

How climate changed ecology: Recent trends in NSF funded ecology research.

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Abstract

Climate change has comprised a significant and growing percentage of federally funded research and development over the past thirty years. The 1978 National Climate Program Act laid out a program to research climate and identify policy implications. Although the National Oceanographic and Atmospheric Administration was the primary source of climate research funding, other funding agencies have focused on different parts of the issue. The National Science Foundation, for example, was charged with supporting basic research relating to climate and conducting the US Antarctic Program and coordinating the 1984 Arctic Research and Policy Act. The US Global Change Research Program was established in 1990 to coordinate the efforts of federal agencies to provide policy relevant science. This burgeoning political and public focus on climate has had effects on the types of science being done in addition to the aforementioned legislative mandates. As early as 1977 there was evidence that biotic cycles could have significant impact on global atmospheric CO₂ and provide climate feedbacks. Since that time there has been a gradual shift in the types of ecology research being conducted, with climate becoming increasingly central in ecological studies. I utilize the National Science Foundation's historical database of awarded grants to analyze keywords in ecology related research proposals to identify the influence of the growing national focus on climate. I describe trends in the types of ecology research funded by the NSF since 1976 as part of a larger attempt to understand the recent history of ecology in the United States.

Methods

I obtained the data for this research by performing keyword searches for terms related to ecology and climate in the National Science Foundation's historical database of grants awarded (available at <http://www.nsf.gov/awardsearch>). The keywords for which I performed searches include: climate, ecosystem, ecology, ecosystem dynamics, habitat, species, and population dynamics. Searches were limited to grant titles because abstracts were not regularly included in the database prior to 1987. With one exception, I did not limit searches to specific programs or directorates within the agency. I then "ground-truthed" the results to verify that grants identified through the search process were related to the keywords used. Because of extensive use of the word "species" in chemistry research unrelated to ecological questions, I excluded results for that search to the biology and oceanography directorates.

Following initial results that showed a significant increase both the number of grants and the dollar amount awarded to climate related research projects, I divided the study period into two based on the founding of the US Global Change Research Program in 1990. I then analyzed the data to determine if climate related research became more prevalent in the period that followed the founding of that program.

Data analysis

The following graphs and statistical analyses were created from the NSF database of historical grant awards. The left hand column represents an analysis on the number of grants awarded each year that were identified by the relevant keyword searches. The right hand column of graphs is a similar analysis on the dollar amount awarded to grants related to ecology and ecosystem science. All dollar amounts are converted to year 2000 constant dollars.

