

**INTEGRATING SOCIAL SCIENCE INTO NOAA PLANNING,
EVALUATION AND DECISION MAKING**

**A REVIEW OF IMPLEMENTATION TO DATE AND
RECOMMENDATIONS FOR IMPROVING EFFECTIVENESS**

A Report from the NOAA Science Advisory Board

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

ACKNOWLEDGEMENTS

BACKGROUND

1.0	Introduction: NOAA Social Science Review	10
1.1	Social Science Definition and Application.....	10
1.2	Previous Review Findings.....	11
1.3	Terms of Reference for the Social Science Working Group	12

CONTEXT

2.0	Social Science and the NOAA Mission.....	13
3.0	NOAA Progress in Social Science	16
3.1	SAB Actions Supporting Social Science.....	16
3.2	NOAA Social Science Reorganization and Present Capabilities	17
3.3	Planning and Funding Social Science within the PPBES.....	23
3.4	Social Science in NOAA Strategic Plans	24
3.5	Progress on 2003 Report Recommendations for Social Science within NOAA	26

IMPROVING EFFECTIVENESS

4.0	A Vision for Social Science within NOAA.....	27
4.1	How can NOAA better identify and measure (qualify and quantify) its programmatic outcomes?.....	27
4.2	How can social science help NOAA and its partners effectively integrate natural science into decision making?.....	27

4.3 How can social science itself be integrated into decision making of NOAA and its partners?	28
4.4 How can social science capabilities at NOAA be strengthened where currently they are weak?.....	28
5.0 A Path for Achieving the Social Science Vision.....	30
5.1 Building Social Science Literacy	30
5.2 Assessing Social Science Needs.....	30
5.3 Developing Staffing Models	31
5.4 Transitioning to a Social Science Research Agenda Within NOAA.....	35
5.5 Adopting a Next Generation Performance Matrix	41
CONCLUSIONS	
6.0 Findings and Recommendations.....	42
6.1 General Findings and Recommendations.....	42
6.2 Institutionalizing Social Science at NOAA.....	43
6.3 Contributions of the Social Sciences to Programmatic Outcomes	45
References.....	46
Appendix A.....	48
Appendix B	51
Appendix C: 2003 Social Science Review Panel Findings and Recommendations.....	54

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EXECUTIVE SUMMARY

The 2007-2008 review by the NOAA Science Advisory board (SAB) Social Science Working Group (SSWG) took place against the background of the 2003 NOAA SAB Social Science Review Panel (SSRP) Report and the subsequent implementation of its recommendations. The fundamental finding of the 2003 report was that the capacity of National Oceanic and Atmospheric Administration (NOAA) to meet its mandates and mission is diminished by the underrepresentation and underutilization of social science. This finding remains true in 2009. Social science accounts for a very small proportion of the total NOAA budget, amounting to 0.6% in FY08, and that proportion has declined 0.1% since FY05.

The Social Science Working Group reviewed five areas of NOAA progress in strengthening social science since 2003:

Actions taken by the Science Advisory Board (SAB): The SAB has taken actions that support social science in the areas of cooperative institutes, hurricane intensity research, the organization of NOAA research, and ecosystem science.

Social science budget and staffing: NOAA has made organizational changes intended to support and strengthen its social science capabilities. However, FY08 data indicate that the budget and staffing capabilities of NOAA social science have weakened. Between FY05 and FY08, a period of increase in the NOAA budget, expenditures on social science decreased by slightly less than 10%, and numbers of social science staff decreased by 8%.

Planning and funding social science within the Planning, Programming, Budgeting and Execution System (PPBES): PPBES has become a central focus for the allocation of NOAA funds to programs that cross line offices. How effective the relatively recently implemented matrix organizational structure will be in the development and integration of social sciences remains an open question.

The position of social science in NOAA strategic plans: Social science is increasingly finding its way into the language of the goals and programs.

Implementation of the 2003 SSRP recommendations: Implementation has been uneven. The overall conclusion is that although the need for social science is now more widely recognized throughout NOAA, progress in strengthening social science is slow and, in the case of social science budgets and staffing, has actually eroded.

A central issue for social science within NOAA's new management structure is integration. NOAA asked the SSWG to address four questions:

1. How can NOAA better identify and measure (qualify and quantify) its programmatic outcomes?

The most appropriate way to describe programmatic outcomes is with reference to NOAA's mission and to the societal value generated by NOAA's products and services. When social science capabilities are fully and appropriately integrated into NOAA activities, NOAA will be able to identify and measure the contribution of its products and services to the social and economic value of: (1) the nation's stock of coastal and marine resources; (2) commercial and non-market economic activities; and (3) changes in the health and safety of the nation's citizens.

2. How can social science help NOAA and its partners effectively integrate natural science into decision making?

Social science provides the basis for understanding how NOAA products and services affect decisions and outcomes related to human safety and health and to the economy. Natural science can be better integrated into NOAA decision making if consideration is first given to the users of information, the translation and communication of that information, the processes by which information is used to make decisions, and the level at which decisions will be made; e.g. policy, emergency response, or households.

3. How can social science itself be integrated into decision making of NOAA and its partners?

Key to building and integrating effective social science capability in NOAA goal teams and line offices is a top-down commitment to allocating NOAA resources based, at least in part, on social benefits and economic returns. This commitment will make real the need for each line office, goal team and program to understand and quantify the contribution its products and services make to social and economic goals. It will also encourage efficient internal allocations of resources within programs and projects.

4. How can social science capabilities at NOAA be strengthened where currently they are weak?

Achieving the vision for strengthened social science within NOAA requires advocates within NOAA leadership, support of the Assistant Administrators (AA's), and a commitment to expand the culture of NOAA. Social science capabilities can be strengthened in part by providing the right incentives to line office and program managers to incorporate decision making metrics that are relevant to society. This in turn necessitates developing social science capacity to guide, inform, and support the application of social science for corporate planning and program development. In particular, NOAA can create a leadership role for social science coordination, integration, and implementation by establishing an Office of Societal Impacts that is external to the line offices and reports directly to upper levels of NOAA leadership, such as the Deputy Undersecretary for Oceans and Atmosphere, in a manner similar to the Office of Education.

NOAA has a number of options for staffing, funding, and performance measurement of social science, and it is clear that no single model will be optimal across all line offices and goal teams. The organizational support required for social sciences will likely change over time as needs and capacity develop and with the evolving roles of the line offices and mission goal teams.

A social science research agenda is well articulated within the National Marine Fisheries Service (NMFS) and National Ocean Service (NOS) line offices. Looking across all line offices, the SSWG sees rich opportunities for social science research investments in the thematic areas of climate, coasts and oceans, weather and water, and ecosystems, and commerce and transportation.

In addition to addressing the four questions laid out in the terms of reference, the SSWG has a number of overarching findings and recommendations to NOAA.

General Findings and Recommendations

Finding 1: The SSWG endorses the overall findings of the 2003 SSRP report and finds that the social sciences continue to be underrepresented in NOAA's research, operations, and decision making. The SSWG also finds that if NOAA is to serve society and fulfill its mission, it must integrate the social sciences into the full range of its scientific and programmatic activities.

Finding 2: NOAA lacks sufficient social science expertise to meet its mission and objectives. The social sciences are critical to understanding the vulnerabilities and behavior of the users of NOAA products and information, and the economic risks mitigated and value generated by these uses. Social science can also assist in prioritizing NOAA investments by estimating the economic return from programs, products, and improvements. The social sciences are needed to support improved product design, communications with users, and education.

Recommendation 2.1 NOAA should draw on the full range of excellent science (physical, biological, and social) to better meet its mission in both line offices and mission goals.

Recommendation 2.2 NOAA should recognize and facilitate the contributions of the social sciences to the major challenges in its research and development and to its operational responsibilities, as several other agencies, organizations, and scientific programs have done. NOAA should use social science to understand decision making frameworks at all levels so as to provide information that meets user needs.

Recommendation 2.3 NOAA should use social science analysis to demonstrate and calibrate its accomplishments, to provide a solid basis for its future planning, and to more properly implement and evaluate its planning activities.

Institutionalizing Social Science at NOAA

Finding 3: Social science literacy has improved somewhat throughout NOAA since the 2003 report, but it is still weak in many areas. NOAA leadership is now more aware of the merits of the social sciences, but in most cases still does not assign a significant priority to their role in the agency.

Finding 4: NOAA social science capabilities declined between 2005 and 2008. In that time period the NOAA budget increased by 13% and the social science share of the budget decreased by almost 10%. A precise accounting of social science positions within NOAA is difficult

because NOAA does not fully understand what constitutes a valid social science presence and moreover lacks a tracking system for social science position categories.

Recommendation 4.1 NOAA administrators should address the weakening position of the social sciences by aggressively developing and implementing a plan to strengthen and integrate social science throughout NOAA line offices, programs and mission goals.

Recommendation 4.2 NOAA should conduct a formal needs assessment to determine its needs for social science staff and research by program, and determine the appropriate mix of internal and external staffing to meet these needs.

Recommendation 4.3 NOAA should develop a tracking system that accurately accounts for and monitors social science staff.

Finding 5: NOAA social science activities are mostly *ad hoc* and segregated, rather than sustained, coordinated and comprehensive. (An exception to this is NMFS, which has significantly expanded its emphasis on the use of the social sciences and has a strategic plan with specific social science staffing objectives.) In addition, there is little representation of social science expertise among the higher levels of NOAA leadership. Overall, there is inadequate high level commitment among NOAA administrators to strengthening NOAA's use of the social sciences.

Recommendation 5.1 NOAA leadership should articulate a commitment to strengthen the social sciences within NOAA and develop incentive structures to ensure that this commitment is implemented at the line office, mission goal and programmatic levels.

Recommendation 5.2 Until a coordinated and comprehensive social science capacity can be sustained NOAA-wide, a strong centralized social science presence will be necessary to support corporate and programmatic social science efforts. To put appropriate social science expertise in place to guide, inform, and support the use of the social sciences within NOAA, NOAA leadership should create the Office of Societal Impacts. This office would serve a leadership role in coordinating social science across the agency, integrating it where appropriate in research, programmatic, and planning functions. To ensure that the office has sufficient support to perform these functions, it should be external to the line offices and report directly to upper levels of NOAA leadership, such as the Deputy Under Secretary for Oceans and Atmosphere, in a manner similar to the Office of Education.

Recommendation 5.3 To promote the transition to increased social science capacity, NOAA should consider establishing a NOAA Council of Social Science Advisors to advise NOAA leadership on fruitful areas of investment in social science research and staff.

Recommendation 5.4 The NOAA Science Advisory Board should establish a standing Social Science Working Group to provide ongoing oversight and quality control over the integration of the social sciences into the agency.

Recommendation 5.5 NOAA should use its network of joint and cooperative institutes to strengthen social science research, either through the inclusion of social science research in existing institute programs or by establishing one or more joint/cooperative institutes dedicated to social science.

Recommendation 5.6 NOAA should provide appropriate budgetary support to accomplish these recommendations through special assessments and reprogramming. Line offices should establish budget targets for investments in social science capacity over the next three to five years. Ultimately, the determination of the proportion of NOAA resources to be allocated to the social sciences should be outcome-driven. Until a threshold capacity is developed so that the benefits of the social sciences can be felt, formal needs assessments are completed, and formal procedures are adopted to assess the adequacy of social science investment in each line office, the SSWG recommends that about 5% of all line office budgets should be allocated to the social sciences. This likely will require reallocation of existing staffing budgets.

Recommendation 5.7 Over the long term, NOAA should integrate the social and natural sciences in all its research committees, rather than creating parallel structures. In the short term, it may be necessary to create special purpose social science groups to strengthen the social sciences in NOAA. NOAA should also seek ways to coordinate its activities with social science research activities outside of NOAA, such as those at National Science Foundation (NSF).

The SSWG endorses the following recommendations of the NOAA Social Science Committee to: 1. Combine in-house and external social science staff, as appropriate to each program; 2. Use “test beds” and demonstration projects to illustrate the value of social science to NOAA activities and educate NOAA managers about the benefits of the social sciences; 3. Leverage the growing focus on ecosystem-based management and climate services, two areas where the need for and benefits of integration of social science should be obvious and unquestioned.

Contributions of the Social Sciences to Programmatic Outcomes

Finding 6: The social sciences are essential for quantifying the monetary and human values of NOAA products and services. The social sciences can improve the design of NOAA products and services in light of user needs, adaptation, response, and utilization, and they can help NOAA prioritize future investments.

Recommendation 6.1 NOAA should use the social sciences to: (1) identify and measure social and economic outcomes; (2) achieve socially beneficial outcomes; (3) improve performance within the organization; and (4) set targets for future accomplishments.

