Natural Lands Management Cost Analysis

28 Case Studies

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Contents

Executive Summary

With funding provided by the Environmental Protection Agency's Small Grant Program, the Center completed a survey of long-term conservation management practices at 28 preserves located in Arizona, California and Oregon (see complete list in Table 1, Introduction). This survey includes case studies, descriptions of the preserves, goals, resource characteristics, management organization, management tasks and budgets. California is still the only state that regularly requires consideration of long-term stewardship through evaluating the management organization, its plans and its funding. Elsewhere in the country, such considerations are often limited to Habitat Conservation Plans under the Endangered Species Act.

The subject projects were chosen to illustrate a variety of situations. Their sizes range from 13 acres to more than 100,000 acres with a total of 325,000 acres surveyed. They are owned by public agencies, private non-profits or private parties in mitigation banks. Their lands may have been acquired through either the conservation (grants, conservation purchases, gifts, etc.) or habitat mitigation process.

The variation between preserves was striking not only in the total management cost but in the kinds of activities necessary to manage them. Annual management costs averaged $51 per acre per year for all 28 projects (the median was $122 for the sample). The range in cost per acre per year is $6 to more than $2,100. Therefore, for a 100-acre preserve, the annual cost could range from as little as $600 to as much as $210,000 per year.

Although the cost of stewardship cannot be predicted with any acceptable level of confidence from the size of the preserve, the economies of scale are dramatic. Costs ranged from around a $1,000 an acre per year for many smaller projects to well under a $100 an acre per year for the larger projects.

We caution that while these numbers provide insight into long-term preserve costs, they are not statistically valid and underscore the necessity to complete individual cost analyses for each preserve. This study emphasizes the variation in preserve goals and tasks which determine long-term costs. One cannot conclude that by generalizing these tasks across preserves, preserve management costs would be equal.

Acknowledgments

The Center thanks the Environmental Protection Agency particularly Palmer Hough and Yvonne Vallette for their interest in long-term stewardship and their substantial support of this project. We also are deeply appreciative of the staff for each of the protected properties. They dedicated significant hours between the interviews, the provision of written information and the review of the draft case study. Their care in discerning between short-term tasks and those long-term ones was essential to a reaching a credible conclusion. Others listed here helped make the necessary contacts and administratively kept the project going. We thank you all personally. We hope we have missed no one, but if we have, please accept our apologies.

Arizona: Bill Williams River National Wildlife Refuge-Richard Gilbert and Kathleen Blair; Buenos Aires National Wildlife Refuge-Wayne Shifflett, Sally Gall and Dan Cohan; Gila Box Riparian National Conservation Area-Bonnie Winslow; Hassayampa River Preserve-Mike Rigney and Marty Lawrence; Jewel of the Creek Preserve-Thom Hulen, Robin Kilbane, Jacky Davis and Dave Peterson; McDowell Mountain Regional Park-Rand Hubbell, Paul Marusich and Bob Skaggs; Robbins Butte Wildlife Area-Tom Hildebrandt and Mark Severson; Tortolita Preserve-Leslie Liberti, Andy Laurenzi, Mike Reuwsaate and Jennifer Christelman; Upper Verde River Wildlife Area-Jeff Pebworth and Kevin Morgan.

California: Bryte Ranch Mitigation Bank-Steve French; Carpinteria Salt Marsh Reserve-Andrew Brooks, Maggie Drake and Donna Moore; Laguna Wildlife Area- Tom Beam, Allan Buckmann and Christina Fabula; Dye Creek Preserve-Peter Hujik, Tiffany Holbrook, Rich Reiner, Tony Nelson, Jake Nelson and Dawit Zeleke; Mendota Wildlife Area-Steve Bruggeman; San Elijo Lagoon Ecological Preserve-Doug Gibson, Amy Kitchen, Maryanne Bache, Tom Dillingham, Susan Welker and Katsula Workie; Skyline Ridge Open Space Preserve-John Maciel, Cindy Roessler, David Sanguinetti and Craig Beckman; Starr Ranch Sanctuary-Peter DeSimone; Sycamore Canyon Reserve-Randy Solis.

Oregon: Agate Desert Preserve-Darren Borgias and Cathy MacDonald Blind Slough Swamp Preserve-Debbie Pickering, Tammy Lesh and Cathy MacDonald; Camp Polk Meadow Preserve-Brad Chalfant, Karen Allen and Jessica Rawlings; Denman Wildlife Area-Vince Oredson and Mark Varga; Jackson-Frazier Wetland Preserve-Jerry Davis and Robert Frenkel; Mud Slough Mitigation Area-Mark Knaupp and Debbie Knaupp; Robert's Island Preserve-Ryland Moore and Mike Running; South Slough National Estuarine Research Reserve-Mike Graybill and Craig Cornu; Umatilla National Wildlife Refuge-Gary Hagedorn, David Linehan and Brian Allen; Weathers Wetland Mitigation Bank Site-Patrick Thompson.

We particularly want to thank Darcy McNamara and David Laabs as interviewers and Nancy Ottum at Red Raven Collective for text editing and typesetting this document. Staff members Greg Warrick, Ed Stanton, Cliff Feldheim, as always, brought their expertise and diligence to these interviews.

Introduction

Wildlife preserve management is a relatively new science. There exists little formal documentation detailing the resources and costs required to restore, protect and maintain preserves so that they continue to be rich, vibrant and sustainable habitats. Therefore, it is critical to have a firm understanding about how to manage properties and what the associated costs are. Whether for a mitigation project or straight conservation purchase, the purpose of this study is to help governmental agencies, local cities and counties, land trusts and banking entities determine the most realistic estimate of the long-term stewardship costs and tasks.

