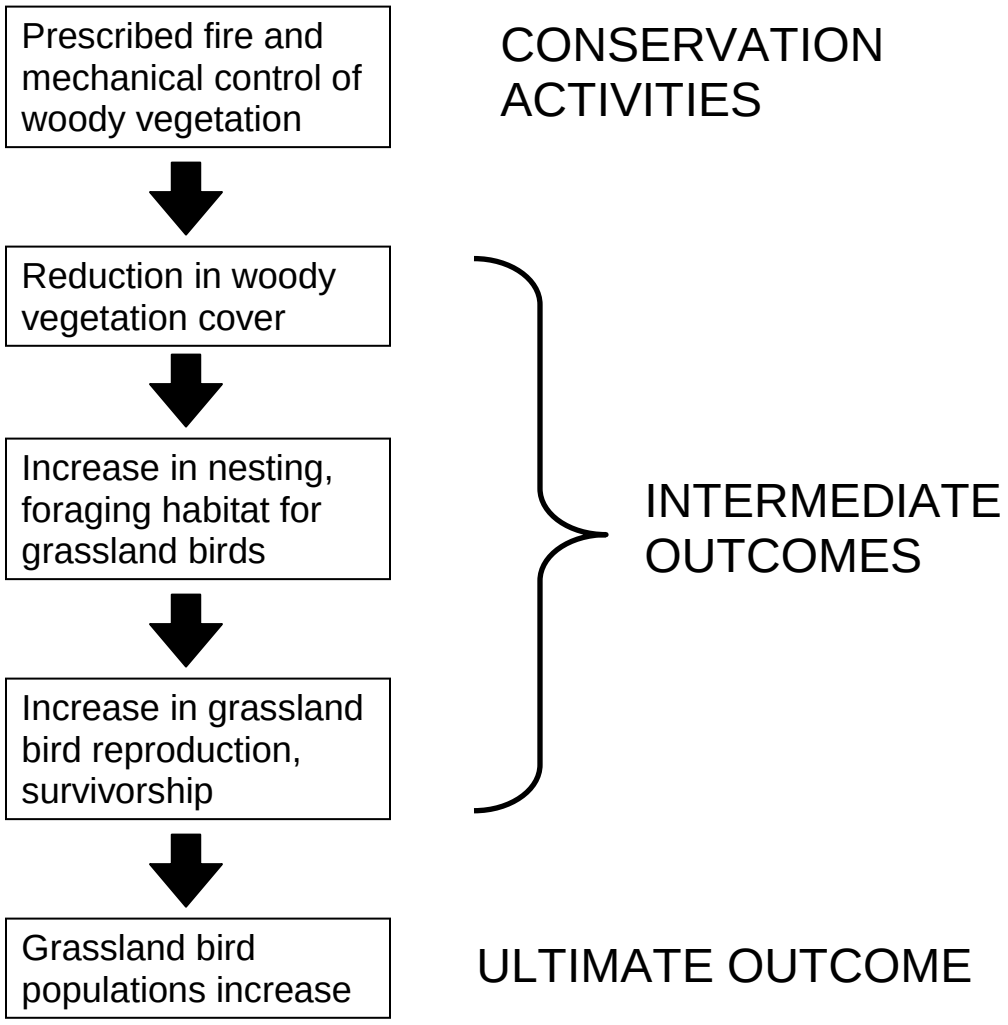
For the grassland bird example a specific action might be -- apply prescribed fire and mechanical treatment methods to reduce woody vegetation cover on the 1,000 acre state grassland preserve in White Pine County.

5) For each action, develop a logic model that shows how that action will contribute toward meeting the goal for the target

Logic models are simple tools that are widely used in performance measurement and project assessment. These models show causal relationships that link actions to anticipated results. Developing even a simple logic model for a project can help managers tell a more compelling story about the work that they are doing, and more effectively characterize the short-term and long-term results that they are expecting to achieve.

The type of logic model that we are discussing here is known as a causal chain or results chain (see for example Margoluis and Salafsky 1998). Causal chains are easily constructed for most conservation projects. The effort starts with a specific action or activity recorded at the top of a piece of paper. At the bottom of the piece of paper, list the project's goal. Between the activity and the goal are listed as many intermediate steps as needed to link the two in an unbroken logical progression. In completing the chain, it is helpful to repeatedly ask the question "and then what happens?" at each step, until the activity and goal are completely linked in a chain of logical steps.

Here is an example of a causal chain for one of the activities in our grassland bird project:



Here there are three steps between the specific conservation activities that the manager is planning to undertake, and her big-picture goal for doing these activities in the first place. The activity statement, goal statement, and intermediate steps could be made even more detailed and specific to fit a particular project.

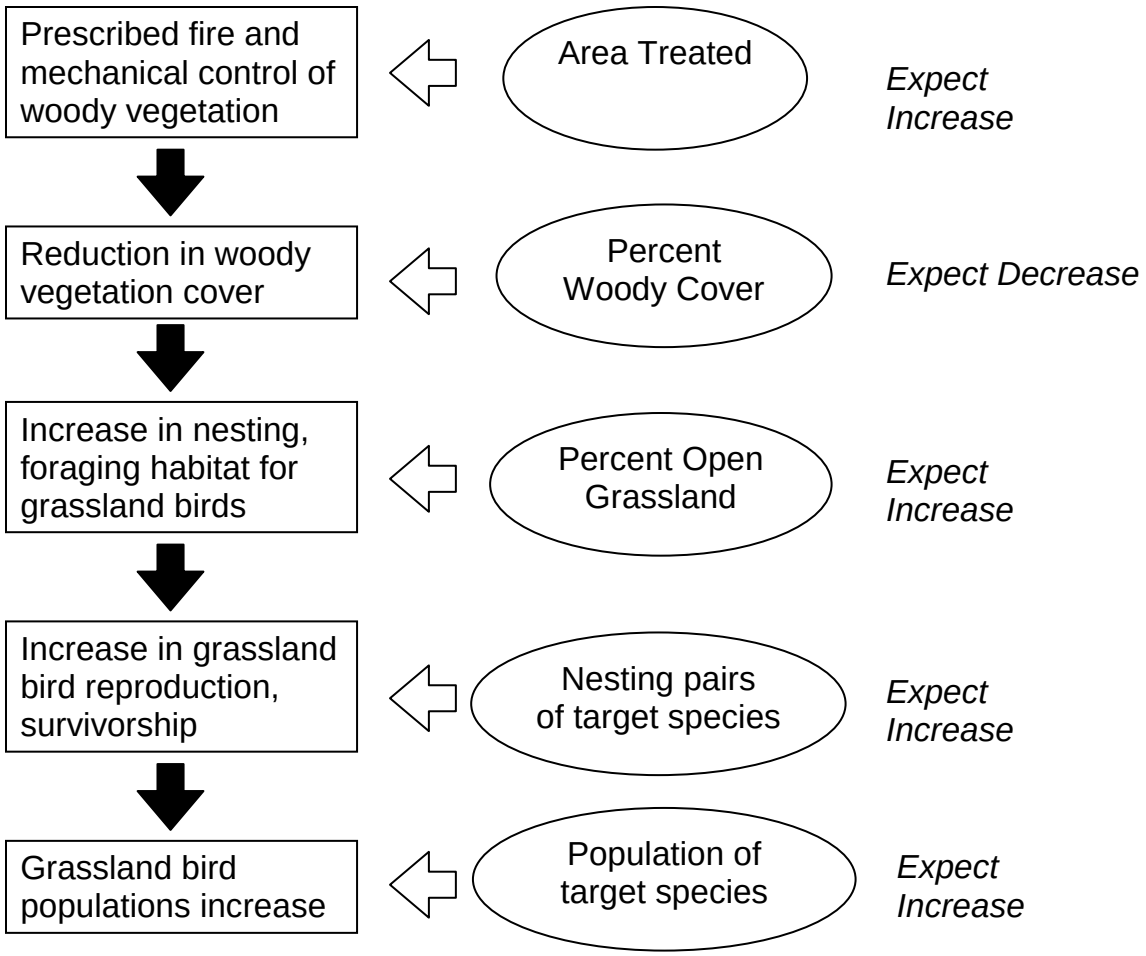
Causal Chains Help You Tell Compelling Stories About the Conservation Project

Causal chains are useful in developing a clear story about your project. Here's an example of a story that could be developed from the causal chain above:

"The goal of this project is to increase grassland bird populations at our prairie preserve. We will implement a vegetation management regime that includes prescribed fire and mechanical treatments to reduce woody vegetation. As a result of these treatments, we expect increases in nesting and foraging habitat for grassland birds, which should lead directly to increased survivorship and nesting success. We expect that these factors will contribute to an increase in the population of these bird species at our preserve."

