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Biological Sciences

Science for parks / parks for science: Conservation-based research in national parks

By Andrew V. Suarez

Introduction

"The use of national parks for the advancement of scientific knowledge is ... explicit in basic legislation. National Parks, preserved as natural comparatively self-contained ecosystems, have immense and increasing value to civilization as laboratories for serious basic research. Few areas remain in the world today where the process of nature may be studied in a comparatively pure natural situation." (from Wagner and Kay 1993)

IN ADDITION TO PROVIDING VISITORS with the opportunity to appreciate natural scenery and wildlife, national parks have a long history of scientific research, dating back to the establishment of Yellowstone National Park (Wyoming, Montana, Idaho) in 1872 (Sellars 1997). National parks historically offered unique opportunities for scientists because their ecosystems are largely unmodified relative to the surrounding landscapes. However, national parks are also important to the conservation sciences as we become more aware that they are not "islands" but interact substantially with surrounding environments. The longevity of these invaluable resources will depend heavily on management recommendations and restoration efforts guided in turn by scientific efforts.

Human activities have greatly modified natural ecosystems and threatened biodiversity. One principal mechanism for these threats is the spread of invasive species, characterized by the establishment of species in environments outside of their native range. Their impact is usually measured by the elimination of native species through direct interactions (for example, competition, parasitism, and predation) or indirectly through cascading mechanisms resulting from the loss of keystone species, mutualists, or nutrient availability (Parker et al. 1999; Mack et al. 2000). While national park units are among our most pristine remaining natural resources, they are by no means immune to invasion by nonnative species. In fact, they are increasingly taking a central role as resources for the study of biological invasions.

A change in the type of research conducted within U.S. national parks is reflected in publications of park-based research over three periods (1968–1975, 1985–1987, and 2000–2001). The proportion of journal articles reporting inventories or describing species remained consistent; however, the proportion of articles reporting research that focused on subjects relating to conservation and restoration increased (fig. 1). National parks worldwide have also become increasingly important in research on biological invasions. An online search for “national parks” and “invasion” in the citation database Web of Science® found more than 650 publications, 225 of which were published since 2005.

Conducting research in national parks

National parks are often perceived as closed to scientists, despite the unique opportunities for research they offer. This perception stems largely from National Park Service regulations regarding collections and research. However, these regulations, in the form of applications, annual reports, and the deposition of vouchers in public museums, can facilitate future research and should not be viewed as a hindrance.

One example highlighting the benefits of this process is the Investigator’s Annual Report (IAR). This reporting system provides a permanent record of research and scientific information in national parks and is accessible via a search engine on the NPS Web site (http://science.nature.nps.gov/research/ac/ResearchIndex). Investigator’s annual reports from all units of the National Park System are compiled to help inform scientists of the parks’ collective research activities. This increases the value of research conducted in national parks as well as the importance of these lands as a scientific resource to other researchers, and scientific progress at large. By making these reports available, the National Park Service promotes communication and collaboration among scientists working both within and outside the National Park System. The compilation of investigator’s annual reports (and other materials such as voucher specimens) also produces a chronological account of research conducted. These records allow for a careful reconstruction of the park’s environmental history and can be used to provide the foundation for current or future work (see Woodroffe and Ginsberg 1998).

This process is illustrated by my own research on invasive ants and lizard communities in Cabrillo National Monument (California). By coordinating research and sampling the same sites, researchers from different agencies and universities were able to link the absence of coastal horned lizards (*Phrynosoma coronatum*) in the monument to the presence of the invasive Argentine ant (*Linepithema humile*). This collaboration, initiated in part by interactions between the researchers and the monument’s chief of Natural Resource Science, contributed to the examination of ant invasions as a possible reason for horned lizard decline throughout southern California (Fisher et al. 2002; Suarez and Case 2002).

This early, positive experience in the National Park System continues to shape my research today. After examining the consequences of Argentine ant invasion in southern California, I became interested in the success mechanisms for invasive ants. Most hypotheses for the success of invasive species stem from differences in biology between native and introduced populations (Kolar and Lodge 2001). Subsequently, my research has concentrated on examining the biology of Argentine ants in their native range (Tillberg et al. 2007). Some of my best study sites for examining Argentine ants under natural conditions in their native range have been under the supervision of the Asociación de Parques Nacionales en Argentina (fig. 2).

Conclusions

Contrary to historical views that the purpose of national parks in research is primarily to study natural or healthy ecosystems, researchers now also use parks to examine the mechanisms of species loss and decline. Rather than viewing parks merely as large, isolated islands, researchers now consider and study parks as dynamic reserves that interact with their surroundings. Parks are ideal for research because of the quality of historical information and regulations that promote communication and collaboration among scientists and agencies.

The role of the National Park Service as stewards or protectors of this nation's natural resources is more important than ever. The National Park System is a cornerstone in a multiagency reserve system including state parks, Bureau of Land Management areas, national forests, wildlife areas, and other public lands. The amount of land for preserving biodiversity, ecosystem function, and the services they provide (Costanza et al. 1997; Pimentel et al. 1997) is decreasing; science is the common language that will tie together the separate pieces of this national reserve system.

Moreover, it has been suggested that park effectiveness in tropical reserves is correlated with basic management activities, indicating that even modest increases in funding might directly increase the ability of park managers to protect biodiversity. The ability to conserve biodiversity and ecosystem function will also improve with increased scientific research.

