Mountain Geography

Article *in* Geographical Review · January 2000

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Geographical Review, Vol. 90, No. 1. (Jan., 2000), pp. 35-56.

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Geographical Review is currently published by American Geographical Society.

MOUNTAIN GEOGRAPHY

DAVID SMETHURST

ABSTRACT. Although mountains have been studied for centuries, they are the subject of only a slender body of formal literature. Instead, those who study high places in specific regions construct working definitions and continually recraft bibliographies. Studies of mountains often focus on comparatively limited themes: physical processes, ecology, or sacred spaces, for example. As scholars become interested in environmental degradation and the development of mountains, there is all the more need to develop a mountain geography literature that expands the study of mountains to include the political, economic, cultural, and social dimensions of their environments and peoples. Three areas—cultural geography, political ecology, and conservation theory—are suggested for additional research. *Keywords: conservation, cultural geography, mountains, political ecology.*

A map showing only the world's mountains and high places resembles a series of island arcs and peaks, surrounded by a sea of lowlands (Wyckoff and Dilsaver 1995) (Figure 1). Many of the arcs trend from north to south: the Rocky Mountains, the Sierra Nevada, and the Andes of the Americas; the Urals and the Verkoyansk Range in Siberia; and the Mitumba Mountains in Africa. Others, such as the Himalayas and the Tian Shan in Asia and the Atlas Mountains in North Africa, are east-to-west trending. Although some of the mountain chains are linked, as are those of the Americas and the approximately 6,000-mile-long band that stretches from the European Alps to Southeast Asia—the Alps, Carpathians, Balkans, Zagros, Hindu Kush, Himalayas, and Hengduan Shan—many are isolated by thousands of miles of lowlands—the Transantarctic Mountains, Urals, and Southern Alps of New Zealand.

Scholars have studied the mountain world for better than two centuries, yet no agreed-upon body of mountain literature has emerged. Instead, there is a vast array of scattered publications dealing with high places that are defined by those who study them, who know each other, and who work (and sometimes quarrel) in specific regions such as the Andes (Troll 1968; Brush 1977; Stadel 1991), the Himalayas (Ives and Messerli 1989; Bishop 1990; Brower 1991; Stevens 1993), or the Alps (Netting 1974; Messerli 1989; Bätzing, Perlik, and Deklevan 1996). And although a flurry of books, papers, articles, and conferences have addressed mountain environments, studies trend in the same direction: toward physical processes, ecological studies (with the two melding into geoecology), evaluation of natural hazards, the modeling of mountain ecosystems and processes, and hazards research. Even though other aspects of mountain environments have recently been treated, the literature remains less than well defined or rigorous (Denniston 1995).

A body of literature named and known as mountain geography could more usefully encompass all aspects of mountain regions and peoples. This would be not just in reaction to a perceived crisis in mountains (Mountain Agenda–UNCED 1992;

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The Geographical Review 90 (1): 35–56, January 2000

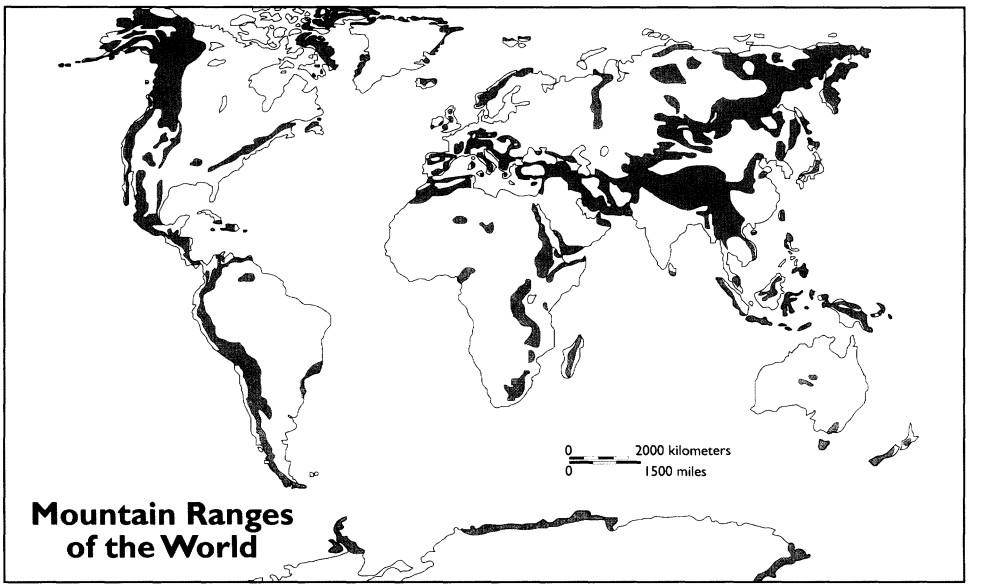

FIG. 1—Some of the major mountain ranges of the world. *Source:* Adapted from Bailey 1996.

Stone 1992; Denniston 1995). Instead, mountain geography as an inclusive field would rightly draw on the rich body of geographical and other technical literature, including cultural geography, political geography (and its cognate field political ecology), economic geography, physical geography, and human geography. Though still in far from its final likely form, the study of mountains has evolved. The progression has so far ignored unique aspects of mountain geography, which has in its turn resulted in methodological biases that are now sadly inherent in mountain literature. A failure of understanding has spawned misinterpretation of factors involved in the transformation and degradation of mountain environments. Three future research directions—cultural geography, political ecology, and conservation theory—are fundamentally needed to create a mountain geography literature.

