

Garden of the Gods Restoration Report



Current Conditions and Recommendations

Prepared for
Parks & Recreation Department
City of Colorado Springs, Colorado

by

Rocky Mountain Field Institute
Bruce Byers, Jim Ebersole, & Mark Hesse, Consultants

August, 2000

Acknowledgements

Thanks are due to the many persons listed below who assisted with the development of this Restoration Report for the Garden of the Gods. The insights and perspectives of each of these individuals, based upon their personal experiences and relationships with the Park, were invaluable to the consulting team.

Parks and Recreation Department

Paul Butcher
Jan Butters
Al Gonzales
Mike McCauley
Terry Putman

Kurt Schroeder
Rick Severson
Gene Smith
Bill Stookey
Stephanie Stover

Garden of the Gods Advisory Committee

Marilyn Billings
Pat Conley
Jim Ebersole
Cliff Eisenach
Tony Hoewisch
Robert Hostetler
Mary Tom Isaac

Ginny Kiefer
Jayne Neville
Eugene RedHawk-Orner
Robert McDonald
DeAna Nasseeth
Hal Prostka

Garden of the Gods Foundation and Visitor Center

Lyda Hill
Nancy Lewis

Bonnie Frum
Parrish Watson

Friends of Garden of the Gods

Cliff Eisenach
Jeannie McElderry

Other Persons Contacted

Ian Appleyard, Coordinator of Volunteer Services, City of Boulder, CO
Ann Armstrong, Boulder Mountain Parks, Boulder, CO
Tom Armstrong, Academy Riding Stables
George Beck, Colorado State University
Mary Bonnell, Naturalist, Roxborough State Park, Littleton, CO
Cheryl Conklin, Garden of the Gods Neighborhood Association
Bob Davies, Colorado Division of Wildlife
Gretchen Grindle, Colorado College
Terry Haas, Garden of the Gods Trading Post
Jason Kreitler, Colorado College
Trina Lynch, Colorado Division of Wildlife
Jeff Noblett, Geology Department, Colorado College
Heather Poe, Ranger, Roxborough State Park, Littleton, CO
Steve Pixley, Volunteer Coordinator, City of Portland, OR

Other Persons Contacted continued. . .

Susan Ross, Coordinator of Volunteer Services, Department of Open Space, Boulder, CO

Marc Snyder, Biology Department, Colorado College

Pat Tegler, Garden of the Gods Neighborhood Association

Barclay Trimble, National Park Service Concessions Program Center, Denver, CO

Susan Trumble, Park Manager, Roxborough State Park, Littleton, CO

John Valentine, U.S. Department of Agriculture, Natural Resources Conservation Service

Alex Vargo, Biology Department, Colorado College

Francisco Valenzuela, U.S. Forest Service

Phil Vorhees, National Parks and Conservation Association, Washington, D.C.

Barbara Winternitz, Biology Department, Colorado College

Consulting Team

Principal Consultants

Bruce Byers, Consultant, Falls Church, VA

Jim Ebersole, Colorado College, Colorado Springs, CO

Mark Hesse, Rocky Mountain Field Institute, Colorado Springs, CO

Other Consultants

Doug Bates, University of Colorado-Colorado Springs

Bill Leon, University of Colorado, Colorado Springs, CO

Tass Kelso, Colorado College, Colorado Springs, CO

Carron Meaney, Mammalogist, Boulder, CO

Bob Steinholz, Bristlecone Trails, Lakewood, CO

Thomas and Thomas, Urban Design- Landscape Architecture, Colorado Springs, CO

Field Assistants

Dave Conlin

Stephanie Durno

Shehnaz Hussain

Photo Credits

Bruce Byers

Dave Conlin

Mark Hesse

Carron Meaney

Table of Contents

Introduction

Restoration Report Background	1
Restoration Report Components	2
Description of the Garden of the Gods	3
Description of Planning Process	7
Setting Priorities for Restoration	8

Public Awareness and Education

Current Situation	9
Recommendations for Public Awareness and Education	11

Designated Trails

Current Situation	13
Unpaved Trails	14
Paved (Hardened) Trails	17
Equestrian Trails	18
Trail Signs and Maps	21
Recommendations for Designated Trails	22

Social Trails

Current Situation	23
Condition of Social Trails	27
Recommendations for Social Trails	28

Bare and Eroded Areas

Current Situation	29
Bare and Eroded Areas: Intensive Use Areas	30
Bare and Eroded Areas: Water Runoff from Roadways and Parking Areas	32
Bare and Eroded Areas: Construction and Improvement Projects	34
Condition of Bare and Eroded Areas	36
Recommendations for Bare and Eroded Areas	36

Vegetation

Current Situation	38
Vegetation Density and Appearance	38
Invasive and Non-native Species	42
Rare, Threatened and Endangered Plants	45
Microbiotic Soils	45
Recommendations for Vegetation	46

Wildlife and Wildlife Habitat	
Current Situation	47
Mammals	47
Birds	48
Invertebrates	48
Recommendations for Wildlife and Wildlife Habitat	49
Geological Features of Concern	
Current Situation	50
Recommendations for Geologic Features of Concern	50
Cultural Features of Concern	
Current Situation	51
Recommendations for Cultural Features of Concern	51
Restoration Report Implementation	
Implementation Process	52
Costs	52
Implementation Schedule	53
Maps Showing Conditions of Designated Trails, Social Trails, and Bare and Eroded Areas	
North Central Zone	59
Central Zone	60
South Central Zone	61
References	62
Consulting Team	64

Introduction

Restoration Report Background

The most recent Garden of the Gods Master Plan was approved in 1994 by the Parks and Recreation Advisory Board and the Colorado Springs City Council. According to the 1994 Master Plan, the overriding goal or principle that would underlie all decisions was the "conservation, preservation, and restoration" of the Garden of the Gods. The aim of the Master Plan was to manage the Park in a way that would allow today's visitors to experience and enjoy it without causing damage and degradation. However, current uses of the Garden of the Gods are causing rapid and unsustainable environmental changes.

Recognizing that significant challenges remained to be met in protecting and restoring the Garden of the Gods, the Colorado Springs Parks and Recreation Department applied to the Great Outdoors Colorado Trust Fund (GOCO) for a planning grant in September, 1998. Funds were requested to develop a restoration plan that would recommend options and guidelines for addressing the concerns about trails, bare and eroded areas, and vegetation and wildlife that were identified in the 1994 Master Plan. The restoration plan was seen as a critical planning resource that would provide the City and the Parks and Recreation Dept. with advice and direction in fulfilling the preservation and restoration mandates of the Master Plan. The purpose of the plan was to, among other things, help the City identify specific preservation and restoration needs in the Park, options and recommendations for addressing these needs, cost estimates, and restoration priorities. The planning grant proposal was accepted by GOCO and funds were awarded to the City to develop the restoration plan. A grant from the Garden of the Gods Foundation was also obtained to provide key matching funds. After selecting a consulting team, the process of developing the Garden of the Gods restoration plan began in May, 1999.

To develop this Restoration Report detailed information was collected on the threats to the Park. This was accomplished using a global positioning system (GPS). The data was processed and analyzed using a geographic information system (GIS). The maps that were developed revealed patterns that were not apparent before, and served as valuable indicators of disturbances in the Park.

Dozens of people were consulted in developing this Report. The information and insights they provided were invaluable. Many different and sometimes contradictory views were expressed about what is needed to restore the environment of the Garden of the Gods and protect it in the future.

The information and recommendations presented in the Garden of the Gods Restoration Report are based on a scientific inventory and analysis of the Park's trails, vegetation, soils, and other Park resources, as well as the views and insights of the people who were contacted. The Report will help citizens, their elected officials, and the City's park management staff make the decisions and take the actions that will lead to the preservation, restoration, and stewardship of the Garden of the Gods.

The biophysical problems of loss of vegetation, soil erosion, proliferation of social trails, and the unnatural growth of trees and shrubs in the central Garden zone are the result of decades of uses and choices. Effectively addressing these problems and restoring the Garden of the Gods to a healthy, natural, and sustainable condition will take time and resources. In order to gain support and funding for this work, public participation and citizen involvement in the implementation of the recommendations of Garden of the Gods Restoration Report will be critical.

Restoration Report Components

This Restoration Report was developed to support the preservation and restoration of the Garden of the Gods. Readers of the Report will include staff of the Parks and Recreation Department who make management decisions on a daily basis; Parks and Recreation Advisory board members who advise the Parks and Recreation Department; City Council members who make funding decisions that effect the Park; and citizens and organizations with an active interest and involvement in the Park. In order to facilitate its use by different groups the Garden of the Gods Restoration Report includes the following components:

- ▲ Summary, the executive summary of the Restoration Report.
- ▲ Current Conditions and Recommendations (this document).
- ▲ Implementation Guide, a resource that provides detailed information for implementing the Restoration Report including recommended standards, illustrative examples, and information about costs.
- ▲ A series of eight large-scale Maps that display the results of the inventory of the Park. These maps show the following:
 - erosion condition of the official designated trails in the Park,
 - location and erosion condition of the social trails network and bare areas,
 - social trails and bare areas in the central core of the Park,
 - areas of biological and geological concern, and
 - noxious weed populations (4 maps): Siberian elm and New Mexican locust; Poison hemlock and Canada thistle; Poison ivy and field bindweed; Toadflax, leafy spurge, musk thistle, and whitetop.

Description of the Garden of the Gods

The Garden of the Gods is a unique natural, scenic and recreational area owned by the City of Colorado Springs and managed by its Department of Parks and Recreation. Its natural values are so high that it has been designated as a National Natural Landmark by the U.S. Department of the Interior. Drawing over a million local, national, and international visitors a year, it stretches the traditional definition of a city park and challenges the management capacity of the city. Current and past uses of the park have caused significant soil erosion, loss of vegetation, and a proliferation of visitor created, social trails in heavily used parts of the Park.

An estimated 1.7 million people now visit the Garden of the Gods each year (Colorado Springs Parks and Recreation Department, 1998). A comparison with some other parks (Table 1) demonstrates the huge challenge faced by the City of Colorado Springs in conserving and managing the Garden of the Gods. Managers of the Garden of the Gods are faced with a unique and very difficult challenge in managing the Park sustainably for such high levels of visitation.

Park	Area (Acres)	Visitors per year	Miles of trails	Acres per trail-mile	Visitors per trail-mile per year	Visitors per acre per year
Garden of the Gods	1,392	1.7 million	16.8	83	101,200	1,221
Roxborough State Park	3,300	100,000	14.3	230	6,990	30
Rocky Mountain State Park	265,727	3.1 million	370	718	8,360	12
Arches National Park	77,000	860,000	18	4,278	47,800	11

Table 1. A comparison of designated trail system length, visitation level and park area among Garden of the Gods and other parks.

