Bienn. Symp. North. Wild Sheep and Goat Counc. 10:136-144.

USING ECOREGION PLANNING AND MANAGEMENT BOUNDARIES TO MANAGE MOUNTAIN SHEEP IN THE UNITED STATES: IS IT POSSIBLE?

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Abstract: The USDA Forest Service, USDI Bureau of Land Management and U.S. fish and Wildlife Service have committed to ecosystem management. These agencies and the Natural resources Conservation service are currently working together to develop a national hierarchial framework of ecological units to be used for ecosystem management. A major concern in managing for mountain sheep is insuring that the management units are large enough to accurately meet mountain sheep habitat requirements. Ecoregion planning boundaries should not dissect mountain sheep populations or their habitat. Information gathering on the distribution of mountain sheep for the interagency *Mountain Sheep Ecosystem Management Strategy in the 11 Western States and Alaska* (USDI 1995) was overlain on the three ecoregion mapping strategies being reviewed by the interagency task force and compared. The comparison was to determine which, if any, of these mapping strategies best fit mountain sheep distribution. Current ecoregion boundaries do not adequately consider California bighorn sheep (*Ovis canadensis californiana*) or Rocky Mountain bighorn (*Ovis canadensis canadensis*) distribution or habitat requirements. Ecosystem management and planning should establish ecosystem boundaries on a case-by case basis which accurately reflect mountain sheep distribution and habitat requirements.

INTRODUCTION

It is rare to find mountain sheep populations confined to a single mountain range or location. Mountain sheep predominately occur as metapopulations. These metapopulations can be megapopulations, core-satellite metapopulations, or patchy metapopulations (Bailey 1992). Managing mountain sheep and their habitat must, therefore, consider the full extent of the metapopulation distribution and habitat needed.

Three federal land management agencies, the Bureau of Land Management (BLM), USDA Forest Service and, U.S. Fish and Wildlife Service (USFWS) have committed to applying ecosystem principles and management (USDA 1993, USDI 1993, USDI 1994). One step in actualizing this commitment is an attempt to establish a national hierarchial framework of ecological units which will be used for land use planning and ecosystem management.

During 1993 through 1995 the BLM coordinated development of the interagency publication *Mountain Sheep Ecosystem Management strategy in the 11 Western States and Alaska* (USDI 1995). Updated maps of mountain sheep distribution are part of this publication. The authors were asked to compare mountain sheep distribution with the 3 ecoregion maps being reviewed for the national hierarchial framework of ecological units, to determine which most accurately coincides with mountain sheep distribution.

METHODS

Mountain sheep distributions in Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, Utah, Washington, and Wyoming were used in this comparison. California bighorn sheep and Rocky Mountain bighorn distribution mapped within the appropriate states were compared separately (Table 1).

Ecoregions of the Conterminous United States (Omernik 1993), *Ecoregions and Subregions of the United States* (Bailey et. al. 1994), and the *Major Land Resource Areas* (MLRA) *of the United States*, mapped by the Natural Resource Conservation Service (NRCS) are the systems being compared for hierarchal ecological units system. Attempts to merge these 3 systems into 1 have been unsuccessful to date. One additional step is to determine if the resulting ecological units would be of sufficient size to account for management for wide ranging wildlife species. The first comparison has focused on mountain sheep.

California bighorn distribution data were overlain on each of the 3 ecological unit maps. A comparison was made to determine if there was a "fit" between

Table 1. California bighorn sheep and Rocky Mountain bighorn distribution.

STATE	WILD SHEEP SUB-SPECIES	
	California	Rocky Mountain
Arizona		X
California	X	
Colorado		X
Idaho	X	X
Montana		X
Nevada	X	X
New Mexico		X
North Dakota	X	
Oregon	X	X
Utah		X
Washington	X	
Wyoming		X

California bighorn distribution and either of the ecoregion maps. If there was no fit the data were compared to determine which of the ecological unit maps was the closest to a "fit" (Maps 1, 2, & 3). The same process was followed for Rocky Mountain bighorn (Maps 4, 5, & 6).

RESULTS

California and Rocky Mountain sheep distribution did not completely match any of the ecological unit maps. Ignoring the subregions, ecoregions developed by Bailey et. al. (1994) have the closest "fit" (Maps 2 & 4) for both sub species. These were followed by the ecoregions of Omernik (1993), (Maps 1 & 3) and finally the MLRAS (NRCS 1993), (Maps 3 & 6).

