

Tallan to on phones shit ( Or it me of ARCo COLORADO NATURAL AREAS PROGRAM Key Department of Natural Resources 1313 Sherman Street, Room-718 CIB Denver, Colorado 80203 (303) 866-33176597 DAVID W. KUNTZ Colorado 4/30 tural Areas Program Altheractor flease neucew the attacked draft plan and sead me your commente. Ole reulse the draffard we'll try towasp this thing up soan. Be sure to call me if un have any major problem. Shanks fre your help.



#### DRAFT

## OWL CANYON PINON GROVE FIRE MANAGEMENT PLAN

### PURPOSE OF FIRE MANAGEMENT PLAN

The purpose of the Owl Canyon Pinon Grove Fire Management Plan is to guide wildfire control, suppression, and management activities to achieve the approved management goals and objectives for the Owl Canyon Pinon Grove Natural Area. Prescribed burns will require separate prescribed burn plans prepared in cooperation with the Larimer County Sheriff's Department and the Colorado State Forest Service.

The objectives of the Owl Canyon Pinon Grove Natural Area Fire Management Plan are to:

- Conserve, perpetuate or restore the pinon grove to a condition which most nearly approximates a naturally functioning native plant community.
- Use the least environmentally damaging fire control actions as possible.
- Introduce prescribed fire in selected areas under strictly controlled conditions as appropriate to maintain natural ecological processes in the grassland and woodland communities.
- 4) Develop procedures and methods for designing and implementing a longterm prescribed burn plan within Owl Canyon Pinon Grove Natural Area to reduce the need for fire control and improve conditions for fire management.

#### AUTHORITY

The Colorado Division of Parks and Outdoor Recreation has management authority and responsibility for the Owl Canyon Pinon Grove Natural Area. The Larimer County Sheriff's Department has authority to control wildfires in Larimer County. The Larimer County Sheriff's Department will be the lead agency responsible for fire control at Owl Canyon Pinon Grove Natural Area. Larimer County will cooperate with the Colorado Division of Parks and Outdoor Recreation and the Colorado State Forest Service in implementing necessary and appropriate fire control measures.

### PREVENTION

Public access and use of Owl Canyon Pinon Grove Natural Area will be permitted and controlled by the Colorado Division of Parks and Outdoor Recreation. Information on the use, role and prevention of fire will be part of educational presentations to public users and visitors by the Division of Parks. Prescribed fires will be used as appropriate to reduce wildfire hazard.

Landowners and surface lessees of the state school lands within the designated natural area will employ all necessary, reasonable and prudent measures to prevent artificially ignited wildfires.

The Larimer County Sheriff's Department will be investigate the causes of all wildfires ignited on the designated natural area. Investigation reports will be available upon request from Larimer County to all landowners of the designated natural area.

#### FIRE CONTROL AND SUPPRESSION

General guidelines for approved fire control and suppression actions at Owl Canyon Pinon Grove Natural Area are the following:

- Larimer County Sheriff's Department is the fire response team leader and will coordinate all fire control and suppression activities on the designated natural area.
- 2) No mechanized equipment (e.g., bulldozers, backhoes, tractors) will be used in the pinon grove (wooded areas of the designated natural areas). Fire trucks and tankers can use existing roads on the state school section (limestone quarry area) to access fires in the designated natural area.
- 3) Low impact fire control techniques will be used on the designated natural area to minimize surface disturbance. Minimum impact techniques include limiting fires to grass fuel types, use of natural fire breaks, limited construction of hand fire lines and cutting of trees only where necessary to prevent loss of human life or destruction of property.
- Fire retardant use will be minimized. Retardant may be used primarily to prevent loss of human life or destruction of property.
- 5) A fire lane/break will be mowed and maintained by the Colorado Division of Parks and Outdoor Recreation inside the property fenceline on that portion of the designated natural area adjacent to U.S. Highway 287 (known as the Brackenbury property).
- 6) Preparation and implementation of a post-fire rehabilitation or reclamation plan is the responsibility of the Colorado Division of Parks and Outdoor Recreation. Local seed sources (from native plant species on the property) will be used for any re-seeding or re-stocking of native vegetation on the natural area following a fire.

7) Approval by the undersigned of these general guidelines for fire control and management at Owl Canyon Pinon Grove Natural Area constitutes agreement of these provisions.

#### PRESCRIBED FIRE

Prescribed fire will be used selectively, carefully and when appropriate as determined by the Owl Canyon Pinon Grove Natural Area Management Advisory Committee, Larimer County Sheriff's Department and Division of Parks and Outdoor Recreation. All prescribed burns will require specific prescribed burn plans. Each prescribed burn plan will (1) describe the treatment area, (2) list objectives of the burn, (3) list specifications for the burn, (4) include a completed pre-burn work checklist, (5) list public information and pre-burn contacts, (6) describe ignition procedures and organization, (7) specify environmental conditions and weather which will enable or preclude a burn from occurring, (7) describe appropriate on-site preparation on the day of the burn (test burn, briefing and communications, public and crew safety, escape contingency and medical response plan and post-fire mop-up and patrol) and (8) list equipment needed to conduct the burn.

### FIRE PLAN REVIEW AND REVISION

The Owl Canyon Pinon Grove Natural Area Fire Management Plan will be reviewed annually, in the context of the review of the Owl Canyon Pinon Grove Management Plan, by the the management advisory committee and recommendations made to landowners and the Colorado Division of Parks and Outdoor Recreation regarding any changes or revisions. The Colorado Division of Parks and Outdoor Recreation is responsible for coordinating with the appropriate state and county agencies to implement any changes in procedures, goals or responsibilities.

**APPROVED:** 

Colorado Division of Parks and Outdoor Recreation	Larimer County Sheriff's Department
Joe Maurier, Regional Manager	Richard E. Shockley, Sheriff
Colorado State Forest Service	Colorado Lien Company
Ray Mahaffrey, District Forester	Robert Shurger, President
Date:	

9395B

#### EXHIBIT A

# OWL CANYON PINYON GROVE NATURAL AREA (Division of Wildlife)

# Legal Description

All of that portion of Section 35, Township 10 North, Range 70 West, of the 6th P.M., lying north and east of the County Road, being 317 acres, more or less.



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# OWL CANYON PINON GROVE FIRE MANAGEMENT PLAN

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Joe Maurier, Regional Manager

Colorado State Forest Service

delete Ray Mahaffrey, District Forester Robert Shurger, President

Larimer County Sheriff's Department

Richard E. Shockley, Sheriff

Colorado Lien Company

Date:

9395B

MEMORANDUM OF CALL Previous editions usable TO: YOU WERE VISITED BY-OU WERE CALLED BY OF (Organization) PLEASE PHONE FTS AUTOVON WILL CALL AGAIN IS WAITING TO SEE YOU RETURNED YOUR CALL WISHES AN APPOINTMENT MESSAGE pm RECEIVED BY DATE TIME 63-110 NSN 7540-00-634-4018 STANDARD FORM 63 (Rev. 8-81) Prescribed by GSA FPMR (41 CFR) 101-11.6 \$ U.S.G.P.O.: 1990-254-312

Brackenberry / Owl Canyon Natural Area Plant List

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			Observed:	
Family	Genus	Species	5/22 6/7/87	5/89
Anacardiaceae	Rhus	trilobata	1	1
Apiaceae	Cymopterus	acaulis	1	0
Apiaceae	Cymopterus	montanus	1	0
Apiaceae	Harbouria	trachypleura	1	1
Apiaceae	Lomatium	orientale	1	0
Asteraceae	Artemisia	campestris	0	1
Asteraceae	Artemisia	dracunculus	0	1
Asteraceae	Artemisia	frigida	1	1
Asteraceae	Artemisia	ludoviciana	1	0
Asteraceae	Artemisia	tridentata	1	0
Asteraceae	Chrysothamnus	nauseosus	0	1
Asteraceae	Cirsium	sp.	1	0
Asteraceae	Erigeron	compositus	1	0
Asteraceae	Erigeron	pumilus	1	0
Asteraceae	Grindelia	sp.	0	1
Asteraceae	Gutierrezia	sarothrae	0	1
Asteraceae	Haplopappus	sp.	0	1
Asteraceae	Helianthus	pumilus	1	0
Asteraceae	Hymenopappus	filifolius	1	0
Asteraceae	Hymenoxys	acaulis	1	1
Asteraceae	Lygodesmia	sp.	1	0
Asteraceae	Senecio	canus	1	0
Asteraceae	Senecio	integerrimus	1	0
Asteraceae	Taraxacum	officinale	1	1
Asteraceae	Thelesperma	megapotanicum	1	0
Asteraceae	Townsendia	grandiflora	1	1
Asteraceae	Tragopogon	dubius	1	0
Boraginaceae	Cryptantha	jamesii	0	1
Boraginaceae	Cryptantha	thrysiflorus	1	1
Boraginaceae	Cryptantha	virgata	1	1
Boraginaceae	Cynoglossum	officinale	0	1
Boraginaceae	Lappula	redowskii	1	1
Boraginaceae	Lithospermum	incisum	0	1
Boraginaceae	Lithospermum	multiflorum	1	1
Brassicacaea	Sisymbrium	sp.	0	1
Brassicacaea	Stanleya	pinnata	0	1
Brassicaceae	Descurainia	pinnata	1	1
Brassicaceae	Descurainia	sophia	1	0
Brassicaceae	Erysimum	asperum	1	1
Brassicaceae	Lepidium	virginicum	0	1
Brassicaceae	Lesquerella	montana	1	1
Cactaceae	Opuntia	polyacantha	1	0
Cactaceae	Opuntia	sp.	1	0
Campanulaceae	Campanula	rotundifolia	1	0
Caprifoliaceae	Symphoricarpos	sp.	1	0
Caryophyllaceae	Arenaria	hookeri	1	1

Brackenberry / Owl Canyon Natural Area Plant List

			Obs	erved:	
Family	Genus	Species	5/22	6/7/87	5/89
Caryophyllaceae	Paronychia	jamesii		1	0
Convolvulaceae	Evolvulus	nuttallianus		1	0
Cyperaceae	Carex	filifolia		1	0
Cyperaceae	Carex	stenophylla		1	0
Euphorbiaceae	Euphorbia	robusta		1	1
Fabaceae	Astragalus	agrestis		1	0
Fabaceae	Astragalus	crassicarpus		1	0
Fabaceae	Astragalus	drummondii		1	1
Fabaceae	Astragalus	flexuosus		1	0
Fabaceae	Astragalus	gracilis		1	1
Fabaceae	Astragalus	shortianus		1	0
Fabaceae	Astragalus	spatulatus		1	0
Fabaceae	Astragalus	tridactylicus		0	1
Fabaceae	Dalea	candida		1	0
Fabaceae	Lupinus	sp.		0	1
Fabaceae	Melilotus	officinalis		1	0
Fabaceae	Oxytropus	lambertii		1	1
Fabaceae	Oxytropus	sericea		1	0
Fabaceae	Psoralea	tenuiflora		1	1
Fabaceae	Vicia	americana		1	0
Hydrophyllaceae	Phacelia	denticulata		0	1
Lamiaceae	Marrubium	vulgare		0	1
Lamiaceae	Scutellaria	brittonii		1	1
Liliaceae	Allium	textile		1	1
Liliaceae	Yucca	glauca		1	1
Liliaceae	Zygadenus	venenosus		1	1
Linaceae	Linum	lewisii		1	0
Loasaceae	Mentzelia	sp.		0	1
Malvaceae	Sphaeralcea	coccinea		1	1
Onagraceae	Gaura	coccinea		1	1
Onagraceae	Oenothera	albicaulis		0	1
Orobancaceae	Orobanche	fasciculata		1	0
Pinaceae	Pinus	edulis		1	1
Pinaceae	Pinus	ponderosa		0	1
Poaceae	Agropyron	dasystachyum		1	0
Poaceae	Agropyron	smithii		1	0
Poaceae	Aristida	sp.		1	0
Poaceae	Bouteloua	curtipendula		1	0
Poaceae	Bouteloua	gracilis		0	1
Poaceae	Bromus	tectorum		1	0
Poaceae	Koeleria	cristata		1	1
Poaceae	Koeleria	macrantha		0	1
Poaceae	Oryzopsis	hymenoides		1	1
Poaceae	Oryzopsis	micrantha		1	0
Poaceae	Poa	sp.		1	0
Poaceae	Schizachyrium	scoparium		1	0

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Brackenberry / Owl Canyon Natural Area Plant List

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		Observed:			
Family	Genus	Species	5/22	6/7/87	5/89
Poaceae	Sitanion	hystrix		1	0
Poaceae	Stipa	comata		1	1
Poaceae	Stipa	neomexicana		1	0
Poaceae	Stipa	sp.		0	1
Polemoniaceae	Ipomopsis	spicata		1	1
Polemoniaceae	Phlox	bryoides		1	1
Polygonaceae	Erigonium	alatum		1	0
Polygonaceae	Erigonium	effusum		1	1
Portulacaceae	Portulaca	oleracea		0	1
Ranunculaceae	Clematis	ligusticifolia		0	1
Ranunculaceae	Delphinium	geyeri		1	1
Ranunculaceae	Delphinium	sp.		1	0
Ranunculaceae	Ranunculus	ranunculinus		1	0
Rosaceae	Amelanchier	alnifolia		1	0
Rosaceae	Cercocarpus	montanus		1	1
Rosaceae	Galium	sp.		1	0
Rosaceae	Physocarpus	monogynus		1	0
Rosaceae	Potentella	hippiana		1	1
Rosaceae	Potentilla	pensylvanica		0	1
Rosaceae	Prunus	virginiana		1	0
Rosaceae	Rosa	sp.		1	0
Salicaceae	Populus	angustifolia		0	1
Salicaceae	Populus	deltoides		0	1
Santalaceae	Comandra	umbellata		1	0
Scrophularaceae	Linaria	dalmatica		0	1
Scrophulariaceae	Castilleja	sessiliflora		1	1
Scrophulariaceae	Penstemon	angustifolia		1	1
Scrophulariaceae	Penstemon	secundiflorus		1	1
Scrophulariaceae	Verbascum	thapsus		1	0
Sinopteridaceae	Cheilanthes	feei		0	1

### OWL CANYON PINYON GROVE NATURAL AREA

### PERMIT FOR USE

PERMIT APPLICANT:	PERMIT NO.
ADDRESS:	DATE:
PERMIT PERIOD:////	
SIZE OF GROUP:	
PERMIT DENIED:	
REASON FOR DENIAL:	

PERMIT APPROVED: \_\_\_\_\_\_ OTHER REFERRALS OR RECOMMENDATIONS: We request a single copy of any publication resulting from this permit.

Colorado State Forest Service Administrator

I have read and agree to the terms and conditions for use of the Owl Canyon Pinyon Grove Natural Area as set forth in the Application for Use Permit.

Appl	icant	s	Signature:	Dat	:e:
			0		

Applicant must sign Permit and present to the Holly Sugar Corporation or its operating contractor at the entrance to the Pinyon Grove,

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for Use Permit.

### OWL CANYON PINYON GROVE NATURAL AREA

## PERMIT FOR USE

PERMIT APPLICANT:	PERMIT NO
ADDRESS:	DATE:
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PERMIT PERIOD:////	
NO. OF VISITS:	
SIZE OF GROUP:	
PERMIT DENIED:	
REASON FOR DENIAL:	
PERMIT APPROVED:OTHER REFERE We request a single copy of any publication resulting	RALS OR RECOMMENDATIONS:
Colorado State Forest Service Administrator	
I have read and agree to the terms and condition Owl Canyon Pinyon Grove Natural Area as set forth in	ons for use of the h the Application

Applicant's	Signature:	Date:

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### APPLICATION FOR USE PERMIT

## OWL CANYON PINYON GROVE NATURAL AREA

APPLICANT:	
GROUP REPRESENTED:	
ADDRESS: City	State Zip
PHONE:	
PERIOD OF TIME FOR WHICH PERMIT IS REQUESTED: //	/_/
EXPECTED NUMBER OF VISITS:SIZE OF GROUP	an and the state of the state o
Describe intended use, research or observations to be m	nade:
1. Purpose:	
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<pre>2. Specific Objectives:</pre>	
3. Methods:	

Except by special permission, the applicant agrees to remove all evidence of human activity created by the applicant or applicant's group before expiration of the permit and to report any irregularities to the Colorado State Forest Service. The applicant and the applicant's group holds the following: the Department of Natural Resources (including the Colorado Natural Areas Program, the Colorado Natural Areas Council and the State Board of Land Commissioners), the Colorado State Forest Service, and Evan and Catherine Roberts, and Holly Sugar Corporation and its operating contractor harmless from any and all liability or claims from damages that may arise from access to and use of the Owl Canyon Pinyon Grove Natural Area.

