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## Desert Puma: Evolutionary Ecology and Conservation of an Enduring Carnivore, by Kenneth A. Logan & Linda L. Sweanor

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the Annotated Literature Appendix, which is quite valuable if one is looking for help on a decision to read an already identified author, the editors are candid: "There was no systematic judgement made as to what would be included or excluded." This is explicitly a work in progress with the authors seeking suggestions of additional citations.

This is a valuable reference resource for scholars and policymakers. It is not a book that one reads, sherry in hand, next to the fireplace. And it uses an irritating set of acronyms throughout (TFWs, TFWDPs). Rather it is a work that will be pulled out again and again to assist with various tasks, ranging from completing an inventory or checking the background of a conflict to searching for systematic relations among types of environmental stress and some manifestations of conflict. Despite the rather ponderous organization of the book, its conclusions—those that others have also reached—are important: There is a rampant lack of consideration of water quality in deciding questions of water quantity. Rights allocations are not made sufficiently specific. Political power in decision making plays a disproportionate role and, as was commonplace a half decade ago but should have been less the case now, there is "a general neglect for environmental concerns in water-resources decision-making."

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***Desert Puma: Evolutionary Ecology and Conservation of an Enduring Carnivore.*** By Kenneth A. Logan & Linda L. Sweeney. Washington, D.C.: Island Press, 2001. Pp. 463. \$70.00 hardcover, \$45.00 paper.

The authors' work launches a "flag-ship" study for the Hornocker Wildlife Institute and emerges as a landmark in puma research and conservation, an epic journey in the pursuit of knowledge of these illusive big cats. The ten-year study from 1985 to 1995 explores the secret life of desert pumas inhabiting the San Andres Mountains of New Mexico. This first long-term intensive study of pumas living in a desert environment becomes the largest investigation ever conducted on any single puma population. It encompasses about 9,780 total person days of field research, with capture and release of 241 individual pumas. Tracking the big cats year round by air and ground gives nearly 14,000 radiotelemetry locations, yet this is only a fraction of the total effort and material presented in this monograph.

The scope of this book serves three different audiences. It targets the academic community as an absorbing scholarly treatise. The story is told in twenty-one chapters under five headings: (1) Setting the stage; (2) Puma life history strategies and population dynamics; (3) Puma behavior and social organization; (4) Puma-prey relationships; (5) Pumas and people. The authors present ten years of detailed data in nearly 100 combined figures, tables, and plates dispersed throughout the sections along with analytical and statistical methods. Review of scientific literature includes information on the large cats in general, the puma being the fourth largest cat in the world, and compares methods of data collection and analysis between this study and prior studies of the puma and other large felids. The work explains and tests various hypotheses concerning survival strategy and reproductive strategy in relation to population structure and dynamics, prey dynamics, innate puma behavior, habitat, climate, and other aspects of its ecology. Many illustrative photographs are given throughout the chapters. The overall content and rigorous scholarship of the authors' work advances scientific knowledge of pumas well beyond that of any previous studies.

Logan and Sweanor's research also serves another audience, that of wildlife managers. The New Mexico Game Commission, to its credit, initiated this long-term investigation to provide scientific information for field application. This study thus establishes basic biological and ecological findings needed for management decisions to sustain self-perpetuating populations of pumas and their prey, while at the same time balancing the needs of other diverse and vested interests. These interests include but are not limited to those of recreational puma hunting, big game (deer) hunting, which may compete with the puma for the prey base; interests of protecting endangered desert bighorn sheep living in the San Andres Mountains; and the interests of minimizing puma predation on livestock. Always present is interest to protect humans and their companion animals that may encroach on puma habitat. *Desert Puma* provides a massive tome of information for the wildlife manager, although some practical aspects of the material may be cumbersome to retrieve due to the extensive detail in the monograph.

A third audience for the book is encouraged as part of a total conservation effort. This may include anyone with some scientific background, an interest in puma or big cat conservation, and the desire to enter the milieu of scholarship to better understand the subject. Many areas of interest are well served, including those of natural resource policy, zoo or mammalian biology, various aspects of environmental study, as well as broader areas of public education on such issues. The involvement of informed advocates is essential, according to the authors, to help transform the scientific findings of this study into a format the general public can understand and become responsive to. Successful

conservation efforts need the active interest of the public. Such efforts require a broad-based acceptance of our ethical obligation to protect natural systems, combined with widely accepted knowledge based on scientific understanding of how natural systems work. Only then can efforts to protect the big cats from extinction be successful.

It may be hard for anyone other than a field biologist to appreciate the effort and commitment involved in this ten-year study. Pumas are among the most difficult of the large terrestrial mammals to study since they naturally shun human contact, have cryptic coloration and are crepuscular and nocturnal. The only reliable method of study requires tracking, then immobilization and capture of each puma. Each is given individual identification, and all but cubs are fitted with a radio collar. Data is recorded from each animal. After this processing, the subjects are released at or near the site of capture. Movements are followed by radiotelemetry both from light aircraft and on the ground. Fieldwork continues year round, in this case ten days in the field followed by four days in civilization to regroup. Tracking and capturing animals involves many skills unknown to the ordinary researcher. These include map reading, orienteering, rappelling, tree climbing, handling dangerous animals, facing many other physical dangers, and living with the privations of life in remote places. Surviving the elements of weather, being lost, hunger, and tiredness are all part of the experience. All of these add to the element of adventure and romance and give epic proportion to this study. Extensive knowledge of many aspects of field biology as well as courage and indomitable spirit are prerequisites.

