

DESIGNATION ORDER

By virtue of the authority vested in me by the Secretary of Agriculture under regulations 7 CFR 2.60(a) and 36 CFR 251.23, I hereby designate as the Red Canyon Research Natural Area the lands described in the following establishment record prepared by Joel S. Tuhy, dated November 14, 1986. These lands shall hereafter be administered as a research natural area subject to the above regulations and instructions issued thereunder.

F. Dale Robertson
Chief

5/5/87
Date

SIGNATURE PAGE

for

RESEARCH NATURAL AREA ESTABLISHMENT RECORD

Red Canyon Research Natural Area
Dixie National Forest
Garfield County, Utah

The undersigned certify that all applicable land management
planning and environmental analysis requirements have been
met in arriving at this recommendation.

Prepared by: Joel S. Tuhy Date 11/14/86
Joel S. Tuhy
Utah Public Lands Coordinator,
The Nature Conservancy

Recommended by: A. Clair Baldwin Date 12/9/86
A. Clair Baldwin
District Ranger,
Powell Ranger District

Recommended by: Hugh C. Thompson Date 12/10/86
Hugh C. Thompson
Forest Supervisor,
Dixie National Forest

Recommended by: J. S. Tixier Date 12/22/86
J. S. Tixier
Regional Forester,
Intermountain Region

Recommended by: Laurence E. Lassen Date 12/18/86
Laurence E. Lassen
Station Director, Intermountain
Forest and Range Experiment Station

ESTABLISHMENT RECORD

for

RED CANYON RESEARCH NATURAL AREA

within

Dixie National Forest

Garfield County, Utah

Introduction

The Paunsaugunt Plateau is one of the high plateaus that occur in a north-south orientation down the central part of Utah. Coniferous forests and sagebrush parks occupy the top of this plateau. Spectacular cliffs or breaks are present along its margins. Major river valleys border the Paunsaugunt Plateau on two sides: the Sevier River valley to the west and the Paria River valley to the east.

Southern Utah was occupied by the Anasazi culture in the early part of this millenium, with major population centers mainly to the southeast of the Paunsaugunt Plateau. Evidence indicates that Piute clans entered southern Utah before the Anasazi culture had entirely disappeared. The Piutes were frequent visitors to the Paunsaugunt region, as shown by artifacts that they left behind.

The Paunsaugunt Plateau and its bordering valleys were outside the traverses of early southwestern explorers such as Escalante and Fremont. The first white men in this area were probably adventurous trappers and prospectors who passed through during the period 1830-1850. Scouts of the Mormon Church reached this far south in the 1850's. Permanent settlement in the upper Sevier River valley dates from 1864, with the founding of present-day Panguitch (Piute for "big fish"). Hostilities with Indians led to abandonment of the village in 1866, but it was reoccupied in 1871. Settlements spread within this valley during the next 20 to 30 years.

The Paunsaugunt Plateau uplands furnished these settlers with natural resources such as timber, water, and summer forage. Federal administration of surface resources on much of the Paunsaugunt Plateau began in 1905 with the creation of the Sevier National Forest, now a unit of the Dixie National Forest. Many of the present-day occupants of the region still rely on these resources for their livelihood.

Accompanying this resource use is a need to maintain undisturbed examples of the area's natural diversity. One means of accomplishing this on National Forest lands is through administrative designation of Research Natural Areas (RNA's). In 1984 The Nature Conservancy proposed a small RNA near the mouth of Red Canyon, on the Powell District of the Dixie National Forest to the southeast of Panguitch.

This Red Canyon site is a small watershed that contains mixed-conifer forests and woodlands on contrasting geologic substrates (photo 1), plus an unusually rich cluster of endemic plant species, some of which are quite rare (photos 9-12). Field and office work in 1983 and 1984 found this site to be qualified for RNA status (Tuhy 1984). The opportunity exists to recognize and protect the values of this area by designating it as the Red Canyon Research Natural Area (RCRNA).

The Red Canyon tract is identified as a candidate RNA in the approved Dixie National Forest Land and Resource Management Plan (USDA Forest Service 1986). The environmental analysis conducted as part of the planning process supports the recommendation to establish the Red Canyon RNA.

Justification

An initial estimate of research natural area needs in Utah and Nevada shows that cells typical of the Utah High Plateaus are outstanding deficiencies in the RNA system (Van Pelt 1982; Table 25b). Table 30 in Van Pelt (1982) lists two specific key RNA needs for the Utah High Plateaus:

1. Undisturbed montane and subalpine forests exemplifying both common and rare habitat types on sedimentary and volcanic parent materials.
2. Centers of plant endemism, particularly on unusual substrates.

Designating the Red Canyon RNA would help to meet both of these needs, as mentioned in FSM 4063.41.4b. The following two paragraphs discuss these topics in more detail.

Red Canyon contains small but significant examples of xeric woodland and shrubland communities that are poorly represented in existing RNA's. The site also supports coniferous forest communities, on two contrasting geologic substrates, that are not well represented in the RNA system. These forest stands are not strongly typical of stands under timber management in the region. However, they are representative of forests that occupy wide areas on the dissected flanks of the Paunsaugunt and adjacent plateaus.

The Red Canyon area is also known among botanists as an unusually rich center of plant endemism. It received the highest priority for RNA recommendation by the rare plant working group at the 1982 Utah/Nevada RNA-needs workshop (Van Pelt 1982; Table 20). The proposed RCRNA contains occurrences of thirteen endemic or otherwise rare plant taxa; it has potential habitat for three more endemics that occur nearby but have so far not been located in the tract. While none of these sixteen taxa are listed as Endangered or Threatened, four that definitely occur (photos 9-12) and two that potentially occur in the proposed RNA are candidates for such listing. RNA designation can protect portions of habitat for these taxa, so that future listing as Endangered or Threatened is unnecessary or at least less likely. In this way the spirit of the Endangered Species Act, which is to protect and recover very rare species, can be fulfilled with less need to invoke the official listing process.

Copies of Tables 20, 25b and 30 from Van Pelt (1982), referenced above, are included in Appendix A as documentation of the needed natural diversity elements (FSM 4063.41.5).

Table 1 shows specific cells to be represented in the Red Canyon RNA. These cells are present in a little-disturbed state within the proposed RNA. As mentioned above, there is very little representation of these cells in existing RNA's, though several of the cells are present in other locations proposed for RNA status. However, the level of cell-duplication between Red Canyon and other proposed RNA's is relatively low.

Table 1. Specific cells to be represented in the Red Canyon RNA.

- I. Forest/Woodland Cell Category.
 - A. Pseudotsuga menziesii/Arctostaphylos patula (Douglas-fir/greenleaf manzanita) habitat type (Youngblood and Mauk 1985) (photos 3-5).
 - B. Pseudotsuga menziesii/Cercocarpus ledifolius (Douglas-fir/curleaff mountain mahogany) habitat type (Youngblood and Mauk 1985) (photo 7).
 - C. Pinus edulis-Juniperus osteosperma (pifion-juniper) communities (photo 8).

 - II. Shrubland Cell Category.
 - A. Cercocarpus ledifolius (curleaff mountain mahogany) community.
 - B. Artemisia nova (black sagebrush) community (photo 6).

 - III. Special Species Cell Category (as listed by F.C.E.R. 1977).
 - A. Unusual cluster of at least thirteen endemic plant taxa, some of which are quite rare (photos 9-12).

 - IV. Landforms Cell Category (as listed by F.C.E.R. 1977).
 - A. Cliffs, Hoodoos (photos 1, 2, 3).