THE EVOLUTION OF MOUNTAIN STUDIES

Mountains have long been revered, held in awe, and viewed as symbols of strength, freedom, and eternity. Mountains are worshiped by diverse peoples throughout the world, from the American Indians, to the Chinese, to the Incas (Bent 1913; Mishkin 1940; Sullivan 1962). Mountains figure prominently in the Old Testament, in Greek and Roman mythology, and in religions throughout the world (Price 1981, 6–23; Hobbs 1995). Western scientists began formal study of mountains in the nineteenth century, during the Age of Empire. That initiative coincided with the budding emergence of the ecological sciences, or study of the relationships between biological communities and physical environments. The ecological sciences were a good match for the study of mountains because mountains were economically, socially,

politically, and physically peripheral to empires. They were seen as distinct ecological islands that were separated but were otherwise untrammeled by an expanding modern world. That said, for ecologists, human activities were—and still are—treated like inconvenient intrusions, with social and cultural processes square pegs and poor fits in rounded ecological systems or tailored plant-community models.

Among the first scholars to scrutinize mountains in the very early nineteenth century was Alexander von Humboldt, who studied tropical mountains in the Americas. He sought to understand the relationship among altitude, climate, and ecological processes and was a pioneer in the systematic study of relationships between vegetation belts and elevation or biogeography (Humboldt and Bonpland 1977). Other mountain scholars included V. V. Dukochaiev, who examined the relationships between soil formation and climate, slope, plants, animals, and geology, and Albrecht Penk, who studied the link between climate and landforms and came up with the term "geomorphology" (Knapp 1988, 130).

These early works helped build an understanding of mountain geography. They also established the relationship between ecology and geology, or "geoecology" (Troll 1973), and the links between ecology and altitude (Forman 1988). The concept of altitudinal zonation or verticality, in which mountains comprise rings of altitudinal zones, each capable of supporting certain communities of plants and animals, and human activities, helped scholars better understand mountain ecosystems (Brush 1977).

Throughout the 1970s the studies of mountains were primarily ecological, or ecosystem oriented, but in the 1980s landscape ecologists began to turn their attention to such hazards as frost, drought, landslides, and erosion (Ives and Krebs 1978). Social and political problems were rarely discussed, and attempts to understand how humans adapted to mountain environments focused on models and diagrams using a systems approach rather than on detailed studies of human interactions with their environment (Hewitt 1988).

The study of mountains is still firmly anchored in the ecological sciences (Price 1981). Scientists who study mountains tend to have an ecological background and include geographers (cultural ecology), geologists (geoecology), anthropologists (ecological anthropology), historians (environmental history), biologists, and sociologists (human ecology) (Knapp 1988, 129). Because of this, much of the current literature on mountains relies on methods drawn from the ecological sciences, which are themselves a fairly incomplete focus of study (Price 1997). Some of the studies concentrate on the dynamic relationship between humans and their environment and attempt to show how humans adapt to and modify mountain environments. They include studies of crop plants and tools (Gade 1972), terracing (Donkin 1979), irrigation (Mitchell 1976), soil management (Winterhalder, Larsen, and Thomas 1974), raised fields (Knapp and Denevan 1985), and adjustments to demographic pressures (Boserup 1965; Knapp 1988, 132). However, the vast majority of mountain studies rely on modeling and systems theory, which treat mountains and the people living there as static elements in what amounts to a scientific equation. The 1973 Man

and the Biosphere Programme Project 6, instituted to study human impacts on mountain environments, relies on a systems approach, which assumes that human communities are in balance with their environment and places little emphasis on people and their role as active agents in the environment (Rappaport 1968; Knapp 1988, 131). This attitude is changing as researchers who have used the models and systems approach now recognize the need to incorporate humans into their models (Ives and Messerli 1990, 106).

In 1992 mountains were restored to the map of world concern at the U.N. Conference on Environment and Development in Rio de Janeiro with the publication of *An Appeal for the Mountains* (Mountain Agenda–UNCED 1992). Just as biologists broadened their attention from mere studies of animal biology to include larger concerns for managing and protecting wildlife in the 1970s, so did researchers studying mountains realize that to continue working on them they had best learn to conserve and protect them (Mountain Institute 1995).

Much of the mountain geography literature of today is driven by interest in conserving environments. Scholars have identified nine areas of particular concern: cultural diversity; sustainable development; production systems and alternative livelihoods; local energy demand and supply in mountains; tourism; sacred, spiritual, and symbolic significance of mountains; mountains as sources of water; mountain biodiversity; and climate change and natural hazards (Mountain Institute 1995). Yet these nine areas of study largely react to a perceived crisis of destruction of mountain environments. The crisis was captured by Erik Eckholm in 1975 and critiqued by Jack Ives and Bruno Messerli almost fifteen years later (1989), but the areas of concern remain notably sterile and technocratic (Hewitt 1988; CWWR 1996).

Calls for increased integration of scientific disciplines persist. But the partition of knowledge in the jealous camps of academia and an even more resolute fragmentation in nongovernmental organizations, the United Nations, and research communities continue to hamper understanding of the unique geography of mountains.

Mountains

Mountains are an important world landscape. They constitute one-fifth of the world's land, or roughly 30 million square kilometers, and they are home to 570 million people (Ives 1992). More than half the world's people depend on mountains for food, water, hydroelectricity, timber, or mineral resources. Mountains are elaborate environments characterized by complex topography, multiple ecological zones, and built-in biological diversity. These three characteristics are linked, and they play a role in understanding mountains.