6) Use the logic model to identify short-term and intermediate indicators for monitoring

A well-developed causal chain can assist in thinking about the design of a monitoring program for a project. Here is the grassland bird causal chain again, but this time with a list of potential indicators (in ovals) that could be measured by a project manager to determine whether or not the project had the desired effect. To the right of these indicators, our project manager has listed the trends that would be expected in each of her indicators if the project was implemented.

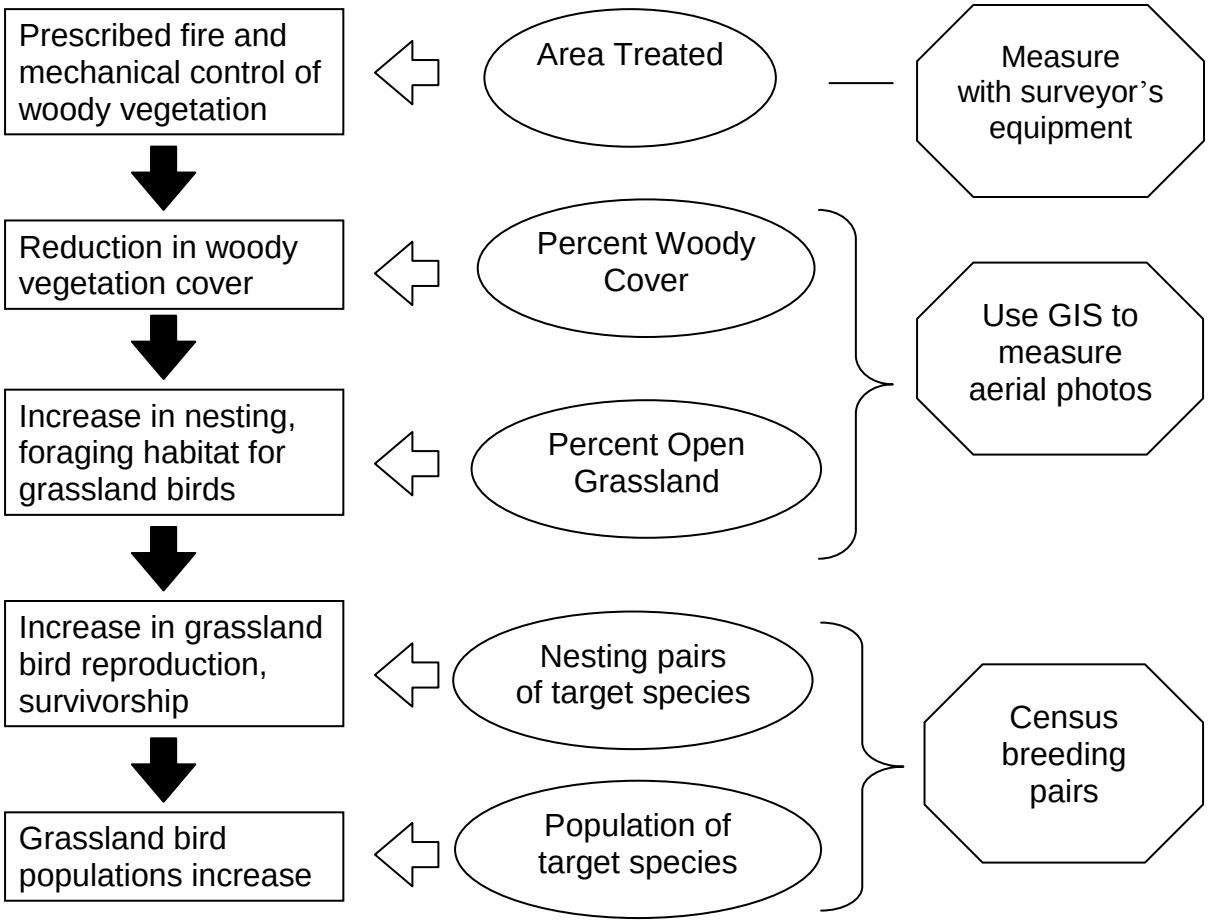


7) Select measures or metrics for each indicator

Note that even though the manager has listed potential indicators, she is still one step removed from selecting a "metric" or "measure," a specific environmental attribute that will actually be measured in her monitoring program. This is because there are often multiple ways to measure a particular indicator. For example, "percent woody cover" or "percent open grassland" could be estimated using digitized aerial photography, or extrapolated from measurements made on the ground using a series of sampling plots. The population size and number of nesting bird pairs could be estimated using data from sample plots, transect walks, or determined directly from a complete census (which is usually only feasible for small sites).

The causal chain also shows that some indicators are closely related and could readily be combined in an actual monitoring scheme. For example, percent woody cover and percent open grassland are complementary for many grassland sites, meaning that an increase in one of these indicators is accompanied by a decrease in the other, and vice versa. Likewise, the number of nesting pairs of a bird species may be closely related to the overall population size, and may be easier to determine than overall population size for certain species in which males are brightly colored and/or exhibit elaborate courtship displays.

The following diagram shows the metrics or methods that our wildlife manager ultimately selected for her grassland bird project.



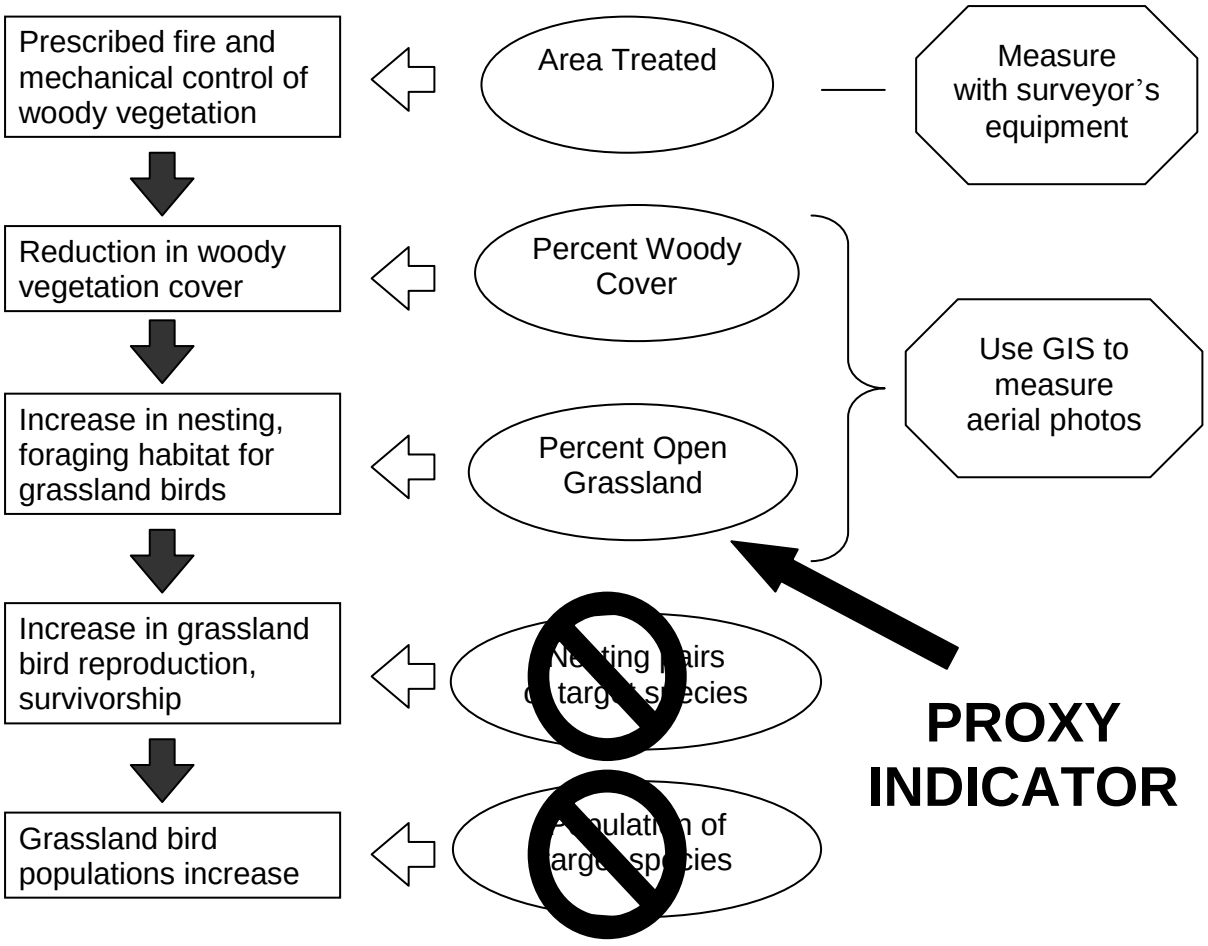
NOTE: Sample causal chains for a variety of conservation activities – including education and outreach - are included in the "Examples" section that begins on p. 11.