Applicant's Signature Date:

Submit to: Colorado State Forest Service Colorado State University Fort Collins, Colorado 80523

## APPENDIX D BRACKENBERRY & OWL CANYON PINYON GROVE NATURAL AREA

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PERMIT APPLICANT:	PERMIT NO
ADDRESS:	DATE:
PERMIT PERIOD: / / - /	
PERMIT DENIED: REASON FOR DENIAL:	
PERMIT APPROVED:	OTHER REFERRALS OR RECOMMENDATIONS:
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APPL	ICANT:			
GROU	P REPRESENTED:			
ADDF	ESS:Street	City	State	Zip
PHON	IE:			
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PERI	OD OF TIME FOR WHICH PERMIT	IS REQUESTED: / /	/	/
EXPE	CTED NUMBER OF VISITS:	SIZE OF GROUP		
Desc	ribe intended use, research	or observations to be mad	le:	
1.	Purpose:			
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Applicant's Signature\_\_\_\_\_Date:\_\_\_\_Date:\_\_\_Date:\_\_\_Date:\_\_\_Date:\_\_\_Date:\_\_\_Date:\_\_\_Date:\_\_\_Date:\_\_Date:\_Date

Submit to: Colorado State Forest Service Colorado State University Fort Collins, Colorado 80523

## APPLICATION FOR USE PERMIT **BRACKENBERRY** & OWL CANYON PINYON GROVE NATURAL AREA

APPLICANT:	FSENTED.	2	*	
ADDRESS:	Street	City	<u> </u>	710
PHONE:		UTCy	State	210
PERIOD OF	TIME FOR WHICH PERMIT IS	S REQUESTED: _/_/_	/	/
EXPECTED N	UMBER OF VISITS:	SIZE OF GROUP		
Describe i	ntended use, research or	r observations to be ma	de:	
1. Purpos	se:			
				_
2. Specif	fic Objectives:			
3. Method	is:			_

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Applicant's Signature Date:\_\_\_\_\_

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Submit to: Colorado State Forest Service Colorado State University Fort Collins, Colorado 80523

## APPENDIX D BRACKENBERRY & OWL CANYON PINYON GROVE NATURAL AREA

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PERMIT APPLICANT:	PERMII NO.
ADDRESS:	DATE:
PERMIT PERIOD:///	
NO. OF VISITS:	
SIZE OF GROUP:	
PERMIT DENIED:	
REASON FOR DENIAL:	
PERMIT APPROVED: OTHER RE	FERRALS OR RECOMMENDATIONS:
Colorado State Forest Service Administrator	
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Applicant's Signature:	Date:

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ROBERT SCHURGER PRESIDENT

> P.O. Box 440 Rapid City, SD 57709 605-342-7224



A Division of Pete Lien & Sons, Inc.

NON-METALLIC MINERALS MATTHEW J. SHURGER Quarry Supervisor

Box 1961 Fort Collins, Colo. 80522 Ft. Collins Office (303) 493-6294 Mobile (303) 222-0171 Home (303) 669-3677

# APPLICATION FOR USE PERMIT BRACKENBERRY & OWL CANYON PINYON GROVE NATURAL AREA

APPL	_ICANT:			
GROI	JP REPRESENTED:	-		
ADDI	RESS:Street	City	State	Zip
PHO	NE:			
PER	IOD OF TIME FOR WHICH PERMIT	IS REQUESTED: / /	- /	/
EXPI	ECTED NUMBER OF VISITS:	SIZE OF GROUP		_
Des	cribe intended use, research	or observations to be m	ade:	
1.	Purpose:			<u></u>
2.	Specific Objectives:			_
3.	Methods:			_
			Area	
Exc of exp Sta fol Nat Boa Eva con may	ept by special permission, th human activity created by the iration of the permit and to te Forest Service. The appli lowing: the Department of Na ural Areas Program, the Color rd of Land Commissioners), th n and Catherine Roberts, and tractor harmless from any and arise from access to and use	ne applicant agrees to r e applicant or applicant report any irregulariti icant and the applicant atural Resources (includ rado Natural Areas Counc ne Colorado State Forest Holly Sugar Corporation d all liability or claim e of the Owl Canyon Piny	remove all ev 's group bef es to the Co s group hold ling the Colo cil and the S c Service, an and its ope and its ope from damag	idence fore lorado ls the prado tate d erating ges that ural Are

Applicant's Signature Date:

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## APPLICATION FOR USE PERMIT BRACKENBERRY & OWL CANYON PINYON GROVE NATURAL AREA

APPL	ICANT:			
GROL	JP REPRESENTED:	5.		
ADD	RESS:	City	State	Zin
PHO	IE:	City	State	219
PER	IOD OF TIME FOR WHICH PERMIT	IS REQUESTED: / /	/	/
EXPI	ECTED NUMBER OF VISITS:	SIZE OF GROUP_		
Des	cribe intended use, research	or observations to be m	made:	
1.	Purpose:			
				_
2.	Specific Objectives:			
3.	Methods:			
Exc	ept by special permission, th	ne applicant agrees to	remove all ev	idence
of exp	human activity created by the iration of the permit and to	e applicant or applican report any irregularit	t's group bef ies to the Co	fore Dorado
Sta	te Forest Service. The appli lowing: the Department of Na	cant and the applicant	's group hold	is the prados
Nat	ural Areas Program, the Color rd of Land Commissioners) th	rado Natural Areas Coun	cil and the S	State
Eva	n and Catherine Roberts, and	Holly Sugar Corporatio	n and its ope	erating
may	arise from access to and use	e of the Owl Canyon Pin	yon Grove Nat	cural Are

Applicant's Signature \_\_\_\_\_ Date:\_\_\_\_\_

Submit to: Colorado State Forest Service Colorado State University Fort Collins, Colorado 80523 APPENDIX D BRACKENBERRY & OWL CANYON PINYON GROVE NATURAL AREA

PERMIT FOR USE

PERMIT APPLICANT:	PERMIT NO
ADDRESS:	DATE:
PERMIT PERIOD:///	
NO. OF VISITS:	
SIZE OF GROUP:	
PERMIT DENIED.	
REASON FOR DENIAL:	
PERMIT APPROVED: OTHER REFER	RALS OR RECOMMENDATIONS:
Colorado State Forest Service Administrator	
I have read and agree to the terms and conditi Owl Canyon Pinyon Grove Natural Area as set forth i for Use Permit.	ons for use of the n the Application
Applicant's Signature:	Date:
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Applicant must sign Permit and present to the Holly its operating contractor at the entrance to the Pin	Sugar Corporation or yon Grove,

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## APPENDIX D BRACKENBERRY & OWL CANYON PINYON GROVE NATURAL AREA

## PERMIT FOR USE

PERMIT APPLICANT:	PERMIT NO
ADDRESS:	DATE:
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NO. OF VISITS:	/
SIZE OF GROUP:	
PERMIT DENIED:	
REASON FOR DENIAL:	
PERMIT APPROVED:	OTHER REFERRALS OR RECOMMENDATIONS:
Colorado State Forest Service Administrator	
I have read and agree to the te Owl Canyon Pinyon Grove Natural Area for Use Permit.	erms and conditions for use of the as set forth in the Application
Applicant's Signature:	Date:

Applicant must sign Permit and present to the Holly Sugar Corporation or its operating contractor at the entrance to the Pinyon Grove,



#### ROBERT SCHURGER PRESIDENT

P.O. Box 440 Rapid City, SD 57709 605-342-7224

### APPENDIX D BRACKENBERRY & OWL CANYON PINYON GROVE NATURAL AREA

### PERMIT FOR USE

PERMIT APPLICANT: G.A. Perkins	PERMIT NO. 91-1
ADDRESS: P.D. Box 2397	DATE: 3/15/91
Fort Collins (2 80522	-
PERMIT PERIOD: 3/16/91 - 4/27/91	
NO. OF VISITS: <u>4</u>	
SIZE OF GROUP: 3	
PERMIT DENIED:	
REASON FOR DENIAL:	

PERMIT APPROVED: 3/15/91 - 3 OTHER REFERRALS OR RECOMMENDATIONS: We request a single copy of any publication resulting from this permit.

Colorado State Forest/Service Administrator

I have read and agree to the terms and conditions for use of the Owl Canyon Pinyon Grove Natural Area as set forth in the Application for Use Permit.

Applicant's	Signature:	AA	Rutin	Date:
	-			And the second design of the s

Applicant must sign Permit and present to the Holly Sugar Corporation or its operating contractor at the entrance to the Pinyon Grove,

APPLICATION FOR USE PERMIT BRACKENBERRY & OWL CANYON PINYON GROVE NATURAL AREA

APPLICANT: J.A. Perkins (Ilen) GROUP REPRESENTED: FRont community College Hicheology 298 ADDRESS: P.O Box 2397 Ft. Collins 60 80522 Street City State Zip PHONE: 226-2500 EK304 PERIOD OF TIME FOR WHICH PERMIT IS REQUESTED: 3 /16/91 - 4/22/9/ EXPECTED NUMBER OF VISITS: 3-4 SIZE OF GROUP 3 Describe intended use, research or observations to be made: Purpose: <u>Photo yraph</u> Johnson Site & Teepee <u>Rings Looking for A</u> 2. Specific Objectives: <u>observe</u> how C. U. did field At Johnson Site 3. Methods: Photographs Visual Observation

Except by special permission, the applicant agrees to remove all evidence of human activity created by the applicant or applicant's group before expiration of the permit and to report any irregularities to the Colorado State Forest Service. The applicant and the applicant's group holds the following: the Department of Natural Resources (including the Colorado Natural Areas Program, the Colorado Natural Areas Council and the State Board of Land Commissioners), the Colorado State Forest Service, and Evan and Catherine Roberts, and Holly Sugar Corporation and its operating contractor harmless from any and all liability or claims from damages that may arise from access to and use of the Owl Canyon Pinyon Grove Natural Area.

Applicant's Signature Date: 3.6.9/

Submit to: Colorado State Forest Service Colorado State University Fort Collins, Colorado 80523

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APPLICATION FOR USE PERMIT BRACKENBERRY & OWL CANYON PINYON GROVE NATURAL AREA

APPLICANT: <u>M. A.</u> <u>Perkins</u> <u>(4/en.)</u> GROUP REPRESENTED: <u>FRont community</u> <u>College</u> <u>Archeology</u> 298 ADDRESS: <u>P.O Box</u> <u>2397</u> <u>Ft. Collins</u> <u>GO</u> <u>80522</u> Street <u>City</u> State Zip
PHONE: 226-2500 EK304
PERIOD OF TIME FOR WHICH PERMIT IS REQUESTED: 3 /16/91 - 4/22/9/
EXPECTED NUMBER OF VISITS: <u>3-4</u> SIZE OF GROUP <u>3</u>
Describe intended use, research or observations to be made:
1. Purpose: <u>Photo yraph Johnson site &amp; Teepee</u> <u>Rings Looking for A</u> Possible Monolith Site
2. Specific Objectives: observe how C. U. did field
At Johnson Site 3. Methods: Photographs Visual

Except by special permission, the applicant agrees to remove all evidence of human activity created by the applicant or applicant's group before expiration of the permit and to report any irregularities to the Colorado State Forest Service. The applicant and the applicant's group holds the following: the Department of Natural Resources (including the Colorado Natural Areas Program, the Colorado Natural Areas Council and the State Board of Land Commissioners), the Colorado State Forest Service, and Evan and Catherine Roberts, and Holly Sugar Corporation and its operating contractor harmless from any and all liability or claims from damages that may arise from access to and use of the Owl Canyon Pinyon Grove Natural Area.

Applicant's Signature Sulan Date: 3.6.91

Submit to: Colorado State Forest Service Colorado State University Fort Collins, Colorado 80523

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		BRACKEN	BERRY	&	
OWL	CANYON	PINYON	GROVE	NATURAL.	AREA

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PERMIT FOR USE

PERMIT APPLICANT:Aaron Martenson	90-4 PERMIT NO
ADDRESS: 2534 Lanyon Drive	DATE: 10/24/90
Longmont, CO 80503	
PERMIT PERIOD: $10 / 29 / 90 - 11 / 02 / 90$	
NO. OF VISITS: <u>one (1) day</u>	
SIZE OF GROUP:ONE	
PERMIT DENIED:	
PERMIT APPROVED: <u>10/24/90</u> OTHER REFER Furnish a	RALS OR RECOMMENDATIONS: copy of the completed study to
R'a mehaffen Colorado State Forest Service Administrator For CO	trict Forester lding 1052 othills Campus rt Collins, 80523
I have read and agree to the terms and conditi Owl Canyon Pinyon Grove Natural Area as set forth i for Use Permit.	ons for use of the In the Application

Applicant's Signature:

Date:

Applicant must sign Permit and present to the Holly Sugar Corporation or its operating contractor at the entrance to the Pinyon Grove,

## APPLICATION FOR USE PERMIT BRACKENBERRY & OWL CANYON PINYON GROVE NATURAL AREA

APPLICANT: Aaron Martenson						
GROUP REPRESENTED: University of Northern Colorado						
ADDR	RESS: 2534 Lanyon Drive Street	Longmont, City	CO 80503 State Zip			
PHON	4E :					
PERI	IOD OF TIME FOR WHICH PERMIT IS I	REQUESTED: <u>10 /29 /90</u>	) <u>- 11/02/90</u>			
EXPE	ECTED NUMBER OF VISITS:	ne SIZE OF GROUP	one			
Desc	cribe intended use, research or o	observations to be m	ade:			
1.	Purpose: <u>Conduct a research p</u> in Pinyon pine at Owl Canyon	<u>roject on "Census of</u> Pinyon Grove.	seeds per cone			
2.	Specific Objectives:					
3.	Methods:					

Except by special permission, the applicant agrees to remove all evidence of human activity created by the applicant or applicant's group before expiration of the permit and to report any irregularities to the Colorado State Forest Service. The applicant and the applicant's group holds the following: the Department of Natural Resources (including the Colorado Natural Areas Program, the Colorado Natural Areas Council and the State Board of Land Commissioners), the Colorado State Forest Service, and Evan and Catherine Roberts, and Holly Sugar Corporation and its operating contractor harmless from any and all liability or claims from damages that may arise from access to and use of the Owl Canyon Pinyon Grove Natural Area.

Applicant's Signature\_\_\_\_\_ Date:\_\_\_\_\_

Submit to: Colorado State Forest Service Colorado State University Fort Collins, Colorado 80523

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## APPENDIX D BRACKENBERRY & OWL CANYON PINYON GROVE NATURAL AREA

#### PERMIT FOR USE

PERMIT NO. 90-5
DATE: 10/1/90
m.

PERMIT APPROVED: <u>10/1/90</u> OTHER REFERRALS OR RECOMMENDATIONS: Ecology Field Trip. Future requests should be made at least 2 weeds in advance of use date.

Colorado State Forest Service

Administrator

I have read and agree to the terms and conditions for use of the Owl Canyon Pinyon Grove Natural Area as set forth in the Application for Use Permit.

Applicant's	Signature:	Semt	a.	Clauke	Date: 10	-1-90

Applicant must sign Permit and present to the Holly Sugar Corporation or its operating contractor at the entrance to the Pinyon Grove,

Page 2

OWL CANYON PINYON GROVE NATURAL AREA

PERMIT FOR USE

 

 PERMIT APPLICANT:
 Brian Heils for Colorado Native Plant Society
 PERMIT NO. 90-2

 Fort Collins Chapter
 DATE: 6/1/90

Fort Collins CO 80522

PERMIT PERIOD: 6 / 1 / 90 - 10/ 31 / 90

NO. OF VISITS: 6

SIZE OF GROUP: 10-15

PERMIT DENIED:

REASON FOR DENIAL:

PERMIT APPROVED: XX OTHER REFERRALS OR RECOMMENDATIONS: We request a single copy of any publication resulting from this permit.

Raymond S. Muhaffey, Sr. - KRP

Colorado State Forest Service Administrator

I have read and agree to the terms and conditions for use of the Owl Canyon Pinyon Grove Natural Area as set forth in the Application for Use Permit.