High places are topographically diverse: Changes in elevation, slope, and sunlight are compressed into relatively small areas, leading to spatially concentrated variations in temperature, radiation, wind, moisture availability, and soils. Physical distinctions create different ecological zones or altitudinal zonation—belts of ter-

rain where climate, soils, and vegetation are similar. Typically, every 100 meters in elevation gained is equivalent to a 100-kilometer change in latitude. The wide variety of ecological niches means that mountains also support, in their manifold small niches, a variety of plants and animals. Half of California's 7,000 vascular plant species are in the Sierra Nevada, and 400 of these are endemic (CWWR 1996, 5). Over time, species have adapted to niches, leading to high endemism. Because of this, mountains are often refuges for species that were once in the lowlands. For example, 131 of the 247 areas where endemic birds are found are in tropical mountains (Blythe 1994). Researchers have also discovered that although diversity generally decreases with altitude, high diversity of plants is synonymous with environments characterized by high elevations in tropical mountains—warm temperatures, large areas, and large seasonal temperature fluctuations (Scheiner and Rey-Benayas 1994). Furthermore, mountains may have more genetic diversity than do rain forests. Although in a straight count of species, rain forests have more species, most of these are insects and are closely related. But in ecosystems such as high-altitude grasslands, although species may be fewer in number, they may represent more genera, families, or phyla and thus, researchers argue, greater genetic diversity (Angier 1994).

Mountains are also unique from a political, economic, and cultural perspective. Borderlands and mountains are synonymous throughout the world. Mountains, along with rivers, are the two most popular means of delineating borders; that has been a fundament of political geography literally through the eons. As borders, however, mountains are characterized by economic, political, and cultural uncertainty and instability. Mountains often represent political divisions, not only between states but also between regions and political units within a state (Tables I and II). Frontiers often stand at international borders and are zones of conflict. Wars have been fought between states and mountain peoples, including four Afghan Wars (1839–1842, 1878–1881, 1919, 1979–1988), the war between the East India Company and Nepal that concluded in 1816, and three wars against the hill peoples of Burma before 1886. This is not just an historic phenomenon: Of twenty-eight armed conflicts that are active in 2000, eighteen are taking place primarily in mountains (Peace Pledge Union 2000). Major disputes are ongoing in mountain regions (Table III). When mountains and highlands form borders or frontiers, there can be difficulties with establishing protected areas. Less than 9.1 percent (2,766) of the world's 16,636 International Union for the Conservation of Nature Category I–VI protected areas classified by biome are located in mountains; and of those just twenty-five are international mountain protected areas (Poore 1992; Stone 1992; Thorsell and Harrison 1992; Green and Paine 1997). Often mountainous protected areas do not cross international borders: For instance, La Vanoise National Park, in France, does not have a counterpart across the border, in Italy. Environmental needs of mountains are subordinate to political considerations, with management weak or fragmented.

Finally, mountains stand culturally apart from lowlands (Tables IV and V). Not only do mountains represent boundaries between cultural groups, but many are

TABLE I—MOUNTAINS AS BORDERS BETWEEN STATES

RANGE	STATE
Andes	Chile / Argentina, Bolivia
Himalayas	Nepal / China; India / China
Guiana Highlands	Guyana, Suriname, French Guiana / Brazil
Carpathian Mountains	Czech Republic / Slovakia
Alps	Italy / France, Austria, Switzerland
Jura Mountains	Switzerland / France
Pyrenees	Spain / France
Elburz Mountains	Iran / Turkmenistan
Tian Shan	China / Kazakhstan
Naga Hills	India / Myanmar
Mitumba Mountains	Zaire / Tanzania, Rwanda, Burundi, Uganda
Atlas	Morocco / Algeria

TABLE II—MOUNTAINS AS TRANSNATIONAL OR REGIONAL BORDERS

RANGE	STATE OR REGION
Bitterroot Range, U.S.	Idaho / Montana
Great Smoky Mountains, U.S.	North Carolina / Tennessee
Allegheny Mountains, U.S.	Virginia / West Virginia
Appalachians, U.S.	East Coast / Midwest
Sierra Morena, Spain	Andalusia / Extremadura, Castilla–La Mancha

TABLE III—MOUNTAINS AS ZONES OF CONFLICT

RANGE	CONFLICT
Caucasus Mountains	Chechnya / Russia
Golan Heights	Israel / Syria
Hindu Kush	Afghani warring factions; India / Pakistan
Zagros Mountains	Kurdistan / Iraq
Chittagong Hills, Bangladesh	Bangladesh / Chakmas, Marmas, Tripuras, and others
Himalayas	Tibet / China
Sarawak	Penan / Malaysia
Timor	East Timor / Indonesia

also home to distinct cultures. In all, the world's mountains are home to several thousand different groups of indigenous peoples (Griggs 1994).

Montane areas can be difficult and complex places in which to live, and outsiders often perceive them as lands where livelihoods are marginal (Blaikie and Brookfield 1987). Mountain peoples embrace predictably varied strategies to cope with and thrive in harsh mountain environments. Typical among these is planting diverse species rather than a single crop. In the Sierra Nevada, grape growers plant multiple varieties of grapes even on plots of less than 40 acres to take advantage of subtle differences in aspect, slope, moisture, temperature, and sunlight (Boeger 1995). In

TABLE IV—MOUNTAINS AS CULTURAL BORDERS

RANGE	BORDER
Cordillera de Talamanca, Costa Rica	Caribbean Coast / Pacific Coast
Sierra Madre	Chiapas / Northern Mexico
Cordilleras Chontaleña and Isabella, Nicaragua	Mosquito Coast / Spanish Nicaragua
Caucasus Mountains	Russian Republics / Azerbaijan / Georgia
Cheviot Hills, Great Britain	Scotland / England
Urals	European Russia / Asian Russia
Himalayas	Nepal / Tibet

