VI. Sources

For each stress afflicting a given conservation target, there are one or more causes or sources of the stress.

For example, nutrient loading is a stress to many aquatic ecosystems, where excess nutrients in the water draw off oxygen and therefore kill fish and other aquatic life. However, the nutrient loading might be caused by many different sources, such as farm fertilizers, animal feed lots, septic systems, sewage treatment facilities, or suburban runoff.

What is most causing the destruction, degradation, or impairment of the priority conservation target(s) at the site?

This chapter presents four fundamental steps for answering this key question, and for assessing the Threat Status and Abatement measure of success:

1. Identify sources of stress
2. Rank the sources
3. Identify critical threats and persistent stresses
4. Assign "Threat Status" for the site

The first three steps are prerequisites for developing conservation strategies (Chapter VII)—and for measuring threat status of the site. The fourth step is specific to measuring threat status.

1. Identify Sources of Stress

Most sources of stress are rooted in incompatible human uses of land, water, and natural resources. Such incompatible uses may be happening now (e.g., surface water diversion, inappropriate livestock grazing), or may have happened in the past but left either a legacy of persistent stresses (e.g., altered composition and structure) or other sources of stress (e.g., feral pigs, kudzu).

The source(s) of each stress afflicting each conservation target need to be identified. Each stress must have at least one source, and may have multiple sources.

When identifying sources of stress, it is important to distinguish between "active" and "historical" sources. An active source is expected to deliver *additional* stresses to a conservation target within the next ten years. These include ongoing sources as well as those that are likely to become active within the ten-year timeframe.

Historical sources are no longer active, and thus are expected to deliver *no additional* stresses to a conservation target. An historical source should be listed if the stresses caused by the source are expected to persist over the next ten years. For example, the condition (i.e., composition, structure, continuity) of a forested system may have been degraded by past timber harvest. Through change in land ownership or timber management policy, timber harvest is no longer occurring—the source of

stress has been abated. However, the condition of the forest system is still degraded from past timber harvest—the forest is still stressed—and is not expected to recover by itself within the next ten years. In this instance, the stress would be identified as altered composition/structure, the "historical" source of stress would be identified as incompatible timber harvest practices, and there would be no "active" source of stress.

Also, it is important to identify the most proximate sources (e.g., incompatible timber harvest) rather than ultimate or indirect sources (e.g., human population growth). Indirect sources of stress will be identified and considered when developing conservation strategies.

Finally, it is critical to identify the source precisely, because addressing each different source often requires a very different conservation strategy. For example, many priority systems are stressed by incompatible residential development. However, different aspects of incompatible residential development are relevant to different stresses. In one riverine system, the highest ranked stress was hardening of the shoreline. The apparent source of stress was second home development along the river. However, the density of development, the pattern of sprawl, the septic systems, and the fragmentation associated with second home development were not the critical sources—rather it was the actual bulkheads and groins built along the riverbank. A strategy to address this particular threat could be much more precise, effective, and accomplishable than a strategy to "control growth" in this rural area.

An illustrative checklist of sources of stress is presented in a pull-down menu in the *Site Conservation/Measures of Conservation Success* Excel workbook and in Appendix C. Use this list as guidance, but consider other sources of stress that may be appropriate at your site. In addition, using definitive subcategories may be helpful. The more precisely the source is defined, the easier to design effective threat abatement strategies.

Appendix C also provides some illustrative examples of the identification and ranking of sources of stress.

A note on mapping sources of stress: The boundaries of sources of stress depict where on the landscape the human or ecological factors that cause stress to the conservation targets or sustaining processes occur. Sources of stress may or may not be coincident with the stresses they cause. For example, a nonnative fish species may cause stress in the form of extraordinary competition to the native fishes with which it co-occurs—the source and the stress are coincident. On the other hand, inappropriate forestry practice in the upper watershed may cause excessive sedimentation, which stresses a downstream aquatic community—the source and the stress are disjunct or not coincident. Additional information on site-based boundaries can be found in the *Supplemental SCP Volume*.

2. Rank the Sources

The relative seriousness of a source is a function of the following factors:

- ***Degree of contribution to the stress.*** The contribution of a source, acting alone, to the full expression of a stress (as determined in the stress assessment), assuming the continuation of the existing management/conservation situation. Does (or did) the particular source make a very large or substantial contribution to causing the current stress, or a moderate or low contribution?