Applicant's	Signature:	Date:

Applicant must sign Permit and present to the Holly Sugar Corporation or its operating contractor at the entrance to the Pinyon Grove,

Page 2

### APPLICATION FOR USE PERMIT

OWL CANYON PINYON GROVE NATURAL AREA

APPLICANT: F. L. KNORF
GROUP REPRESENTED: US FISH + WILDLIFS SERVICE /Nat. ECOLOGY RES. CENTER
ADDRESS: 4512 McMuklay fr Guios Co 50528-3400 Street City State Zip
PHONE: 226 9462
PERIOD OF TIME FOR WHICH PERMIT IS REQUESTED: 614 190 - 190
EXPECTED NUMBER OF VISITS: 58-10 SIZE OF GROUP
Describe intended use, research or observations to be made:
1. Purpose: Conduct Survey of BREEDING BIRDS
2. Specific Objectives: Document avan assemblage
RELATIVE TO OTHER GEOGRAPHIC LOCATIONS
3. Methods: NONDESTRUCTIVE. IDENTIFY BIRD SPECIES
DURING SLOW-MOVING, WALKING TRANSEGS.

Except by special permission, the applicant agrees to remove all evidence of human activity created by the applicant or applicant's group before expiration of the permit and to report any irregularities to the Colorado State Forest Service. The applicant and the applicant's group holds the following: the Department of Natural Resources (including the Colorado Natural Areas Program, the Colorado Natural Areas Council and the State Board of Land Commissioners), the Colorado State Forest Service, and Evan and Catherine Roberts, and Holly Sugar Corporation and its operating contractor harmless from any and all liability or claims from damages that may arise from access to and use of the Owl Canyon Pinyon Grove Natural Area.

Applicant's Signature

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Date: 6

Submit to: Colorado State Forest Service Colorado State University Fort Collins, Colorado 80523

### OWL CANYON PINYON GROVE NATURAL AREA

## PERMIT FOR USE

PERMIT APPLICANT: Fritz L. Knopf USF&WS	PERMIT NO. 90-1
ADDRESS: 4512 McMurray Avenue	DATE: 6/1/90
Fort Collins CO 80525-3400	
PERMIT PERIOD: 6 / 4 / 90- 6 / 22 / 90	
NO. OF VISITS: 8-10	
SIZE OF GROUP: 1	
PERMIT DENIED:	
REASON FOR DENIAL:	

PERMIT APPROVED:  $\chi\chi$  OTHER REFERRALS OR RECOMMENDATIONS: We request a single copy of any publication resulting from this permit.

Raymond S. Muhaffey

Colorado State Forest Service Administrator

I have read and agree to the terms and conditions for use of the Owl Canyon Pinyon Grove Natural Area as set forth in the Application for Use Permit.

Applicant's	Signature:	AL	K-	1	Date;	6-1-90
		P				

Applicant must sign Permit and present to the Holly Sugar Corporation or its operating contractor at the entrance to the Pinyon Grove,

JUN 15 1990

## APPLICATION FOR USE PERMIT

OWL CANYON PINYON GROVE NATURAL AREA

APPLICANT: Brian W. Geils GROUP REPRESENTED: Colorado Native Plant Society ADDRESS: P.O. Box 200 Fort Collins, Co State PHONE: 482-8607 / 498-1247

PERIOD OF TIME FOR WHICH PERMIT IS REQUESTED: 6/l/90 - 10/31/90EXPECTED NUMBER OF VISITS: 3 SIZE OF GROUP 10-15Describe intended use, research or observations to be made:

1. Purpose: Complete a floristic iventory of OCPENA

plants during 2. Specific Objectives: identify flowering uly and tugest habitit's and ance 3. Methods: Visit a number d y and list those plants in or atheringe identifyoble

Except by special permission, the applicant agrees to remove all evidence of human activity created by the applicant or applicant's group before expiration of the permit and to report any irregularities to the Colorado State Forest Service. The applicant and the applicant's group holds the following: the Department of Natural Resources (including the Colorado Natural Areas Program, the Colorado Natural Areas Council and the State Board of Land Commissioners), the Colorado State Forest Service, and Evan and Catherine Roberts, and Holly Sugar Corporation and its operating contractor harmless from any and all liability or claims from damages that may arise from access to and use of the Owl Canyon Pinyon Grove Natural Area.

Date: June 10, 1990 Applicant's Signature

Submit to: Colorado State Forest Service Colorado State University Fort Collins, Colorado 80523

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OWL CANYON PINYON GROVE NATURAL AREA

PERMIT FOR USE Brian Weils for PERMIT APPLICANT: Colorado Native Plant Society PERMIT NO. 90-2 Fort Collins Chapter ADDRESS: PO Box 200 DATE: 6/1/90 Fort Collins CO 80522 PERMIT PERIOD: 6 / 1 / 90 - 10/ 31 / 90 NO. OF VISITS: 6 SIZE OF GROUP: 10-15 PERMIT DENIED: \_\_\_\_\_\_ REASON FOR DENIAL: \_\_\_\_\_

PERMIT APPROVED: <u>XX</u> OTHER REFERRALS OR RECOMMENDATIONS: We request a single copy of any publication resulting from this permit.

Raymond 2. Mehaffey, Jr. - KRP

Colorado State Forest Service Administrator

I have read and agree to the terms and conditions for use of the Owl Canyon Pinyon Grove Natural Area as set forth in the Application for Use Permit.

Sum W. Di Date: June (0, 6990) Applicant's Signature:

Applicant must sign Permit and present to the Holly Sugar Corporation or its operating contractor at the entrance to the Pinyon Grove,

JUN 1 0 1990 CSFS-SO and the second 2. S. S. M.

ASAP P.O box 200 FC. 60 82522 MEMORANDUM OF CALL Previous editions usable TO 4981247 @ dok YOU WERE CALLED BY-YOU WERE VISITED BY-OF (Organization) Oul Canyon Permit PLEASE PHONE FTS AUTOVON Colo. Native Plant Society WILL CALL AGAIN IS WAITING TO SEE YOU RETURNED YOUR CALL WISHES AN APPOINTMENT MESSAGE Rocky Mt- Station ( Campeur) Brian Geils Period: 5/15-10/31/89 Perdopin list of nation plants to and in area. had pen 63-110 NSN 7540-00-634-4018 STANDARD FORM 63 (Rev. 8-81) Prescribed by GSA FPMR (41 CFR) 101-11.6 \*U.S.GPO:1987-0-196-343/79063

Need (89-) her permit vez similier to 822 permit. New new or ottechy

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# APPLICATION FOR USE PERMIT

### OWL CANYON PINYON GROVE NATURAL AREA

APPLICANT: (s) Derek Marchi, Betsy Neely, Judy Von Ahlefeldt, Carol Brandt, Brian Geils

GROUP REPRESENTED: Colorado Native Plan Society, Fort Collins Chapter

ADDRESS: PO Box 200 Fort Collins CO 80521 Street City State Zip PHONE: 493-1247

PERIOD OF TIME FOR WHICH PERMIT IS REQUESTED: 5 /1 / 89 -11 / 1 / 89

EXPECTED NUMBER OF VISITS: 1/month SIZE OF GROUP 10-15

Describe intended use, research or observations to be made:

1. Purpose: To compile a complete species list of the plants growing

in the Owl Canyon-Brackenbury State Natural Area

2. Specific Objectives: Identify those plants growing in the Owl

<u>Canyon Pinyon Grove, compiling a species list. This data will be</u> given to the State Natural Areas Program.

3. Methods: The majority of our work will be sight identification as

we walk through the pinyon grove. If the plant cannot be identified in the field, we will collect the plant to be identified at the CSU Herbarium, where it will be archived as a voucher specimen. Only frugal collecting will be allowed.

Except by special permission, the applicant agrees to remove all evidence of human activity created by the applicant or applicant's group before expiration of the permit and to report any irregularities to the Colorado State Forest Service. The applicant and the applicant's group holds the following: the Department of Natural Resources (including the Colorado Natural Areas Program, the Colorado Natural Areas Council and the State Board of Land Commissioners), the Colorado State Forest Service, and Evan and Catherine Roberts, and Holly Sugar Corporation and its operating contractor harmless from any and all liability or claims from damages that may arise from access to and use of the Owl Canyon Pinyon Grove Natural Area.

Applicant's Signature\_\_\_\_\_Date:\_\_\_\_\_

Submit to: Colorado State Forest Service Colorado State University Fort Collins, Colorado 80523

### OWL CANYON PINYON GROVE NATURAL AREA

# PERMIT FOR USE

PERMIT APPLICANT: Colorado Native Plant Society	FERMIT NO. 89/1		
ADDRESS: PO Box 200	DATE: 5/18/89		
Fort Collins CO 80522			
FERMIT PERIOD: 5 / 1/ 89- 11/ 1/ 89			
NO. OF VISITS:6			
SIZE OF GROUP: 10-15			
PERMIT DENIED:			
REASON FOR DENIAL:			
PERMIT APPROVED: 5/18/89 OTHER REFERE	ALS OR RECOMMENDATIONS:		

Colorado State Forest Service Administrator

. . . . . .

I have read and agree to the terms and conditions for use of the Owl Canyon Pinyon Grove Natural Area as set forth in the Application for Use Permit.

Applicant's	Signature:	Date:	
Applicant's	Signature:	Date:	

Applicant must sign Permit and present to the Holly Sugar Corporation or its operating contractor at the entrance to the Pinyon Grove, **University of Wisconsin-Parkside** Box No. 2000 Kenosha, Wisconsin 53141

Division of Science Telephone: 414 553-2326

Collins doctant JUN 21 1989 Owl Conyon

May 16, 1989

Tom Owens Colorado State Forest Service Colorado State University Fort Collins, CO 80523

Dear Mr. Owens:

I obtained permission to core ponderosa or pinyon trees in your forest back on August 4, 1984. The isotopic study of the growth rings from your site along with a number of other sites has been completed and has now been published. Enclosed is a reprint of the publication for your files. The site from your forest is designated "Owl Canyon" in the isotopic chronology.

Thank you very much for your assistance in the project. The contribution of cores from your pine has made this the most complete isotopic chronology in the world to date.

Sincerely,

~ W. Leavitt

Steven W. Leavitt Assistant Professor Department of Geology 414–553–2503

SWL/eb Enc.



# STABLE CARBON ISOTOPE CHRONOLOGIES FROM TREES IN THE SOUTHWESTERN UNITED STATES

Steven W. Leavitt

Department of Geology, University of Wisconsin-Parkside, Kenosha

Austin Long

Department of Geosciences, University of Arizona, Tucson

Abstract. Plant fixation of CO2 and subsequent incorporation of this carbon into growth rings is the basis for attempts to use tree rings to reconstruct <sup>13</sup>C/<sup>12</sup>C ratios (δ<sup>13</sup>C) of atmospheric carbon dioxide. Accurate 813C chronologies of atmospheric CO<sub>2</sub> are important to distinguishing biospheric and fossil fuel CO2 inputs to the atmosphere. We have sampled 14 sites in the American Southwest, pooling four cores from each of four trees at most of the sites. Cellulose from pooled 5-year ring groups was analyzed to develop  $\delta^{13}C$  chronologies for each of the sites. The 10 pinyon (Pinus edulis, P. monophylla) chronologies, plus two additional pinyon chronologies formed from groups of sites where single trees had been analyzed, were examined in detail. Significant correlations of differences in successive values of ring width indices and  $\delta^{13}C$ (first differences) were used to "correct" each chronology for climate influences primarily responsible for high-frequency fluctuation. The master corrected  $\delta^{13}C$  chronology reveals an overall decrease of 1.2-1.4‰ from 1700 to present, greater than the atmospheric change expected from fossil fuel CO2 inputs alone and comparable to that measured in ice cores. The biospheric CO<sub>2</sub> input to the atmosphere implicated in this chronology is greatest is the nineteenth and early twentieth centuries. High-frequency fluctuations in the chronologies appear dominantly related to climate (drought).

### INTRODUCTION

In the interest of better understanding the global carbon cycle, a chronology of atmospheric carbon dioxide changes would be extremely valuable. It appears that analysis of gases

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Paper number 8J0421. 0886-6236/88/008J-0421\$10.00 trapped in cryosphere ice provides both atmospheric CO<sub>2</sub> and  $\delta^{13}$ C chronologies, although with a time resolution of perhaps decades because of circulation of air through ice for a number of years until the bubbles become isolated [Friedli *et al.*, 1986]. Other proxy measures seem worthy of continued scrutiny to verify ice core results and/or provide greater time resolution. The  $\delta^{13}$ C chronologies as derived from tree rings (or ice cores) will ideally provide a means of helping sort out biospheric versus fossil fuel carbon dioxide contributions to the atmosphere.

Tree rings, however, are complex interactive, rather than passive, monitors of atmospheric  $\delta^{13}$ C. Francey and Farquhar [1982] have demonstrated that the  $\delta^{13}$ C values of tree rings may not simply reflect those of atmospheric CO<sub>2</sub>, but may also be affected by atmospheric CO2 concentration, rate of carbon fixation and stomatal conductance. Some of these factors affecting  $\delta^{13}C$  of growth rings may in turn be affected by climatic conditions. These influences on plant isotope fractionation may be responsible for the wide variations in trends of  $\delta^{13}C$  chronologies derived from tree rings [Leavitt and Long, 1983; Peng et al., 1983]. For the past several years we have been collecting and analyzing  $\delta^{13}C$  of growth rings from trees in the southwestern United States, dominantly pinyon pinyon pine. Nine single-tree chronologies have already been discussed in Leavitt and Long [1985] and five pooled-tree chronologies have been described in Leavitt and Long [1986]. In this paper we present eight additional new pooled-tree chronologies, provide important details about sampling and analysis, examine evidence of climate influence on these chronologies and the degree of that influence, and develop a master 813C chronology for the southwestern United States from the pinyon.

### METHODS

In general, we selected sites where the Laboratory of Tree-Ring Research at the University of Arizona had already estab-

lished dendrodated pinyon (Pinus edulis and P. monophylla) growth ring chronologies. At each pinyon site we normally selected 8-12 trees which we sampled with four orthogonal cores per tree, usually north, south, east and west, but sometimes adjusted for branches, irregularities in the trunk, and other obstacles. The area over which the trees were sampled was typically about 1-2 ha over which soils, soil parent material, moisture, slope, aspect and elevation were uniform. We attempted to sample free-standing trees, or at least trees that were much taller than closest neighbors. The sites were all located in low population density areas, frequently National Forests, so that local pollution effects (CO<sub>2</sub>, ozone, SO<sub>2</sub>, etc.) would be minimal. Although we did not have site histories and life histories of the sampled trees to determine possible disturbances, recent results of Leavitt and Long [1987b] on nonpinyon pine species suggest that effects of fire, deforestation and defoliation have relatively minor influence on the  $\delta^{13}$ C chronologies from tree rings.

Cores were dried and surfaced with successively finer grit until finished with 400 grit sandpaper. Personnel of the Laboratory of Tree-Ring Research dated the cores and in most cases measured individual ring widths. For those cores which were ultimately analyzed isotopically, we calculated the mean cumulative widths of each 5-year ring group. For four of the pinyon sites (Ozena, Hawthorne, Mimbres, Owl Canyon) ring widths from all trees sampled (whether included in the pooled sample for isotopic analysis or not) were used to calculate ring width indices with the INDEX program of the Laboratory of Tree-Ring Research (Don Graybill edition). This program fits growth curves (usually negative exponential) to each ring width time series and then calculates indices as the ratio of actual ring width to curve value for each year. The program subsequently merges these into a master set of indices as the average of all trees. We calculated mean ring width indices for each pentad from this master ring width index chronology produced by INDEX. For the other six pinyon sites we simply used the master index chronologies which had already been developed by the Laboratory of Tree-Ring Research during past projects.

Of the 8-12 pinyon trees sampled at each site, we selected the four "best" to pool into a single, representative [Leavitt and Long, 1984] series of samples for analysis. This subjective choice was based on balancing qualities including the degree to which the tree was free-standing, the apparent health and vigor of the tree, the age of the tree, whether dating was complete for all radial directions, absence of bud scars, and the degree to which rings were missing or the ring series was too "tight" to physically work with. Ideally, we strived for equal age trees at each site so that possible "juvenile" effects in the early part of the younger trees would not be pooled in with rings from the mature growth stage of older trees, but given the diverse factors to contend with in selecting the "right" trees, this was rarely the case (Table 1). To minimize any possible juvenile effects in the pooled chronology, rings from the earliest 40-50 years (8-10 pentads) of each tree were excluded from the composite site sample. Material from some cores was excluded before reaching the inside 50 years if an inordinate amount of ring boundary curvature in a given core was producing a disproportionately large contribution to the pooled sample.

