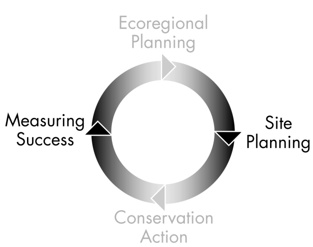
The Five-S Framework *for* Site Conservation

A Practitioner's Handbook for Site Conservation Planning and Measuring Conservation Success



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The Nature Conservancy®
Saving the Last Great Places

The Five-S Framework for Site Conservation:

A Practitioner's Handbook for Site Conservation Planning and Measuring Conservation Success

The mission of The Nature Conservancy is to preserve the plants, animals, and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive.

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Preface

In 1997, The Nature Conservancy adopted *Conservation by Design: A Framework for Mission Success*, which established the Conservancy's long-term conservation goal and ecoregional approach for achieving the goal—the long-term survival of all viable native species and communities through the design and conservation of portfolios of sites within ecoregions. To implement this approach, the Conservancy has had to develop and apply more sophisticated methods for site-based conservation and for measuring progress towards our conservation goal.

Translating the ecoregional conservation approach as set forth in *Conservation by Design* into effective on-the-ground action encompasses four fundamental steps: ecoregional conservation planning, site conservation planning, taking conservation action, and measuring conservation success. The concepts, standards, and procedures for these steps (except taking action) are encapsulated in two practitioner's handbooks:

- *Designing a Geography of Hope: Guidelines for Ecoregion-Based Conservation in The Nature Conservancy* (March 2000, second edition) presents the methodology and guidelines for conservation planning at the ecoregional scale.
- *The Five-S Framework for Site Conservation: A Practitioner's Handbook for Site Conservation Planning and Measuring Conservation Success* (March 2000, first edition) sets forth a frame-work for site-based conservation, including strategic conservation planning and assessing measures of conservation success.

(*Note: Delivery mechanisms for taking conservation action are being assessed and developed.*)

To facilitate their use and to emphasize the pervasiveness of underlying conservation and planning concepts, the two handbooks overlap somewhat in the presentation of underlying concepts, and use terminology in a consistent fashion. Taken together, these handbooks provide the comprehensive rationale, standards, and procedures for implementing Conservation by Design.

This handbook is a short, how-to work-book. It is designed to serve as a stand-alone document—with brief explanations, fill-in-the-blank charts, and directions for determining conservation targets, analyzing threats, planning conservation strategies, and measuring success. It provides some contextual information, and references a *Supplemental SCP Volume* [in preparation] that contains more detailed explanations and descriptions of concepts, planning tools, and techniques.

The Nature Conservancy practiced land conservation for decades before developing and documenting the approach to site conservation presented in this handbook. Many times, we did smart things, either because they were obvious or because we had good intuition. Other times, we did things that were not very strategic in achieving biodiversity conservation results. In these latter instances, we misdirected our efforts or misspent our resources. The approach described in this handbook attempts to "unravel" the intuition that has led to sound conservation strategies at ecologically important places.

In addition, measuring the effectiveness of our conservation strategies and the progress toward achieving our conservation goals have played critical roles in directing the efforts of the staff to accomplish enduring, on-the-ground conservation results. For many years, the Conservancy's conservation goals and measures focused on acres acquired and dollars raised, and the organization traditionally assessed the performance of the various operating units according to these standards. *Conservation by Design* demands more sophisticated measures of conservation success than just "acres saved." This hand-book presents the set of conservation measures to meet that purpose.

Throughout the handbook you will encounter a series of "sidebars" covering key questions, tools, and useful hints. Each topic is set off from the main text and is introduced by a specific icon.

Key Questions. The key icon indicates key questions associated with each of the five S's that should be answered as part of site conservation planning.

Tools and Techniques. The hammer icon identifies specific planning tools, analytical techniques, and useful information that may be helpful in answering key questions or providing more in-depth analysis. The icon briefly introduces these tools, and refers the reader to appendices, the *Supplemental SCP Volume*, or other references for more detailed explanations.

Practical Tips and Hints. The lightbulb icon indicates a brief comment about a practical consideration of the current topic.