 - V. Geologic Cell Category (as listed by F.C.E.R. 1977).
 - A. Igneous: basalt (Quaternary).
 - B. Sedimentary: primarily limestone (Tertiary: Eocene).
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The proposed RCRNA could support several research or educational uses. As a whole small watershed, studies could be conducted with little chance that adjacent (upstream) activities are a significant influence. A number of previous studies have focused on relationships between narrowly distributed plants and environmental factors (Kruckeberg 1969, Mason 1946, Welsh 1978, Welsh 1979). Red Canyon would be an excellent site for similar investigations, including the autecologies of the endemic plants. The juxtaposition of contrasting geologic materials (basalt and limestone) affords an opportunity to study vegetational differences based on parent material where climate is the same. Brooks (1970) conducted such an investigation in this general area. Studies of erosion rates are also possible. LaMarche (1966) performed this type of work near the proposed RNA, using tree-ring chronologies to infer rates of gully cutting and reasons for its occurrence.

Principal Distinguishing Features

The proposed RCRNA encompasses an entire small watershed near the lower western edge of the Paunsaugunt Plateau. Two major geologic types, limestone and basalt, occur in the natural area. These geologic units generally correspond with two different physiographic types. The eastern part of the proposed RNA contains highly dissected terrain formed from the limestone. Steep gravelly slopes, hoodoos, low cliffbands and small washes characterize

this part of the site (photo 2). Some small forested flats occur in the extreme northeast (photo 4). The western portion of the area is comprised of gentle to moderately steep basalt slopes of Black Mountain. These slopes are little dissected by drainage courses, in contrast with the exposed limestone to the east.

The principal biotic features of the proposed RCRNA are xeric forests, woodlands and shrublands. Small stands of mixed conifers, primarily ponderosa pine and Douglas-fir, occur on sites where soils and aspect are favorable. The most indicative understory plants are greenleaf manzanita on the limestone, and curleaf mountain mahogany on the basalt. Communities of piñon-juniper, curleaf mountain mahogany and black sagebrush are also present. Much of the eastern part of the tract consists of sparsely-vegetated slopes and outcrops of limestone. These nearly barren habitats support most of the rare plant populations in the proposed RNA. As mentioned previously, the area contains at least thirteen plant taxa that are endemic or otherwise rare. None of these are currently listed as Endangered or Threatened, but four are candidates for such listing.

Location

The proposed Red Canyon RNA is located on the Powell Ranger District of the Dixie National Forest. It lies 8 miles (13 km) southeast of Panguitch, in western Garfield County (see Maps 1A&1). Latitude and longitude are 37° 46' North and 112° 20' West, respectively. Specifically, the area lies in portions of sections 14, 15, 22 and 23 of T35S R4-1/2W, Salt Lake Meridian (Map 2). It is included on the Casto Canyon and Wilson Peak 7.5' topographic quadrangles.

The potential RNA encompasses an entire small watershed. Its boundary follows topographic features in the form of ridge crests and cliff rims (see Map 2). The boundary is quite evident on the ground and also when viewed in stereo on aerial photographs. A description of this boundary is as follows:

Beginning at Point 7937 in the NW4 of Section 23 (T35S R4-1/2W); thence directly along the watershed divide generally northeastward and then westward into Section 15; thence deviating slightly north of the watershed divide along a prominent rim to Point 7792; thence westward down the crest of a spur ridge, curving northwestward to meet a prominent rim (at the heads of tributaries to Losee Canyon); thence generally southwestward along this rim to the ridgecrest northwest of Black Mountain; thence southeastward up this ridge and along the western rim of Black Mountain's top; thence in a sinuous line generally eastward along the edge of a prominent rim; thence down a prominent limestone spur into and through the wash in the SW4 SW4 NE4 Section 22; thence southeastward up the crest of a spur ridge to the main watershed divide between the RNA and the main Red Canyon wash; thence generally northeastward directly along the watershed divide back to the point of beginning.

The proposed Red Canyon RNA encompasses an area of 460 acres (186 ha). Elevation ranges from about 7250 feet (2210 m) at the south-central margin

of the area, up to 7937 feet (2420 m) along the eastern border. This represents a vertical relief of 687 feet (210 m).

The proposed RCRNA is easily accessible, involving a drive of about 10 miles (16 km) from Panguitch (Map 1). Utah Highway 12, the main western approach to Bryce Canyon National Park, passes to the south of the natural area. This is a paved road kept open year round. It is recommended that RNA users park along the highway at the spot marked by the asterisk (*) on Map 2, preferably in the unpaved area on the south side of the highway for safety reasons. From this spot it is a short walk of ca. 0.3 mile (0.5 km) into the site (see arrow on Map 2); there are no obstructions along the way.

Foot travel is recommended within the proposed RNA. Use of horses is limited by cliffbands and steep, hard-packed slopes in the limestone part of the area, and by thick brush and small boulder fields in the basalt part of the site. These features are only slight hindrances to foot travel. Water is essentially absent; the only source found within the area is dry by early to mid summer. Campsites are available in Red Canyon (Forest Service campground), while less rustic accommodations are available in Panguitch and near Bryce Canyon.

Area by Cover Types

The extent and distribution of cover types in the proposed Red Canyon RNA has been derived from field surveys and subsequent aerial photo interpretation. Three classification systems are considered, as discussed below.

The Society of American Foresters cover type classification (Eyre 1980) is fairly applicable to the forests and woodlands of the natural area. Most of the mixed-conifer stands contain both ponderosa pine and Douglas-fir; because the pine tends to be more abundant overall, these stands are included in SAF Type 237: Interior Ponderosa Pine. Other woodlands are represented by SAF Type 239: Piñon-Juniper. Non-forest types are not considered in the SAF system. The distribution of SAF cover types in the proposed RCRNA is shown on Map 3.

The classification of potential natural vegetation by Kuchler (1964) may also be used to describe certain vegetation types of the proposed RCRNA: The juniper-piñon woodlands correspond to Type 21*. The taller forests appear to fit into Type 17 (pine-Douglas fir) and Type 18 (Arizona pine). There are also small examples of Type 31 (mountain mahogany scrub, without oak) and Type 32 (Great Basin sagebrush). The distribution of these Kuchler types in the natural area is shown on Map 3.

Based on more-detailed classification work in coniferous forests of the region (Youngblood and Mauk 1985), forests of the proposed RCRNA are identified as belonging to three habitat types. Non-forested communities were delineated in more detail based on observed floristic composition. The distribution of these types in the proposed RNA is shown on Map 4.

* Type numbers are from 1969 map.

Table 2 shows the estimated areas of vegetation types defined by the three classification systems.

Table 2. Estimated areas of cover types and habitat/community types in the proposed Red Canyon Research Natural Area.

Type	Type Number			Estimated Area	
	1980 SAF	1964 Kuchler	1969 Kuchler	Acres	Hectares
<u>SAF and Kuchler</u>					
Interior ponderosa pine	237	18,19	17,18	231	93
Piñon-Juniper	239	23	21	17	7
Mountain mahogany scrub (no oak)	---	37	31	7	3
Great Basin sagebrush	---	38	32	7	3
Not classified by either	---	--	--	198	80
				<u>Total</u>	<u>460 186</u>

<u>Habitat/Community Types</u>					
<u>Pseudotsuga menziesii/Arctostaphylos patula</u> habitat type				150	60
<u>Pseudotsuga menziesii/Cercocarpus ledifolius</u> habitat type				76	31
<u>Pinus ponderosa/Cercocarpus ledifolius</u> habitat type				12	5
<u>Pinus edulis-Juniperus osteosperma</u> community				17	7
<u>Artemisia nova</u> community				7	3
Sparsely-vegetated and barren limestone				195	79
Sparsely-vegetated and barren basalt				3	1
				<u>Total</u>	<u>460 186</u>

Physical and Climatic Conditions

The proposed RCRNA lies along the dissected western edge of the Paunsaugunt Plateau, just east of where it meets the valley of the Sevier River. The tract encompasses an entire small watershed to the north of the main wash in Red Canyon. Two major geologic types, limestone and basalt, occur in the natural area.