The necessity for active, perpetual management of these sites cannot be understated. It is critical to maintain the resources for which they were set aside. Each year, millions and millions of dollars are spent acquiring conservation lands, yet very little funding is dedicated to maintaining these areas once purchased. Without active management, invasive species, inappropriate or unauthorized uses, vandalism, overgrazing and encroachments can all impact and destroy the resources that we have labored so diligently to protect. In addition, without regular monitoring of the habitat and select species, we will never know if we are achieving our conservation goals or meeting mitigation requirements.

In this report we strive to illustrate long-term stewardship activities. It is often true, that, agencies, nonprofit organizations and the community believe that restoration is the object of management and that a project is complete when the restoration phase is finished. Stewardship, is instead, a continuing activity and is clearly demonstrated by the ongoing tasks performed in the care of the subject sites.

It is our hope that these case studies will help preserve managers to create realistic budgets that reflect their individual needs. This study shows one way of determining these costs and what tasks need to be considered to ensure our natural resources are protected in perpetuity.

Goals

Our primary goal is to ascertain whether some common variable determines management costs. However, the number of unique conditions on each site that translate to management activities and costs precludes any simple estimating formula. The true denominator of the cost relationship is not only acreage but more importantly, public use/misuse, presence of invasive exotics, uses of the surrounding areas, edge effect and the quality and appropriateness of any restoration efforts.

The second goal of the study is to improve the Property Analysis Record (PAR) software. This software was developed by the Center to determine the long-term stewardship tasks and costs for a specific conservation property. When the physical site attributes and potential impacts are input, the PAR can assist in developing tasks to cope with those potential and actual impacts and to develop the budget necessary to actually get the job done. The PAR results gives managers a concrete budgetary analysis which is critical when applying for grants, budget increases or endowments.

Under this methodology, the Center is currently managing some 50,000 acres of mitigation lands in California with about $21 million dollars in endowments. It is our intent that the PAR software tasks and costs will be upgraded and improved based on the findings of this study.

The present study is an update to previous work that takes advantage of our increased understanding of the range of activities that occur on managed sites. It also expands out of California to Arizona's arid landscape and Oregon's wetter climate. Once again, the work contributes to the PAR which is presently being reprogrammed as PAR 3.

Preserve planners and managers can use the information on tasks for individual projects to help plan management for new or existing preserves. A compilation of long-term stewardship tasks may help in requesting grants or budget allocations for individual tasks or task categories. Having a comprehensive budget may also assist in evaluating priorities for certain services over others. For many projects, particularly mitigation projects, such a budget is essential in creating an endowment for long-term stewardship.

Background

In 1994, CNLM completed a study called "Habitat Management Cost Analyses" that was the forerunner of the present study. That study looked at ten sites in California. Its purpose was to "improve our ability to value natural habitats through an increased understanding of the types and costs of management activities required for effective habitat conservation and enhancement." The results of the previous work has been used by conservation planners to develop management plans and to project budgets. The case studies contained tasks that were incorporated into the PAR software that was then in its early conceptual phase.

Study Design

In the effort to provide the broadest range of tasks facing protected land stewards, this survey was designed to achieve the maximum diversity of projects in terms of size, managers, locations, goals and conditions. Available protected sites in each of the three states were surveyed and lists prepared. Most sites were found using an internet search. The choice of sites in each state was from a group of 30 to 40 candidates.

The next step was to determine which managers were willing to participate in the study. Each person was interviewed by phone to explain the intent of the study and the time and materials required. Only willing managers were included. In some cases, managers of multiple properties were reluctant to be interviewed regarding specific sites. As a result, alternate sites were substituted if they did not closely duplicate other survey properties. If the substitution did closely duplicate other properties, it and the manager were dropped from the list.

Interviewers were chosen for each of the sites. Staff members at CNLM were chosen for the California sites. The location of each staff member was as close as possible to the subject site. Dr. Michael Robson, CNLM's science director, was chosen for his extensive experience in Arizona. Darcy McNamara, a trusted consultant, who had worked previously on the West Eugene Wetlands Bank site surveyed the Oregon sites. Each preserve manager was sent a letter detailing a list of materials that would be helpful to the survey and the name and contact information for their interviewer.

The amount of information varies widely between projects. Most projects have a webpage as part of their organization's website. A few, typically private mitigation banks, do not. Three-quarters of the projects have management plans although some are ten years old. Almost all have species lists. Most have excellent summaries of volunteer activities and hours created as part of the award system for volunteers. Professional volunteers' ongoing commitments were seldom summarized, however. Inventories of real property assets such as on-the-ground structures were seldom found but equipment inventories were common.

Each site was visited by the interviewer at least once. At that time the surveyor met with the preserve manager or the manager's representative. The regional manager, professional volunteers and preserve staff were often visited as well. On large and complicated sites, a spreadsheet detailing time usage by activity for staff and volunteers was developed and submitted to the preserve manager. Frequent follow-up phone calls and emails were required to finalize documentation.

The description of each preserve is freely adapted from materials previously prepared by the site's staff including the website, management plan and other materials. Budget figures are used only when they conform with an ongoing activity and when they provide sufficient detail. No effort is made to reconcile the total PAR budget with the preserve budgets because, as described in a later section, their purpose and definition are too dissimilar.