TABLE V—MOUNTAINS AS CULTURAL ISLANDS

RANGE	INDIGENOUS PEOPLES
Mount Kenya, Kenya	Meru
Mount Kilimanjaro, Kenya	Chagga
High Atlas, Morocco	Berber
Andes	Quechua, Aymara, Mapuche
Himalayas	Sherpa, Tibetan, Uighur
Zagros Mountains	Kurds
Burma-Thailand Highlands	Karen, Hmong, Lisu, Kachin, Shan, Chin
Cordillera Region, Philippines	Igorots, Kalinga, Ifugao, Hanunoo, Bontoc, Bangsa Moro
Ethiopian Highlands	Oromo, Somali, Tigrayan, Eritrean
Hindu Kush	Pathan
Sierra Madre Occidental, Mexico	Lacandon, Yucatec, Huichol, Tarahumara, Nahua, Zapotec
Northern Highlands, Thailand	Hmong
Pamirs, Pakistan	Shimshali
Sierra Nevada, Colombia	Kogi, Arhuaco, Asario

Sources: Bodley 1982; Burger 1990.

the Andes, farmers plant seven domesticated species and thousands of land races of potatoes to take advantage of unique microclimates (Zimmerer 1998, 447).

Montane borderlands are commonly at a far remove, both physically and politically, from centers of power. Difficult to reach and with fragmented systems of transportation, borderlands contain limited populations and, as a rule, muster disproportionately low representation at the seats of government. The actual influence of mountain peoples rarely amounts to more than a political sidebar (Blaikie and Brookfield 1987). Descriptions of mountain peoples routinely fall back on terms with pejorative implications: *hillbillies* in the United States, *oberwalder* in Austria, *kohestani* in Afghanistan, or *bhotias* in India (Denniston 1995, 20). Mountain peoples are described in ways that minimize an already diminished power. Kurds are called "mountain Turks," and many mountain peoples are simply called "mountain peasants" or "hill tribes." When these terms are used, mountain peoples lose their cultural identity. Ultimately, power of decision and participation is curtailed when

it comes to matters of land and resource use. For example, the High Atlas are both a geographical border and a political border (Figure 2). Not only do they separate Morocco from Algeria, they also insulate the Berber, who live there, from Moroccan society (Spencer 1980).

Mountains stand on the economic margins where resources are extracted for use elsewhere, generally to the advantage of the lowlands. In California's Sierra Nevada, water and hydroelectric power are the range's largest exports, amounting to more than $1.32 billion in 1996 (CWWR 1996, 3). As frontiers or areas beyond the limit of convenient settlement, mountains are less developed than are adjacent regions, as the Himalayas and the Appalachians illustrate. The result is poverty, a characteristic shared by all mountain peoples, even in the Swiss Alps (Ives 1996). For example, more than 60 percent of the rural Andean population lives in poverty (Psacharopoulos and Patrinos 1994); and most of the 98 million people in China considered to be among the world's "absolute poor" live in the mountains (Ives 1996). However, marginality may also be a strength: Isolation can translate to protection of the environment, whereas integration makes easier all manner and means of development, harming the environment and jeopardizing the culture of mountain peoples (Ives 1991; Forman 1993).

Methodological Biases

Mountains are geographically unique, yet much of the current social scientific literature on them overlooks this fact (Blaikie and Brookfield 1987, 18, 113). Moreover, a remarkable degree of bias—whether self-selection or fashion—is present in the formal study of mountains. A survey of articles published in *Mountain Research and Development,* one of the preeminent journals devoted to the study of mountain environments, between 1988 and 1998 suggests notable patterns (Tables VI and VII). Editorial decisions play a role in what is published, of course, but other factors, including preferences of funding organizations, political considerations, and geographical interests, are also important in understanding this geographical bias.

Some mountains are more studied than others. Through these ten years 27.8 percent of the 263 articles that could be categorized focused on the Himalayan–Karakoram–Hindu Kush region; 17.9 percent, on the mountains of Africa; and 14.1 percent, on the Andes. The remainder of the world's mountains received scant attention. Only 4.9 percent of the articles covered the Alps, and 2.3 percent each dealt with the mountains of China and the former Soviet Union. Only one article each considered the mountains of Japan, Greece, and Mexico.

Some mountains are rarely studied. Mountains on high continental islands such as Borneo, Madagascar, New Zealand, and Cape Verde saw some attention, but those on high volcanic islands such as Dominica or Saint Lucia received none. Of the articles surveyed, only fourteen focused on mountains in the United States, including Alaska; and six, on the mountains of Canada. Even where continents were well represented, as with South America, many mountains and highland areas were not studied. Whereas the Andes were the subject of twenty-seven articles, no attention