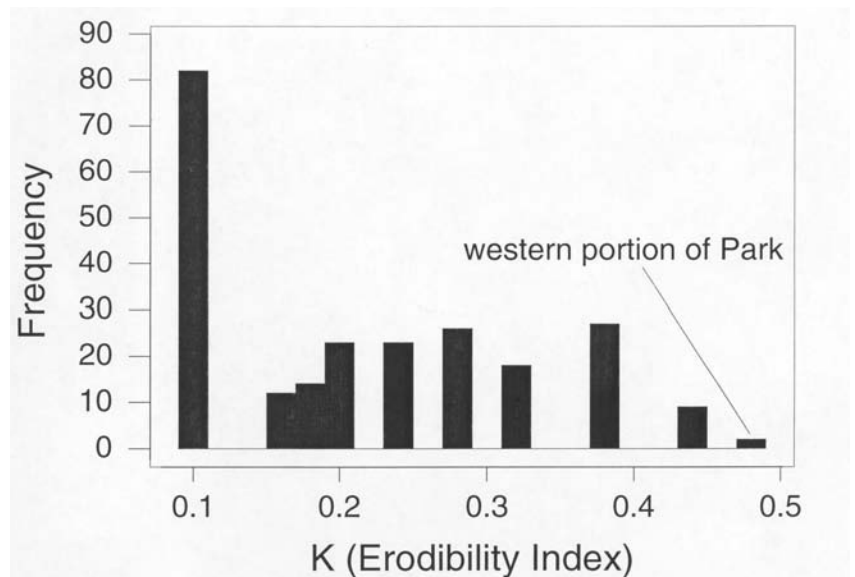
Compared to other parks, the Garden of the Gods is exceptionally crowded with roadways, parking areas, and designated trails. This visitor infrastructure is also heavily used. The Park is visited by more than 1,000 persons per acre per year, over 100 times as high a visitor density as Rocky Mountain or Arches National Parks. It has 12 times as many visitors per trail mile per year as Rocky Mountain National Park, and 14 times as many as Roxborough State Park, a scenic park in a similar geological setting near Denver. With so many visitors using a small area there is an unusually high use of off-trail areas in the Garden. Even the statistics above do not really indicate the unique crowding and pressure in the Garden of the Gods. Most visitor use is concentrated in a core area of 400 acres, not distributed throughout the 1,392 acre Park (Garden of the Gods Interpretive Plan, 1994). An extensive network of visitor created, social trails has developed as people seek to escape the crowds. The resulting damage to the Park's biophysical resources has been extensive.



This photo shows major vegetation and soil loss initiated by Park visitors walking off of designated trails. This site was level and vegetated with native scrubs and grasses. Trampling killed the plants and initiated soil erosion. This is typical of many areas in the Park.

The extremely heavy use or visitation occurs in an area that has a very poor ability to withstand it. The Connerton soils that cover most of Garden of the Gods are the most erodible soils in El Paso County. These soils are up to five times more erodible than many other soils. Of the 236 soil horizons in the county listed in the Soil Conservation Service's soil survey, the subsurface horizon of the Connerton soils (below 13 inches) has the highest erodibility index. The surface soil has the third highest erodibility index in the county. Since the Garden of the Gods contains many steep slopes, the potential for soil loss is far greater than other soils with the same erodibility index on more moderate slopes.

Soil erodibility index, K , of mapped soils in El Paso County (from Soil Conservation Service). Frequency is the number of soils, of the 236 soils mapped in the County, with a particular K . K is a relative index that indicates how much soil would be lost under a given set of conditions. For example, twice as much soil would be lost from a soil with a K of 0.4 as from a soil with a K of 0.2.





Extensive vegetation and soil loss between scrub oak and mountain mahogany shrubs above the upper Scotsman Trail are typical of many sites in heavily used areas of the Park. A loss of one foot or more of soil has resulted in “pedestals” of vegetation. Erosion is the result of a number of interacting causes: loss of vegetation from off-trail trampling and social trails, drainage from designated trails, and inadequately managed runoff from Juniper Way Loop road.

A natural turf of native grasses between Gambel oak and mountain mahogany shrubs only a few yards from the above photo. In its natural, undisturbed state, ground-covering vegetation in the Park should look like this.



The most recent Garden of the Gods Master Plan was approved in 1994 by the Parks and Recreation Advisory Board and the Colorado Springs City Council. The aim of the Master Plan was to provide direction for the management and development of the Park. The Plan made clear that the preservation of the Park was the chief priority. According to the Plan,

“Conservation, preservation and restoration are overriding principles, and, within those principles, the ultimate aim is to allow uses in the park which will not conflict and which are appropriate to the setting.”

The Parks and Recreation Department has been implementing recommendations of the 1994 Master Plan since it was approved. Major improvements have been made to Park roads, parking areas, restrooms, walkways, and interpretive shelters. Several buildings have also been removed. The Department is now ready to begin concentrating its efforts on trails, erosion control, weed control, restoration of natural vegetation, and the maintenance of wildlife habitat in the Park.

Description of the Planning Process

The focus of the Garden of the Gods Restoration Report was to develop an integrated, strategic plan for preserving and restoring the Garden of the Gods. One objective was to develop technical, biophysical “prescriptions” for stopping erosion on and away from trails, for revegetating badly eroded areas, for controlling invasive weeds, and restoring and enhancing native vegetation and wildlife habitat. A second objective was to develop recommendations for managing the human uses of the Park through education, communication, outreach, and the enforcement of regulations that protect Park resources. Without effective “visitor management” investments in restoration will be wasted as resource-damaging behaviors cause the same problems again and again.

Student field assistants worked throughout the summer of 1999, carried out much of the work of the inventory, mapping, and documentation of trails, eroded areas, weeds, and vegetation. They also gathered information about the behavioral motivations of users of the park.

It is important to note the distinction between land reclamation and restoration. Reclamation generally refers to bringing a landscape back to a stable and usable condition. This condition does not necessarily reflect the original or “pre-disturbance” conditions inherent in the landscape and, therefore, does not involve the restoration of native ecological communities, and/or the physical features or characteristics of the landscape. In keeping with the importance of the Garden of the Gods as a national historical landscape and the preservation and restoration mandates of the 1994 Master Plan, the central focus of the Garden of the Gods Restoration Report is on restoring the Park’s natural landforms and native vegetation, and enhancing wildlife habitat- true “ecological restoration,” not merely “reclamation.”

In addition to the biophysical restoration that is a goal of this Report, the concept of restoration should be interpreted even more broadly as restoring not only the biophysical attributes of soils and native vegetation, but also restoring the less tangible aesthetic values inherent in a serene, natural and historical landscape. Implementing such a vision of restoration may in some cases require strict limits or even the elimination of some uses that have historically been allowed or have not been regulated.

The biophysical problems of loss of vegetation, soil erosion, the proliferation of social trails, and the unnatural growth of trees and shrubs in the central Garden zone are the result of decades of uses and choices. Controlling these problems and restoring the Garden of the Gods to a healthy, natural, and sustainable condition will likewise require decades of hard work. Throughout this long-term process continuous public participation and citizen involvement will be important. This ongoing participation of citizens is necessary to make the difficult choices that must be made, and to sustain the level of public funding that will be required.

Setting Priorities for Restoration

Restoration will require consistent efforts that are staged and managed in logical sequences and implemented over time. The availability of resources (both human and financial) will dictate the scope and pace of the restoration.

Carrying out any long-term restoration plan requires setting priorities. The criteria listed below were identified to help with this process. The importance of a restoration project can be determined by the following:

- ▲ the degree to which the project is a necessary prerequisite or requirement for the success of other restoration projects;
- ▲ the importance of the project in preserving and restoring critical physical, biological, and cultural resources;
- ▲ the project's value as a demonstration of how active management (both behavioral and biophysical) can help restore and protect Park resources;
- ▲ the project's value as an experiment to test and refine effective restoration strategies- both biophysical and behavioral;
- ▲ the value of the project in halting or reversing degradation that will be significantly more expensive to address in the future;
- ▲ the park-wide benefit of the project.

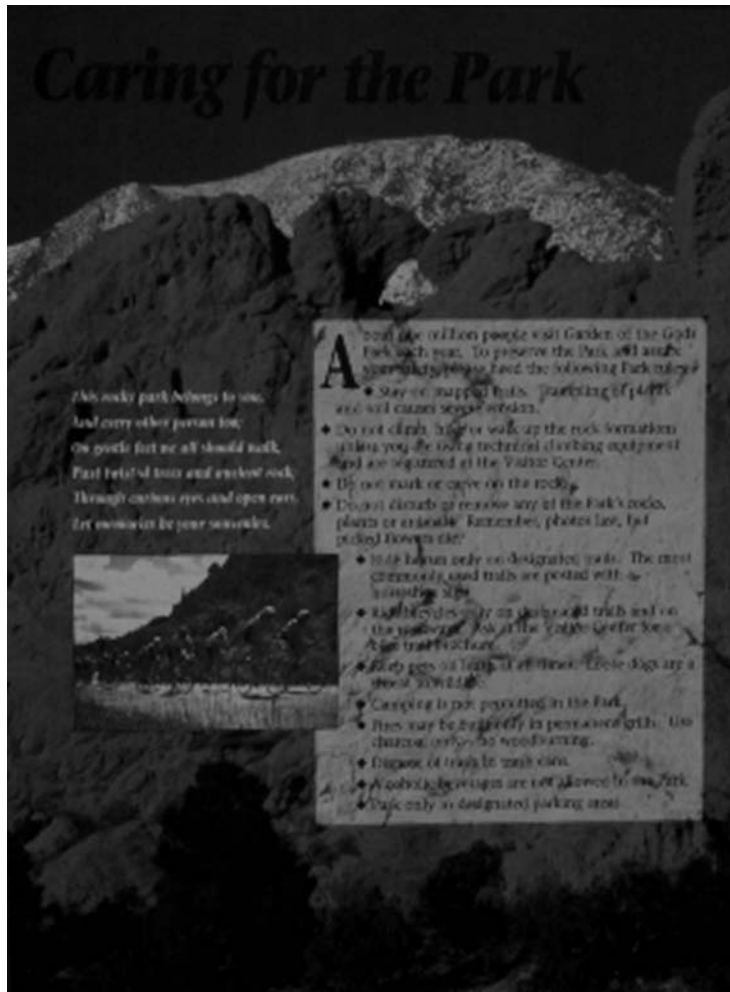
This Garden of the Gods Restoration Report recommends a balance of technical biophysical actions and educational/social actions as solutions to the problems and threats to Park resources.

Public Awareness and Education

Current Situation

Public awareness and knowledge about the extent of soil erosion and vegetation loss, the condition of designated trails, and the development of social trails is crucial to the success of any restoration effort. This Report will first address the need for public and Park visitor education.

Many visitors to the Garden of the Gods are not aware of the significant problems of erosion and loss of natural vegetation. This is true for both out-of-town visitors to the Park and local residents, from nearby neighborhoods as well as throughout the city. Erosion and vegetation loss have developed over a century of increasing human impact. No one has seen the Garden of the Gods in a “natural” condition and most people do not have a conceptual understanding of what the Park could, and should, look like.



The sign in this photo is the only one in the Garden of the Gods at this time that explains to visitors the problems of human impact on vegetation and soils in the Park, the reasons for Park rules, and the environmental protocol for visiting the Park.

A study in Mount Rainier National Park (Rochefort and Gibbons, 1992) found that people who hiked off of designated trails and trampled fragile meadow vegetation were not aware that such behavior damaged the vegetation; furthermore, they did not perceive the meadow as degraded by the impact of previous off-trail hikers. The same is true in the Garden of the Gods. In most cases, Park visitors are not acting maliciously when they hike off of established trails. They simply are not aware of the full consequence of their actions on the fragile soils and vegetation. Also, it is likely that those visitors who do possess this awareness see the landscape as already degraded: whether or not they hike on or off the Park's trails makes little difference.

The environmental problems of the Garden of the Gods cannot be solved unless the citizens of Colorado Springs and the hundreds of thousands of out-of-town visitors who come to the Garden of the Gods acknowledge them, understand their causes, and support Park management and restoration programs.



Members of the community have made a significant contribution to the stewardship of the Garden of the Gods. However, volunteer involvement in the Park will need to be increased substantially if the preservation and restoration mandates of the 1994 Garden of the Gods Master Plan are to be realized.