Recommendation 6.2 NOAA should establish performance metrics to set targets for and evaluate progress toward improved social science capability within NOAA.

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BACKGROUND

1.0 Introduction: NOAA Social Science Review

1.1 Social Science Definition and Application

Social science is the process of describing, explaining and predicting human behavior and institutional structure in interaction with their environments (SSRP 2003). The role of people can be understood through the application of scientific methods. As with other sciences, what makes an endeavor scientific is not the subject of its investigation but the methods applied. To be scientific, we require that a process be objective, transparent, documented, and replicable.

The purview of social science disciplines in relation to NOAA's mission is represented in the sample of applications listed below.

Sociology and Anthropology

- Understanding issues of vulnerable populations and weather and climate impacts
- Anticipating and examining societal adaptation to global change;
- Analyzing and optimizing the effectiveness of NOAA organizational structures;
- Increasing effectiveness of resource management policies in various socio-cultural environments;
- Developing methods for survey data collection, analysis and interpretation.

Demography

- Assessing population pressures on coastal resources;
- Analyzing demographic changes in vulnerability to coastal hazards;
- Identifying populations that are vulnerable to changes in the availability of marine life;
- Understanding the demographic drivers of demand for NOAA products and services.

Geography

- Investigating behavioral responses to weather risks;
- Developing strategies to improve hazards communication;
- Defining ecosystem boundaries and analyzing interactions among ecosystems, including humans;
- Developing methods for integrating user needs and capacities into global observing systems, including the spatial referencing network;
- Identifying inter-modal transportation bottlenecks to assess potential benefits of improved data and information.

Economics

- Estimating existing and potential benefits of NOAA programs, products and services;
- Establishing net benefits of programs for budgetary justification and program evaluation;
- Evaluating the economic impacts of weather, climate and space weather variability as a basis for planning and decision making;

- Understanding incentives of participants and stakeholders in organizational and economic processes relevant to NOAA missions;
- Developing methods for survey data collection, analysis and interpretation;
- Estimating value of non-market goods and services, such as ecosystem services;
- Policy design and evaluation.

Psychology

- Understanding how constituents perceive and use NOAA products and services;
- Understanding risk perception, risk assessment, and risk communication;
- Improving the communication value of stakeholder education materials;
- Understanding how people make decisions with regard to weather, climate, ocean hazards and resource use, including intrinsic uncertainty.

Political Science

- Analyzing political demand for programs and reactions to programs and regulations;
- Understanding governance structures of vulnerable communities;
- Understanding constraints and opportunities for interactions with private sector secondary users of NOAA products and services.

Communication

- Developing methods of communication of NOAA products and services to various stakeholders;
- Understanding best practices in presenting and communicating uncertainty in scientific assessments related to weather variability and climate change.

1.2 Previous Review Findings

In 2001 the NOAA Science Advisory Board (SAB) requested that a review panel be formed to evaluate the adequacy of NOAA's social science research, staffing and data. The Social Science Review Panel (hereafter SSRP) conducted its review over a period of 18 months, submitting its report to the SAB in March 2003 (SSRP 2003).

The 2003 report's fundamental finding was that the capacity of NOAA to meet its mandates and mission is diminished by the underrepresentation and underutilization of social science. This finding remains true in 2008. Taken together, the major findings of the 2003 report provide background and context to the present review of the status of social science within NOAA. They describe the secondary and weak position of NOAA social sciences.

Social Science Literacy: Throughout NOAA, there is a lack of formal understanding of what social science is and what its contributions can be, leading to an organizational culture that is not conducive to social science research.

Social Science Research: NOAA's social science research effort is small and unbalanced across disciplines.

Social Science Data: The lack of appropriate data limits the contribution of social science to NOAA.

Social Science Staffing and Senior Representation: Social science staffing is insufficient to meet the mission of each of the line offices, a problem that is exacerbated by the lack of social science representation in line office directorates.

Education and Outreach: The lack of expertise in social science survey methodology and other social science methods limits the ability of NOAA Assistant Administrators to understand and communicate with their constituents.

Strategic Planning: There is almost no long-term strategic planning for social science at NOAA (Office of Global Programs (OGP) and NMFS are exceptions). NMFS is the only line office in which social science objectives in the strategic plan track into a long-term social science research agenda.

Performance Evaluation: The application of social science is a necessary component of program effectiveness measurement and monitoring.

Economic Valuation: NOAA has immediate needs for data and research directed at environmental assessment and stewardship.

The current review takes place against the background of these findings and the five-year history of NOAA's implementation of their accompanying recommendations. A more detailed list of the 2003 findings and recommendations is included in Appendix C. NOAA's implementation of the recommendations is described in Section 3.

1.3 Terms of Reference for the Social Science Working Group

In 2007, the SAB was asked to assemble a working group of external experts to assist NOAA in the development of a strategy to strengthen and integrate social science into corporate- and Program-level planning, analysis and evaluation within the Goal Team structure. The SAB's prior recommendations for social science were framed within a management structure based on Line Offices (SSRP 2003). NOAA has subsequently instituted a matrix management structure and has developed a formal Planning Programming Budgeting and Execution System (PPBES).

Although the need for social science has been more widely recognized throughout NOAA since the 2003 report, the implementation of social science has been uneven. A central issue is the integration of social science within NOAA's new management structure. NOAA asked the Working Group (hereafter SSWG) to look in particular at four questions:

- How can NOAA better identify and measure (qualify and quantify) its programmatic outcomes?
- How can social science help NOAA and its partners effectively integrate natural science into decision making?

- How can social science itself be integrated into decision making of NOAA and its partners?
- How can social science capabilities at NOAA be strengthened where currently they are weak?

The SSWG began its review in Fall 2007, meeting four times between October 2007 and June 2008. The group reviewed a wide range of material, including the 2003 SSRP report, NOAA Line Office strategic plans, Mission Goal Team plans, and social science research plans. The SSWG also met with and received written communications from line office Assistant Administrators (AAs), the NOAA Research Council (RC), the Social Science Committee (SSC) of the NOAA RC, and other representatives of NOAA line offices, mission goal teams, and corporate planning functions. It also met with staff of other federal agencies: U.S. Department of Agriculture (USDA) Economic Research Service (ERS); USDA Cooperative State Research, Education, and Extension Service (CSREES); Environmental Protection Agency (EPA); U.S. Fish and Wildlife Service (USFWS); and U.S. Army Corps of Engineers (USACE).

The report is divided into three major sections representing the integration of social science in NOAA in the past, present and future. The introduction describes the background to the question of social science within NOAA, including findings of the 2003 SSRP. Sections 2 and 3 discuss the current context of social science in NOAA by focusing on its role in meeting NOAA's missions. In these sections, we address both the utility of social science for NOAA operations (as emphasized in the Terms of Reference) and the strong need for a substantive understanding social science research to accomplish NOAA's mission to the nation (as emphasized in the 2003 SSRP). Sections 4 and 5 present a way forward for improving effectiveness of the social sciences through staffing, research agendas and performance evaluation. In conclusion, Section 6 presents findings and recommendations.

CONTEXT

2.0 Social Science and the NOAA Mission

NOAA plays a wide-ranging and critical role in helping the nation achieve sustainable economic growth and protection of human life, health, and the environment.

NOAA accomplishes this role by providing information to enable other government agencies, private enterprises and citizens to make better informed decisions—each of which can contribute to improving society's well-being. For example, a broad cross-section of the nation's economic activity, including agriculture, transportation and energy production, is sensitive to weather and climate and is dependent on accurate forecasts for economic and physical well-being. NOAA scientists contribute information and advice to the EPA on permitting decisions under section 404 of the Clean Water Act. NOAA provides information on the health of the coastal and marine environment and also has regulatory responsibilities for commercial and recreational marine fisheries. NOAA administrators and scientists contribute to the protection and use of international fish stocks through international fishery commissions. The status and utilization of all of these natural resources in turn have direct bearing on the wealth and health of those who

participate in coastal recreation and harvest and consume seafood, and an indirect bearing on all current and future citizens.

The ultimate rationale for the information and stewardship services NOAA provides is clearly stated in NOAA's Vision of "an informed society that uses a comprehensive understanding of the role of the oceans, coasts, and atmosphere in the global ecosystem to make the best social and economic decisions." Human behavior is also reflected throughout the NOAA Mission. "To understand and predict changes in Earth's environment" requires an understanding of people as causes of change and as recipients of impacts of change. "To conserve and manage coastal and marine resources to meet our nation's economic, social and environmental needs" requires an understanding of people as the focus of regulations and as adapters to change.

The wide range of NOAA's contributions to society are represented in the mission statements of NOAA and each of its line offices. (Figure 1)

Many other government agencies have similar and compelling missions that bolster their claim to a share of limited fiscal resources. Inter-agency competition for these resources is strong. NOAA is therefore in a position of needing to demonstrate how investment in its missions meets "our Nation's economic, social, and environmental needs". Ideally, it must be able to do this at the aggregate level (the value of all NOAA services) and at the margin (the value of incremental investment, or additional funding in NOAA services). In addition, NOAA must allocate its limited resources across and within its major missions, to the extent possible within the constraints of its current operational requirements and Congressional earmarks.

Resource allocations lead to outcomes that affect our nation's health and wealth by influencing the economic decisions and activities of individuals, firms, and governance entities. For NOAA to understand how its investments affect health and wealth, it must have knowledge about how information and stewardship activities influence decisions and affect outcomes.

In order to make more informed decisions about allocation of resources and the design of products and services, NOAA needs sound information on: (1) the linkages between atmospheric and marine conditions and resources, human activity, and wealth and health outcomes, and (2) the effect of NOAA products and services on human activities. Without this information, it is much more difficult to understand and convincingly articulate NOAA's contribution to the nation's economic, social, and environmental needs.

The disciplines and skills that provide this kind of information are found within the social sciences. The SSRP found that these skills were underrepresented and underutilized within NOAA, diminishing its capacity to make informed decisions.

NOAA cannot effectively carry out its mission without sound and relevant social science research, because it cannot be certain that it is designing and delivering products and services to best match the needs of its constituents. Meeting constituent needs includes understanding who constituents are, how they interpret and respond to regulations, how they use information to make decisions, and how these decisions map into changes in wealth and health.

NOAA's Mission: to understand and predict changes in Earth's environment and conserve and manage coastal and marine resources *to meet our Nation's economic, social, and environmental needs.*

NWS Mission: to provide weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters and ocean areas, *for the protection of life and property and the enhancement of the national economy.*

NOS Mission: to provide products, services, and information that promote safe navigation, support coastal communities, sustain marine ecosystems, and mitigate coastal hazards.

NMFS Mission: to provide stewardship of living marine resources through science-based conservation and management, and the promotion of healthy ecosystems; and *to conserve, protect, and manage living marine resources in a way that ensures their continuation as functioning components of marine ecosystems, affords economic opportunities, and enhances the quality of life for the American public.*

NESDIS Mission: to provide timely access to global environmental data from satellites and other sources *to promote, protect, and enhance the Nation's economy, security, environment, and quality of life.*

OAR Mission: to provide the research foundation for understanding the complex systems that support our planet; to working in partnership with other organizational units of NOAA to *provide better forecasts, earlier warnings for natural disasters, and a greater understanding of the Earth;* and to provide unbiased science *to better manage the environment, nationally and globally.*

Figure 1: NOAA Mission Statements.

Note: The objectives acknowledging the social impact of NOAA and requiring the use of social science to meet those objectives are highlighted and italicized.

Similarly, NOAA cannot consistently articulate the value its products and services deliver to the nation, nor can it be sure that its resources are allocated optimally across programs and objectives, without sound and relevant corporate social science. The effective and efficient

allocation of resources across goals and programs within NOAA is a core aspect of corporate social science.

The SSWG believes that when social science capabilities are fully and appropriately integrated within NOAA, the agency will be able to better demonstrate the contribution of its products and services to the social and economic value of the nation's coastal and marine resources, to the value of commercial and non-market activities, and to changes in the health of the nation's citizens. NOAA will also be able to show that it is achieving these results cost-effectively.

The NOAA strategic plan reaches the same conclusion: "a strong economic and social science capability is needed so that we can analyze and understand evolving user requirements, priorities, and benefits of our information, services, and products" (NOAA 2005). A member of the SSC articulated this as "more social science equals better outcomes" in decision making.

3.0 NOAA Progress in Social Science

The SSWG reviewed NOAA's progress in strengthening social science since the 2003 report. We summarize our findings along the following dimensions: (1) actions taken by the SAB; (2) social science reorganization and present capabilities; (3) planning and funding social science within the Planning, Programming, Budgeting and Execution System (PPBES); (4) the position of social science in NOAA strategic plans; and (5) implementation of the 2003 SSRP recommendations.