Pentads (in the sequence ...1700–1704, 1705–1709, 1710– 1714...) were cut from each of the 16 cores at each site (four cores from the four selected trees) with a razor knife under a binocular microscope, and pooled into the composite sample for isotopic analysis. For the Ozena site, only two cores from each of the four trees were pooled. For a few pentads, ring groups from each tree were processed and analyzed separately to determine the range of isotopic variation among trees at each site. For the  $\delta^{13}$ C time series, a mass-weighted  $\delta^{13}$ C value was calculated from these separate tree values. (When pooling prior to analysis each tree (or core) really contributes to the measured  $\delta^{13}$ C in proportion to its mass, and therefore when analyzing each tree separately, we must mass weight  $\delta^{13}$ C values in order to calculate a mean comparable to that of the pooled samples.)

All wood was ground in a mill and extracted sequentially with 2:1 toluene:ethanol, then 100% ethanol in a soxhlet. We boiled the extracted wood in distilled water, then bleached it to (holo-)cellulose in a 70°C acetic acid acidified solution to which sodium chlorite was added to decompose lignin in the method of Green [1963].

Although our pinyon network contains one site (Ozena) which was approximately 50 km from the Pacific, we collected additional sites (other species) along the California coast to determine if there might be isotopic differences between our more "continental" sites relative to the coastal sites. The Prewitt *P. ponderosa* site did not date dendrochronologically, so we simply took the cores from one of the older trees, and pooled the four cores (which cross-dated with one another) in pentads based on ring counting. The Mount Laguna *P. jeffreyi* and Figueroa *P. ponderosa* samples were dated but fewer cores were taken per tree so that the Mount Laguna chronology represents two trees with two cores per tree and the Figueroa chronology comprises four trees with two cores per tree.

### RESULTS

### Raw $\delta^{13}$ C Chronologies

The pinyon sites where cores were pooled from four trees per site are shown in Figure 1 as solid circles. Each of the two open circle locations (north central and northeast Arizona (NCAZ and NEAZ)) actually represents the average of four sites analyzed in an earlier stage of research [Leavitt and Long, 1985] where a single tree was sampled at nine different sites. Although separated by tens of kilometers, two groups of four sites fell within two of the major climatological subdivisions of Arizona, so we averaged each group of four to get chronologies representative of each cluster.

Figure 2 displays the  $\delta^{13}$ C chronologies for the 10 pinyon sites where four trees have been pooled. The first five of these have been previously presented in Leavitt and Long [1986]. Figure 3 contains the two pinyon chronologies (NCAZ, NEAZ) that were derived from averaging four single-tree site records. Generally, all the chronologies show trends of constant  $\delta^{13}$ C prior to about 1800 and decreasing thereafter. In some cases (notably Lower Colonias and Hawthorne), increasing  $\delta^{13}$ C values in the earliest part of the chronologies may be attributable to juvenile effects in the older trees. The size of the post-1800 decrease is as much as 2‰ at the Alton site but perhaps just 0.2 to 0.3‰ at the Cerro Colorado site. This ,

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Tree Number	Contribution of Each Core to Pooled Sample	Earliest Dated Year from Tree
	Kane, 1490–1983, Pinus edulis, 1956 m elevation	
7	1500-1983(F) 1510-1983(N) 1540-1983(SW)	1488
8	1495-1983(S), 1505-1983(N), 1520-1983(E), 1565-1983(W)	1490
9	1490–1983(N.E), 1500–1983(S), 1510–1983(W)	1486
10	1490-1983(S), 1495-1983(E), 1505-1983(N), 1570-1983(W)	1485
	Alton, 1520–1983, Pinus edulis, 2245 m elevation	
1	1620–1949(W), 1630–1939(S), 1645–1983(E), 1670–1983(N)	1617
3	1520-1983(N,E), 1555-1983(S), 1520-1579/1600-1983(W)	1480
4	1740-1983(N), 1795-1969(S), 1800-1983(E), 1815-1983(W)	1722
7	1610–1983(W), 1655–1983(E), 1715–1983(S), 1725–1983(N)	1601
	Dry Canyon, 1615–1983, Pinus edulis, 2150 m elevation	
6	1660-1983(N.S.F.) 1660-1969(W)	1622
7	1750–1983(N.S.E.W)	1714
8	1625 - 1983(N, S, E, W)	1600
10	1625–1983(E,W), 1630–1983(N,S)	1611
	Lower Colonias, 1655–1983, Pinus edulis, 2375 m elevation	
1	1705-1983(N,E), 1710-1983(W), 1715-1983(S)	1680
6	1655-1983(N,S,W), 1670-1983(E)	1640
7	1725–1983(N,S,E,W)	1690
8	1755–1983(N,E), 1760–1983(S), 1765–1983(W)	1746
	Aztec, 1710–1983, Pinus edulis, 2080 m elevation	
3	1710-1983/N S F W)	1677
4	1735_1983(N S F W)	1712
7	1735-1983(N S F W)	1720
10	1735–1983(N,E,W), 1735–1954(S)	1720
	Cerro Colorado, 1650–1983, Pinus edulis, 2500 m elevation	
4	1720-1983(S.E), 1675-1983(N.W)	1670
5	1770-1983(S,E), 1795-1983(N,W)	1740
6	1700-1983(N,E,W), 1750-1754(S)	1690
8	1630–1983(N,W), 1610–1983(S), 1620–1983(E)	1605
	Ozena, 1750–1983, Pinus monophylla, 1370 m elevation	
3	1765–1983(E), 1750–1983(W)	1748
10	1810–1983(E,W)	1773
11	1760–1983(N), 1755–1983(S)	1750
12	1770–1983(E), 1750–1983(W)	1748
	Hawthorne, 1620–1983, Pinus monophylla, 2330 m elevation	
1	1700–1983(N.S.E.W)	1673
2	1700-1884/1890-1983(NW), 1700-1983(SE.NE), 1735-1983(SW)	1660
4	1605-1983(N), 1705-1983(S), 1740-1983(E), 1630-1983(W)	1600
8	1620-1904(N), 1620-1983(S,W), 1630-1983(E)	1616

# TABLE 1. Pentad Contributions from Each Tree and Each Core to the Pooled Samples from Which $\delta^{13}C$ Chronologies Were Derived

Tree Number	Contribution of Each Core to Pooled Sample	Earliest Dated Year from Tree
	Mimbres, 1790–1983, Pinus edulis, 2025 m elevation	
2	1880-1983(N.S.E.W)	1849
6	1840-1983(N), 1900-1983(S), 1895-1983(E), 1840-1983(W)	1810
7	1790-1983(N,S), 1885-1983(E), 1800-1974(W)	1790
8	1800–1983(N,S), 1880–1983(E), 1790–1983(W)	1785
	Owl Canyon, 1600–1984, Pinus edulis, 1860 m elevation	
3	1730-1984(N.S.E.W)	1690
5	1730-1984(N.S.E.W)	1689
8	1660-1984(N,S,W), 1680-1984(E)	1569
9	1600–1984(N,E,W), 1610–1984(S)	1619
	Figueroa, 1860–1983, Pinus ponderosa, 1280 m elevation	
1	1870-1983(N), 1865-1983(S)	1862
2	1880-1983(N), 1890-1983(S)	1879
4	1885–1983(E,W)	1881
8	1870-1983(N), 1860-1983(S)	1857
	Mount Laguna, 1800–1983, Pinus jeffreyi, 1880 m elevation	
7	1845–1983(N), 1815–1983(S)	1815
8	1815–1983(N), 1800–1983(S)	1799
	Prewitt, 1820(?)-1983, Pinus ponderosa, 1000 m elevation	
13	1830–1984(N), 1820–1944(S), 1820–1984(E), 1825–1944(W)	1820(?)

Table 1 (continued)

N, S, E, W, etc. refer to the direction from which the cores were taken on the trunk.

dissimilarity is not currently explainable in terms of some obvious climatic differences among sites. As discussed for bristlecone pine results [Long, *et al.*, 1987], there is the possibility that changing atmospheric CO<sub>2</sub> produces an additional effect on tree  $\delta^{13}$ C which is dependent on altitude. However, we find no evidence that the flat or the steep pinyon isotope chronologies somehow correspond to elevational differences. In all cases, high-frequency variability is superimposed on these long-term trends, and inspection of the chronologies indicates numerous minima and maxima are common to many sites. This high-frequency variability provides the key to climate effects on the chronologies as discussed later.

Figure 4 depicts the mean of all 12 pinyon sites produced after first "normalizing" each chronology as the time series of isotopic differences with respect to its 1800–1849  $\delta^{13}$ C mean. The period 1800–1849 was chosen because it is common to all pinyon chronologies and it is early in the industrial period when related pollution effects should be minimal. The vertical bars are ±1 standard deviation of the scatter about the mean. For most points in Figure 4 after 1700, vertical bars representing 2 standard errors about the mean would be about 0.1 to 0.3‰ less than the 1 standard deviation values depicted, so the means actually have much less uncertainty than would appear from cursory inspection. This mean chronology shows a drop of about 1–1.2‰ from the pre-1800 period to the present. The scatter bars between about 1750 to 1900 are fairly small, but in the post-1900 period they are notably larger, indicating the trends become increasingly diverse over the most recent 80 years. This may be a consequence of pollution or some type of disturbance effects becoming more important with time. For comparison, the mean normalized chronology from all 10 Arizona juniper trees (sites) of Leavitt and Long [1983] for the period 1930–1979 is included in Figure 4. There is a similarity of overall trend with the pinyon results and a match of the 1940–1944 minimum and 1950–1954 maximum.

The individual nonpinyon coastal site chronologies are displayed in Figure 5 and their mean at the bottom of Figure 4. Although these trees were generally very large, they were in favorable growth sites and therefore their ages are fairly young compared to most of the pinyon in more stressed environments. They show a range of  $\delta^{13}$ C decreases from 1860 to the present, from about 1.5‰ at Figueroa to 3‰ at the Prewitt site. High-frequency fluctuations are associated with all three



Fig. 1. Map of site locations including pinyon sites where cores from four trees have been pooled prior to analysis (solid circles) and pinyon sites where  $\delta^{13}$ C chronologies from four trees from different sites were averaged (open circles). Three nonpinyon sites are also located (triangles).

sites but there is little correspondence to the maxima and minima of the pinyon chronologies. For several reasons, we have chosen not to include these in the additional analysis to which the pinyon were subjected. First, the Prewitt site did not dendrodate so we have no ring width indices, and our  $\delta^{13}C$ chronology consists of only one tree. Second, the Mount Laguna site only consists of two trees. Third, although the Mount Laguna and Figueroa sites apparently did dendrodate, these are sites where dating chronologies had not been previously developed by the Laboratory of Tree-Ring Research so there is greater potential for dating errors in these sites than the pinyon sites. Fourth, these ponderosa and Jeffrey pine sites tend to be more mesic than the pinyon sites. Because of these circumstances, these last three  $\delta^{13}C$  chronologies may not be as representative of the trends of their respective sites as are the pinyon chronologies. Furthermore, because of the short length of the pinyon chronologies, two of three cannot be normalized to a 1800-1849 mean which was the reference period used for the pinyon.

### Climate Influence

Our experience with pinyon pine has been that climate is contributing to the  $\delta^{13}$ C curves, primarily in relation to the high-frequency fluctuations rather than the long-term trends. With the single trees sampled from nine sites in Arizona [Leavitt and Long, 1985], we found good correlations of  $\delta^{13}$ C with ring widths and ring width indices. The  $\delta^{13}$ C correlations with ring width indices were uniformly negative, indicating that periods of poor growth correspond to elevated  $\delta^{13}$ C values. In the American Southwest, narrow growth rings (small ring width indices) usually represent growth limited by high temperature and/or low precipitation, i.e., drought [Fritts, 1976]. When the first five of the pooled-tree pinyon sites were analyzed (Kane, Alton, Dry Canyon, Lower Colonias, Aztec), we



Fig. 2. The  $\delta^{13}$ C chronologies of 10 pinyon sites where cores from four trees have been pooled prior to analysis. Overall precision for cellulose preparation, sample combustion and isotopic analysis is estimated to be  $\pm 0.1$ ‰.

tested them for relationships with climate [Leavitt and Long, 1986]. Specifically, we examined relationships of  $\delta^{13}$ C with measures of drought, namely the Palmer Hydrological Drought Indices (PHDI) that are available for climate subdivisions of each state for the period 1931 to 1982 [Karl *et al.*, 1983]. We found strong inverse relationships between  $\delta^{13}$ C and PHDI, indicating drought periods correspond with elevated  $\delta^{13}$ C values. This is consistent with the  $\delta^{13}$ C ring width index



Fig. 3. The  $\delta^{13}$ C chronologies produced by averaging two groups of four  $\delta^{13}$ C chronologies representing eight sites where only single trees were sampled [Leavitt and Long, 1985].



Fig. 4. Mean  $\delta^{13}$ C chronology of 12 pinyon sites produced after first normalizing each chronology to differences with regard to their respective 1800–1849  $\delta^{13}$ C means. Vertical bars are ± 1s of scatter and numbers at bottom indicate the number of sites in the mean. For comparison, the normalized (to the 1930– 1979 mean) mean  $\delta^{13}$ C chronology of 10 Arizona juniper trees of Leavitt and Long [1983] is shown, along with the mean of the three nonpinyon coastal sites of this study (normalized to the 1800–1849 mean for Mount Laguna, to 1820–1849 for Prewitt, and to 1850–1879 for Figueroa.

correlations previously observed, and may be explained as a consequence of drought decreasing stomatal conductance, resulting in a smaller pool of CO<sub>2</sub> for photosynthesis and reduced ability of the plant to discriminate against <sup>13</sup>CO<sub>2</sub> relative to <sup>12</sup>CO<sub>2</sub> [Francey and Farquhar, 1982]. Because the record of PHDI is relatively short there is a good chance of reconstructing drought from the  $\delta^{13}$ C time series [Leavitt and Long, 1987a], but limited potential of "correcting" the isotopic time series for climate influence with PHDI. In fact, reconstruction and mapping of "drought" using the  $\delta^{13}$ C chronologies indicate a good correspondence of high  $\delta^{13}$ C values with drought as expressed as PHDI or PDSI (Palmer Drought Severity Index) [Leavitt and Long, 1987a].

Table 2 gives the correlation coefficients (r) for  $\delta^{13}$ C versus ring width, ring width index, and PHDI, to give an idea of how well the long-term trends compare. Correlations are also given for first differences (time series of differences in successive values of the original time series) of  $\delta^{13}C$  with ring width, ring width index, and PHDI, which provide a better indication of their relation to high-frequency fluctuations and generally show less autocorrelation than the original time series [Ezekiel and Fox, 1959]. For some sites the number of data points for the index correlations is slightly smaller than that of the ring width correlations because we used indices previously determined for the sites by the Laboratory of Tree-Ring Research some 5-15 years prior to our sample collection. For the width and index correlations it is very clear that there is stronger correspondence of first differences than for the original time series, suggesting that the short-term fluctuations are being influenced by the same factors that influence ring growth in the Southwest, i.e., climate. All correlations are negative, indicating elevated  $\delta^{13}$ C values correspond to periods of limited growth such as might be associated with drought conditions.

Although there are not as many significant correlations of  $\delta$  versus PHDI and  $\Delta\delta$  versus  $\Delta$ PHDI, perhaps because there are

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many fewer data for comparison, for all sites the relationships are indeed inverse. Overall, the correlation coefficients indicate the  $\delta^{13}C$ -climate relationships are far from perfect, but they are quite consistent considering that (1) these  $\delta^{13}C$  measurements are on 5-year ring groups when each ring in the group likely has different 813C values so that small rings are contributing proportionately less to the  $\delta^{13}$ C analysis, and (2) we are using 5-year mean ring width indices and 5-year cumulative ring widths for comparison. Other factors that may prevent stronger correlations would include factors other than climate which could also influence the carbon fixation rate/stomatal conductance ratio, such as light (and shading), nutrients and site disturbances. Because most of these other influences are beyond our ability to compensate for, we have only these ring width and index correlations with which to correct our pinyon chronologies for climate effects.