This is the first edition of the *Practitioner's Handbook for Site Conservation Planning and Measuring Conservation Success*. You are encouraged to share your experiences, lessons learned, and best practices from applying the Five-S framework presented in this handbook so that the methodology and future editions of the handbook stay current and continue to be useful. Please contact the conservation ecologist or other appropriate support staff within your state, country, or divisional program, or the Site Conservation Program of the Conservation Science Division (site_conservation@tnc.org) with any questions, comments, suggestions, or experiences to share.

I. Introduction

Conservation by Design established the Conservancy's long-term conservation goal and ecoregional approach for achieving the goal—the long-term survival of all viable native species and communities through the design and conservation of portfolios of sites within eco-regions. Current and future ecoregional portfolios will include thousands of important conservation sites. For the near-term, the Conservancy's U.S. and International programs have established ambitious ten-year goals in pursuit of the long-term goal:

> *In 10 years, The Nature Conservancy and its partners will conserve 2500 sites identified by ecoregional plans in the United States—with special emphasis on 500 landscape-scale projects.*
>
> *Over the next 10 years, The Nature Conservancy and its partners will take direct action to conserve 100 landscape-scale projects in 35 countries, leveraging these investments to protect at least 500 additional sites in national portfolios.*

To achieve our ten-year goals, we will need to make strategic decisions regarding appropriate conservation actions at priority sites. We also must measure our progress towards these challenging goals. This *Practitioner's Handbook* provides a relatively simple, straightforward and proven process for developing conservation strategies and measuring the effects of those strategies, regardless of the spatial scale of the site or the type of biodiversity that is targeted for conservation. The process is known as site conservation planning. The conceptual framework and practicality of site conservation planning have been tested and refined through successful on-the-ground application of the process by experienced conservation practitioners.

The Framework, the Process, and the Plan

The Nature Conservancy initially developed the planning approach presented here for the "bioreserve" initiative, and called it the "Five S's": systems, stresses, sources, strategies, and success. Some people have added a sixth "S" (situation). Subsequently, the Five-S approach has been the basis for landscape-scale, community-based conservation workshops presented through the Center for Compatible Economic Development and Efroymson Fellowships. The Conservancy's Site Conservation Planning working group adapted it for the process known as site conservation planning. And most recently, it has become the foundation for the new measures of conservation success.

The Five-S approach to site conservation integrates the experience and knowledge gained through these various applications into a single, unified site-based framework. While the approach continues to focus on the original five S's for site conservation planning—*systems*, *stresses*, *sources*, *strategies*, and *success*—it has been updated to meet the demands of our more sophisticated approach to site conservation under Conservation by Design.

The Five-S approach to site conservation is the framework for the site conservation planning *process*. The Five-S framework is presented in more detail in Chapter III. The site conservation planning process assesses contextual information about a site (i.e., systems, stresses, sources) and results in two specific *products*—conservation strategies and measures of conservation success. The planning steps associated with each of the five S's are laid out in Chapters IV through VIII. Finally, the systems-stresses-sources assessment, the conservation strategies, and the measures of conservation success should all be documented in a site conservation plan. The standards for the site conservation planning process and for site conservation plans are set forth in Chapter II.

Conceptual Foundation

Three concepts are fundamentally important to understanding the logic and terminology of the Five-S approach to site conservation: scales of biodiversity and geography, functionality of conservation sites, and functional landscapes.

A more thorough description and discussion of these concepts than is provided in this handbook can be found in:

- Functional landscapes and the conservation of biodiversity, by Karen Poiani and Brian Richter. Working Papers in Conservation Science, No. 1. February 2000.

This working paper is available on the internet at http://consci.tnc.org/library/pubs/wpapers/WP1.PDF

- Biodiversity conservation at multiple scales, by Karen Poiani, Brian Richter, Mark Anderson, and Holly Richter. 2000. Bioscience. 50 (2). 133-146.