The geologic units generally correspond with two contrasting physiographic types. The eastern two-thirds of the proposed RNA is characterized by highly dissected terrain formed from the limestone. Steep gravelly slopes, hoodoos, low cliffbands and small washes typify much of this part of the site (photo 2). Some small forested flats occur in the extreme northeast (photo 4).

The western third of the natural area is characterized by the basalt slopes of Black Mountain. These slopes are gentle to moderately steep. They consist of raw to weathered basalt and, while "rough" on a small scale, are smooth and not dissected by drainage courses in contrast with the exposed limestone to the east.

The Powell Ranger District Land Systems Inventory describes the climate for this general area as follows:

"Three major storm systems determine the precipitation regime of the District. The first and most important is the storm system from the Pacific. These storms move into the area from the Pacific Northwest and the northern California coast. Precipitation from these storms is mostly snow. The second storm system is the high altitude, low pressure system that develops over Nevada and southwestern Utah from October to April. These two storm systems account for 65 percent of the moisture received on the District. The third storm system develops in the summer as a high pressure area over the southeastern United States. This storm system transports moisture from the Gulf of Mexico into the Colorado Plateau and generates high intensity thunderstorms."

The National Oceanic and Atmospheric Administration (NOAA) maintains several installations in the vicinity of Red Canyon that record temperature and precipitation. Table 3 shows record type, elevation, and location relative to the proposed RNA for four NOAA sites in the vicinity. Temperature and precipitation data from these stations are shown in Tables 4 and 5, respectively (NOAA 1960-84, NOAA 1982).

Table 3. Record type, elevation and location of NOAA sites near Red Canyon.

<u>NOAA Installation</u>	<u>Type of Record</u>	<u>Elevation</u>	<u>Distance from RCRNA</u>
Panguitch	Temp. & Precip.	6720 ft (2050 m)	8 mi (13 km) to NW
Hatch	Precip. only	6900 ft (2105 m)	9 mi (14 km) to SW
Bryce Canyon FAA AP	Temp. & Precip.	7595 ft (2315 m)	10 mi (16 km) to ESE
Bryce Canyon NP HDQ	Temp. & Precip.	7915 ft (2410 m)	11 mi (18 km) to SE

Table 4. Temperature data from NOAA sites near Red Canyon.

NOAA Site	Mean January		Mean April		Mean July		Mean October	
	°F	°C	°F	°C	°F	°C	°F	°C
Panguitch (1960-84)	24.0	-4.4	41.6	5.3	65.7	18.7	46.0	7.8
Bryce Canyon FAA AP (1951-80)	20.3	-6.5	37.2	2.9	62.1	16.7	42.9	6.1
Bryce Canyon NP HDQ (1951-84)	22.6	-5.2	37.7	3.2	63.0	17.2	43.0	6.1

Table 5. Precipitation data from NOAA sites near Red Canyon.

NOAA Site	Mean Annual		Mean June-Sept.		Mean Oct.-May	
	in	mm	in	mm	in	mm
Panguitch (1951-84)	10.10	257	4.83	123	5.27	134
Hatch (1951-84)	11.20	285	4.99	127	6.21	158
Bryce Canyon FAA AP (1951-80)	12.11	308	4.66	118	7.45	190
Bryce Canyon NP HDQ (1951-84)	15.35	390	5.86	149	9.49	241

Description of Values

Flora and Communities

Table 6 lists plant species collected or observed during field inventories in the proposed Red Canyon RNA. Scientific nomenclature follows Welsh et al. (1981) with two exceptions: Berberis repens Lindl. is used instead of Mahonia repens (Lindl.) G. Don., and the treatment of Welsh (1983) is followed in using Gutierrezia sarothrae (Pursh) Britt & Rusby rather than Xanthocephalum sarothrae (Pursh) Shinnars. Nomenclature for trees agrees with Little (1979).

The Red Canyon area is noteworthy as a center of plant endemism. Occurrences of thirteen taxa with various degrees of rarity were discovered in the natural area. Three other species not observed during field inventories may also be present.

None of these species are presently listed as Endangered or Threatened, although four of them are candidates for such listing. These four are defined as Category 2 taxa by the U.S. Fish and Wildlife Service (Federal Register Vol. 50, No. 188, pages 39526-39584; September 27, 1985). Category 2

Table 6. Plant species in the proposed Red Canyon RNA.

Species ¹ (common name)	Habitat ²							
	A	B	C	D	E	F	G	H
<u>Trees³</u>								
<u>Abies concolor</u> (white fir)	x							
<u>Juniperus osteosperma</u> (Utah juniper)		x			x	x		
<u>Juniperus scopulorum</u> (Rocky Mountain juniper)	x	x		x	x			
<u>Picea pungens</u> (blue spruce)	x							
<u>Pinus edulis</u> (two-needle piñon pine)	x		x	x	x	x		
<u>Pinus flexilis</u> (limber pine)	x	x						
<u>Pinus longaeva</u> (bristlecone pine)	x	x						
<u>Pinus ponderosa</u> (ponderosa pine)	x	x	x	x	x			x
<u>Populus tremuloides</u> (quaking aspen)				x				
<u>Pseudotsuga menziesii</u> (Douglas-fir)	x	x		x				
<u>Shrubs and Subshrubs</u>								
* <u>Arctostaphylos patula</u> (greenleaf manzanita)	x	x		x				
<u>Artemisia frigida</u> (fringed sagebrush)			x					
<u>Artemisia nova</u> (black sagebrush)			x	x	x			
<u>Artemisia tridentata</u> (big sagebrush)					x	x		
<u>Berberis repens</u> (Oregon grape)	x	x						
* <u>Ceanothus martinii</u> (Martin's ceanothus)				x				
<u>Ceratoides lanata</u> (winterfat)			x					
<u>Cercocarpus ledifolius</u> (curleaf mtn. mahogany)				x	x	x		
<u>Chrysothamnus nauseosus</u> (rubber rabbitbrush)	x		x					
<u>Chrysothamnus viscidiflorus</u> (Douglas rabbitbrush)			x					
* <u>Fallugia paradoxa</u> (Apache plume)	x	x						
<u>Gutierrezia sarothrae</u> (broom snakeweed)	x	x	x					
* <u>Holodiscus dumosus</u> (mountain spray)		x						
<u>Juniperus communis</u> (common juniper)	x							
* <u>Potentilla fruticosa</u> (shrubby cinquefoil)								x
<u>Purshia tridentata</u> (bitterbrush)					x			
* <u>Rhus trilobata</u> (squawbush)	x	x						
* <u>Ribes cereum</u> (wax currant)								x
* <u>Rubus idaeus</u> (red raspberry)								x
* <u>Symphoricarpos oreophilus</u> (mountain snowberry)	x	x						
<u>Tetradymia canescens</u> (gray horsebrush)	x							
* <u>Yucca angustissima</u> (yucca)		x						
<u>Graminoids</u>								
* <u>Agropyron dasystachyum</u> (thickspike wheatgrass)			x					
* <u>Agropyron scribneri</u> (Scribner wheatgrass)	x	x						
* <u>Agropyron spicatum</u> (bluebunch wheatgrass)	x	x		x				
<u>Bouteloua gracilis</u> (blue grama)					x			
* <u>Carex occidentalis</u> (western sedge)								x
* <u>Juncus longistylis</u> (long-styled rush)							x	
* <u>Koeleria macrantha</u> (junegrass)			x					
* <u>Oryzopsis hymenoides</u> (Indian ricegrass)	x		x			x		
* <u>Poa fendleriana</u> (muttongrass)			x	x		x		

Table 6 (continued). Plant species in the proposed Red Canyon RNA.

