

# Isolated Butte and Mesa Summits of the Colorado Plateau

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**Abstract** — Isolated buttes and mesas are dramatic features of the Colorado Plateau of New Mexico, Arizona, Utah, and Colorado. The isolation of the summits of these landforms is easily recognized. The sites discussed here range in size from 2 to more than 800 ha and support a variety of vegetation types, including piñon-juniper woodland. Most summits are inaccessible to livestock and some native animal species and are rarely visited by people. The most isolated sites support only a small subset of the terrestrial vertebrates that occurs in nonisolated areas.

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Biological communities on isolated buttes and mesas have been unaffected by most human activities. For scientists and land managers, these pristine sites could be baselines for gauging impacts occurring elsewhere, define productive potentials of woodlands, constitute sanctuaries for native species, and are important for study of ecological processes.

Pristine or little-disturbed ecological communities are rare in the western United States. Resources of most accessible lands have been used by people for 100s if not 1000s of years. In the piñon-juniper woodland, grazing and browsing by domestic livestock, gathering wood for fuel and building material, off-road vehicle use, human-caused fire, hunting, and physical manipulation such as chaining have altered the woodland. The woodland community we see today does not reflect the presettlement or undisturbed condition. Do we know what the natural characteristics of the piñon-juniper woodland are?

This paper discusses some of the research that has examined the undisturbed communities—including piñon-juniper woodland—on the summits of isolated buttes and mesas in southern Utah.

Monoliths surrounded by cliffs or steep talus aprons with a caprock are prominent desert landforms throughout the Colorado Plateau Ecoregion (fig 1). Buttes are columns whose breadth approximates or is less than the height of the cliffs. Mesas are many times wider than high and have larger summit areas (over 40 ha). Buttes and mesas are not confined to this highly scenic Ecoregion, which includes southern Utah, part of western Colorado, northwestern New Mexico, and a small area of

northern Arizona (Omernik 1987). However, they are probably more numerous, varied, and striking there than in other North American or foreign arid zones. Monument Valley on the Navajo Indian Reservation provides abundant popular images of dry buttes. The seclusion of summit areas is readily comprehended and illustrates “natural area” exceedingly well. Scientific or historiographic problems of confidently locating presettlement terrain fragments (Noss 1985) are completely absent.

Buttes and mesas provide superb natural “exclosures” (Laycock 1975). They are inaccessible to one or more domestic or wild animal species that elsewhere influences vegetation and soils. Some summits are only difficult for hikers to reach, while others exclude ungulates and persons on foot. The most isolated sites admit only birds, a few species of small mammals, a sparse herpetofauna and invertebrates. A zoological researcher can select degrees of exclusion represented by a set of summits. Helicopters are often the sole or safest means of access for studies (Johnson 1986) and surveys (Tuhy and MacMahon 1988).

Canyonlands National Park and Glen Canyon National Recreation Area (GCNRA) in southeastern Utah contain the best-studied and most explicated summit environments. The forested mesas of Zion National Park are partly studied, dissimilar, and more humid. Other kinds of cliff geology occur in south-central Utah. Isolated summits of the southern Colorado Plateau (Jameson et al. 1962) are not considered here.

Buttes and mesas have received little mention and consequent action in inventories of geologic natural areas or landmarks (Spicer 1987). This is because the constituent sedimentary strata and their sequences are widely expressed and no known summits have geologic or paleontologic curiosities. About seven mesa tops in southern Utah are established Research Natural Areas