- ***Irreversibility of the stress.*** The reversibility of the stress caused by the source. Does (or did) the source produce a stress that is irreversible, reversible at extremely high cost, or reversible with moderate or little investment?

Based upon the best available knowledge and judgments, rank each source with respect to each stress it causes. Rank the contribution and irreversibility as "Very High", "High", "Medium", or "Low". The source is then ranked, using the same four classes, based on the assessment of contribution and scope (see the Microsoft Excel *Site Conservation/Measures of Conservation Success Workbook,* and Appendix A). The rules for combining contribution and irreversibility into a source rank are presented in Appendix A.

When multiple sources all contribute to a given stress, we want to focus our threat abatement strategies on the source or sources that are most responsible for the stress. We also want to focus on those sources that, if allowed to occur at a site, will cause long-term impacts (e.g., housing development).

3. Identify Critical Threats and Persistent Stresses

The final step in the assessment of stresses and sources is a synthesis of the individual stress and source analyses to identify the critical threats and persistent stresses to the conservation targets.

A "threat" is actually a combination of a stress and a source of stress. Critical threats are those highly ranked threats that have an active source of stress. For taking corrective action, the active source is the thing on which the Conservancy must focus its *threat abatement strategies*, under the assumption that abatement of the source will alleviate the stress and result in higher viability of the conservation target(s).

Highly ranked threats that have an historical source are best thought of as persistent stresses since the source component of the threat is no longer active. The Conservancy must focus its *restoration strategies* on directly reducing persistent stresses.

Identifying critical threats and persistent stresses has three steps: For each conservation target, (1) calculate a Threat rank for each stress-source combination, and (2) combine the Threat ranks for each source into a Threat-to-System rank. The Threat-to-System rank represents the degree to which a particular source of stress causes stress to a given conservation target. Finally, for each source of stress, (3) combine the Threat-to-System ranks across conservation targets into a Overall Threat rank of "Very High", "High", "Medium", or "Low". The Overall Threat rank represents the degree to which a particular source causes (active sources) or has caused (historical sources) stress to the focal conservation targets at the site. The Overall Threat ranks for threats with active and historical sources, respectively, are summarized in separate tables. The rules for combining Threat ranks into Threat-to-System ranks, and Threat-to-System ranks into Overall Threat ranks are described in Appendix A. (*Note: this process is more easily understood by running through the* Stresses/Sources *and* Threat Summary *worksheets in the* Site Conservation/Measures of Conservation Success *Excel workbook and in Appendix A.*)

The critical threats are those active sources of stress with "Very High" (and perhaps "High") Overall Threat ranks.

The persistent stresses are the "Very High" ranked stresses caused by the historical sources of stress with "Very High" (and perhaps "High") Overall Threat ranks.

Note: Completing these three steps is a prerequisite for developing conservation strategies (Chapter VII) and for measuring the threat status of a site. The fourth step, below, is specific to measuring the threat status. We strongly recommend that you complete step 4 before moving on to developing conservation strategies.

4. Assign "Threat Status" for the Site

The Threat Status of the site is assigned as "Very High", "High", "Medium", or "Low" based on the assessment of the eight highest ranked critical threats. (Eight was determined to be the number of threats that is small enough to provide focus on the most critical threats while being large enough to show threat abatement over time.) With all sites using the same number of threats for purposes of calculation, the Conservancy can see at a glance the relative degree of threat at its full portfolio of sites.

The rules used for combining the eight highest Overall Threat ranks into Threat Status are described in Appendix A.

The previously referenced Microsoft Excel workbook entitled *Site Conservation/Measures of Conservation Success Workbook* contains computer-automated *Stresses/Sources Worksheet* templates that automatically rank the identified sources of stress based on an assessment of contribution and irreversibility, and automatically determine Threat-to-System ranks. The workbook also contains a *Threat Summary Worksheet* template that automatically determines the Overall Threat rank for each source of stress, and the Threat Status of the site. The *Threat Summary Worksheet* will allow a graphic presentation of the current Overall Threat rank of each source of stress. The Excel workbook is included on the diskette that accompanied this handbook, and is available upon request from the Site Conservation program of the Conservation Science Division (site_conservation@tnc.org). A set of "manual" *Stresses/Sources and Threat Summary Worksheets* is provided in Appendix A. These worksheets are analogous to the worksheets in the Excel workbook, and can be copied and manually filled out to determine Source, Threat, Threat-to-System, and Overall Threat ranks, and to assign Threat Status to the site.