Species ¹ (common name)	Habitat ²							
	A	B	C	D	E	F	G	H
<u>Graminoids (continued)</u>								
* <u>Poa secunda</u> (Sandberg bluegrass)			x			x		
* <u>Sitanion hystrix</u> (squirreltail)	x		x		x	x		
* <u>Stipa columbiana</u> (Columbia needlegrass)		x						
* <u>Stipa comata</u> (needle-and-thread)	x		x					
<u>Forbs and Succulents</u>								
* <u>Androsace septentrionalis</u> (northern androsace)			x					
* <u>Antennaria microphylla</u> (rosy pussytoes)	x		x	x				
* <u>Antennaria parvifolia</u> (Nuttall's pussytoes)					x			
* <u>Arabis holboellii</u> (Holboell's rockcress)			x	x				
* <u>Arabis pendulina</u> (rockcress)			x	x			x	
* <u>Arabis sparsiflora</u> (elegant rockcress)				x				
* <u>Arenaria fendleri</u> (Fendler's sandwort)		x						
* <u>Arenaria kingii</u> (King's sandwort)	x	x						
* <u>Astragalus brandegei</u> (Brandege milkvetch)							x	
* <u>Astragalus calycosus</u> (Torrey milkvetch)	x			x				
* <u>Astragalus convallarius</u> (lesser rushy milkvetch)				x				
* <u>Astragalus humistratus</u> var. <u>humivagans</u> (groundcover milkvetch)				x				
* <u>Astragalus kentrophyta</u> (kentrophyta)		x						
* <u>Astragalus megacarpus</u> (great bladder milkvetch)	x			x				
* <u>Astragalus welshii</u> (Welsh milkvetch)				x				
* <u>Calylophus lavandulaefolius</u> (evening primrose)	x	x						
* <u>Castilleja chromosa</u> (desert paintbrush)	x		x					
* <u>Castilleja linariaefolia</u> (narrowleaf paintbrush)	x		x					
* <u>Chamaechaenactis scaposa</u> (chamaechaenactis)		x						
<u>Cirsium</u> sp. (thistle)	x	x						
<u>Clematis columbiana</u> (Columbia virgin's-bower)	x							
* <u>Cordylanthus kingii</u> (King's bird's-beak)				x				
* <u>Coryphantha vivipara</u> (cushion coryphantha)				x				
* <u>Cryptantha humilis</u> (round-spike cryptantha)	x		x	x			x	
* <u>Cryptantha ochroleuca</u> (yellow-white cryptantha)	x	x						
* <u>Cymopterus bulbosus</u> (onion spring-parsley)			x					
* <u>Cymopterus rosei</u> (spring parsley)		x						
<u>Descurainia</u> sp. (tansymustard)							x	
* <u>Draba subalpina</u> (subalpine whitlowgrass)	x	x						
<u>Echinocereus triglochidiatus</u> (hedgehog cactus)							x	
* <u>Erigeron eatonii</u> (Eaton fleabane)				x				
* <u>Erigeron pumilus</u> ssp. <u>concinoides</u> var. <u>condensatus</u> (vernal fleabane)			x				x	
* <u>Eriogonum alatum</u> (wing buckwheat)	x							
* <u>Eriogonum aretioides</u> (Widtsoe buckwheat)		x						
<u>Eriogonum microthecum</u> (slenderbush buckwheat)		x						
* <u>Eriogonum panquicense</u> var. <u>panquicense</u> (Panguitch buckwheat)	x	x						

Table 6 (continued). Plant species in the proposed Red Canyon RNA.

Species ¹ (common name)	Habitat ²							
	A	B	C	D	E	F	G	H
<u>Forbs and Succulents (continued)</u>								
* <u>Eriogonum racemosum</u> (redroot buckwheat)				x				
* <u>Euphorbia fendleri</u> (Fendler spurge)	x			x		x		
* <u>Euphorbia robusta</u> (robust spurge)	x							
* <u>Gentianella tortuosa</u> (gentian)	x							
* <u>Gilia aggregata</u> (scarlet gilia)			x	x				
* <u>Haplopappus acaulis</u> (stemless goldenweed)		x						
* <u>Haplopappus armerioides</u> (thrift goldenweed)		x						
* <u>Hedeoma drummondii</u> (Drummond's pennyroyal)		x					x	
* <u>Hymenopappus filifolius</u> (hymenopappus)	x	x	x	x			x	
* <u>Hymenoxys acaulis</u> (stemless bitterweed)	x	x						
* <u>Ivesia sabulosa</u> (Sevier ivesia)		x						
* <u>Leptodactylon caespitosum</u> (tufted leptodactylon)		x						
* <u>Lesquerella intermedia</u> (bladderpod)	x	x	x					
* <u>Lesquerella rubicundula</u> (Bryce bladderpod)		x						
* <u>Leucelene ericoides</u> (roseheath)		x	x					
* <u>Linum kingii</u> (King's flax)	x							
* <u>Linum perenne</u> (wild blue flax)	x	x	x					
* <u>Lithospermum incisum</u> (plains stoneseed)	x							
* <u>Lithospermum multiflorum</u> (southwest stoneseed)	x							
* <u>Lotus utahensis</u> (Utah trefoil)					x			
* <u>Lygodesmia grandiflora</u> (showy rushpink)					x			
* <u>Machaeranthera grindelioides</u> (machaeranthera)	x	x						
* <u>Monardella odoratissima</u> (mountain monardella)		x						
* <u>Oenothera caespitosa</u> (desert evening primrose)		x						
* <u>Opuntia</u> sp. (prickly pear)					x		x	
* <u>Oxytropis jonesii</u> (Jones' locoweed)		x						
* <u>Pedicularis centranthera</u> (dwarf lousewort)	x	x	x	x				
* <u>Penstemon bracteatus</u> (Red Canyon beardtongue)	x	x						
* <u>Penstemon caespitosus</u> (mat penstemon)	x	x	x					
* <u>Petradoria pumila</u> (rock goldenrod)	x	x			x			
* <u>Petrophytum caespitosum</u> (rock spiraea)	x	x						
* <u>Phlox austromontana</u> (desert phlox)					x	x		
* <u>Phlox gladiformis</u> (daggerleaf phlox)	x	x						
* <u>Phlox longifolia</u> (longleaf phlox)					x			
* <u>Physaria chambersii</u> (Chambers' twinpod)	x	x						
* <u>Senecio multilobatus</u> (lobeleaf groundsel)					x	x		x
* <u>Silene petersonii</u> (plateau catchfly)		x						
* <u>Stephanomeria spinosa</u> (spiny skeletonweed)	x	x						
* <u>Streptanthus cordatus</u> (heartleaf streptanthus)	x	x						x
* <u>Taraxacum officinale</u> (common dandelion)						x		
* <u>Townsendia exscapa</u> (Easter daisy)	x							
* <u>Townsendia incana</u> (townsendia)						x	x	
* <u>Townsendia minima</u> (least townsendia)	x	x						
* <u>Zigadenus elegans</u> (elegant death camas)								x

Table 6 (continued). Plant species in the proposed Red Canyon RNA.