We have specifically taken the  $\Delta\delta$  versus  $\Delta$ ring width index regression equations for each of the pinyon sites to "correct" the  $\delta^{13}$ C time series for the effects of climate as contained in these ring width indices. Even after reduction of degrees of freedom for effects of autocorrelation (not shown) as described by Ezekiel and Fox [1959], all these relationships are still significant at P<.01. For each  $\delta^{13}$ C chronology, a "climate correction" value for each pentad was computed by determining the differences between the ring width index and the average ring width index (=1.000) and then using the regression coefficients to convert this index difference into a  $\delta^{13}$ C value. These  $\delta^{13}$ C-climate corrections were then added to the  $\delta^{13}$ C values of the original isotopic time series. With those sites using the older ring width index chronologies, for pentads 1970–1974, 1975–1979 and/or 1980–1983 where no index was available,



Fig. 5. The  $\delta^{13}$ C chronologies from three coastal sites where *P. ponderosa* (Figueroa and Prewitt) and *P. jeffreyi* (Mount Laguna) were sampled.

**0.33(99)	***0 50/08				
	0.50(98)	**0.27(96)	***0.62(95)	***0.93(11)	***0.90(10)
0.05(93)	***0.31(92)	*0.18(92)	***0.38(91)	0.48(11)	**0.75(10)
*0.21(72)	***0.48(71)	***0.45(70)	***0.51(69)	0.47(11)	*0.60(10)
**0.27(66)	***0.50(65)	***0.51(63)	***0.69(62)	0.09(11)	**0.63(10)
**0.70(55)	*0.27(54)	0.11(52)	***0.41(51)	***0.83(11)	***0.77(10)
**0.28(67)	***0.66(66)	***0.41(64)	***0.54(63)	**0.68(11)	0.41(10)
**0.34(47)	***0.62(46)	***0.52(47)	***0.70(46)	0.46(11)	0.42(10)
0.10(73)	***0.70(72)	***0.45(73)	***0.63(72)	***0.75(11)	0.39(10)
0.27(39)	***0.49(38)	**0.37(39)	***0.49(38)	0.49(11)	0.22(10)
*0.19(77)	***0.49(76)	*0.22(77)	***0.39(76)	0.41(11)	0.24(10)
		***0.48(57)	***0.58(56)	***0.86(11)	0.39(10)
		***0.52(51)	***0.64(50)	0.50(11)	**0.70(10)
	0.05(93) *0.21(72) **0.27(66) **0.70(55) **0.28(67) **0.34(47) 0.10(73) 0.27(39) *0.19(77)	0.05(93) ***0.31(92)   *0.21(72) ***0.48(71)   **0.27(66) ***0.50(65)   **0.28(67) **0.66(66)   **0.34(47) ***0.62(46)   0.10(73) ***0.70(72)   0.27(39) ***0.49(38)   *0.19(77) ***0.49(76)	0.05(93) ***0.31(92) *0.18(92)   *0.21(72) ***0.48(71) ***0.45(70)   **0.27(66) ***0.50(65) ***0.51(63)   **0.70(55) *0.27(54) 0.11(52)   **0.28(67) ***0.66(66) ***0.41(64)   **0.34(47) ***0.62(46) ***0.52(47)   0.10(73) ***0.70(72) ***0.45(73)   0.27(39) ***0.49(38) **0.37(39)   *0.19(77) ***0.49(76) *0.22(77)    ***0.48(57) ***0.52(51)	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$

TABLE 2.	Correlation Coefficients (r) Between 813C Chronologies and Variou	s
Clim	te-Related Parameters and Between Their First Differences ( $\Delta$ )	

The number of cases (n) is given in parentheses and all r values are negative.

\*P<0.10, \*\*P<0.05, and \*\*\*P<0.01, but the significance does not include adjustment for autocorrelation, which reduces degrees of freedom (see text).

we simply inserted the original  $\delta^{13}C$  values into this new, corrected chronology.

Each corrected chronology was then normalized to its 1800-1849 mean, and the chronologies were averaged to produce Figure 6. The overall trend is not substantially different from that in Figure 4 with a total drop of about 1-1.2‰ from 1800 to 1983. The major changes in the corrected chronology are found in the damping of the high-frequency fluctuations to about two thirds or less of the amplitudes they show in Figure 4, producing a much smoother curve. The scatter about the mean values is still highest in the post-1900 period, indicating differences in ring width indices (representing climate effects at each site) are not responsible for this late divergence of chronologies. However, we did not attempt any climate correction of the long-term trend beyond whatever may have been accomplished in these efforts which emphasized the high-frequency fluctuations. We do not have long-term site climate data to attempt such a correction and our proxy climate ring width indices have a mean of 1.000 and are not useful proxies of long-term climate trends.

#### COMPARISON AND INTERPRETATION

Because the "climate-corrected" chronology in Figure 6 represents 48 trees, it is one of the most substantial produced to date. Only the chronology of Freyer [1986] has compiled more trees (up to about 60 over a 30-year portion of the time series), but this includes nine Arizona pinyon trees (sites) of Leavitt and Long [1985], eight of which are included in the time series presented here. Both Freyer [1986] and Freyer and Belacy [1983] show a  $\delta^{13}$ C drop substantially larger than that presented here, more on the order of  $1.5-2\infty$ . However, the Freyer time series show a slightly elevated  $\delta^{13}$ C value or at least an inflection in the curve about 1950, which corresponds to a maximum in Figure 6 at about the same time. This isotopic maximum may then represent a real global atmospheric effect, and indeed there is a corresponding local maximum in the  $\delta^{13}$ C time series derived from ice cores and atmosphere (Friedli *et al.*, 1986).

The Stuiver *et al.* [1984] and Stuiver [1986] tree ring isotopic time series which have been normalized to ring area show a  $\delta^{13}$ C drop from pre-1850 to 1980 of about 1‰, closer to our post-1800 result of about 1–1.2‰. The Stuiver time series also show elevated values at about 1950, 1900 and 1600, in line with the maxima seen in our chronology.

The decreasing  $\delta^{13}$ C of the pinyon chronology, however, stands in marked contrast to the Southern Hemisphere tree ring results of Francey [1981], who found the  $\delta^{13}$ C trend in Tasmanian trees to be fairly flat over the past 150–200 years. Three of four  $\delta^{13}$ C chronologies from Chilean trees [Stuiver *et al.*, 1984] also tend to be flat-trending, with the exception showing a  $\delta^{13}$ C drop of about 1‰ from 1800 to 1980. These differences in trend between the Northern and Southern Hemisphere chronologies are not understood. On one hand, we know the  $\delta^{13}$ C of CO<sub>2</sub> in the Southern Hemisphere has been decreasing, but most of the trees sampled thus far do not show it. On the other hand, a  $\delta^{13}$ C decrease is seen in most of the Northern Hemisphere trees, but there is probably greater potential for man-induced influences to confuse the issue, per-



Fig. 6. Mean, normalized, ring-width-index-corrected  $\delta^{13}C$  chronology representing 12 pinyon sites. Site contributions are the same as those depicted in Figure 4.

haps exemplified by the increased post-1900 scatter about the mean in the pinyon chronology. This study cannot resolve this discrepancy, but the pinyon results show compatibility to other independent atmospheric measurements.

The  $\delta^{13}$ C drop as measured directly from atmospheric CO<sub>2</sub> between 1956 and 1978 by Keeling *et al.* [1979, 1980] is 0.65‰. In Figure 6, the drop from the 1955–1959 value to the 1975–1979 value is 0.24‰, but given the size of the scatter bars a drop of 0.65‰ cannot be excluded. If, however, the drop from the 1950–1954 value to the 1980–1983 value is considered, the difference from Figure 6 is 0.69‰, corresponding much more closely to the Keeling measurements.

Finally, Figure 6 may be compared directly to the results of Friedli *et al.* [1986] who estimate an overall 1800 to 1980 decrease of  $1.14 \pm 0.15\%$  based on direct measurements from CO<sub>2</sub> of ice cores together with the direct atmospheric measurements of Keeling *et al.* [1979, 1980]. This is quite similar to the  $\delta^{13}$ C drop represented in Figure 6: about 1.2‰ from 1800 to present and about 1.4‰ from 1700 to present. Both curves show the greatest portion of the drop from the late nineteenth century onward.

Although a formal smoothed curve (running mean, spline or polynomial) to filter the remaining high-frequency variation has not been calculated, the curve in Figure 6 is simple enough so that as a first approximation a smooth curve may be fit by eye (Figure 7). Several interpretations may then be made with regard to the carbon cycle if we assume such a curve does actually represent the  $\delta^{13}C$  of atmospheric CO<sub>2</sub>. The pre-1800 (1600–1800) "baseline" mean  $\delta^{13}C$  value is slightly higher (about 0.2‰) than the 1800–1849 mean to which the chronologies were normalized. This suggests that even by 1800 there had been an isotopic decrease, perhaps attributable to a preindustrial biospheric input.

Because the Peng *et al.* [1983] carbon cycle model indicates a  $\delta^{13}$ C decrease to 1900 of only about 0.1‰ (dashed line in Figure 7), and the smoothed curve shows a decrease of about 0.3 to 0.5‰ from the pre-1800 baseline to 1900, a substantial biospheric input is inferred prior to 1900, and the deconvolution by Siegenthaler and Oeschger [1987] calculated this to be equivalent to a cumulative biospheric production of about 40 GT carbon(1 GT =  $10^{15}$  g). After the early 1900s in Figure 7, the fossil fuel contribution becomes progressively larger, and the biospheric contributions decrease to a small value by 1980.

If the maxima at 1900 and 1950 and minima just prior to each are real atmospheric changes and not climatic artifacts for which we were unable to correct, then there were pronounced surges in biospheric CO2 contributions just prior to 1900 and again from 1910 to about 1940, and enhanced biospheric growth (elevated  $\delta^{13}$ C) at about 1900 and again at 1950–1960. In the latter case, Elliott et al. [1985] do not find evidence for a large biospheric sink in their analysis of post-1958 Mauna Loa CO2 measurements. Oeschger and Stauffer [1986] and Pearman et al. [1986], however, feel the ice core CO2 results indicate a major biospheric source for the late nineteenth and early twentieth centuries. The maxima and minima in the 1600s and 1700s may likewise reflect a natural variation in atmospheric CO2 as related to fluctuations in the size of the biosphere. Oeschger and Stauffer [1986] have suggested that such natural CO2 variations about the pre-industrial baseline operating on decadal time scales may exist as related to El Niño or some other influence.



Fig. 7. Curve in Figure 6 to which a best fit line (solid) has been drawn by eye. The fossil fuel  $\delta^{13}$ C contribution to the atmosphere as determined by Peng *et al.* [1983] is indicated with the dashed line, beginning at a value of 0 in 1800.

It is not currently clear whether the remaining short-term fluctuations in Figure 6 are climate-induced or not. If they are an effect of climate on plant fractionation but not on global CO<sub>2</sub>, then a smoothed curve as in Figure 7 may be appropriate but it does not match the 1956-1978 measured drop of  $\delta^{13}$ C of CO<sub>2</sub> (0.65‰). If climate effects have indeed been removed so that the best fit line should fit all the remaining maxima and minima, this will better match the 1956-1978  $\delta^{13}$ C drop but it means there has been substantial variation of atmospheric  $\delta^{13}$ C about its mean value, the large size of which may be unrealistic for atmospheric changes on such short time scales. If one looks at the  $\Delta\delta$  versus  $\Delta$ index correlation coefficients whose regression coefficients were used to correct the isotopic time series, the r<sup>2</sup> values indicate that typically about 20-50% of the variability can be explained by these relationships. Contribution to the balance of the variability could be from other climatic factors, environmental factors, or even real changes in atmospheric CO<sub>2</sub> and  $\delta^{13}$ C of CO<sub>2</sub>.

### SUMMARY AND CONCLUSIONS

The results presented here represent perhaps the most systematic investigation of tree ring  $\delta^{13}$ C chronologies from a single region in the world, strengthened by the "depth" of sampling (number of trees and cores per tree) from each of the sites. We tend to discount the three nonpinyon coastal chronologies because of reservations on dating or the degree to which they are truly representative of the trees at their sites. However, we have much greater confidence in the pinyon results and we have drawn the following conclusions from our pinyon analysis:

1. The 12 pinyon  $\delta^{13}$ C time series are concordant with respect to high-frequency fluctuations which are common among most chronologies, but there is some discordance in regard to the long-term trends which show varying degrees of decline from the preindustrial period to the present.

2. The short-term fluctuations in the pinyon chronologies appear related to climate as evidenced by their significant correlations with ring width indices and drought indices. The variations in long-term trends do not appear attributable to differences in climate between the sites, to site distance from the Pacific Ocean, or to some effect of elevation on  $CO_2$  concentrations and plant fractionation.

3. Although each pinyon chronology probably represents its site accurately because of the sampling procedures, when the chronologies are averaged there is still significant scatter about the means. This scatter about the means from 1800 to 1900 is fairly small ( $1s = \pm 0.2$  to 0.3‰) but it is substantially larger after 1900 ( $1s = \pm 0.4$  to 0.6‰). This indicates the increasing dissimilarity of trends toward the present, per-

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4. The  $\Delta\delta$  versus  $\Delta$ ring width index regression provided a means of correcting the isotope chronologies for the effects of climate. This correction smooths out the mean normalized isotopic curve by reducing high-frequency fluctuations, rather than producing a clear alteration of the long-term trend.

5. Despite questions about the suitability of tree rings to reconstruct atmospheric  $\delta^{13}$ C, the climate-corrected mean  $\delta^{13}$ C curve shows a post-1700 drop of about 1.2–1.4‰, which is quite similar to the decrease of 1.14 ± 0.15‰ reconstructed from ice core measurements by Friedli *et al.* [1986]. A maximum around 1950 in the pinyon curve is approximately coincident with one seen in the ice core measurements.

6. The climate-corrected curve (assuming it represents the atmospheric  $\delta^{13}$ C chronology) is strong evidence for a preindustrial biospheric CO<sub>2</sub> contribution to the atmosphere. This contribution continues into the late nineteenth and early twentieth centuries, but appears to have decreased to a small contribution (if any) by 1980.

7. It is presently not clear whether the remaining high-frequency fluctuations in Figure 6 are related to some unaccounted climate effects outside the realm of our ring-widthindex-derived correction factors, or whether they actually represent short-term  $CO_2$  fluctuations.

Acknowledgments. Numerous people have contributed to this long-term project. Many public and private agencies have provided both permission and assistance in sampling, including many U.S. Department of Agriculture National Forests (Dixie, San Juan, Carson, Los Padres, Cibola, Santa Fe, Toiyabe, Gila, Cleveland, Apache-Sitgreaves, Coconino, Tonto, and Prescott), the U.S. Department of Interior Bureau of Land Mangement (Grand Gulch Primitive Area), the Colorado State Forest Service Owl Canyon Pinyon Grove Natural Area, the Navajo Indian Reservation, the Nature Conservancy Santa Cruz Island Project, and the University of California-Santa Barbara. Various phases of sample preparation and analysis were assisted by R. Kalin, R. Sweeney, C. Endrezzi, C. Stevens, and especially L. Warneke and S. L. Cheng. Sample dating, ring width measurements and ring width index generation were promoted or performed by W. Robinson, J. Dean, D. Bowden and T. Harlan of the Laboratory of Tree-Ring Research at the University of Arizona. We are grateful for support by the U.S. Department of Energy through subcontract 19X-22290C from Oak Ridge National Laboratory/Martin Marietta Systems.

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S. W. Leavitt, Department of Geology, University of Wisconsin-Parkside, Box 2000, Kenosha, WI 53141.

A. Long, Department of Geosciences, University of Arizona, Tucson, AZ 85721.

(Received January 26, 1988; revised June 2, 1988; accepted June 2, 1988.)

### OWL CANYON PINYON GROVE NATURAL AREA

### PERMIT FOR USE

PERMIT APPLICANT: Fritz L. Knopf USF&WS	PERMIT NO. 90-1
ADDRESS: 4512 McMurray Avenue	DATE: 6/1/90
Fort Collins CO 80525-3400	
PERMIT PERIOD: 6/4/90-6/22/90	
NO. OF VISITS: 8-10	
SIZE OF GROUP: 1	
PERMIT DENIED:	
REASON FOR DENIAL:	

PERMIT APPROVED:  $\chi\chi$  OTHER REFERRALS OR RECOMMENDATIONS: We request a single copy of any publication resulting from this permit.

