## Homework Assignment for FLN Workshop #1

**ALL** landscape project teams do Parts A and B. **Demonstration** landscapes also do Part C. **Participating** landscapes can chose to do Part C as their one required homework assignment. Part C is optional for **Contributing** landscapes.
Please submit completed homework to: ashlisky@tnc.org by **MARCH 20**.

**Part A**. **Project description** (this will be put in workshop binders).

Please describe your landscape project in 2 pages or less (12 pt font) using the following format.

***Project Name:*** The "official" name we'll use from now on for FLN documents/reports
***Project Contact:*** Name, affiliation, address, email, phone
***Partners:*** TNC and other staff and their affiliation directly participating in project
***Funding:*** % by partner; specify funds provided through the FLN and federal cooperative agreement as "USFS/DOI"
***Ecoregion:***
***State:***
***Landscape Project Extent:*** In acres/hectares
***Landscape Description:*** Briefly describe in one or two paragraphs: 1) general location, 2) land ownership/administration, 3) landscape context/character (e.g., current management emphases, character of wildland-urban interface, social/economic issues relevant to fuels or fire restoration activities, etc.

***Conservation Targets, Threats and Viability***: (limit to ≤ 8; fire-adapted targets first)

| Target | Threats | Viability Ranking |
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***Natural/Historical Fire Regime(s):*** To the best of your knowledge, what is the natural or historical fire frequencies, intensities and extents for matrix fire-adapted systems? Specify how certain you are about these fire regimes

***Current Fire Regime(s):*** Are fire regimes currently altered? How?

***Actions Taken To Date:*** Describe the types and success of fuel treatment/fire restoration actions already implemented, if applicable.

**Part B. Revised Work Plan and Budget**
List the objectives and products you will accomplish as a part of the FLN (you can include work completed since January 2, 2002 - the start date of the coop agreement)

FLN Project Objectives:
FLN Products:
Year 1:
Year 2:

Revised Budget: **One-Year Projected Budget January through December 2002**
(non-federal match must total ≥ 30% of award)

| CATEGORY | Awarded FLN Funds** | TNC Match (note whether confirmed or pending) | Other Sources of Match (non-TNC, non-federal) | Other Sources of Match (non-TNC, federal) |
|---|---|---|---|---|
| **Personnel** | | | | |
| **Fringe Benefits @ (Full-time – 37% ; Short-term – 8.5%)** | | | | |
| **Travel*** | | | | |
| **Supplies** | | | | |
| **Contractual** | | | | |
| **Other** | | | | |
| **Total Direct Expenses** | | | | |
| **GRAND TOTAL** | | | | |

* Include here only funds needed above and beyond $1200 per site available from other FLN sources for travel expenses.

** Cannot include indirect costs due to the nature of the matching funds program.

**Narrative: Provide detail on how the amounts listed above will be used to meet the goals of this project. Also, please list where confirmed or pending sources of match will come from, as well as any partners who contribute matching funds.**

**Part C. Conceptual Ecological Models and Collaborative Landscape Goals**
Demonstration project teams will make a brief presentation of their completed homework (presentation guidelines, below), and obtain peer review at the workshop.

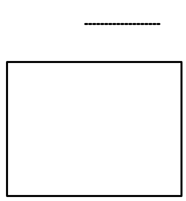
*Overall Homework Objectives:*
1) Collaboratively develop the scientific basis for landscape scale fire management, in the form of a conceptual ecological model for one or more fire-adapted systems.
2) Draft a collaborative landscape goal statement with partners.

***Tasks***
1. ***Draft a conceptual ecological model of at least one fire-adapted matrix system*** in the form of a box and arrow diagram (state-transition model, see example below). The model illustrates what you currently know or can hypothesize about how your ecosystem works. Try to construct this model in collaboration with your landscape partners. Introduce your partners to the 5-S Conservation Area Planning process, if you haven't already. See Appendix A for some tips on ecological modeling in general (courtesy of Karen Poiani).