Upon completion of a draft case study for a particular preserve, it was sent back to the preserve manager for his/her review. The preserve manager's comments concerning both the text and the budgets were incorporated. In no case were these comments detrimental to the substance of the study.

Major Conceptual Issues

Task Determination

The concept of a task was always difficult. Tasks included work conducted to achieve the mission of the preserve; they also included the maintenance and replacement of equipment and capital items designed to achieve the mission of the preserve. Managers and the stewardship interviewers, may have demonstrated their own set of priorities in describing tasks and in linking them to the mission of the preserve.

Timing was also a factor. At any particular survey date, a preserve may be planning new trails, a new visitor's center or a new restoration program based on a recent grant. New staff positions may also be anticipated. The choice of whether to include the new item depended on whether it was in process and whether the preserve manager wanted to include it. When included, the new element was reviewed for its long-term components rather than its current impact on costs or activities.

The stewardship interviewers found particular difficulty in assigning tasks that were not part of the preserve's management program. For instance, some preserves conducted little monitoring of their resources even though their goals cited habitat conservation. Understanding that habitat conservation is a difficult goal without understanding the changes in habitat and species that occur over time, interviewers added a considered monitoring program. In these cases, the added items are pointed out in the text.

Existing preserve budgets were seldom a help in determining tasks because: 1) labor costs are grouped by the employee or the group of employees rather than broken into the tasks that are performed; 2) budgets also do not reflect amortization of equipment and other capital items already purchased and not yet ready to be repurchased; and 3) some preserves simply don't have the budget to fulfill their mission over the long-term. The case studies represented here are intended to transcend these limitations to reflect the average annual long-term cost of stewardship .

Task Categories

The case study on each preserve includes the following sections: Property Description, Project Goals, Biological Description and Organization. The last two sections, Habitat Management Tasks and Habitat Management Costs summarize the survey results.

Interviewers handled the Habitat Management Tasks and Cost sections differently. Many describe the tasks and capital according to the task breakdown in the PAR. The task breakdown in the PAR is shown in Table 2. In this case, the assumptions and definitions of each task is described in the document.

Table 2. Categories of Tasks in the Budget.

A.	Acquisition
B.	Site Construction
C.	Biotic Surveys
D.	Habitat Restoration
E.	Habitat Management
F.	Water Management
G.	Public Services
H.	General Maintenance
I.	Reporting
J.	Office Maintenance
K.	Field Equipment
L.	Operations

Other surveys describe the major tasks for the project without reference to the categories. Detailed assumptions concerning each task are provided instead in a footnote at the end of the document. These two methods of illustrating the preserves are both considered appropriate and only reflect the interviewers' personal styles.

A more substantive difference between interviewers' and indeed preserve managers' versions is in the allocation of tasks between categories. In many cases, the survey was successful in discerning new tasks that have not historically been in the PAR. The allocation of these tasks then became a subjective matter between the surveyor and the preserve manager. The cause of the variation is generally how the participants link the new task to the definitions of the category in the PAR. They may link to the categories by function which was the original intent of the PAR or by similarities. For example, structures such as a preserve office, a nature center and an equipment garage may be linked together or they may be linked functionally to services to the public, to management of the office or to the field equipment category. Most of the major differences have been adjusted and the following paragraphs describe the intent of each category and points out where variation may occur.

Acquisition covers tasks that occur prior to management. Title reports, agreements, negotia-

tion and costs of acquisition are not considered a long-term task in this study.

Site Construction generally includes items of major construction such as fencing and roads; however, in some cases it also includes water tanks and piping for cattle which could appear under water management as defined.

Biotic Surveys include monitoring and surveys of natural communities, plants and animals. In some cases, it also includes extensive hours of cultural surveys. Several projects also systematically monitor for human impacts in biologically sensitive areas though these tasks could be included in the Public Services category as defined below.

Habitat Restoration is generally a front-end endeavor and is not included as part of long-term management costs. However, when a certain project such as an invasive exotic species control program, that preserve managers identify as restoration appear to be long-term coping with ongoing impacts; they are included in Habitat Management below.

Habitat Management is the ongoing care of natural communities, plants and animals. It may include invasive-exotic control as an ongoing task as well as plant production and nurseries though the latter is generally thought of as a restoration item.

Water Management includes care and maintenance of wetlands. It also includes water testing, artificial systems of controlling water, the acquisition of water and wells.

Public Service is a vast category that is defined to cover all activities and assets that serve the human element including both visitors and staff. Obviously, there can be a substantial confusion in allocating some of these tasks. Surveys for impacts in biologically sensitive areas could be included here. Most structures are classified in this category even though some might consider them more reasonably categorized them as major construction that could be included in the Site Construction. Parking lots are listed here because they generally serve the public even though their maintenance is similar that of the roads in Site Construction.

General Maintenance includes trash and toilets. However, it has also become the location for maintenance sheds, shops and garages. These are differentiated from other structures by their function.

Reporting includes major reports such as management plans, internal management reporting and as well as mapping functions. Biological reports, however, are listed in the Biotic Survey category.

Office Maintenance includes office equipment and time if it is used to run the office. Larger offices have dedicated office staff but smaller ones generally do not. Office equipment in smaller offices is counted and so is quite accurate. In large offices, where the equipment is extensive, estimates of office equipment and office support services may be linked to the number of computers.

Field Equipment covers equipment that is multipurpose which is the reason it is not included in a functional category like Site Construction or Habitat Maintenance. The complexity and variety of equipment in this category tends to expand rapidly with the largest preserves.