Raymond L. Mehaffey, gr.

Colorado State Forest Service Administrator

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I have read and agree to the terms and conditions for use of the Owl Canyon Pinyon Grove Natural Area as set forth in the Application for Use Permit.

Applicant's	Signature:	Date:	
	•		

Applicant must sign Permit and present to the Holly Sugar Corporation or its operating contractor at the entrance to the Pinyon Grove,

OWL CANYON PINYON GROVE NATURAL AREA

PERMIT FOR USE

PERMIT APPROVED: <u>XX</u> OTHER REFERRALS OR RECOMMENDATIONS: We request a single copy of any publications resulting from this permit.

Raymond 2. maketter, fr. Colorado State Forest Service

Administrator

. . .

I have read and agree to the terms and conditions for use of the Owl Canyon Pinyon Grove Natural Area as set forth in the Application for Use Permit.

Applicant's Signature:_	THEAT	Date: 6/8/89
	1 9	

Applicant must sign Permit and present to the Holly Sugar Corporation or its operating contractor at the entrance to the Pinyon Grove,



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# APPLICATION FOR USE PERMIT

OWL CANYON PINYON GROVE NATURAL AREA

APPLICANT: FRIEZ L. KNOPF
GROUP REPRESENTED: U.S. FISH & WILDLIFE SERVICE
ADDRESS: 1300 Bur Space G. Cours Co 80324-2098 Street City State Zip
PHONE: 226 9462
PERIOD OF TIME FOR WHICH PERMIT IS REQUESTED: 6/9/89 - 7/31 /89
EXPECTED NUMBER OF VISITS: 8-10 SIZE OF GROUP ]
Describe intended use, research or observations to be made:
1. Purpose: INVENTORY BREEDING BIRD COMMUNITY
2. Specific Objectives: DESCRIBE BIRD ASSEMBLACE
3. Methods: Binoculars, Goot TRavel
Except by special permission, the applicant agrees to remove all evidence of human activity created by the applicant or applicant's group before expiration of the permit and to report any irregularities to the Colorado State Forest Service. The applicant and the applicant's group holds the following: the Department of Natural Resources (including the Colorado Natural Areas Program, the Colorado Natural Areas Council and the State Board of Land Commissioners), the Colorado State Forest Service, and Evan and Catherine Roberts, and Holly Sugar Corporation and its operating contractor harmless from any and all liability or claims from damages that may arise from access to and use of the Owl Canyon Pinyon Grove Natural Area. Applicant's Signature
Submit to:

Submit to: Colorado State Forest Service Colorado State University Fort Collins, Colorado 80523

### OWL CANYON PINYON GROVE NATURAL AREA Brackenbury Property PERMIT FOR USE

PERMIT APPLICANT: ROBERT BURKHARDT	PERMIT NO. 89-6
ADDRESS: 2415 HAMPSHIRE RD	DATE: 11/22/89
FT COLLINS CO 80526	
PERMIT PERIOD: 11/24/89 - 1/30/90	
NO. OF VISITS: 3-4	
SIZE OF GROUP: 2-3	
PERMIT DENIED:	
REASON FOR DENIAL:	

PERMIT APPROVED: <u>1/22/89</u> OTHER REFERRALS OR RECOMPLY DATIONS: We request a single copy of any publication resulting from this permit.

Kan mehaffe

Colorado State Forest Service Administrator

I have read and agree to the terms and conditions for use of the Owl Canyon Pinyon Grove Natural Area as set forth in the Application for Use Permit.

Applicant's Signature:

Date:

Applicant must sign Permit and present to the Holly Sugar Corporation or its operating contractor at the entrance to the Pinyon Grove,

Page 2

## APPLICATION FOR USE PERMIT

OWL CANYON PINYON GROVE NATURAL AREA

APPL	LICANT: ROBERT BURKHARDT		
GROU	JP REPRESENTED:		
ADD	RESS: 2415 HAMPSHIRE RD FT. COLLINS	Co.	80526 710
PHO	HE: <u>482-6370 Horné X 11-22-89</u> 7-3:30 221-6660 WORK	5456	LIP
PER	IOD OF TIME FOR WHICH PERMIT IS REQUESTED: 112418	9 - 11	30 / 90
EXPI	ECTED NUMBER OF VISITS: 3-4 SIZE OF GROUP 2	-3	
Desc	cribe intended use, research or observations to be mad	e:	
1.	Purpose: WILDLIFE/SCENIC PHOTOGRAPHY		
2.	Specific Objectives: SAME AS (1)		
3.	Methods:		
	· · · · · · · · · · · · · · · · · · ·		

Except by special permission, the applicant agrees to remove all evidence of human activity created by the applicant or applicant's group before expiration of the permit and to report any irregularities to the Colorado State Forest Service. The applicant and the applicant's group holds the following: the Department of Natural Resources (including the Colorado Natural Areas Program, the Colorado Natural Areas Council and the State Board of Land Commissioners), the Colorado State Forest Service, and Evan and Catherine Roberts, and Holly Sugar Corporation and its operating contractor harmless from any and all liability or claims from damages that may arise from access to and use of the Qwl Canyon Pinyon Grove Natural Area.

Date: 11-21-89 Applicant's Signature whan

Submit to: Colorado State Forest Service Colorado State University Fort Collins, Colorado 80523



Foothills Campus Colorado State University Fort Collins, Colorado 80523 (303) 491-8660

January 16, 1990

Richard W. Greer 1439 Wakerobin Ct. Fort Collins, CO 80526

Dear Mr. Greer:

Although I sympathize with your objectives for use of the Owl Canyon Pinyon Grove Natural Area, I must deny your application for use permit. Purpose of the Natural Area is limited to scientific research and educational activities. One of the permit stipulations is to provide me a copy of data gathered and copies of all publications resulting from the use permit.

Direction in the management plan does not provide for recreational use. A copy of page 3 of that plan is enclosed for your information.

I realize the Division of Wildlife sign is misleading. It encourages the general public to abide by the law and request a permit from the Colorado State Forest Service. The sign is located on DOW property that was donated to them and is not part of the Owl Canyon Pinyon Grove Natural Area. I have no authority to issue permits for that property.

My telephone number should not be on the sign. It was placed there without my knowledge and has resulted in numerous futile requests for permits. I hope it will be removed until such time as the "Brackenbury" property in DOW ownership is legally combined with the Natural Area. This was discussed in 1988 but has not been addressed since then.

I regret that I must deny your request for use of the Natural Area. Perhaps a new management plan will permit your requested use if the two properties are eventually combined. Until then, I encourage you to pursue your objectives on other more accessible public land such as exists in our State Parks system.

Sincerely,

Ray mehoffey

Raymond L. Mehaffey District Forester

RLMkrp

cc: DOW, NE Regional Office

This plan is prepared in agreement with the lease between the Colorado State Board of Land Commissioners and CSU, and pursuant to the Articles of Designation for the Owl Canyon Pinon Grove (Roberts Ranch) between the Colorado Department of Natural Resources and J. Evan and Catherine Roberts. (Appendix C - forthcoming)

# Duration of Management Agreement:

The management agreement shall remain in effect unless the Articles of Designation for either of the two named parts are terminated, or CSU, as the lessee of the portion owned by the State Board of Land Commissioners, defaults. The plan will, however, be continually reviewed and updated. It shall also be flexible in nature to provide for contingencies.

# 5. Purpose of Management:

The Owl Canyon Pinon Grove Natural Area, with the addition of the Roberts Ranch area, will be managed for scientific research and educational purposes. Consistent with these purposes, it is the policy of the Colorado State Forest Service and the Colorado Natural Areas Council to evaluate and limit any human activity that might interfere with the processes of nature.

# 6. Management Goals:

- To protect the area from excessive human activity and to limit use of the area to scientific research and educational activities;
- To observe processes of nature occuring in the area to centralize documentation of research activities in readily retrievable form.
- To monitor scientific and educational activities on the grove.
- 4. To monitor the physical condition of the grove.

# Specific Management Activities:

A. To protect the area from excessive human activity and to limit use of the area to scientific research and educational activities.

# APPLICATION FOR USE PERMIT

OWL CANYON PINYON GROVE AND BRACKENBURY PR APPLICANT: Richard W.	NATURAL AREA OPERTY TREER	JAN 12 1990
GROUP REPRESENTED: Self, Spouse,	2 children	
ADDRESS: 1439 Wakerobin Ct. Street	Ft. Collins City	CO Bos26 State Zip
PHONE: 226-5446 daytime p	hone @ 229-24	10
PERIOD OF TIME FOR WHICH PERMIT IS REQU	JESTED: 2/1/90	/ /
EXPECTED NUMBER OF VISITS: 2-4 /year	SIZE OF GROUP	/
Describe intended use, research or obse	ervations to be mad	e:
1. Purpose: recreation / educat	ion. Also, a	ct as
forward observer in identifyin	ng any irregulari	ties.
2. Specific Objectives: identify a	nimal sign, Struc	by The
areas previously exposed by	quarry	
3. Methods: 2-4 hr trips; walk	in; take only p.	tures;
leave only footprints; reinfor	ce this ethic	to my
children.	57	/
en e		

Except by special permission, the applicant agrees to remove all evidence of human activity created by the applicant or applicant's group before expiration of the permit and to report any irregularities to the Colorado State Forest Service. The applicant and the applicant's group holds the following: the Department of Natural Resources (including the Colorado Natural Areas Program, the Colorado Natural Areas Council and the State Board of Land Commissioners), the Colorado State Forest Service, and Evan and Catherine Roberts, and Holly Sugar Corporation and its operating contractor harmless from any and all liability or claims from damages that may arise from access to and use of the Owl Canyon Pinyon Grove Natural Area.

ROOM Date: 1/7/90 Applicant's Signature Tichan

Submit to: Colorado State Forest Service Colorado State University Fort Collins, Colorado 80523

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APPLICATION FOR USE PERMIT

OWL CANYON PINYON GROVE NATURAL AREA

APPLICANT: MAURICE K. E	PHILLIS M.	MILLER	
GROUP REPRESENTED:NA			
ADDRESS: <u>800 Redwood Court</u> Street	Bellvue City	CO State	<u>    80521</u> Zip
PHONE: 221-2140			

PERIOD OF TIME FOR WHICH PERMIT IS REQUESTED: <u>10/10/89</u> - <u>12/31/89</u> EXPECTED NUMBER OF VISITS: <u>5</u> SIZE OF GROUP <u>2</u> Cescribe intended use, research or observations to be made:

1. Purpose: PHOTOGRAPHY - RAPTORS - (FUN!)

2. Specific Objectives: PHOTO GRAPH AREA - DOCUMENT Pinyon PINE AREA WITH PHOTOS & ASSESMENT

3. Methods:

Except by special permission, the applicant agrees to remove all evidence of human activity created by the applicant or applicant's group before expiration of the permit and to report any irregularities to the Colorado State Forest Service. The applicant and the applicant's group holds the following: the Department of Natural Resources (including the Colorado Natural Areas Program, the Colorado Natural Areas Council and the State Board of Land Commissioners), the Colorado State Forest Service, and Evan and Catherine Roberts, and Holly Sugar Corporation and its operating contractor harmless from any and all liability or claims from damages that may arise from access to and use of the Owl Canyon Pinyon Grove Natural Area.

Apolicant's Signature Phyllis Meller Date: 10-10-89

Submit to: Colorado State Forest Service Colorado State University Fort Collins, Colorado 80523

OWL CANYON PINYON GROVE NATURAL ARFA

# PERMIT FOR USE

FERMIT APPLICANT:	PERMIT 10. 89-5
ADDRESS: 800 Redwood Court	DATE: 10/10/89
Bellvue, CO 80512	
PERMIT PERIOD: 10 / 10 / 89 - 12 / 31 / 89	
NO. 07 VISITS: 5	
SIZE OF GROUP: 2	
PERMIT DENIED:	
REASON FOR DENIAL:	

PERMIT APPROVED: XXXX OTHER REFERRALS OR RECOMMENDATIONS: We request a single copy of any publication resulting from this permit.

7 Colorado State Forest Service

Administrator

. . . .

I have read and agree to the terms and conditions for use of the Owl Canyon Pinyon Grove Natural Area as set forth in the Application for Use Permit.

Applicant's	Signature:	Phyllic	miller	Date:	10-10-89
					,

Applicant must sign Peruit and present to the Holly Sugar Corporation or its operating contractor at the entrance to the Pinyon Grove,

APPLICATION FOR USE PERMIT

OWL CANYON PINYON GROVE NATURAL AREA

APPLICANT: TINA HAMILTON GROUP REPRESENTED: LIVERMORE ELEMENTARY SCHOOL ADDRESS: 360 REDFEATHER LAKES ROAD LIVERMORE CO 80536 Streat City State Zip PHONE: 226-9383

PERIOD OF TIME FOR WHICH PERMIT IS REQUESTED: <u>10/16/89 - 10/17/89</u> EXPECTED NUMBER OF VISITS: <u>1</u> SIZE OF GROUP <u>30-35</u> Cescribe intended use, research or observations to be made: 1. Purpose: <u>Observation of Hawk migration</u>.

2. Specific Objectives: Observe and record hawk Explore ground for signs of hawks. Nation exploration 3. Methods: pervised.

Except by special permission, the applicant agrees to remove all evidence of human activity created by the applicant or applicant's group before expiration of the permit and to report any irregularities to the Colorado State Forest Service. The applicant and the applicant's group holds the following: the Department of Natural Resources (including the Colorado Natural Areas Program, the Colorado Natural Areas Council and the State Board of Land Commissioners), the Colorado State Forest Service, and Evan and Catherine Roberts, and Holly Sugar Corporation and its operating contractor harmless from any and all liability or claims from damages that may arise from access to and use of the Owl Canyon Pinyon Grove Natural Area.

Applicant's Signature Jina Hamilton Date: 10-9-89

Submit to: Colorado State Forest Service Colorado State University Fort Collins, Colorado 80523

· · 2/2 Kart OK to type up permit. Cine a 12/31/89 expiration date. Also note about receiving copies of essays for our files. Kay

OWL CANYON FINYON GROVE NATURAL AREA

FERMIT FOR USE

TERMIT APPLICANT: Sue Ellen Campbell	PERMIT NO. 89-3
ADDRESS: PO Box 101	DATE: 7/14/89
Livermore CO 80536	
PERMIT PERIOD: 8 / 1 / 89 - 12 / 31 / 89	
NO. OF VISITS: Once every week or two	7
SIZE OF GROUP: 2	
FERMIT DENIED:	
REASON FOR DENIAL:	

PERMIT APPROVED: XX OTHER REFERRALS OR RECOMMENDATIONS: We request a single copy of any publication resulting from this permit.

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Administrator

I have read and agree to the terms and conditions for use of the Owl Canyon Pinyon Grove Natural Area as set forth in the Application for Use Fermit.

Applicant's Signature:	Date:

Applicant must sign Permit and present to the Holly Sugar Corporation or its operating contractor at the entrance to the Piryon Grove.

### APPLICATION FOR USE PERMIT

### OWL CANYON PINYON GROVE NATURAL AREA

APPLICANT: JOHN CALDERAZZO / SUE ELLEN CAMPBELL GROUP REPRESENTED: Colorado State U. ADDRESS: <u>P.O. Box 101</u>, Livermore, CO 80536 Street City State PHONE: 493-6995

PERIOD OF TIME FOR WHICH PERMIT IS REQUESTED: <u>8/1/89</u> - <u>1</u> indefinite EXPECTED NUMBER OF VISITS: <u>or two</u> SIZE OF GROUP 2 Describe intended use, research or observations to be made: 1. Purpose: We are bother professors in CSU's English pept. J.C. traches nature writing & has written frequently for AUDUBON & other national masazines. S.E.C. traches wilderness natiative courses. In addition to truse professional 2. Specific Objectives: writing interests we have, we also live night across the street (287) from this land. We simply what to walk 3. Methods: We do not hunt or fish; ~ we have no plansto camp on the Ind or welle ony kind of fire - We just want to walk

Except by special permission, the applicant agrees to remove all evidence of human activity created by the applicant or applicant's group before expiration of the permit and to report any irregularities to the Colorado State Forest Service. The applicant and the applicant's group holds the following: the Department of Natural Resources (including the Colorado Natural Areas Program, the Colorado Natural Areas Council and the State Board of Land Commissioners), the Colorado State Forest Service, and Evan and Catherine Roberts, and Holly Sugar Corporation and its operating contractor harmless from any and all liability or claims from damages that may arise from access to and use of the Owl Canyon Pinyon Grove Natural Area.