Choosing Among Multiple Possible Indicators

Developing a causal chain for a project can also help in making a choice among multiple possible indicators. In real-world situations, budgetary constraints frequently limit the size of monitoring programs, meaning that only a few of the numerous potential indicators (and even more numerous metrics) can be actually measured. The causal chain shows which of the possible indicators are closest in "logical proximity" to the overall project goal. If a manager can only measure one thing, it stands to reason that she would want to measure something that directly reflects whether or not a goal has been achieved. For the case we have examined here, this would mean focusing monitoring resources on measuring the bird populations.

In real-world situations, it is often not possible to measure the project's ultimate outcome directly. For many projects, there is a significant lag between the time when a project is implemented and the time when a response could be reasonably expected in the wildlife population of interest. This could very well be the case in our grassland bird example above. In other cases, it may be prohibitively expensive to measure outcomes. In such cases, it becomes necessary to measure a "proxy indicator" which provides information, albeit indirectly, on the outcome of your actions and their likely effect on the target.

The following example shows how the causal chain can be helpful in identifying a proxy indicator. Let's suppose that, for whatever reason, our manager did not have a way to measure the grassland bird population directly at the project site. Going one step back up the causal chain suggests that the next best thing to measuring the bird population would be to measure the percentage of open grassland at the site. The causal chain would suggest that this is probably her best choice for a proxy indicator.



8) Design a monitoring program for each measure/metric

There are numerous standard references that describe how to set up monitoring programs for particular species or taxonomic groups of interest, as well as vegetation or ecosystem

types. You will undoubtedly find it helpful to collaborate with existing monitoring programs for your state or region, and consult with species experts or GIS specialists in your area if it turns out that you need to develop new monitoring protocols for your targets.

9) Implement actions and monitoring program; revise conceptual model and adjust actions as needed.

The next step is to implement the conservation actions that have been identified for the target species or ecosystem/vegetation type of interest, as well as the monitoring program. We won't go into detail here, as there are numerous manuals and standard reference books that describe how to implement particular types of conservation activities. There is also an extensive literature describing how to monitor the effects of conservation activities on populations and ecosystem types of interest.

As information from your monitoring program comes in, you will undoubtedly want to periodically revisit your original assumptions about the project, as described in your conceptual model and logic framework. As time passes, the world changes, and your understanding of the system will shift. As your understanding changes, different conservation actions will increase or decrease in relevance, and you will likely need to shift the focus of your conservation activities to reflect the new knowledge.

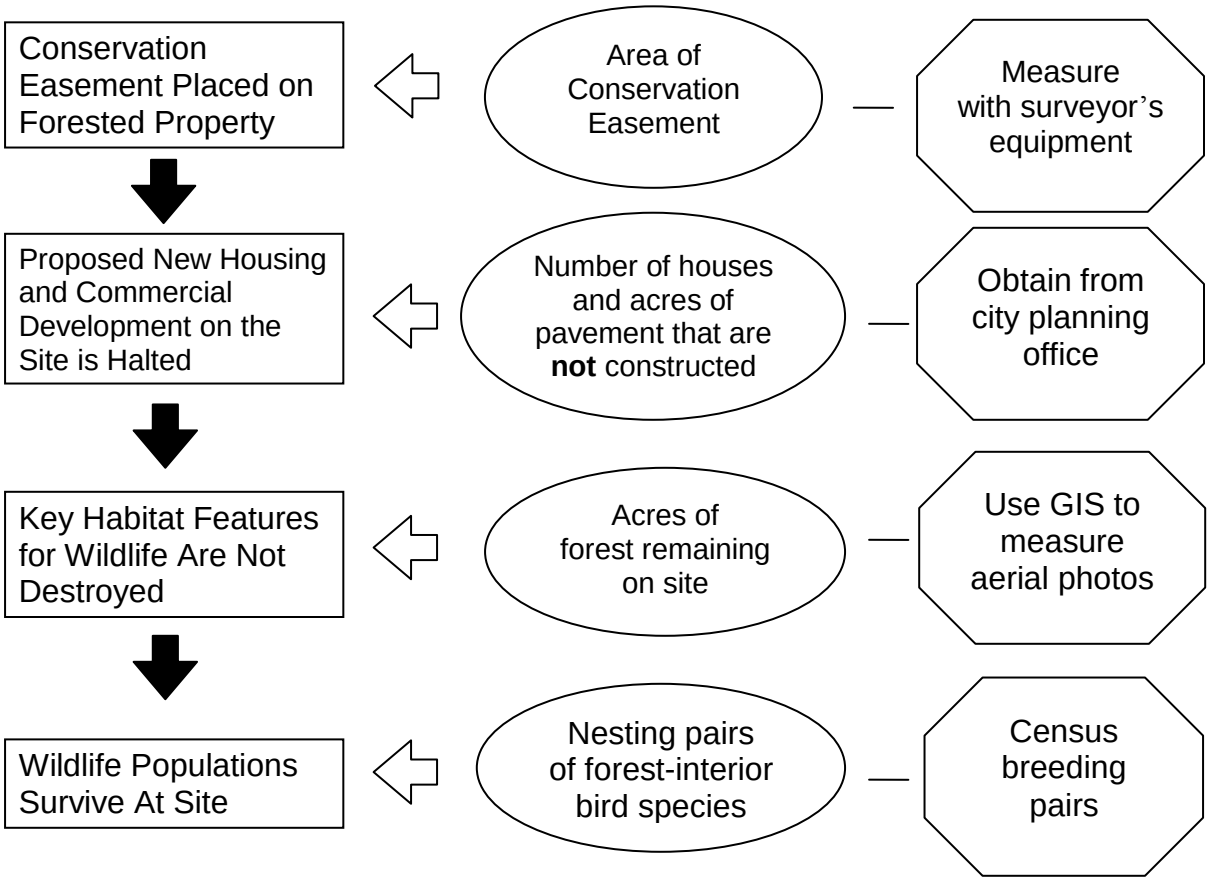
Examples: Logic Models for Other Conservation Activities

In the section that follows is a series of sample logic models for a variety of common conservation activities. The format for these models is the same as the grassland bird example above: the left-hand column represents a series of logical steps linking an activity in the upper left hand corner with a desired outcome in the lower left hand corner. The center column lists possible indicators for each of the steps in the logic chain. The right-hand column lists one possible metric or method by which a manager could measure each of the indicators.

For each of these simple examples, there are of course many other indicators and metrics that could be used besides just the few possibilities that are shown here. Different management situations and contexts will likely require different management indicators, depending on the specific information needs and interests of individual managers, wildlife agencies, and funding organizations. There will likely also be some variation in the level of detail and the particular steps that are included in the logic chains that are developed for specific projects, even when the actions and desired outcomes are similar. There is not necessarily a single "correct" logic model and set of indicators for a particular project. Rather than worrying about finding the one "right answer," managers should instead focus on making sure that their logic models accurately reflect their own thinking about a project's outcomes and how the intermediate steps towards those outcomes might best be measured.