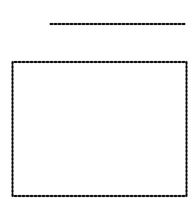
Things to consider:
- appropriate scale - the model should represent landscape scale structure, composition and process - avoid getting into stand-scale details
- consider doing models at 2 scales - try it with just four boxes (e.g., openings, ponderosa pine, ponderosa pine with Douglas-fir, multi-story old growth pine) - and then add more complexity if needed
- emphasize simplicity over complexity; embed small patch systems into matrix systems
- natural successional processes
- natural disturbance processes (e.g., fire, insects, disease, wind, herbivory), emphasizing fire and related processes
- abiotic/environmental factors and constraints (soils, topographic position, geology)
- effects of human-caused disturbances (harvest, prescribed fire, livestock grazing)

Clarify differences between abiotic constraints on ecosystem structure and function (e.g., moisture conditions, aspect, landform) and agents of change (e.g., natural disturbance, succession, prescribed fire). For example, transitions should not occur between states that represent vastly different abiotic conditions important to fire regimes (e.g., aspect). You may want to put attributes like elevation, moisture or fire regimes on the X or Y axes of the model as a whole (see example, below).

Distinguish between states and transitions that you are relatively certain about, versus those that you are hypothesizing. One way to do this is with solid versus dotted boxes and arrows for relatively certain versus hypothesized conditions.