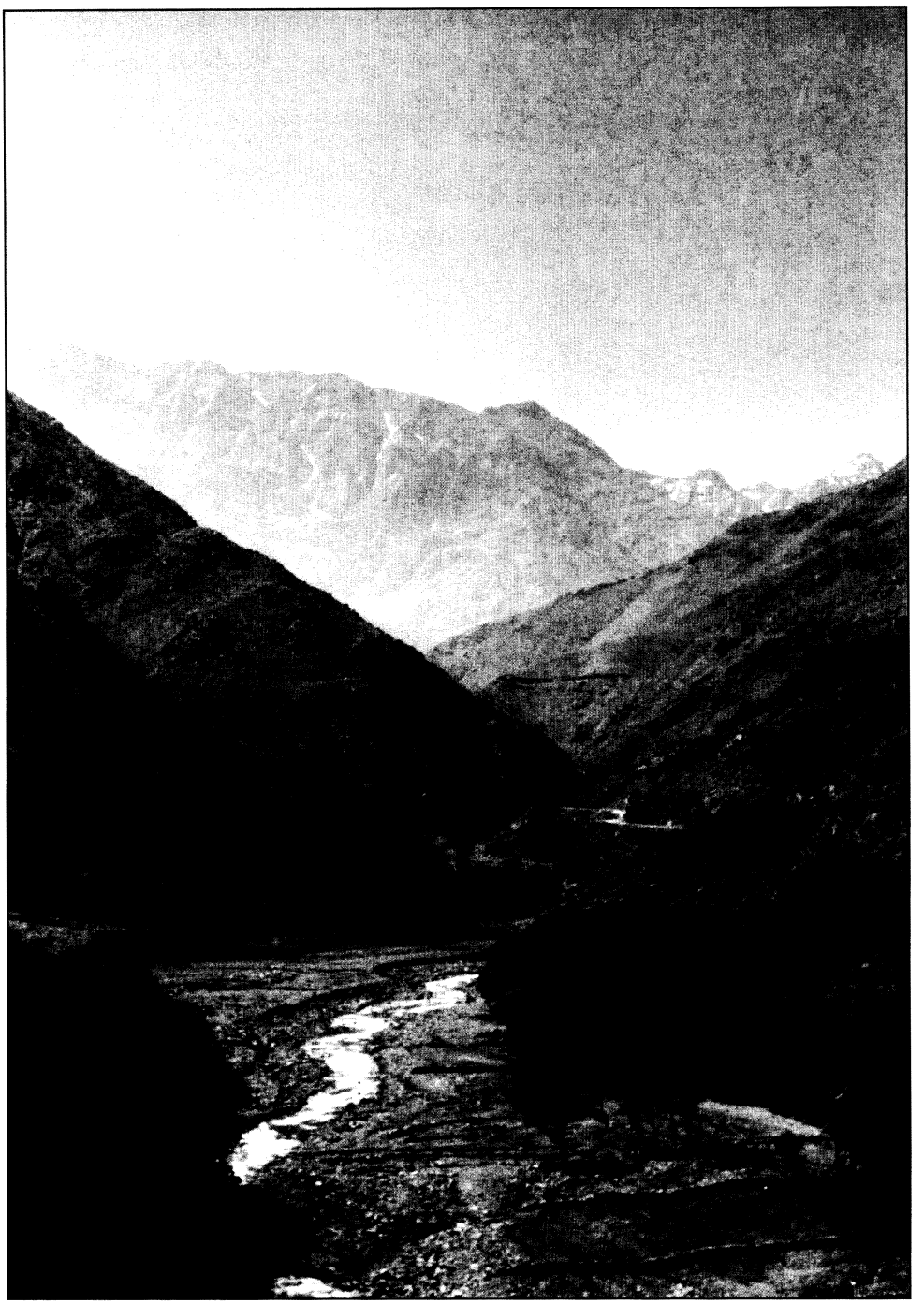

FIG. 2—The Atlas Mountains of Morocco are not only a geographical barrier but also a political one, dividing Morocco from Algeria and the Berber from Moroccan society. (Photograph by the author, June 1990)

TABLE VI—GEOGRAPHICAL BIAS IN MOUNTAIN STUDIES

AREA STUDIED	PERCENTAGE OF ARTICLES
Himalayas–Karakoram–Hindu Kush	27.7
Africa	17.8
Andes	14.0
United States, including Alaska	5.3
Papua New Guinea	4.9
Alps	4.9
Pyrenees	4.1
China	2.3
Soviet Union and former Soviet Union	2.3
Canada	2.3
Tatras, Poland	2.3
Thailand	1.9
Philippines	1.5
Scandinavia	1.1
New Zealand	0.4
Mexico	0.4
Dominican Republic	0.4
Saudi Arabia	0.4
Former Yugoslavia	0.4
Apennines	0.4
Costa Rica	0.4
Borneo	0.4
Cape Verde	0.4
Peruvian Amazon	0.4
Japan	0.4
Tajikistan	0.4
Hawaii	0.4
Armenia	0.4
East Germany	0.4
West Indies	0.4
Sinai Peninsula	0.4
Greece	0.4
Madagascar	0.4

Source: Author's analysis of 263 articles published in *Mountain Research and Development* between 1988 and 1998.

TABLE VII—METHODOLOGICAL BIAS IN MOUNTAIN STUDIES

SUBJECT STUDIED	PERCENTAGE OF ARTICLES
Physical processes	33.4
Natural resource development and management	30.1
Top-down management of mountains	15.2
Natural hazards and environmental degradation	12.1
Local people	9.2

Source: Author's analysis of 282 articles (19 of which could not be categorized by mountain range) published in *Mountain Research and Development* between 1988 and 1998.

was paid to the Guiana Highlands or the Brazilian Highlands. In Europe, there were thirteen articles on the Alps but few on other mountains, including the Carpathians and the mountains of the British Isles. In Asia, even though the Himalayas, Karakoram, and Hindu Kush were copiously studied, as the doyennes of massif chic, the Tian Shan and other ranges were not. Six articles were on China, and six were on the mountains of the republics of the former Soviet Union. Other areas off the radar screen were Central America, Australia, the Appalachians of the eastern United States, and Mexico.

Methodological bias in the study of mountains is marked (Table VII). One-third of 282 articles analyzed over a decade of *Mountain Research and Development* focused on physical processes. Another 30.1 percent considered natural resource development and management. Only 9.2 percent of the articles were concerned with the human element of mountains, including local people.

The interaction between humans and mountains is poorly studied. The culture of mountain peoples, political geography of mountains, political ecology, and other areas dealing with the interaction between mountains and people are underrepresented in mountain literature. Although some fine books on the subject exist (Bishop 1990; Brower 1991; Stevens 1993), many others give scant attention to people. For instance in *The State of the World's Mountains*, only 3 of 391 pages are devoted to cultural identity, and discussions of political factors receive little notice (Stone 1992). The building of a mountain geography literature would seem to require a different mortar and materials.