3.1 SAB Actions Supporting Social Science

Subsequent to the 2003 report, the NOAA Science Advisory Board (SAB) has taken actions that support social science in the areas of cooperative institutes, hurricane intensity, research review, and ecosystems.

3.1.1 Cooperative Institute Evaluation Matrix

In 1999 the SAB adopted eight overarching themes that it recommended be woven into all aspects of NOAA science, considered in SAB reviews of NOAA science, and used to evaluate proposals for cooperative institutes. The seventh theme is social science integration. The SAB's intent was to ensure that all eight themes are considered to a sufficient degree when NOAA science activities are planned, developed, implemented and reviewed. Although the SAB desired that the themes be espoused and supported by NOAA leadership and form the basis of any SAB review of NOAA science, it also indicated that they should not be viewed as necessary or sufficient criteria for the science review of any individual program. Subsequent conversations with directors of cooperative institutes indicate that social science integration is not an important consideration in the approval of cooperative institutes and in fact is a missing component in most cooperative institutes' plans of work.

3.1.2 Hurricane Intensity Research Working Group

At the request of NOAA HQ, the SAB commissioned the external Hurricane Intensity Research Working Group (HIRWG) to assess the agency's capabilities in forecasting hurricane intensity. While the agency has made marked progress in forecasting hurricane tracks, it has made little improvement in forecasting hurricane intensity, particularly changes in intensity. Ocean

warming over the past century has led and will continue to lead to more intense hurricanes, with serious societal implications. Growth in coastal populations that was linear during the first half of the 20th Century became exponential in the second half. This demographic migration has meant that over the past 50 years, society has increasingly placed itself in harm's way. There is an immediate need for coastal regions and communities to make plans to adapt to more intense events, particularly to those that would be at the \$100B dollar level of impact. NOAA's physical scientists are not equipped to deal with this regional and community issue. In-house social scientists are needed to work with communities at risk and assist in developing effective adaptation strategies and response options.

3.1.3 Research Review Team

The Review of the Organization and Management of Research in NOAA (Moore et al. 2004), although not explicitly including social science research in its review, noted that the 2003 SSRP report contained important recommendations for strengthening of social science research. It also noted that the Office of Global Programs (subsequently much reduced; cf. Figures 6 and 7) had made a "small but significant investment in extramural social science research that is particularly vital for the NOAA Climate Goal and the nation's Climate Change Science Program" (Moore et al. 2004; 2005).

3.1.4 Ecosystems Working Group

The SAB adopted the Final Report of the External Ecosystem Task Team (EETT) in 2006 (EETT 2006). The EETT makes two broad recommendations: 1) develop social science methods for linking ecosystem science to governance; and 2) develop an understanding of society and its response to changing environmental components. The report argued that to develop methods for linking ecosystem science to governance, we must analyze government policies, regulations, and management services and understand the conditions leading to government successes and failures. Developing an understanding of societal response to changing ecosystems requires new tools for identifying and predicting the dynamics and spatial extent of human responses. In response to the report's recommendations, NOAA requested that the SAB appoint a standing committee on Ecosystem Science and Management to provide continuing advice on implementation. The committee's terms of reference clearly specify integration of social and natural sciences as an important element of its charge (NOAA SAB 2008).

3.2 NOAA Social Science Reorganization and Present Capabilities

After accepting the recommendations of the 2003 SSRP report, NOAA senior management tasked the Research Council to oversee their implementation. The Office of Program Planning and Integration (PPI) was asked to coordinate and lead the implementation effort. In 2007 the Research Council formed the Social Science Committee (SSC) to promote and advance the implementation of the recommendations. The SSC, with membership consisting of social scientists and others representing line offices and mission goals, is charged specifically with identifying corporate social science research priorities, advising the Research Council on opportunities for social science research, coordinating social science research across agencies and programs, and evaluating corporate planning in terms of scale, scope, and consistency of social science research (Weiher 2007).

These organizational changes were intended to support and strengthen NOAA’s social science capabilities. However, FY08 data indicate that instead of being strengthened, the capabilities of NOAA social science are in decline. The decrease exists in both budget and staffing. Between FY05 and FY 08, despite an increase in the NOAA budget, expenditures on social science decreased by slightly less than 10%, and numbers of social science staff decreased by 8%.

3.2.1 Social Science Budget

Line Offices

Social science is very small proportion of the total NOAA budget, amounting to 0.6% in FY2008 (Figure 2). This budget level represents a decline of 0.1% since FY2005 (Figure 3). Comparing the FY05 and FY 08 budgets, we see that while NOAA’s budget increased over this time period, the social science portion decreased, in both absolute and proportional terms. Between FY05 and FY08 the NOAA budget increased by \$475M (13%) and the social science budget decreased by \$2.2M (slightly less than 10%). These figures are not adjusted for inflation, which would make the changes even more significant.

By line office, NMFS accounted for the greatest increase (\$1.35M; 13%) in social science budget in this time period. NWS and NESDIS, both of which have relatively small social science budgets (\$0.75M and \$0.5M respectively), had a 25% growth in their social science budget. OAR decreased its social science budget by \$0.2M (3%). NOS decreased its social science budget by \$1.7M (29%). PPI decreased its social science budget by \$0.35M (60%). The reason for the OAR budget decline appears to be a combination of attrition of social scientists, reclassification of social scientist positions as physical scientists and reduction in the number of some social science staff. Budget numbers are best estimates. The decline in the NOS social science budget resulted from a decrease in contract funds and cooperative agreements (Wiley 2008.) The SSWG was not provided information on the reason for the PPI social science budget decline.

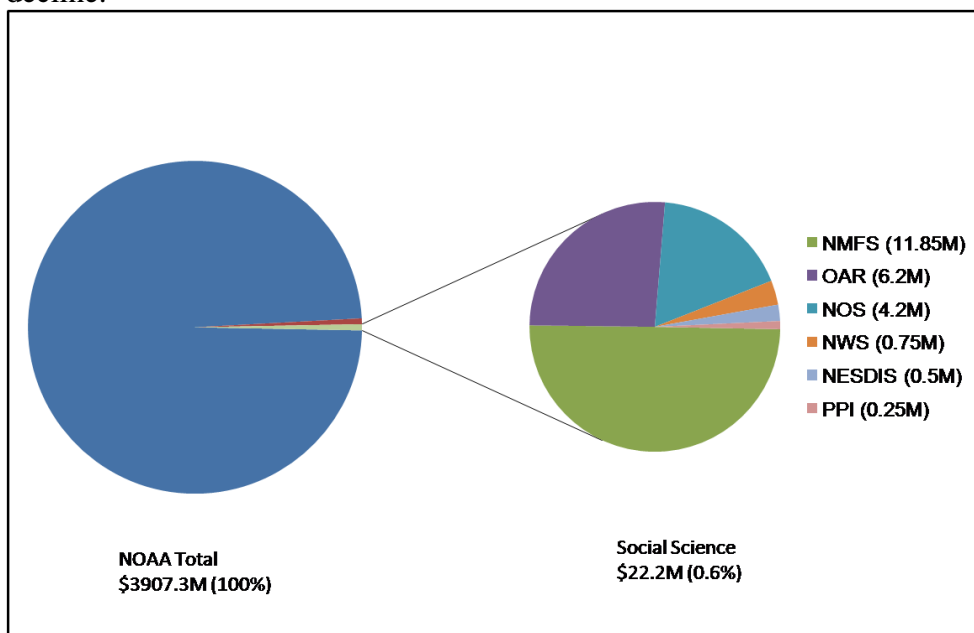


Figure 2. **FY 08** social science budget as a proportion of total NOAA budget and as distributed across line offices. Data source: Wiley 2008.

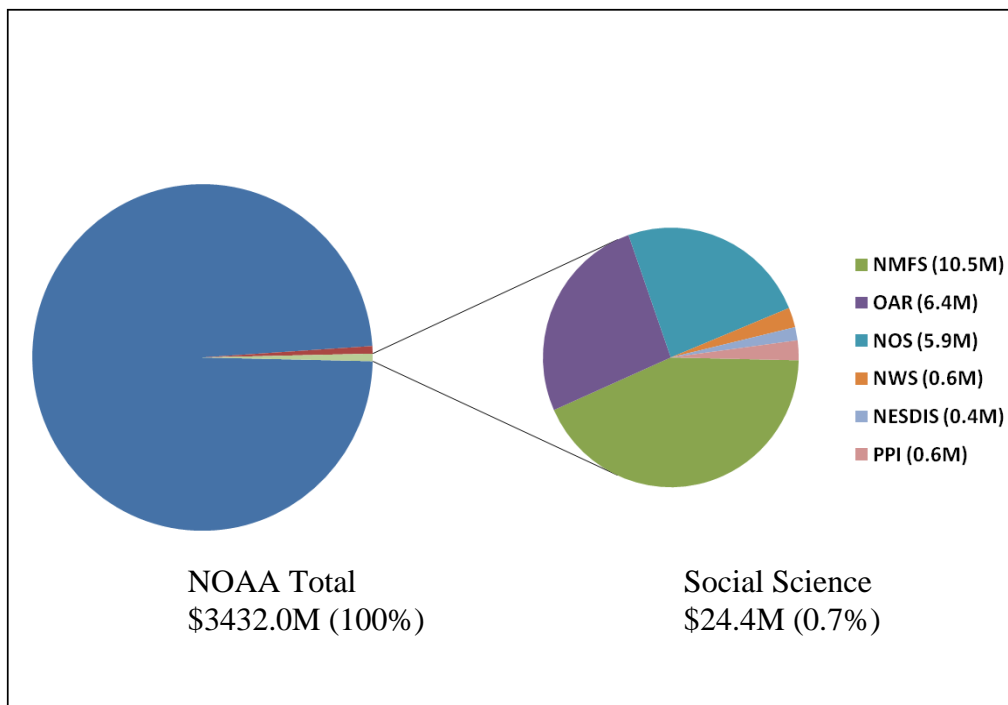


Figure 3. **FY05** social science budget as a proportion of total NOAA budget and as distributed across line offices. Data source: Weiher 2007.

Mission Goals

Between FY05 and FY08 the social science budget remained distributed across mission goals in roughly the same proportions, although the budgets for different mission goals changed in this time period (Figures 4 & 5). We are particularly disappointed to find that the social science budget of the Ecosystems (ECO) goal declined by \$3.1M (16.6%), because ecosystems is an area where a social science research agenda has been adopted and supported by the SAB. The budget decrease in the Ecosystems goal appears to be driven by decreases in the social science budget within NOS (Wiley 2008).

The other mission goals experienced increases in social science budgets, but their overall levels of funding appear to be very low. In particular, Weather and Water (W&W) increased \$0.15M (25%), Climate (CLI) increased by \$0.65M (15.9%), and Commerce and Transportation (C&T) increased \$0.05M (12.5%). The budget for Mission Support (MS) in FY08 is assumed to equal to FY05. Mission support includes functions that provide critical support to NOAA's mission: satellite services; fleet services; modeling and observing infrastructure; leadership and corporate services.

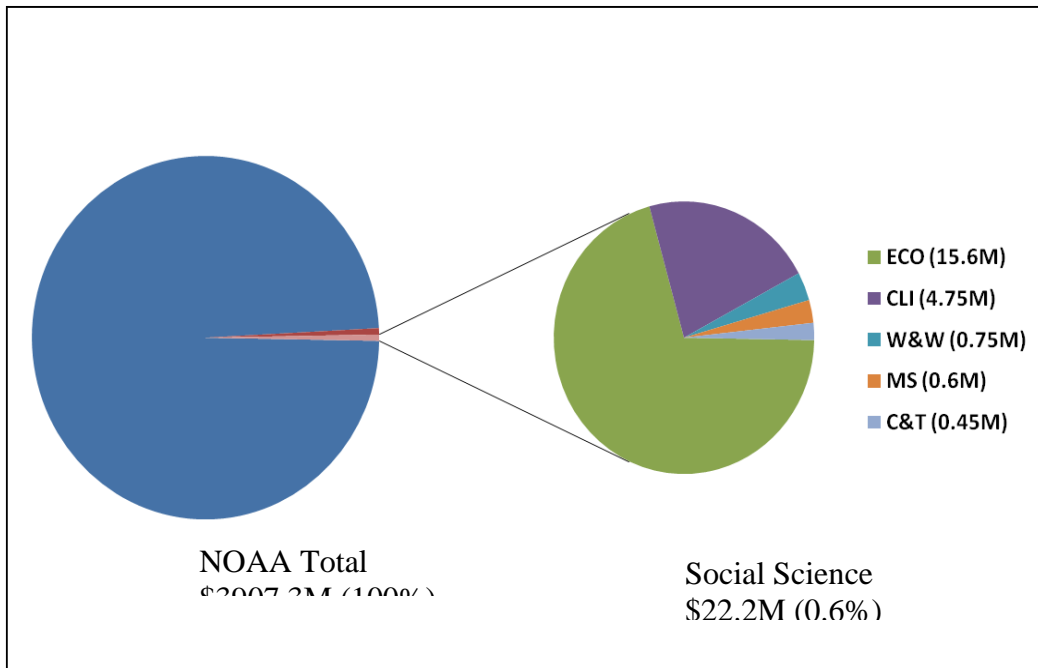


Figure 4. **FY08** social science budget as a proportion of total NOAA budget and as distributed across mission goals. Data source: Wiley 2008.