Operations are those staff functions that occur at the preserve level. Bookkeeping and contracts for the preserve itself are included here. Nonprofits generally must seek property tax exemptions and often include fundraising. Mitigation properties with endowments are often required to be audited under their mitigation agreements. Larger organizations also include more general management responsibilities in this category such as personnel work and supervision whereas smaller organizations generally include such items in the functional category.

In addition to direct cost categories, two rates are applied to all case studies. The first is a contingency rate of 10 percent. A contingency is included because of the likelihood of missing some important element over the forecast term. The rate of 10 percent is typical and acceptable in projections of costs. The second rate is an administrative rate that applies to all direct costs and the contingency. The administrative rate is meant to capture the preserve's share of organizational costs or those legal, personnel, administrative, public relations costs that benefit all of the organization's preserves. Each organization was asked to set the rate appropriate for their organization, however, most deferred to the default rate in the PAR. Very small organizations or single project organizations where all time was accounted for within the direct costs were given a lower administrative rate.

Costing and Accounting

The goal of this project is to determine the long-term annual average cost of a task where a task might be a job accomplished by staff, a purchased service or the replacement cost or amortization of a structure or a piece of equipment. The long-term annual average cost is the objective because it transcends the year-to-year budgets that are affected by economic or political conditions. Such a number is also the basis for an appropriate endowment. To estimate costs, the study sought seven elements concerning each task:

1. Category
2. Task
3. Task specification
4. Unit by which the task is measured
5. Unit quantity in a year
6. Cost per unit
7. Life or incidence of the task.

The task category has been discussed in the previous section.

The task and its specification is meant to describe the task. For some of the larger more complicated projects, the specification designates the staff position involved such as preserve manager, assistant preserve manager, ranger, or field technician. In many cases, additional descriptive material is needed which is provided in the text and/or footnotes.

The unit takes several forms depending upon how the task is structured. For instance, labor costs (L. Hours) are staff but may also be volunteers. Contract labor (C. Hours) would include consultants and contractors. Road costs can be described per mile costs, per square yard or per square foot. Trail maintenance is more often measured per linear foot. In some cases where only labor is used to maintain trails, the unit may be labor costs. Where this occurs, the report tries to also provide the linear feet maintained. Other measurements may be by the item or per person.

The unit count or the number of units necessary to accomplish the task comes largely from the preserve managers. Unfortunately for our goal, the number of hours allocated to a task is necessarily influenced by recent experience and current priorities. Other types of units like the number of vehicles or the number of feet of trail can be readily documented, however.

The cost per unit is captured in a number of ways. Labor costs are calculated as hourly wages plus benefits. These are sometimes provided by the preserve. However, where the preserve can not release such figures, the midpoint of the federal GS standard for the location is used. Given the wide range of wage levels for any given position, this method is considered appropriate for this study. However, the preserve managers were asked to particularly consider these wage levels during their review of the draft.

Where the managers do not have costs for structures, the square foot estimate for a similar structure is taken from R S Means Cost Works (www.rsmeans.com). Means is also the source for fencing, road, irrigation and miscellaneous other costs where the numbers are not available from the preserve.

Equipment costs are usually provided by the preserve but where they are not, equipment suppliers in the area are contacted. If this does not result in an appropriate figure, the internet is used. This is particularly true of heavy equipment. Costs for signs, camping equipment, picnic tables, boats, windmills and similar items are usually provided by the preserve, but when that is not available, representative figures for similar products come from suppliers by telephone or the internet.

For some costs representing well known products, the default cost in the PAR is used. Each number is judged by whether it appropriately represents the type of task, product or service. In short, it needs to earn the preserve manager's approval and pass muster using our own instincts.

Service costs for long-term tasks are usually secured through recent bills. This is true for utility and other regular costs. Larger tasks such as dredging a wetland are usually estimated from relevant bids provided by the preserve manager.

The life of the task or the amortization period is needed to arrive at the average annual cost of stewardship. For instance the average annual cost of telephone service is the same as the annual cost. However, a task (asset, equipment or service) costing $500 that is done every two years has an average annual cost of $250. Similarly a task (asset, equipment or service) costing $50,000 that is repeated every 10 years has an average annual cost of $5,000.

The life or incidence of a task is also subject to considerable variation and discretion. Most tasks

occur every year. However, others may occur every two, five, or fifty-five years depending on the item and its circumstances. For instance, the determination of how often to monitor for a particular species may be every year, every two or every three years. Such a judgment is usually left to the preserve manager.

Some tasks have a midrange life. A computer may last four to six years depending on the memory requirements and the use to which it is put. Vehicles are typically driven for an average of eight years in a preserve setting.

The life of buildings from 30 to 50 years is based on the preserve manager's recommendation, a result of an RS Means search or the default in the PAR. Similarly, heavy equipment has a long useful life as do wells, berms and various water control structures.

Average Annual Cost of Stewardship

The average annual cost of long-term stewardship is the figure reported in this document. Table 3 illustrates how the varying costs and terms of tasks are combined to arrive at the annual average cost figure.

Table 3. Annual Average Cost Illustration.

Task	*Cost*	*Ongoing Years*	*Annual Average Cost*
Monitoring	$500	2	$250
Road Grading	$15,000	15	$1,000
Telephones	$300	1	$300
Total			$1,550

Endowments

An endowment is a mechanism for funding long-term stewardship. A properly designed, invested and managed endowment can produce income to support stewardship for the long-term. The amount of an appropriate endowment is dependent upon several factors, but first and foremost is the average annual stewardship cost. The endowment should be able to produce this amount annually while the principle grows with inflation. The average annual stewardship cost is the figure produced for these case studies.