Building a Mountain Geography

Calls for the development of a body of literature focused on mountain environments are not new. Geographers have resorted to creating bodies of literature for complex geographical regions, including arid lands (Hills 1966), islands (Nunn 1994), karst (Jennings 1971), and coral reefs (Stoddart 1973). A current focus of mountain literature is on conserving mountain environments. However, because of the way mountain literature has evolved, and with its methodological bias toward the study of ecological and physical processes without strong linkages to the cultural and political geography of mountains, conserving mountain environments becomes a much more difficult task.

If mountain conservation is based on areas already known and on existing categories and themes, not many mountains will be conserved. The past study of a few mountains limits the conservation of many mountains. Second, the study of mountains without people limits conservation efforts for mountains with people—and almost all mountains have people. If conservation is to work, mountain geography as a field must be developed. Without a proper understanding of the broader geography of mountain environments, and absent knowledge of the cultural geography or political ecology of mountains, conservation strategies will go awry. Three fields for further work are linked by the theory that the best way to protect mountain environments is to protect the rights and resources of local people.

CULTURAL GEOGRAPHY

In much of the current literature, calls for attending to the cultural diversity of mountains (Denniston 1995) compete with claims that traditional land-use practices cause environmental degradation (Stone 1992). Divergent views are a result, in part, of ignorance of the cultural geography of mountains.

Part of the problem lies in the maps people use. World maps typically feature the 192 states of the world. Underlying these states are more than 5,000 bedrock nations, distinct from states. A main difference between nations and states is that in a nation, people have a relationship with their land, which they have used for hundreds or even thousands of years. For this reason, culture is seen as an increasingly important component in conservation. Culture is defined as *cult-* (worship) and *-ure* (land). Researchers have found a familiar link between cultural diversity and biodiversity (Chapin 1992). Local or indigenous land-use systems are best incorporated into conservation strategies rather than applying top-down approaches to managing protected areas, so that local people's views are not ignored (Zimmerer 1993; Hobbs 1996; Naughton-Treves 1997; Illgner, Nel, and Robertson 1998; Sundberg 1998). The distinction is important because many of the problems facing mountain environments are created when states make claims on mountain nations. These claims are often in the guise of development (agricultural, hydroelectric), to preserve a unique environment (national parks, protected areas), or to "modernize" people who live in mountains (Ojany 1992, 311). Such a threat also imposes a certain type of solution, usually from the state. On Mount Kenya, discussed by Francis Ojany, the Kenyan government set up tea plantations to stop tropical deforestation from spreading into higher elevations (1992, 312). No settlers are allowed in this buffer zone between forest and cultivation. In effect, a montane crisis allowed the state to increase control over land in the name of managing the land better than can local people.

The theory of Himalayan environmental degradation is another example of states making claims on mountain peoples' nations. The theory, championed by Eckholm (1975) and represented in "The Fragile Mountain" (Nichols 1982), implies that a few million farmers in the Himalayas are responsible for environmental changes that affect several hundred million people who live in Gangetic India and Bangladesh (Ives 1987, 190). The theory is simplistic, untenable, and unsupportable with any reliable data, but it is instructive because it highlights the basis for environmental claims on mountains (Ives 1987, 189). Local people are blamed for destroying the mountains, so protected areas, tough environmental regulations, and development assistance are required to stop the damaging effects on lowland people of deforestation, soil erosion, and flooding. For example, in California's Sierra Nevada, ranchers and loggers are blamed for soil erosion and deforestation. In "Majesty and Tragedy: The Sierra in Peril," Tom Knudson writes, "These modes of decreasing the vegetation cover, that is, logging and grazing, lead to obvious soil loss and downstream erosion many times higher than normal" (1991, A5). As a result, ranchers and loggers are blamed for the degradation of forests, the fouling of reservoirs, damage to hydroelectric facilities, and the reduction of aquatic life (Stone 1992, 172).

Positions that traditional practices cause environmental degradation ignore much of the literature which states, to the contrary, that common-property resources, such as forests and pastures in Japan and Switzerland, have been managed well using traditional methods for hundreds of years (Netting 1981; McKean 1986; McCay and Acheson 1987). In addition, these arguments ignore evidence showing that tourism and development, not traditional mountain agriculture, are the major threats to mountain regions such as the Alps (Kariel 1988).

If theories are invalid, why do they persist? Because they serve powerful downstream, lowland interests. For instance, in the Himalayas, these theories attract a substantial flow of international aid to the region. A massive Bangladesh flood project, funded by loans and grants from the World Bank, owes its political life to the danger of flooding caused by deforestation in the uplands. In Nepal, the government relies on aid to plant forests in the uplands even as it generates revenue through commercial cutting of forests in the lowlands (Ives 1991, 37). In calls for increased state control of resources, bigger is presumed tantamount to better, and, invariably, what is strengthened is the hand of the state in managing resources. Understanding the cultural geography of resource use and control makes this much more evident.

POLITICAL ECOLOGY

Political ecology, a term derived from ecology and political economy (Watts and Peet 1993, 239; Grossman 1997; 1998), offers an understanding of the reasons for environmental change in mountains. Changes in the political economy link mountain environments to ecological change. The focus of various political ecology studies is on how political economy shapes and affects the environment (Blaikie and Brookfield 1987; Adams 1990; Sachs 1993; Watts and Peet 1993; Redclift and Benton 1994).

Current concern with environmental change is both local and global in scope (Sachs 1993). Environmental change, in this vision, is rarely a matter of mere ecology; it is also linked with state-nation "political integration" (Nietschmann 1995), poverty (Blaikie and Brookfield 1987; Peluso, Humphrey, and Fortmann 1994), and changes in political economy (Turner 1993).