Scales of Biodiversity and Geography

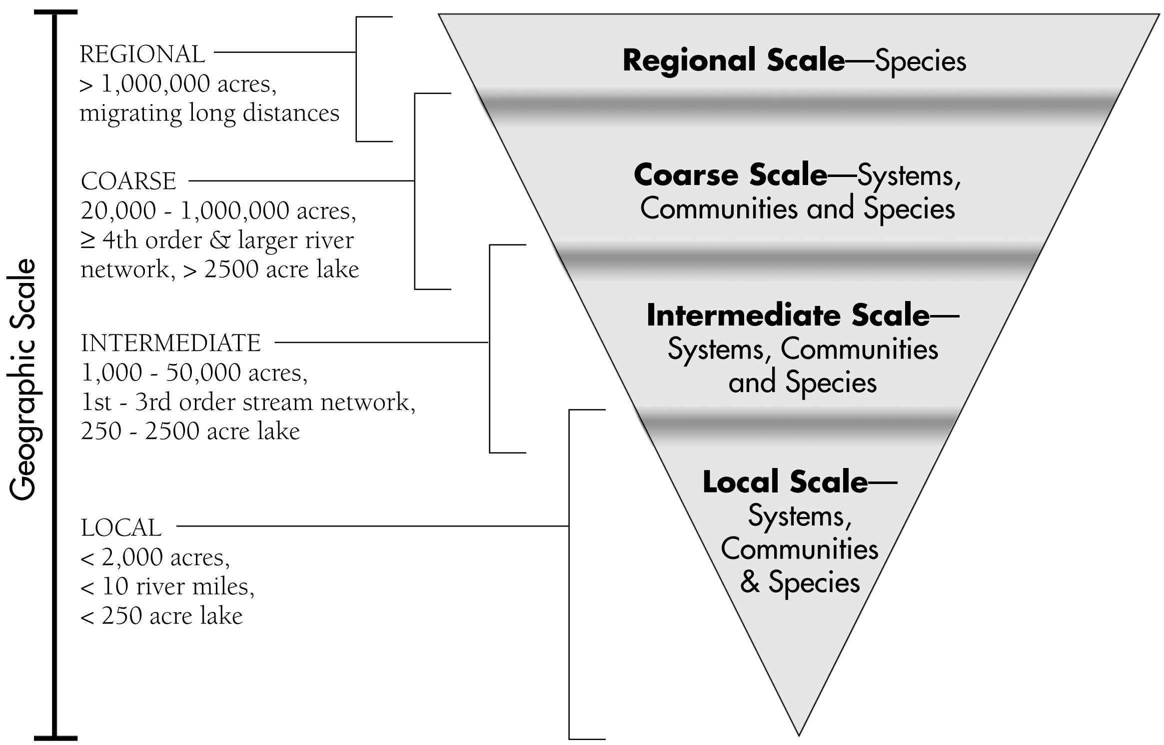
Two concepts of scale underlie the Five-S approach to site conservation: (1) level of biological organization, or biodiversity scale, and (2) geographic or spatial scale. To fully appreciate the logic and terminology of the Five-S frame-work for site conservation, it is necessary, to understand how biodiversity and spatial scale interact.

Scientists and conservation practitioners have long recognized that biodiversity exists at many levels of biological organization (i.e., genes, species, communities, ecosystems, and landscapes). In addition, biodiversity occurs at a variety of spatial or geographic scales (e.g., square feet to millions of acres; stream reach to stream/river networks). The levels of biological organization on which the Conservancy now focuses its conservation efforts—***species***, ***ecological communities***, ***ecological systems***[1,2]—can occur and function at various spatial scales. Figure 1 illustrates four geographic scales—***local***, ***intermediate***, ***coarse***, and ***regional***—at which species, ecological communities, and ecological systems occur, with each scale corresponding to a characteristic range in area or stream

[1] Levels of biodiversity organization are defined in Chapter IV (*Systems*).

[2] Throughout this handbook, the unmodified term "systems" represents the first "S" of the Five-S framework, and refers to the inclusive set of conservation targets (i.e., species, ecological communities, ecological systems) that are the focus of planning for a site. The term, when modified as "ecological systems," refers more specifically to conservation targets at the highest level of biodiversity organization, i.e., spatial assemblages of ecological communities (see Chapter IV).

Figure 1



length[3]. See Appendix B for a more in-depth description of levels of biological organization and corresponding spatial scales.