The conversion of the average annual stewardship cost to an endowment is usually accomplished through a capitalization rate. A project costing $20,000 a year using a capitalization rate of 5 percent is $400,000 computed as $20,000/.05=$400,000.

The appropriate range of capitalization rates is from about 2.5 percent to 5 percent. The choice of a capitalization rate is dependent upon the investment portfolio in use. The highest capitalization rate of 5 percent is only appropriate for a large, balanced, diversified portfolio of stocks and bonds. The choice of a 2.5 percent capitalization rate is appropriate for a strictly bond portfolio limited to government and relatively short-term corporate bonds. Rates between 2.5 and 5 percent may be used by smaller less diverse endowments.

Used in this manner, the capitalization rate represents the spread between long-term earnings from a given portfolio and the long-term rate of inflation. Figure 1 shows a balanced, diversified portfolio that includes both stocks and bonds. The long-term earnings for such a portfolio is 9 to 9.5 percent, the inflation rate is 4 percent and money management fees are 0.5 percent. There remains, therefore, 4.5 percent to 5 percent on average for stewardship work.

The following formulas demonstrate the realistic range.

$$9.0\% - (4\% + 0.5\%) = 4.5\%$$

$$9.5\% - (4\% + .0\ 5\%) = 5\%$$

In this case the portion of the earnings attributable to inflation remains in the endowment. In one sense, it is reinvested into the endowment. This allows the endowment to grow at the same rate as inflation thus retaining its purchasing power over time. Conversely, using all income from the endowment causes the purchasing power of the endowment to fall at the same rate as prices increase as in Figure 2.

Many organization have restrictions on the securities available for investment. Most state and local governments are prohibited from investing in any stocks or stock mutual funds. Their returns are, therefore, commensurately lower. For this reason, a capitalization rate not exceeding 2.5 percent to 3 percent is thought to be appropriate depending upon the bond alternatives available.

Small endowments cannot achieve the diversity necessary for reliance on a 5 percent capitalization rate and also pay more fees than the 0.5 percent illustrated above. For these two reasons, it is thought that they should also choose a lower rate.

Fig. 1. Inflation and Portfolio Returns.

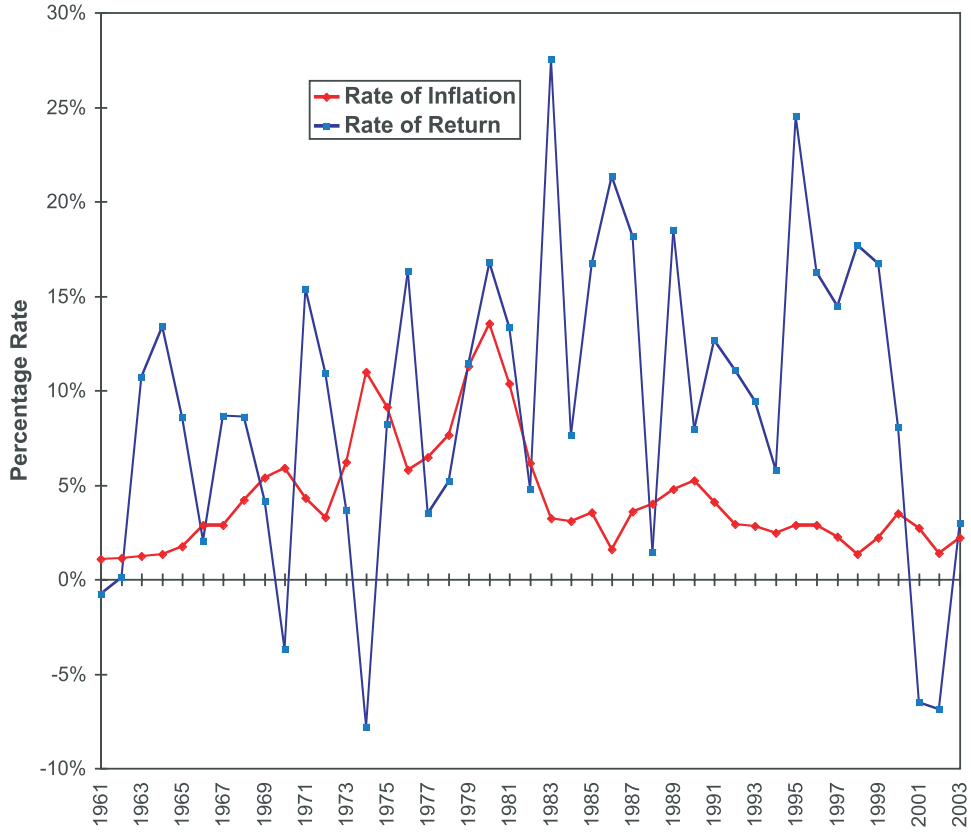
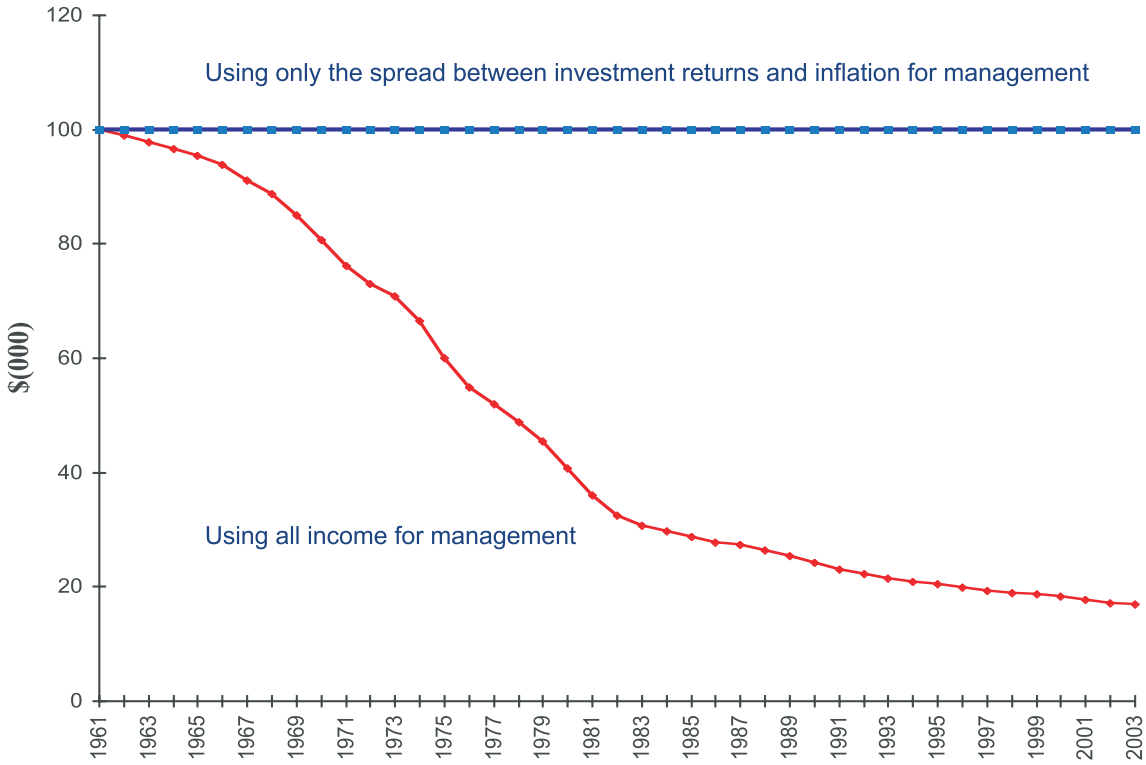