Recommendations for Public Awareness and Education

- ▲ Develop a campaign to raise public awareness and educate citizens and visitors about the seriousness of the threats to the Garden of the Gods. Information should be adapted for multiple audiences giving equal emphasis to local residents and out-of-town visitors. Messages and media that will reach many different audiences must be considered. Elements of this campaign should include informational exhibits and displays, signs, demonstration projects, printed materials, and news media articles and stories.
- ▲ Develop a major exhibit or display at the Visitor Center that explains the threats to the Park as well as the restoration strategies and prescriptions that have been identified to address these threats. This exhibit could include:
 - maps showing the designated trail network and social trails in the Park;
 - photographs showing erosion problems on Park trails;
 - information on how the impact visitation effects the Park;
 - photos and/or drawings, with interpretive text, explaining some common features of trail construction that help to prevent erosion, such as water bars, risers, switchbacks, and crowning;
 - photos comparing an area of natural ground-covering vegetation and an area where such vegetation has been destroyed;
 - photos and/or drawings, with interpretive text, on techniques being used to close and revegetate eroded areas in the Garden, including split rail fences, erosion matting, hydromulching, and transplanting; and a photo of successful revegetation;
 - photos to demonstrate the unnatural increase of woody vegetation in some parts of the Park, with an explanation of why some removal and thinning is needed to restore scenic views and reduce the danger of wildland fire;
 - a list of “dos” and “don’ts” for individuals to follow to help prevent erosion and loss of vegetation and protect the Park for future users;
 - a plea to visitors to stay on trails.
- ▲ Adapt the information included in the above Visitor Center exhibit for visitor information signs. Place these signs at interpretive hubs, shade shelters, parking areas, and trailheads in the Park.
- ▲ Place one or more restoration demonstration projects at strategic locations in areas of high visitation. Interpretive information at the demonstration site should show the site in its disturbed condition and during the various stages of restoration. This information would educate park visitors about the actions being taken to restore the Park.

- ▲ Complete the process of developing an informational newspaper for distribution at the Visitor Center. Publish a brochure highlighting threats to the Park and current and planned restoration projects, and distribute this piece to residents of the neighborhoods bordering the Park to help inform and educate this group.
 - ▲ Develop press releases or stories for local print and broadcast media to build public support for the restoration of the Park.
 - ▲ Host public presentations that explain the threats to the Park and the strategies and prescriptions for addressing these threats. These presentations could be made by the Garden of the Gods Parks and Recreation Department staff, members of Friends of the Garden of the Gods, and/or members of the Garden of the Gods Advisory Committee.
 - ▲ Expand community and volunteer opportunities to help with the restoration of the Garden of the Gods and the ongoing stewardship of the Park. Volunteer programs could be developed in concert with local schools and nonprofits.
- .

Designated Trails

Current Situation

The designated trail system in the Garden of the Gods Park consists of 14.4 miles of unpaved trails and 2.4 miles of paved (concrete) walkways. Many of the unpaved trails accommodate multiple uses including hiking, running, horseback riding, and mountain biking. Mountain bikes are restricted to a subset of the unpaved trails.

The system of designated trails in the Garden of the Gods plays a key role in conserving the soils, vegetation and other resources in the Park. Trails are a critical part of the Park's visitor infrastructure that allow users to enjoy a natural landscape like the Garden of the Gods with the least amount of impact. Trails that are properly planned, built, and maintained focus and direct the impacts of visitors to places and surfaces that can withstand those impacts. Properly constructed trails encourage trail users to stay on them because they provide the easiest and safest route. To the contrary, trails that are poorly planned, constructed or maintained can exacerbate problems rather than protect Park resources. Like other types of recreational infrastructure, trails require capital investments to construct, and recurrent investments for maintenance to protect the initial investment.

The current designated trail system in the Park was never designed and constructed in the way a modern trail system should be. It evolved from a network of visitor created, social trails, some of which were "adopted" and designated as official trails. Many park trails, especially those used by commercial horse trips, lack the structures that are needed to accommodate the types and levels of use that they receive. As a result the Parks and Recreation Department has been slowly losing the fight against trail erosion. Poorly designed and constructed trails also cause the proliferation of social trails because visitors do not have the option to efficiently and safely go where they want to go.

A number of factors contribute to the degradation of designated trails in the Garden of the Gods. These include:

- ▲ problems with the design and construction of the Park trail system as a whole;
- ▲ poorly designed and/or constructed trails or trail segments in relation to the types and levels of use, and the topography and soil characteristics of the Park;
- ▲ inadequate trail signs and other navigational aids throughout the trail system;
- ▲ lack of integration between the trail system and the Park's road system, especially parking areas;
- ▲ bare and eroded areas that channel water onto trails and contribute to their degradation;
- ▲ inadequate trail maintenance.

The problems listed above frequently interact with one another in a synergistic way, thus compounding the level or degree of disturbance. In order to successfully improve or repair the Park's trail system, each of the problems must be rectified.

Unpaved Trails

One of the objectives of this planning process was to assess the condition of the Garden of the Gods designated trail system and determine the severity of erosion and maintenance problems on designated trails in the Garden of the Gods Park. A semi-quantitative, ordinal scoring system for the condition of unpaved designated trails was developed as follows:

Class 1: trail in good condition, trail surface not eroded

Class 2: 1-6 inches of soil eroded from trail surface

Class 3: 7-12 inches of soil eroded from trail surface

Class 4: more than 12 inches of soil eroded from trail surface

The following photographs illustrate examples of each of the trail condition classes.



Class 1 Trails: Good condition with little to no erosion.



*Example of Class 2 Trails:
1-6 inches of soil loss.*



*Example of Class 3 Trails:
7-12 inches of soil loss.*



*Example of Class 4 Trails:
More than 12 inches of soil loss.*

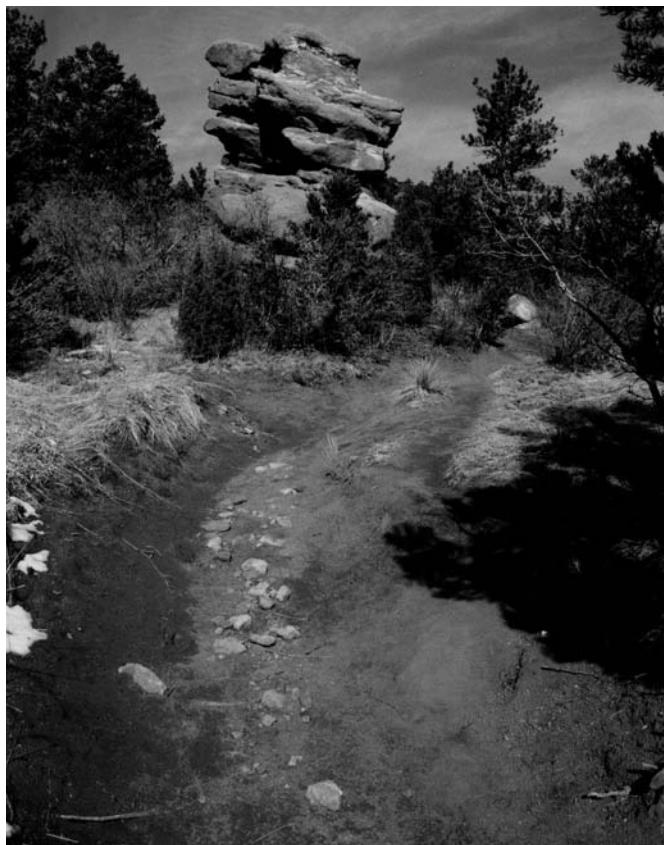
Condition of Unpaved Trails

All designated trails were surveyed and condition scores along each trail segment were recorded using a global positioning system (GPS) unit. This information was transferred to a geographic information system (GIS) and a series of maps were developed. (See Designated Trails map). The length of designated trails falling in each of the erosion/condition classes was calculated. This information is given in Table 2.

Condition Class	Length (feet)	Length (miles)	% of total
Class 1: no soil loss	326	.06	.4%
Class 2: 1-6 in. soil loss	46,481	8.80	61.1%
Class 3: 7-12 in. soil loss	22,403	4.24	29.5%
Class 4: more than 12 in. soil loss	6,832	1.29	9%
Total	76,042	14.4	100%

Table 2. Condition of unpaved designated trails.

As Table 2 clearly shows, the unpaved trails in the designated trail system of the Park are in poor condition, with some severely degraded sections. Some soil loss is to be expected on trails. However, nearly a third of the Park's trails show 7-12 inches of soil loss, and almost 10% are deeply "channelled" or have turned into major gullies. This condition presents serious problems for the trail and the surrounding landscape along the trail corridor.



Many sections of the Park's designated trail system are severely degraded (Class 4), as this photo of the Palmer Trail shows.

Paved (Hardened) Trails

More than 2 miles of the Foothills Trail and designated trails in the central Garden zone have been hardened with concrete in order to minimize erosion and reduce maintenance. However, vegetation loss and soil erosion is occurring along the edges of some of these walkways. This has been caused by Park visitors walking off the walkways and surface runoff. Erosion on the shoulders of paved trails was scored as follows:

- Class 1: good condition, no soil loss
- Class 2: 1-6 inches of soil eroded
- Class 3: 7-12 inches of soil eroded
- Class 4: more than 12 inches of soil eroded

Table 3 gives the lengths of paved walkways falling in the different erosion score classes.

Condition Class	Length (feet)	Length (miles)	% of total
Class 1: no soil loss	2,921	.55	22.9%
Class 2: 1-6 in. soil loss	3,170	.60	24.9%
Class 3: 7-12 in. soil loss	6,322	1.19	49.6%
Class 4: more than 12 in. soil loss	335	.06	2.6%
Total	12,748	2.40	100%

Table 3. Condition of shoulders of paved walkways.



*Erosion (Class 3)
along the edge of
paved (concrete)
walkway in central
Garden zone.*

Equestrian Trails

In 1993 survey was completed by the Rocky Mountain Research Group as part of the Master Plan process to identify Park visitor recreational preferences or uses. The study indicated that visitors to the Garden of the Gods engage in the following recreational activities. Overlap in some categories explains the fact that these add up to more than 100% of visitor uses of the Park.

Driving through for viewing, photography	45%
Hiking	26%
Climbing on rocks	12%
Picnicking	8%
Bike riding	4%
Running/jogging	4%
Technical rock climbing	3%
Horseback riding	2%

Table 4: Recreational uses of the Garden of the Gods.

Although relatively few people visiting the Garden of the Gods engage in equestrian activities, equestrian use is the primary cause of erosion on the designated trails and along the trail corridors in the Park. The soils and topography of the Park present extreme challenges for the construction and maintenance of sustainable equestrian trails. While equestrian use may be a valid recreational use of the Park, the impacts of this use at the current level in which it is being conducted cannot be ignored.



Commercial equestrian ride on the Bretag Trail. The commercial operator presently conducts between 16,000- 20,000 rides per year over roughly 5 miles of trails.

Two kinds of equestrian use occur in the Garden of the Gods: use by private recreational riders, and use by clients of the commercial stable located on the south side of the Park. The commercial stable, Academy Riding Stable, maintains about 70-75 horses during the summer, and conducts approximately 200 rides per day during peak visitation times. During the last several years, equestrian use has averaged somewhere between 16,000 and 20,000 rides per year. The overwhelming majority of these rides, an estimated 98%, are commercial trail rides (T. Armstrong, personal communication, M. Billings, personal communication). Private individual horseback riding is a small fraction of total equestrian use. The recommendations for equestrian use in this Restoration Report are, therefore directed primarily at commercial equestrian use.

Commercial equestrian use of the designated trails in the Park, e.g., Scotsman, Buckskin Charlie, and Siamese Twins Trails, has had a major negative impact on these trails at a disproportionately greater level than the impact of all other trail uses and users. This is primarily due to the fact that these trails were never constructed to withstand intensive equestrian use. Furthermore, current levels of trail repair and maintenance have not been adequate or sufficient. As a result, erosion is occurring that will be expensive to mitigate through trail repair and restoration of the trail corridor.

Trail erosion, more than 1 foot of soil loss (Class 4), on same section of Bretag Trail as photo on page 18.



Damaged trail structure. Trails in the Park were never designed or built to accommodate high levels of equestrian use.