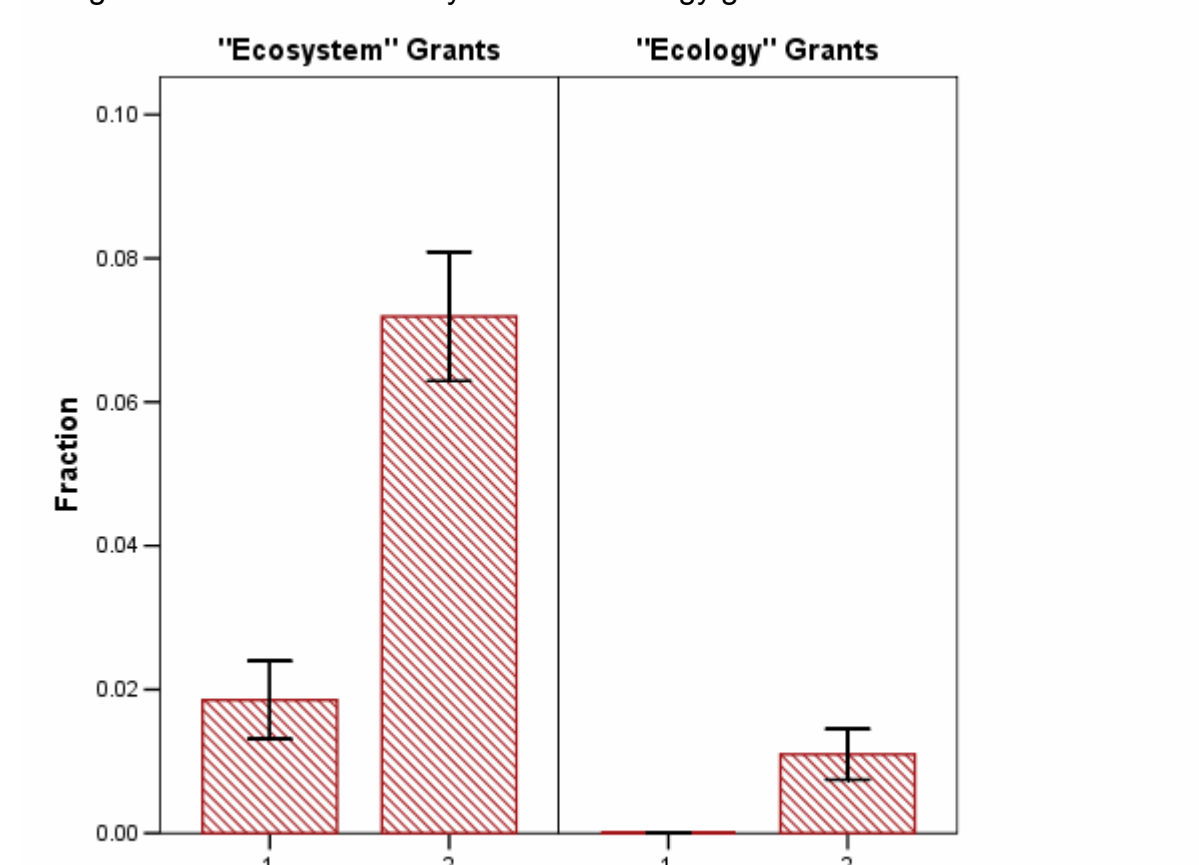