VII. Conservation Strategies

The way we respond, or fail to respond, to the critical threats and persistent stresses will very likely be the ***single most important factor*** affecting the long-term viability of the priority conservation targets at the site.

The ultimate objective of our conservation strategies is to reduce the stresses that are degrading and impairing, and thus lowering the viability of, the focal conservation targets. There are two major paths for accomplishing this objective (see Figure 2, Chapter IV). The first is to abate the critical threats, i.e., remove the active sources of stress, under the assumption that the associated stress will decrease if the source is removed. This is the objective of *threat abatement strategies*. However, in some instances, even if the active source is abated, the stress to the target may persist. In these instances, it will be necessary to deploy *restoration strategies*, with the objective of directly reducing the persistent stress. Also, at times it will be necessary to deploy strategies that build capacity, engage stakeholders, or promote priority policy actions rather than directly abate threats or reduce persistent stresses. Such indirect strategies have high leverage in that they pave the way for more direct threat abatement and restoration strategies.

What strategies will best abate the critical threats and persistent stresses to the conservation targets?

This chapter presents four fundamental steps for identifying and assessing conservation strategies and setting priorities for action:

1. Consider the array of strategic approaches
2. Develop a list of potential strategies
3. Rank the proposed strategies
4. Consider top priorities for immediate action

1. Consider the Array of Strategic Approaches

Broadly speaking, there are three complementary strategic approaches that can be deployed to abate the critical threats and reduce the persistent stresses that degrade the viability of the conservation targets:

Land and Water Conservation

Directly establishing land and water uses and resource management that are compatible with the maintenance of the targeted systems, and ensuring their short- and long-term application, is the objective of land and water conservation strategies. This strategic approach focuses directly on resource protection and management, and includes *acquisition of interest in land or water* and *adaptive*

management of public and private lands and waters.

- **Acquisition of Interest in Land or Water**
  To ensure appropriate land or water use and management for the long term, highly significant natural areas and water resources may require *acquisition of fee interest* by a local land trust, a public resource agency, The Nature Conservancy or other group with a mission of protecting such resources. *Conservation easements* offer permanence in land protection, while retaining land in private ownership. They may range from simple prescriptions for open space to detailed standards and goals for managing significant natural resources. Private landowners and public land managers may enter into a *management lease* with a non-profit conservation group or a state or local agency, such as a soil conservation office.

- **Adaptive Management of Public or Private Lands and Waters**
  Critical threats and persistent stresses may be abated and conservation targets maintained, restored, or enhanced through proper management of land, water, and other natural resources. Communities can educate, encourage, and reward landowners and managers who follow best management practices for farming, grazing, forestry, or aquaculture on their property. Strategies to establish resource management and restoration programs that recognize and address the uncertainty of how the ecolo-gical system will respond to management and restoration actions fall within the rubric of adaptive management strategies.

Public Policies

Some threats to biodiversity can be addressed most effectively through good public policy. For example, haphazard residential growth and urban sprawl fragment significant ecosystems across the country, not only near growing cities and suburban areas but also in rural and coastal landscapes. To address this threat, local comprehensive plans and development standards are needed to define, design, and locate the types and amount of development that meets community needs, protects the local environment, and generates a fair economic return. A community might provide financial incentives like tax abatements or purchase of development rights to keep land in traditional land uses, such as farming and forestry.

Because threats operate at various scales, not all threats can be addressed simply through local policies. Regional and national policy initiatives —such as the combined efforts of Maryland, Virginia, and Pennsylvania to clean up the Chesapeake Bay and revitalize its fisheries—are also needed. These policies must be founded on good information and public support.

Compatible Development Alternatives

Most threats to biodiversity ultimately are caused by incompatible human economic activities. To address these threats, we must often do more than appropriately use and manage resources, and foster good policies that prevent incompatible activities and development. We must actively develop, promote, and implement compatible development alternatives.

Compatible development is the production of goods and services, the creation and maintenance of businesses, and the pursuit of land uses that conserve biodiversity, enhance the local economy, and achieve community goals.