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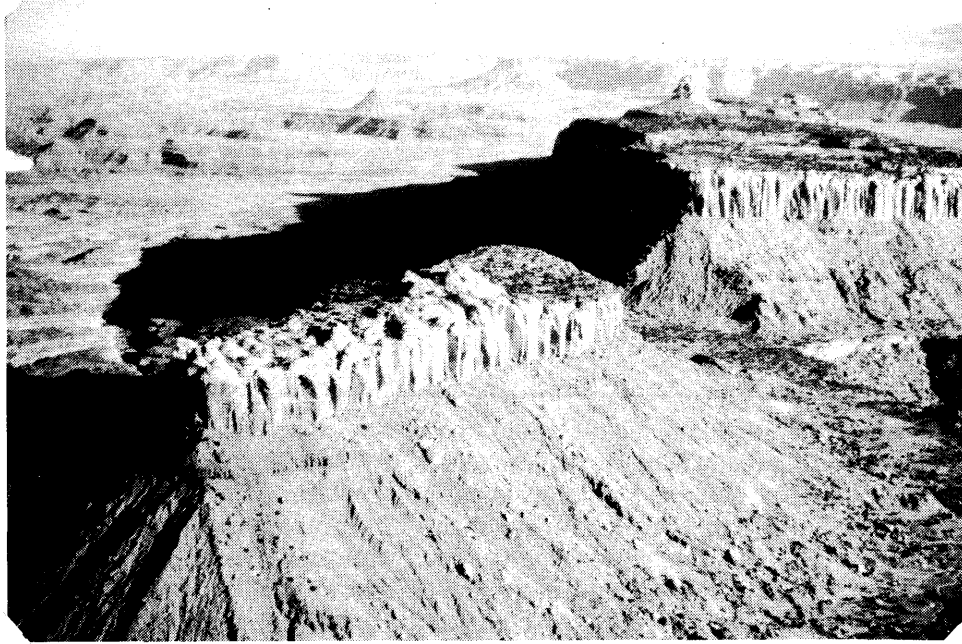


Figure 1. — Isolated butte in foreground, isolated mesa in right background; 60 km S of Moab, Utah.

and/or Areas of Critical Environmental Concern. Twenty-one summits have been inventoried but not protectively designated yet. At least two undisturbed piñon-juniper woodland communities in New Mexico are designated Research Natural Areas.

The size of most summits under discussion is between 8 and 800 ha. A few mesas are tenuously connected to larger, more accessible uplands by narrow rock peninsulas. Hikers can generally negotiate these causeways, which otherwise bar livestock or motor vehicles.

The primary criterion for “isolation” is the absence of historical and current livestock grazing. Ungrazed sites may also have few and infrequent human visitors, usually range conservationists (Mason and others 1967) or descriptive ecologists (Tuhy and MacMahon 1988). Mule deer (*Odocoileus hemionus*), wild sheep (*Ovis canadensis*) and elk (*Cervus elaphus nelsoni*) have been barred from numerous summits, termed “super-relict” (Tuhy and MacMahon 1988). Furthermore, cliffs may also repel some small mammals and nonavian predators.

Scientific interest in isolated summits began about 55 years ago. Observers wondered if remote promontories of the Grand Canyon rim were “lost worlds” where undescribed species could be living. Such notions were soon dispelled by credible survey parties (Anthony 1937). However, later quantitative work showed that smaller summits do support faunas unlike those of lower terrain or what is termed the accessible “mainland” lying some distance away at comparable elevations (Johnson 1986).

The most thorough and theory-grounded studies are summarized in Johnson (1986:154), who chose faunal groups “that might be affected by the cliff barriers and that significantly influence desert community structure, specifically terrestrial

mammals, ants, and reptiles”. Study areas were free of livestock or wild ungulates, and were believed to have a reduced suite of rodent and reptile species.

The canyon mouse (*Peromyscus crinitus*) was one of only two mammalian species on one butte. On another butte it was the only species of *Peromyscus*. In these situations, the canyon mouse used a broad range of microhabitats. A “mainland” control site supported at least 16 mammalian species. Mammalian species diversity was inversely correlated with the density of canyon mice. Interspecific competition probably restricted canyon mice to rocky habitats of the mainland. The canyon mouse was the only terrestrial mammal to occur on all the isolated buttes because it is an excellent climber. Most other mammalian species cannot climb cliffs to reach summits (Johnson and Armstrong 1987).

Small-mammal and reptile faunas of the studied buttes and mesas were depauperate in comparison to control tracts of equal area. Reduced species richness was not offset by endemism or the presence of species not living at the base of monoliths or on the “mainlands”. Butte-top species are not holdovers from more favorable paleoclimates, stranded above the cliffs.

