THE EFFECT OF RECREATIONAL USE ON A FRAGILE DESERT ENVIRONMENT: a fieldtrip to Road Canyon, South-eastern Utah, USA. March/April 2001

(966 words, plus abstract and appendices)

ABSTRACT:

Aim: to research the effect of recreational use on a fragile desert environment.

Objectives:

i) To make an inventory of riparian plants.
ii) To note evidence of trample damage, the effect of flash floods and animal activity.
iii) To make photographic records.
iv) To collect samples of cryptogamic crust.

Method:

Four sites along the trail were selected. 15x1m^2 quadrats along the path and each side were used. A site description was noted and photographs taken. Information was gathered on total estimated % cover, % plant cover, % crust cover, total number of plants (up to 50) and number of different species. Difficulties were encountered with plant identification, most field guides using the flower for identification and many plants were not yet in bloom. Plants flowering on a sheltered, south-facing ledge helped. Identification at least to family was made. Samples were taken of lichen and crypto biotic crust.

Results: see Appendix One

Conclusions:

Fig. 1 shows lower % cover and number of plants/m2 on the path, as expected. The number species/m2 varied with habitat rather than location of quadrats. Level of damage was low. Extensive bedrock in some sections reduced damage as did small numbers of visitors.

The expedition was a most useful preparatory study. Real benefit would come through further research.

Future Research Recommendations:

Comparisons between areas with different levels of recreational use, the effect of flash floods or further taxonomic studies would be productive. An exploratory day hike to two further sites was carried out.

Study of the samples is ongoing. Samples from two other desert types in the USA suggest a study of the variety of species occurring in different desert environments.

Fieldtrip to South-eastern Utah, USA in March/April 2001

Introduction

The aim of the project was to research the effect of recreational use on plant diversity, vegetation cover and stable soil formation in a fragile desert ecosystem.

Hikers are attracted to the Grand Gulch Primitive Area, a desert environment with hundreds of Ancient Pueblo Indian sites, which are protected by law. Most of the area's trails follow the course of a dry riverbed, running along the bottom of a steep-sided canyon. Much of the vegetation grows along the river courses. Much of the surface is covered by cryptogamic crusts, the slow-growing precursor to stable soil formation, which is extremely vulnerable to trample damage. The U.S. Bureau of Land Management (B.L.M.) administers the area. It is interested in monitoring the impact of recreational use, for its own forward planning.

Objectives:

v) To make an inventory of riparian plants growing along the trail between two Pueblo Indian Ancestral Ruins, known as *Seven Kivas* and *The Citadel,* in Road Canyon, off Cedar Mesa, Grand Gulch Primitive Area, South-east Utah, U.S.A.

vi) To note evidence of trample damage to plants and the cryptogamic crust occurring in the area.

vii) To note evidence of the effect of flash floods and animal activity on the plant populations and cryptogamic crust.

viii) To make appropriate photographic records of sampling areas.

ix) To collect samples of cryptogamic crust for further study, if permission is given by the B.L.M.

Method:

Four sites along the trail were selected as representative of four typical, but different, environments. At each site, information was gathered from 15x1m^2 quadrats. 3 were placed, 1m apart, on the trail, 2m each side of the trail and 5m each side of the trail. The quadrats were constructed of 3mm nylon cord, with a knot to mark each corner, giving dimensions of 0.6mx1.4m. The trail width was consistent, and 0.6m covered the trail with an overlap of 5-8cm each side. The distances of 2m and 5m each side of the path allowed investigation of any differences, without hitting the very steep, bare rock walls of the canyon; if this had not been a limiting factor, the distances chosen would have been greater, or there would have been more of them. Using cord for the quadrats gave flexibility over vegetation and rocks of varying heights, although using lightweight tubes with a cord running through them would, I thought afterwards, be more accurate.

At each site, a site description was noted and photographs were taken, to enable future identification of the sites for any follow-up work.

Within each quadrat, information was gathered on total estimated % cover, % plant cover and % crust cover, total number of plants (up to 50) and number of different species.