Site conservation planning primarily focuses on biodiversity at the coarse, intermediate, and local scales. Conservation of regional-scale species transcends individual sites and therefore must be addressed by networks of conservation sites, as described below. However, many specific attributes of regional-scale species occur at smaller geographic scales, such as the local-scale breeding aggregation of an anadromous salmon population, the intermediate-scale stopover area for migratory birds, or the coarse-scale migration corridor for wide-ranging ungulates. Although protection of these sites-specific attributes at a particular site is not sufficient to conserve a regional-scale species, such attributes are appropriately considered in site conservation planning. As discussed in Chapter IV (*Systems*), identifying the species, ecological communities, and ecological systems that are the conservation focus at a site (i.e., the conservation targets) is the first step in site conservation planning.

Site Functionality

Every conservation site where the Conservancy and our partners work has a set of conservation targets that represents and captures the biodiversity we seek to conserve. Our intention is to maintain

[3] Acreage and river miles/stream order are preliminary estimates and should be considered guidelines, not hard and fast boundaries.

the viability of the conservation targets over the long-term by maintaining the species, ecological communities, and ecological systems themselves and the ecological processes that sustain them. Site functionality is a measure of how well the site maintains the viability of the conservation targets.

Functional conservation sites have several characteristics. First, the size and configuration of the site are determined by the characteristics of the targeted species, ecological communities, and ecological systems, including the ecological processes that sustain them. Second, the fundamental ecological patterns and processes that maintain the targeted biodiversity must be within their natural (or acceptable) ranges of variation over a time frame relevant to conservation planning and management (e.g., 50-500 years). Third, human activity is not precluded from a functional conservation site, but functionality is likely to be greatly influenced by such activity. Finally, conservation sites may require ecological management and restoration, in addition to threat abatement, to maintain or enhance their functionality.

Presumably all conservation sites in an ecoregional portfolio are currently functional, or can have functionality restored through appropriate conservation action. In this respect, all sites in an ecoregional portfolio can be considered *functional conservation sites.*

Functional Landscapes

In site conservation planning, a particular set of functional conservation sites warrants special consideration—***functional landscapes***. Functional landscapes seek to conserve a large number of ecological systems, ecological communities, and species at coarse, intermediate, and local scales. In other words, the identified conservation targets at functional landscapes are intended to represent many other ecological systems, communities, and species, both known and unknown (i.e.,"all" biodiversity). Functional landscapes have a high degree of ecological intactness and retain (or can have restored) most or all of their key components, patterns, and processes. Functional landscapes, because they necessarily include coarse-scale conservation targets, are typically large in size.

The distinction between functional landscapes and other functional conservation sites, in practice, is not always clear cut because all ecological systems and ecological communities represent other elements of biodiversity to some extent (i.e., have a coarse-filter effect). Thus, the operational difference between functional landscapes and other functional conservation sites is the degree to which the conservation targets (1) are intended to represent other biodiversity, and (2) occur at coarse, intermediate, and local scales. If you deliberately define or select conservation targets to represent "all" biodiversity at the site and the targets occur at coarse, intermediate, and local scales, then the site is a functional landscape. If you have not deliberately identified targets to be representative in this way or if the targets are confined to only one or two spatial scales, then the site is not a functional landscape. This is so regardless of the coarse-filter characteristics of the identified targets or the geographic scale of the site. The challenges of selecting targets to represent "all" biodiversity and defining functionality for functional landscapes are discussed in Chapter IV (*Systems*).

Functional Networks of Conservation Sites

Site conservation planning focuses on the conservation of coarse-, intermediate-, and local-scale targets. Specific attributes of regional-scale species that occur at smaller geographic scales (e.g., breeding aggregation of a migratory bird or fish species) can also be addressed at individual conservation sites. However, successful conservation of regional-scale species requires a functional network of conservation sites. Regional-scale species and the key ecological processes that maintain them operate on a spatial scale that transcends individual conservation sites. Designing a functional network of sites for a regional species is part of the portfolio design process of ecoregional planning.

However, as mentioned above, regional-scale species are likely to have specific attributes operating at coarse, intermediate, or local scales that can and should be addressed through site conservation planning at individual sites. In such cases, the attributes themselves are considered conservation targets at the site. For example, a population of anadromous salmon may spawn and reproduce in one or two headwater streams, whereas the population utilizes spatially distant and distinct habitats as nursery areas, for migration to the ocean, and for marine life stages. For site conservation planning purposes, the breeding aggregation might be considered a conservation target for a site that encompasses the headwater stream system. The site would be functional for that specific life stage of the regional-scale species if the salmon were able to successfully spawn and reproduce. However, the site would not be considered functional for the population as a whole; a network of sites from headwater streams to the ocean would need to be conserved for the population to meet all its life history requirements.