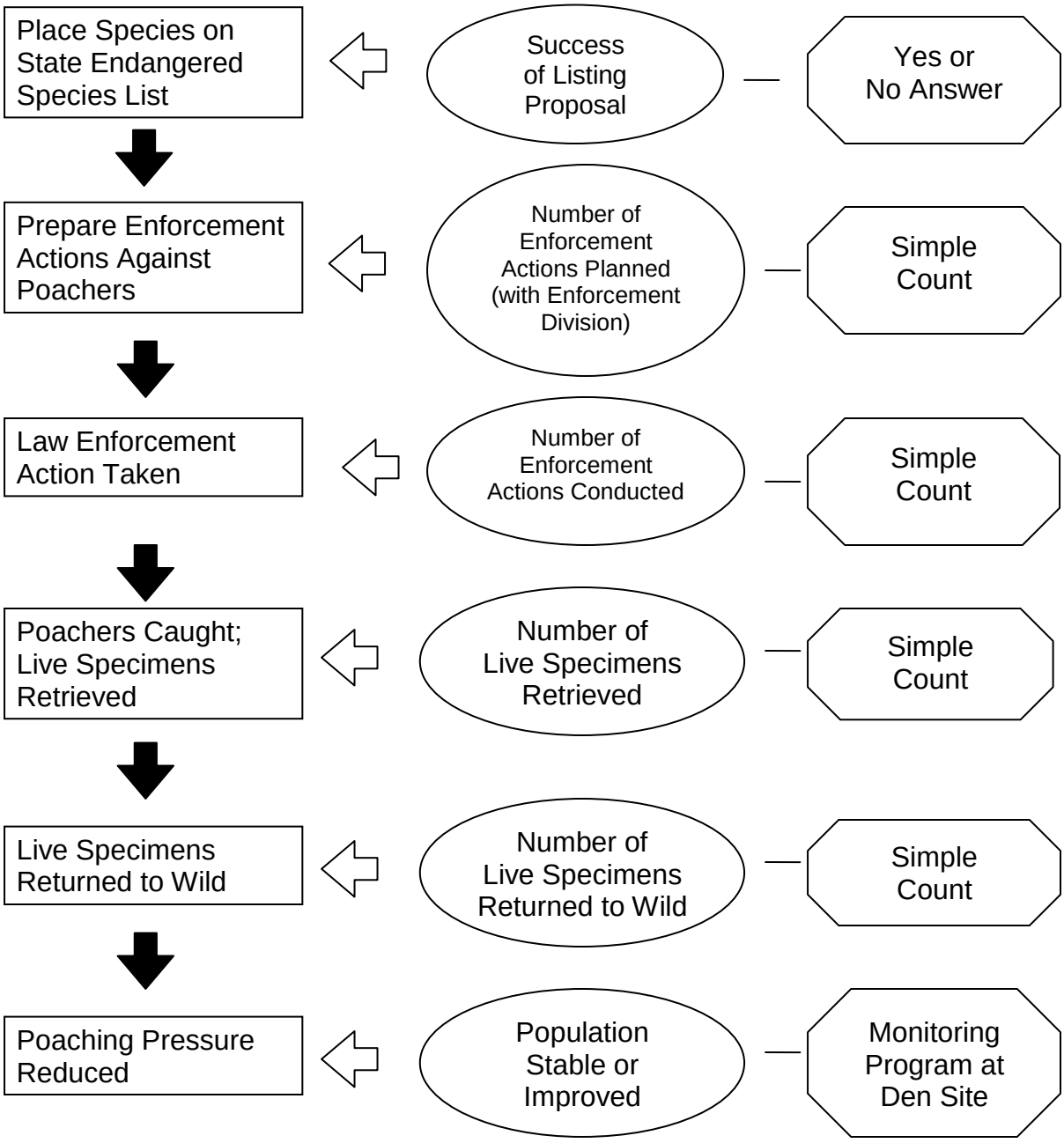
Habitat Protection Example

In this example, a restrictive conservation easement is placed on a property that would otherwise be subdivided sold for commercial development. This example shows how it is possible to think beyond simple measures such as "number of acres protected" and actually begin to quantify the potential impacts to wildlife that were **prevented** by taking a particular conservation action. Such quantification is possible in this case because plans for subdivision and development of the property had already been drawn up by a developer and filed with the city planning office.



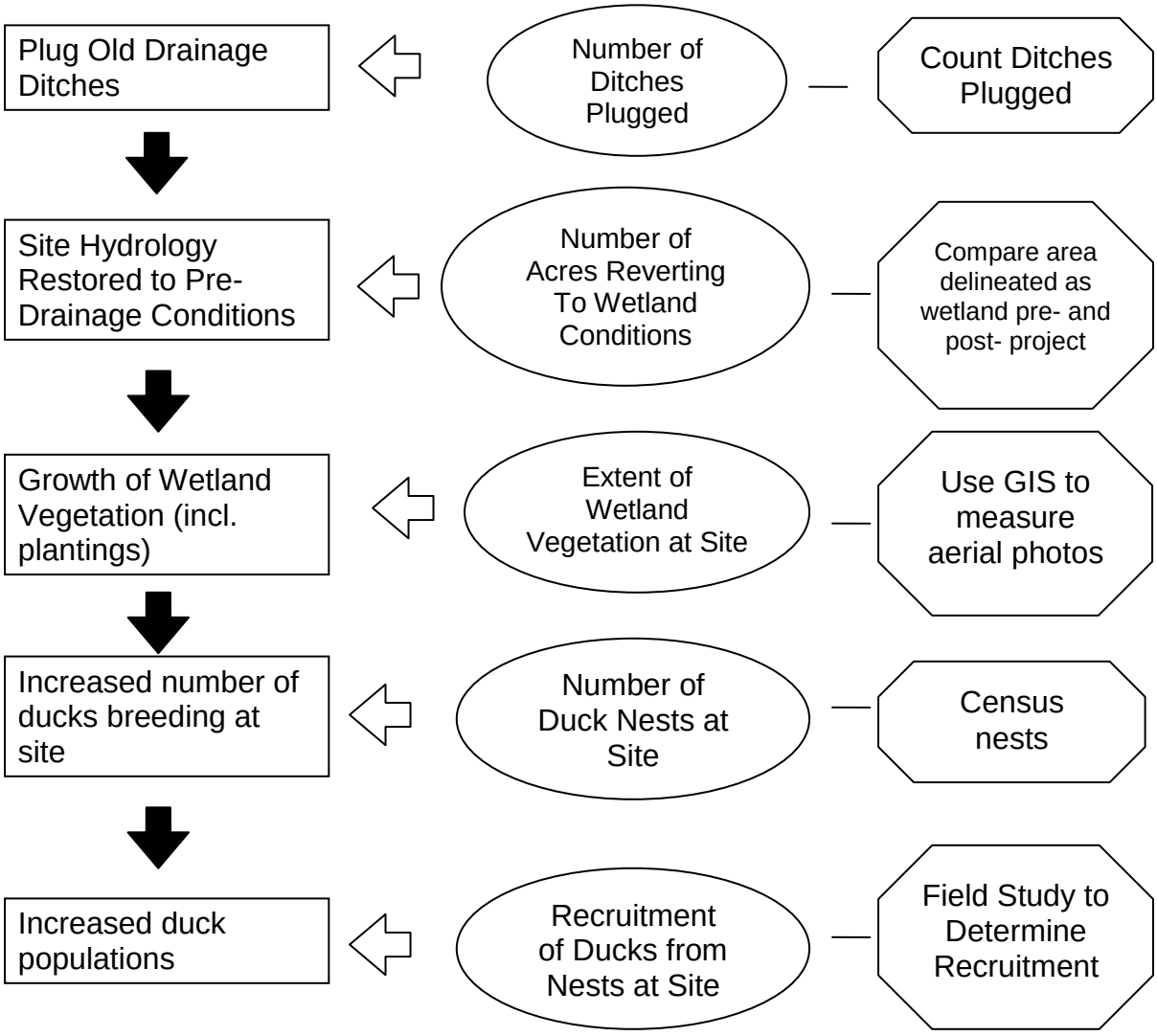
Regulatory Protection Example

Many states have their own endangered species laws or other legislation that protects particular species from certain human activities. This logic model shows how legal protection might benefit a rare reptile species. The specific context here is one of the northeastern states in the U. S., where rare or endemic reptile species have come under heavy pressure from collectors who wish to sell live, wild-caught specimens to the collector and hobbyist trade.