Accurate plant identification was attempted, although difficulties were encountered. Field guides had no dichotomous key, most guides using the flower for identification; some had no key at all. Spring was a little cold and late so many plants were not in bloom. Because of the focus on flowers, it was difficult to find good pictures and/or drawings of leaves. Many of the plants were unfamiliar. Discovery of many plants already flowering on a sheltered, south-facing ledge helped. Identification at least to family was made. Photographs were taken to improve the accuracy afterward.

Samples were taken of lichen and crypto biotic crust, for further study in Edinburgh. This is still on going.

Results

See Appendix 1

Conclusions:

Fig. 1 shows lower % cover, number of plants/m2 on the path, as expected; number species/m2 varied with habitat, not quadrat. The level of damage was low. The trail was quite distinct and hikers did not stray off to trample the cryptogamic crust; the existence of extensive bedrock in some parts also prevented damage. The number of visitors was small – days passed without a single hiker.

The earliness of the season and consequent early stage of development of many of the plants, coupled with the field guide emphasis on flower identification, raised questions about the accuracy of the identifications made.

Being a first experience in planning and carrying out a field study, and being new to the region, the expedition was a most useful preparatory study. Real benefit would come through conducting further research.

Future Research Recommendations:

Comparisons between areas with different levels of recreational use, the effect of flash floods and further taxonomic studies on the crypto biotic crust and lichens would all be productive areas and possibly more useful than riparian plant inventories.

A day hike to two different sites – Cedar Mesa, the plateau above Road Canyon, and along Kane/Grand Gulch, accessible from the main Ranger station, suggested a much higher rate of usage with possibly greater recreational effect on the terrain. During August and September every year, there are at least 4 or 5 major flash floods that can wash away much of the trail and change the environment of the canyons.

The samples of lichens and crypto biotic crust have shown promise regarding species found at the different sites. In addition, samples contributed by Dr Jim Deacon from two other desert types in the USA suggest an interesting study of the variety of species that may be found in different desert environments.

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Dr Colin Legg, Institute of Ecology & Resource Management, for overall planning, information on studying effects of recreational use and especially advice on method.
Dr Jim Deacon, Director of the Biology Teaching Organisation, for information, advice and help & equipment to analyse samples of soil crusts and lichen.

Logistical Support:
Bureau of Land Management, Monticello, Utah, especially Mr Phil Gezon, Outdoor Recreation Planner and the Rangers at Kane Gulch Ranger Station for help with transportation, supplies and looking at future research possibilities.

APPENDIX ONE

Table 1. Descriptions of the sites at which observations were made, photographs taken and samples collected.

Site No.	Site Description	Reasons for selecting
1	East end of the *Seven Kivas*, near a water channel which exits the site near a large boulder	It is a common goal for visitors; easily identifiable; terrain: broad valley floor comprised of bedrock; water channel visible; variety of species present.
2	Down canyon from 1, trail rises up from the wash through a section of sandy soil; round the next bend is a distinct 'pour-off' on the N side.	Identifiable landmark (the pour-off); different terrain from 1: the trail rises above the wash; sufficient distance each side of the trail to accommodate quadrats.
3	Down canyon, east of 2; there is a spring, with a permanent pool; just east of the pool, the trail rises south above a steep gorge; there is a petroglyph inscribed onto a large boulder.	Different habitat; easily identifiable (petroglyph)
4	The stretch of rock beginning at the western edge of 3; a water channel 3m wide & 1.5m deep runs along the s. edge of the rock.	Very close to the spring, but different habitat – is the vegetation? Easily identifiable (flat rock and water channel)

