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The Science and Practice of Ecological Restoration

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The Restoring Ecological Health to Your Land Workbook

Steven I. Apfelbaum and Alan Haney

With illustrations by Kirsten R. Vinyeta

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PREFACE

It is in man's heart that the life of nature's spectacle exists; to see it, one must feel it.

Jean-Jacques Rousseau

This workbook provides detailed information for preparing and implementing an ecological restoration project. It closely follows our previous book, *Restoring Ecological Health to Your Land*¹, in which we describe an approach that has been consistently successful in restoring ecosystems. The methodology we describe is pragmatic. It is the result of years of experience with restoration of hundreds of ecosystems, including prairies, forests, deserts, wetlands, and streams around the world. It is our aim in this book to provide the basic tools and techniques, with enough instruction so that you can tailor them to the specific and unique aspects of your project.

We have organized this book in the sequence that should be followed for every project, beginning with evaluation of the land. We provide guidance for each step and sources for obtaining the essential information required to prepare a good restoration plan; then we progress to implementation of the plan. Monitoring results of restoration treatments and good record keeping are necessary to adaptively manage and refine restorations during implementation; we provide guidance for both. We also have included information on such things as financing and contracting for services and strategies for reducing costs.

This logical flow of preparing and implementing a restoration plan is important for three reasons: it facilitates communication with others, it supports your need to optimally utilize your investments of time and money, and it guides you in building the essential knowledge and understanding of the ecosystems you are restoring. Do not underestimate the importance of communications. If there is a most important lesson learned by the authors, it is the importance of developing a simple, understandable way to share the restoration project with the stakeholders, be they your own family, neighbors, financial partners, or volunteers. We emphasize careful

organization and good communication throughout the book, primarily because we have seen good projects fail for lack of attention to these elements more than for any other reason.

Getting started is the hardest part of any difficult task. Restoration and management of ecosystems is complex, with a staggering array of things to consider. It is easy to get discouraged, and even the most experienced of us often feel overwhelmed. We have tried to identify the common barriers and stumbling points, and provide you with an approach for dealing with them that increases your comfort and confidence. The approach always should begin with learning your land, how it has changed, how it has been impaired, and why and where it is presently being stressed. Starting work on the land prematurely without this knowledge, or without the understanding of how to address the stressors, can cost you time and money, at best, or increase the problems on the land, at worst.

Finally, we offer something unique for our readers. To help ensure that you are successful, we have established a website (www.restoringyourland.com) and offer a one-hour, free consultation that will help you into and through the restoration process. Additional information about the website, such as how to apply for assistance, is found in appendix 4.

This book is part of the series *The Science and Practice of Ecological Restoration*, sponsored by the Society for Ecological Restoration and published by Island Press. Other books in the series are listed at the end of the book. Many are written by restoration experts for those experienced with at least some aspects of restoration ecology and will provide you with useful references for specific ecosystems like those you are planning to restore. These books contain details not included in this book; as you gain experience and knowledge about your restoration, this information will become more useful. The book you are holding in your hands, along with our previous book, differs from others in the series, because we have assumed as little as possible about your experience or formal training. If you are just getting into ecological restoration, we hope that our books will give you the information you need to begin.

In preparing both books, we have drawn from our personal experiences in restoring our own lands, as well as from hundreds of other projects with which we have been involved. We also drew from the experiences of others and applied our accumulated knowledge to lay out an approach to ecological restoration that we have found to be consistently successful.

We think of those engaged in ecological restoration as the “land-connection community.” This community includes private landowners interested in conservation, land stewards working for land trusts or conservancies (one of the fastest growing conservation movements in the world), governmental and nongovernmental personnel engaged in ecosystem restoration and management, personnel working

with for-profit corporations and developers, and volunteers. The common thread for all of us engaged in ecological restoration and ecosystem management is the ecological health of the land.

What Is the Meaning of “Ecological Health”?

Aldo Leopold explored ecological processes on his down-trodden central Wisconsin farm in his seminal book, *A Sand County Almanac*.² He introduced the concept of land health and related it to environmental ethics:

A land ethic . . . reflects a conviction of individual responsibility for health of the land. Health is the capacity of the land for self-renewal. Conservation is our effort to understand and preserve this capacity. (Leopold 1949)

Nina Leopold Bradley, daughter of Aldo, worked as a child with her parents and siblings to restore the land to which she retired. Nina noted that restoration is putting back what has been taken or lost from the land. She observed that restoration requires a good understanding of the land—what some have called ecological literacy, and respect for the Earth.