The San Andres Mountains offer an ideal habitat for long-term basic research on pumas. The mountains are part of the basin and range physiographic province, composed of broken narrow ranges flanked by large desert basins. Isolation of the mountains by the surrounding desert basins provide a self-contained ecosystem wherein none of the large mammals migrate seasonally. Another factor makes this area ideal for study. The land is restricted by the U.S. Army and is relatively undisturbed by humans, minimizing many confounding variables from human activity.

In this study, the scientists' first hurdle was to censor the San Andres puma population using the methods of capture-mark-release and radiotelemetry tracking. They repeated the censor process annually throughout the ten years and found the population on average is comprised of 61 percent adults, 6 percent sub-adults, and 33 percent cubs. Population structure and dynamics are further elaborated in several chapters of the book. These include chapters with information on adult home-range characteristics, interactions between pumas, puma social organization, and dispersal (or ranging) behavior. The researchers found that the San Andres pumas constitute a metapopulation, which is

defined as a network of semi-isolated populations with some level of regular or intermittent gene flow among them. Such populations depend on both emigration and immigration to and from other groups for numeric and genetic augmentation. This structure allows for the best local adaptation to habitat while avoiding the adverse effects of isolation, that of increasing genetic load from inbreeding. In practical terms, it is important for wildlife managers to provide corridors or land linkages to allow contact between localized populations of pumas to maintain genetic diversity and long-term survival.

Several aspects of reproduction are discussed in a chapter that gives information on fecundity rates, natality rates, timing of births, mating system, gestation, birth intervals, sex-ratios of offspring, nursing litter size, puberty, philopatric females, icteroporous females, reproductive behavior, and more. Information on mortality and survival is given in another chapter in which the researchers establish intra-species strife, with pumas killing other pumas, as the dominant mortality factor in the population. This is not unique to the San Andres pumas. Other chapters describe diet, interactions with desert mule deer, and interactions with desert bighorn sheep.

An experimental reduction of one part of the San Andres puma population was made in late 1990 to mid 1991 to allow study of population dynamics following a sharp decline in resident pumas in a given area. One section of the study area, designated as the Treatment Area (TA), 703 km. sq., was utilized for this manipulation. Thirteen pumas were experimentally translocated without injury to northern New Mexico. Three others either died of natural causes or disappeared. In all, the resident population of the TA was reduced by 47 percent. The remainder of the study area was designated as the Reference Area (RA), 1356 km. sq., in which the puma population was not manipulated. The undisturbed RA allowed the scientists to continue observing in an area free of human manipulation. Various aspects of population dynamics in the TA and RA were monitored and compared during the remainder of the study. Much detail is given in the results, but in essence, the population recovered within 31 months. Recruits were from progeny born within the TA, as well as from immigrants from both the RA and from outside the study area. Recruits were basically of the same number and sex as animals removed. This shows the strong influence of mating system and social behavior on puma population structure, and that protected populations can quickly recover from a sudden and sharp decline.

The final two chapters of the book include discussion of overall conservation and management of wild pumas. The authors argue that protected zones of habitat, such as the San Andres Mountains, are vital to prevent unnecessary overkill of the puma. Safe corridors or land linkages

are needed to allow movement between the protected areas. Empirical data from this study suggests that protected zones should be at least as large as the San Andres Mountains chain, about 3,000 km sq.

The full details of this study add greatly to the richness and fabric of human understanding of an illusive predator, the desert puma. Hopefully this information will be heard. Scientists Logan and Sweaner give us all the elements of an extraordinary adventure story as well. It deserves the wide popular readership enjoyed by the best of the genre of popular animal stories. All that is needed is an old-fashioned storyteller.

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*The Basin of Mexico: Critical Environmental Issues and Sustainability.* By Exequiel Ezcurra, Marisa Mazari-Hiriart, Irene Pisanty, & Adrián Guillermo Aguilar, United Nations University Studies on Critical Environmental Regions. New York: United Nations University Press, 1999. Pp. 216. \$25.95 soft cover.

When I was growing up in New York City in the late 1950s, I lived in the world's most populous metropolitan area. But though New York still ranks high, it was overtaken long ago by Tokyo, Sao Paulo, and Mexico City—cities that unlike New York have grown enormously over the past decades. While the number of people living in greater New York has remained steady at about 16 million, the other three cities now have six times as many inhabitants as in 1960. Those cities illustrate what the authors of this volume on Mexico City term "metropolitanization" and "hyperurbanization," important trends among nonwestern cities of explosive growth in population and area. Mexico City embodies this phenomenon and for that reason provides an excellent case for evaluating the relationships of such megacities to their environments.

*The Basin of Mexico: Critical Environmental Issues and Sustainability*, by Exequiel Ezcurra, Marisa Mazari-Hiriart, Irene Pisanty, and Adrián Guillermo Aguilar, is one of a family of recent and forthcoming books on critical environmental regions of the world published by the United Nations University Press. The region in question, the large water basin that includes Mexico City, is the only urban zone among nine areas of the globe targeted for study by the editors of the series: Jeanne X. Kasperson, Roger E. Kasperson, and B. L. Turner II. It would be difficult to find a metropolis with better *bona-fides* than Mexico City, where 20 percent of the nation's residents live on just 0.03 percent of the real estate. It would