Fig. 2. Inflation's Effect on Purchasing Power of an Endowment.



Results

Size and Total Cost

The surveyed preserves range in size from 13 to 173,000 acres. The average size is 11,600 acres and the median is 928. Oregon has by far the smallest preserves with an average size of 3,459 while Arizona's average size was over 19,000 acres.

There are three federal preserves in the study in Arizona, none in California and one in Oregon. The average size of the federal preserves was nearly 43,000 compared to 6,400 acres for the remaining preserves. Preserves with mixed management includes the South Slough National Estaurine Research Reserve which is managed by state personnel with funding and influence from National Oceanic and Atmospheric Administration. Because of its strong state orientation, however, it is included as a state preserve. Similarly, San Elijo is a county owned preserved but the majority of onsite management is conducted by a nonprofit. It is included in the nonprofit category (see Table 4).

Table 4. Distribution of Managment Entities.

	Arizona	*California*	*Oregon*
City/County/District	2	1	1
State	2	2	2
Federal	3	0	1
Nonprofit	2	4	4
Private	0	1	2
University	0	1	0

The average annual cost by preserve is $588,000 which result is strongly influenced by the number of very large preserves in Arizona. The average cost in Arizona is $958,000 compared to $463,000 in California and $366,000 in Oregon.

Table 5 provides the total annual average costs for each preserve as well as a breakdown by category. This information was used to develop the following discussion and figures

Per Acre Cost

The range is from $6 per acre per year to over $2,100 per acre per year. This range is highly volatile depending upon the preserve. However, as Figure 3 shows, there are dramatic economies of scale to the larger preserves. This is despite the fact that the larger preserves often offer far more services to the public. They may provide picnic