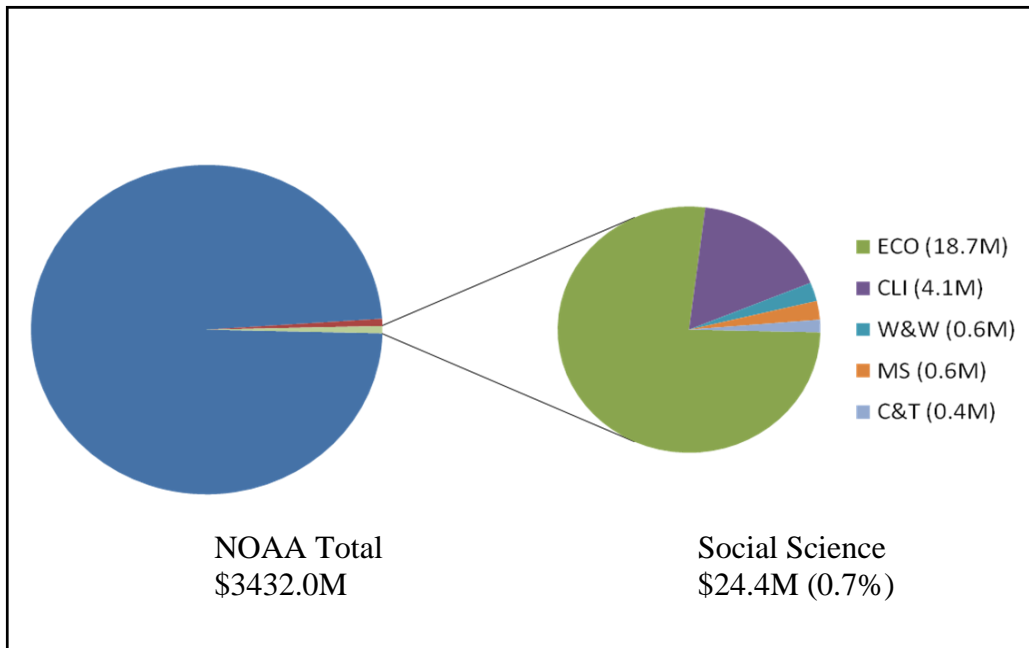


Figure 5. **FY05** social science budget as a proportion of total NOAA budget and as distributed across mission goals. Data source: Weiher 2007.

3.2.2. Social Science Staffing

Although numbers of NOAA social scientists increased slightly between 2003 and 2005, they decreased by 8% between FY 05 and FY 08, from 114 to 105. The decline in this time period was not uniform across the agency. Figure 6 shows that between FY05 and FY 08 NMFS was the only line office that increased its social science staff by a significant number (NESDIS and NWS increased their staff by 1 and 0.5, respectively.) This increase is in line with NMFS' social science strategic plan which contains specific FTE targets for social scientists. In 2004 NMFS revisited its original FTE targets in light of new or expanding mandates, and increased its target to 140 FTEs and a budget of \$30M (Holliday 2008). In contrast, OAR social science staff declined by 85%. NOS staff numbers remained constant.

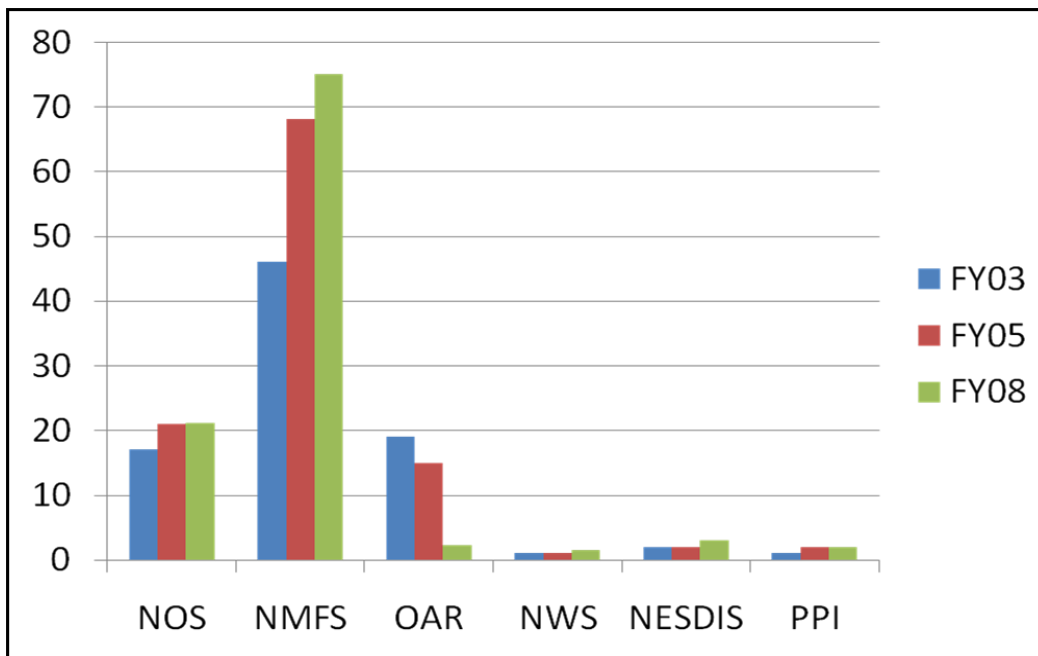


Figure 6. NOAA Social Science Staffing by Line Office, FY 2003-08. Data source: Wiley 2008.

The functions of social science staff vary by line office and illustrate the diversity of social science needs within NOAA (Wiley 2008).

National Ocean Service (NOS): Damage assessment, database development; economic and demographic analysis; socioeconomic analysis and monitoring; spatial analysis.

National Marine Fisheries Service (NMFS): Regulatory and management support, applied research, analytical infrastructure development, survey design and implementation.

Oceanic and Atmospheric Research (OAR): Support human dimensions and RISA programs; program management and analysis at HQ.

National Weather Service (NWS): Support a range of strategic planning and policy analysis activities.

National Environmental Satellite Data and Information Service (NESDIS): GIS application development supporting social science efforts via visualization techniques.

Looking at social science staffing by mission goal (Figure 7), Ecosystems has shown the greatest growth in staff, continuing the trend since 2003. This increase was combined with a decrease in that goal team's social science budget of over 16% between FY05 and FY08. Possible explanations for this change in staffing are: (1) reprogramming of staff to the social sciences; or (2) a change in the definition of social scientist.

Weather and Water and Mission Support (MIS; MS in Figures 4 & 5) have shown slight growth in their social science staffing component between FY05 and FY08. Over that same period, social science staffing in Climate declined by 85%.

With the exception of the Ecosystem Goal Team, in which social science is conducted primarily in-house, the social science conducted by other Goal Teams is primarily external.

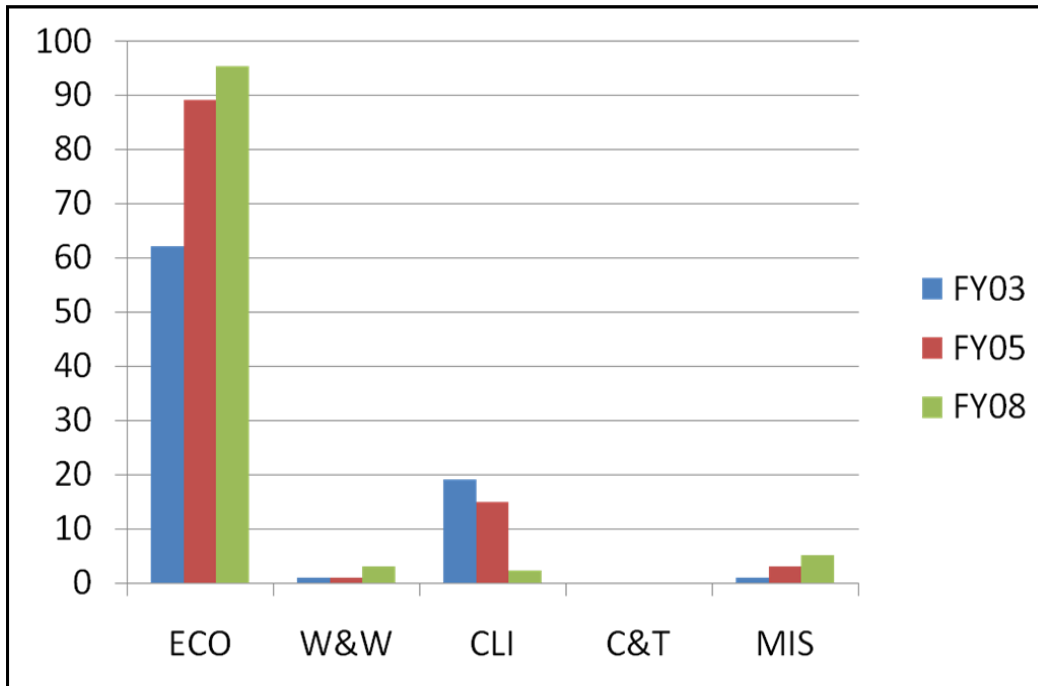


Figure 7. NOAA social science staffing by mission goals, FY 2003-08. Data source: Wiley 2008.

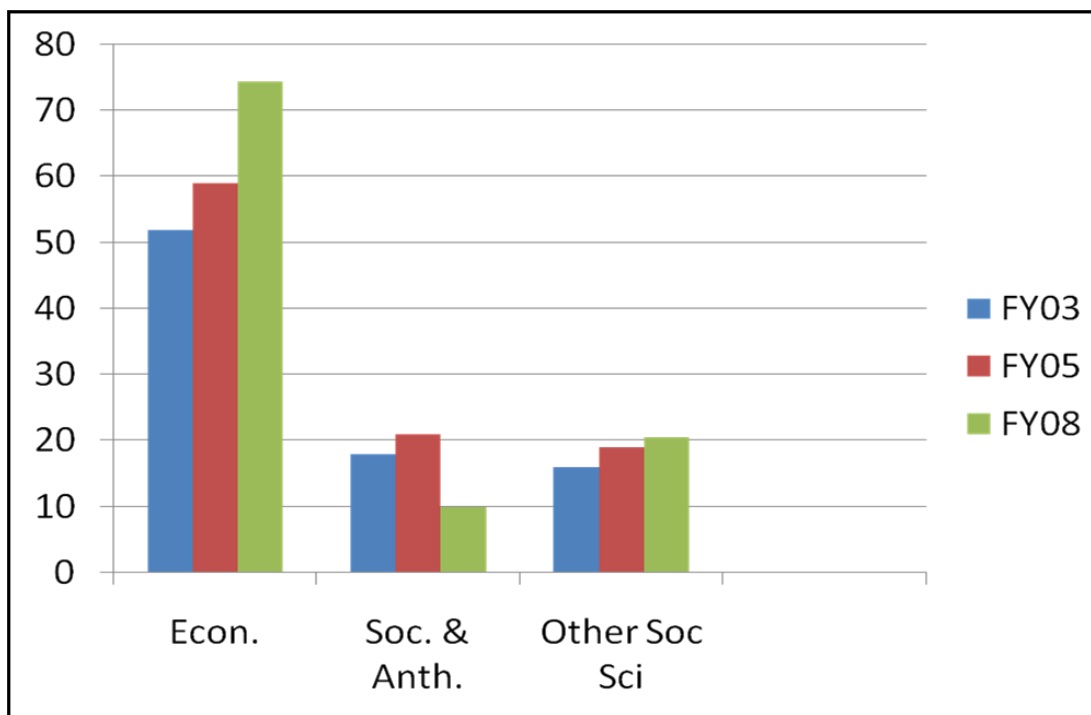


Figure 8. NOAA social science staffing by discipline, FY 2003; 05; 08. Data source: Wiley 2008.