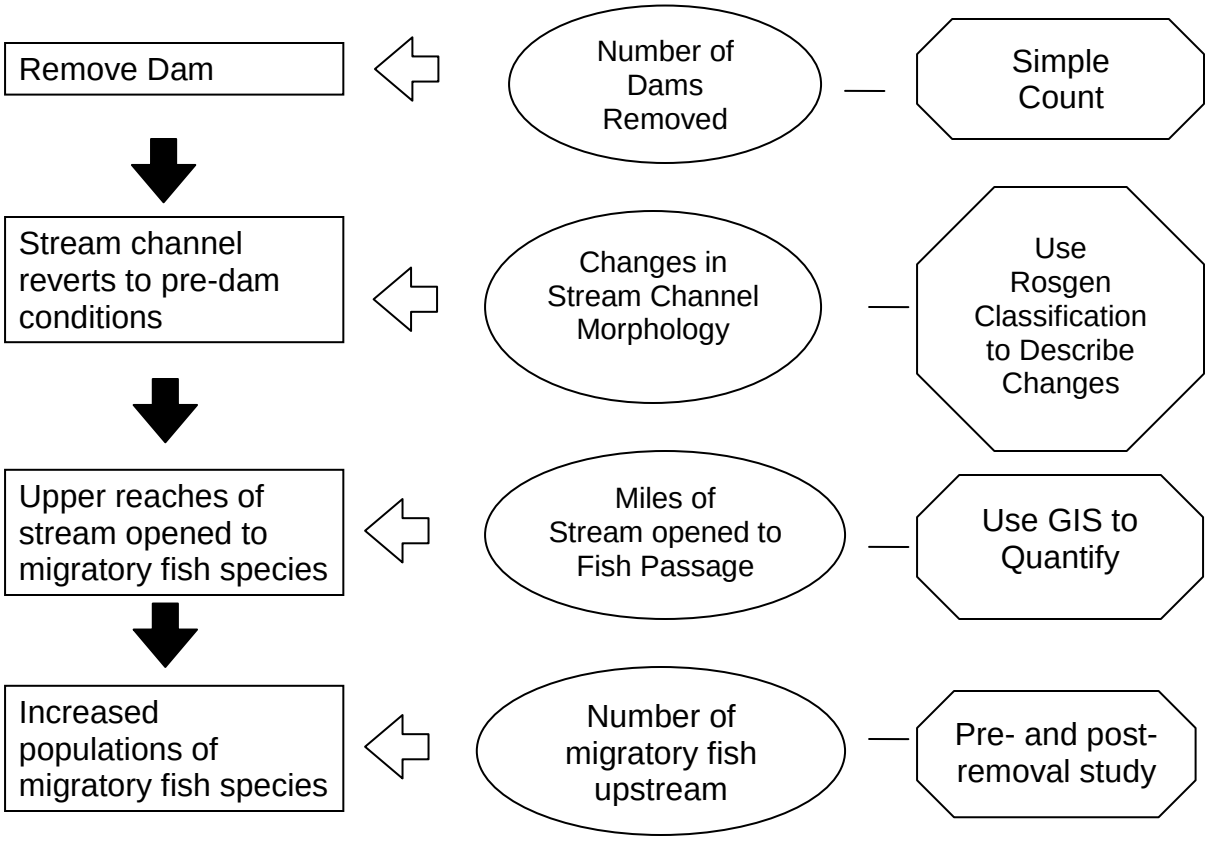
Wetland Restoration Example

This example focuses on a very common activity: restoration of hydrology in an area that was formerly a wetland, with the intent of improving nesting habitat for waterfowl.



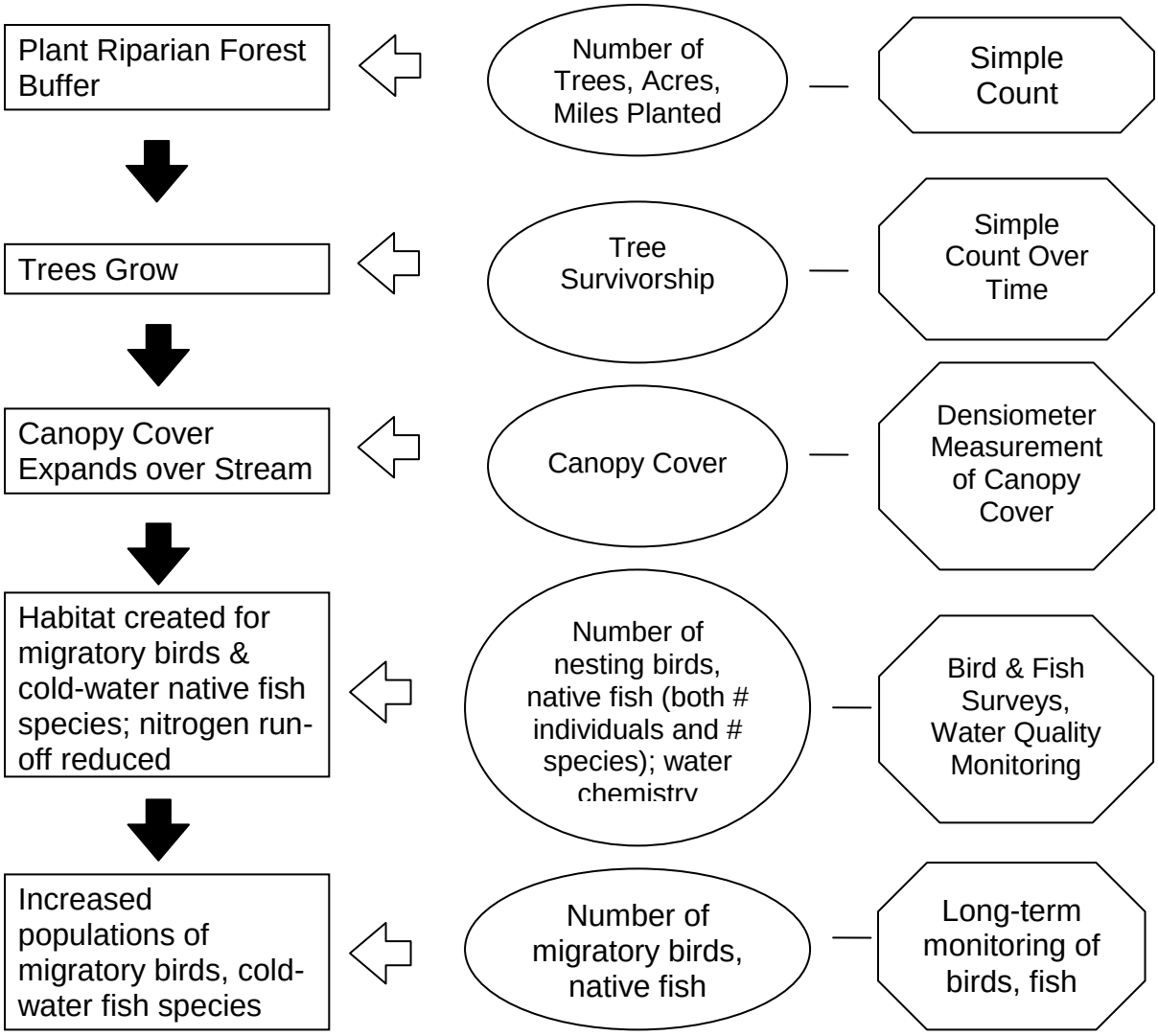
Dam Removal Example

Dam removals are increasingly common, particularly in the northeastern United States where many dams are no longer actively maintained and become safety hazards and eyesores. The conservation justification for removing dams is that such removals benefit migratory fish species. Measuring populations of fish species is a resource-intensive activity that is often beyond the capacity of local conservation groups; thus, benefits to fish populations from these projects are typically inferred from the number of miles opened to fish passage (a **proxy indicator**) rather than being measured directly.