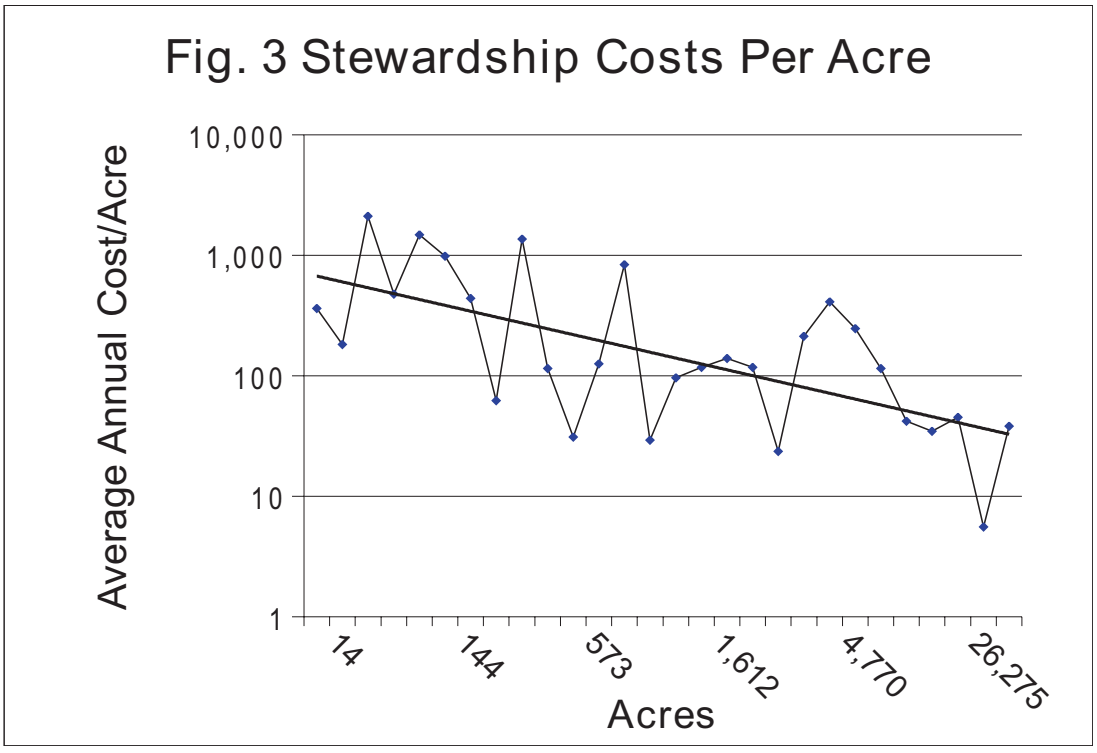


Table 5. Stewardship Activities by Task—Annual Average Ongoing Costs (Dollars)

Preserve Name	*Total*	*Site Const.*	*Biotic Surveys*	*Habitat Mtn.*	*Water Mgmt.*	*Public Services*	*General Mtn.*	*Reporting*	*Office Mtn.*	*Field Equip.*	*Operations*	*Contingency*	*Admin.*
Arizona													
Jewel	57,134	616	4,770	1,890	0	18,465	1,918	1,286	8,455	114	5,771	4,328	9,522
Hassayampa	453,531	22,099	64,850	14,400	117	148,181	4,149	5,030	16,501	18,205	34,020	32,984	90,706
Upper Verde	100,425	25,261	11,390	4,615	1,020	16,283	3,380	3,220	669	5,453	3,540	7,483	18,109
Robbins Butte	235,221	17,069	2,240	40,683	34,900	13,379	0	1,165	13,370	45,239	7,232	17,528	42,417
Tortolita	56,602	76	7,550	1,920	0	25,679	1,250	1,620	702	1,645	1,737	4,218	10,207
Bill Williams	1,505,566	7,643	124,500	19,970	1,320	712,584	7,026	17,947	45,860	48,973	117,964	110,309	291,400
Gila Box	928,373	175,947	123,518	42,880	3,525	203,055	17,109	29,675	22,461	47,984	37,260	70,331	154,729
McDowell Mtn.	795,247	31,526	28,800	14,651	5,862	307,435	59,084	10,472	68,943	29,888	35,924	59,258	143,405
Buenos Aires	4,498,739	694,867	115,600	1,305,010	17,208	454,678	13,963	61,740	137,460	324,579	227,160	335,226	811,248
Subtotal	8,630,838	975,104	483,218	1,446,019	63,952	1,899,739	107,879	132,155	314,421	522,080	470,608	641,665	1,571,743
California													
Carpinteria	178,110	1,218	3,458	41,770	58,523	15,285	0	2,492	5,849	3,350	774	13,272	32,118
Laguna	61,948	5,156	15,792	5,560	0	10,564	752	2,331	1,687	3,446	872	4,616	11,171
Bryte Ranch	17,841	1,897	5,286	587	0	19	280	1,646	225	868	2,273	1,308	3,453
San Elijo	755,359	1,640	59,200	60,856	128,833	141,441	4,760	77,413	38,742	8,189	70,900	59,197	104,187
Sycamore	145,049	4,467	21,890	22,347	0	15,611	1,197	6,720	13,445	16,874	2,940	10,549	29,010
Skyline Ridge	189,794	4,355	526	36,561	8,770	65,911	11,752	297	3,125	3,707	5,864	14,143	34,225
Starr Ranch	853,993	20,771	85,975	104,283	0	213,826	21,300	28,520	43,212	55,047	74,030	64,696	142,332
Mendota	1,433,912	10,381	117,467	241,203	178,839	133,792	145,214	0	78,605	68,748	94,240	106,849	258,574
Dye Creek	534,065	61,256	102,250	11,350	26,000	72,906	21,328	7,260	21,866	21,794	42,400	38,841	106,813
Subtotal	4,170,071	111,141	411,844	524,517	400,965	669,355	206,583	126,679	206,756	182,023	294,293	313,471	721,883
Oregon													
Weathers	4,959	0	720	1,070	24	720	0	90	169	27	1,205	402	531
Roberts Island	3,648	0	165	1,470	0	3	0	420	58	1	897	301	332
Agate Desert	25,242	538	5,392	1,292	0	1,361	0	3,784	1,682	1,611	2,697	1,836	5,048
Jackson-Frazier	141,481	195	2,520	6,800	0	41,400	10,730	2,215	18,952	24,000	9,161	11,587	14,021
Camp Polk	65,285	2,861	3,460	11,012	0	16,959	825	1,430	8,230	752	3,119	4,865	11,773
Mud Slough	19,983	257	1,575	8,088	945	0	3,375	1,894	708	21	438	1,730	952
Blind Slough	27,219	2,860	198	6,774	0	1,320	0	956	458	340	6,890	1,980	5,444
Denman	225,999	1,504	4,808	45,094	6,330	32,483	6,700	6,956	34,391	17,936	10,024	16,622	43,152
South Slough	1,957,104	43,525	215,400	113,158	0	493,833	65,899	134,460	208,074	60,715	123,295	145,835	352,920
Umatilla	1,193,903	145,138	10,890	259,400	42,662	107,043	53,990	9,330	48,494	142,630	70,068	88,964	215,294
Subtotal	3,664,823	196,878	245,128	454,158	49,961	695,122	141,519	161,535	321,216	248,033	227,794	274,122	649,467
Total	16,465,732	1,283,123	1,140,190	2,424,694	514,878	3,264,216	455,981	420,369	842,393	952,136	992,695	1,229,258	2,943,093

and camping areas, hunting and other active recreational services compared to the smaller nonprofit preserves that are available for passive recreation only. Private protected lands may not be open to the public at all.