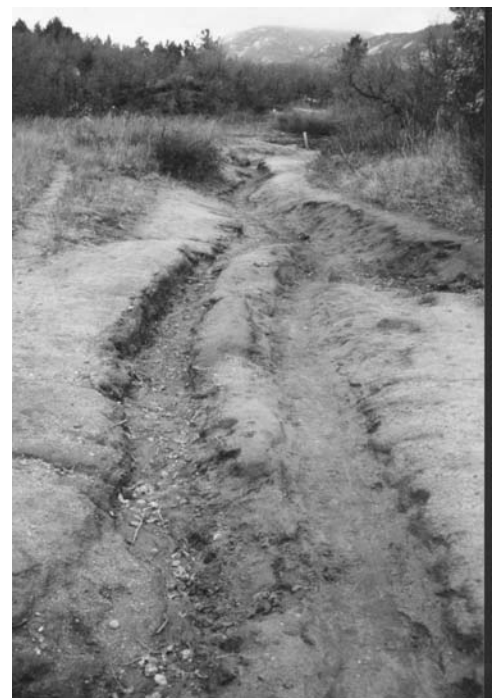
A number of studies have demonstrated that horse use causes several times as much erosion as an equivalent amount of pedestrian or hiking use (Deluca, et al., 1998). Trail structures that stabilize the trail, prevent erosion, and manage water drainage must be built and maintained at a higher standard for equestrian trails than for pedestrian trails. In addition, trails that are used by both riders and hikers must have sufficient width to allow trail users to safely and comfortably pass one another. All of these factors increase trail construction costs dramatically. Furthermore, equestrian trails are far more costly to maintain (Deluca, et al., 1998; F. Valenzuela, personal communication).

Based on a 1978 City Council resolution, the commercial stable now pays a user fee of \$25 per horse per year to the City of Colorado Springs for the privilege of using the Garden of the Gods. The money from this fee goes into the City's general fund, and is not targeted to mitigate the impact of equestrian use of Park trails.



This photo shows a section of Scotsman Trail that is heavily used by commercial equestrian rides. The trail is severely eroded with several feet of soil loss.

Trail erosion on same section of trail as above. Water runoff and drainage has resulted in higher than normal soil erosion.



Trail Signs and Maps

It is very important that Park visitors be provided with the information they need to effectively and safely navigate the Park's trail system. Strategically located, well-designed trail signs are essential. Personal trail maps that are available for distribution are also very important. The value of these informational tools is especially great given the number of Park visitors, the complex network of trails, and the sometimes-confusing nature of the terrain. Expenditures on trail navigation aides should go hand-in-hand with physical improvements or repairs to the trails.

The following improvements in the Park's trail signs and maps would help both Park visitors and the Park's natural resources:

- ▲ road signs should indicate directions to major trailheads,
- ▲ trailhead signs should have a "You Are Here" locator,
- ▲ loop trails should be indicated on maps,
- ▲ major trail junctions should be clearly signed,
- ▲ trail maps posted on signs should be oriented with the surrounding landscape,
- ▲ trail maps should indicate distances between points.



This photo shows a confusing sign at a trail junction on the upper Scotsman Trail. Arrow pointing up on the junction sign points to a well-developed social trail, indistinguishable from the eroded Scotsman Trail with which it connects. The designated trail actually makes a "hairpin" bend here, with both forks going to the left, not a right angle as shown on the sign.

Recommendations for Designated Trails

- ▲ Develop a comprehensive Trails Plan for the Garden of the Gods to formally evaluate the present designated trail system and identify specific improvement and repair needs. This planning process should begin as soon as possible and involve public input. The planning process should determine which uses are to be allowed in the Park and on what trails. In developing the 1994 Master Plan some trail management decisions were made. However, the study of the Park's designated trails system that was completed for the Restoration Report provides a comprehensive assessment of current trail conditions and needs. Furthermore, the Restoration Report Implementation Guide includes recommendations for construction standards that will need to be formally approved by the Parks and Recreation Dept.
- ▲ Improve the Park's designated trail system to a modern standard that will allow trails to meet their use objectives as determined in the above recommended Trails Plan. The Restoration Report Implementation Guide provides detailed information about trail construction, standards, illustrative examples, and costs.
- ▲ Resolve the issue of whether or not commercial equestrian use of the Park should be continue and, if so, on what trails. This should take place as part of the development of the above recommended Trails Plan for the Garden of the Gods. The decision should take into account the large capital costs involved in constructing a trail that would be sustainable for current levels of commercial equestrian use. If commercial equestrian use is to be continued, a fee mechanism should be implemented to recover the costs of constructing and maintaining the horse trails at a modern standard. (See the Restoration Report Implementation Guide for detailed information about equestrian trail construction standards, costs, and model fee mechanisms used by other land management agencies).
- ▲ Integrate the park trail system with the Park road system by developing trailheads at all parking lots. Designated trails should provide efficient and safe access to the Park trail system from each parking area.
- ▲ Develop trail signs for trailheads and major trail junctions, trail markers, and maps (both displayed on signs and printed for distribution) to enable users to navigate the Park's designated trail system.
- ▲ Hire and train a trail crew to work exclusively in the Garden of the Gods for the summer seasons to repair and maintain trails. This crew could also assist with or complete other restoration projects in the Park.

Social Trails

Current Situation

Social trails are trails that have been created or worn into the landscape by visitors repeatedly walking off of or outside designated trails. Social trails can be very damaging to a landscape. Repeated trampling, soil compaction or destabilization, and displacement or loss of litter, humus, and topsoil pose severe threats to plants and plant communities. Since vegetation is the primary stabilizing influence in a landscape, vegetation loss can result in serious erosion.

The social trails in the Garden of the Gods are among the greatest contributors to vegetation loss and soil erosion in the Park. In many sectors of the Park extensive networks of social trails have formed. In some cases, social trails in the Park are single paths; in other instances, social trails resemble “spider webs” of interconnecting trails.

“Spider web” effect of social trails. In many cases plants communities become fragmented and only “pedestals” of plants remain. Eventually these plants will be lost, resulting in further erosion.



Social trail to the west of the Scotsman Trail. Though seldom used, it remains a significant erosion gully.

One of the objectives of the planning process was to assess and document social trails in the Park. A semi-quantitative, ordinal scoring system for social trail condition was developed as follows:

- Class 1: Vegetation trampled but mostly present; minor soil loss.
- Class 2: Up to two-thirds of vegetation gone; soil loss from 1-2 inches in some places.
- Class 3: Vegetation mostly gone; width less than 24 inches; 1-6 inches of soil loss in most places.
- Class 4: No vegetation; width 24-42 inches; 7-12 inches of soil loss in most places
- Class 5: No vegetation; width greater than 42 inches; more than 12 inches of soil loss.

The following photographs show examples of these five classes.



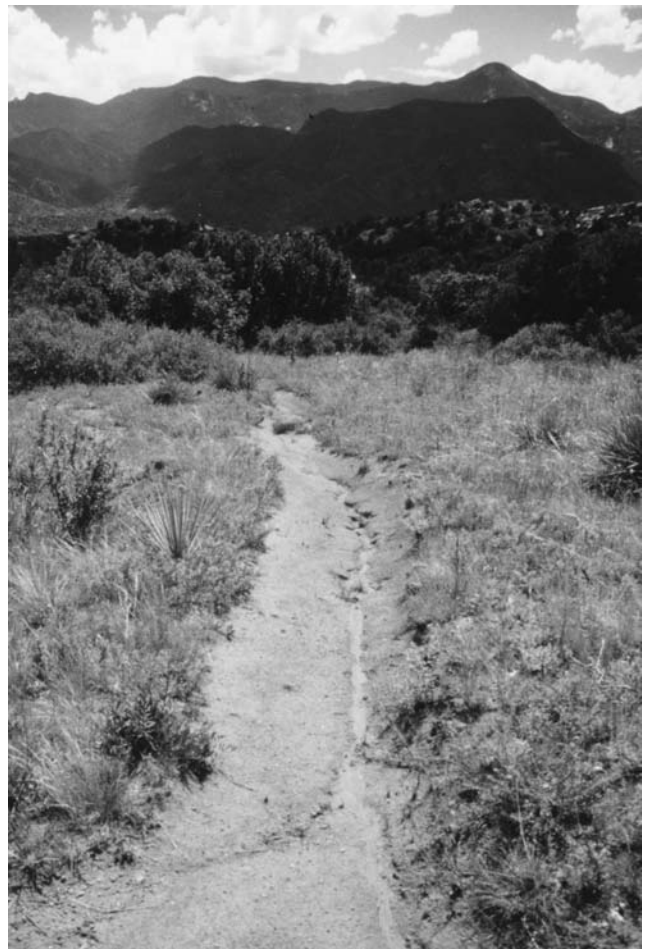
*Class 1 Social Trail:
Vegetation trampled but mostly present;
minor soil loss.*



*Class 2 Social Trail:
Up to two-thirds of vegetation gone; soil
loss from 1-2 inches in some places.*



*Class 3 Social Trail:
Vegetation mostly gone; width less than 24
inches; 1-6 inches of soil loss in most places.*



*Class 4 Social Trail:
No vegetation; width 24-42 inches; 7-12
inches of soil loss in most places.*



*Class 5 Social Trail:
No vegetation; width greater than 42
inches; more than 12 of soil loss.*



Note: Abandoned trail west of Scotsman Trail.

Condition of Social Trails

All social trails in the Park were surveyed and their conditions recorded using a global positioning system (GPS). This data was processed using a geographic information system (GIS). Maps, portions of which are presented on pages 59- 61, were then produced. A summary of the status of social trails is given in Table 5.

Condition Class	Length (feet)	Length (miles)	% of total
Class 1: vegetation trampled	8,088	1.53	3.9 %
Class 2: 2/3 of vegetation gone	35,127	6.65	17.0 %
Class 3: 1-6 in. soil loss	89,469	16.94	43.2 %
Class 4: 7-12 in. soil loss	57,469	10.88	27.7 %
Class 5: more than 12 in. soil loss	16,950	3.21	8.2 %
Total	207,103	39.22	100.0 %

Table 5. Condition of social trails.

How quickly social trails develop depends upon use levels and specific site characteristics including vegetation and soil types, and the physical features of the terrain. Long-term observations by Park staff show that social trails have in some cases developed rapidly in the Garden of the Gods, progressing from Class 1 to Class 4 within a relatively short period of time (5-8 years). This makes social trails an urgent matter.

Successfully addressing this issue requires an understanding of why social trails develop in the first place. Social trails are a key indicator of visitor use patterns and preferences. The formation and existence of social trails in the Garden of the Gods indicates that the designated trail system does not provide all Park visitors with established trails that meet their desires. In the Garden of the Gods, the social trails reflect the desire of many park visitors to get close to the rock formations. A number of social trails in the Park have developed as access routes to popular rock climbing sites. Other social trails in the Park reflect preferences for solitude, scenic views, or adventurous explorations of the Park that are not provided by the designated trail system. In some cases social trails may, in fact, be more efficient trails than some sections of designated trails. These preferences, and their legitimacy and value, must be taken into consideration when addressing the problem of social trails in the Park.

It is important to note that, given the preservation and restoration mandates of the Park's Master Plan, it is not possible or desirable to meet all of the access needs of Park visitors. Education and the enforcement of Park regulations that protect the Park's resources will be essential parts of any program to address social trails in the Park.

The Restoration Report Implementation Guide recommends a set of guidelines for Park managers to follow in addressing the issue of social trails in the Park. These guidelines will lead to closing some redundant or resource damaging trails while recognizing that it is not practical or desirable to close all social trails. Some of the current social trails will likely be incorporated into the Park's designated trail system and will require repair or improvement.