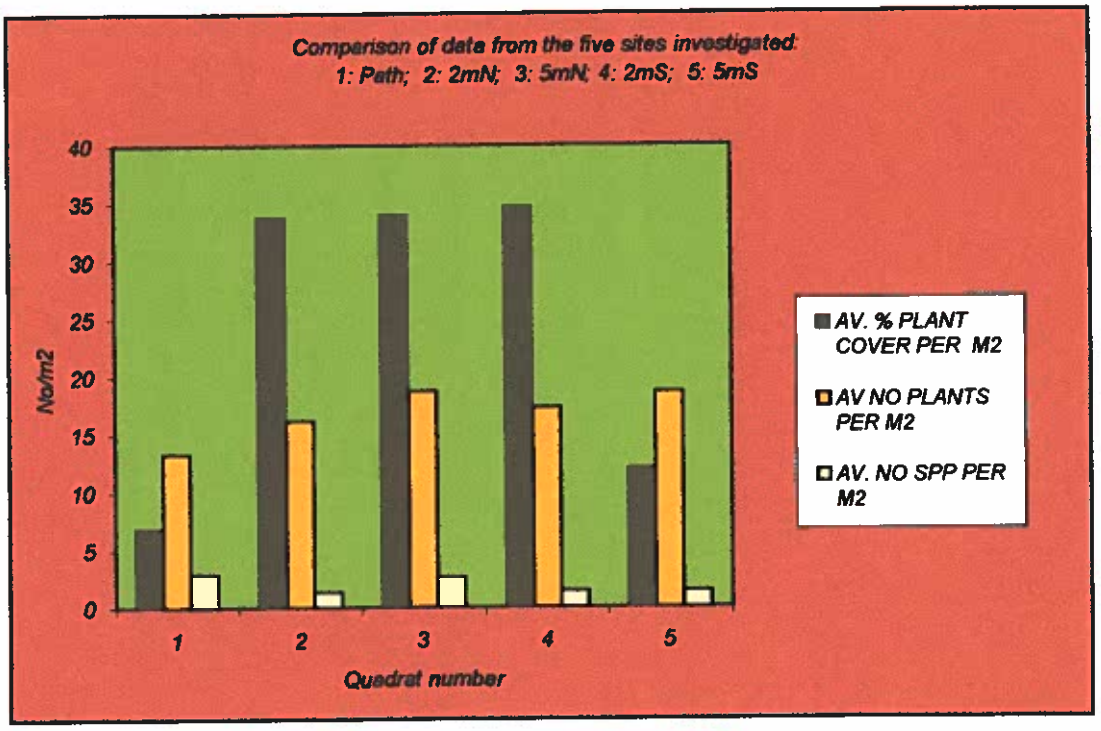
Table 2. List of samples of crypto biotic crust and lichen, and where collected from

Sample No.	Collected From	Description
1	Site 1, quad 1, 2m south (s) of path	Crypto biotic crust (crypto)
2	Site 1, quad 1, 5m s of path	Crypto
3	Site 1, quad 1, 5m s of path	Crypto
4	Site 1, quad 1, edge of path	Crypto
5	Site 1, quad 1, 2m north (n) of path	Crypto
6	Site 1, quad 1 5m n of path, nr water channel	Crypto
7	Site 2	Mature (castle shape) crypto
8	Quad 3, edge of path	Lichen
9	S-facing ledge above Site 2	'Pincushion' crypto
10	"	Crypto with lichen
11	"	Mature crypto
12	Cedar Mesa, above Road Canyon	5 different spp lichen
13	Cedar Mesa, above Road Canyon	3 samples of crypto

Table 3. List of plants identified at 3 areas in the region. * = Road Canyon; **= Cedar Mesa; * = Kane Gulch/Grand Gulch. Cedar Mesa and Kane/Grand Gulch were surveyed for potential future research, which could include comparisons between sites experiencing different levels of recreational use.**