Johnson (1986) concluded that the list of butte inhabitants was constant, as was the pool of species capable of reaching summits. No island biogeography theory in the extant literature accounted for the observed patterns in southeastern Utah. Instead, buttes were colonized only by certain species, unlike oceanic or lacustrine islands which many species can reach. The airline or surface distance between a butte and the “mainland” has no influence on the size and composition of the summit fauna.

Summits are not rare-animal sanctuaries or evolutionary “hotspots”. Summit-dwelling rodents are not morphologically differentiated and no vertebrate species is fully restricted to any

known summit. Faunal richness is less than on the surrounding terrain. Nonetheless, communities of buttes and small mesas are cryptically different from their mainland counterparts. They illustrate a distinct form of natural diversity.

These environments are not genuinely island-like animal or plant habitats. This is true whether they occur in the Ecoregion or elsewhere in the West. The only truly insular, intermontane situations with which buttes and mesas may be poorly compared are rocky islands in the Great Salt Lake of northern Utah. Species richness is closely correlated with lake-island area, and rodent endemism is notably high (Bowers 1982). No comparable species-area relationship nor incidence of subspeciation has been reported for summit animal communities (Johnson 1986).

Buttes and mesa have been used integrally in studies of postsettlement grazing impacts and fire history. Jeffries and Klopatek (1987) used Romana Mesa (GCNRA) in conjunction with three non-relict sites in their study of grazing effects on the blackbrush ecosystem. The mesa had more herbaceous, shrub, microphytic and total vegetal cover than the ostensibly comparable, grazed or once-grazed sites. Jeffries and Klopatek (1987) admittedly could not "control for" the lack of native grazers and browsers on Romana Mesa. Madany and West (1984) contrasted mesa and "mainland" vegetation in light of management and land-use factors that might have altered wildfire return intervals.

Buttes and mesas may be drier, rockier and more depauperate than ostensibly comparable "mainland" tracts of the same size. Their true benchmark value is thereby reduced. The very long-term absence of native browsers can confound comparisons made between ungrazed mesa and grazed "mainland" communities (Jeffries and Klopatek 1987). This raises the serious issues of realism (West 1991) and representativeness (Mackey and others 1988). For reference uses, the main requirement is that study assumptions and site limitations be explicit before extrapolations are made.

Even if buttes and mesas do not genuinely represent the Ecoregional landscape or provide valid management comparisons, they safeguard valuable expressions of dryland environmental quality (West 1991). Regional community classifications are enriched by types—such as piñon-goldenrod—first noticed on and possibly restricted to summits. New associations have surfaced in proportion to search effort, as inventories reach unvisited summits.

The study of butte and mesa environments could help agencies and institutions charged with assessing the overall health of Western ecosystems. The National Park Service (NPS) is considering the Colorado Plateau as a "platform" for detecting climatic-change impacts on the Southwestern parks and kindred drylands. The value of completely pristine, inaccessible places has not been mentioned in global-change literature (Mooney 1991), nor has a supportive role for butte and mesa tops been articulated in operational terms.

For atmospheric changes, pristine summits would enable unambiguous and unconfounded comparison with "mainland" community or species responses. Whereas the disappearance of

decimation of a species might be due to anthropogenic factors affecting the "mainland", on a summit it could be more directly attributed to measured ambient warming. All summits discussed here are in federal or joint federal/state ownership, enabling control of access. Ecologists have urged that projects as long as a decade or more get underway on diverse and appropriate sites (Likens 1989). Undisturbed summits surely qualify on many counts.

Ancillary field survey activities on isolated butte and mesa summits of the Ecoregion have included permanent vegetation transects (Tuhy and MacMahon 1988) and repeatable color panoramas obtained over marked ground locations (Schelz and Van Pelt 1990). Both transects and photopoints will enable investigators to obtain comparable data or photographs in the years ahead. Photographic stations could be reoccupied and matching panoramas, stereopairs, or single scenes obtained. Totally undisturbed dryland sites are best documented and analyzed using both photogrammetric and permanent-plot techniques (Turner 1990).

Isolated buttes and mesas provide a set of natural experiments in which natural ecological processes, such as competition, predation, herbivory, and primary production, can be studied at sites that have been little influenced by human activity.

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