The research that was done on trails in the Park (both designated and social) makes one thing clear: it will not be possible to successfully close and revegetate the extensive network of social trails until designated trails are improved or repaired. The research provides a key comparison between the Park's designated trails and social trails. Designated trails in Class 2 condition have the same amount of soil loss as Class 3 social trails. Class 3 designated trails are as eroded as Class 4 social trails. And Class 4 designated trails are in the same condition as Class 5 social trails. In other words, the Park's designated trails are generally indistinguishable from social trails with the same level of soil loss. In other words, virtually all of the 14 miles of unpaved designated trails do not look any different to a trail user than the 31 miles of social trails in erosion Classes 3- 5. Even if Park visitors want to stay on the designated trails it is hard for them to do so because in many instances they are not able to distinguish designated trails from social trails.

Recommendations for Social Trails

- ▲ Clearly define and establish the Park's designated trail system in a comprehensive Trails Plan. This plan will help determine which social trails should be adopted and incorporated into the Park's designated system and which ones should be closed and restored.
- ▲ Designate, repair, and maintain select social trails if they provide access for Park visitors to currently designated trails, viewpoints, and rock formations, or if they provide Park visitors with a legitimate experience, i.e. solitude or exploration of the Park.
- ▲ Close and restore undesirable social trails, i.e. those social trails that closely parallel designated trails, duplicate access provided by designated trails (or social trails that are to be incorporated into the Park's designated trail system), or enter sensitive biological and/or cultural areas. (See the Restoration Report Implementation Guide for specific recommendations).

Bare and Eroded Areas

Current Situation

The areas addressed in this section include those locations in the Park where extensive vegetation and soil loss have occurred as a result of concentrated and repeated levels of visitation and use.

Bare and eroded areas in the Park range from sites where native vegetation has been lost. . .

. . . to areas that have become severely eroded, like this site on the west side of the Three Graces formation.



Although only 17 of the 1,392 acres of the Garden of the Gods are bare and eroded, many of the bare and eroded areas are concentrated in the most heavily visited parts of the Park. The visual impact is magnified and in some areas, like Balanced Rock, the majority of site is heavily disturbed or denuded:

The areas addressed in this section of the Report include the following areas:

- ▲ Areas where intensive visitation or use occurs, i.e. popular rock formations, picnic sites, and the areas surrounding parking areas and pull-offs.
- ▲ Erosion sites caused by runoff from Park roadways and parking sites.
- ▲ Sites where construction has taken place in the Park but where subsequent restoration efforts have been incomplete or ineffective.

Bare and Eroded Areas: Intensive Use Areas

Trampling and soil compaction caused by Park visitors has resulted in bare or denuded and eroded ground in the more heavily visited areas of the Park. In some cases the impacts at these locations are the outcome of decades of disturbance. Three photographs below illustrate the damage that has resulted in intensive use areas. Similar bare and eroded areas exist elsewhere in the Park such as at High Point, Siamese Twins, and Balanced Rock.



Viewpoint near the junction of Juniper Way Loop and Garden Drive. Soil erosion and vegetation loss at this site is typical of pullouts and parking sites along roadways throughout the Park. Social trails emanate from these sites toward other locations within the Park.



Scotsman Picnic Area. Vegetation loss and soil erosion has occurred extensively in and around this site. The drainage and slopes below the parking area have also been compromised, contributing to increased soil erosion.



Three Graces formation, a major landmark in the central Garden zone. This site is one of the more heavily damaged sites in the Park. Hundreds of cubic yards of soil has been lost here. The original surface level of the terrain is indicated by the shrubs in the photo.

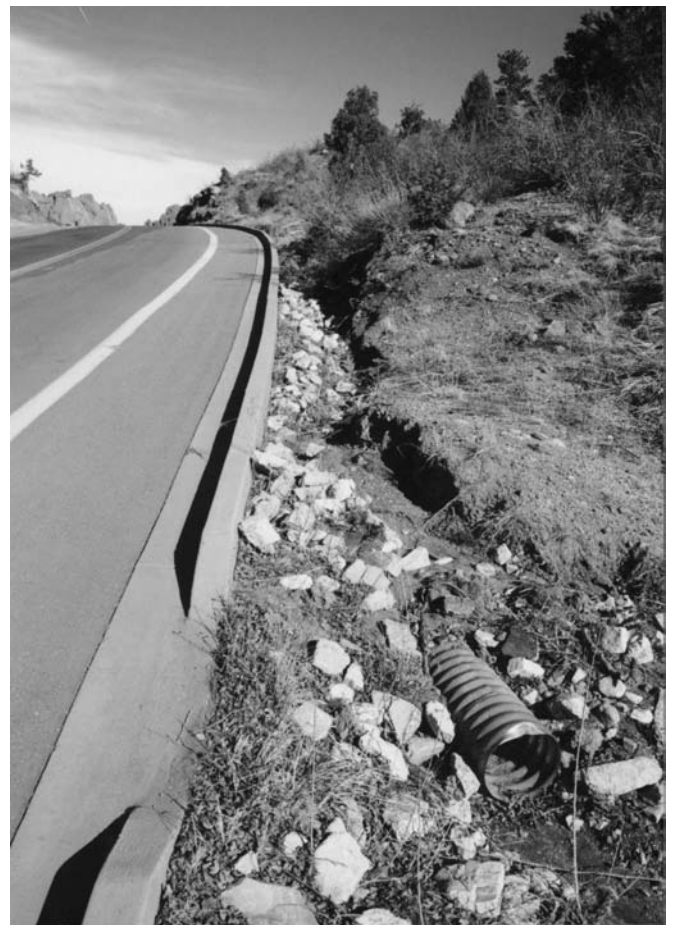
Bare and Eroded Areas: Water Runoff from Roadways and Parking Areas

Runoff from the roadways and parking sites in the Garden of the Gods has significantly altered the natural drainage patterns of the Park. In many locations water draining off the roadways and parking areas has increased erosion levels in the drainages into which the runoff is being directed by several factors. Much of the severity of the erosion is the result of inadequately designed and constructed water control structures. In locations where curb and gutter has been built, the curb cuts do not sufficiently control the velocity and volume of the runoff given the Park's highly erodible soils and the many steep slopes or grades. Additional curb cuts are needed to increase the number of drainage points. The curb cuts also need to be designed and built to appropriately manage the runoff. Furthermore, stabilization and erosion control structures are needed in the major drainages.

Significant erosion is also occurring along the perimeters of the roadways in the Park. Erosion control structures are needed to prevent erosion.



Examples of the erosion occurring along the edges of the roadways in the Park.





Curb cuts and drainage structures in the Park like the ones shown in the above photos are not adequately controlling runoff volume and velocity when major storms occur. This is accelerating natural erosion in the drainages into which the runoff is directed.



Erosion in the streambed near the Scotsman Picnic Area.

Bare Areas and Erosion: Construction and Improvement Projects

During the past several years buildings, roads, and structures have been removed from the Garden of the Gods. Some ground disturbing projects have taken place in the Park in the process of improving the infrastructure of the Park. There are several cases where trail improvements have resulted in the disturbance of previously undisturbed ground. These actions have presented the need for restoration work.

Many of the efforts to restore disturbed ground in the Park have been unsuccessful. The reasons for this are several; however, the most influential factor has been the lack of restoration standards and prescriptions.

Restoration at the standard established by this Report involves recreating the pre-existing contours of the terrain, as well as re-establishing native plant communities. As stated in the Introduction, the goal is true ecological restoration, not reclamation. It is critical to the success of this Restoration Report that this standard be adopted by Parks and Recreation staff, and that the City devote the expertise and resources that are required for restoration to take place.



This photo shows the drainage gully on the east side of North Gateway (Kissing Camels Rock). A sewer line for the toilets near the parking lot was installed, but the site was not fully restored. A gully of this size never existed at this location.



Palmer Trail re-route (old trail on right). Failure to restore the old trail has resulted in an increase in ground disturbance at this site.

An, as yet, unsuccessful restoration of the new sewer line cut just east of North Gateway (Kissing Camels) Rock.



Successful revegetation of the area just south of the Main Parking lot with native grasses.

Condition of Bare and Eroded Areas

Bare and eroded areas of the Park were inventoried and assessed in the same method as the Park's designated trails and social trails. A semi-quantitative, ordinal scoring system for bare and eroded areas was developed. This system is as follows:

- Class 1: Vegetation depressed; 1-6 inches of soil loss in some places
- Class 2: Up to 1/3 of vegetation gone; 6-12 inches of soil loss in some places
- Class 3: Up to 2/3 of vegetation gone; 12-24 inches of soil loss in most places; shrubs on pedestals
- Class 4: Vegetation virtually gone; more than 24 inches of soil loss

The bare and eroded areas of the Park were then inventoried using a GPS unit. Maps were then prepared showing the location and condition of these areas. The extent of bare and eroded areas is shown in Table 6.

<u>Condition Score/Class</u>	<u>Area (sq. ft.)</u>	<u>Area (acres)</u>	<u>% of Park</u>
Vegetation depressed (Class 1)	24,149	0.55	< 0.04 %
Vegetation 1/3 gone (Class 2)	86,431	1.98	0.14 %
Vegetation 2/3 gone (Class 3)	364,420	8.37	0.61 %
Vegetation gone (Class 4)	270,699	6.21	0.45 %
Total bare areas	745,699	17.11	1.24 %
Total Park	60,635,520	1,392,00	100.0 %

Table 6. Condition of bare and eroded areas.

Recommendations for Bare and Eroded Areas

This Restoration Report establishes a high standard for the restoration of disturbances in the Park given its importance as a key natural area. This standard calls for disturbed sites to be restored to predisturbance conditions to the greatest extent possible. This includes recreating the natural contours of the landscape and restoring native plant and wildlife communities.

- ▲ Implement the standards for restoring bare and eroded areas that are provide in the Restoration Report.
- ▲ Stabilize and revegetate erosion gullies and bare areas. Close off restoration area to prevent Park visitors from interfering with the restoration work.
- ▲ At locations where the restoration of major bare and eroded areas is taking place, develop and construct educational exhibits that inform Park visitors about the project and the importance of not disturbing the site.
- ▲ Complete a study of the Park's roadways and parking areas to determine how water runoff can be better controlled and managed. This study should include a thorough examination of the major drainages into which the runoff is presently being directed.

- ▲ Add to and improve water control structures to reduce the volume and velocity from Park roads and parking areas. Install erosion control structures in the drainages into which runoff is directed.
- ▲ Explore viability of limiting vehicle access to a shuttle system during peak visitation periods to reduce vehicle congestion and noise in the Park.
- ▲ Consider converting Balanced Rock into pedestrian area and restoring the surrounding landscape.

Vegetation

Current Situation

Vegetation Density and Appearance

Vegetation in the Garden of the Gods has changed dramatically over the past century and a half due to visitor impact, the suppression of fire, and the planting of trees. Historic paintings and photos (ca. 1870-1910) show no Rocky Mountain juniper and much smaller and less dense stands of Gambel oaks in the Central Garden zone than are present today.



Walter Paris's 1875 painting, "Garden of the Gods and Pikes Peak with Indians," (Joseph B. Benedict Collection, Pioneers Museum, Colorado Springs, CO)



Gateway, Garden of the Gods, 1925 historic photo. Pioneers Museum collection.

Compared to the present, the small Gambel oaks and the reduced number and size of pinyon and juniper on the ridges east of Gateway Rocks as depicted in the Paris painting and earlier photos is most likely the result of fires in the 1850s. These fires are thought to have been started by Indians in a deliberate attempt to manipulate the vegetation of the area. The fires likely killed one-seed juniper and pinyon, and set back the oaks. Fires have been suppressed since then, and natural regrowth has led to an increase in vegetation cover and density.

During the 1930s tree species not normally found in the Central Garden zone (including Rocky Mountain juniper, ponderosa pine, and white fir) were planted by the Civilian Conservation Corps. Today, in many places these large, mature trees block the dramatic views from and to the Central Garden zone. These dense trees completely change the character of the landscape, from an open situation to an almost forested setting. The dense, highly flammable evergreens also increases the risk of fire in the urban-wildland interface. Cutting some of the planted trees that did not occur in the Central garden zone before the 1930s is recommended. Cutting should begin with those trees growing immediately along roads and trails that block views of the sandstone monoliths (this would be perhaps 5 to 10% of the total planted trees in that area). Thinning some planted trees away from roads and trails and selectively thinning the very tall scrub oak would also open up views and reduce fire danger.