DISCUSSION

Boundaries of ecoregions and subregions are drawn using climate, physiography, soils, hydrology, and potential natural communities (Bailey et. al. 1994, Omernik 1993). The NRCS develops MLRA boundaries to include geographically associated land resource units, and identify nearly homogeneous areas of land use, elevation, topography, climate, hydrology, potential natural vegetation, and soils (NRCS 1993).

Although mountain sheep may move through areas not usually identified as habitat, they occupy areas which provide for their habitat requirements. Topography is the principle habitat component which is fixed in the physiographic landscape. Wild sheep can be found on both sides of the mountain whereas many of the ecoregion, subregion and MLRA boundaries follow watershed and hydrologic basins. Insuring that ecosystem management is carried out properly when addressing mountain sheep is more important than determining why metapopulation boundaries and ecoregion boundaries do not coincide.

A frequent major issue in managing ecosystems containing large, wide ranging wildlife species is that the management boundaries are not large enough to provide adequate habitat (Bailey 1992, Grumbine 1994, Noss and Cooperrider 1994). Bailey (1992) and Grumbine (1994) also recommend that geopolitical boundaries not be a consideration and that all agencies involved work for the mutual benefit of ecosystem and mountain sheep management.

RECOMMENDATIONS

Ecosystem management which includes California and Rocky Mountain bighorn sheep will require boundaries other than those provided on current ecoregion and MLRA maps. The authors recommend that land management agencies use dynamic ecosystem management boundaries which accurately reflect the habitat requirements of mountain sheep metapopulations. The enormity of the ecoregions will preclude developing a single workable ecosystem plan of management effort for an entire ecoregion or MLRA. Each ecoregion contains a variety of ecosystems which will allow for adjustment of planning or management boundaries without violating sound ecosystem criteria. Using this fluid approach will require a case-by-case analysis rather than attempting to pre-define boundaries for every management or planning situation. To perpetuate this effort we further recommend those agencies concerned with the management of California and Rocky Mountain bighorn sheep complete consolidation of the bioregion maps provided for the interagency *Mountain Sheep Ecosystem Management Strategy in the 11 Western States and Alaska.*