Notes:

1. Scientific nomenclature follows: Welsh, S.L., N.D. Atwood, S. Goodrich, E. Neese, K.H. Thorne, and B. Albee. 1981. Preliminary index of Utah vascular plant names. Great Basin Naturalist 41:1-108.
 2. Habitats: A. Pseudotsuga menziesii/Arctostaphylos patula habitat type.
B. Sparsely-vegetated limestone.
C. Artemisia nova community.
D. Pseudotsuga menziesii/Cercocarpus ledifolius habitat type.
E. Pinus ponderosa/Cercocarpus ledifolius habitat type.
F. Pinus edulis-Juniperus osteosperma community.
G. Potentilla fruticosa/Zigadenus elegans community.
H. Sparsely-vegetated basalt.
 3. Nomenclature for trees follows: Little, E.L., Jr. 1979. Checklist of United States trees. USDA Forest Service Agricultural Handbook 541. 375 p.
- * Collected and deposited in regional herbaria.
-

taxa are those for which listing proposals are possibly appropriate, though substantial data needed to support listing are still unknown or not on file. These four species are:

<u>Eriogonum aretioides</u> (photo 9)	<u>Cryptantha ochroleuca</u> (photo 11)
<u>Penstemon bracteatus</u> (photo 10)	<u>Silene petersonii</u> (photo 12)

Six more species are relatively rare, but are not being considered for listing. These are included in Category 3C by the U.S. Fish and Wildlife Service: taxa removed from consideration for listing because they are more abundant or widespread than previously believed. These six species are:

<u>Cymopterus rosei</u>	<u>Oxytropis jonesii</u>
<u>Draba subalpina</u>	<u>Phlox gladiiformis</u>
<u>Lesquerella rubicundula</u>	<u>Townsendia minima</u>

Three other plant taxa present in the proposed RNA are recognized as being endemic or otherwise uncommon, but not to the degree of being formally categorized by the U.S. Fish and Wildlife Service. These three are Astragalus brandegeei, Eriogonum panquicense var. panquicense and Ivesia sabulosa.

In addition to the thirteen plant taxa discussed specifically in the preceding paragraphs, there are three other species that could be present in the proposed RCRNA, although they were not observed there during field inventories. The natural area contains habitat apparently suitable for these species, and further searching may locate them there. These three species are:

Castilleja revealii (Category 2)
Cymopterus minimus (Category 2)
Lomatium minimum (Category 3C)

Castilleja revealii and Lomatium minimum are known from elsewhere in the Red Canyon vicinity. Cymopterus minimus occurs on nearly-identical limestone habitats in Cedar Breaks National Monument, and might be expected in Red Canyon.

Eight types of habitats or communities were identified in the proposed RCRNA (see Table 6). Distributions of the non-forest types outside of the natural area are not well known, because comprehensive classifications do not exist for non-forest communities or habitats in southern Utah. Some comparisons can be made with communities of the "breaks" in the main amphitheater of Bryce Canyon National Park (Graybosch and Buchanan 1983). The eight vegetation types identified in the proposed RNA are described in more detail as follows.

A. Pseudotsuga menziesii/Arctostaphylos patula (Douglas-fir/greenleaf manzanita) habitat type.

This habitat type is described by Youngblood and Mauk (1985). It is scattered through the eastern two-thirds of the natural area, being almost entirely restricted to limestone parent materials. It generally occurs on less-harsh sites such as north-facing slopes, alluvial flats, and flat ridge crests.

Ponderosa pine is usually the predominant overstory species and Douglas-fir generally occurs in this stratum as well. Douglas-fir regeneration is present on most sites; even where it is locally absent, the stands were assumed to represent the dry extreme of this habitat type. Limber pine, piñon pine and Rocky Mountain juniper are also often present. These are generally open forests, with trees mostly under 60 feet (18 m) tall. Understories have a discontinuous shrubby appearance, with greenleaf manzanita prominent. Many other shrubs and herbs are present, including several of the rare plants, as shown in column A of Table 6.

Two local variations of this type were observed in the natural area, corresponding to topographic position: 1) north-facing slopes, and 2) alluvial bottoms and flat ridgecrests. On north-facing slopes, Douglas-fir often codominates or even dominates the overstory; understories are generally species-poor (photo 5). Stands on alluvial flats (photo 3) and on flat ridge crests (photo 4) contain proportionately less Douglas-fir. Their understories usually contain a much richer complement of species.

B. Sparsely-vegetated limestone.

These habitats comprise much of the eastern two-thirds of the natural area, where limestone is the predominant substrate. This type generally represents the harshest sites in the natural area.

As the name indicates, little vegetation cover occurs on these sites

(photo 2). Scattered bristlecone pine, limber pine and Rocky Mountain juniper may be present. On the whole these sites support many different shrubs and herbs (column B of Table 6), though none are abundant in any one location. Virtually all of the rare plants for which Red Canyon is noted occur on these sparsely vegetated slopes, and some of these species are restricted to these habitats.

Distinctions between this and the preceding type are not always clear. Many locations in the natural area appear transitional between the two, supporting a few stunted ponderosa pine and scattered manzanita shrubs.

C. Artemisia nova (black sagebrush) community.

The floor of the saddle to the northeast of Black Mountain is an elongate clearing dominated by black sagebrush (photo 6). Fringed sagebrush (Artemisia frigida) is also abundant. This is a fairly rich community, with over thirty species present in a small area. Oryzopsis hymenoides, Stipa comata and Erigeron pumilus were the most abundant herbs observed.

Scattered regeneration of ponderosa and piñon pines is encroaching on the edges of this clearing. It could not be determined if trees will eventually take over this site, or if the sagebrush represents an edaphic climax.

This community is in a location transitional between limestone and basalt parent materials. The soil is protected by a relatively well-developed and little-disturbed microphytic (cryptogamic) crust.

D. Pseudotsuga menziesii/Cercocarpus ledifolius (Douglas-fir/curleaf mountain mahogany) habitat type.

This habitat type is described by Youngblood and Mauk (1985). It occurs on the northern and eastern slopes of Black Mountain, being essentially restricted to basalt parent materials.

Ponderosa pine is generally the predominant overstory species; Douglas-fir is often codominant. Piñon pine and Rocky Mountain juniper are also usually present. Douglas-fir regeneration is present on most sites. These stands are generally taller and more dense than mixed-conifer stands on the limestone parent material (photo 7).

Understories are characterized by curleaf mountain mahogany and Martin's ceanothus (Ceanothus martinii). This type includes mountain mahogany stands without appreciable conifer overstory on the upper northeast slopes of Black Mountain. Here on the basalt there are few shrub and herb species in common with limestone substrates to the east.

E. Pinus ponderosa/Cercocarpus ledifolius (ponderosa pine/curleaf mountain mahogany) habitat type.

This type, described by Youngblood and Mauk (1985), occurs only on the small, level top of Black Mountain, on basalt parent material. Its presence is not considered to be extensive enough to fill a cell for this type in

the RNA system. Vegetation is similar to the Douglas-fir/curleaf mountain mahogany type, except that Douglas-fir is absent. Ponderosa pine, piñon pine and Utah juniper form an open overstory; curleaf mountain mahogany, black sagebrush, big sagebrush and bitterbrush occur in the understory.

F. Pinus edulis-Juniperus osteosperma (two-needle piñon-Utah juniper) community.

This community occupies the southeastern slope of Black Mountain, on basalt parent materials. It has the short, open-woodland physiognomy typical of piñon-juniper stands in the intermountain region (photo 8). The understory of this particular stand is fairly sparse and rocky. The most common understory plants are Hymenopappus filifolius, Oryzopsis hymenoides and Sitanion hystrix.

G. Potentilla fruticosa/Zigadenus elegans (shrubby cinquefoil/elegant death camas) community.

This is a very small but distinct community observed in only one location in the proposed RNA. It borders the small wash about 540 feet (165 m) west-northwest of the corner of Sections 14, 15, 22 and 23 (T35S R4-1/2 W, SLM). In this location, groundwater is forced to flow on or near the surface by a shallow, less-permeable lens of white sandstone. This is not a perennial water source, but it flows long after other washes in the area have dried up after runoff events. As a result, plants that require more moisture than is available in adjacent habitats are able to grow here. Such species include the shrubby cinquefoil and death camas, plus long-styled rush (Juncus longistylis).

H. Sparsely-vegetated basalt.

Small, nearly-barren areas of basalt boulders occur on the upper north and southeast sides of Black Mountain. Soil material that has accumulated in widely-scattered crevices supports species such as Ribes cereum, Rubus idaeus and Carex occidentalis.

Fauna

Table 7 lists animal species with known or potential occurrence in the proposed RCRNA. This information is drawn from the HABDAT wildlife data base maintained by the Intermountain Region of the Forest Service (Winn et al., no date). In this data base, animal species are listed by District as to their general occurrence, and by general community type with an indication of overall importance rating. Scientific nomenclature follows lists in this same publication.