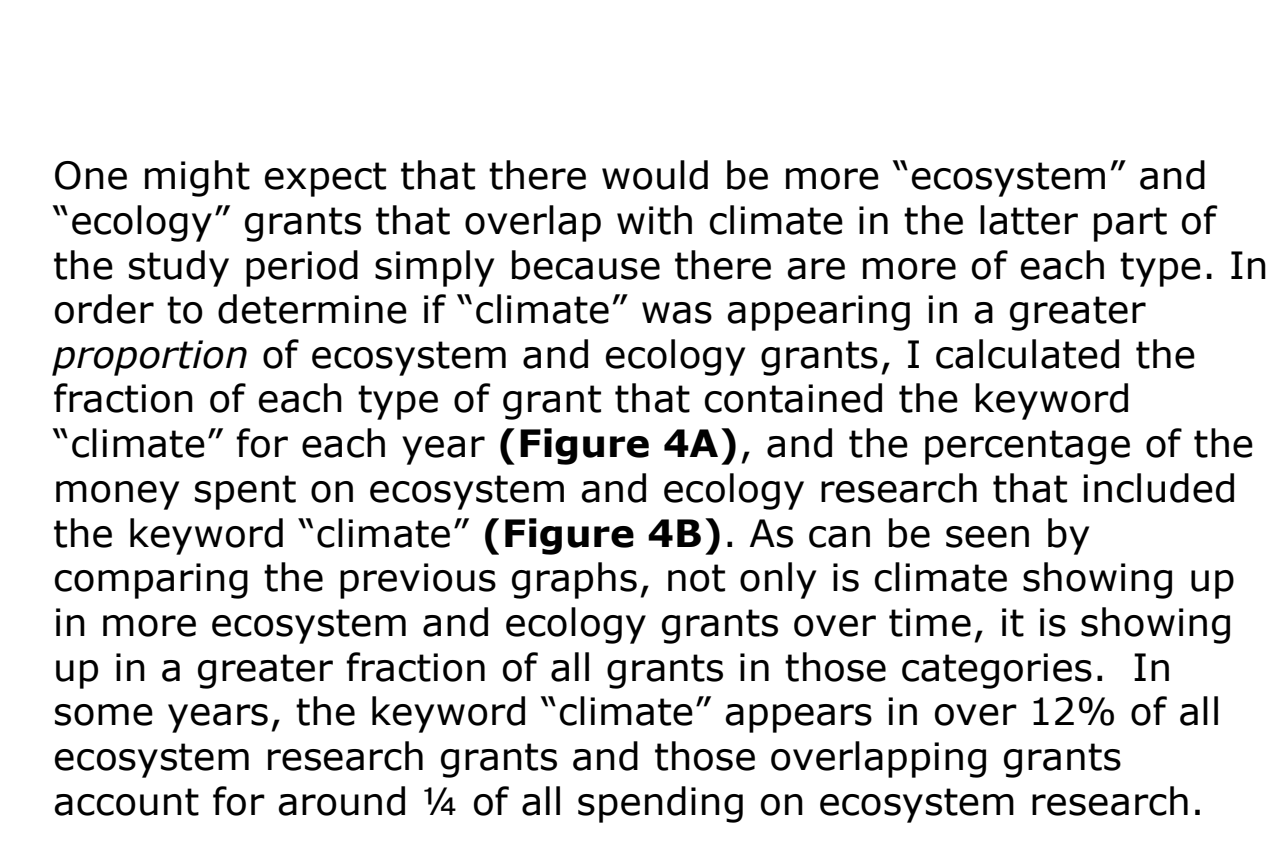
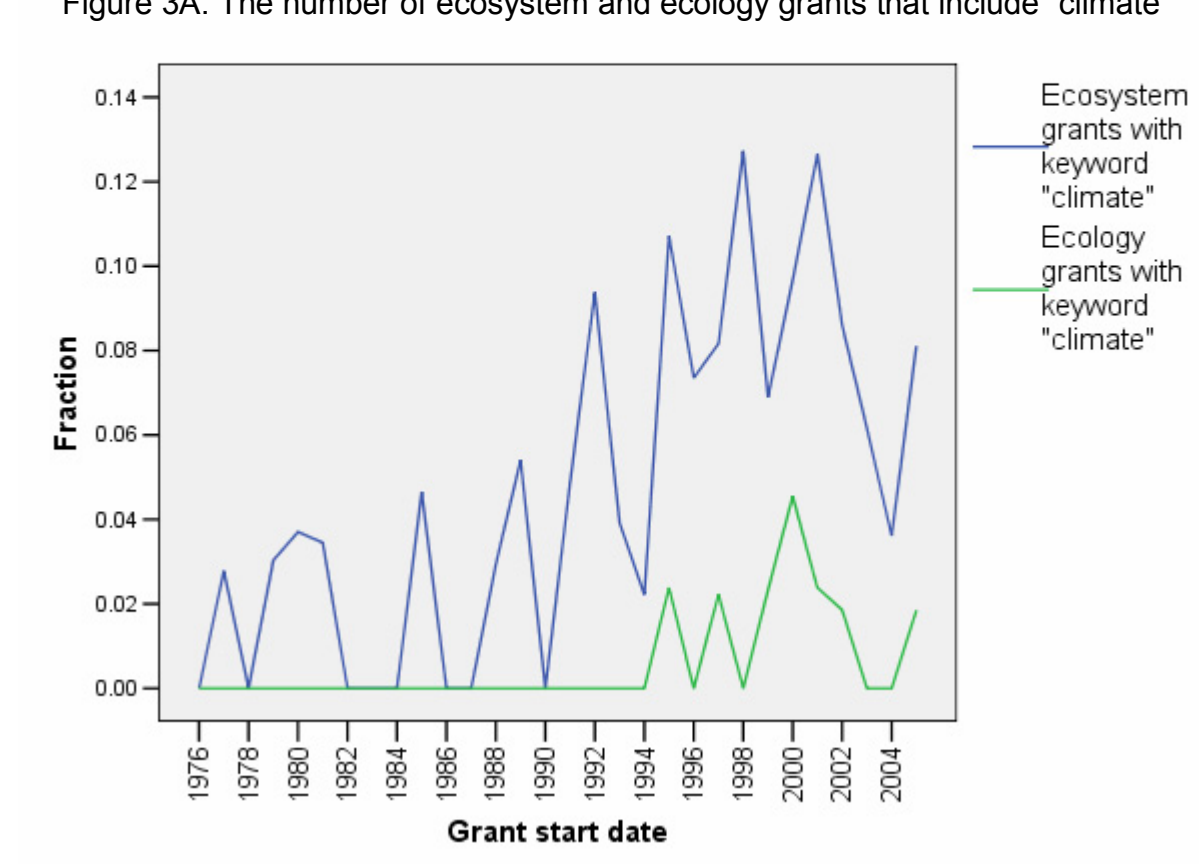