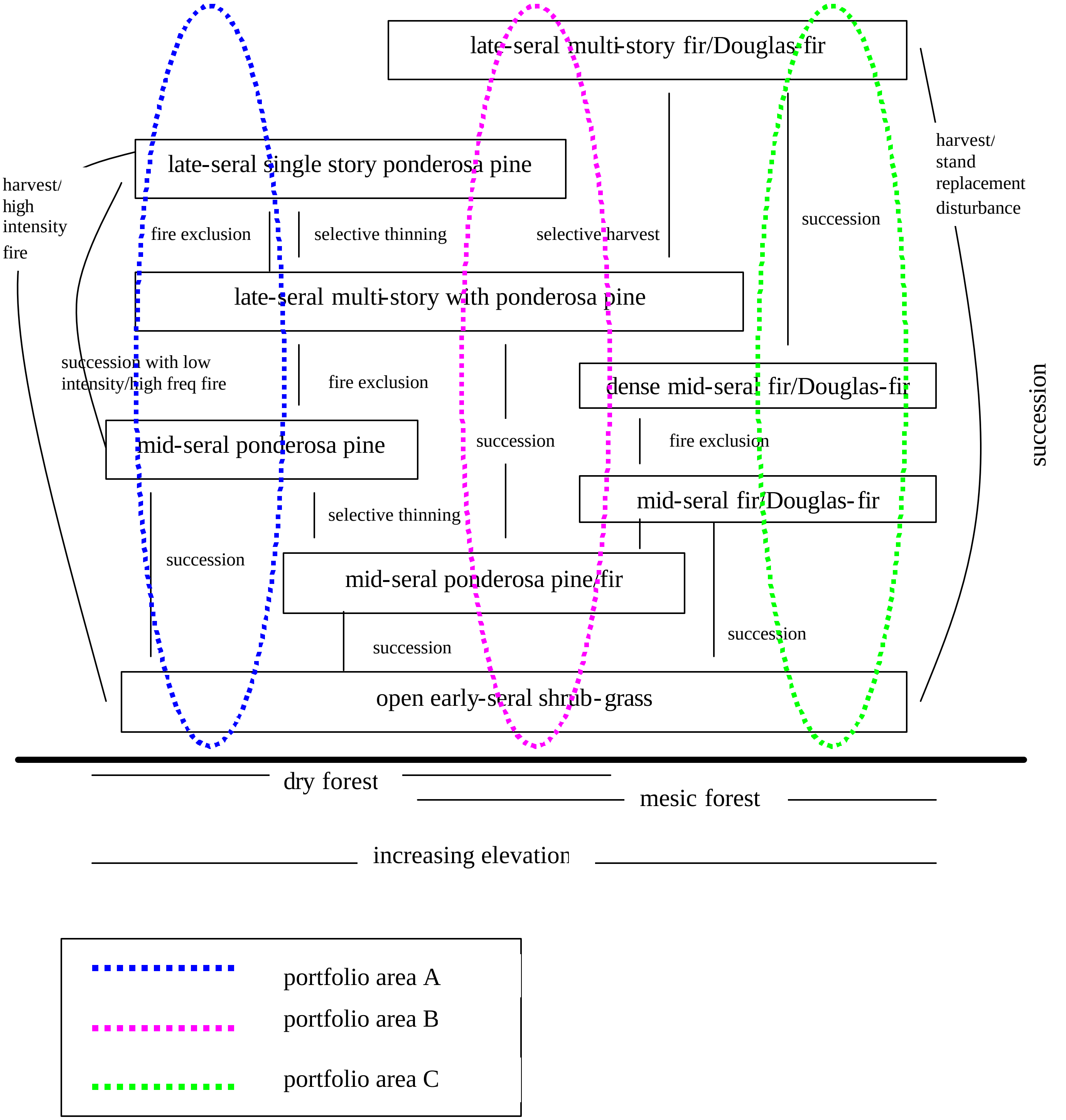


states and transitions understood with some certainty (have data or expert opinion)



hypothesized states and transitions (less certainty)

***Example:*** Hypothetical conceptual ecological model for a fire-adapted ponderosa pine/Douglas-fir forest ecosystem. Ovals represent the extent of three separate portfolio areas. Your model should *not* be more complex than this, and preferably simpler.



2. ***Develop a draft collaborative landscape goal statement***

Engage landscape partners in drafting a goal statement for your landscape. The goal statement is a vision integrating partner objectives or missions, and providing a long-term picture of what the landscape will look like. "Long-term" in this context represents more than one generation time of the dominant vegetation.

Things to consider when drafting your goal statement:

- use the conceptual ecological models constructed in Task 1 as the scientific foundation and common ground between partners
- this is a first draft; it is only a few ($\leq$4) sentences long
- envision the characteristics of success - success is not necessarily "increasing the amount of prescribed fire" - put success in terms of ecosystem, economic or social conditions
- the goal statement is broad, but as specific as possible (i.e., a goal like "Ecosystem conditions outside the WUI, as defined by partners, is maintained within the historical range of variation using a combination of prescribed fire and mechanical means, the appropriateness of which will be decided based on relative risks to biodiversity values and economic benefits..." is better than: "Landscape ecosystems are healthy and communities are economically viable...")
- don't get stuck on differences and conflicts - get around barriers by agreeing to document assumptions, differences of opinion and conflicts in vision
- review goal statements in existing land management plans, agency or organizational mission statements, existing fire management plans and other sources

Document 3-5 assumptions that were made while creating the goal (e.g., we assumed air quality regulations won't restrict increased levels of prescribed burning), 3-5 difficulties you came across (e.g., DOI email unavailable), and 3-5 possible barriers to achieving this goal (e.g., conflicting partner missions).

| **Assumptions** | **Difficulties in composing goals** | **Barriers to achieving goals** |
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So, what do you submit for Part C by MARCH 20? Submit your: 1) draft model, 2) $\leq$4 sentence collaborative goal statement, and 3) table of observations about goal assumptions, difficulties and barriers.

## Demonstration Project Presentation Guidelines

**Workshop Day 1: Conceptual Ecological Models** (20 - 25 minutes, excluding discussion)

a) brief description of the project location, partners, targets, threats to conservation targets and risks to community safety or other values (5-7 minutes)

b) describe your conceptual ecological model for one or two primary fire-adapted matrix ecosystems (10-15 minutes)
   1. Who was involved in building the model?
   2. What do the model components (states and transitions) represent?
   3. Are there any important small patch systems not represented by the model? Within which matrix systems may small patch systems be embedded?
   4. If known, which states are likely outside the range of acceptable or desired landscape conditions
   5. Where are you relatively certain about the structure and composition of states and effects of transitions, and where is information lacking?

c) provide one primary question you want help in answering during the peer review process (1-2 minutes)

**Workshop Day 3: Collaborative Landscape Goal Statement**
Present your short landscape goal statement. Provide one or two of the most important assumptions, difficulties and barriers encountered during the process (5 minutes).