Table 7. Animal species with known or potential occurrence in the proposed Red Canyon RNA.

Species ¹ (common name)	Habitat ²		
	A	B	C
<u>Birds</u>			
<u>Cathartes aura</u> (turkey vulture)	x		
<u>Accipiter gentilis</u> (goshawk)	X		
<u>Dendragapus obscurus</u> (blue grouse)		X	
<u>Meleagris gallopavo</u> (turkey)	X		
<u>Actitis macularia</u> (spotted sandpiper)		x	
<u>Zenaidura macroura</u> (mourning dove)	x	x	
<u>Bubo virginianus</u> (great horned owl)	x	x	
<u>Glaucidium gnoma</u> (pygmy owl)	x	x	x
<u>Otus asio</u> (screech owl)			x
<u>Otus flammeolus</u> (flamulated owl)	X	x	
<u>Strix occidentalis</u> (spotted owl)	X	X	
<u>Stellula calliope</u> (calliope hummingbird)	X	X	
<u>Colaptes auratus cafer</u> (redshafted flicker)	X	x	
<u>Sphyrapicus varius</u> (yellowbellied sapsucker)	X	X	
<u>Corvus corax</u> (common raven)	x	x	
<u>Cyanocitta stelleri</u> (Stellers jay)	x	x	
<u>Nucifraga columbiana</u> (Clarks nutcracker)	x	x	
<u>Perisoreus canadensis</u> (gray jay)	x	x	
<u>Pica pica</u> (blackbilled magpie)	x		
<u>Parus atricapillus</u> (blackcapped chickadee)	x		
<u>Parus gambeli</u> (mountain chickadee)	X	x	
<u>Sitta canadensis</u> (redbreasted nuthatch)	x	x	
<u>Sitta carolinensis</u> (whitebreasted nuthatch)	X	x	
<u>Sitta pygmaea</u> (pygmy nuthatch)	X	x	
<u>Certhia familiaris</u> (brown creeper)	X	x	
<u>Troglodytes aedon</u> (house wren)	x	x	
<u>Catharus ustulata</u> (Swainsons thrush)	X	X	
<u>Myadestes townsendi</u> (Townsend's solitaire)	x	x	
<u>Sialia currucoides</u> (mountain bluebird)	x		
<u>Turdus migratorius</u> (American robin)	x	x	
<u>Regulus calendula</u> (rubycrowned kinglet)	x	x	
<u>Regulus satrapa</u> (goldencrowned kinglet)	x	x	
<u>Bombycilla cedrorum</u> (cedar waxwing)	x	x	
<u>Vireo gilvus</u> (warbling vireo)	x		
<u>Dendroica graciae</u> (Grace's warbler)	X	x	
<u>Piranga ludoviciana</u> (western tanager)	X	x	
<u>Carpodacus cassinii</u> (Cassins finch)	X		
<u>Carpodacus purpureus</u> (purple finch)	X		
<u>Junco caniceps</u> (gray-headed junco)	x	x	
<u>Junco hyemalis</u> (slate-colored junco)	x	x	
<u>Junco hyemalis oregonus</u> (Oregon junco)	x	x	
<u>Loxia curvirostra</u> (red crossbill)	x	x	
<u>Pheucticus melanocephalus</u> (black-headed grosbeak)	x		
<u>Spizella passerina</u> (chipping sparrow)	X		

Table 7 (continued). Animal species with known or potential occurrence in the proposed Red Canyon RNA.

Species ¹ (common name)	Habitat ²		
	A	B	C
<u>Mammals</u>			
<u>Sorex vagrans</u> (vagrant shrew)	x	X	
<u>Eptesicus fuscus</u> (big brown bat)	X		X
<u>Euderma maculatum</u> (spotted bat)	X		X
<u>Lasiorycteris noctivagans</u> (silver-haired bat)	X		
<u>Myotis californicus</u> (California myotis)	X		X
<u>Myotis evotis</u> (long-eared myotis)	X	X	x
<u>Myotis lucifugus</u> (little brown myotis)	X	X	
<u>Myotis subulatus</u> (small-footed myotis)	X	X	x
<u>Myotis volans</u> (long-legged myotis)	X	x	x
<u>Plecotus townsendi</u> (western big-eared bat)	X	x	X
<u>Canis latrans</u> (coyote)	x		
<u>Felis concolor</u> (mountain lion)		x	
<u>Eutamias dorsalis</u> (cliff chipmunk)	x		
<u>Glaucomys sabrinus</u> (northern flying squirrel)		X	
<u>Spermophilus lateralis</u> (golden-mantled ground squirrel)	X		
<u>Thomomys talpoides</u> (northern pocket gopher)	X	X	
<u>Peromyscus maniculatus</u> (deer mouse)	x	x	
<u>Erethizon dorsatum</u> (porcupine)	x	X	
<u>Lepus americanus</u> (snowshoe hare)	x	X	
<u>Sylvilagus nuttallii</u> (mountain cottontail)	x		
<u>Odocoileus hemionus</u> (mule deer)		X	
<u>Reptiles</u>			
<u>Crotaphytus collaris</u> (collared lizard)			X
<u>Crotaphytus wislizeni</u> (leopard lizard)			X
<u>Phrynosoma douglassi</u> (short-horned lizard)	x		X
<u>Phrynosoma platyrhinos</u> (desert horned lizard)			x
<u>Sceloporus graciosus</u> (sagebrush lizard)	x		X
<u>Sceloporus undulatus</u> (eastern fence lizard)	x		X
<u>Urosaurus ornatus</u> (tree lizard)	x		X
<u>Uta stansburiana</u> (side-blotched lizard)			x
<u>Eumeces skiltonianus</u> (western skink)	X	x	x
<u>Cnemidophorus tigris</u> (western whiptail)	X	X	X
<u>Cnemidophorus velox</u> (plateau whiptail)	X	x	X
<u>Charina bottae</u> (rubber boa)	X	X	
<u>Arizona elegans</u> (glossy snake)			x
<u>Coluber constrictor</u> (racer)	x	x	x
<u>Hypsiglena torquata</u> (night snake)			X
<u>Lampropeltis getulus</u> (common kingsnake)	x	x	X
<u>Lampropeltis pyromelana</u> (Sonora mountain kingsnake)	x	X	X
<u>Lampropeltis triangulum</u> (milk snake)	X	X	X
<u>Masticophis flagellum</u> (coachwhip)			x
<u>Masticophis taeniatus</u> (striped whipsnake)	X	x	X
<u>Ophedryx vernalis</u> (smooth green snake)	X	X	X

Table 7 (continued). Animal species with known or potential occurrence in the proposed Red Canyon RNA.

Species ¹ (common name)	Habitat ²		
	A	B	C
<u>Reptiles (continued)</u>			
<u>Phyllorhynchus decurtatus</u> (spotted leaf-nosed snake)			x
<u>Rhinocheilus lecontei</u> (long-nosed snake)			x
<u>Salvadora hexalepis</u> (western patch-nosed snake)			X
<u>Sonora semiannulata</u> (western ground snake)	X	X	X
<u>Tantilla planiceps utahensis</u> (Utah black-headed snake)	X	x	X
<u>Diadophis punctatus</u> (ringneck snake)	X	X	
<u>Amphibians</u>			
<u>Ambystoma tigrinum</u> (tiger salamander)	x	x	
<u>Scaphiopus intermontanus</u> (Great Basin spadefoot)	X		X
<u>Bufo microscaphus</u> (southwestern toad)			x
<u>Bufo punctatus</u> (red-spotted toad)			x
<u>Bufo woodhousei</u> (Woodhouse's toad)			X
<u>Hyla arenicolor</u> (canyon treefrog)	x	x	
<u>Pseudacris triseriata maculata</u> (boreal chorus frog)	x		x
<u>Rana pipiens</u> (leopard frog)		x	

X Denotes major importance: Species is commonly encountered in community, and community provides important breeding, feeding or loafing sites.

x Denotes minor importance: Species is encountered in community several times each year, or species is only a periodic visitor to community.