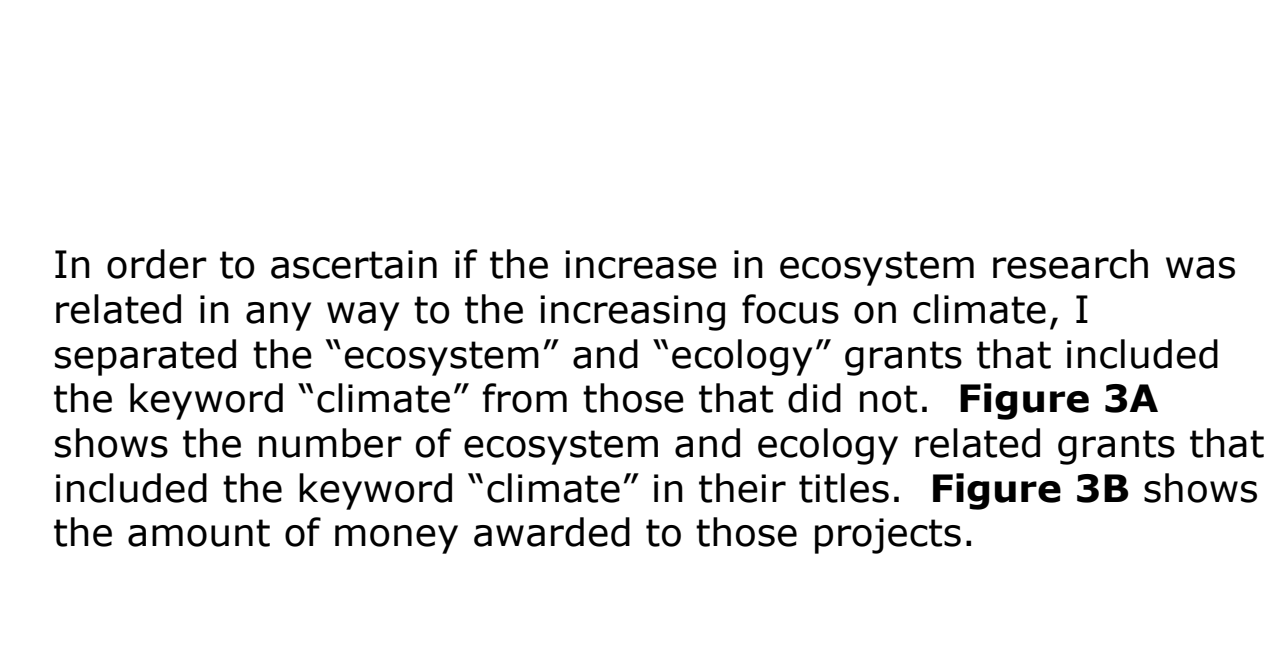