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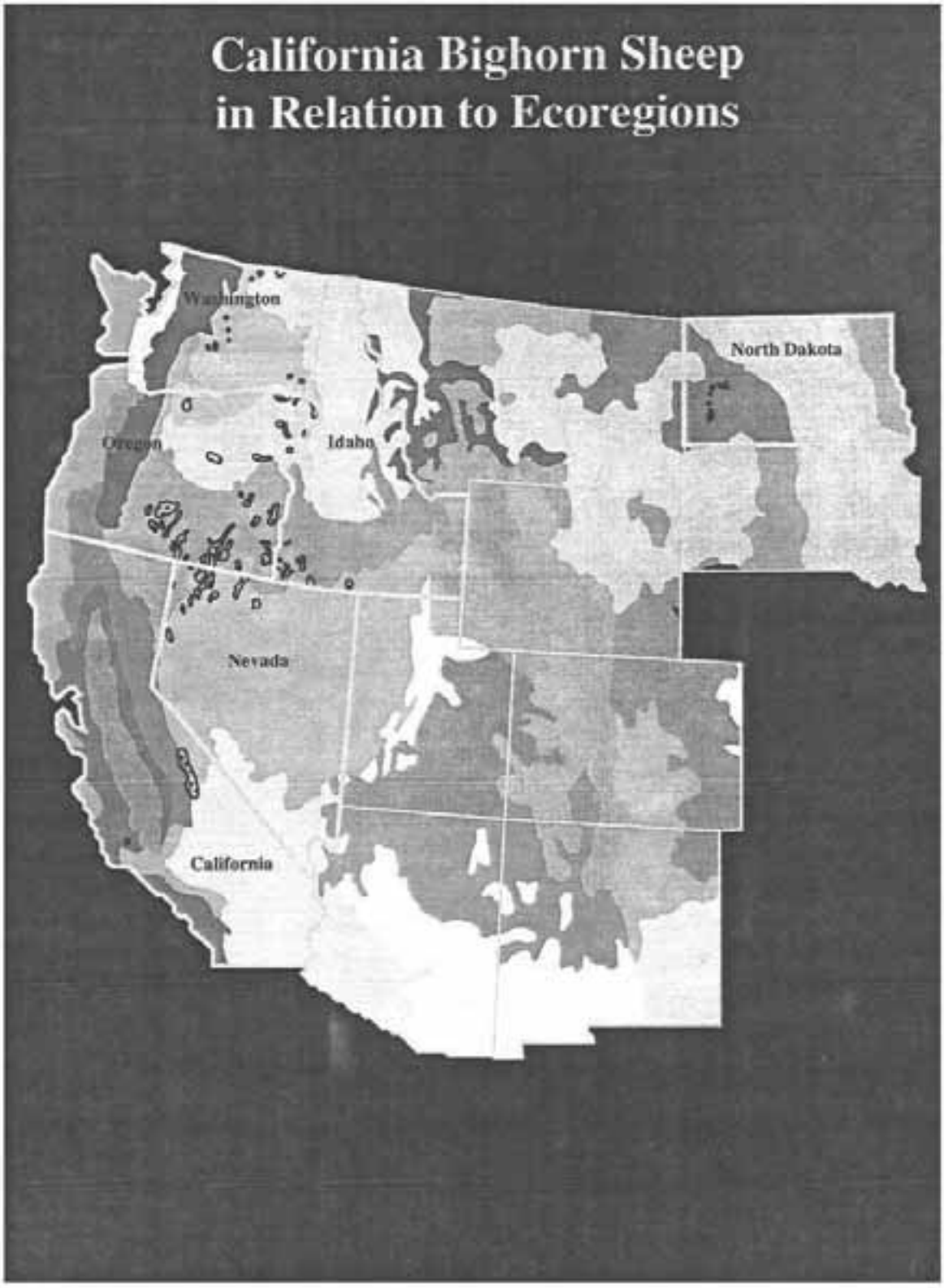
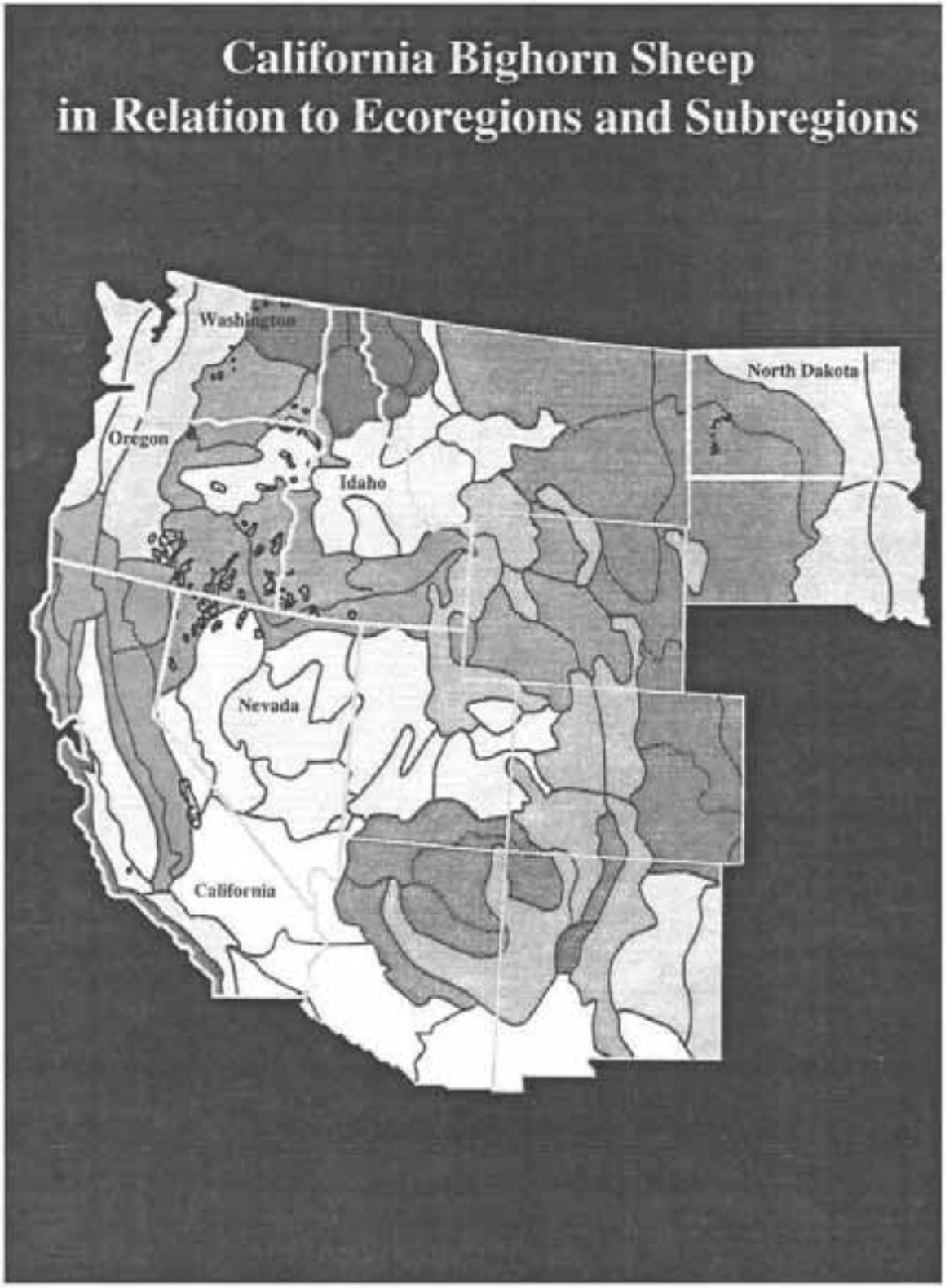