Any or all of these strategic approaches may require **community-based programs** designed to secure short-term and long-term community support.

Landscape-Scale, Community-Based Conservation: A Practitioner's Handbook provides more detailed information on community-based programs and building community support as conservation strategies. The handbook and additional information are available upon request from the Center for Compatible Economic Development. [contact Carolyn Georgen, cgeorgen@cced.org]

2. Develop a List of Potential Strategies

Review your list of critical threats, e.g., those active sources of stress with "Very High" and "High" Overall Threat ranks. Consider the array of conservation strategies that might abate or preempt these critical threats.

Also, review the list of persistent stresses, i.e., those "Very High" ranked stresses caused by historical sources with "Very High" or "High" Overall Threat ranks. Consider conservation strategies that might directly reduce these stresses and directly enhance or restore the viability of affected conservation targets.

Hint: It is important to state each conservation strategy as precisely as possible. For example, "control residential development" is too broad a statement of strategy. "Secure an improved local development ordinance to manage overall development density in agricultural areas" is a more focused strategy statement.

Because critical threats typically stem from incompatible economic activities in the immediate or adjacent human communities, an understanding of the cultural, political, and economic context that represents the driving forces (i.e., indirect or ultimate sources) behind the critical threats is essential for developing sound conservation strategies. In developing strategies, it is important to consider the following two key questions:

What are the key characteristics (economic, political, cultural) of the local human communities, as related to the critical threats and conservation targets?

Which individuals, groups, or institutions are likely to affect or be affected by conservation action?

The *Supplemental SCP Volume* provides additional information on assessing human context factors (e.g., land use, economic activities, policies, cultural attitudes and norms, and constituencies and stakeholders) as the basis for identifying high priority strategies.

3. Rank the Proposed Strategies

Potential strategies to abate the critical threats and persistent stresses should be evaluated and ranked using three criteria: *Benefits*, *Feasibility and Probability of Success*, and *Costs of Implementation*.

Benefits

Benefits result from *abating critical threats, reducing persistent stresses*, and *developing opportunities and building support for conservation.* Benefits can be both direct (e.g., cows fenced out of stream, or size of target occurrence increased by fifty percent) and indirect (farmer/rancher education program launched). Some benefits that seem small or less tangible can provide an important foundation for future actions. Consider the marginal benefits that would arise from implementing the strategy. If the results would likely occur anyhow, without special actions by you and your conservation partners, don't rank the benefits highly.

To assess the potential benefits of a proposed conservation strategy, consider three factors:

- **Threat Abatement**
  The degree to which the conservation strategy is likely to reduce the Threat rank of one or more threats with active sources. This benefit will accrue only through threat abatement strategies, which focus on active sources of stress.

- **Reduction of Persistent Stresses**
  The degree to which the conservation strategy is likely to reduce the persistent stresses (i.e., those stresses with historical sources). This benefit will accrue only through restoration strategies, which focus on the direct reduction of stresses that have historical but no active sources.

- **Leverage**
  Frequently, the most effective strategies are catalytic in nature—a little bit of effort or a small investment triggers positive work or resources from others, and other new opportunities. High-leverage strategies pave the way for other strategies.

There is no shortage of worthwhile ideas. There **is** *a shortage of resources for getting things done. You must be hard-nosed in evaluating the benefits of your proposed actions.*

Feasibility and Probability of Success

All other things being equal, a program should invest in the strategies that are the most likely to succeed, in light of potentially available human and financial resources, as well as existing circumstances. The probability of successful implementation depends on many variables, but two key factors are perhaps most critical:

- **Lead Person and Institution**
  Perhaps the single most important factor of success is finding the right person to take the lead and the responsibility to implement the strategy.

- **Ease and Lack of Complexity**
  Despite the best plans and the best people, there are myriad forces outside of anyone's control that can cause plans to succeed, fail, or change. *The more complex the strategy, the more likely that unanticipated outside events will substantially affect the outcome. For this reason, it is wise to invest in some relatively small, simple, do-able strategies.* Evidence of success will

then help encourage your conservation partners to undertake challenges that are more complex.