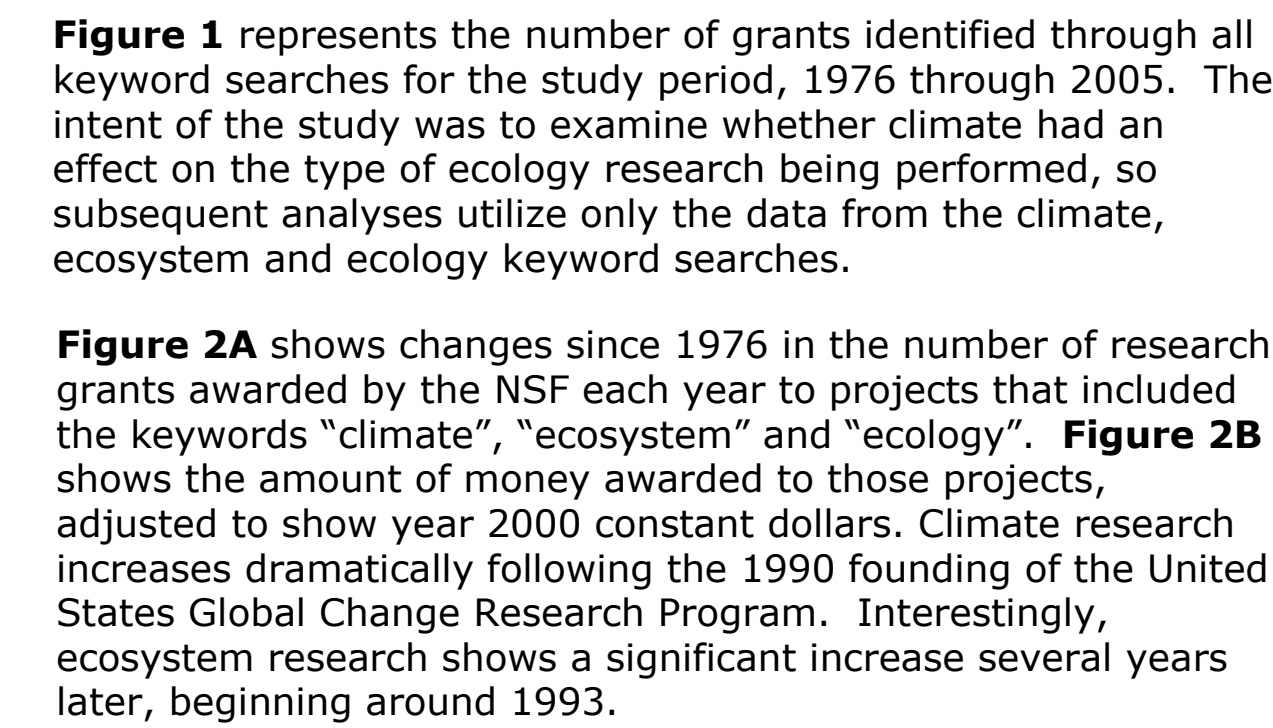