Applicant's Signature Alun Calchy Date: 7/3/89 Sue Ellen Campbell

Submit to: Colorado State Forest Service Colorado State University Fort Collins, Colorado 80523

and observer.

OWL CANYON PINYON GROVE NATURAL AREA

PERMIT FOR USE

PERMIT APPLICANT: Colorado Native Plan Society	PERMIT	r NO.	87-2
Ft. Collins Chapter			
ADDRESS: PO Box 200	DATE:	5/20/8	87

Fort Collins CO 80522

PERMIT PERIOD: 5 / 1 / 87 - 11 / 1 / 87

NO. OF VISITS: 6

SIZE OF GROUP: 10-15

PERMIT DENIED:

REASON FOR DENIAL:

PERMIT APPROVED: · 5/20/87

Kaymond I mehoffer hr. Colorado State Forest Service

Administrator

I have read and agree to the terms and conditions for use of the Owl Canyon Pinyon Grove Natural Area as set forth in the Application for Use Permit.

Applicant's Signature: \_\_\_\_\_ Date:

Applicant must sign Permit and present to the Holly Sugar Corporation or its operating contractor at the entrance to the Pinyon Grove,

Page 2

OTHER REFERRALS OR RECOMMENDATIONS: A copy of any written report of activity should be sent to administrator for CSFS files.

### APPLICATION FOR USE PERMIT

## OWL CANYON PINYON GROVE NATURAL AREA

APPLICANT(:S): Derek Marchi, Betsy Neely, Judy Von Ahlefeldt, Carol Brandt GROUP REPRESENTED: Colorado Native Plant Society, Fort Collins Chapter

ADDRESS: P.O. Box 200 Fort Collins CO 80525 Street City State Zip PHONE: 224-3324 (Derek Marchi)

PERIOD OF TIME FOR WHICH PERMIT IS REQUESTED: <u>5 / 1 / 87</u> - <u>11 / 1 / 87</u> EXPECTED NUMBER OF VISITS: <u>1/month</u> SIZE OF GROUP <u>10-15</u> Describe intended use, research or observations to be made:

1. Purpose: To compile a complete species list of the plants growing

in the Owl Canyon-Brackenbury State Natural Area.

 Specific Objectives: Identify those plants growing in the Owl Canyon Pinyon Grove, compiling a species list. This data will be

given to the State Natural Areas Program.

 Methods: The majority of our work will be sight identification as we walk through the pinyon grove. If the plant cannot be identified

in the field we will collect the plant to be identified at the CSU

Herbarium, where it will be archived as a voucher specimen. Only frugal collecting will be allowed.

Except by special permission, the applicant agrees to remove all evidence of human activity created by the applicant or applicant's group before expiration of the permit and to report any irregularities to the Colorado State Forest Service. The applicant and the applicant's group holds the following: the Department of Natural Resources (including the Colorado Natural Areas Program, the Colorado Natural Areas Council and the State Board of Land Commissioners), the Colorado State Forest Service, and Evan and Catherine Roberts, and Holly Sugar Corporation and its operating contractor harmless from any and all liability or claims from damages that may arise from access to and use of the Owl Canyon Pinyon Grove Natural Area.

Carol Brandt Date: 5/14/87 Applicant's Signature

Submit to: Colorado State Forest Service Colorado State University Fort Collins, Colorado 80523

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· Judy, here is the application. you need to take it to Ray Mahafey, the foothills Campus, Colorado State Forest Service, Foothills Bldg # 1052.

Could you request that we have three copies of the permit?

Thanks, Carol



The applications were brought by Judy om ahlefelott

493-7849



Previous editions usable

то:	
YOU WERE CALLED BY-	YOU WERE VISITED BY-
OF (Organization)	The Charles The
PLEASE PHONE	FTS AUTOVON
WILL CALL AGAIN	IS WAITING TO SEE YOU
RETURNED YOUR CALL	WISHES AN APPOINTMENT

MESSAGE

RECEIVED BY	DATE	TIME
63-110 NSN 7540-00-634-4018 GPO : 1984 0 - 430-306	STANDARD FORM Prescribed by GSA FPMR (41 CFR) 101-	<b>53</b> (Rev. 8-81) -11.6
#### OUL CANYON PINYON GROVE NATURAL AREA

#### PERMIT FOR USE

PERMIT APPLICANT: William Schuster	FERMIT NO. 88-2
ADDRESS: EPO Biology, 122 Ramaley, Campus Box 334	DATE: 11/14/88
Boulder CO 80309-0334	
FERMIT PERIOD: 11 / 14 / 88 - 12 / 1 / 88	
NO. OF VISITS: 1	
SIZE OF GROUP: 3	
PERMIT DENIED:	
REASON FOR DENIAL:	

PERMIT APPROVED: 11/14/88

1 ....

OTHER REFERRALS OR RECOMMENDATIONS:

Colorado State Forest Service Administrator

I have read and agree to the terms and conditions for use of the Owl Canyon Pinyon Grove Natural Area as set forth in the Application for Use Permit.

Applicant's Signature:	Date:
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Applicant must sign Permit and present to the Holly Sugar Corporation or its operating contractor at the entrance to the Pinyon Grove.

Page 2

## APPLICATION FOR USE PERMIT

JWL.	CANYON	PINYON	GRCVE	NATURAL	AREA
	A				

NOV 1 0 1988

.1 .

APPLICANT: William Schoster	r		
GROUP REPRESENTED: Dapt. of EPG	Biology, UNI	o of Cotor	0 60
ADDRESS: BOX B-334	Bouldes	CO	80309
Street	City	State	Ziz
PHONE: 303 492-8956			
PERIOD OF TIME FOR WHICH PERMIT IS R	EQUESTED: 1004 ( July)	r - 12/1	135
EXPECTED NUMBER OF VISITS:	SIZE OF GROUP	3	
Describe intended use, research or of	bservations to be m	ade:	

- 1. Purpose: Obtain Needle samples from pinyens at . Owl Canyon
- 2. Specific Objectives: Examine genetic variation at enzyme loci to test for founder effect
- 3. Methods: Take 1 3' sample of Needle Tissue from each of 150 randomly sulected trees

Except by special permission, the applicant agrees to remove all evidence of human activity created by the applicant or applicant's group before expiration of the permit and to report any irregularities to the Colorado State Forest Service. The applicant and the applicant's group holds the following: the Department of Natural Resources (including the Colorado Natural Areas Program, the Colorado Natural Areas Council and the State Board of Land Commissioners), the Colorado State Forest Service, and Evan and Catherine Roberts, and Holly Sugar Corporation and its operating contractor harmless from any and all liability or claims from damages that may arise from access to and use of the Owl Canyon Pinyon Grove Natural Area.

Applicant's Signature	Williom Achuste	Date: 11/4/88
· · · · · · · · · · · · · · · · · · ·		



# William Schoster

Environmental, Population and Organismic Biology

122 Ramaley Campus Box 334 Boulder, Colorado 80309-0334 State of Colorado Official Mall Penatty for Private Use



#### APPLICATION FOR USE PERMIT

#### OWL CANYON PINYON GROVE NATURAL AREA

APPLICANT:	Jim	Brownhill			
GROUP REPRESENT	TED:	Colorado	Lien Co.		
ADDRESS: <u>PO Box</u> Stree	<u>1961</u>		Fort Collin City	ns <u>CO</u> State	<u>805</u> 22 Zip
PHONE :					

PERIOD OF TIME FOR WHICH PERMIT IS REQUESTED: <u>3</u> / <u>28</u> / <u>88</u> - <u>4</u> / <u>1</u> / <u>88</u> EXPECTED NUMBER OF VISITS: <u>1</u> SIZE OF GROUP <u>3 Maximum</u> Describe intended use, research or observations to be made:

- Purpose: Cross pinyon grove property to gain temporary access via existing road to applicant's property.
- Specific Objectives: <u>Obtain core samples from quarry of applicant</u>, (1 trip permitted).
- 3. Methods: Drive pickup to quarry, load sample, and drive back to main road. 1 trip permitted. Locating key to gate is respon-

sibility of applicant.

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Except by special permission, the applicant agrees to remove all evidence of human activity created by the applicant or applicant's group before expiration of the permit and to report any irregularities to the Colorado State Forest Service. The applicant and the applicant's group holds the following: the Department of Natural Resources (including the Colorado Natural Areas Program, the Colorado Natural Areas Council and the State Board of Land Commissioners), the Colorado State Forest Service, and Evan and Catherine Roberts, and Holly Sugar Corporation and its operating contractor harmless from any and all liability or claims from damages that may arise from access to and use of the Owl Canyon Pinyon Grove Natural Area.

Applicant's Signature Jemes Brounkill Date: 3-24-88

Submit to: Colorado State Forest Service Colorado State University Fort Collins, Colorado 80523

RECEIVED MAR 2 4 1988

#### OWL CANYON PINYON GROVE NATURAL AREA

PERMIT FOR USE

PERMIT APPLICANT: Jim Brownhill/Colorado Lien Co.	PERMIT	NO. 88/1
ADDRESS: PO BOX 1961	DATE:	3/18/88
Fort Collins CO 80522		
PERMIT PERIOD: 3 / 28 / 88 - 4 / 1 88		
NO. OF VISITS: 1		
SIZE OF GROUP: 3		
PERMIT DENIED:		
REASON FOR DENIAL:		

PERMIT APPROVED: 3/18/88

OTHER REFERRALS OR RECOMMENDATIONS:

Sa Colorado State Forest Service

Administrator

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I have read and agree to the terms and conditions for use of the Owl Canyon Pinyon Grove Natural Area as set forth in the Application for Use Permit.

Applicant's	Signature: James C	Bernhill	Date: 3.24-88
		0	

Applicant must sign Permit and present to the Holly Sugar Corporation or its operating contractor at the entrance to the Pinyon Grove,

OTHER: This is a one-time, one-trip permit. Any request for further access should be made at least 15 days in advance of needed use.

Page 2

#### APPLICATION FOR USE PERMIT

OWL CANYON PINYON GROVE NATURAL AREA

APPLICANT: Glen D. Weaver			
GROUP REPRESENTED:			
ADDRESS: Dept. Earth Resources, CSU	City	State	71p
PHONE: 491-5454, 493-3297			- · P
PERIOD OF TIME FOR WHICH PERMIT IS REQ	JESTED: 7/5/87	/	/
EXPECTED NUMBER OF VISITS:/	SIZE OF GROUP 2		
Describe intended use, research or obs	ervations to be made	:	
1. Purpose: of general interest to Geo	prophy of Colorado class	that I to	ach
at CSU.	1 - 0		
2. Specific Objectives:			
3. Methods:			

Except by special permission, the applicant agrees to remove all evidence of human activity created by the applicant or applicant's group before expiration of the permit and to report any irregularities to the Colorado State Forest Service. The applicant and the applicant's group holds the following: the Department of Natural Resources (including the Colorado Natural Areas Program, the Colorado Natural Areas Council and the State Board of Land Commissioners), the Colorado State Forest Service, and Evan and Catherine Roberts, and Holly Sugar Corporation and its operating contractor harmless from any and all liability or claims from damages that may arise from access to and use of the Owl Canyon Pinyon Grove Natural Area.

Applicant's Signature Slen D. Weaver Date: 7/1/87

Submit to: Colorado State Forest Service Colorado State University Fort Collins, Colorado 80523

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OWL CANYON PINYON GROVE NATURAL AREA

PERMIT FOR USE

PERMIT AF	PLICAN	r:_	Glen	D. Weaver		PERMIT	NC.	87-4
ADDRESS:	Dept.	of	Earth	Resources,	CSU	DATE: 7	/2/87	

PERMIT PERIOD: 7 / 5 / 87 - 7 / 12 / 87

NO. OF VISITS: 1

SIZE OF GROUP: 2

PERMIT DENIED:

REASON FOR DENIAL:

PERMIT APPROVED: XX OTHER REFERRALS OR RECOMMENDATIONS:

Kaymond I mehoffer for Colorado State Forest Service

Administrator

I have read and agree to the terms and conditions for use of the Owl Canyon Pinyon Grove Natural Area as set forth in the Application for Use Permit.

Applicant's	Signature:	Glen D. Weaver	Date: 7/2/87

Applicant must sign Permit and present to the Holly Sugar Corporation or its operating contractor at the entrance to the Pinyon Grove,

Page 2

#### OWL CANYON PINYON GROVE NATURAL AREA

#### PERMIT FOR USE

PERMIT APPLICANT: Denver Field Ornithologists	PERMIT NO. 87-3
ADDRESS: c/o Ruth Wheeler 3340 W 37th Avenue Denver C0 80211	DATE: 5/20/87
PERMIT PERIOD: 6 / 17 /87 - XXXXXXXXXXXXXX	
NO. OF VISITS: 1	
SIZE OF GROUP: 6-20	
PERMIT DENIED:	
REASON FOR DENIAL:	

files.

OTHER REFERRALS OR RECOMMENDATIONS:

A copy of any written report of activity should be sent to administrator for CSFS

PERMIT APPROVED: X

Colorado State Forest Service

Administrator

I have read and agree to the terms and conditions for use of the Owl Canyon Pinyon Grove Natural Area as set forth in the Application for Use Permit.

Applicant's	Signature:	Date:
	•	and the point of concerning of the second

Applicant must sign Permit and present to the Holly Sugar Corporation or its operating contractor at the entrance to the Pinyon Grove.

Page 2

APPLICATION FOR USE PERMIT OWL CANYON PINYON GROVE NATURAL AREA Wheeler ith APPLICANT: Ornithologists GROUP REPRESENTED: Denver ADDRESS: 3340W.37th Street CO 80211 State 7in enver PHONE: 455-3924 PERIOD OF TIME FOR WHICH PERMIT IS REQUESTED: 6/17/87 - / SIZE OF GROUP 6 to 20 EXPECTED NUMBER OF VISITS: Describe intended use, research or observations to be made: 1. Purpose: Jo o o birds to be serve. in th ound to see h 2. Specific Objectives: 💊 areas in southern part of state. 3. Methods: rozet area 10 lesco

Except by special permission, the applicant agrees to remove all evidence of human activity created by the applicant or applicant's group before expiration of the permit and to report any irregularities to the Colorado State Forest Service. The applicant and the applicant's group holds the following: the Department of Natural Resources (including the Colorado Natural Areas Program, the Colorado Natural Areas Council and the State Board of Land Commissioners), the Colorado State Forest Service, and Evan and Catherine Roberts, and Holly Sugar Corporation and its operating contractor harmless from any and all liability or claims from damages that may arise from access to and use of the Owl Canyon Pinyon Grove Natural Area.

Wheeler Date: May 9, 1987 Applicant's Signature



3340 W. 37th ave, Denver, CO 80211 April 30, 1987

MAY 8 1987

Mr. Thomas Owens State Forest Service, C.S.U. Ft. Collins, CO 80523

Dear Mr. Owens: If it is possible, I would like a permit to take a group of Denver Field Ornithol-ogists to the Owl Canon Pinon Grove on Wednesday, June 17. Dr. Ron Ryder has consented to lead the trip for us, Sincerely, Reth Wheeler, D. 7.0.





State Forest Service CSU Ft: Collins, CO 80523

Colorado State University Fort Collins, Colorado 80523

May 7, 1987

. . . ,

Ms. Ruth Wheeler 3340 West 37th Avenue Denver CO 80211

Dear Ms. Wheeler:

District Forester, Ray Mehaffey, is the forester now in charge of issuing visitor permits for the Owl Canyon Pinon Grove. Ray is currently on vacation and will not be back in the office until May 14. In the interest of time, I am forwarding the enclosed permit application. Please complete and return to our office in the enclosed envelope.

I will be sure to bring it to Ray's attention when it is returned so he may review it. This way, we may mail a permit to you before your planned field trip.