The first step in restoring ecological health to the land, as with administering to the health of a person, is accurate diagnosis. We are all familiar with the process. The medical staff collects family and personal history, considers symptoms, and gathers data that can be related to functionality: temperature, urine and blood chemistry, blood pressure, and so forth. Careful observation is an important part of this process. Determining ecological health is a parallel process, but it is far more complex. Unlike a human patient, the land cannot tell you how it feels. Moreover, an ecosystem does not have easily measured indicators of health like blood pressure or temperature. Thus, it is up to you to gather the history and make the appropriate observations for a correct diagnosis.

Ecologists have developed a good understanding of how ecosystems work. The processes, such as soil development and maintenance, succession, regulation of populations, and nutrient cycling are based on the interactions of literally thousands of species (most of which are invertebrates and microorganisms). It is difficult, at best, to measure these processes in any meaningful way, so measurements focus on the condition of “indicators” of ecosystem health. There are many indicators, each revealing only a tiny perspective of the whole system. This complexity, and the difficulty in assessing the condition of an ecosystem, might seem hopelessly challenging, especially for someone with minimal training or experience. Take heart from the observation that some farmers, with little formal education, have managed

their farms well for decades. Ecological restoration has much in common with farming. Both require careful attention to soil and water, invasive species, and health of desired species. Having a good business plan and good management skills is important for both. This book guides you toward the observations and ecological functions you need to observe in your land, and steps for developing a sound restoration plan. Remember, if you get stuck or need help, please see appendix 4, and the website www.restoringyourland.com, on how we can help you.

Notes

1. Steven I. Apfelbaum and Alan Haney, *Restoring Ecological Health to Your Land*. (Washington DC: Island Press, 2010).
2. Aldo Leopold, *A Sand County Almanac*. 1949. (London: Oxford University Press, 1949).

INTRODUCTION

Whatever you do, or dream you can, begin it. Boldness has genius and power and magic in it.

Johann Wolfgang von Goethe

We introduce the process of ecological restoration with a brief overview of the ten-step process that has proven to be consistently successful in all kinds of ecosystems throughout North America and beyond. This approach is based on years of experience, ours and that of colleagues, with thousands of projects around the world. Although you should approach it systematically, as we have outlined it in this book, it is not a linear process. You may have to loop back through the diagnosis and analysis steps many times over several years as you gain insight or run into new problems or questions. Consequently, you may engage some of the ten steps simultaneously. This is mostly because the complexity of ecosystems inevitably leads to uncertainty in the diagnosis and, consequently, in treatments. You also will continue to learn as you implement treatments, leading to refinement of your restoration plan. The return of land to a healthy condition typically will take a few years, and there is plenty of opportunity to review and revise your restoration plan. This ten-step process may appear simple, but as you will see when we get into details, few things are certain or absolute. Ecosystem restoration requires an adaptive management approach.

The sequence of the ten steps is important, although in simple projects you can initiate several steps at the same time. Avoid skipping steps. We break most steps into a series of tasks. These, too, should be undertaken sequentially in most cases, but some may take much longer to complete, and therefore, work will sometimes overlap. Most steps build on information collected in previous steps, so a systematic approach will yield the best results. A good restoration plan is possible only with attention to the details in each task and step.

Step 1. Inventory and Map Your Land

In this step you will interpret the landscape and its condition. You will identify the ecological units based on edaphic (soil, hydrology, and topography) setting, land use, and vegetation. As you progress through the tasks in step 1, there will be increasing attention to detail, eventually leading to as much understanding as possible about how the ecological units have changed as a result of human activities on the land.

Step 2. Investigate Historic Conditions

Exploring and mapping historic conditions in and around your project can be both enjoyable and enlightening. What did the landscape look like before it was developed? What ecosystems covered the land? How did they change as a result of activities of native peoples and early, as well as more recent, settlers and farmers? Information can come from any source, including old aerial photographs, plat books, elderly neighbors, and local libraries. Some natural history books that focus on regional ecology may also be useful.