By discipline, economics continues to dominate the NOAA Social Sciences. Numbers of sociologists and anthropologists declined between FY05 and FY08, while the numbers of “other” social scientists increased slightly. These changes in the mix of disciplines appear to work against one objective of the Ecosystem Goal Team to increase the representation of non-economic social sciences over the next 3-5 years (NOAA RC 2008).

3.3 Planning and Funding Social Science within the PPBES

The Planning Programming Budgeting and Execution System (PPBES) has become a central focus for the allocation of NOAA funds to programs that cross line offices. A key question for NOAA is how the relatively recently implemented matrix organizational structure can be used in the development and integration of social sciences into NOAA’s missions.

At the programmatic level, the PPBES is aimed at improving design and execution of programs as well as delivery of NOAA services to end users. At the corporate level, the PPBES assists in developing decision support assessments in the investments of funds across the agency (Doremus 2008).

PPBES is used to assist NOAA in assessing: 1) utility of next generation products and services; 2) impacts of disturbance events; 3) demand for natural resources; 4) perception and understanding of risk; 5) behavioral incentives; and 6) programmatic outcomes. The extent to which social science investments are made in each of these applications may vary, but in general, the social science investment has been low.

The SSWG heard from various sources that NOAA acknowledges the need to better integrate social sciences in the PPBES process. The kinds of social science that the PPBES process would promote includes analysis to provide better decision-support, analysis of economic benefits and costs (including the development of preferred methodologies), and analytical tools for tracking and predicting market trends and consumer behavior.

The PPBES is designed to ensure that the multiple missions of NOAA are met and that investments in research are more effective across the agency. However, the PPBES can be costly in terms of time and effort required to participate in the process. Social science expertise is underrepresented at NOAA, and, as a result, is underrepresented in the PPBES process. The underrepresentation is reflected in the absence of standards for social science information in the “business case” documentation called for by PPBES, a situation that NOAA recognizes (Doremus 2008a).

In addition to these constraints, NOAA has struggled with limited budgets and a relatively high percentage of funds earmarked for specific projects. This creates a situation where the agency lacks much discretion in how to allocate its scarce funds across competing needs, including greater integration of social sciences into programmatic and corporate applications.

The SSWG heard in interviews with the AAs that under these conditions social science efforts, which are commonly seen as a luxury, are often put aside for better budgetary times. We believe, however, that tight budgetary environments are the times when social science is most needed. Corporate social science can assist in analyzing options for allocating scarce resources to their most valuable uses. With better outcomes, the ability to “sell” NOAA to Congress and its constituents is enhanced.

To NOAA outsiders, the PPBES process is largely opaque; and it appears from our interviews, that the process may not be transparent even for NOAA insiders. We did get indications, however, that institutional learning is occurring, and that the process is improving with each annual cycle (Doremus 2008a).

The PPBES is capable of effecting change in a large organization, but significant organizational inertia remains. Creating a demand for social science integration at the corporate level through the PPBES by applying social science standards for the “business case” can create incentives for the integration of social science throughout NOAA programs.

3.4 Social Science in NOAA Strategic Plans

After reviewing many documents and discussing the current role of social science and social scientists throughout NOAA, the SSWG concurs with the comments of SSC members regarding the trend in understanding the importance of and incorporating social science research into NOAA’s missions. Social science is increasingly finding its way into the language of goals and programs.

Some prominent examples of the increasing presence of social science within goal team plans include: (1) Regional Decision Support in Climate; (2) Ecosystem Observation Program in Ecosystems; (3) Marine Transportation Systems in Commerce and Transportation; and (4)

Hydrology in Weather and Water. Table 1 includes examples of statements in the Research Council’s 5-year Research Plan that articulates the importance of social science research (NOAA Research Council 2008).

Table 1: Illustrative statements illustrating the role for and importance of additional social science research from NOAA’s Research Council 5-year Research Plan.

<p>Weather and Water (page 43) “NOAA will improve its Advanced Hydrologic Prediction Services (AHPS) to monitor and predict the runoff from snow-melt, forecast snow levels, and monitor soil moisture which can precondition runoff rates... Because of the substantial economic impacts of reservoir operations on power generation, flood control, and potable water and agricultural water use, these research efforts will include social scientists.”</p>
<p>Commerce and Transportation (page 55) “NOAA has identified the societal, economic, and cultural consequences of spills and associated response activities on affected communities as a high priority for research. Specific project topics ... for improved understanding and effective response include: subsistence, social impacts, response organization impacts, risk communications, and environmental ethics issues. This area of research has the potential to greatly affect commerce and transportation by revolutionizing the response organization.”</p>
<p>Societal Impacts (page 7) “The integrated observing and modeling system will, in large part, be defined by and be responsive to local needs; ... In this context, research and assessments in social science and in the economics of weather, climate, and ecosystems will become increasingly important in expanding our understanding of processes and structures that describe how humans interact with the environment. This research includes understanding the most effective means of communicating NOAA’s science and information to users, determining the needs of users and what is required to meet those needs, and assessing the economic value of this information.”</p>

Regarding the corporate social science functions within NOAA, PPI states in its strategic plan that it works towards ensuring that “NOAA’s plans, investments, and actions are guided by a strategic plan responsive to societal needs and that its investments are based on sound socio-economic policy.”

The SSWG applauds this trend toward increased visibility for social science in strategic plans, but at the same time, we concur with the SSC members in their view that that while many Program Operating Plans (POPS) claim there is a societal impact, there is very little research to measure the magnitude of the impact. A sustained, coordinated, and comprehensive social science research agenda to quantify societal impacts has not been developed. In addition, while senior administration acknowledges the importance of social science, it has not provided social science with a high level advocate. We conclude that social science is welcomed for its rhetorical benefit but is given a low priority in resource allocation decisions. The FY08 data on social science budgets and staffing support this observation.

3.5 Progress on 2003 Report Recommendations for Social Science within NOAA

The consensus of a number of sources interviewed by the SSWG is that some progress is being made in strengthening social science within NOAA, but that progress is slow and mixed, and many challenges remain. However, the FY08 data on budgets and staffing for social science contradict even this conservative assessment of progress. The data indicate that the progress in social science made between FY03 and FY05 has eroded, leaving social science in a weaker position in 2008 than in 2005.

Despite the overall picture of decline, there are specific examples of progress that are worth noting. A briefing to the SSWG in 2007 summarized areas of progress and remaining challenges (Weiher 2007).

Areas of progress

- NMFS commitment to fully implement its enhanced social science strategic plan;
- NOS comprehensive social science plan and planning process;
- National Centers for Coastal Ocean Science (NCCOS): social science strategic plan
- Coastal Services Center (CSC): increasing social science capacity
- Commerce & Transportation Goal Team: analysis of benefits of navigation products;
- Weather & Water Goal Team: support for NCAR's Societal Impacts of Weather Program;
- NOAA Strategic and Research Planning and PPBES: increased consideration of social science;
- Various NOAA programs: approaches to PPI staff to assist with integration of social science.

Remaining Challenges

- Social science research and analysis does not adequately support "One NOAA" objectives because it is largely "programmatic" rather than corporate in focus and consistent in execution;
- Social science is not integrated into Goal Teams' and Research Council's analyses for resource prioritization;
- Many social science research and analytic capabilities are opportunistic rather than sustainably integrated into permanent program planning;
- Social science is still a low budget priority in most programs and in NOAA;
- While social science supports certain management actions, NOAA-wide it is still viewed more as a tool to justify NOAA products rather than a tool to improve how products are produced;
- Social science needs to be integrated into climate research in the design and operation of a Climate Service.

IMPROVING EFFECTIVENESS

4.0 A Vision for Social Science within NOAA

A central issue for NOAA social science is its integration within the new NOAA management structure. In establishing the Terms of Reference for the SSWG, NOAA framed four questions specifically related to outcomes achievable with the integration of social science. The answers to these questions outline critical themes that should shape the vision for integrating social science within NOAA over the next 5 years.

4.1 How can NOAA better identify and measure (qualify and quantify) its programmatic outcomes?

The most appropriate way to describe programmatic outcomes is with reference to NOAA's mission and to the societal value generated by NOAA's products and services. When social science capabilities are fully and appropriately integrated into NOAA activities, NOAA will be able to demonstrate the contribution of its products and services to the economic value of: (1) the nation's stock of coastal and marine resources; (2) commercial and non-market economic activities; (3) changes in the health and safety of the nation's citizens. Integration of social science will also enable NOAA to show that it is achieving these results in a cost-effective manner. The value of NOAA's programmatic outcomes is seldom directly observable in market data because NOAA products and services are not sold in markets. Instead, their value requires estimation and modeling, primarily with the tools of social science.

For example, NOAA has a significant backlog of hydrographic surveys using multi-beam technology to map water depth and navigational hazards. Much of the nation's waters have been surveyed only with widely spaced single-beam technologies. At the present level of investment, this backlog will take decades to eliminate. Prioritizing areas in need of (re-)survey and the appropriate rate at which to carry out these surveys, is best done with analysis. This analysis should consider the physical and economic risks and benefits that follow from either carrying out or deferring a new survey in a given place. At present, NOAA does not have the capability to carry out this analysis.

4.2 How can social science help NOAA and its partners effectively integrate natural science into decision making?

Social science provides the basis for understanding human behavior, specifically, for how NOAA products and services affect decisions and outcomes related to human safety and health and to the economy. Natural science can be better integrated into NOAA decision making if consideration is first given to the users of information, the processes by which information is used to make decisions, and the level at which decisions will be made; e.g. policy, emergency response, or households.

For example, in designing natural science research and products to support the nation in its response to climate change, it will be useful for NOAA to begin with a clear understanding of the political and economic constraints of alternative responses. By first considering the range of decisions that organizations and individuals will make in response to potential future climate change, NOAA will be able to design and target its natural science efforts to best support those decisions.

4.3 How can social science itself be integrated into decision making of NOAA and its partners?

One of the keys to building and integrating effective social science capability in NOAA goal teams and line offices is a top-down commitment to allocating resources within NOAA based, at least in part, on social benefits and economic returns. This commitment will make real the need for each line office, goal team and program to understand and quantify the contribution its products and services make to social and economic goals. It will also encourage efficient internal allocations of resources within programs and projects. Each of these aspects requires social science. When line offices, goal teams and programs are expected to produce information on their contribution to social and economic goals, they will have the incentive to invest in social science capabilities. NOAA decision making that is focused on social benefits, value-added, and efficient use of resources will necessarily have social science at its base.

For example, an important feature of weather and climate forecasts is the uncertainty they embody. Public and private users of these forecasts must consider this uncertainty, the range of risks it represents, and their own risk perception and tolerance when using these forecasts to inform short-term and long-term decisions. The way NOAA communicates the uncertainty contained in its weather and climate forecasts therefore has the potential to make a large difference in the way forecasts are used and the outcomes they affect. Recent responses to Hurricane Ike, such as the refusal of large numbers of people to obey evacuation orders, are a case in point. It is important for NOAA to design the delivery of the information it generates with end users in mind. Understanding the perception of, tolerance for, and aversion to risk among the users of its products – a field of social science incorporating economics, psychology, and other disciplines – should therefore be central to NOAA’s decisions about product design and communication.

Because it will take time for the incentives that stem from these commitments to change the culture at NOAA, the SSWG believes that NOAA should invest simultaneously in social science research in ongoing projects. We believe that these efforts should be larger than just one project, in order to demonstrate the capacity of social science to enhance the value of natural science research across a broad spectrum of topics. NOAA should also consider using social science research to analyze the benefits and costs of using in-house social science capacity and/or contractors.

4.4 How can social science capabilities at NOAA be strengthened where currently they are weak?

Social science capabilities can be strengthened in part by providing the right incentives to line office and program managers to incorporate decision metrics that are relevant to society. This in turn necessitates developing social science capacity through hiring social science staff or retaining outside expertise.

Corporate social science requirements initiated by the Business Case approach for FY11+ provide a motivation for programmatic social science (Doremus 2008a). The SSWG supports the business planning approach described in the 2008 Attachment to Planning Guidance Memorandum III (Doremus 2008b) and recommends that NOAA leadership use this process to motivate and incentivize all NOAA managers to include the social sciences in program planning, design, execution, and evaluation. To accomplish this, NOAA senior leadership should commit in concrete terms to strengthening over the next five years the requirement for economic and

other societal impact information in the intra-NOAA planning and resource allocation process. This would be a way of using corporate social science information to drive integration of social science. In addition, this commitment should be reinforced by incorporating specific indicators into annual work plans and by using them in the annual performance evaluation of administrators.