Figure 3 is a log scale of acres and management cost per acre. Although the variation from project to project is evident, the regression shows declining per acre costs as project size increases. The regression is based on an exponential formula. Compared to other common regression formulas, it offers the highest R2 at .41. While it is evident that economies of scale occur, there is, nevertheless, little predictive value for stewardship costs based on the acreage of a preserved area.

Costs by Category

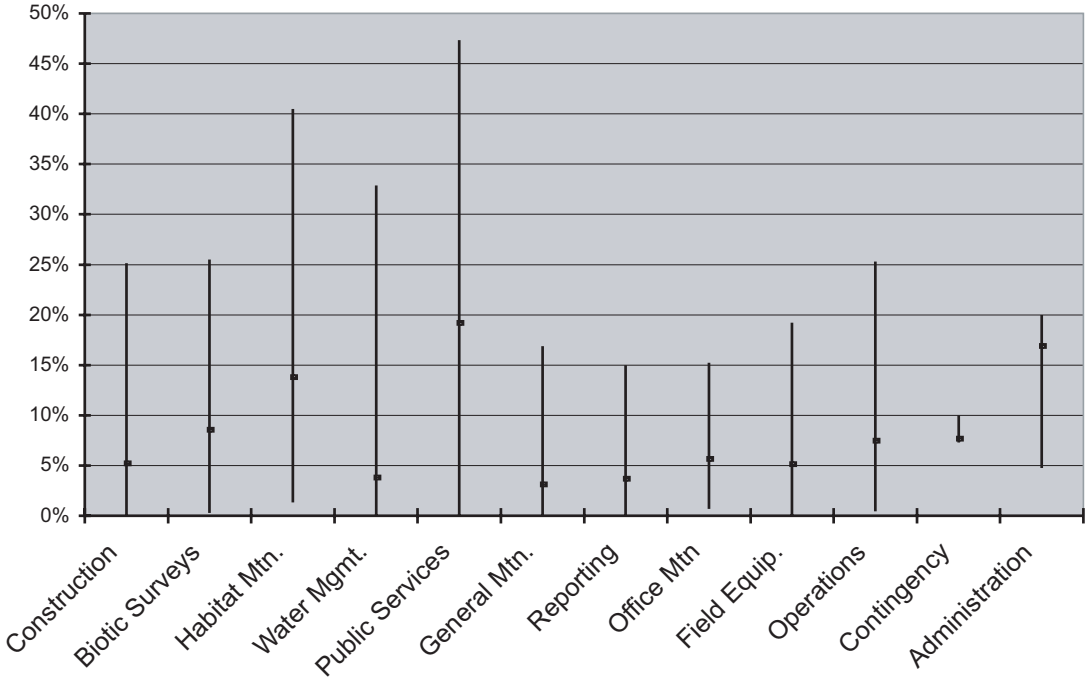
Cost by category varied widely. In fact every category of cost could be zero or near zero depending on the project except for the built-in contingency and administrative fee. The variation as a percentage of the total annual cost is shown in Figure 4. The largest variation occurred in Public Services where the effort could range from no access to docent, educational, recreational, community outreach and resource use activities.

Biotic Surveys also experienced considerable variation due to different levels of monitoring. Third was Water Management where most projects had little work but some had extensive water control infrastructure.

The average share of cost by category is shown in Figure 5. Once again, Public Services accounts for the major part of costs at 19 percent. On average administration of projects is the second largest category at 18 percent of the total costs. A few projects are considerably lower and some are marginally higher but the majority of managers accept the default rate of 22 percent as appropriate for their preserves. Although the confidence level of this assumption is high, the cost of administration is not determined through an itemization of costs but through the use of an overall rate.

The third major category is Habitat Management at 15 percent of total budgets. The remainder of categories account for 3–8 percent of the total.

Fig. 4. Range and Average Stewardship Cost by Category



Conclusions

The variation between preserves was striking not only in the total management cost but in the kinds of activities necessary to manage them. Annual management costs averaged $51 per acre per year for all 28 projects (the median was $122 for the sample). The range in cost per acre per year is $6 to more than $2,100. Therefore, for a 100-acre preserve, the annual cost could range from as little as $600 to as much as $210,000 per year.

Although the cost of stewardship cannot be predicted with any acceptable level of confidence from the size of the preserve, the economies of scale are dramatic. Costs ranged from around a $1,000 an acre per year for many smaller projects to well under a $100 an acre per year for the larger projects. We caution that while these numbers provide insight into long-term preserve costs, they are not statistically valid and underscore the necessity to complete individual cost analyses for each preserve separately. This study emphasizes the variation in preserve goals and tasks which determine long-term costs. One cannot conclude that by generalizing these tasks across preserves, preserve management costs would be equal.

Figure 5. Stewardship Cost by Category