Sincerely,

11

Kathy Porter Senior Admin. Clerk

Enclosures





63-110 NSN 7540-00-634-4018 **STANDARD FORM 63** (Rev. 8-81) GP0 : 1984 0 - 430-306 Prescribed by GSA FPMR (41 CFR) 101-11.6

#### APPLICATION FOR USE PERMIT

#### OWL CANYON PINYON GROVE NATURAL AREA

APPLICANT: Sue Galatowitsch			
GROUP REPRESENTED: Natural Areas Co	puncil		
ADDRESS:DNR, RM 718, 1313 Sherman S	St Denver	CO 80203	
Street	City	State	Zip
PHONE: 866-3311			
PERIOD OF TIME FOR WHICH PERMIT IS	REQUESTED: <u>5 / 12 / 87</u>	<u> </u>	<u>X / X</u> 1-4 pm
EXPECTED NUMBER OF VISITS:1	SIZE OF GROUP12	!	÷
Describe intended use, research or	observations to be made	2:	
1. Purpose: Field tour to acquaint	members of Council wit	h area.	

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2. Specific Objectives:

3. Methods:

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Except by special permission, the applicant agrees to remove all evidence of human activity created by the applicant or applicant's group before expiration of the permit and to report any irregularities to the Colorado State Forest Service. The applicant and the applicant's group holds the following: the Department of Natural Resources (including the Colorado Natural Areas Program, the Colorado Natural Areas Council and the State Board of Land Commissioners), the Colorado State Forest Service, and Evan and Catherine Roberts, and Holly Sugar Corporation and its operating contractor harmless from any and all liability or claims from damages that may arise from access to and use of the Owl Canyon Pinyon Grove Natural Area.

Applicant's Signature Jusan M. Galatowitsch Date: May 12, 1987

- RECEIVED-OCT 2 7 1980 QSES-SO

APPLICATION FOR USE PERMIT

OWL CANYON PINYON GROVE NATURAL AREA

APPLICANT: LIZ Caile GROUP REPRESENTED: Myself, writer, Anticipated article in Colorado Outdoors ADDRESS: SALINA STAR RTE BOULDER, Co. 80302 Street City State 7in 258-3565 PHONE: Toma

PERIOD OF TIME FOR WHICH PERMIT IS REQUESTED: 11/4/80 - 1/1/81 EXPECTED NUMBER OF VISITS: 1- SIZE OF GROUP 1 or 3 people Describe intended use, research or observations to be made:

 Purpose: My visit will be to acquaint myself with the area in order to describe
 Specific Objectives: it for <u>Colorado Outdoors</u> or other articles, I will probably 3. Methods: <u>spend 1/2 a day walking</u> leaking inside the area. + not its location, but it's physical attributes

Except by special permission, the applicant agrees to remove all evidence of human activity created by the applicant or applicant's group before expiration of the permit and to report any irregularities to the Colorado State Forest Service. The applicant and the applicant's group holds the following: the Department of Natural Resources (including the Colorado Natural Areas Program, the Colorado Natural Areas Council and the State Board of Land Commissioners), the Colorado State Forest Service, and Evan and Catherine Roberts, and Holly Sugar Corporation and its operating contractor harmless from any and all liability or claims from damages that may arise from access to and use of the Owl Canyon Pinyon Grove Natural Area.

Applicant's Signature Signature

Date: Oct 23, 1980

Submit to: Colorado State Forest Service Colorado State University Fort Collins, Colorado 80523

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Page 1

### APPLICATION FOR USE PERMIT

OWL CANYON PINYON GROVE NATURAL AREA

APPLICANT: Gregory E. Bryant
GROUP REPRESENTED: I Papt. of Fishery Wild! Bio.
ADDRESS: 5520 Terry Lake RQ Fl. Colling (do., 80123 Street City City State Zip
PHONE: 493-6784

PERIOD OF TIME FOR WHICH PERMIT IS REQUESTED: 125/81 - 611 181
EXPECTED NUMBER OF VISITS: 15 SIZE OF GROUP
Describe intended use, research or observations to be made:
1. Purpose: Researchi Breeding Bird
CONSUS. + Territorial investigations.
2. Specific Objectives: Examine which bird species are
resting on the are bow many of each, etc.
3. Methods: Transect and/or grid observations
on several occasions.

Except by special permission, the applicant agrees to remove all evidence of human activity created by the applicant or applicant's group before expiration of the permit and to report any irregularities to the Colorado State Forest Service. The applicant and the applicant's group holds the following: the Department of Natural Resources (including the Colorado Natural Areas Program, the Colorado Natural Areas Council and the State Board of Land Commissioners), the Colorado State Forest Service, and Evan and Catherine Roberts, and Holly Sugar Corporation and its operating contractor harmless from any and all liability or claims from damages that may arise from access to, and use of the Owl Canyon Pinyon Grove Natural Area.

Applicant's Signature an Date:

#### APPLICATION FOR USE PERMIT

#### OWL CANYON PINYON GROVE NATURAL AREA

APPLICANT: Kent Stanton		<u> </u>
GROUP REPRESENTED: Triansle	Review Newspape	er 1109.Alford
ADDRESS: College Ave.	Fort Collins	(0 80526
Street	City	State Zip
PHONE: 221-2000		
PERIOD OF TIME FOR WHICH PERMIT I	S REQUESTED: 12/12/80	- 11/2181
EXPECTED NUMBER OF VISITS:	1 - 2 SIZE OF GROUP /	2

Describe intended use, research or observations to be made:

Except by special permission, the applicant agrees to remove all evidence of human activity created by the applicant or applicant's group before expiration of the permit and to report any irregularities to the Colorado State Forest Service. The applicant and the applicant's group holds the following: the Department of Natural Resources (including the Colorado Natural Areas Program, the Colorado Natural Areas Council and the State Board of Land Commissioners), the Colorado State Forest Service, and Evan and Catherine Roberts, and Holly Sugar Corporation and its operating contractor harmless from any and all liability or claims from damages that may arise from access to and use of the Owl Canyon Pinyon Grove Natural Area.

Atan tan Date: 12/12/90 Applicant's Signature //-ent

Submit to: Colorado State Forest Service Colorado State University Fort Collins, Colorado 80523

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RECEIVED JUN 3 1980 CSES-SO

APPLICATION FOR USE PERMIT

OWL CANYON PINYON GROVE NATURAL AREA

APPLICANT: Calvin roy GROUP REPRESENTED: ( alvin roy City State ADDRESS: Dept. of Botan 1 + Mant Street 491-6824 PHONE: 482-0821

PERIOD OF TIME FOR WHICH PERMIT IS REQUESTED: 5/19/80 - 8/30/80
EXPECTED NUMBER OF VISITS: 30 SIZE OF GROUP 1
Describe intended use, research or observations to be made:
1. Purpose: to make guartitative measurements on
the relative sizes and shapes of plants
2. Specific Objectives: same as above + to test
some measuring techniques
3. Methods: simple observation and measuring with
yardsticks and measuring tapes
0

Except by special permission, the applicant agrees to remove all evidence of human activity created by the applicant or applicant's group before expiration of the permit and to report any irregularities to the Colorado State Forest Service. The applicant and the applicant's group holds the following: the Department of Natural Resources (including the Colorado Natural Areas Program, the Colorado Natural Areas Council and the State Board of Land Commissioners), the Colorado State Forest Service, and Evan and Catherine Roberts, and Holly Sugar Corporation and its operating contractor harmless from any and all liability or claims from damages that may arise from access to and use of the Owl Canyon Pinyon Grove Natural Area.

al Applicant's Signature Date: 5-20-80

# APPLICATION FOR USE OWL CANYON PINON GROVE NATURAL AREA

Name of Applicant Succh 4 Jours
Group Represented Size of Group
Address 203 Ingersoll CSu Ft Collins Co Street Town State
Phone Number 491-4056 Period of time for which permit is requested Noul 79 - Dec 30, 79 From To
Describe intended use, research or observations to be made. A. Objectives gather data for B450 plantecology Class
B. Methods Vegetation Survey
Expected number of visits Size of group Size of group Size of human activity created by special permission, the applicant agrees to remove all evidence of human activity created by the applicant or applicants group before expiration of the permit and report any irregularities to CSFS. Permittee Signature
Permit Number <u>79-3</u> Permission <u>L</u> Granted Denied Denied Denied Permittee Reason for denial:
Darry Recom

Colorado State Forest Service Other Referrals CSU Natural Areas Committee Administrator

## APPENDIX C

APPLICATION FOR USE
OWL CANYON PINON GROVE NATURAL AREA
Name of Applicant KICHARD T. WARD-
Group Represente BY220 - GENERAL ECOLOGY Size of Group 8-15
Addres DEPT. OF BOTTALY & Pe. PATH, COLO, STATE UNIU. Fr. COLLINS Street Town State
Phone Number 491-7591
Period of time for which permit is requested $\frac{9/79}{From} - \frac{5780}{To}$
Describe intended use, research or observations to be made.
A. Objectives To provide field trip experience for
students in general ecology, and to deal with
the interesting questions of grove origin and
history, Also questions of blotic characterization -
B. Methods Non-destructure observation only.
Will minimize any use of thesance
pathnay through the grove. Will leave no
trash,
Expected number of visits 4+0 6 in Academic Year Size of group
Except by special permission, the applicant agrees to remove all evidence of human activit created by the applicant or applicants group before expiration of the permit and report an irregularities to CSFS.
Permittee Signature Lichard, Marx
Permit Number 3 Date Date
Permission Denied Permittee
Deacon for denial:
reason for definal:

Colorado State Forest Service Administrator

1.5

RECEIPT OFFICE MEMO TO: Jerry Leson FROM: Dick Ward Date 10/15/19 OCT 1 6 1979 CSFS-SO SUBJECT: REMARKS: Permit request for the record Have taken a couple Amall groups This fall Dech You may need a copy of the permit (endosed) ierry

## APPENDIX C

# APPLICATION FOR USE OWL CANYON PINON GROVE NATURAL AREA

Name of Applicant Basy & Rosalie M.
Group Represented Student B450 CSU 6702 Size of Group 1
Address 1912 Navajo Dr. Ft. Collins Colo Street Navajo Dr. Ft. Collins State
Phone Number 489-2496
Period of time for which permit is requested Oct 79 - Dec 79
Describe intended use, research or observations to be made.
A objectives Evaluation of age structure by
trusk diam. + ht. measurement.
Eval of dispersion
B. Metnods
Expected number of visits Size of group
Except by special permission, the applicant agrees to remove all evidence of numer activit, created by the applicant or applicants group before expiration of the permit and report er, irregularities to CSFS.
Permittée Signature Apolie M. Avoye
Permit Number 02 Date $9/26/79$
Permission L Granted Denied Permittee
Peason for decial:
Olorado State Forest Service Other Referrals CSU Natural Areas Committee

OWL CANYON PINYON GROVE NATURAL AREA

PERMIT FOR USE

PERMIT APPLICANT: Cathe la	Lecter	PERMIT NO. 10
ADDRESS: 3342 10.37%	a auri	DATE: GAPKIL 1484
PERMIT PERIOD: 612184 -	_//	
NO. OF VISITS: /		
SIZE OF GROUP: $5 - 22$		
PERMIT DENIED:		
REASON FOR DENIAL:		

FERMIT APPROVED: 9 APRIL, 1984

OTHER REFERRALS OR RECOMMENDATIONS:

Colorado State Forest Service Administrator

I have read and agree to the terms and conditions for use of the Owl Canyon Pinyon Grove Natural Area as set forth in the Application for Use Permit.

					- /				
Applicant'	S	Signature:	i.	1.1	1 1000	1 1.	1:50	Date: 11	2
••						 			10.00

Applicant must sign Permit and present to the Holly Sugar Corporation or its operating contractor at the entrance to the Pinyon Grove,

## APPLICATION FOR USE PERMIT

OWL CANYON PINYON GROVE NATURAL AREA

APPLICANT: <u>Portal vicipe eleg</u> GROUP REPRESENTED: <u>Concercia de Concercato</u> ADDRESS: <u>130 1037 in l'accordente de Societa</u> Street City State Zip PHONE: 135 3014

PERIOD OF TIME FOR WHICH PERMIT IS REQUESTED: <u>612184</u> - <u>1</u>
EXPECTED NUMBER OF VISITS: <u>1</u> SIZE OF GROUP <u>5-22</u>
Describe intended use, research or observations to be made:
1. Purpose: <u>Bird in alching.</u> <u>Interinted to per-</u>
<u>if any of birds found in southern punymous</u>
2. Specific Objectives: <u>a mane</u> <u>c Carsus c</u>
<u>ind</u> <u>ind</u>

Except by special permission, the applicant agrees to remove all evidence of human activity created by the applicant or applicant's group before expiration of the permit and to report any irregularities to the Colorado State Forest Service. The applicant and the applicant's group holds the following: the Department of Natural Resources (including the Colorado Natural Areas Program, the Colorado Natural Areas Council and the State Board of Land Commissioners), the Colorado State Forest Service, and Evan and Catherine Roberts, and Holly Sugar Corporation and its operating contractor harmless from any and all liability or claims from damages that may arise from access to and use of the Owl Canyon Pinyon Grove Natural Area.

#### APPLICATION FOR USE PERMIT

#### OWL CANYON PINYON GROVE NATURAL AREA

APPLICANT: <u>BARBARA GROSHEK</u> GROUP REPRESENTED: <u>CS4 W.121.6 Dept</u> ADDRESS: <u>224 N. ROOSEVELT FT. COLLINS CO 80521</u> Street City State Zip PHONE: <u>484-7926</u>

PERIOD OF TIME FOR WHICH PERMIT IS REQUESTED: <u>12/14/84</u> - <u>12/31/84</u> EXPECTED NUMBER OF VISITS: <u>/O</u> SIZE OF GROUP <u>Z-4</u> Describe intended use, research or observations to be made: 1. Purpose: to take data for an independent study, part of the required corriculum for Wildlife Biology majors at CSU.

2. Specific Objectives: to perform small mummal

live-trupping; to determine if pinyon mouse occurs in a rea

3. Methods: place trapping grids in area, using Sherman or Hav-a-hort live traps; trapping will occur 3 consecutive nights

Except by special permission, the applicant agrees to remove all evidence of human activity created by the applicant or applicant's group before expiration of the permit and to report any irregularities to the Colorado State Forest Service. The applicant and the applicant's group holds the following: the Department of Natural Resources (including the Colorado Natural Areas Program, the Colorado Natural Areas Council and the State Board of Land Commissioners), the Colorado State Forest Service, and Evan and Catherine Roberts, and Holly Sugar Corporation and its operating contractor harmless from any and all liability or claims from damages that may arise from access to and use of the Owl Canyon Pinyon Grove Natural Area.

Applicant's Signature Barbana Grosher Date: 3 Dec. 84

Submit to: Tom Owins Colorado State Forest Service Colorado State University Fort Collins, Colorado 80523

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OWL CANYON PINYON GROVE NATURAL AREA

PERMIT FOR USE

PERMIT APPLICANT: BARBARA GROSHER	PERMIT NO								
ADDRESS: 224 N. ROOSEVELT	DATE: 3 DEC. 84								
FT. COLLINS, CO 80521									
PERMIT PERIOD: 12 / 14 / 89 - 12 / 31 / 84									
NO. OF VISITS: 10									
SIZE OF GROUP: 2-4									
PERMIT DENIED:									
REASON FOR DENIAL:									

PERMIT APPROVED: 84

OTHER REFERRALS OR RECOMMENDATIONS:

Colorado State Forest Service Administrator

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I have read and agree to the terms and conditions for use of the Owl Canyon Pinyon Grove Natural Area as set forth in the Application for Use Permit.

Applicant's Signature: Barbara	Frashek	Date: 6 Dec. 84
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Applicant must sign Permit and present to the Holly Sugar Corporation or its operating contractor at the entrance to the Pinyon Grove,

Oul Campon Permits younglerg. 79-3 CT Troy Calin. Cory Sumsuar '80 Valerie Thomas 804 Liz Caile 80-5 Greg Bryant 81-1

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1	2 3	4	5	S	7 8	9	10 1	1 12	13	14 1	15 16	1 17	18	13 2	0 21	22	23 2	4 2	5 23	27	28 2	9 30	1 31	32 :	33 3	4 35	36	37 :	38 3	9 40	41	42	43 4	4 4	5 4S	47	43 4	3 50	1 51	52 :	53 5	4 55	56	57 5	8 59	50	51 8	2 63	64	55 68	67	68 6	9 70	n	1211	3 74	151	5 11	18	79 8	1
1	11	1	1	1	11	1	1	11	1	1	11	1	1	11	1	1	1	11	1	1	1	11	1	1	1	1	1	1	11	1	1	1	1	11	1	1	1	11	1	1	11	1	1	1	11	1	1	1	1	11	1	1	11	1	4	11	1	11	1	11	
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