1. Scientific nomenclature follows lists of animals of the Intermountain Region in: Winn, D.S., R.W. Maw, and A. Wywialowski. No Date. WILD RAM user guide. USDA Forest Service, Intermountain Region, Ogden, UT. 101 p.

2. Habitats: A. Ponderosa pine B. Douglas-fir C. Piñon-Juniper

Geology

The proposed RCRNA contains two contrasting geologic materials. The eastern two-thirds of the area is derived from the Eocene-age Wasatch Formation (photo 2). It consists primarily of red, orange or pink limestone, but also contains some interbedded mudstone, conglomerate and white calcareous sandstone (Gregory 1951). This unit is also termed the Claron Formation by Doelling (1975) and several other authors.

Quaternary basalt overlies the Wasatch Formation on the slopes of Black Mountain. The source of this extrusive igneous rock is unknown; no cones or extrusion-center features occur in the vicinity. The basalt probably originated in dikes now concealed from view (Gregory 1951).

The western edge of the Paunsaugunt Plateau is generally outlined by the Sevier Fault. Its exact location with respect to the proposed RNA is shown slightly differently on three geologic maps seen. Maps at 1:250,000 scale by Hintze (1963) and by Doelling (1975) show the fault just west of the natural area. A map of about 1:100,000 scale by Gregory (1951) shows the fault going through the northwestern part of the tract, on the north-northwest ridge of Black Mountain.

Soils and Landtypes

The Soil Conservation Service has conducted soil surveys on much of the Paunsaugunt Plateau. Survey work dating from the late 1960's is currently being consolidated with more-recent information; the resulting manuscript and map compilations are still awaiting publication.

Local relief and parent material are probably the most important factors affecting soil development on the Paunsaugunt Plateau. Generally, soils on gentle slopes with little past geologic erosion are deeper, have more transformation of silicate clays, and higher intensities of carbonate leaching than soils on steeper slopes with greater geologic erosion. Soils on steep north exposures have a denser canopy of conifers, lower temperatures, more effective moisture and more strongly developed profiles than soils on steep south exposures.

Soils derived from limestone (and other sedimentary rocks) of the Wasatch Formation are generally high in carbonates, and have reddish brown loam and clay loam subsoils with more than 35 percent coarse fragments. Reaction in surface layers is usually neutral to mildly alkaline. Canyon-bottom soils derived from the Wasatch Formation contain fewer coarse fragments and have moderately fine and fine textured subsoils.

The Powell Ranger District Land Systems Inventory (LSI) identifies specific landtypes and soils that occur in the Red Canyon area. The proposed RNA contains parts of three landtypes. The following information on these landtypes and soils is drawn from the Powell District LSI:

Landtype 11: Rough Broken Land.

This landtype covers much of the proposed RNA, with only the lower wash bottom and parts of Black Mountain excluded. It consists of steep, highly-dissected slopes with numerous rock outcrops (photo 2). Hoodoos sculptured from the pink limestone occur in several locations. Scattered lenses of sandstone form small cliffbands. Gently-undulating flats occur in the higher, northeastern part of the tract. Slopes range from 5 to 75 percent, with 40 to 60 percent most common.

Shallow, gravelly, medium-textured soils are predominant. A typical soil has a very gravelly silt loam surface horizon 2 inches (5 cm) thick. Beneath this is a gravelly silt loam horizon 8 inches (20 cm) thick. The subtending layer is a very gravelly silt loam 5 inches (13 cm) thick, that overlies fractured limestone bedrock at a depth of 15 inches (38 cm).

Landtype 32: Rolling to Steep Hillsides.

This landtype coincides with the basalt parent material on the northern through eastern slopes of Black Mountain. It consists of raw and weathered basalt flows and scattered rock outcrops. Slope gradients generally range from 20 to 40 percent.

These soils and basalt flows are mapped as the Circleville-Volcanic Rockland complex. The soils are generally shallow to moderately deep cobbly loams, often with numerous cobbles and stones on the surface. A typical soil has a very gravelly loam surface layer 2 inches (5 cm) thick. This is underlain by a gravelly clay loam horizon 7 inches (18 cm) thick, which in turn is subtended by a cobbly loam horizon 8 inches (20 cm) thick. The subsoil is a cobbly loam about 7 inches (18 cm) thick.

Landtype 45: Narrow Canyon Bottoms.

This landtype is present only in the extreme south-central part of the proposed RNA, along the bottom of the wash that drains this small watershed (photo 3). It consists of the narrow canyon bottom and associated alluvial materials. Slope gradients generally range from 2 to 7 percent.

Soils are mapped as the Winet gravelly sandy loam. They are formed in mixed alluvium derived mostly from limestone of the Wasatch Formation. The soils are generally deep, with erosion and deposition occurring at infrequent intervals along the floodplain. A typical soil has a gravelly sandy loam surface horizon 4 inches (10 cm) thick. This is successively underlain by a gravelly sandy loam horizon 13 inches (33 cm) thick, a heavy sandy loam horizon 7 inches (18 cm) thick, and a very gravelly sandy loam horizon 28 inches (71 cm) thick.

Lands

The proposed Red Canyon RNA is entirely reserved public domain land with no encumbrances or withdrawals. A special use permit issued to the Utah State Department of Highways along State Highway 12 does not involve the RNA tract.

Cultural

The Paunsaugunt-Sevier Planning Guide (USDA Forest Service 1979) notes the existence of historical sites in the general Red Canyon area. Sites in Butch Cassidy Draw and west of the Red Canyon Campground are mentioned, but no reference is made to sites in the RNA tract.

There is no indication that prehistoric cultural resources occur in the proposed RNA. Any artifacts that may have been present have probably disappeared due to soil movement.

Impacts and Possible Conflicts

Mineral Resources

Several publications concerning economic geology of the region indicate that the proposed RCRNA may contain certain mineral values. A discussion of this information follows.

Molenaar and Sandberg (1983) report a medium potential for oil and gas reserves beneath a cluster of lands that includes the proposed RCRNA. This cluster surrounds the Upper Valley field (ca. 30 mi/48 km east of the RNA), which produces oil from the Permian Kaibab Limestone. These authors indicate that possibilities exist for oil reservoirs in Permian or Mississippian rocks in this part of Utah. They do note, however, that many dry holes have been drilled throughout this vicinity. Fairly thorough seismograph exploration took place near Red Canyon in 1981. A well drilled on BLM-administered land west of Red Canyon was officially dry to a depth of about 12,000 feet (about 3600 m). A 1982 well north of Panguitch was abandoned at a depth of about 13,500 feet (about 4100 m).

The entire Paunsaugunt Plateau is thought to have good quality coal buried beneath it, but no outcrops occur as far north as Red Canyon (Doelling 1975, Doelling and Smith 1982). The Panguitch vicinity is reported to be a geothermal area by Doelling (1975), but only a few warm springs are recorded there. Prospects are not encouraging for steam development despite late Tertiary or Quaternary volcanism.

The proposed RNA lacks significant or unique deposits of locatable minerals. No uranium or other metals have been discovered near the site. Construction materials in the form of crushed, field, dimension or ornamental stone can be derived from the Wasatch Formation. This formation is widely exposed, however, and abundant sources exist outside the proposed RNA. A deposit of diatomaceous earth occurs about 4 miles (6 km) south of the mouth of Red Canyon (Crawford 1951), but no such deposits are known within the natural area.

Gravel is the only common variety mineral occurring in the Red Canyon area. It is taken from the wash bed near the National Forest boundary, and a pit is located on BLM-administered land west of Black Mountain. There is nothing significant about gravel in the natural area that would necessitate its extraction.