The bulk of discussion about goals will occur in small groups.

**LOGISTICS FOR THE PRESENTATION:**

We will assume that you will be making a power point presentation. If you need alternative audio visual equipment, let us know ASAP.

Please stay within time limits.

Please bring a CD copy of your presentation with you - this will allow us to use one laptop for all presentations and avoid difficulties with laptop-LCD projector incompatibilities

# APPENDIX A

# Conceptual Ecological Models & Site Conservation Planning

# A Brief Overview

March 1999

## Introduction

One of the greatest challenges we face in conserving biodiversity is articulated in the following statement by Frank Egler, quoted in a recent conservation planning book by Reed Noss[1]: "*Ecosystems not only are more complex than we think, but more complex than we can think*." Given this truism, it is critically important that as conservation practitioners we are honest and humble regarding our limited knowledge and understanding of the natural world. On the other hand, we must not allow incomplete knowledge to deter our conservation actions, but must use the best available information to guide them. Formulating a picture of the way our conservation targets work through the use of ecological models can help sort through the complexities. There will always be many ecological intricacies we do not understand, but ignorance is no bar to action or to constructing ecological models. This paper provides a brief overview of ecological models, outlines different types of models, and provides some thoughts on their construction and role in site conservation planning and management.

## What Models Are and Are Not

An ecological model is a conceptual or mathematical representation of a natural phenomenon. Ecological models are abstractions or simplifications of the real world that portray the dominant components and key processes. Typically, models define relationships among <u>*states*</u> (parts of the ecosystem) and <u>*transitions*</u> (processes that change the states). These relationships are the basis on which to predict changes in our conservation targets over time depending upon trajectories of, or perturbations to, key processes. Ecological models are excellent tools for generating questions about the behavior of our conservation targets and guiding decision making for planning and management. Models also document and record major assumptions and current understanding.

Ecological models, however, are not a panacea for solving every problem or answering every question. Models are a means of integrating data to more comprehensively understand complex ecosystem dynamics. They are only as good as the information they are built upon. It would be unwise to think of models as answers in and of themselves. They are simply *powerful tools* for organizing and communicating ideas, synthesizing current understanding and data, elucidating unknowns, and generating hypotheses. In the best of circumstances, they provide a peek into the future to help guide present decisions. Although ecological models have limitations in predicting future states, these limitations do not overshadow benefits derived from their construction and use.

## Types of Models

Ecological models come in a variety of forms and levels of complexity. Models can be simple conceptualizations consisting of *narrative descriptions*, *schematic diagrams*, or *box and arrow flowcharts* (i.e., state-transition models). They also consist in some cases of simple or complex *numerical equations or graphs*, or numerical relationships programmed within a computer environment to form the basis of a dynamic *simulation model*. This latter group of models varies

[1] Noss, R.F., M.A. O'Connell, and D.D. Murphy. 1997. The Science of Conservation Planning. Island Press, Washington, D.C.

greatly themselves. Computer simulation models include for example, population viability models, forest succession and disturbance models, fire simulation models, animal habitat and dispersal models, wetland and river dynamics models, and whole-ecosystem biogeochemical models.

The most common types of models used in the Conservancy for site conservation planning are conceptual ecological models in the form of box and arrow diagrams. Conceptual ecological models can be created for a variety of conservation targets, including individual or groups of species, vegetation community types or assemblages of community types (*a.k.a.* "systems"). The type of model constructed depends on the scientific questions asked, goals and objectives of the project, and characteristics of the conservation targets at the site.