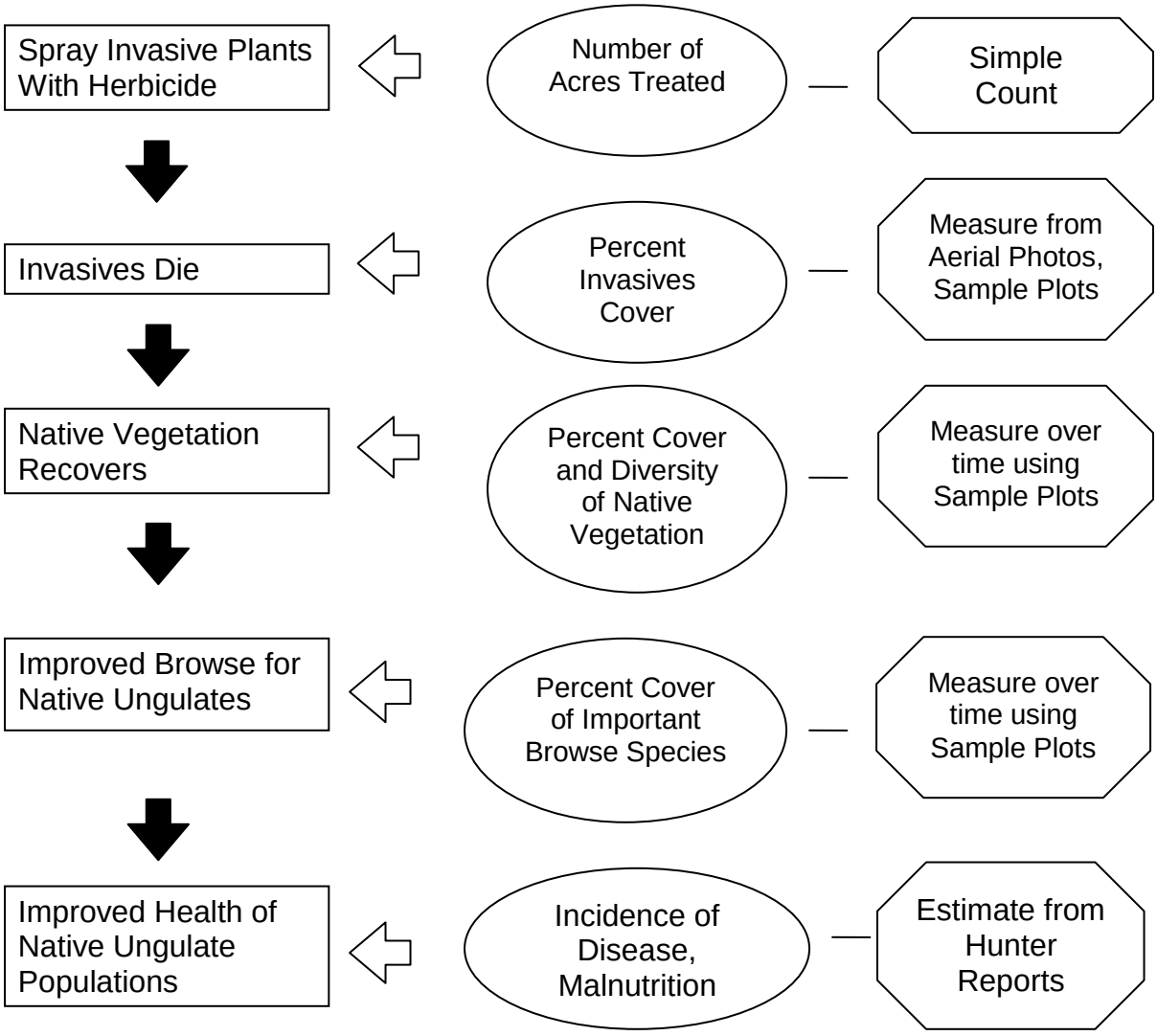
Riparian Planting Example

Riparian buffer plantings are a priority conservation activity for conservation groups in many parts of the U. S. Because these plantings can potentially benefit multiple wildlife species and may also help improve water quality, they are widely promoted by the USDA Natural Resources Conservation Service, the U. S. Fish and Wildlife Service, and the U. S. Environmental Protection Agency.



Invasive Control Example

Invasive plant and animal species threaten all manner of conservation areas and restoration projects. In this example, a native meadow is being treated to eradicate invaders that out-compete native browse plants for deer and elk.



Examples for non-Biological Activities: Linking Education and Outreach Activities to Biological Outcomes

Wildlife management, like any human endeavor, takes place within a broader societal context. Many members of society, including elected officials, hunters, anglers, gardeners, and birdwatchers, greatly value wildlife and have an interest in maintaining healthy wildlife populations. Programs that fund wildlife management activities are critically dependent on these same individuals for their continued survival: elected officials must vote to authorize funding; hunters and anglers must continue to purchase licenses and pay excise taxes, and so forth. Given this context, it is essential for wildlife managers to take the time to explain their work and cultivate support from these key constituencies. It is no surprise that outreach and education activities have become a significant part of the daily work of many wildlife biologists. However, in spite of their obvious importance, these activities are often undervalued and made a lower priority because they don't directly benefit wildlife or wildlife habitats.

We recognize that these education and outreach activities are necessary and important as first steps towards broadening the base and more effectively coordinating resources for wildlife management. However, we also see the importance of being able to measure the direct results of these activities, and, equally importantly, to show how these other activities will ultimately benefit wildlife populations.

Examples of these types of other activities include (but are not limited to):

-
- Coalition building
- Partnership development
- Coordination of activities with other agencies and organizations
- Outreach to new partners outside agency
- Outreach within agency, or within state government
- Outreach to the general public
- Fundraising

In this section, we'll explore how wildlife managers might measure the results of these different types of activities. We'll also consider how managers might be able to reasonably link these activities to longer-term wildlife conservation objectives.

1) Start With Output Measures

We suggest that managers start by developing some simple short-term **output** measures for their outreach and coalition building activities. The natural tendency here is to immediately reach for very simple measures like "how many times did you show the PowerPoint?" or "how many groups came to the meeting." These types of measures are easy to track but don't really tell you anything particularly interesting (and are hard to relate to wildlife).

Some equally simple but perhaps more interesting measures might include:

- How many acres are managed by the agencies we have in our coalition?
- How many members are represented by the private organizations in our coalition?
- How many new partners did we acquire who do on-the-ground habitat management?
- How many new partners did we acquire who do land protection work?
- How many [more] dollars will be spent in our state on priority habitat and species conservation work as a result of our outreach and coalition-building efforts?

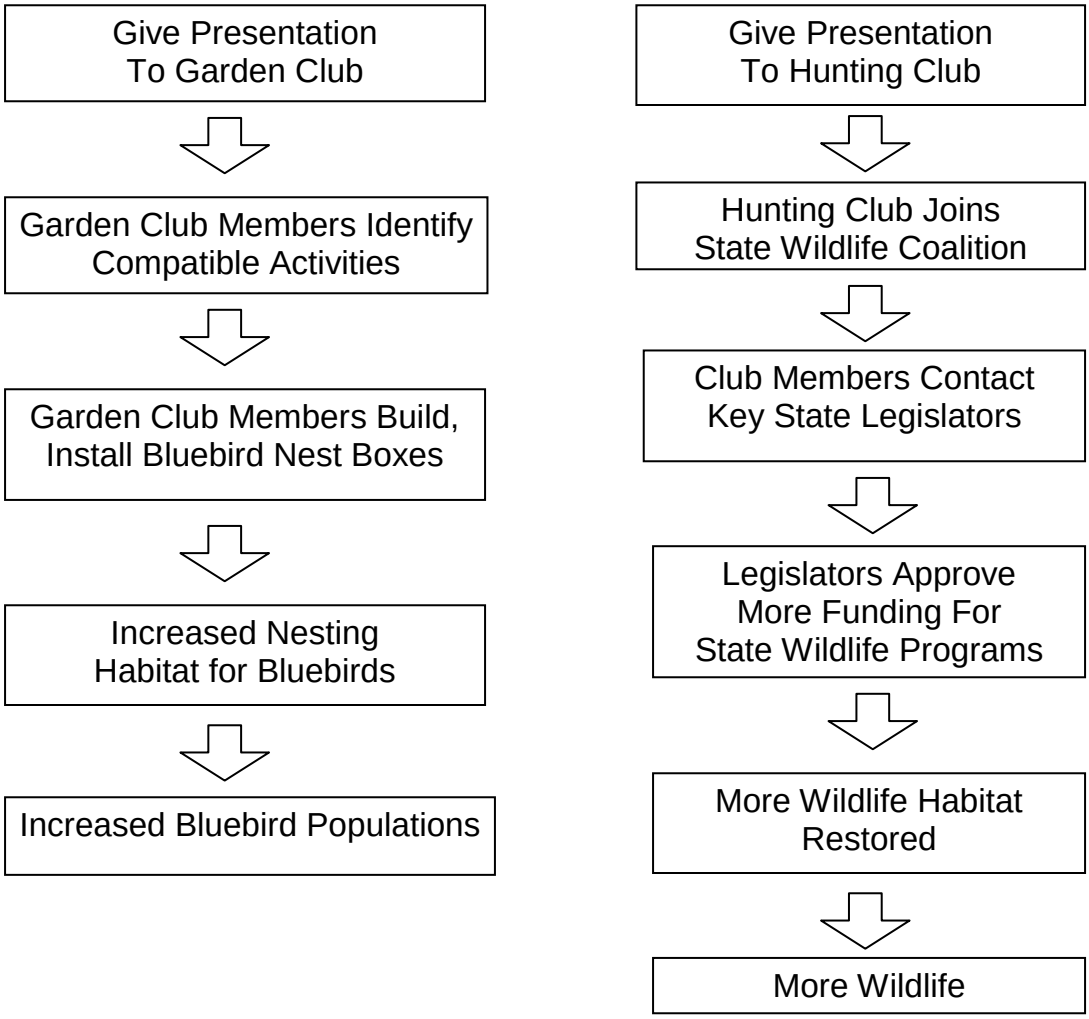
These measures start to relate particular outreach and education activities to longer-term benefits to wildlife that we expect will eventually accrue from these activities.

2) Then Use Logic Models to Link Activities to Wildlife Conservation Outcomes

After selecting output measures, the next important step is to be able to tell a compelling story explaining why these kinds of activities are critical for wildlife conservation. This means linking outreach and educational activities through a series of intermediate results to longer-term outcomes, including any direct benefits to wildlife that could reasonably be anticipated. As with the direct conservation examples above, we suggest that a logic model or causal chain may be helpful in developing these stories.