A 1999 photo from the same viewpoint as the Paris painting and the 1925 historic photo on the previous page. This photo, and the ones on the following page, show the change in vegetation cover and density over the past one hundred and twenty-five years.



Undated photo of the central Garden zone, probably from the 1930s. (Garden of the Gods Collection, Pioneers Museum, Colorado Springs).



1999 photo of the central Garden zone. This photo compared to the photo above shows the dramatic change in vegetation that has occurred within the last 70 years.



Rocky Mountain juniper (planted) and native scrub oaks grow tall along the edge of Juniper Way overlooking the Central Garden zone, blocking the scenic views of the Central Garden zone for visitors driving as well as walking through the Park.



Invasive and Non-native Species

Weeds in the Garden of the Gods threaten the conservation and restoration goals of the 1994 Master Plan because they harm native plant communities and wildlife habitat. The weeds listed below are widely known to increase rapidly if not controlled, reducing the size and vigor of native plants and sometimes even crowding out native species. On rangelands, weeds can reduce grazing capacity of land by up to 75%, and some are poisonous to livestock. Weeds harm wildlife. Ungulate species, including deer, tend to avoid heavy infestations of weeds, so that usable habitat for these species decreases when many weeds are present. If weeds replace native plant communities, erosion usually increases. Weeds also can change the entire look of ecosystems. For example, weedy trees such as Siberian elm and New Mexican locust are invading grassland areas of the Garden of the Gods, changing an open landscape to one that is full of small trees. In some places these species create impenetrable thickets that eliminate human access. The State of Colorado and El Paso County require control of many weeds (Table 7).



New Mexican locust, a non-native shrub growing along the Bretag Trail. Other “invader” plant species now grow throughout the Park.



Leafy spurge, one of the several noxious weeds found in the Park.

The table below (Table 7) lists the weeds mapped in the restoration planning process. This list includes all plants El Paso County lists as noxious, all weeds on the list of the top ten noxious weeds in Colorado, and also those invasive plants in Garden of the Gods that threaten native plants and animals in some way. Locations of those species found were mapped using a GPS unit and entered into a GIS. Four 1:5000 scale maps showing where these weeds occur were prepared as part of the Restoration Report. These maps have been prepared under separate cover.

<u>Common name</u> ¹ <u>list</u>	<u>Scientific name</u>	<u>Mapped</u>	<u>El Paso</u>	<u>Top ten</u>	<u>State</u>
Canada thistle	Cirsium vulgare	Y	Y	Y	Y
Dalmatian toadflax	Linaria dalmatica	Y	-	-	Y
diffuse knapweed	Centaurea diffusa	-	Y	Y	Y
field bindweed	Convolvulus arvensis	Y	-	Y	Y
hoary cress	Cardaria draba	Y	-	Y	Y
leafy spurge	Euphorbia esula	Y	Y	Y	Y
musk thistle	Carduus nutans	Y	Y	Y	Y
New Mexican locust	Robinia neomexicana	Y	-	-	-
Oriental clematis	Clematis orientalis	-	-	-	Y
poison ivy	Toxicodendron rydbergii	Y	-	-	-
poison hemlock	Conium maculatum	Y	-	-	Y
purple loosestrife	Lythrum salicaria	-	Y	-	Y
Russian knapweed	Centaurea repens	-	Y	Y	Y
saltcedar	Tamarix pentandra	-	-	-	Y
Siberian elm	Ulmus pumila	Y	-	-	-
spotted knapweed	Centaurea maculosa	-	Y	Y	Y
yellow toadflax	Linaria vulgare	Y	Y	Y	Y

¹ See Implementation Guide for synonyms.

Y = yes; - = no

“El Paso” column = on the newly-updated El Paso County noxious weed list (all 8 species are listed here)

“Top Ten” column = on the list of top ten weed species in Colorado (jointed goatgrass not listed here)

“State List” column = on the state noxious weed list;

see: <<http://www.ag.state.co.us/DPI/rules/noxious.html#2.00>> for the lengthy complete list

Table 7. Weeds searched for in the Garden of the Gods and their legal status.

No weed survey can find every occurrence of every species in more than two square miles. If field personnel add the few occurrences missed, control efforts will be more complete. The weed maps show current locations of weeds. Weeds will continue to invade new locations in Garden of the Gods and these locations should be marked as they are discovered. A fairly complete resurvey needs to be done at least every 2- 3 years.

A number of weed species are not currently present that could potentially invade the Park. Park field staff and volunteers should be familiar with the species in Table 7. Since initial infestations often can be eliminated with prompt action, monitoring weeds can save large amounts of money and effort. Potential invasive species to carefully monitor include:

- ▲ Yellow star thistle (*Centaurea solstitialis*):
In California, this species covers vast areas and has recently invaded some Front Range areas. This species would most likely occur first along roads. Plants should be pulled before flowering.
- ▲ Knapweeds (spotted knapweed, diffuse knapweed, and Russian knapweed):
Knapweeds occur in Colorado Springs, including on nearby Queens Canyon Quarry. They are likely to appear in Garden of the Gods soon. Prompt action could prevent major problems with these species. Even though pulling does not work well with larger, well-established infestations, small populations of young plants may be effectively eradicated by pulling before seeds are produced. Seeds may last 5-10 years in the soil, so areas where knapweeds have been pulled must be closely monitored for at least 10 years.
- ▲ Purple loosestrife (*Lythrum salicaria*):
This wetland plant occurs in Front Range areas and would most likely invade areas along Camp Creek. Small infestations (<100 plants) should be pulled before flowering occurs. Plants will resprout if all roots are not removed.

Many non-native plants occur in Garden of the Gods but for some no action is recommended. Some plants, such as apple trees planted during the last century, do not threaten native plants and animals. Other non-native species, such as crested wheat *Agropyron cristatum*, and smooth brome, *Bromus inermis*, planted for erosion control and revegetation in the past, do displace native plants. These species become established, form closed canopies, and out-compete native vegetation. However, removing them and restoring native vegetation, would require considerable resources and a major restoration effort. No action is recommended at this time for these species until more urgent problems in the Park are addressed.

Other plants are on the state list, but currently do not appear to be invasive in the Park. If these species begin to spread, control measures should be instituted. These species are:

- ▲ common burdock , *Arctium minus*
- ▲ common mullein, *Verbascum thapsus*)
- ▲ downy brome (cheatgrass), *Bromus tectorum*- while this species causes huge problems in other places, problems currently appear modest in the Park and do not seem to be increasing.

Rare, Threatened and Endangered Plants

On three dates covering the growing season of summer, 1999, searches were conducted for rare, threatened and endangered vascular plants in Garden of the Gods. No species whose habitats and ranges indicated that they could potentially occur in the Park were found.

A 1997 survey had found one rare species, *Unamia alba*, in lower Spring Canyon. This species is rare in the Colorado Springs region but not legally threatened or endangered. Dr. Kelso hypothesized that floods since 1997 may have changed the habitat enough to kill the *Unamia*, which was not found in the 1999 survey. However, because plants sometimes resprout from underground parts even when no stems remain, the area where the *Unamia* occurred was mapped as an area of biological concern. Kelso also notes Spring Canyon contains habitats most likely to support unusual plant species and that uncommon plant communities (mesic ponderosa pine-grass) occur in the Canyon.

Microbiotic Soils

Microbiotic soil (formerly called cryptogamic soil) consists of a mixture of blue-green bacteria, lichens, and algae that usually form a dark crust on the soil surface. This crust stabilizes the soil surface, helping to prevent soil erosion. These microbiotic crusts may have occurred in many areas of the Park before heavy use destroyed them. Microbiotic soils currently occur in the Park on gypsum of the Morrison Formation, as shown on the map Areas of Biological and Geological Concern.

Recommendations for Vegetation

- ▲ Restore native plant communities in the Garden of the Gods wherever and whenever possible.
- ▲ Revegetate bare and eroded areas, including social trails, with native plants. (See the Restoration Report Implementation Guide for detailed information about revegetation techniques, recommended species, and costs).
- ▲ Manage the potential habitat of the plant *Unamia alba* in Spring Canyon as an area of biological concern. Prevent all disturbances that pose a threat to this species. Managers should not take actions that increase use in Spring Canyon, such as constructing new trails. If any construction activity occurs in this area, another survey for *Unamia* should be done. Otherwise, no special management consideration is needed for rare plant management in the Garden of the Gods.
- ▲ Selectively remove Rocky Mountain juniper and white fir from certain areas of the Park, such as the Central Garden zone, in order to restore natural, historical vegetation patterns and scenic views, and to reduce the danger of wildfire. Prune scrub oak in selected areas to reduce fire danger and restore scenic views.
- ▲ Control noxious weeds and other non-native invasive species, and eradicate them whenever possible. Immediate, strong, concerted efforts may eradicate small, newly established populations of weeds. Populations of all sizes should be prevented from dispersing seed by regular mowing and cutting. Complete a noxious weed survey of the Park every 2- 3 years. (See the Restoration Report Implementation Guide for detailed information about weed control).
- ▲ Protect and preserve those areas in the Park where microbiotic soils exist. Avoid constructing designated trails in the area where microbiotic soils still exist. Educate the geology field trip leaders using this area about this concern, and in information provided with permits, ask them to keep students on already bare areas and to avoid the dark areas on the gypsum soil.
- ▲ Develop and implement a wildfire control plan that reduces the risk of wildland fire in the Park and surrounding neighborhoods, and provides a fire response protocol. This plan should include contingency plans for cutting firebreaks in locations that would protect cultural, geological, and biological resources, as well as minimize post-fire erosion and revegetation needs; and, at the same time, prevent the spread of a fire beyond the boundaries of the Park.

Wildlife and Wildlife Habitat

Current Situation

Mammals

Preble's meadow jumping mouse

The Garden of the Gods contains areas of potential habitat for Preble's meadow jumping mouse. (See Restoration Report Wildlife Habitat map). Preble's meadow jumping mouse, *Zapus hudsonius preblei*, is a rare subspecies of meadow jumping mouse whose distribution is limited to portions of Colorado and Wyoming. In 1998 it was listed as threatened by the U.S. Fish and Wildlife Service. Locations slightly north of the Garden of the Gods represent the southernmost known populations of the species. The preferred habitat of this species consists of drainages with well-developed vegetation characterized by diverse grasses, forbs, and shrubs, especially willows. The 1.5 mile section of Camp Creek in the Garden of the Gods Park north of Rock Ledge Ranch provides exactly the type of habitat needed by this species. This area would be able to support a population of 75 to 100 mice. If present, this would be a disjunct and isolated population of Preble's mouse, because suitable habitat no longer exists between this part of Camp Creek and sites to the north that support known populations of this species. No trapping studies were conducted as a part of this planning process to determine whether or not this species is currently present in the Garden of the Gods.



The dense shrubs east of Camp Creek provide potential habitat for the threatened the Preble's meadow jumping mouse.

Bighorn sheep

Bighorn sheep use rocky ridges in the northern part of the Park (see map Areas of Biological and Geological Concern). Although these sheep tolerate moderate human activity nearby, they will run if humans approach or if dogs come even moderately close. Since the North Parking Lot was built, social trails have developed up the ridge to the north. If these receive much use, especially by people with dogs, the sheep are likely to use these areas less (Bob Davies & Trina Lynch, CO Division of Wildlife).

Predators

Many large mammal predators such as black bears, mountain lions, bobcats, and coyotes use the Garden of the Gods, especially areas used by few people, such as the western part of the Park. The potential for dangerous human-bear encounters is increased because trash cans and dumpsters in the Park are not bear-proof, and bears are frequently attracted to accessible trash.