Within political ecology, several frontiers are useful for understanding mountain geography. One is environmental degradation. Piers Blaikie and Harold Brookfield argue for a link between a region's spatial marginality and its degradation, asserting that "substantial degradation" has occurred in hills and mountains (1987, 113). This results from a shared history of development, the ecological marginality of mountain agriculture, a history of wars and conflict, and political marginality that has brought about environmental degradation and transformation of mountain environments (p. 117).

A second useful avenue of study that provides historical depth to use of natural resources is environmental history (Cronon 1983; Worster 1988; Watts and Peet 1993, 241; Buckley 1998). The study of environmental discourse is also important because it provides an "understanding of the perceptions of local inhabitants and institu-

tions with respect to biophysical resources in general and environmental degradation in particular" (Zimmerer 1993, 312). Research also explores links between politics and environmental degradation. Excellent studies include Nancy Peluso's work on resistance to forest management in Java (1992) and Nancy Langston's work on the Blue Mountains of Oregon (1995). This subfield raises important questions about how criminalizing the use of natural resources affects conservation efforts.

A fifth area of political ecology that is important in studying mountain geography joins landownership and the environment. Landownership is based on property rights, which are a bundle of rights that people have affecting access and control of resources and land use. Property is not a physical object but a social relationship among people (Rose 1994). Property rights govern the control of resources, including land, and the derivation of income from their ownership. These include the right to possess, use, manage, alienate, transfer, and gain income from property.

Why is an understanding of property rights important to building a mountain geography literature? Because changes in property rights affect land use, which can lead to environmental degradation. Understanding such linkages is outside the scope of current methodologies (Allan, Knapp, and Stadel 1988; Ives and Messerli 1990). The case of Sagarmatha illustrates this point. Deforestation has been a major concern in the Himalayas ever since Eckholm brought it to the world's attention in 1975: "Without a massive effort to preserve and restore the ecological integrity of the mountains, within a few decades they will not be idyllic vacation spots but, rather, barren eyesores that perennially present the lowlands with devastating torrents and suffocating loads of silt" (p. 764). To arrest crises that included excessive wood cutting by Sherpas, deforestation, flooding, overgrazing, and population growth in the Everest region of the Nepal Himalayas, Sagarmatha National Park was established in 1976 (Brower 1991, 152–154). Western planners believed that, through planning and management, these crises could be thwarted. However, as Barbara Brower noted, the creation of the park spurred increased degradation because planners did not understand how changing property rights, from communal landholding to state property (the national park), would affect land use: "When rumors of impending park status began to circulate in Khumba, people started to worry. . . . Sherpas went into their forests, disregarded their own traditional proscriptions on indiscriminate felling, and stockpiled fuel wood and building timbers that today are stacked, rotting, in dozens of front yards" (1991, 156). In other words, faced with the loss of rights to their land, the Sherpas set about stockpiling those rights in the form of logs—thereby increasing, not decreasing, degradation.

Property rights lie at the core of threats to mountain environments in Appalachia, where concentrated property holdings foster poverty and environmental degradation (Stone 1992). In the central Appalachians, eighty-five counties have economies based on coal mining and are impoverished (p. 321). In other parts of the Appalachians, notably Maine and New Hampshire, timber companies hold much of the land. Landownership and property rights are concentrated in the hands of a few powerful interests based outside the region. In fact, 77 percent of the coal-rich

areas are owned by out-of-state corporations (p. 324). Money (or salable goods) departing mountain regions can leave behind impoverished people. Outsiders are, as a rule, far more devoted to extracting resources than to preserving environments. Where land is owned by local people, the reverse is true. Local people are interested in long-term sustainability of land uses. Robert Netting's now-classic studies of communally owned land in Switzerland buttress secure property rights as healthful to mountain environments (1981).

Finally, researchers recognize landownership as crucial to conservation. Scientists have found links between high biodiversity and areas inhabited by indigenous people (Chapin 1992) and sustainable use of natural resources and enduring common-property resources (Ostrom 1990). They have also found links between environmental degradation and open access to resources (McCay and Acheson 1987) and degradation due to local peoples' loss of property rights (Neumann 1992; Naughton-Treves 1997; Sundberg 1998).

CONSERVATION THEORY

Conservation theory is a third research domain for an effective mountain geography literature. Mountain studies are heavily weighted toward establishing protected areas. Ever since Yellowstone National Park was created in 1872, a central pillar of the worldwide conservation of wildlife, trees, landscapes, and other nature has been the national park in its many permutations: wildlife reserve, national monument, national forest, marine wilderness area (McNeely and Miller 1984). The ideology behind protected areas such as Yellowstone, which seek to separate humans from wildlife and scenic landscapes, is grounded in an ideal view of nature, hailing from the seventeenth century, when European powers became concerned with the destruction of island paradises as a result of Europe's economic expansion (Glacken 1967; Beinhart 1989; Grove 1995). Protected areas still tend to be viewed as islands of unspoiled nature threatened by development, population growth, overgrazing, and poaching.

Conservationists and policymakers have discovered that the simple designation of an area as "protected" does not ensure its preservation. A mountain island is never an entire island, and many protected areas fail to encompass the entire ecosystem necessary for the survival of flora and fauna within the area (Homewood and Rodgers 1991). In addition, many protected areas were created by excluding local people and are currently managed without their involvement and their conservation knowledge. Today degradation of the wider ecosystem and conflicts over natural resources threaten protected areas.

Two perceived solutions to environmental degradation go hand in hand: establishment of even larger protected areas to encompass entire ecosystems, and involvement of local people living adjacent to protected areas in order to protect the wider ecosystem and ensure the sustainability of current protected areas (Kiss 1990). Implied in this new conservation thinking is that bigger is better. Bruce Hamilton, conservation director of the Sierra Club, illustrates this point in an article he pub-

lished in *Sierra:* "All told we've protected more than 100 million acres. Yet the National Wilderness Preservation Systems is far from complete. . . . It also leaves vulnerable approximately 80 million acres of roadless land that meet the [Wilderness Act's] criteria but haven't yet won a nod from Congress" (1994, 47).