Planning for Action

The Conservancy's ten-year conservation goals emphasize those conservation sites in ecoregional portfolios where the Conservancy will play a substantial conservation role—Conservancy "action sites."[4] It is these 2,500 domestic and 100 international conservation sites on which our site conservation planning efforts will be focused and over which our conservation success will be measured for the next ten years. The Conservancy's action sites will include functional landscapes as well as other functional conservation sites. Any particular action site may be geographically large or small depending on the characteristics and needs of the conser-vation targets that are the focus of conservation at the site.

The ten-year goals place special emphasis on the subset of "landscape-scale projects," or ***landscape action sites***. Landscape action sites are distinguished from other action sites by their large spatial scale and the need for a dedicated, full-time project director. Landscape action sites are geographically large—they are functional conservation sites (including, but not necessarily limited to functional landscapes) that have (1) coarse-scale conservation targets, or (2) intermediate- or local-scale targets with sustaining processes that operate at a coarse scale. The large geographic scale and the complex conservation situation that usually accompanies large size are what dictate the need for a full-time project director.

[4] "Action sites" include those sites formerly called "Phase I" sites, which were identified in advance of fully completed ecoregional plans, as well as those sites identified by ecoregional plans where the Conservancy will be substantially engaged over the next five to ten years. Ecoregional plans are asked to identify action sites based on biodiversity significance, threat, feasibility, and leverage.

II. Standards for Site Conservation Planning

The Five-S framework represents a set of guiding principles for making strategic conservation decisions and measuring conservation success at sites. The site conservation planning process can be adapted to meet the needs of local planning teams while maintaining the integrity of the guiding principles. Similarly, a site conservation plan should be designed and formatted to meet the needs and situation of the local conservation team.

While flexible, the site conservation planning process and site conservation plans must meet certain minimum standards:

Site conservation plans should be developed by interdisciplinary teams

Small teams typically are more effective than large teams, but local need should dictate team size. At a minimum, the team should include:

- One or more scientists who are knowledgeable about the site, conservation targets, and supporting natural processes.
- The local project director or other staff members who will be assuming responsibility for conserving the site and have knowledge of the local "situation" for conservation.
- The state conservation program director or the state/country program director.
- An experienced conservation practitioner who has demonstrated success at sites of similar character and complexity.

(*Note: The above criteria are not mutually exclusive.*)

Site conservation planning teams should deploy the Five-S methodology

- Assess and rank conservation targets (systems), stresses, and sources of stress.
- Develop strategies to abate threats and enhance the viability of conservation targets.
- Assess measures of conservation success—biodiversity health and threat abatement.

Site conservation planning teams periodically should review and update the plan, incorporating new knowledge, experience, and lessons learned

The thought process underlying the plan, shared among knowledgeable staff, is more important than a written document that sits on a shelf—so the plan should be kept current to maintain its usefulness.

There is no standard format for a site conservation plan. A plan should communicate the site-based information to the intended audience; the format, and type and amount of information may vary depending on the audience. At a minimum, site conservation plans should include a brief description of the systems, stresses, sources, and strategies; a map delineating the site and showing other relevant boundaries; and the status of Biodiversity Health and Threat Abatement measures of success. The description of the "S's" and measures can be simple (e.g., the Excel workbook, or the tables provided in Appendix A) and should emphasize the underlying logic and connection among them. Additional supporting information (e.g., ecological models and information, human context information, stakeholder analysis, implementation plan) can be included in the body of the plan or in appendices, as warranted.