NOAA can strengthen social science capabilities by putting in place appropriate social science expertise to guide, inform, and support the application of social science for corporate planning and program development. The social science expertise needed for specific programs, line offices or goal teams can be determined through a formal needs assessment, which is discussed in more detail in Section 5.2. In addition, NOAA can create a leadership role for social science coordination, integration, and implementation by establishing an Office of Societal Impacts. This office would serve a leadership role in coordinating social science across the agency, integrating it where appropriate in research, programmatic, and planning functions. The Office should be external to the line offices so that it is able to coordinate across the matrix organization. It should report directly to upper levels of NOAA leadership, such as the Deputy Under Secretary for Oceans and Atmosphere, so that it can help nurture the creation of incentives for the line offices and goal teams.

The Office of Societal Impacts would provide a centralized social science capacity to address needs for knowledgeable and sustained social science input at the upper levels of NOAA administration. It would also serve as an advocate for NOAA social sciences and a support for line offices whose needs for social science might be too variable or are insufficient to develop internal capacity. The office could facilitate efforts among NOAA social scientists to negotiate the Office of Management and Budget (OMB) approval process for surveys and other social research and data collection activities, a process that is presently viewed as a barrier to social science research. Even those line offices that are able to increase their internal social science capacity will continue to need some centralized social science capacity over the long term.

The Office of Societal Impacts would also have the benefit of providing consistency for social sciences across all of NOAA. It could support a critical mass of social scientists that enables professional interactions and disciplinary diversity in the agency's social science portfolio. The Office of the Chief Economist is the closest NOAA has come to this organizational structure, but in addition to being internal to a single line office and so limited in its ability to serve cross-line office functions, the staffing of the office has never approached levels that would be considered a critical mass, nor has it embodied the disciplinary diversity that NOAA needs.

For a period of transition until social science capabilities are strengthened, NOAA could further strengthen social science by establishing a NOAA Council of Social Science Advisors composed of senior academic social scientists. Council members would be appointed to fixed terms and charged with advising NOAA leadership on fruitful areas of investment in social science research and FTE.

NOAA will also be assisted in strengthening social science capabilities by establishing a

standing Social Science Working Group of the SAB to provide ongoing advice, oversight and quality control for NOAA social science, and to contribute to the articulation of the “grand challenges” facing the social, behavioral and economic sciences within NOAA (NSTC 2007).

5.0 A Path for Achieving the Social Science Vision

Achieving the vision for strengthened social science within NOAA is a path that requires advocates within NOAA leadership, support of the AAs, and a commitment to change the culture of NOAA. NOAA has a number of options for staffing, funding, and performance measurement of social science, and it is clear that no single model will be optimal across all line offices and goal teams. The organizational support required for social sciences will likely change over time as needs and capacity develop, and with the evolving roles of the line offices and mission goal teams.

5.1 Building Social Science Literacy

The 2003 report recommended that “NOAA leadership should establish goals and objectives for achieving social science literacy within the agency, and a social science workshop should be conducted for NOAA Assistant Administrators and senior management.”

While we agree that social science literacy needs to improve at NOAA, we take a slightly different perspective from the previous report on how to achieve that goal. Social science literacy is an important intermediate objective, but it is not an end-goal for NOAA; the end-goal is to improve the agency’s ability to meet its mission through the full integration of appropriate social science into NOAA activities. Although the use of 1 or 2-day workshops to improve literacy can create a short-term increase in understanding of the benefits of social science to the NOAA mission, the long-run persistence of the information is unclear, as Administrators, senior management, and natural scientists return to their everyday activities. And, based on our findings, these activities in most cases are not yet incorporating social science research.

Because we are interested in providing a path to achieving a sustained integration of social science within the agency, we have chosen to emphasize the need to provide the correct incentives in the everyday activities of NOAA managers. In our view, literacy will only be achieved through the adoption of incentives and the change in culture that will ensue.

This does not mean that literacy training should be abandoned. Carefully targeted workshops that instruct senior management on how integrating social science is critical for their mission and how decisions might have changed had social science research been included can be very useful. There are also opportunities to hold targeted workshops for other staff, including temporary staff such as the John A. Knauss Sea Grant Fellows, many of whom will work in policy areas during their fellowship or eventual employment at NOAA. The tendency, however, to measure literacy achievements in terms of the number of attendees and frequency of the workshops should be resisted.

5.2 Assessing Social Science Needs

NOAA would be greatly assisted in its social science planning by conducting a formal assessment of its social science needs. Two kinds of needs assessments are relevant to NOAA:

the internal needs assessment for social science FTE and research and the external needs assessment focused on NOAA products.

We encourage NOAA to conduct both internal and external needs assessment, as some elements of NOAA have already done. A good example of the internal needs assessment is the social sciences plan and budget initiative developed within NMFS in 1999. The initiative is a long-term planning framework for social science FTE and research based on NMFS mission and statutory responsibilities (NMFS 1999). A good example of assessing external needs for NOAA products and services is the needs assessment for the NOAA Gulf Coast Services Center, conducted in 2006 by the Coastal Services Center to gather information about audiences concerned with coastal management issues in the Gulf of Mexico. Assessment results are expected to be used to inform the design of products and services that support regional ecosystem management and foster community resilience (NOS 2007). Further information on need assessments, including where they fit in the project development process, assessment instruments and assessment methods, can be found at <http://www.csc.noaa.gov/needs/>.

Without conducting formal need assessments, it will be impossible to be specific about the need for social science staff or budgets. A necessary precondition for the conduct of the internal needs assessment is strong guidance from senior NOAA leadership defining what is expected in terms of corporate social science information for the PPBES process and other NOAA needs.

5.3 Developing Staffing Models

The SSWG reviewed a number of staffing models for social science, including those used by the USDA Economic Research Service (ERS), USDA Cooperative State Research, Education, and Extension Service (CSREES), USEPA National Center for Environmental Economics (NCEE), USEPA National Center for Environmental Research (NCER), and USFWS Division of Economics. These social science programs emphasize economics and represent only a small portion of the total professional staff of their respective agencies. For example, as of 2001, NCEE had 112 economists, less than 3% of EPA professional staff (McGarland 2008).

The social science programs of these agencies developed over a multi-year period of investment and commitment to undertake and integrate social sciences. The model adopted by each federal agency is a result of its mission, mandates, constraints, and opportunities. Much of the social science research has been driven initially by regulatory requirements, executive orders, or legal mandates. Some programs were later further enhanced following the identification of issues requiring focused research efforts, such as environmental valuation at NCEE, land and species management at USFWS, and food safety issues at USDA.

Presenters from several agencies noted that it is difficult to measure the outcomes of their social science investment using the same metrics as for natural science outcomes. They identified staffing and budget issues as key constraints to the development of social science capacity. Some also noted the advantages of leveraging and cooperating across agencies – such as working with NSF to develop and implement cross-agency grant programs.

5.3.1 Internal Staffing

In an internal staffing model NOAA would hire social scientists as federal employees. Internal staffing could involve a centralized or “top down” capacity where a critical mass would be developed to serve social science needs across NOAA, a “bottom up” capacity where each line office develops social science capacity to meet its specific needs, or a combination of top-down and bottom-up approaches.

In the short-term, until NOAA can develop and support adequate capacity at all levels throughout the agency, the SSWG feels that a strong centralized social science capacity, such as the proposed Office of Societal Impacts (Section 4.4), will be optimal for undertaking and supporting both corporate and programmatic social science. Longer term, a mixed centralized/diffused social science model may best meet NOAA’s needs once sufficient capacity is developed agency wide. A centralized social science capacity could focus on corporate needs for social sciences while capacity within the line offices or goal teams could meet programmatic needs such as those faced by NMFS.

The National Ocean Service and National Marine Fisheries Service currently follow an internal staffing model, partly in response to specific regulatory needs. These line offices represent the largest social science capacity in NOAA. Each employs social scientists across different offices and programs. Although both have increased capacity since 2003, only NMFS has continued to increase its internal social science staff since 2005. Both line offices are at sub-optimal levels of social science staffing (Matlock 2008; Holliday 2008). This is illustrated within NMFS by the fact that although the number of economists and anthropologists in every science center has more than doubled, NMFS still achieves only about one-third of identified social science needs (Holliday 2008.)

Within the line offices, the optimal allocation of social science capacity between the headquarters and field offices or programs needs to be considered closely. For example, a dedicated social science position at the HQ level would help coordinate across program offices, integrate social science into PPBES alternatives and promote inclusion of critical concepts and research in outreach products.

5.3.2 External Staffing

The external staffing model obtains social science capacity without hiring social scientists as federal employees. This approach may provide cost savings, allow flexibility in undertaking shorter term projects, allow faster response in obtaining analysis if internal capacity is inadequate, and allow collaboration with external groups such as the private sector and academia. External models include: (1) outside contracting; (2) virtual centers; (3) cooperative institutes; and (4) grants programs.

Outside Contracting

Contractors comprise a growing proportion of the NOAA workforce (Sen 2007). Some contractors are largely integrated into the NOAA line office structure but are not federal employees. Whether a contractor produces the same results for NOAA as a federal employee is an open question.

Outside contracting can also take the form of contracts to external entities, such as consulting firms, for specific projects. The NOAA Chief Economist has used this approach over the last several years to support a series of economic studies. Reports from these contracts are the base of much of the current knowledge about economic benefits and costs of NOAA products and services. If contracting is used to provide access to social science expertise, however, it will be important to work with a variety of contractors who have training in a broad range of social science disciplines.

Virtual Centers

The virtual center approach allows for flexible integration with external entities such as the American Meteorological Society (AMS), National Center for Atmospheric research (NCAR), World Meteorological Organization (WMO), and private sector weather interests. It also helps build a broader community and capacity beyond NOAA, and promotes the development of a research agenda that ranges from basic research to applications development. As non-Federal employees outside of headquarters, virtual center employees may not be as connected internally to the NOAA workforce, but the centers have the advantage of greater administrative and funding flexibility.

A good example of the virtual center approach is the Societal Impacts Program (SIP) at NCAR that has been supported in part since 2003 by the NOAA's US Weather Research Program (USWRP). In recognition of NOAA's lack of internal capacity in this area, the SIP was funded to achieve a number of objectives: (1) develop social science capacity focused on valuation and communication of weather information; (2) support and develop the *Weather and Society * Integrated Studies (WAS*IS)* program; (3) develop a set of information resources including an online database of weather impacts and a societal impacts newsletter; and (4) be integrally involved in developing weather related social science capacity at national and international scales. NOAA, in cooperation with the University of Oklahoma, is also supporting a small social science effort to support research, outreach, and collaboration largely related to severe weather.

Joint and Cooperative Institutes

The SSWG met with the directors of the joint and cooperative institutes to discuss their use of social science research and followed up this discussion with a questionnaire. Although a few of the CI's are topically focused outside the realm of the social sciences, most of the directors of the cooperative institutes indicated a strong interest in incorporating social science research into their programs. Directors felt they were limited by what they perceive to be a lack of encouragement and financial support from NOAA for placing greater emphasis on social science research within their institutes, despite the recommendation from the NOAA SAB that social sciences be considered in the re-competition process for joint and cooperative institutes. In addition to expecting that existing and future cooperative institutes incorporate social science dimensions in keeping with the SAB guidance, NOAA could also enhance its network of institutes by establishing one or more dedicated social science joint/cooperative institutes or a consortium of institutes. These social science institutes would promote the exchange of research and social science expertise between universities and NOAA through co-location and would provide a directed source of capacity and expertise on issues of NOAA's choosing.

Grants

Social science capacity could be enhanced through external grants. This approach would be similar to external contracting, with the primary difference being that grants provide less direct control on the content and conduct of the research effort. While the general focus for a grant program can be defined by NOAA, the exact topics and methods of grants are generally defined by the researchers. This approach has the advantage of letting those with expertise in a particular area identify the basic research needs. Such an approach is more amenable to primary research than to developing specific products or applications. For example, EPA coordinated a grants program with NSF to address primary research issues on environmental economics with a focus on valuation methods. As an example of a grant program to meet NOAA needs, NOAA cooperated with NSF in 2008 on a grant solicitation on Communicating Hurricane Information (CHI – Program Solicitation NSF 08-551) to support primary research on societal aspects of the communication of hurricane forecast information. It should be noted that the grant approach still requires an internal capacity at NOAA to appropriately identify issues, oversee the scientific components of the grant process, and incorporate grant results.