Birds

Prairie falcons are a sensitive species for which the Parks and Recreation Department already has a management policy. The policy closes part of Kindergarten Rock to climbing near one of two nest sites used by the prairie falcons (see map Areas of Biological and Geological Concern). No climbing routes exist near the nest site on the east side of North Gateway Rock.

Invertebrates

Honeypot ants, *Myrmecocystus mexicanus hortidorum* [species and subspecies probable], are the only known invertebrate species of concern in the Park. Although no agency lists this species as threatened or endangered, honeypot ant nests were mapped because these ants are uncommon in the Colorado Springs area, and because past trail work in the Park has buried known nests.

Two field assistants spent a total of 18-20 hours searching for nests in the known habitat-unvegetated areas of clay soils on ridge tops. They identified nests as mounds of gravel and pebbles 2-5 cm high with a central hole 1-2 mm in diameter, and confirmed by observing the ants. Three nests were found, and their locations are shown on the Areas of Biological and Geological Concern map. Existing trails pass near two nests. Prior to this survey these ants were reported from only one location in the Park.

Recommendations for Wildlife and Wildlife Habitat

- ▲ Maintain existing native wildlife habitat in the Park. Identify and implement management actions to help keep native wildlife disturbance levels and the potential for conflicts between humans and wildlife to a minimum. (See Restoration Report maps for locations of specific features).
- ▲ Restore vegetation to replace lost cover and forage for wildlife.
- ▲ Develop and implement a visitor wildlife education program throughout the Park.
- ▲ Conduct a live-trapping survey to determine presence or non-presence of the Preble's meadow jumping mouse, a federally protected species, prior to any development of trails and/ or other Park infrastructure in or near areas of potential habitat.
- ▲ Protect bighorn sheep habitat in the northern sector of the Park by closing social trails and restricting visitor access to this area.
- ▲ Avoid designating social trails or constructing new trails to the western part of the Park to maintain use of this area by mammalian predators and other native wildlife.
- ▲ Continue to close rock climbing routes during prairie falcon nesting season. If climbing routes become established near the nest site on North Gateway Rock, include that area in the seasonal closure.
- ▲ Minimize disturbance to honeypot ant nest sites by maintaining, and not rerouting or expanding, nearby designated trails. Close any social trails that threaten these nest sites.

Geological Features of Concern

Current Situation

The spectacular geology of Garden of the Gods draws many, if not most, visitors to Garden of the Gods. Fortunately most of these geological features resist degradation far better than the Park's soils and biota. Locations of geological concern were mapped in consultation with a local geologist who has done research in Garden of the Gods and written a geological guide to the Park. These locations meet two criteria: 1) They are important to researchers attempting to understand formation of Garden of the Gods and/or are very important to geology classes at local colleges and universities, and 2) user activity or management action could conceivably harm them or management options have implications for other concerns (impact to soils and vegetation or safety).

One of the accompanying rolled maps shows these features:

- ▲ exposures of the Rampart Range fault, key to structural geology of the area
- ▲ exposures of three minor faults; used heavily by geology classes
- ▲ outstanding example of interbedding of Fountain and Lyons Formations with sedimentary features including ripples, graded beds, and cross beds
- ▲ overturned beds
- ▲ stromatolite and gypsum layers; used heavily by classes.

Recommendations for Geological Features of Concern

- ▲ Restore native vegetation surrounding geologic features to reduce erosion.
- ▲ Consult the Restoration Report's map of Areas of Geological Concerns before any construction or grading, including any activities effecting road cuts. Consult local geological experts if construction will occur near these areas, especially exposures of the Rampart Range fault. Because these exposures occur partially in road cuts, any disturbances to the road cut could damage these features.
- ▲ Consider carefully any actions that would concentrate users at sites of geological concern, such as constructing designated trails through these areas.
- ▲ Monitor the interbedded monolith with ripple marks, graded beds, and crossbeds. Photos should be taken of important features susceptible to damage. If climbing begins to damage these features, consider closing the rock formation, or portions of it, to climbing.
- ▲ Provide access to sites used by geology classes by stabilizing one social trail to the following sites: the small fault at the north end of North Gateway Rock; the gypsum and stromatolite layers; the saddle south of South Gateway Rock; and the overturned beds. Provide information on access routes in the permits issued for educational off-trail use. The trail to the gypsum/stromatolite area should not be designated, because this area has very sensitive microbiotic soil and designating the trail could draw more people to the area.

Cultural Features of Concern

Current Situation

Prehistoric archeological sites such as hearths exist in the Garden of the Gods. Continued water erosion, the existence of a dense network of social trails, and the threat of wildland fire (increased by unnaturally thick vegetation) threaten the integrity of the prehistoric sites.

Recommendations for Cultural Features of Concern

- ▲ Consult the Restoration Report's map of Areas of Cultural Concerns before any construction or improvement projects. Consult local cultural experts if construction will occur near these areas.
- ▲ Restore native vegetation surrounding cultural features to reduce erosion and protect these sites.
- ▲ Follow the recommendations given in the Restoration Report that address erosion problems to help protect the cultural features of the Park
- ▲ Increase the priority of erosion control measures, revegetation, and closure of social trails in areas with cultural sites.

Restoration Plan Implementation

Implementation Process

The restoration of the Garden of the Gods presents a formidable challenge. Restoration is an incremental process that involves eliminating or mitigating the underlying causes of the disturbance, and restoring those natural systems that have been compromised. Accomplishing this for the Garden of the Gods will require considerable expertise, resources, and time.

In many instances there are a number of interacting factors that are contributing to disturbances in the Park. Many of these factors are social and relate to how the Park is presently being used by visitors. Successful restoration in the Park will, therefore, require both appropriate and effective technical and social prescriptions.

Restoration projects in the Park are more likely to be successful if all of the disturbance factors are addressed in an integrated fashion, on a drainage by drainage basis. The reason for this is that the level of disturbance that is occurring at a specific location is frequently influenced by disturbances far removed from the site.

It is imperative that Park staff who are responsible for the day to day operation of the Park be provided with the training and resources to properly restore the Garden of the Gods. Recruiting or hiring outside expertise will be required for some projects.

Finally, there is little question that the restoration of the Park will not be achieved unless citizen involvement and volunteerism is significantly increased.

Costs

The total cost of implementing the major recommendations of the Garden of the Gods Restoration Report is estimated at between \$3 million and \$5 million dollars. The difference is dependent upon the potential costs savings of volunteer programs designed to complete work that otherwise would be completed by Park staff and outside contractors. The estimate also does not include costs for several restoration actions, like drainage and erosion control structures in the ephemeral streambeds and the completion of a wildland fire control plan. Nor does it include the costs of operating the Park. If \$250,000 per year is budgeted (approximately the level of funding for Master Plan implementation since 1994), it will take between 18 and 32 years to implement the restoration actions recommended in the Restoration Report. Unless levels of funding are increased it is clear that restoring the Garden of the Gods will be a long process. It is also important to note that many of the present threats to the Park will increase in severity unless timely action is taken; consequently, restoration costs will only increase with time.

Implementation Schedule

This section provides a recommended timeline and estimated costs for the implementation of the recommendations of the *Garden of the Gods Restoration Report*. The costs are based upon standards and restoration prescriptions described in the *Restoration Report Implementation Guide*. Several of the recommendations are listed as "no cost". These are recommendations that are to be implemented by Parks and Recreation Dept. staff. Other recommendations with assigned costs were determined to require the advice and expertise of outside consultants.

Public Awareness and Education

Recommendations	Cost Estimate	Implementation Schedule
Develop a campaign to raise public awareness and educate citizens and visitors about the seriousness of the threats to the Garden of the Gods.	\$25,000- \$35,000	Begin immediately and completed in 2-4 years, with ongoing public outreach.
Develop a major exhibit or display at the Visitor Center that explains the problems of trail erosion, social trails, loss of ground-covering vegetation, and the unnatural increase of woody vegetation in some parts of the Park, and includes solutions to these problems.	\$10,000	Within 2- 4 years.
Adapt the information included in the above Visitor Center exhibit for visitor information signs. Place these signs at interpretive hubs, shade shelters, parking area, and trailheads in the Park.	Park staff	Within 2- 4 years
Place one or more restoration demonstration projects at strategic locations in areas of high visitation. Interpretive information at the demonstration site should show the site in its disturbed condition and during the various stages of restoration.	\$3,000- \$5,000	Begin immediately in conjunction with restoration projects.
Complete the process of developing an informational newspaper for distribution at the Visitor Center. Publish a brochure highlighting threats to the Park and current and planned restoration projects, and distribute this piece to residents of the neighborhoods bordering Garden of the Gods.	Park staff	Implement when publications are printed.
Develop press releases or stories for local print and broadcast media.	Park staff	Implement as restorations projects are completed.
Encourage public presentations explaining the need for restoration of the Garden of the Gods.	Park staff, Citizen organizations	Begin immediately.
Expand community and volunteer opportunities.	\$350,000- \$500,000 for 10 years	Within 1 year.

Designated Trails

Recommendations	Cost Estimate	Implementation Schedule
Develop a comprehensive Trails Plan.	\$10,000	Within 1 year.
Resolve the issue of erosion cause by commercial equestrian use of the Park. If commercial equestrian use continues to be allowed, develop a funding mechanism to cover the costs of constructing and maintaining the horse trails to a standard that can withstand this use.	Part of Trails Plan.	Within 1 year.
Re-build and maintain trails to standards established by Trails Plan.	\$415,000-\$770,000	Begin immediately upon completion of Trails Plan.
Integrate the park trail system with the Park road system by developing trailheads at all parking lots	\$50,000	Begin immediately upon completion of Trails Plan.
Develop trail signs, trail markers, and maps that enable users to better navigate and stay on the designated trails.	\$25,000- \$30,000	Within 1- 2 years.
Hire and train a trail crew to work exclusively in the Garden of the Gods for the summer seasons to repair and maintain trails (complete restoration work as well).	Included in costs of restoration actions.	Within 1 year.

Social Trails

Recommendations	Cost Estimate	Implementation Schedule
Clearly define and establish the Park's designated trail system in a comprehensive Trails Plan to determine which social trails in the Park should be incorporated into the Park's designated trails system and which should be closed and restored.	Included in Trails Plan costs.	Within 1 year.
Designate, repair as needed, and maintain some social trails if they provide access for Park visitors to system trails, viewpoints, and rock formations or if they provide Park visitors with a legitimate experience, i.e. solitude or exploration of the Park.	Cost unknown.	Begin immediately upon completion of Trails Plan.
Close and restore undesirable social trails, i.e. those social trails that closely parallel designated trails, duplicate access provided by designated trails (or social trails that are to be incorporated into the Park's designated trail system), or enter sensitive biological and/or cultural areas.	\$1.13 million-\$1.68 million	Begin immediately upon completion of Trails Plan.

Bare and Eroded Areas

Recommendations	Cost Estimate	Implementation Schedule
Implement the standards for restoring bare and eroded areas that are provide in the Restoration Report.	Park staff	Immediately
Stabilize and revegetate erosion gullies and bare areas. Close off restoration areas to prevent Park visitors from interfering with the restoration work.	\$530,000- \$1.26 million (costs of revegetation included in Vegetation section, pg. 56).	Completed over 15- 25 years on a phased, drainage-by-drainage basis, and integrated with other restoration objectives.
At locations where the restoration of major bare and eroded areas is taking place, develop and construct educational exhibits that inform Park visitors about the project and the importance of not disturbing the site.	Costs included in above costs.	Complete in conjunction with restoration projects.
Complete a study of the Park's roadways and parking areas to determine how water runoff can be better controlled and managed. This study should include a thorough examination of the major drainages into which the runoff is presently being directed.	\$10,000- \$15,000	Within 1- 2 years.
Add to and improve water control structures to reduce the volume and velocity from Park roads and parking areas. Install erosion control structures in the drainages into which runoff is directed.	\$454,000- \$496,000	Within 3- 5 years.
Explore viability of limiting vehicle access to a shuttle system during peak visitation periods to reduce vehicle congestion and noise in the Park.	Park staff.	Within 3-5 years.
Consider converting Balanced Rock into pedestrian area and restoring the surrounding landscape.	Park staff.	Long range- no schedule.