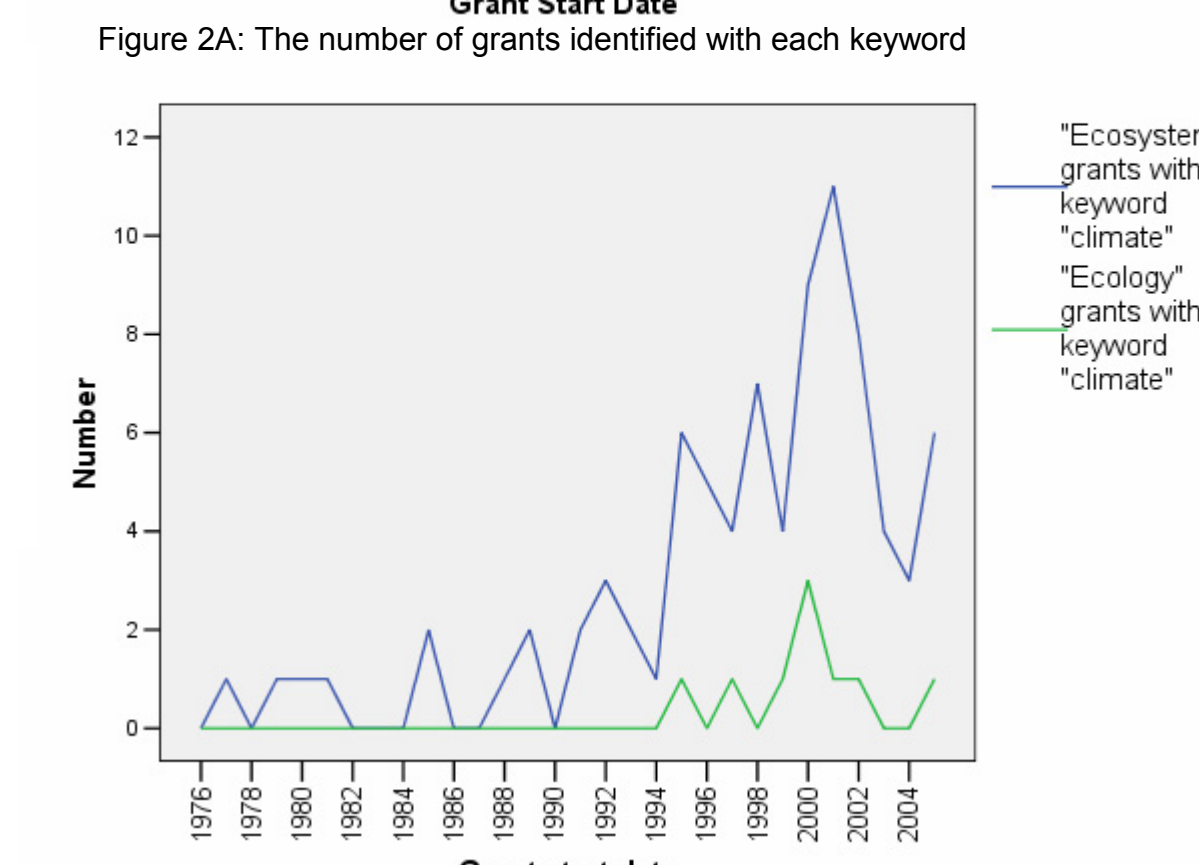
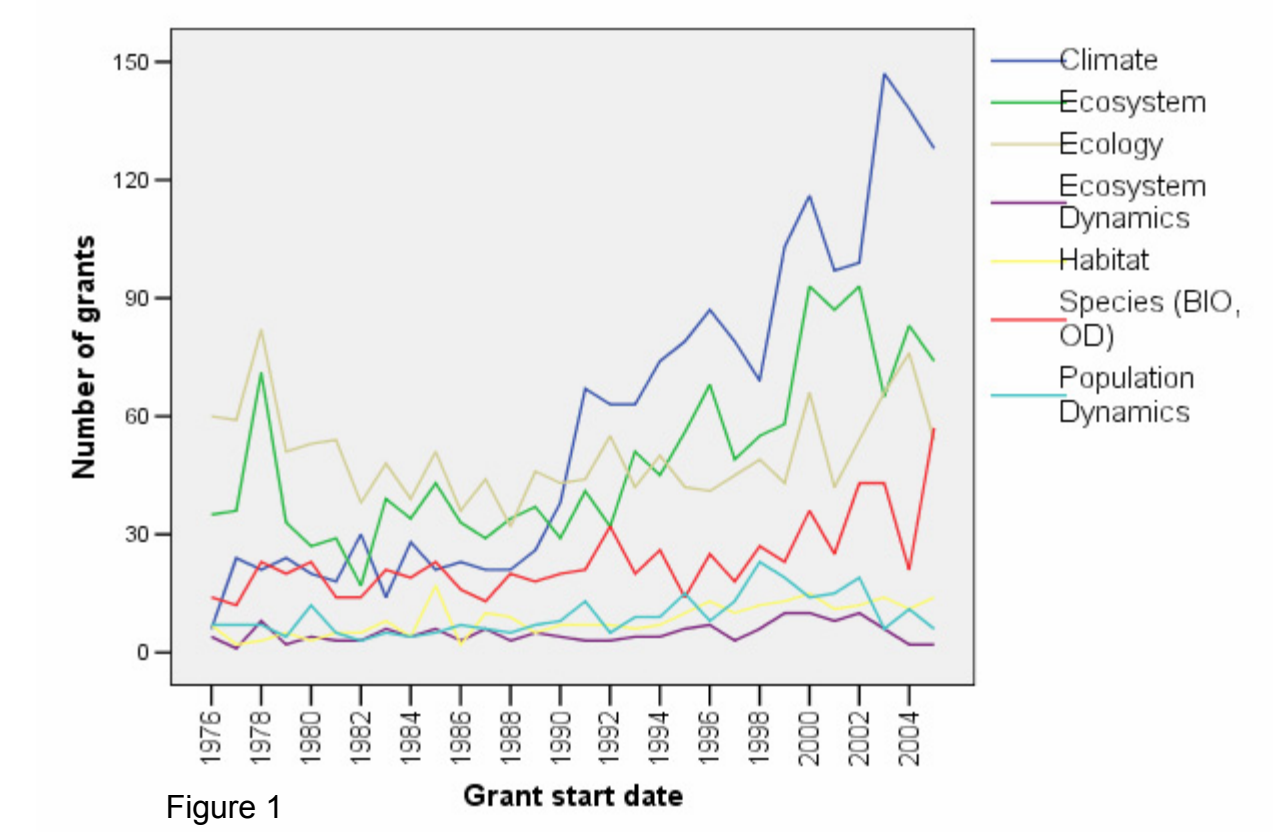