California Bighorn Sheep
in Relation to Ecoregions
Washington
North Dakota
Oregon
Idaho
Nevada
California

California Bighorn Sheep in Relation to Ecoregions and Subregions



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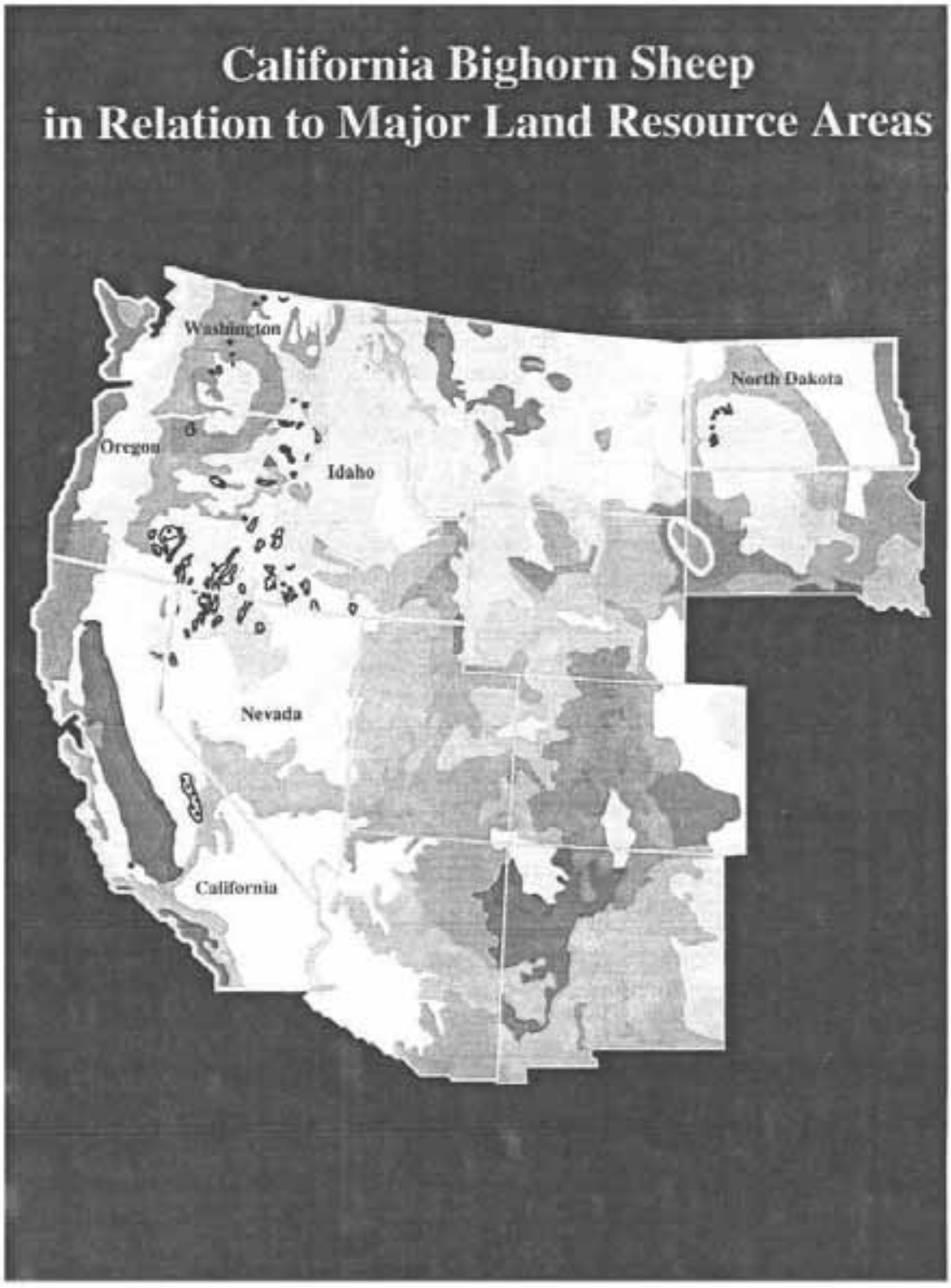
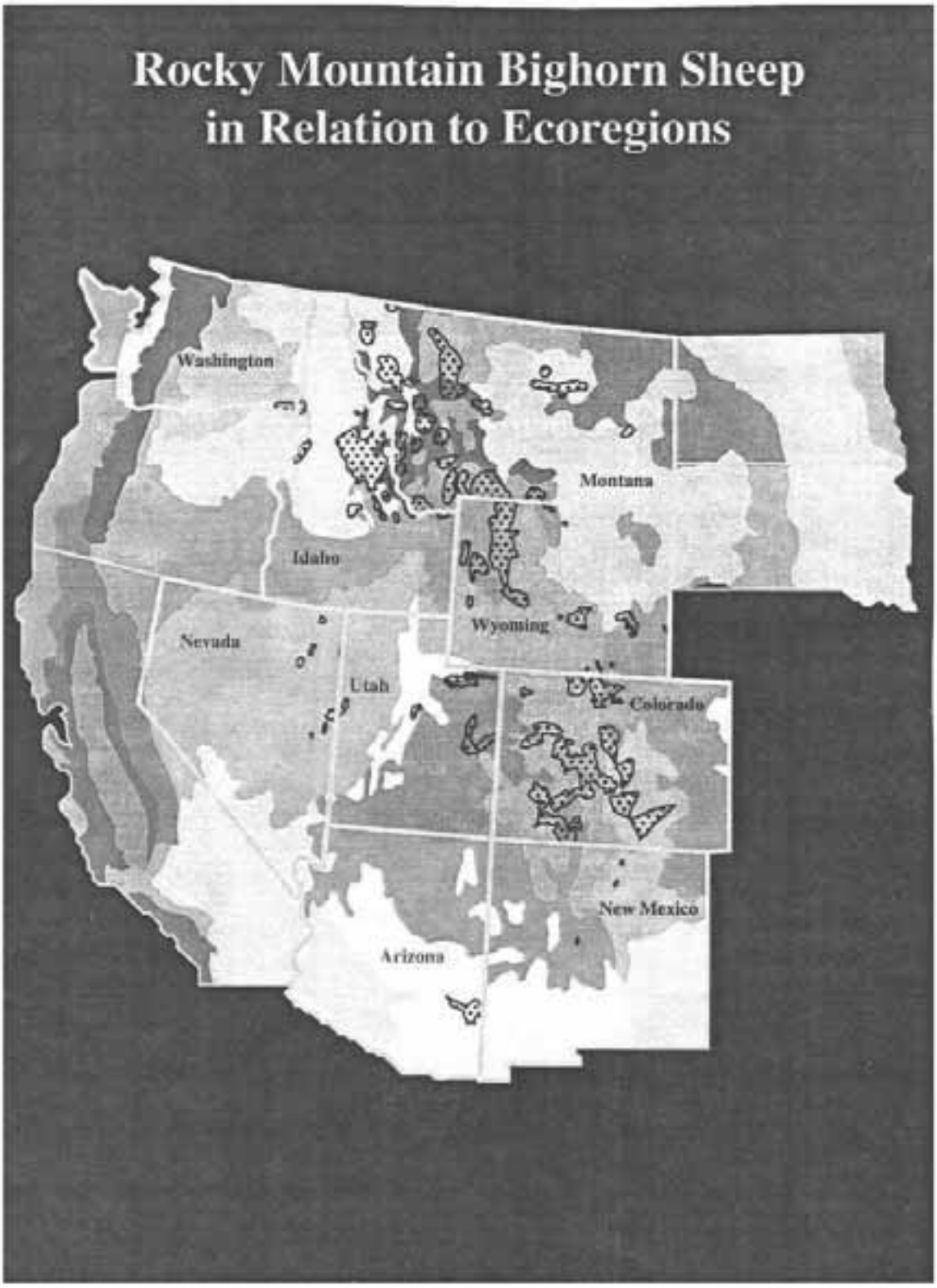
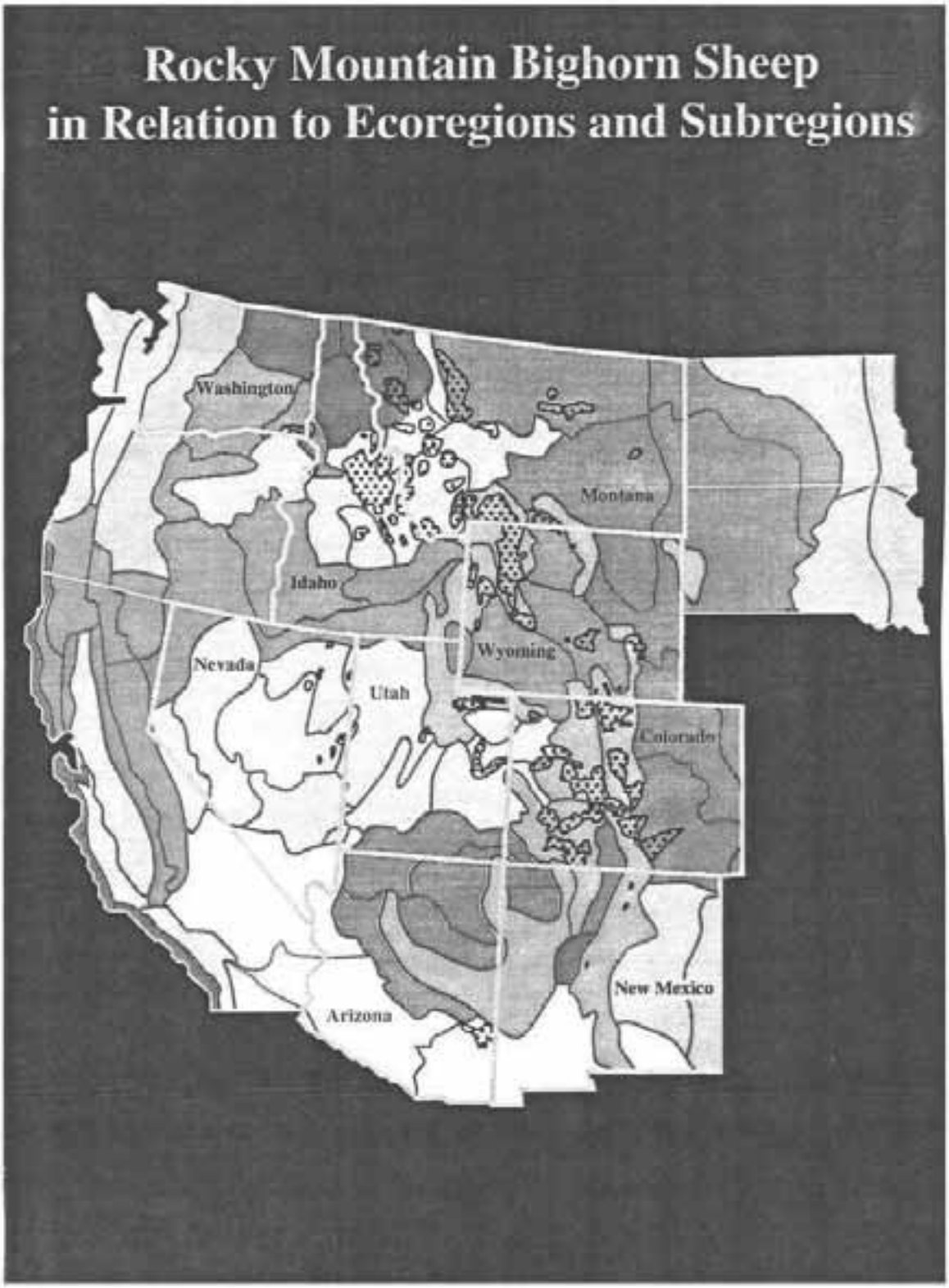



Rocky Mountain Bighorn Sheep
in Relation to Ecoregions
Washington
Montana
Idaho
Wyoming
Nevada
Utah
Colorado
New Mexico
Arizona

Rocky Mountain Bighorn Sheep in Relation to Ecoregions and Subregions



Rocky Mountain Bighorn Sheep in Relation to Major Land Resource Areas