**Constructing Ecological Models**

Constructing an ecological model is an interactive, iterative process. Models are never complete. Sometimes it makes most sense to gather data and information on an entire site, then decide the subset of conservation targets that should be modeled. In other circumstances, it is desirable to select focal species, communities, or systems first, and then gather information for a model. The order of events depends partly on the use of the model, how well the site and conservation targets are understood, and whether there are obvious targets or key components to model. Sometimes key components are mandated (e.g., endangered species targets) or extremely obvious, in which case modeling efforts can focus on these as a starting point.

Gathering information for constructing an ecological model takes many forms. All sources of information and data should be considered, including:

- literature searches
- heritage programs
- BCD
- Element Stewardship Abstracts
- published papers
- unpublished reports
- gray literature documents
- state and federal agencies
- comparison to other similar systems
- expert or local knowledge
- logic and intuition.

There are many resources within the Conservancy to help with ecological modeling. Look to heritage programs and BCD (Biological and Conservation Database) for much information on tracked elements. Element stewardship abstracts are great sources of information on specific elements available from Home Office Stewardship and the intranet. Members of the national stewardship team assist in model development and information synthesis (e.g., fire, weeds, landscape ecology, freshwater, adaptive management). Also, expert knowledge is an important source of information for building ecological models and is often underutilized. Informal "modeling workshops" with local biologists and land managers can provide a first-draft model in a relatively short period. Scientists and managers working in the field can contribute knowledge and intuition typically not found in journal papers. In particular, they often know which ecosystem components and relationships are least understood.

Below is a series of suggested steps for assembling ecological models. Most experienced modelers suggest starting at the simplest level and progressing to more complex models as warranted (e.g., written descriptions, to flow diagrams, to numerical rules or equations). Although the discussion below emphasizes assembling conceptual state-transition models, the same general process can be used for other types.

(1) *Gather and assemble relevant data, information, and knowledge* on the conservation targets and supporting natural processes to be modeled (see above).

(2) *Choose structure of model.* For example, is the system or targets best represented by a schematic diagram, a state-transition flowchart, or a written description? Who is the audience? What will the model be used for (e.g., to figure out what to monitor, to analyze threats, to present information to stakeholders)? Can you build on something already started?

(3) *List all important states and transitions.* It may be helpful to begin by generating a written list of all important states and transitions before proceeding with the box and arrow diagram. Then, the emerging flowchart can be checked against the initial list to ensure that no key components were omitted.

(4) *Illustrate known and record unknown transitions among states*. Draw key states in boxes and show interactions among components using arrows. Show all known relationships as applicable, including successional processes, forcing functions, driving variables, human alterations, and biotic and abiotic processes. Indicate all unknown or suspected relationships and identify their level of uncertainty. Transitions are identified as verbal descriptions or numerical relationships if they are known (see Waterboro Barrens model for a great example).

(5) *Discuss draft and revise as needed.* Step back from model and view progress. Digest, discuss, and revise diagram as needed. Revisit and discuss more thoroughly those components that appear uncertain or controversial.

(6) *Send out model for review.* An outside peer review of the model is immensely helpful. Solicit responses from ecologists and biologists working in similar ecosystems or in other locations. Review of results by nonscientists is important if models are used to express ideas to the public or other non-technical users.

(7) *Update and improve models as new information becomes available.* It is crucial to revisit models periodically. Knowledge of our conservation targets is always increasing. Monitoring and research will provide important feedback to model assumptions that may support or conflict with current understanding. Update models often. Review

assumptions and key components. Adaptive conservation and management depend on this feedback.

**Role of Ecological Models in Site Conservation Planning & Management**

Ecological models help guide conservation planning and management in many ways. Models are the expression of a progression of scientific thought that starts with determining key ecological components, and ends with a summary of the causal ordering and relationships among these essential properties. Ecological models are maps or flowcharts that literally help navigate direction and interpret results. Models provide information on the most important ecosystem descriptors, spatial and temporal scales of major biotic and abiotic processes, and current and potential threats to processes and components. They provide feedback to and help formulate many aspects of planning and management including: setting goals and objectives, identifying threats, developing strategies, assessing good indicators for monitoring and measures of success, and identifying research needs.