Costs of Implementation

There is one cost factor to consider:

- **Commitment of Limited Discretionary Resources**
  There are limited human and financial resources to invest in the future. Special attention should be paid to the commitment of limited discretionary resources required to implement a conservation strategy. While discretionary resources are limited, there may be opportunities to secure new resources that might be earmarked for a particular strategy.

Based upon the best available knowledge and judgments, rank each strategy as "Very High", "High", "Medium", or "Low". The ranking should be based on the explicit assessment of the benefits, feasibility and probability of success, and cost of implementation (see Appendix D).

The previously referenced Microsoft Excel workbook entitled *Site Conservation/Measures of Conservation Success Workbook* contains computer-automated templates that automatically determine the target-specific benefits of each selected conservation strategy, as well as the overall strategy rank based on an assessment of benefits, feasibility and probability of success, and costs of implementation. The Excel workbook is included on the diskette that accompanied this handbook, and is available upon request from the Site Conservation program of the Conservation Science Division (site_conservation@tnc.org). A "manual" *Summary of Strategies Worksheet* is provided in Appendix D. This worksheet is analogous to the *Summary of Strategies Worksheet* on the Summary sheet of the Excel workbook, and can be copied and filled out manually to determine strategy ranks. However, we highly recommend that you use the Excel workbook to rank the target-specific benefits of the conservation strategies.

4. Consider Top Priorities for Immediate Action

Working from the list of highest ranked strategies, select a small number for immediate implementation. Look for the strategies that will produce high benefits with the greatest chance of success and affordable costs. The best people and discretionary resources should be focused early on the highest leverage ideas.

- ***Pick early winners***—those actions that are the most likely to succeed and offer tangible results. Strive to show early success that rein-forces the interests and issues important to partners and key sectors in the community. Success then tends to beget more success.
- ***Pick big winners***—Carefully consider strategies that may be big winners. Adequate resources and staff experience are needed to launch complex, high-leverage projects. In addition, a more difficult and complex strategy often needs a foundation of smaller successes. The temptation to tackle big projects must be weighed against the perils that the project could bog down or cause tension in fragile community or partner alliances.

▶ There is often confusion between objectives and strategies. An objective is a desired state or end of action—something toward which effort is directed. For site conservation planning purposes, abatement of critical threats and persistent stresses are the general objectives, and strategies are the means to these ends. More specific objectives can be articulated for individual strategies. Don't worry about the technical differences in these terms. Just clearly state what needs to be done to abate the critical threats and persistent stresses to the conservation targets. Meeting these objectives will translate into meeting the site-based conservation goals, i.e., the maintenance and enhancement of the viability of the conservation targets.

▶ For purposes of describing your program, group together related, action-oriented strategies into a smaller set of three to five strategic initiatives or strategic priorities—these groupings help keep the focus on the bigger picture.

▶ Different strategies are often linked. For example, demonstrating a successful compatible residential development approach could help lay the groundwork for an improved land use plan and development ordinance. Look for these linkages.

▶ Strategies should not be viewed as fixed plans. Circumstances change as work proceeds and strategies must change accordingly. Use the Five-S framework to incorporate changing circumstances into your decision-making process, and update and refine strate-gies as needed.

▶ Time frames for strategies differ. Some things can be accomplished in relatively short order. Other things will require a long, persistent effort. Recognize and be prepared to do both.

A Note on Implementation of Strategies

Although implementation of strategies is beyond the scope of this handbook, there are two related issues that need to be mentioned: Implementation Plans and Conservation Zones.

What actions are necessary to implement the conservation strategies? Who will do them, when will they be done, how long will they take, and how much will it cost?

Where are the areas on the ground in which specific conservation strategies and actions apply?

Addressing these two key questions will help ensure that staff and financial resources are applied in the appropriate ways and in the appropriate places within the site to best implement conservation strategies and achieve conservation success.

A more in-depth discussion of implementation plans and of issues related to mapping strategy boundaries (i.e., conservation zones) is provided in the *Supplemental SCP Volume*.

A note on mapping strategies: Strategy boundaries locate those places where we must take conservation action either to abate threats or restore conservation targets. Threat abatement strategies generally coincide with the location of the **sources of stress** to be abated, restoration strategies with the degraded or impaired target occurrences and processes (**systems**) to be enhanced or restored. Conservation strategies that are general or programmatic in nature (e.g., community education program; participation in a multi-agency endangered species recovery program) may not be amenable to mapping.