5.3.3 Staffing Incentives

The SSWG feels that the best way to ensure sustainable long term results in integrating social sciences into NOAA is to make sure the correct incentives are implemented to support social science activities. As NOAA is defined as a mission agency, this would involve adequately judging outcomes in terms of stated objectives of societal impacts, requiring social science to: (1) measure outcomes; (2) achieve outcomes beneficial to society; and (3) improve performance within the organization. When performance metrics relevant to society are in place, line offices and mission goal teams will have the incentive to build and fully integrate social science capacity.

5.3.4 Social Science Budgets

The SSWG concludes that, in the long term, a blanket requirement that a specific portion of NOAA budgets be allocated to social sciences is inappropriate. Our reasoning is that in the long term, once social sciences are fully integrated into NOAA and their value and capabilities fully recognized by NOAA decision makers, the appropriate level of social science funding will be determined by outcomes, and balanced against funding other activities based on the relative benefits of different activities. In the long run, it is also likely that the appropriate fraction of budget allocated to social science will vary across line offices and functions, in accordance with their specific social science needs.

However, there is at present inadequate incentive in most parts of NOAA to fund social sciences, and an inadequate understanding on the part of decision makers as to why they need to do so. As a result, present levels of funding for social science work are inadequate, to the detriment of NOAA's mission. Based on NOAA's own assessments of the degree to which social science objectives are being met, experience in other federal agencies (e.g. EPA), and the SSWG's judgment of the general level of effort needed to achieve meaningful integration of social science into NOAA's operations, the SSWG recommends that in the short run, about 5% of all line-office funds be allocated to social sciences. Once formal needs assessments are completed for all parts of NOAA, and social science metrics are established and incorporated into management and budgeting, the allocation of funding to social science should be based on outcomes and

tradeoffs with other funding priorities. Until then, the SSWG strongly feels that “waiting until more money is available” is not a viable strategy for increasing social science capacity, and indeed is counterproductive to NOAA’s future success in meeting its mission and ensuring adequate funding for the agency as a whole. Given that budgets are likely to remain tight in the near term, funding social science at the 5% level likely will necessitate reallocation of some resources from other activities.

5.4 Transitioning to a Social Science Research Agenda Within NOAA

A social science research agenda is well articulated within the NMFS (NMFS 2004) and NOS (NOS 2007) line offices. Looking across all line offices, the SSWG sees rich opportunities for social science research investments in the thematic areas of climate, coasts and oceans, weather and water, ecosystems, and weather, commerce and transportation.

5.4.1 Climate

The goal of a social science strategic plan for climate would be to create a coordinated social science capability that is integrated with programs and decision support systems related to climate.

Climate as an organized activity is in its literal infancy and thus is not yet well conceived. Even the definition of “climate” as it relates to or contrasts with “weather” is still a source of debate. That definition, be it temporal or spatial or both, may seem purely academic -- but it quickly takes on concrete meaning in the federal division of responsibilities within an agency, and between agencies and organizations.

Ultimately the value of climate as an enterprise is not in knowledge per se but in the provision of climate information as a decision support tool. As in NOAA’s other research areas, scientific information alone is not sufficient for decision making. The user of the information must be a part of identifying what information is needed and how it is provided. Social scientists can provide the tools for analyzing this societal interface. Yet despite the importance of social science in addressing critical questions related to what users of climate information do, and therefore what they need, the use of social science in climate has not been well defined nor formally established, nor has it even gained core acceptance. Thus social science has not yet carved a niche within NOAA’s climate mission goal.

NOAA’s social science objectives for climate can be accomplished through the incorporation of social science as a core element in the ongoing discussion of the definition and development of a national climate service capability within NOAA. The social science objectives would include: (1) building long-term capacity; (2) developing methods, analyses and data for decision support; (3) infusing results of analyses into decisions and programs to improve products and services; (4) improving the use of social science; and (5) assuring an appropriate level of effort for climate social science to meet growing needs.

There are several short-term opportunities for social science to contribute to NOAA decisions and operations by conducting and building capabilities for studies in priority areas. External research can be more fully examined to ensure that available studies are utilized without duplication. Analyses can assist in setting priorities in the FY 2012- 2016 and subsequent

Program Operating Plans (POPS), including coordination with test bed programs. Coordination can be increased through the NOAA RC SSC. Cooperative grant relationships can be developed with organizations such as the National Science Foundation and its Social, Behavioral, and Economic Sciences Directorate. NOAA's support for and relationship with the NSF sponsored Societal Impacts Program at NCAR can be strengthened.

Analytic priorities include assessing user needs, understanding perceptions of and responses to climate information, analyzing demand for services and distribution methods, communication of forecast uncertainty and complex information more generally, understanding the societal effects of climate conditions, addressing interrelated needs of communities and regions, valuation of program benefits and other decision support services, and developing tools for communicating with and educating stakeholders.

To further these efforts, a Social Science Strategic Plan for Climate should be formally integrated as a core element of national climate services and as such into the R&D portfolio of the Climate Goal Team. The Climate Social Science Strategic Plan should be coordinated with present and future versions of the social science plans of other mission goals as well as the NOAA Strategic Plan and NOAA Research Plan as part of the development of a national climate service. Delaying these plans will result in losing a valuable opportunity to integrate social sciences.

A complement and supplement to the social science strategic plan for climate is a social science strategic plan for climate and national security. NOAA's and other agencies' geospatial technologies are capable of assessing climate change and its impacts at the global scale. Recent imagery has clearly shown a strong connection between emerging climate-induced changes and national security through climate effects such as extremes in water availability, more frequent and extensive inundation of coastal areas, agricultural zone migration, desertification, loss of habitats, frequent disease outbreaks, and the creation of climate refugees. These effects could lead to destabilization of both developing and developed countries, including the United States. Dealing with this emerging challenge requires the engagement of social scientists. An in-house NOAA social science capability could bring the agency to the fore.

5.4.2 Coasts and Oceans

The National Ocean Service (NOS) published a Social Science Plan in 2005 (NOS 2005). The stated purpose of the plan is "to initiate a coordinated effort to build social science capacity in NOS, in order to help NOAA NOS achieve its Mission Goals."

The Plan's vision is to: "Strengthen program planning and management, decision making, and performance measures throughout the agency to improve NOAA integration of physical and social sciences within NOS, across NOAA, and with outside organizations."

The Plan has four goals, all of which engage the social sciences:

- Enhance NOAA's ability to monitor, understand, evaluate, and communicate socioeconomic benefits of NOAA/NOS information, services, and products;
- Provide more accurate and comprehensive decision-support tools for ecosystem management by integrating social science, natural science, and monitoring results;

- Improve models and methods for assessing the impact of human and natural disturbances to coastal and ocean resources and infrastructure;
- Increase the relevancy of NOAA efforts by improving understanding of the needs, knowledge, perceptions, and values of NOAA partners and constituents.

The Plan identifies priority social science topics and themes, existing (FY04/05) social science capacity and efforts, needs and issues related to social science, a strategy to achieve social science goals, and a list of ongoing and potential future projects for eight NOAA PPBES thematic areas: (1) Coastal and Marine Resources, (2) Corals, (3) Ecosystem Research, and (4) Habitat Restoration in the Ecosystem Mission Goal; (5) Geodesy, (6) Emergency Response, and (7) Marine Transportation Systems in the Commerce and Transportation Mission Goal; and (8) Coasts, Estuaries and Oceans in the Weather and Water Mission Goal.

The goals and objectives articulated in the Plan are consistent with the intentions of the 2003 SSRP report and with the present SSWG report, but there appears to have been no high-level commitment within NOS to carry forward the process described in the Plan for integrating social science work across NOS activities. The social science projects in the Plan are a largely programmatic in nature, linked to overarching goals only in general terms, and were assembled in a bottom-up process of discussions with program managers rather than a top-down, goal-driven process designed to ensure information useful for NOAA corporate purposes. The Plan acknowledges that it does not present a fully developed, consistent, and sufficient social science agenda, but rather a starting point to which NOS would have to make continuous adjustments as circumstances, and the understanding of social science needs across NOS, evolve. That has not happened to date, although economists and others within NOS continue to advocate for this work.

Following the NOS Social Science Strategic Plan, the NOS National Centers for Coastal Ocean Science developed a Human Dimensions Strategic plan for FY2009-2014 (NCCOS 2007). The mission of the NCCOS is to “provide coastal resource managers and other decision-makers and stakeholders with scientific information and tools needed to balance society’s environmental, social and economic goals” (NCCOS 2004). The Human Dimensions plan is intended to expand NCCOS’ science program to include a focus on people. It provides the basis for the implementation plan currently in development (Matlock 2008).

The Human Dimensions Strategic Plan contains four goals critical to support an ecosystem approach to management (NCCOS 2007):

- Provide human dimensions understanding: coastal decision making, human causes and socioeconomic drivers of ecosystem stress, societal consequences of policy and management, traditional and local ecological knowledge, institutional strategies, evaluation of products and services, and socially responsible science;
- Provide integrative ecosystem understanding: integrative ecosystem models and decision support tools and integrated ecosystem assessments;
- Promote ecosystem resilience: risk and vulnerability assessments and risk communication;
- Provide critical support for human dimensions research: organizational capabilities and communications, outreach and education.

5.4.3 Weather and Water

A Social Science Strategic Plan for Weather and Water is near completion (NOAA 2008). The stated goal of the plan is to create “a stronger, more distributed, and coordinated social science capability that is integrated with programs and decision systems in support of improved decision making.” Noting that the Weather and Water Mission Goal lags behind other NOAA mission goals in the use of social science, the plan advocates: (1) long term capacity building; (2) developing methods, analyses and data for decision support including improving user-needs assessment; (3) infusing results of analyses into decisions and programs to improve NOAA products and services; (4) improving the use of social science through a broader mix of social sciences, integration with physical and biological sciences, and collaborations with social science capacity outside of NOAA; and (5) assuring an appropriate level of effort for social science in Weather and Water to meet growing needs.

There are a number of short-term strategies in the Plan, including conducting and building capabilities for studies in priority areas, more fully examining existing external research, developing analyses to assist Program Operating Plans (POPS) and FY 2012- 2016 priority setting, coordination with test bed programs, coordination with NOAA Research Council Social Science Committee, cooperative grant relationships with external organizations, and strengthening NOAA’s support for and relationship with the NCAR’s Societal Impacts Program. The Plan identifies analytic priorities as user needs assessment, communication of forecast uncertainty, use and impacts of localized forecasts and warnings, understanding societal effects of high impact weather, addressing interrelated needs of communities and regions, valuation of program benefits and other decision support services, and communicating with and educating stakeholders.

A good example of the need for such analysis is seen in the human behavior that complicates rescue efforts and restoration in extreme weather conditions. Given an increase in the ability to predict the severity and geographic distribution of impacts from abrupt events like the Hurricane Ike storm surge on coastal Texas, why do some people ignore warnings and others do not? To save lives does NOAA invest in better predictions or in understanding how people respond?

5.4.4 Ecosystems

The SSWG applauds the Ecosystem Goal Team for leading the integration of social science within NOAA. At the same time we are concerned about the \$3.1M reduction in the social science budget for this goal team between FY05 and FY08. The ecosystem mission goal represents a fruitful place for future social science expansion because of NOAA’s definition of ecosystem management:

“Sound ecosystem management requires scientifically-based information on ecosystem condition, the causes and consequences of that condition, forecasts of their future condition, and the costs and benefits of different management actions to respond to that condition”. (NOAA Research Council 2008)

This statement lays out an ambitious social science research agenda that if pursued would go a long way toward weaving social science into these efforts. For example, developing scientifically-based information on the “causes and consequences” of ecosystem degradation

requires understanding the everyday decisions of households and firms and mapping them to past and current ecosystem conditions. Forecasting future ecosystem conditions entails not just measuring and monitoring decision outcomes but also understanding the multiple facets of the decision making process such that behavioral responses are integrated into these forecasting tools. Ignoring behavioral responses and changing attitudes leads to unintended consequences that will considerably reduce the quality of forecast information.

The ecosystem management definition can also be interpreted as illustrating a lack of current understanding of the important role social science can play in ecosystem-based management, because it seems to limit the role of social science to an assessment of the costs and benefits of management actions that will respond to the ecosystem condition. In contrast, social scientists can significantly contribute to all aspects of measuring, designing, monitoring, and assessing scientifically-sound ecosystem management.

The SSWG would not want to judge the ecosystem management enterprise solely on a single statement. The discussions of scenario development in the NOAA 5-year research plan clearly highlight the broader social science dialogue. The social science research questions articulated are important ones. However, the milestones in the research plan do not represent the scenario development discussions. The milestones focus on making scientific advances, with humans relegated to the status of exogenous anthropogenic stressors. As an example, the 3-5 year milestone for the performance objective of “increasing the number of regional coastal and marine ecosystems delineated with approved indicators of ecological health and socioeconomic benefits that are monitored and understood” is: “Produce at least two integrated ecosystem assessments that evaluate the ecological response to various anthropogenic stressors.” This milestone does not map into research that will generate understanding of the socioeconomic-political landscape that will determine the “right” set of ecological indicators to consider in management *and* the measurement of the socioeconomic benefits.