Bureau of Land Management oil and gas plats dated October 9, 1985 show the proposed RNA as occurring within two simultaneous offering tracts ("OG SIM"). These could be leased in the future, with appropriate protective stipulations. BLM microfiche dated November 7, 1985 show no mining claims in the natural area.

In summary, the potential for mineral resource development in the proposed Red Canyon RNA is very low, with the possible exception of oil and gas which have only a medium potential. Mineral values do not appear to be a significant encumbrance to RNA designation.

A forthcoming amendment to Section 4063 of the Forest Service Manual states that the Regional Forester may ask the Bureau of Land Management to withdraw a research natural area from mineral entry after its establishment in conformance with section 204 of the Federal Land Policy and Management Act of 1976 (90 Stat. 2743, 43 U.S.C 1701). However, difficulty of or resistance to such a withdrawal should not be a deterrent to establishment of desirable areas.

Grazing

The proposed RCRNA is not presently within an allotment. Authorized grazing does not occur because of poor forage, sparse ground cover and highly erodible soils. Livestock did graze this country in the past. Use in lower Red Canyon was probably light due to the sparse forage, rough terrain and scarcity of water away from the main Red Canyon wash. Grazing values pose no conflict with RNA designation.

Timber

Total forested area of the proposed RCRNA, including the piñon-juniper woodland, is 255 acres (103 ha). None of this is commercial forest, based on the criterion of at least 20 ft³/ac/yr (1.4 m³/ha/yr) growth. Therefore RNA designation involves no significant withdrawal from the timber producing base.

Watershed Values

Intense rainstorms produce large amounts of runoff and sediment from the Red Canyon area, due to its sparse vegetation and naturally-erodible soils. The local Soil Conservation District had proposed landform modification projects (terraces, trenches) on the limestone country, in order to reduce sediment inputs to the Sevier River. These projects were never undertaken, and probably would have proven futile if attempted. RNA designation should have no impact on the dynamic watershed properties of the Red Canyon drainage.

Recreation Values

The Red Canyon area is largely a stopover for tourists en route to or from Bryce Canyon National Park, but it is becoming a recreational center in its own right. Of the many people who pass through and linger in Red Canyon, surprisingly few wander into the site of the proposed RNA. The interior of this tract remains quite isolated.

Land surrounding the natural area is managed for semi-primitive non-motorized recreation opportunities. A horse-back riding business has been operated to the east of the proposed RNA; their preferred trails lead to the east and north of the natural area, and pose little conflict with it.

Although the greater Red Canyon area receives a good deal of recreational use, the specific RNA tract is removed from practically all recreational traffic. There appear to be no significant recreation-oriented con-

flicts with RNA establishment. RNA designation should not result in changes in recreational use of the area.

Wildlife and Plant Values

The proposed RCRNA contains occurrences of thirteen endemic or otherwise rare plant taxa, four of which are candidates for listing as Endangered or Threatened. RNA designation can maintain portions of habitat for these taxa, with no special management required, so that future listing as Endangered or Threatened is unnecessary or at least less likely. In this way the spirit of the Endangered Species Act, which is to protect and recover very rare species, can be fulfilled with less need to invoke the official listing process.

Wilderness, Wild and Scenic River, or National Recreation Area Values

None of these special designations apply to the proposed Red Canyon RNA. The Red Canyon North RARE II tract was recommended for wilderness status, but was not designated as such by the 1984 Utah Wilderness Act.

Transportation Plans

There are no transportation plans that would adversely affect the proposed RCRNA. Designation of an RNA should have no effect on the Dixie National Forest transportation system.

Management Plan

The objectives for establishing the Red Canyon RNA are to protect ecosystem structure and function in several of the more xeric forest and woodland situations typical of parts of the Utah high plateaus, and to maintain habitat for certain endemic or otherwise rare plant species. These objectives can be accomplished at Red Canyon without requiring any special management actions, other than protection against use that might jeopardize values for which the RNA is proposed.

Vegetation Management

No special practices such as prescribed burning or livestock grazing will be used to maintain certain ecological conditions.

Fences

At present there does not appear to be a need for fencing around any part of the proposed Red Canyon RNA.

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Appendix A

Appropriate tables from

Research Natural Area Needs in Nevada and Utah: A First Estimate

Table 25b
 OUTSTANDING RNA DEFICIENCIES¹
 --Portions of All Provinces--

General Area or Subprovince	Cell Category
1. Southern and western Nevada	Aquatic...Habitats; Wildlife
2. Northern Nevada (north of I-80)	Shrublands and Grasslands Aquatic and Riparian Habitats Wildlife (fishes, primarily)
3. High Great Basin ranges	All except Wildlife and Rare Plants
4. Lowlands of southwestern Utah	Rare Plants Shrublands Wildlife
5. Utah High Plateaus	Alpine Lands Forests and Woodlands Geology and Landforms Rare Plants
6. Southeastern Utah, including the high laccolithic mountains	Alpine Lands Forests and Woodlands Geology and Landforms Shrublands and Grasslands
7. The Uinta Mountains	Alpine Lands Aquatic and Riparian Habitats Forests Geology and Landforms
8. The Uintah Basin	Rare Plants Geology and Landforms

¹. Not in priority order.

Table 30

KEY RESEARCH NATURAL AREA NEEDS
--Utah High Plateaus Province--

Need	Cells or Combinations	Possible Location	Land Unit
1. Undisturbed montane and subalpine forests exemplifying both common and rare habitat types on sedimentary and volcanic parent materials	<u>Picea engelmannii</u> series <u>Abies lasiocarpa</u> series <u>Picea pungens</u> series	Tushar Mtns. Wasatch Plateau Markagunt Plateau Boulder Top Aquarius Plateau	Fishlake NF Manti-LaSal NF Dixie NF
2. Centers of plant endemism, particularly on unusual substrates	Many plant taxa Montane and subalpine forest series	Red Canyon Tushar Mtns.	Dixie NF Fishlake NF
3. A ponderosa pine area typifying stands under commercial timber production in southwestern Utah	<u>Pinus ponderosa</u> series Other coniferous forest series Grassland types ?	National parks Paunsaugunt Plateau Aquarius Plateau	Zion & Bryce NP's Dixie NF
4. One large or several smaller sites protecting examples of presettlement herblands on Wasatch Plateau	Shrubland and Grassland types A few rare plant taxa Forest and Woodland cells	Protected tops on Wasatch Plateau -- e.g., Nelson Mountain	Manti-LaSal NF

Table 20
 RECOMMENDED RESEARCH NATURAL AREAS
 For
 RARE PLANTS
Utah

--In Priority Order--

Area Name	Land Unit	Taxa of Concern	Associated Features and Remarks
1. Red Canyon	Dixie NF	Castilleja revealii Cryptantha ochroleuca Draba sobolifera Erigeron aretoides E. panguicense var. panguicense Lesquerella rubicundula Lomatium minima Oxytropis jonesii Penstemon bracteatus Phlox gladiformis Silene petersonii var. minor Townsendia minima Ivesia subulosa ?	Diverse coniferous forests; bristle- cone pine and ponderosa pine prominent Northwest of Bryce Canyon NP
2. High Tushar Mtns.	Fishlake NF	Astragalus perianus Castilleja parvula Draba sobolifera D. subalpina Lesquerella rubicundula Astragalus platytropis Chamaerodos erect var. parvifolia	Unusual lithology; complex substrates. Two or three po- tential RNA's (see Appdx. I) Contains "Bullion Canyon endemic center"
3. Coral Pink Sand Dunes	Cedar City BLM	Asclepias welshii Astragalus strati- florus Erigeron religiosus Eriogonum zionis Penstemon leiophyllus Yucca kanabensis	Extensive area of sand dunes with much off-road vehicle use. Curious ponderosa pine groves within dunes