We would caution that it is important that the logic models be realistic, describing what you would reasonably expect would happen in a particular situation, not what would happen in the best of all possible worlds. You don't want to make extravagant claims for activities which, after all, will not be directly affecting the wildlife populations that you are hoping ultimately to conserve.

Here are two very simple examples that show how a simple outreach activity such as a presentation to a local citizens group could potentially lead to more meaningful conservation outcomes. The example on the left leads directly to a desired biological outcome; the example on the right shows how achieving a political (social) outcome can be seen as an effective intermediate step towards achieving desired biological goals of wildlife management.



VII. Further Reading

Healy, W. M. (ed.) 2002. Performance Measures for Ecosystem Management and Ecological Sustainability. The Wildlife Society Technical Review 02-1:i-vi + 1-33.

Margoluis, R., and N. Salafsky. 1998. Measures of Success: Designing, Managing, and Monitoring Conservaiton and Development Projects. Island Press, Washington, D. C. xx + 362 pp.

Noon, B.R. 2003. Conceptual issues in monitoring ecological resources. Pages 27-72 In: Monitoring Ecosystems: Interdisciplinary Approaches for Evaluating Ecoregional Initiatives. D.E. Busch and J.C. Trexler (eds.). Island Press.

Salzer, D. and N. Salafsky. 2006. Allocating resources between taking action, assessing status, and measuring effectiveness of conservation actions. Natural Areas Journal 26(3):310-316

Stankey, G. H., R. N. Clark, and B. T. Bormann. 2005. Adaptive Management of Natural Resources: Theory, Concepts, and Management Institutions. USDA Forest Service Pacific Northwest Research Station General Technical Report PNW-GTR-654. 73 pp.

Trochim, W. M. K. 2006. Research Methods Knowledge Base. World Wide Web site at: http://www.socialresearchmethods.net/kb/index.php [especially valuable for social science topics such as measuring effectiveness of education and outreach programs]

Walters, C. 1986. Adaptive Management of Renewable Resources. The Blackburn Press, Caldwell, New Jersey. x + 374 pp.

VIII. NEXT STEPS

Developing Performance Indicators for the Nevada Wildlife Action Plan: Next Steps

The next steps in developing a set of performance indicators for the Nevada Wildlife Action Plan will include several key activities: refinement of the draft indicators, selection of monitoring approaches and protocols, and the commencement of data collection.

1.) Form a coordinating group

We recommend the formation of a coordinating group to guide the process of finalizing and implementing the monitoring plan. A coordinating group can provide oversight and continuity throughout the process. During the process of indicator refinement, the group should be prepared to meet on a regular basis to review progress and resolve any issues that may arise. Once data collection begins, the group can meet periodically as needed to review the data that have been collected and make suggestions for refinement of data collection and management.

Some suggestions for membership include:

* Dennis Murphy, UNR
* Larry Neel (and Laura Richards if available), NDOW

* Susan Abele, TNC
* Elroy Masters, BLM
* At least one other federal agency representative

We recommend that one person serve as the coordinator of the coordinating group. This person should have excellent project management and facilitation skills. Scientific knowledge is less important than the right skill set to keep the project moving along. The coordinator could even be a graduate student or a part-time contractor (in order to keep costs low).

One of the key areas where the facilitator can help is in narrowing down the number of indicators that are being recommended by technical experts and others involved with this process. There is a natural tendency to want to have more indicators rather than fewer. Yet budget and staff limitations mean that only a few indicators can actually be measured at the level of precision necessary to inform management decisions. One of the important messages to keep in mind during this process is that **it is better to measure a few key indicators well than to measure many things poorly**.

2.) Convene technical experts who are knowledgeable on priority ecosystems

The coordinating group will want to convene groups of technical experts on each of the priority ecosystems (Sage, Mojave, Springs/Springbrooks, others on Laura Richards' priority list?). Each group should contain a minimum of 2 experts but ideally more (4-12 is often cited as an optimal size). Care should be given in selecting group members to ensure a diversity of opinions, backgrounds, and areas of expertise. Working group members need not see eye-to-eye on every issue – in fact, the evaluation literature suggests that disagreement among this group is healthy. Based on the Heinz Center model, we also suggest trying to include experts from different stakeholder groups (federal and state agencies, affected business interests, interested/knowledgeable NGOs, and academics). Their participation clearly strengthens buy-in from key constituencies.

We recommend convening at least one face-to-face meeting of each expert group. Face-to-face meetings are much more valuable – and much more likely to elicit in-depth discussion and substantive input - than either conference calls or e-mail communications.

The expert groups have two key tasks. The first task is to review the lists of potential status indicators that were developed at the March 6-7 workshop and select a much smaller set of indicators (1-2 if possible) that the group feels are the most important attributes for tracking the status or condition of the ecosystem.

With regards to the status indicators, the key question for the technical working groups is:

* If you could only measure and report on one attribute of this system, what would you measure?

The working groups may not be able to reach consensus on this question, but the goal is to reduce the very large number of possible indicators down to a smaller set that could actually be measured as part of a real-world monitoring program. It is safe to assume that the monitoring program for the NWAP will operate under severe budget constraints, with limited abilities to collect new data, so "fewer indicators measured well" is preferable to "many indicators measured poorly."

The second task for the technical workgroups is to review the conceptual models and construct simple logic chains for each action that will **actually be undertaken** by NDOW and its partners in the next 1-5 years.

The first question in this process is:

> * What specific management activities are most likely to be implemented, by whom, and when?

The next question in this process is:

> * What is the sequence of steps between each of these individual activities and the target? The group should construct a simple logic chain diagram for each activity that will actually be undertaken by NDOW and its partners

Next comes the identification of possible "effectiveness" indicators:

> * For each step in the chain, list one indicator that would tell you whether or not this step actually proceeded in the way that you think it will.

And review of the list of possible indicators:

> * Of the possible indicators, which ones are most important (would give you the most information about whether the action is having the desired effect)? If you could only monitor one or two things regarding each management action, what would they be?

The outcome of the expert review should be a short list of ecosystem status/condition indicators, as well as a short list of potential "effectiveness" indicators for the activities that will actually be undertaken in the next 1-5 years. This should be provided to the coordinator for transmittal to the coordinating group.

3.) Coordinating group reviews the lists produced by the expert panels, seeks congruences/similarities, and groups them into potential monitoring clusters

Each of the expert groups will provide the coordinating group with refined lists of status indicators and management indicators. Once all of these lists have been compiled, the coordinating group will then need to review the entire set of lists and look for commonalities and congruences across the potential indicators.

The goal here is to group sets of variables that could potentially be included in a single monitoring program. For example, ecosystem extent variables might be recommended as a "coarse-filter" status indicator for sagebrush communities as well as Mojave desert plant communities. In an actual monitoring program, both of these variables could be measured from a single set of remotely-sensed imagery. Thus, at the macro scale it would not be necessary to develop independent sets of monitoring protocols and data sources for ecosystem extent variables in the Mojave Desert and sagebrush ecosystems – a single data layer on vegetation cover would probably suffice.

The coordinating committee should also consider whether certain variables could be added to existing monitoring programs (for example, current sage grouse monitoring programs might be enhanced to collect data on pygmy rabbits or sagebrush understory communities).

The output of this review should be a refined set of indicators, grouped by similarities in data collection and monitoring methodology.

4.) Convene monitoring experts from region to review draft indicator lists and recommend protocols

The coordinating committee should next convene a group of monitoring experts, monitoring practitioners, and data providers to review the lists of indicators and make recommendations for actually measuring each indicator cluster. The group should include:

* Representatives from state and federal agencies with land cover data
* Representatives from existing wildlife monitoring programs (state, federal, non-profit)
* Members of the ecosystem expert panels who have real-world experience in monitoring

These monitoring experts will need to have copies of the refined indicator list sent to them in advance of the first meeting.

Together, the coordinating committee and monitoring experts should develop a detailed strategy for measuring each of the indicators identified by the technical groups. Such a strategy should include, at minimum: a description or reference to an existing monitoring protocol, a sampling strategy that is relevant for the scale/scope/timeframe of the question being asked (status or effectiveness), a description of the types of data that will be collected, a description of the data management system (database, GIS, etc.), and a description of how data will be provided to key decision-makers (NDOW, other Nevada state agencies, USFWS, and federal land management agencies).