Also implied in this thinking is the biological imperative of ecosystems management. Protected areas need to be larger and better bounded; current protected areas are too small to allow plants and animals found in them to survive (Soulé and Terborgh 1999). The larger ecosystem of which a protected area is a part also needs protection, and biological corridors are required in order to allow plants and animals to move between protected areas. Biodiversity is the key: Conservation must protect the broadest possible array of species. Bigger is better, and an all-encompassing approach to conservation is championed. This kind of thinking begs for strong, centralized management of natural resources—which is, obviously, at odds with arguments for local control and use.

The need to protect entire ecosystems is taken as a given, but theorists disagree on the level of involvement of local people. Scholars concur that local people must gain economically from protected areas if they are to be enlisted in protecting them (Kiss 1990; Murphree 1991). Participation schemes in Africa call for accrual of economic benefits to local people in return for protecting the wildlife that graze on their lands (Kiss 1990). However, the desirable level of political involvement by local people in protected-area management is still being debated, ranging from participation (no formal voice in protected-area management but an outlet for concerns), to comanagement of natural resources (Pinkerton 1989), to political autonomy (Nietschmann 1991). What the literature does agree on is that there must be some outlet for the voice of local people, even if that outlet is often obscure or not clearly stated.

However, conserving resources and using them in a sustainable manner are not politically or ideologically neutral. In broad terms the competing conservation ideologies can be categorized as either statist or populist. Statist strategies are top-down approaches that impose outside control over local people and natural resources (Nietschmann 1986; Beinhart 1989; Grove 1995). Populist strategies are bottom-up approaches based on self-determination and management of local or indigenous peoples' management of their own territory and resources (Bodley 1982; Nietschmann 1991).

Protected areas are sometimes advanced as a neutral solution to degradation of mountain environments. Although this can be true if planners work with local people and do not impinge on traditional tenure systems, it is often not the case. If protected-area managers want to safeguard mountain landscapes, they can do so best by paying attention to property rights and the cultural geography of mountains.

In Central America, natural environments are healthiest where indigenous people live (Chapin 1992). In other words, indigenous people are stewards of the land and, it can be argued, protect their montane environments better than do the coal companies of the Appalachians, the state planners of Nepal, or the U.S. Forest Ser-

vice of the American West. Yet park planners in mountain areas focus on land, not people (Poore 1992; Thorsell and Harrison 1992). For instance, James Thorsell and Jim Harrison say that special attention needs to be given to the Atlas Range, the Alps, Papua New Guinea, the Hindu Kush, and the mountains of Burma (1992, 120). Unmentioned are the people of these mountain regions, the Berber in the High Atlas and the Karen people who straddle the highland between Burma and Thailand.

There is growing acknowledgment that local people must be part of the development of protected areas; in fact, local participation has become the dominant mode of thinking about protected areas (Kiss 1990; Hobbs 1996; Whitesell 1996; Sundberg 1998). Yet people's participation is a weak strategy because it only involves people in protected-area management through meetings, education, and benefits from tourism. Largely ignored are questions of property rights and who the local people are. For example, in *Guidelines for Mountain Protected Areas,* Duncan Poore notes that "traditional indigenous groups with threatened cultures often occupy or use these areas" (1992, vi). He adds that consultation with local communities is necessary, that local people's knowledge of land management is important, and that local people should be involved. Yet these goals are at odds with environmental and ecological goals: "The management of lands within protected landscapes . . . should be carried out in such a way that reasonable populations of wild plants and animals are maintained in them" (p. 9); "open fires should be totally excluded or only permitted in periods when there is no fire danger" (p. 25); and "there may need to be restrictions on use of potential vectors such as horses and vehicles" (p. 27).

However, Poore also notes that "there should be an assessment of resources and their use by local people, the rights of ownership and use of land, and kinds and effectiveness of local organisation" but that "boundaries need to be demarcated in a way which provides for an equitable sharing of rights between those inside and outside them" (1992, 20). The worry here is that although attention is paid to local people, there are conflicting guidelines for creating mountain protected areas that can result in a loss of rights for local people and a corresponding increase in degradation. Although protected areas are a solution to many threats, they can also be part of the problem if they are improperly managed and not created with the idea that local people who live in them are the very reason for the protection.

Lastly, the conservation of mountain resources, though seen as politically neutral and morally justified by the environmental community, amounts to little more than an attempt to wrest ownership of mountain environments from mountain peoples. Although claims on mountains are often couched in environmental terms, such as the creation of protected areas and the passing of environmental regulations to preserve biological diversity and reduce such perceived threats to mountain environments as overgrazing, the establishment of protected areas can produce cultural impoverishment, as local people's rights and control over resources are reduced (Brower 1991). Furthermore, increased state control over mountain environments may cause an increase in environmental degradation, as states develop and increase access to recreational opportunities in mountains through the construction of roads.

Conclusion

Detailed maps of the world's mountains are rare, and this in itself tells us much about the state of mountain studies. Much of the literature on mountains focuses heavily on environmental and ecological processes without addressing the fundamental cultural, political, human, social, and economic geography that make mountains unique environments. This is partly the result of the way in which mountain studies have evolved and of who has studied mountains.

Although understanding physical, ecological, and environmental processes is important, this limited approach leads to a narrow understanding of mountain environments. As mountains draw increased attention from scholars who wish to save them, the study of mountains needs to be broadened. First, mountains are unique environments and should be studied as such. Second, the creation of a mountain geography literature would serve as a foundation for a better understanding of mountain environments and of the threats they face. Areas for further research include cultural geography, political ecology, and conservation theory.

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