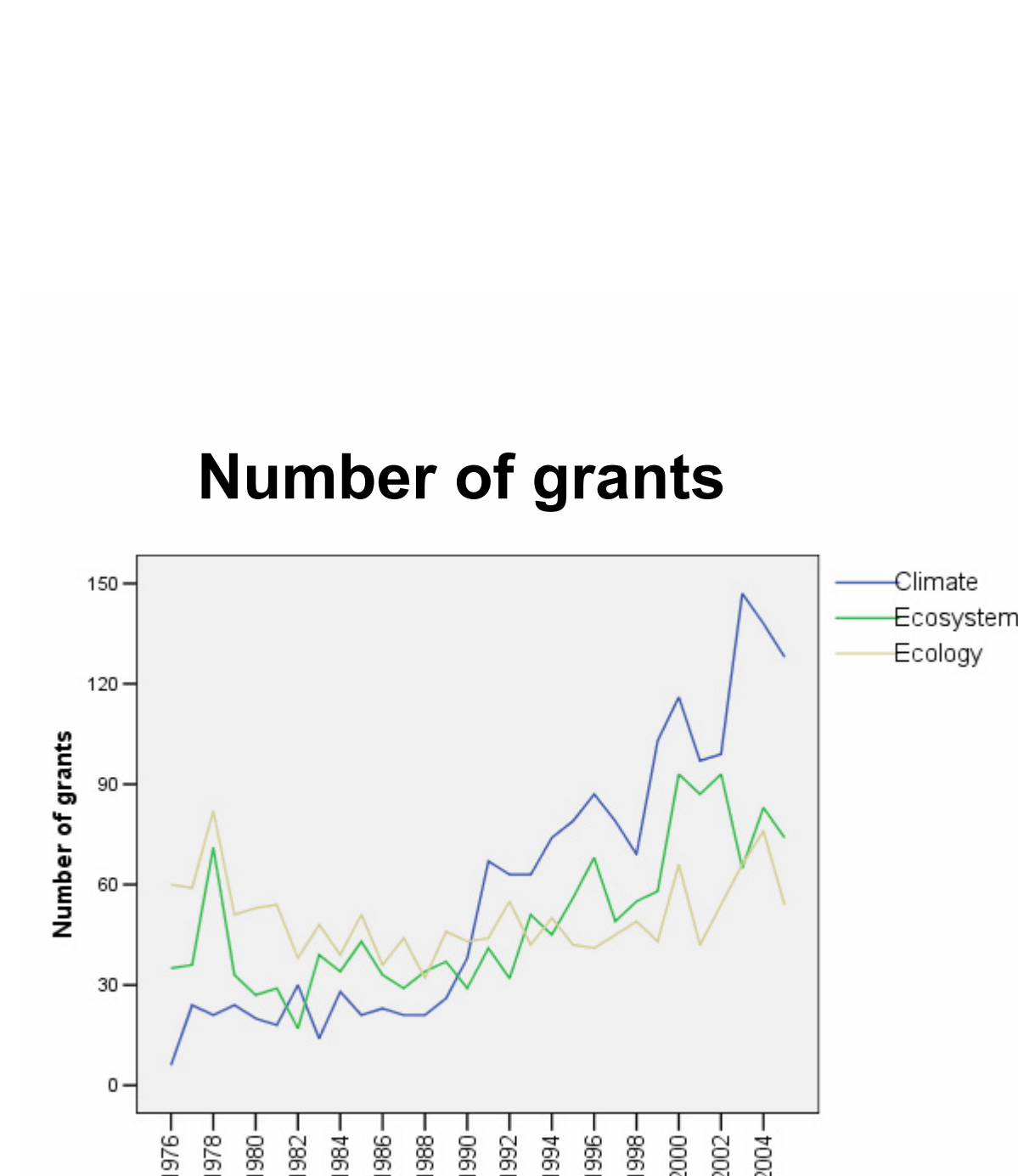