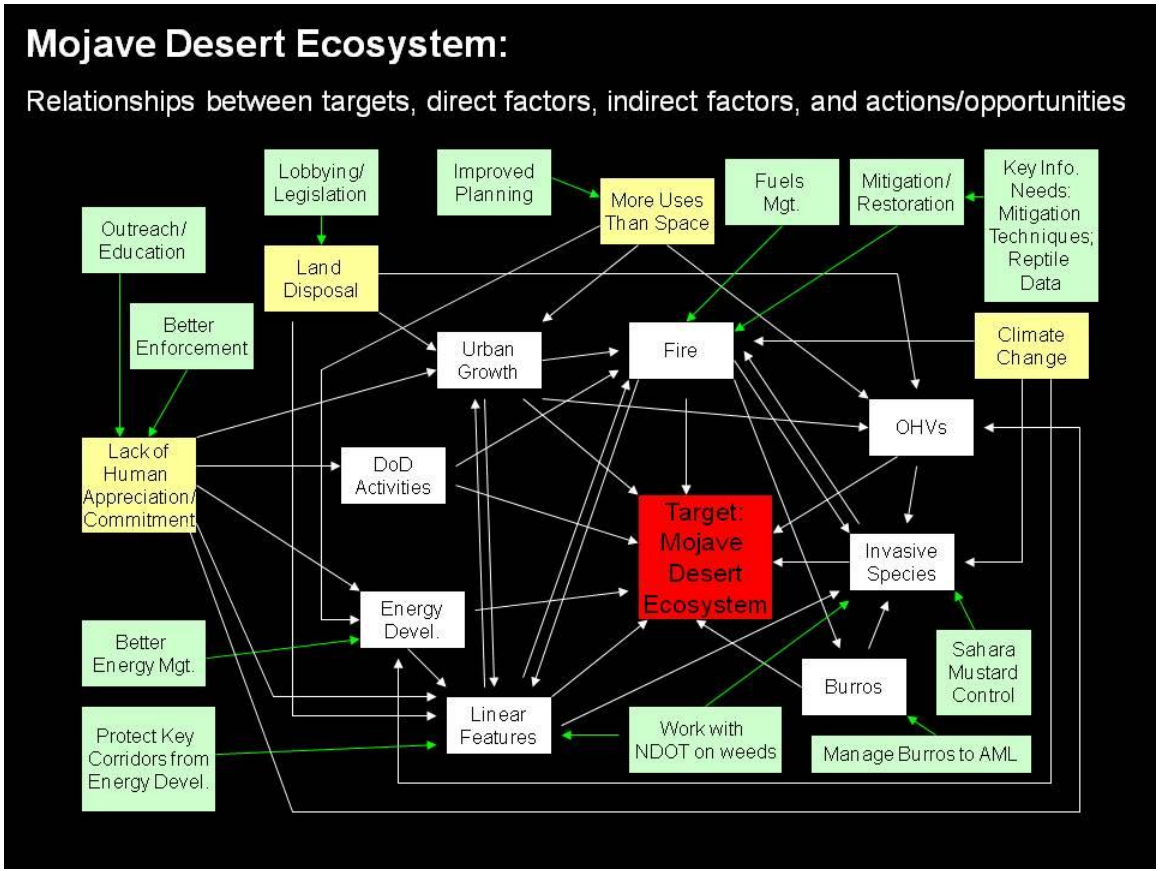
The results of this review will be a set of recommended protocols for measurement and a strategy for implementing these protocols.

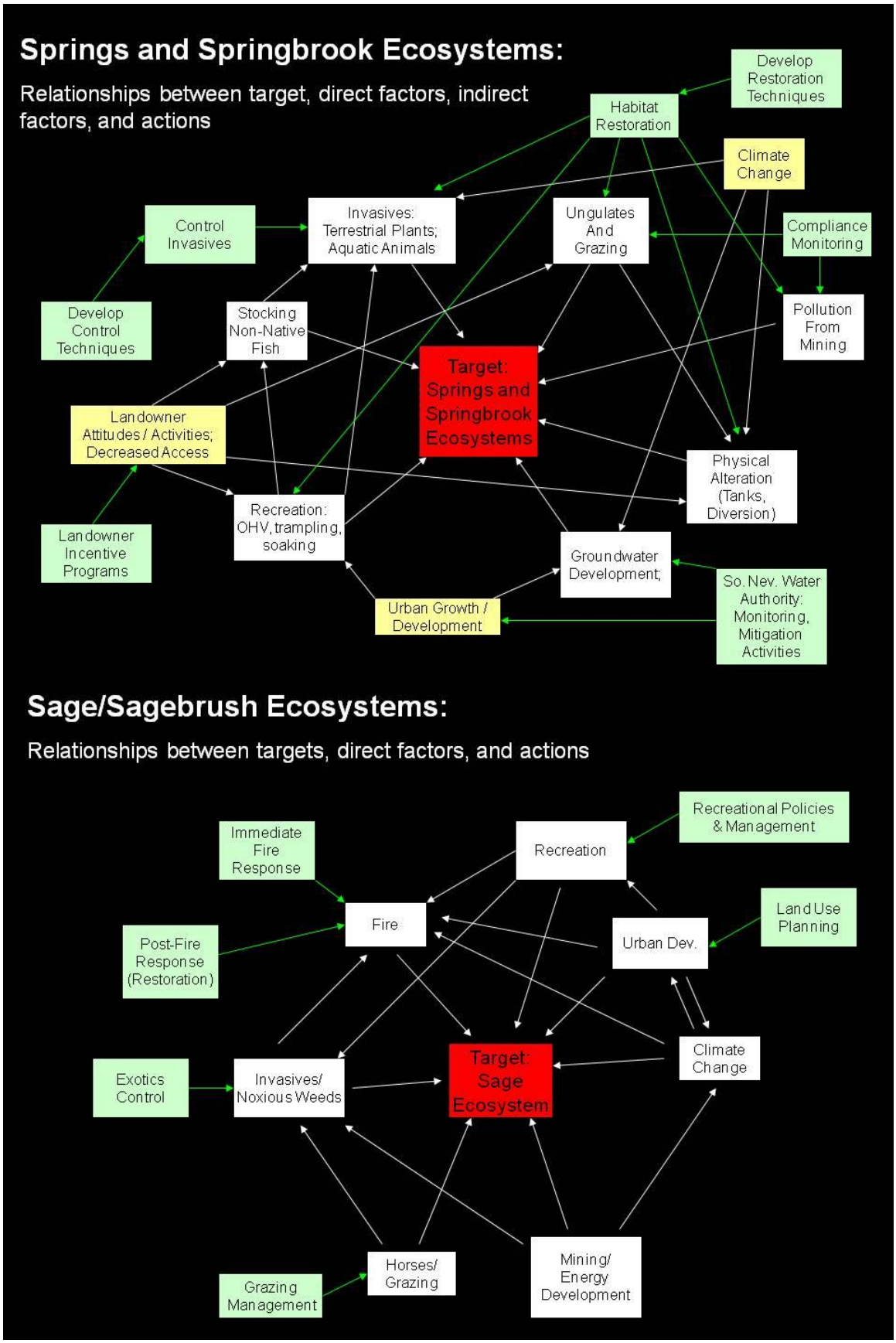
5.) Make decisions regarding data collection, management, and reporting

At this point, NDOW and the partner agencies will need to go through a series of discussions leading to real decisions regarding:

* What data are actually going to be collected?
    - What amendments can be made to existing monitoring programs, and how exactly do we do that?
    - What new data do we need, and how will we collect it?
    - What budget, staff time do we need?
* How will these data be managed (databases, GIS, etc.)?
    - Who will manage (USGS, NDOW, others?)
    - What budget, software, staff time is needed?
* How will we use these data to inform adaptive management of wildlife and ecosystems? What type and frequency of reporting is most effective? Who gets the reports?

IX. CONCEPTUAL MODELS




Springs and Springbrook Ecosystems:
Relationships between target, direct factors, indirect factors, and actions
Develop Restoration Techniques
Habitat Restoration
Climate Change
Control Invasives
Invasives: Terrestrial Plants; Aquatic Animals
Ungulates And Grazing
Compliance Monitoring
Develop Control Techniques
Stocking Non-Native Fish
Pollution From Mining
Target: Springs and Springbrook Ecosystems
Landowner Attitudes / Activities; Decreased Access
Physical Alteration (Tanks, Diversion)
Recreation: OHV, trampling, soaking
Landowner Incentive Programs
Groundwater Development;
So. Nev. Water Authority: Monitoring, Mitigation Activities
Urban Growth / Development
Sage/Sagebrush Ecosystems:
Relationships between targets, direct factors, and actions
Recreational Policies & Management
Immediate Fire Response
Recreation
Fire
Land Use Planning
Post-Fire Response (Restoration)
Urban Dev.
Climate Change
Exotics Control
Invasives/ Noxious Weeds
Target: Sage Ecosystem
Horses/ Grazing
Mining/ Energy Development
Grazing Management