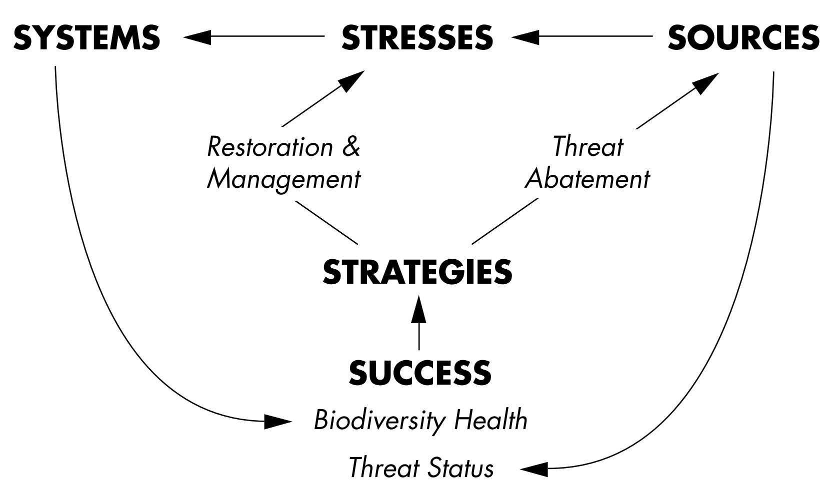
III. The "Five-S" Framework for Site Conservation Planning

The five S's include:

- **Systems:** the conservation targets occurring at a site, and the natural processes that maintain them, that will be the focus of site-based planning.
- **Stresses:** the types of degradation and impairment afflicting the system(s) at a site.
- **Sources:** the agents generating the stresses.
- **Strategies:** the types of conservation activi-ties deployed to abate sources of stress (threat abatement) and persistent stresses (restoration).
- **Success:** measures of biodiversity health and threat abatement at a site.

The logic underlying the Five-S framework is simple (Figure 2). Our implicit conservation goal at a site is to maintain viable occurrences of the conservation targets, i.e., maintain a functional site. By definition, viable occurrences are not significantly stressed. Therefore, the stresses must be abated to ensure viable conservation targets. Logically, there are two ways to lessen the stress and enhance or maintain the viability of the targets. The first is to abate the sources that are causing the stresses, under the assumption that the stress will subside if the source is removed. The second is to directly reduce the stresses that may persist once the source is removed. Thus, we develop and implement conservation strategies to (1) abate the critical sources of stress (i.e., threat abatement); and

Figure 2



(2) directly reduce persistent stresses (i.e., restoration). The measures of conservation success assess the effectiveness of our strategies at abating critical threats (Threat Status and Abatement measure) and the response in the viability of the conservation targets (Biodiversity Health measure), and provide the feedback for revising strategies, as warranted.

Two planning steps—defining conservation targets (systems) and critical threats (stresses and sources of stress)—are the vital foundation for developing sound strategies and measuring success. Chapters IV, V, and VI describe a proven, step-by-step approach for understanding and defining the conservation targets and critical threats at a site, and measuring biodiversity health and threat abatement.

A recommended approach for determining and prioritizing conservation strategies to abate critical threats and enhance or maintain systems is presented in Chapter VII.

Chapter VIII presents the foundation for the site-based measures of conservation success—Biodiversity Health and Threat Status—and provides the step-by-step method for assessing the conservation capacity indicators. (Note: the step-by-step approach for measuring Biodiversity Health and Threat Status are described in chapters IV [Systems], V [Stresses], and VI [Sources].) This chapter also presents a brief discussion of the inter-relationships between the measures of success, ecological monitoring, and adaptive management.

An automated Microsoft Excel workbook entitled *Site Conservation/Measures of Conservation Success Workbook* has been developed to assess systems, stresses, sources of stress, strategies, and to measure biodiversity health, threat abatement, and conservation capacity. The workbook is included on the diskette that accompanies this handbook, or is available upon request from the Site Conservation program of the Conservation Science Division (site_conservation@tnc.org). An analogous set of charts and instructions for completing these planning steps manually is provided in Appendix A (*A Step-by-Step Approach to Systems, Stresses, Sources, and Measures of Conservation Success*), Appendix D (*A Step-by-Step Approach to Developing Conservation Strategies*), and Appendix E (*A Step-by-Step Approach for Assessing Conservation Capacity*).

The automated workbook and manual worksheets are not intended to replace the good judgement of seasoned conservation professionals. They do, however, provide a clear pathway for evaluating systems, stresses, sources, and strategies, and for measuring biodiversity health, threat status, and conservation capacity. They can be useful even to the most seasoned practitioners, as a way of articulating the assumptions and testing the intuition of the site planning team.

