

bership can only be viewed as a financial bargain. This point is best made in terms of the cost to the member of *Science*, the most tangible benefit of membership. It costs the Association \$28.41 a year to place a copy of *Science* each week in the hands of the individual member. Meanwhile, \$10 of his dues are allocated for this purpose.

We cannot be optimistic about significant increases in advertising revenue. Product sales and investment

represent only a minor portion of revenue, so that even if they were to be increased significantly, they do not represent the key to the problem of income. Vigorous efforts have been made in recent years to effect operational economies and to improve efficiency, but many costs are beyond the Association's control.

In 1969, the Board adopted a resolution calling for an order-of-magnitude increase in the membership over the

decade of the 1970's. It may become essential that Board and Council join in a vigorous campaign to achieve a significant increase in the size of our roster. If every member recruited a member, we could double our size rather quickly. The vigor of the Association's present programs and the challenge to the scientific community from every aspect of modern life make increasing the Association's size as important now as at any time in our history.

Off-Road Vehicle Use

AAAS Committee on Arid Lands

Recreational use of the arid lands of the United States is increasing rapidly as people seek to escape crowded metropolitan areas or to enjoy the open space and beauty of the desert. Rock hounding, hiking, camping, and sight-seeing attract most of the visitors. Less common, but growing rapidly in numbers, is the use of off-road vehicles in areas with few or no roads, usually for cross-country travel. The term "off-road vehicle" refers to any motorized vehicle (motorcycles, four-wheel-drive vehicles, dune buggies, and so forth) that travels off an established road. These vehicles are our primary concern at present because of their potential for destruction. This potential for destruction is great in all areas but is most serious in arid lands. The southern California desert, with its proximity to 10 million people in and around Los Angeles, has the unfortunate distinction of having suffered greater destruction than any other arid area.

Southern California is experiencing now a recreational pressure upon its desert resources that is growing by leaps and bounds and which is almost completely uncontrolled. Other population centers in the arid West are subjected to pressures which differ only in degree from those of southern California. What is happening there pro-

vides a warning of what will happen elsewhere as leisure-time activities assume increasing importance.

The intensity of recreational use of the 16 million acres in the southern California desert is almost unbelievable, and it has only begun. In fiscal year 1968, nearly 5 million visitor-days were estimated to have been spent on the approximately 11 million acres of federal land there. In 1971, the total was estimated to be 7.5 million visitor-days, an increase of 50 percent in 3 years. By the year 1980, this figure may well rise as high as 23 million.

A 1968 survey showed that camping and sight-seeing accounted for about 50 percent of the visitor use. Hiking, rock hounding, and motorcycling represented 13, 12, and 9 percent, respectively. The 9 percent for motorcycles does not include racing motorcycles brought in for sanctioned races, which accounted for 375,000 to 450,000 visitor-days. A single Hare and Hound motorcycle race on Thanksgiving Day in 1971 had some 2,900 entries, with a total attendance of around 10,000 people. That same race in 1968 had 900 entries. Dune buggy travel was 9 percent of the total recreational use and four-wheel-drive vehicles constituted 8 percent of the total number of vehicles entering the public lands.

The end result of the unregulated use of the desert is a sharp conflict of interests among cattlemen, miners, and various groups of recreational visitors;

a serious threat to the preservation of the environment in a desirable and stable condition; and a series of demands that something be done to control or prohibit many of the current activities.

Formulation of an overall plan for the recreational use of the arid regions is fraught with difficulties. For one thing, land use planning is virtually nonexistent, as is research on the impact of recreational use. Moreover, no single government agency is charged with development or control of the public lands. Blocks of land are administered by the Bureau of Land Management, the National Park Service, the Forest Service, the Bureau of Reclamation, state park and recreation agencies, sundry county agencies, state and county road departments, and the military. Additionally, some regions are spotted with large and small blocks of private land. One agency of the Department of the Interior, the Bureau of Land Management, administers two-thirds or more of the federally owned arid lands in the 11 Western states and should, logically, take the leadership in resolving conflicts in land use.

Recommendations

Our recommendations for controlling the exploitation of arid lands are based upon the following assumptions: (i) recreation is a legitimate, and soon may become the largest, use of these lands; (ii) preservation of unique flora and fauna and of scenic, educational, historic, and archeological sites is in the public interest; (iii) agriculture and mining have legitimate economic interests in desert land use; and (iv) destructive influences should be strictly controlled. The issue at hand is how much damage to the environment should be permitted in order to accommodate recreational groups.

Members of the AAAS Committee on Arid Lands in 1973 were Harold E. Dregne (chairman), David W. Goodall, Carl N. Hodges, Dean F. Peterson, Troy L. Pewe, William W. Rubey, and Richard B. Woodbury.

Unrestricted use of desert areas is growing so rapidly that action must be taken immediately to initiate comprehensive controls. There no longer is time for prolonged study of the problem and preparation of detailed recommendations before taking action, however desirable that approach would have been a few years ago. What is needed now is positive interim action, based upon reasonable assumptions, that will control the more damaging uses and will allay the sharper interuse conflicts. Action must be accompanied by research that will help to correct management mistakes already made and to provide guidance for future management programs.