Figure 5A: The fraction of ecosystem and ecology grants that included the word "climate" in their titles before (period 1) and after (period 2) the founding of the US Global Change Research Program in 1990.

Mann-Whitney U test	U score	P value	n
Fraction of "ecology" grants with keyword "climate"	63	P<.05	30
Fraction of "ecosystem" grants with keyword "climate"	39	P<.001	30

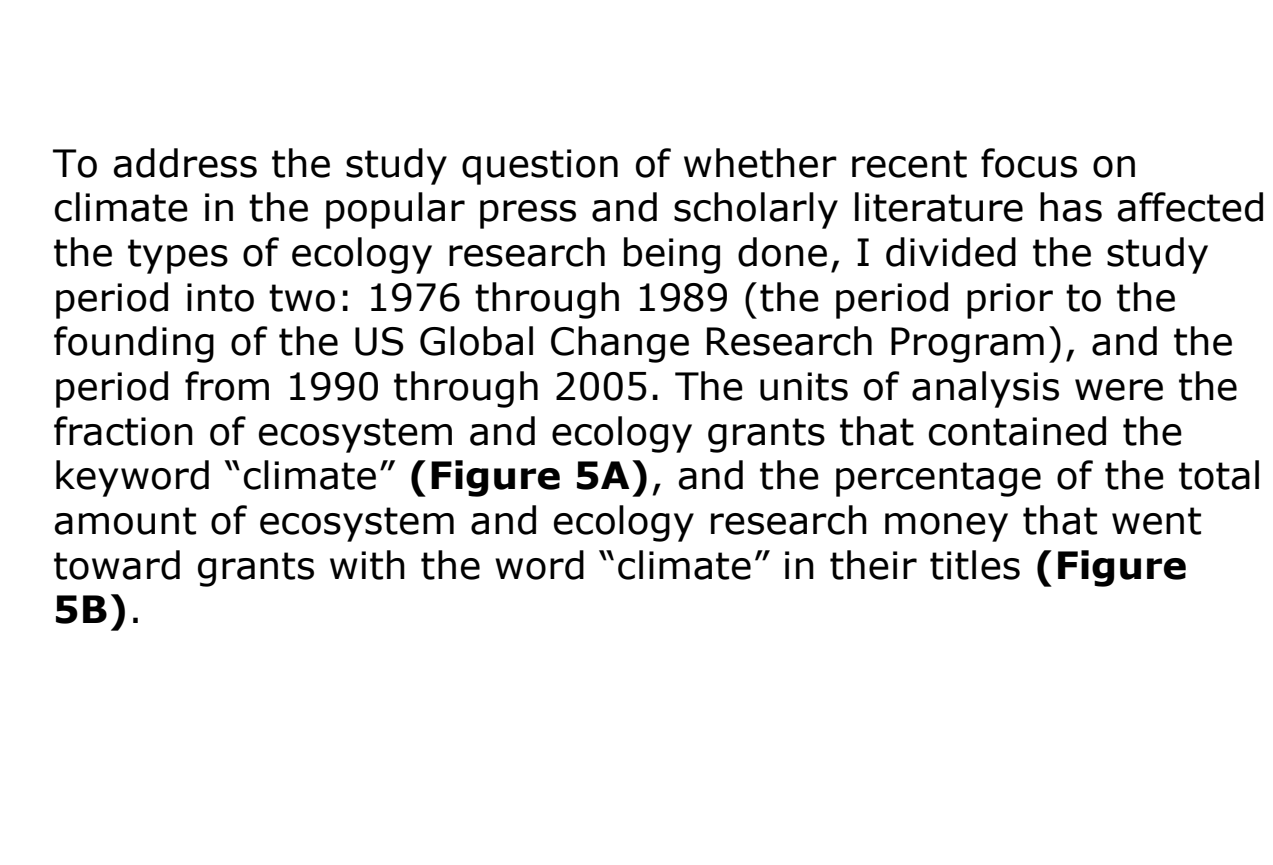


Figure 5B: The percent of ecosystem and ecology funding that went toward grants with the word "climate" in their titles before (period 1) and after (period 2) the founding of the US Global Change Research Program in 1990.

Mann-Whitney U test	U score	P value	n
Percentage of total dollars spent on ecology research that went to grants with keyword "climate"	70	P=.085 (not significant)	30
Percentage of total dollars spent on ecosystem research that went to grants with keyword "climate"	39	P<.01	30

Why it matters

Throughout its early development, ecology tended to focus on local and regional scale research questions. Climate change offers both interesting questions and funding opportunities to ecologists who are willing to address phenomena that operate on global scales (e.g., Kwa 2005). The results presented here show that the National Science Foundation increasingly funded research that connected ecosystems to larger climate scale phenomena. The focus of ecology may be evolving because of the perceived importance of climate change. Regardless of causation, the changing focus of ecology is worth studying because science plays the de facto role of identifying both management problems that need to be addressed as well as possible solutions to those problems. While climate has feedbacks with ecosystems, other anthropogenic drivers of change such as land use, species introductions, and management are likely to have significant impacts on our ecosystems as well. Because resources are limited, research attention should be commensurate with our best understanding of the importance of the drivers of change. The Consortium for Science, Policy and Outcomes is working on related projects to characterize the importance of these and other drivers of change in two ecosystems. Our goal is to provide insight into the connection between research priorities and actual drivers of change, with the intent of guiding research priorities as well as natural resource policy decisions.

Future research

This research demonstrates changes in the types of grants funded by the NSF over the past 30 years. With this analysis it is not possible to identify if these changes stem from a change in the types of proposals submitted by ecologists, or, alternately, if they reflect changing priorities of the funding agency. Additionally limiting, this analysis does not show that ecologists are actually researching different topics now than they did in the past; they may be including the word "climate" as a strategy to increase the fundability of their research by tying it to climate change. In order to address these deficiencies, I plan to complement these findings with a bibliometric analysis, content analysis and interviews with ecologists.

Literature Cited

Kwa, C. (2005). "Local Ecologies and Global Science: Discourses and Strategies of the International Geosphere-Biosphere Programme." *Social Studies of Science* 35(6): 923-950.

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For further information

Please contact Mark.Neff@asu.edu for copies of this poster or for additional information about this ongoing project to characterize recent changes in ecological research priorities.

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