Applications of the Five-S Framework

As with ecoregional conservation planning, four variables—*time, cost, quality,* and *scope*—constrain the site planning process. A planning team's decision regarding time, cost, quality, and scope will depend on several factors, including the level of analysis deemed useful or necessary, the amount of (ecological and human context) information available, the urgency of taking action, and the expected commitment of resources to the site by the Conservancy.

Often, when we first begin to work at a site, we lack a thorough understanding of the ecological systems and human context; thus, initial site conservation planning efforts are likely to be cursory, resulting in the identification of a limited set of preliminary or "no regret" strategies. Subsequent planning iterations will be based on additional information, new knowledge, and a better understanding of the human and ecological systems, resulting in a more thoughtful and perhaps broader set of conservation strategies.

The time taken to apply the Five-S framework can vary. A site planning team may develop a "rapid" site conservation plan in the course of a one- or two-day meeting; or it may meet several times over a period of weeks or months to develop a plan. Ideally, the thought process underlying the planning should be ongoing and shared among knowledgeable staff, leading over time to a more thorough understanding of the five "S's" and the conservation requirements at a site. Periodically, our strategic thinking should be consolidated and the plan updated to incorporate and document new knowledge, changing circumstances, and lessons learned.

Careful consideration of two guidelines will help ensure an efficient process and high quality product, regardless of the level of knowledge or time available:

1. Meet the site conservation planning standards set out in Chapter II.
2. Fully invest in the effort that will result in a useable but perhaps not "perfect" plan, and don't invest in the remaining, relatively large effort that may only marginally increase the usefulness of the plan.

Information Needs

Understanding the natural environment as well as the human context (situation) at a site underlies the application of the Five-S framework. Thus, two types of information are fundamental to the planning process, ecological information and human context information. Information about the ecological context of the conservation targets at a site underlies the assessment of systems, stresses, and biodiversity health. Information about the human context (i.e., land use and economic factors, laws and policies, cultural attitudes, constituencies and stakeholders) is essential for assessing sources of stress, developing effective conservation strategies, and measuring threat abatement. The local planning team will determine the level of information and expertise appropriate for a particular application of the Five-S framework. This decision will be made in the context of how much information, time, money, and other resources are available for the planning process, and the level of analysis deemed necessary or useful.

> The *Supplemental SCP Volume* provides detailed information on appropriate types of ecological and human context information to collect, and key sources of this information.

A Note on the Use of "Ranks" and Scores

In site conservation planning, the assessment of each "S" includes at least one step in which each item in a set of items is "ranked." We do not use the term "rank" in the sense of placing items in order relative to each other, i.e., highest to lowest, or greatest to least. Rather, we mean assigning each item to a particular class in an ordered classification—a common practice when different degrees of some phenomenon can be recognized. For example, the ordered classes we've identified for system viability are "Very Good", "Good", "Fair", and "Poor". The viability of some systems may be ranked (i.e., assigned to the class) "Very Good", others ranked "Good", and yet others ranked "Fair" or "Poor". Thus, the rank of a particular item designates the class to which it has been assigned.

Under certain circumstances a numerical score can be attached to each class[1], so that each item not only has a rank but also a score. The scores can then be added, multiplied, averaged, etc. We use numerical scores in assigning the biodiversity health measure of success.

A Note on Mapping and Site Delineation

Each of the five S's has a geographic aspect—where it occurs or where it is implemented can be located on a map. Locating particular systems, stresses, sources, and strategies is helpful for deploying conservation resources and taking conservation action at the appropriate places within the site. Subsequent chapters in this handbook briefly address mapping issues with the five S's, where appropriate. Collectively, the boundaries of the conservation targets and sustaining processes (i.e., ecological boundaries) delineate the functional conservation site—the area necessary to maintain the viability of the conservation targets over time, including the natural patterns and processes that sustain the targets. However, given that stresses, sources, and strategies also can be mapped, it is important that any mapped boundary be explicitly defined and labeled to avoid confusion.

[1] Assigning scores is appropriate when (1) the phenomenon in question could be measured on a continuous scale if we had measuring instruments that were accurate enough, and (2) the ordered classification can be regarded as an attempt to approximate the continuous scale with a cruder scale that is the best we can do in the present state of knowledge.