We recommend, in order of priority, that the following action be taken by the Bureau of Land Management, in concert with other federal and state agencies and with user groups, in all of the arid land states.

1) Designate a number of large, easily accessible areas for unrestricted use by off-road vehicles. Areas should be selected in which damage, even destruction, of natural resources (soils, flora, fauna) can be tolerated. No areas of important scenic, educational, historic, or archeological value should be included. Supporting facilities (sanitation, water, information, and so forth) should be made available to encourage use of these areas rather than others.

2) Designate portions of the desert as wilderness or other kinds of areas in which access is permitted to non-motorized travel only. These areas should protect unique flora and fauna as well as archeological and historic sites and places of special scenic or educational value in which reversibility of damage is unlikely or impossible.

3) Prohibit off-road vehicular travel, except to land-use permittees and lessees, in the remaining desert lands. Restrict off-road vehicular travel and limit construction of roads by permittees and lessees to that essential for the operation of the permit or lease. Establish campgrounds for various types of users, improve and maintain access roads, and designate and mark trails to places of special interest.

4) Establish buffer strips approximately 1 mile wide, depending upon the terrain, in the open country along major highways in the desert. No off-road vehicular traffic should be permitted in the buffer strips except in areas designated for recreational use. Their purpose would be to preserve esthetic qualities and to prevent excessive wind

and water erosion with its hazard to highway traffic.

5) Encourage states in which desert lands occur to enact legislation requiring state and county units to establish land-use zones designed, particularly, to control residential and industrial development and to facilitate execution of comprehensive management plans.

6) Classify all public lands for recreational, archeological, historic, educational, mining, watershed, and agricultural uses, as the basis for comprehensive land-use planning and development of more permanent management regulations.

7) Conduct research on the impact of recreational use on vegetation regrowth and succession, soils and animals, water supplies, and other aspects of the environment and on the potential for multiple use, including recreation.

8) Consolidate holdings of public land through exchanges and purchases of private land having unique preservation value.

9) Initiate a program to educate schoolchildren and adults on the variety and uniqueness of living and non-living components of the desert environment and to encourage wise use.

Conclusion

The critical thing now is prompt and decisive action. Guidelines must be formulated and interim controls established before greater havoc is wrought and further irreparable damage is done to resources that cannot be substituted or replaced.

Appendix

There is an estimated 10 million acres of extremely arid land, 210 million acres of arid land, and 460 million acres of semiarid land within the limits of the 48 contiguous states of the United States (1). A large, but unknown, percentage of the 220 million acres of arid and extremely arid land is owned by the federal government and administered by the Bureau of Land Management (BLM) of the Department of the Interior. All 172 million acres of BLM land lie in the western part of the United States (2).

Data on recreational use of federal lands obtained in a study commissioned by the Public Land Law Review Commission (2) indicates that annual recreation visits to BLM lands amounted

to 13.7 million in 1964 and 44.2 million in 1967, an increase of 200 percent in 3 years. On the 8 million acres of land in BLM's Riverside (California) District, there were 4 million visitor-days counted in 1963 and 7.5 million in 1971 (3). The Riverside District is close to Los Angeles and includes most of the BLM land lying within the boundaries of what has been termed the California Desert.

A report on the California Desert was prepared in 1968 by the California State Office of BLM and the western regional office of the National Park Service (4). Projected recreational use of this desert area is estimated at 7.8 million visitor-days in 1980 and 13.2 million by the year 2000 if no attempt to identify or develop recreational areas is made. If recreational areas are identified, projected use would be 23.4 million visitor-days in 1980 and 39.6 million in 2000. If identified recreational areas are developed, these figures are expected to rise to 29.3 million in 1980 and 49.5 million in 2000. The report notes that the agencies that manage federal lands are not now prepared to handle such numbers of visitors in a manner that will preserve resources, provide adequate sanitation, and protect people and property.

President Nixon gave official recognition to the magnitude of the problem of off-road vehicles on federal lands when he issued Executive Order 11644 on 8 February 1972 (5). The purpose of the order was to ensure that the use of off-road vehicles on public land would be directed and controlled to protect resources, promote safety, and minimize conflicts among the different users of land. It stated that an estimated 5 million off-road recreational vehicles are in use in the United States today.

The board of directors of the Sierra Club adopted in 1972 a policy resolution on the use of off-road vehicles on public lands (6). The resolution calls for strict control of off-road vehicle use and the initiation of educational programs to instruct operators on safety measures and environmental impact.

References and Notes

1. Estimated from maps by P. Meigs, in *Reviews of Research on Arid Zone Hydrology* (Unesco, Paris, 1953), maps revised in 1960.
2. *Outdoor Recreation Use of the Public Lands* (H. D. Ruth & Associates, Berkeley, Calif. 1969), vol. 1.
3. D. Vail, personal communication.
4. *The California Desert* (Bureau of Land Management, U.S. Dept. of the Interior, Sacramento, Calif., 1968).
5. *Fed. Reg.* 37, 2877 (9 February 1972).
6. *Sierra Club Bull.* 57 (No. 3), 18 (1972).