How do we turn the mantra "science for parks/parks for science" into a reality? The National Park Service and its collaborators can start by focusing on the next generation of scientists, providing opportunities that promote graduate-student research in parks. Positive experiences with the National Park Service early in a career can lead to long-term relationships between national parks and scientists. The value of public lands in science for parks and parks for science will become more apparent as science conducted in national parks continues to benefit both parks and scientists.

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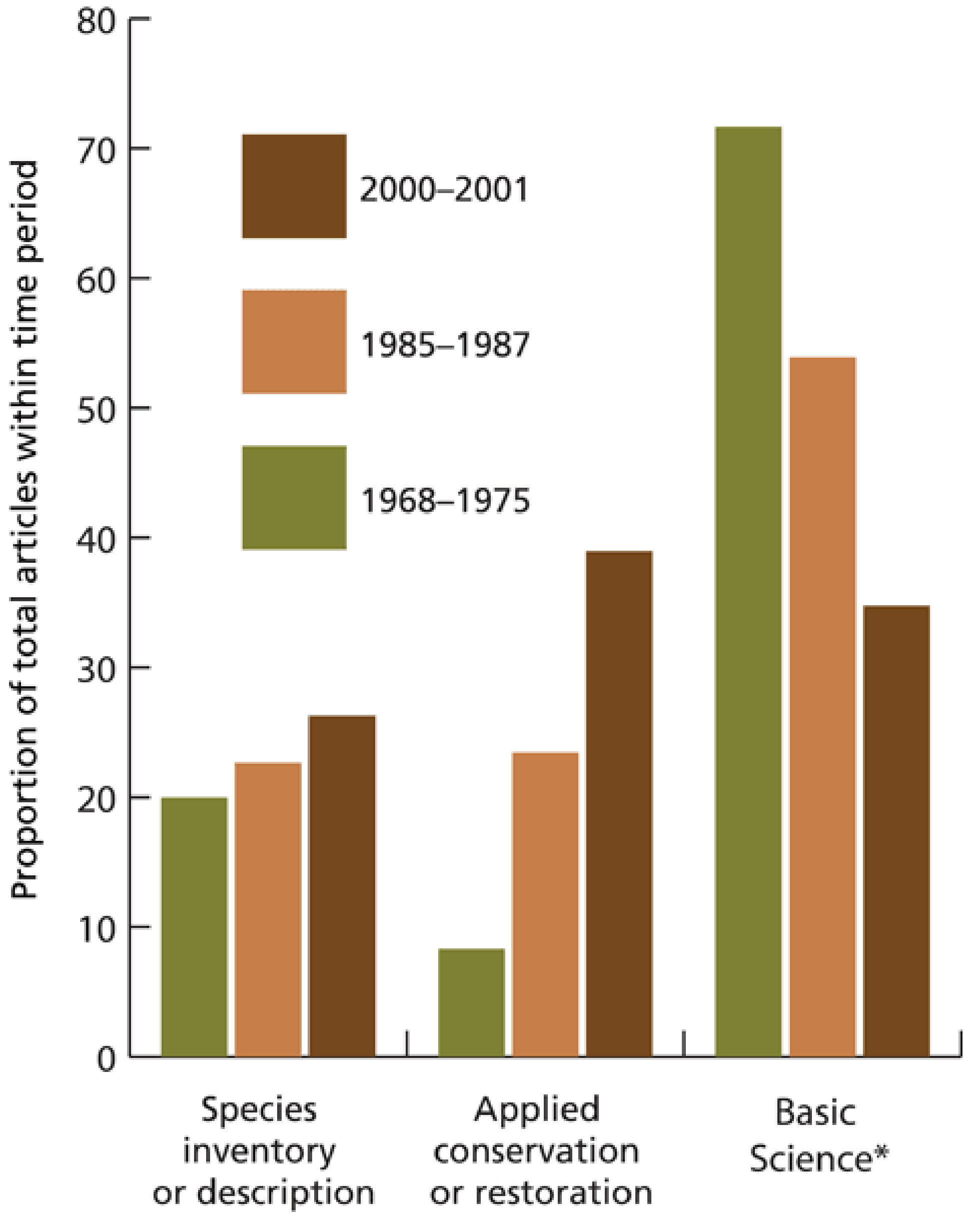
About the author

Andrew V. Suarez was a 1997 Canon Scholar. He completed his dissertation, "Causes and consequences of biological invasions: The Argentine ant in southern California," at the University of California, San Diego, in 2000. He is an assistant professor in the Department of Entomology and the Department of Animal Biology at the University of Illinois, Urbana-Champaign.



*No direct link to conservation or management

Publication source: JSTOR database (Andrew Mellon Foundation) for 1968–1975; BIOSIS database (Biological Abstracts, Inc.) for 2000–2001 and 1985–1987.

Figure 1. Categories of published studies of biological research conducted in U.S. national parks over three periods.

Courtesy of Neil Tsutsui

Figure 2. Research on the invasive Argentine ant has benefited from cross-continental comparisons of its biology in its introduced range (Cabrillo National Monument, USA, shown here) and its native range (Parque Nacional El Palmar, Argentina, next image). The Argentine ant is able to monopolize plant-based resources in introduced populations while being primarily predatory in its native range. This change in trophic biology may allow Argentine ants to attain higher worker densities in introduced populations (where they displace other ants) relative to their native range where they coexist with other ants in species-rich communities.

Courtesy of Andrew Suarez

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