Step 3. Interpret Landscape Changes

Because there is no way to be certain how ecosystems have changed as a result of human activity, this step involves the development of working hypotheses about changes and causes for them based on what you find on the land and what was present historically. How did the original landscape look, and what were the ecological processes that maintained the ecosystems? For example, periodic fire and flooding may have been important. What plant and animal species were prominent? Which are now missing, and what are the effects of their absence? Try to define as best you can the kinds of ecosystems and their relationships to the landscape and processes. This is one of the steps that you will continue over the years you work with your restoration, but careful attention to the tasks in steps 1 and 2 will prepare you to begin to see what potential the land has for restoration. This is the basis for the next step.

Step 4. Develop Goals and Objectives

What do you hope to achieve with restoration? How will it look? What species and conditions will each management unit support? As you do this, you will need to de-

fine management units where common tasks can be applied to achieve specific objectives. Remember that goals are often more general statements, while objectives have measurable outcomes and links to technical performance. Thus, the latter especially tend to apply to specific management units within your project.

Step 5. *Develop Your Restoration Plan*

A very specific plan is important for several reasons. First, it allows you to develop a timetable for implementation that is in keeping with your available resources. Second, it acknowledges the logical seasonal and successional timing of tasks. Finally, it affords the opportunity to start small, especially where there is more uncertainty, and scale up as you learn.

Step 6. *Develop a Good Monitoring Program*

Monitoring facilitates learning as you go. Initially, you may want to capture baseline data before restoration begins, but certainly you will need to determine how units respond to treatments to be sure you are moving each ecosystem in the direction desired. If you do not carefully evaluate how the land responds to treatments, and adjust as necessary, you can waste a lot of time and money.

Step 7. *Implement the Plan*

This follows logically from the plan that you have developed through the previous six steps. Implementation will require that you have lined up necessary materials, tools, and help, and develop a phasing schedule for specific treatments. We lead you through this preparation.

Step 8. *Maintain Good Records*

Documenting changes is primarily accomplished by implementing the monitoring plan. Records allow you to periodically summarize where you are and what you have learned. Formal reports may not be necessary in most noncommercial restorations, but sharing the project's successes and failures with stakeholders should be a priority.

Step 9. *Review the Project*

We recommend that you review the project at least annually and make adjustments to reflect what you have learned and any changes in resources available for the coming year. There will be unexpected setbacks as well as successes, and adjustments are inevitable during restoration. We also suggest patience with ecosystem recovery and not making hasty, unnecessary changes.

Step 10. *Share the Restoration Process*

Working close with nature and seeing the changes that result is exciting. Certainly, stakeholders will want to look over your shoulder, if not join in the actual work, but there are many others who will profit from sharing your experience. These include school children, Scouts, and neighborhood organizations, such as garden and bird clubs. Many may provide additional hands for routine tasks.

How to Use This Book

The ten steps are a framework to organize the process of restoration. Most steps are divided into a series of specific tasks that are explained and illustrated with examples. In each step, data forms are presented for you to complete as you progress through each task. We have collected all forms in appendix 1. We also included a “crib sheet,” which outlines the essential process called the “Restoration and Management Planning” data form. Data forms are provided to help you organize your investigation and planning. These forms provide an outline within which you can summarize the information you derive from the tasks in each step.

We want to emphasize one other important point that we have learned during our thirty years of managing and restoring ecosystems. When working with nature, one must have humility. Simply going through a planning process is empowering, but nature will throw you curves that no one can anticipate. Remain humble and be flexible. You likely will become discouraged at some point. Nearly all of us do. But be prepared to be awed as well. Perhaps the hardest lesson for many is learning to work *with* rather than *against* nature.

We recommend reading our previous book, *Restoring Ecological Health to Your Land*, first, although this book is designed to stand alone. Each chapter in the first book, and step in the second, builds on the preceding information to help you develop a complete and practical restoration plan. In this book, each step is detailed with specific tasks and reference to forms and tools needed to complete them.

Remember that the forms and tools provided in this book are also available online. You can download them from the www.restoringyourland.com website. The table of contents will give you the big picture, and may help you better track where you are in the process.

Staying Safe and Comfortable in the Field

Field mapping and other work outdoors should be enjoyable. Undertaking any work requires the proper equipment. Without it, productivity decreases and discomfort increases, usually leading to poorer results. Appendix 2 includes suggestions for basic equipment, safety, and protection for restoration planning. We make recommendations, but it is up to you to choose the right equipment to fit the unique aspects of your project, climate, and experience. If you are taking others, especially inexperienced people, you need to ensure that they will be safe and comfortable. Should an emergency arise, know proper procedures. We cannot overstress the importance of being properly prepared.

Let's get started!