First, the picture provided by an ecological model forms a good starting place for development of conservation goals. Models define an idealized state or desired attributes of a conservation target; goals should direct conservation strategies and management actions toward these desired characteristics. Models also help determine natural variability expected within an ecosystem or its components that goals must take into consideration. For example, a conceptual model of sand transport for the Thousand Palms natural area in southern California, suggested that flood events in nearby mountains delivered sand to a dune system of interest[2]. Investigations determined that important historic inputs of sand from source areas corresponded to two major rainfall events during the last 100 years. It also was determined that the existing dune field would migrate outside preserve boundaries without additional inputs of sand over a similar time frame. Thus, conservation goals for the site focus explicitly on protecting and monitoring transport processes and source areas over the appropriate spatial and temporal scales.

Using an ecological model can also help identify threats to important natural processes that sustain conservation targets. Models outline key processes and patterns and often illustrate the effects of various human uses. Models show undesirable states (e.g., disturbed or degraded communities, non-viable populations) and what causes the system to move toward those states.

Ecological models also provide a useful focus for exploring alternative courses of action, although admittedly, predictive capabilities are limited. Such exploration, however limited, still offers a powerful template for assessing possible alternative decisions. In particular, models are useful for exploring the impacts of various management actions, natural ecological variability, and human-influenced change. The effects of anthropogenic impacts to ecosystems, such as global climate change, atmospheric deposition, or other large-scale effects are difficult if not impossible to determine experimentally. Our understanding depends on the use of simulation models for these global-scale assessments.

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[2] Barrows, C.W. 1996. An ecological model for the protection of a dune ecosystem. Conservation Biology 10:888-891.

Ecological models play an important role in determining indicators for monitoring and measuring success. For example, models may be useful in determining keystone species. Such species are those whose effect is disproportionately large relative to their abundance. Models also help determine ecosystem components and processes that are: biologically or socially relevant, sensitive to stress, broadly applicable, diagnostic and measurable, integrative, and of an appropriate scale to the problem, all characteristics of good indicators.

Finally, models are used to help interpret changes in the targets resulting from conservation and management strategies. Changes should be viewed within the context of key ecological components and processes identified by the model and modeling process. Resulting questions are answered more easily with the help of an ecological model: Are values within the natural range of variability expected? Do results point to the deterioration of key processes? If so, what other components might be affected or influenced? Should these be investigated or monitored? Do strategies need adjustment to address these issues? Is more research needed? Are goals and objectives realistic?

As part of an adaptive, iterative process, new information is used to update and improve ecological models. Often, new information from monitoring and management either supports or conflicts with current understanding of key components and processes. Results sometimes uncover missing links in ecosystem dynamics or reinforce well-understood relationships. Future research should be prioritized according to such gaps.

**Practical Advice for Constructing Ecological Models**

1. It is often useful to develop a modeling sub-team to construct ecological models for site conservation planning. This can achieve a balance between collaboration and efficiency. The sub-team can be composed of the scientists on the broader site planning team, plus other local experts or knowledgeable people as needed and available. A relatively small group works best (2-4 people). Additional people can review and provide input on the resulting products.

2. Ecological models are most useful before performing a threats analysis. A one- or two-day workshop with the sub-team is a great way to synthesize and draft a first-cut model for the conservation targets. Obviously, conservation targets need to be selected ahead of time and should be done with the entire planning team, if necessary. Some relevant information may also need to be assembled before models can be constructed.

3. If there is not enough information available or known on the targets, do what you can. Remember that models represent the most current, best state of understanding. Realize that plans and models will be updated and improved as new knowledge or information becomes available. Ecological models are part of adaptive management. Use expert or local knowledge in model development and review. Use intuition and logic. Use comparative information from similar systems or other places. Record assumptions, so these can be reviewed when more information becomes available. Remember that the process of constructing models is just as important as the final model product.