FAMILY NAME	SPECIES	PLACE FOUND
Agavaceae	*Yucca larrimaniae*	*/**/***
	Yucca baccata	**/***
Apiaceae	*Cymopterus newberryi*	*
	Lomatium latilobum	**
Apocynacea	*Cycladenia humilis*	*
Asclepiadaceae	*Asclepias tuberosa*	*
Asteraceae	*Artemisia tridentata*	*/**/***
	Baileya spp (multiradiata?)	*
	Chrysothammus nauseosus	***
	Cirsium spp	***
	Erigeron divergans	*/***
	Erigeron pumilis	***
	Heterotheca villosa	*
	Machaeranthera tanacetifolia	*
	Malacothrix sonchoides	***
	Petrodoria pumila	*
	Senecio multilobatus	*/***
Berberidaceae	*Mahonia fremontii*	*/***
	Berberis repens	***
Boraginaceae	*Cryptantha flava*	*
	Lithospermum incisum	*/**/***
Brassicaceae	*Arabis perennans*	*
	Arabis pulchra	*
	Draba cuneifolia	*
	Erysinum asperum	*/**
	Lesquerella gordonii	*
	Physaria newberryi	*/***
	Streptanthus cordatus	**/***
	Thelypodiopsis elegans	*/**/***
Cactaceae	*Scelerocactus whipplei*	*/**
	Opuntia erindacea	*/**/***
	unidentified	***
Cupressaceae	*Juniperus osteosperma*	*
Elaeagnaceae	*Sheperdia rotundifolia*	*/**/***
Ephedraceae	*Ephedris viridis*	*
Fabaceae	*Astragalus ceramicus*	*
	Astragalus desperatus	**
	Lupinus pusillus	**
	Astragalus spp, unidentified	***
Fagaceae	*Quercus spp – various*	***
Nyctaginaceae	*Abronia fragrans*	*
Onagracea	*Oenothera pallida*	*
Pinaceae	*Pinus edulis*	*/**
	Pinus ponderosa	***
	various unidentified	***
Polemoniacea	*Leptodactylon watsonii*	*/**
	Phlox longifolia	*
	Phlox austromontana	*/**
Polygonaceae	*Rumex hymenosepalus*	*
	Erigonum alatum	***
Primulaceae	*Primula spp, unidentified*	*
Rosaceae	*Cerocarpus intricatus*	*
	Cerocarpus betuloides	*/**
	Rosa woodsii	***
Santalaceae	*Commandra umbellatum*	*
Saxifragaceae	*Fendlera rupicola*	***
Tamaricaceae	*Tamarix pentandra*	*/***
Typhaceae	*Typha latifolia*	*

Figure 1. Comparison of data using averages from the quadrat locations at all sites.



APPENDIX 2

Itinerary: The Project ran during the Easter vacation. The first 5 days were spent in Albuquerque, travelling to B.L.M office at Monticello, Utah, arranging final details of the fieldwork, buying supplies etc. The fieldwork took 15 days, including a stay at Kane Gulch Ranger Station for initial data collation and discussion of further research possibilities. The final 4 days were used to report back to B.L.M. and for the return journey to Albuquerque. This journey was made with a combination of a lift, car hire and Greyhound Bus.

Travel: Flew Edinburgh/Albuquerque; Greyhound Bus to Durango; car hire to Cortez; lift to Monticello. Reverse to return.

Accommodation: Lodging for 9 days; camping for 15; subsistence for all 24 days.

Equipment: Higher than anticipated expenditure on field guides and equipment (camping stove was confiscated en route by customs).

Budget:

Travel: Return flight, Edinburgh/USA:	£550
Vehicle rental	£300
Greyhound bus	£ 80
Insurance:	£160
Subsistence: 9 days lodging @ £40/d	£360
24 days subsistence @ £18/d	£432
Equipment (e.g. field guides, film, computer CDs)	£200
Petty cash (personal expenditure)	£130
Report production:	
(Film development, p/copy, postage)	£ 50
TOTAL	**£2262**

Sources of Funding:

Personal Contribution	£ 460
Davis Fund	£ 600
Weir Fund & Barnson Bequest	£ 900
James Rennie Bequest	£ 300
TOTAL	**£2260**

Assessment of Costs: Generous financial support from Edinburgh University Funding Committees made the expedition possible. Approaches to local companies and other possible sources were unsuccessful. Personal contribution was higher than budgeted. Total cost was £85 above forecast due to extra expenditure on equipment and subsistence. Travel was more difficult without a vehicle but hire costs were prohibitive.

Overall the accuracy of the financial forecast and the financial support received were very satisfactory.