Vegetation

Recommendations	Cost Estimate	Implementation Schedule
Restore native plant communities in the Garden of the Gods wherever and whenever possible.	Costs included below.	Begin immediately. Ongoing.
Revegetate bare and eroded areas, including social trails, with native plants.	\$192,000- \$254,000	Begin immediately. Ongoing.
Manage the potential habitat <i>Unamia alba</i> in Spring Canyon as an area of biological concern. Prevent all disturbances that pose a threat to this species.	No cost.	Begin immediately. Ongoing.
Selectively remove Rocky Mountain juniper, white fir from certain areas of the Park, such as the Central Garden zone, in order to restore a more natural and historical vegetation patterns and scenic views, and to reduce fire danger. Prune scrub oak in select areas to reduce fire danger and restore scenic views.	Not provided.	1-2 years following public education campaign.
Control noxious weeds and other non-native invasive species, and eradicate them when possible. Complete a noxious weed survey every 2-3 years.	Not provided.	Begin immediately. Ongoing.
Protect and preserve those areas in the Park where microbiotic soils still exist.	No cost.	Begin immediately. Ongoing.
Develop and implement a wildfire control plan that reduces the risk of wildland fire in the Park and surrounding neighborhoods, and provides a fire response protocol.	Unknown.	Within 2- 4 years.

Wildlife and Wildlife Habitat

Recommendations	Cost Estimate	Implementation Schedule
Maintain existing native wildlife habitat in the Park. Identify and implement management actions to keep native wildlife disturbance levels and the potential for conflicts between humans and wildlife to a minimum.	No cost.	Begin immediately.
Restore vegetation to replace lost cover and forage for wildlife.	Cost unknown.	Within 3- 4 years.
Develop and implement a visitor wildlife education program throughout the Park.	Cost unknown.	Implement as needed.
Conduct a live-trapping survey to determine presence or non-presence of the Preble's meadow jumping mouse, a federally protected species, prior to any development of trails and/or other Park infrastructure in or near areas of potential habitat.	Cost unknown.	Ongoing.
Protect bighorn sheep habitat in the northern sector of the Park by closing social trails and restricting visitor access to this area.	Included in social trails restoration costs.	Begin immediately.
Avoid designating social trails or constructing new trails to the western part of the Park to maintain use of this area by mammalian predators and other native wildlife.	No cost.	Begin immediately.
Continue closures of rock climbing routes during prairie falcon nesting season.	No cost.	Ongoing.
Minimize disturbance to honeypot ant nest sites by maintaining, and not rerouting or expanding, nearby designated trails. Close any social trails that threaten these nest sites.	No cost.	Begin immediately.

Geologic Features

Recommendations	Cost Estimate	Implementation Schedule
Restore native vegetation surrounding geologic features to reduce erosion.	Included in Vegetation section, pg. 56.	Begin immediately.
Consult the map of Areas of <i>Geological Concern</i> before any construction or grading, including any activities effecting road cuts. Consult local geological experts if construction will occur near these areas, especially exposures of the Rampart Range fault. Because these exposures occur partially in road cuts, any disturbances to the road cut could damage these features.	Park staff.	Ongoing.
Consider carefully any actions that would concentrate users at sites of geological concern, such as constructing designated trails through these areas.	No cost.	Begin immediately.
Monitor the interbedded monolith with ripple marks, graded beds, and crossbeds. Photos should be taken of important features susceptible to damage. If climbing begins to damage these features, consider closing the rock formation, or portions of it, to climbing.	No cost.	Begin immediately.
Provide access to sites used by geology classes by stabilizing one social trail. Provide information on access routes, including rationale, in the permits issued for educational off-trail use.	No cost.	Begin immediately.

Cultural Features

Recommendations	Cost Estimate	Implementation Schedule
Consult the Restoration Plan's map of Areas of Cultural Concern before any construction or improvement projects. Consult local cultural experts if construction will occur near these areas.	No cost.	Begin immediately.
Restore native vegetation surrounding cultural features to reduce erosion and protect these sites.	Included in Vegetation section, pg. 56.	Begin immediately.
Follow the recommendations given in the Restoration Report that address erosion problems to help protect the cultural features of the Park	Park staff.	Begin immediately.
Increase the priority of erosion control measures, revegetation, and closure of social trails in areas with cultural sites.	No cost.	Begin immediately.

Maps Showing Conditions of Designated Trails, Social Trails, and Bare and Eroded Areas

North Central Zone- Garden of the Gods

Central Zone- Garden of the Gods

References

- Colorado State Parks. 1999. Planning Trails with Wildlife in Mind: A Handbook for Trail Planners. Colorado State Parks, 1313 Sherman St., Room 618, Denver, CO 80203.
- Colorado Springs Parks and Recreation Department. 1994. Garden of the Gods Master Plan.
- Colorado Springs Parks and Recreation Department. 1994. Garden of the Gods Management Plan.
- Colorado Springs Parks and Recreation Department. 1994. Garden of the Gods Interpretive Plan
- Colorado Springs Parks and Recreation Department. 1995. Revenue Policy. Unpublished photocopy.
- Colorado Springs Parks and Recreation Department. 1998. Garden of the Gods Planning Grant for Implementation of Key Components of the Master Plan. Unpublished proposal to the Great Outdoors Colorado Trust Fund (GOCO), September, 1998.
- Deluca, T.H., W.A. Patterson, W.A. Freimund, D.N. Cole. 1998. Influence of Llamas, Horses, and Hikers on Soil Erosion from Established Recreation Trails in Western Montana, USA. *Environmental Management* 22, pp. 255-262.
- Getty, Stephen R. 1995. Garden of the Gods Trails Management Project: Evaluating the condition of trails in Garden of the Gods. Unpublished report for Colorado Springs Parks and Recreation Department.
- Heede, Burchard H. 1976. Gully Development and Control: The Status of Our Knowledge. USDA Forest Service Research Paper RM-169, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.
- Johnson, Johnson and Roy, Inc. 1976. Garden of the Gods Plan/May 1976. Unpublished report ("Master Plan") prepared for the Garden of the Gods Steering Committee.
- National 4-H Council. 1994. To Build a Trail: Enhancing America's Pathways. National 4-H Council, 7100 Connecticut Ave., Chevy Chase, MD 20815.
- National Park Service. 1995. Concessions Permit. Permit No. CP-ROMO-012, Aspen Lodge and Guest Ranch. Unpublished photocopy.
- Noteboom, Carrie. 1997. Garden of the Gods Park. Unpublished report for Colorado Springs Parks and Recreation Department.
- Proudman, Robert D. and Reuben Rajala. 1981. AMC Field Guide to Trail Building and Maintenance, 2nd Ed. Appalachian Mountain Club Books.
- Rocheftort, Regina M., and Stephen T. Gibbons. 1992. Mending the Meadow: High-Altitude Meadow Restoration in Mount Rainier National Park. *Restoration & Management Notes* 10: 120-126.
- Rocky Mountain Research Group, 1993. User Survey. Unpublished report.
- Sauer, Leslie Jones and Andropogon Associates. The Once and Future Forest: A Guide to Forest Restoration Strategies. 1998. Island Press, Washington, D.C. 20009.
- Tonneson, Alex S., and James J. Ebersole. 1997. Human Trampling Effects on Regeneration and Age Structures of *Pinus edulis* and *Juniperus monosperma*. *Great Basin Naturalist* 57: 51-55.
- U.S. Department of the Interior. 1983. NPS Trails Management Handbook. National Park Service, P.O. Box 25287, Denver, CO 80225.

U.S. Department of the Interior. No date. BLM Handbook 9114-1 Trails. Bureau of Land Management, 1849 C Street NW, Washington, D.C. 20240.

U.S. Department of Agriculture. 1986. Standard Specifications for Construction of Trails. USDA Forest Service Publication No. EM-7720-102. Available from: Publications Specialist, P.O. Box 2417, Washington, D.C. 20240.

U.S. Department of Agriculture. 1991. Trails Management Handbook. USDA Forest Service. Available from: Publications Specialist, P.O. Box 2417, Washington, D.C. 20240.

Consulting Team

Bruce A. Byers, Ph.D.

405 Timber Lane, Falls Church, VA 22046

Tel: (703) 534-4436 Fax: (703) 534-1714

E-mail: bbyers@igc.org

Bruce Byers is a self-employed consultant based in Falls Church, Virginia, who provides assistance to diverse clients on a range of conservation and natural resources management issues in the U.S. and overseas. His clients have included nongovernmental organizations such as the World Wildlife Fund and The Nature Conservancy, and government agencies such as the U.S. Fish and Wildlife Service and U.S. Agency for International Development. An ecologist by academic training, he has developed expertise in the human, social, and behavioral aspects of natural resource management in his work over the last decade. Dr. Byers has been the team leader and lead consultant on several projects, and authored reports that synthesized the findings of teams of diverse disciplinary specialists. He has organized and facilitated strategic planning workshops, and led planning teams. Since 1996 he has taught at Colorado College as a Visiting Professor six times, teaching courses on natural resources planning and management using an approach that integrates ecological and social approaches.

James Ebersole, Ph.D.

#3 Garden Drive, Colorado Springs, CO 80904

Tel: (719) 389-6401 (w) Fax: (719) 389-6940

E-mail: jebersole@ColoradoCollege.edu

Jim Ebersole is a plant ecologist who has done research on disturbance and recovery of vegetation for 20 years. This research includes published papers on the effects of human trampling on pinyon pines and one-seed juniper in Garden of the Gods. In the past several years he has focused his research on ecological restoration of plant communities. Dr. Ebersole teaches ecology, botany, and biological statistics courses at Colorado College and frequently brings student field trips to Garden of the Gods. He has supervised numerous student research projects in the Park, including studies on effects of trampling on growth and reproduction of several dominant trees and shrubs and effects of roads on nesting bird densities. He has lived near Garden of the Gods for ten years and visits the Park several times per week. In addition to intimate ecological knowledge of the Park, he has been actively involved in Park management issues for a number of years. He brings a strong understanding of interactions between users and resources, of user conflicts in the Park, and of the social-political issues in managing this Park.

Mark Hesse, Executive Director

Rocky Mountain Field Institute (RMFI)

1520 Alamo Avenue, Colorado Springs, CO 80907-7304

Phone: (719) 471-7736 Fax: (719) 577-4552

E-mail: rmfihesse@aol.com

Mark Hesse is Director of the Rocky Mountain Field Institute (RMFI). He holds a Masters Degree in Education from the University of Colorado at Boulder. Prior to assuming the directorship of RMFI in 1989, he worked for over fifteen years in the field of outdoor education. Hesse's leadership of RMFI's research, education, internship, and volunteer-stewardship programs has enabled RMFI to play an important role in resolving recreational management problems and restoring heavily impacted sites at many natural areas in Colorado and in Utah. RMFI has received numerous awards for its work including the national "Take Pride in America" from the Dept. of Interior. RMFI has assisted the City of Colorado Springs Department of Parks and Recreation with managing visitor impacts and restoring impacted areas in the Garden of the Gods Park for several years.

Legend

System Trails

Single blue lines: Color gradations indicate condition of trail.

Light blue- good condition (Class 1). Dark blue- severe erosion (Class 4)

Social Trails

Single red lines: Color gradations indicate severity of impact.

Light red- minor impact (Class 1). Dark red- severe impact (Class 5)

Bare and Eroded Areas

Large colored areas: Color gradations indicate severity of impact.

Yellow- minor impact (Class 1). Dark brown- severe impact (Class 4)