Part of the reason for the milestones not including social science research questions may be that social science is emphasized in its own milestone. The last 3-5 year milestone says: “at least a 25% increase in NOAA’s applied, non-economics social science research capacity to support increased research focus on social, cultural, and policy aspects of ecosystem-based approaches to management.”

The External Ecosystem Task Team (EETT) makes a case for NOAA taking the lead to develop social science methods needed for the preparation of regional Integrated Ecosystem Assessments (IEA) (EETT 2006). The EETT makes two broad recommendations: 1) develop social science methods for linking ecosystem science to governance; and 2) develop an understanding of society and its response to changing environmental components.

To develop methods for linking ecosystem science to governance, the EETT recommends that government policies, regulations, and management services be analyzed to understand the conditions that lead to government successes and failures. With such analysis and understanding, it is possible to prescribe ways to correct the obstacles in the public sector that lead to failures of government processes and policies. These obstacles are expected to be

common when governments are faced with the complex trade-offs inherent in ecosystem approaches to integrated management (EETT 2006).

The EETT also recommends that capacity to obtain useful information on public priorities and preferences be increased through greater use of opinion polls and general attitude surveys on ecosystem resource issues, and that more ethnographic fieldwork be done to provide in-depth assessment of values and the degree to which they are strongly or weakly held (EETT 2006).

Understanding societal response to changing ecosystem components requires new tools for identifying and predicting the dynamics and spatial extent of human responses to ecosystem change. An example is provided by the complex governance decisions in the impasse between upstream land and water use practices in the Mississippi watershed and their downstream deleterious impacts on coastal ecosystems.

The EETT recommendations cannot be easily incorporated into line offices in NOAA. Understanding this, the EETT recommended that NOAA develop centers of specialized expertise for the social sciences where new methods could be developed, tested and distributed across the agency with specific application to regional IEAs. Alternatively, NOAA could partner with extramural groups with the capacity to advance social science methods for ecosystem based management.

NOAA agreed with the thrust of the EETT recommendations, that increased attention to development of methods is a critical need for regional IEAs. It is seeking to implement those concepts in the context of ongoing pilot regional IEAs (Levin et al. n.d.). Stakeholders and public involvement are key elements of IEAs because the issues and interests cross ecological, social and political boundaries, have multiple uses, users and objectives, have unclear property rights, and contain multiple ecosystem services (EETT 2006).

5.4.5. Weather, Climate and Transportation

Transportation in the U.S. involves three principal venues. The first is land surface, which includes cars, trucks, commuter rail, long-haul rail, and pipelines. The second is marine, incorporating the Pacific and Atlantic Ocean, Gulf of Mexico and Great Lakes, St. Lawrence Seaway, Panama Canal and, in the likely future, the Northwest Passage. Marine transportation includes cargo, coastal and inland ferries, barge and recreational boating. The third venue is aviation, which involves not only in-transit, airport and in-flight systems, but also supporting ground transportation.

All three venues are sensitive to weather, especially to extreme weather conditions, and also to space weather. Climate variability also affects transportation through changes in extreme conditions. Two important long-term weather and climate conditions that will affect transportation are drought, adversely affecting river barge traffic through low water, and Arctic sea ice melt, opening the Northwest Passage. The U.S. transportation system was built for typical regional weather and climate, rather than extremes. Moderate changes in the mean climate may have little impact on transportation, but extreme changes in weather and climate may have considerable impact on transportation.

Extremes in temperature, precipitation and storms, especially atmospheric and solar, have changed over the past several decades and are projected to continue to change with both positive and negative impacts on transportation. As the climate warms, cold temperature extremes are projected to decrease, creating milder winter conditions that would likely improve the safety of rail, air and ships. Conversely, warm temperature extremes are projected to increase, leading to more buckling of roadbeds and railroad tracks, adversely affecting maintenance work.

As the cold season decreases and the warm season increases, northern transportation dependent upon ice roads and permanently frozen soil would be adversely affected while marine transportation would be positively affected through the commercial opening of the Northwest Passage. Warming would also benefit transportation by shifting more precipitation from snow to rain. However, not all precipitation changes are likely to be beneficial. Heavy precipitation events are projected to increase, causing local flooding. At the same time, summer drying in the interior will contribute to low water levels in inland waterways.

Strong storms, including hurricanes, are projected to increase, leaving coastal transportation infrastructure vulnerable to the combined effects of storm surge and global sea-level rise.

In accommodating these projected changes, it is important to recognize that transportation planning takes place at many different time scales. Road planners typically use a 25-year planning horizon, while railroad planners use 50 years. Bridges and underpasses are generally designed for a 100-year horizon. In all cases, it will be important that planning incorporates the anticipated changes in weather and climate. The social sciences have a key role to play in providing research to understand transportation policy, organizational performance, transportation markets, demographic change and human behavioral response.

5.5 Adopting a Next Generation Performance Matrix

Performance metrics are a useful way to set targets for and evaluate progress toward improved social science capability within NOAA. Table 2 suggests a simple set of performance metrics, summarized in “report card” format, that measure progress toward achieving the desired level of social science capability and integration within NOAA. The standing SAB Social Science Working Group as proposed in Section 4.4 might be an appropriate body to administer this kind of tracking system in collaboration with senior NOAA leadership, to gauge progress toward achieving stronger social science.

Table 2: Example indicators of performance toward social science capacity building and integration in NOAA

	NOAA corporate	Line office 1	Line office 2	Line office 3
Knowledge of user behavior and influence of NOAA info on decisions				
Understanding of outcomes at stake, risks, exposures, etc.				
Understanding of link between user decisions and physical outcomes				

Understanding of link between physical outcomes and economic outcomes				
Understanding of coastal and marine resource stock values				
Use of outcomes data to allocate resources across lines, within lines				
Articulation of aggregate NOAA outcome to Congress				
Social science research priorities defined, plan, execution				
Staffing/funding: operational social science				
Staffing/funding: social science research				

CONCLUSIONS

6.0 Findings and Recommendations

In addition to addressing the four Terms of Reference (TOR) questions (Section 4), the SSWG has a number of overarching findings and recommendations to NOAA. These are discussed in the following paragraphs. SSWG answers to the TOR contain several recommendations that provide a more complete roadmap for how to address these findings.

As a general note, the SSRP's 2003 finding that NOAA's underinvestment in social science diminishes its capacity to meet its mandates and mission is echoed by the 2008 report of the SAB Extension Outreach and Education Working Group (EOEWG), which finds that NOAA's return on investment to society is reduced because of shortcomings in these areas (NOAA SAB 2008). The SSWG 2009 findings on investment, corporate culture, coordination and literacy are also similar in character to those of the EOEWG. Given this similarity, it would be appropriate for NOAA to explore options for coordinating the implementation of recommendations of both reports. Although the social sciences and education and outreach are not the same nor are they interchangeable, they are complementary and are both critical to NOAA.

6.1 General Findings and Recommendations

Finding 1: The SSWG endorses the overall findings of the 2003 SSRP report and finds that the social sciences continue to be underrepresented in NOAA's research, operations, and decision making. The SSWG also finds that if NOAA is to serve society and fulfill its mission, it must integrate the social sciences into the full range of its scientific and programmatic activities.

Finding 2: NOAA lacks sufficient social science expertise to meet its mission and objectives. The social sciences are critical to understanding the vulnerabilities and behavior of the users of NOAA products and information, and the economic risks mitigated and value generated by these uses. Social science can also assist in prioritizing NOAA investments by estimating the

economic return from programs, products, and improvements. The social sciences are needed to support improved product design, communications with users, and education.

Recommendation 2.1 NOAA should draw on the full range of excellent science (physical, biological, and social) to better meet its mission in both line offices and mission goals.

Recommendation 2.2 NOAA should recognize and facilitate the contributions of the social sciences to the major challenges in its research and development and to its operational responsibilities, as several other agencies, organizations, and scientific programs have done. NOAA should use social science to understand decision making frameworks at all levels so as to provide information that meets user needs.

Recommendation 2.3 NOAA should use social science analysis to demonstrate and calibrate its accomplishments, to provide a solid basis for its future planning, and to more properly implement and evaluate its planning activities.

6.2 Institutionalizing Social Science at NOAA

Finding 3: Social science literacy has improved somewhat throughout NOAA since the 2003 report, but it is still weak in many areas. NOAA leadership is now more aware of the merits of the social sciences, but in most cases still does not assign a significant priority to their role in the agency.

Finding 4: NOAA social science capabilities declined between 2005 and 2008. In that time period the NOAA budget increased by 13% and the social science share of the budget decreased by almost 10%. A precise accounting of social science positions within NOAA is difficult because NOAA does not fully understand what constitutes a valid social science presence and moreover lacks a tracking system for social science position categories.

Recommendation 4.1 NOAA administrators should address the weakening position of the social sciences by aggressively developing and implementing a plan to strengthen and integrate social science throughout NOAA line offices, programs and mission goals.

Recommendation 4.2 NOAA should conduct a formal needs assessment to determine its needs for social science staff and research by program, and determine the appropriate mix of internal and external staffing to meet these needs.

Recommendation 4.3 NOAA should develop a tracking system that accurately accounts for and monitors social science staff.

Finding 5: NOAA social science activities are mostly *ad hoc* and segregated, rather than sustained, coordinated and comprehensive. (An exception to this is NMFS, which has significantly expanded its emphasis on the use of the social sciences and has a strategic plan with specific social science staffing objectives.) In addition, there is little representation of social

science expertise among the higher levels of NOAA leadership. Overall, there is inadequate high level commitment among NOAA administrators to strengthening NOAA's use of the social sciences.

Recommendation 5.1 NOAA leadership should articulate a commitment to strengthen the social sciences within NOAA and develop incentive structures to ensure that this commitment is implemented at the line office, mission goal and programmatic levels.

Recommendation 5.2 Until a coordinated and comprehensive social science capacity can be sustained NOAA-wide, a strong centralized social science presence will be necessary to support corporate and programmatic social science efforts. To put appropriate social science expertise in place to guide, inform, and support the use of the social sciences within NOAA, NOAA leadership should create the Office of Societal Impacts. This office would serve a leadership role in coordinating social science across the agency, integrating it where appropriate in research, programmatic, and planning functions. To ensure that the office has sufficient support to perform these functions, it should be external to the line offices and report directly to upper levels of NOAA leadership, such as the Deputy Under Secretary for Oceans and Atmosphere, in a manner similar to the Office of Education.

Recommendation 5.3 To promote the transition to increased social science capacity, NOAA should consider establishing a NOAA Council of Social Science Advisors to advise NOAA leadership on fruitful areas of investment in social science research and staff.

Recommendation 5.4 The NOAA Science Advisory Board should establish a standing Social Science Working Group to provide ongoing oversight and quality control over the integration of the social sciences into the agency.

Recommendation 5.5 NOAA should use its network of joint and cooperative institutes to strengthen social science research, either through the inclusion of social science research in existing institute programs or by establishing one or more joint/cooperative institutes dedicated to social science.

Recommendation 5.6 NOAA should provide appropriate budgetary support to accomplish these recommendations through special assessments and reprogramming. Line offices should establish budget targets for investments in social science capacity over the next three to five years. Ultimately, the determination of the proportion of NOAA resources to be allocated to the social sciences should be outcome-driven. Until a threshold capacity is developed so that the benefits of the social sciences can be felt, formal needs assessments are completed, and formal procedures are adopted to assess the adequacy of social science investment in each line office, the SSWG recommends that about 5% of all line office budgets should be allocated to the social sciences. This likely will require reallocation of existing staffing budgets.

Recommendation 5.7 Over the long term, NOAA should integrate the social and natural sciences in all its research committees, rather than creating parallel structures. In the short term, it may be necessary to create special purpose social science groups to strengthen the social sciences in NOAA. NOAA should also seek ways to coordinate its activities with social science research activities outside of NOAA, such as those at National Science Foundation (NSF).

The SSWG endorses the following recommendations of the NOAA Social Science Committee to: 1. Combine in-house and external social science staff, as appropriate to each program; 2. Use “test beds” and demonstration projects to illustrate the value of social science to NOAA activities and educate NOAA managers about the benefits of the social sciences; 3. Leverage the growing focus on ecosystem-based management and climate services, two areas where the need for and benefits of integration of social science should be obvious and unquestioned.

6.3 Contributions of the Social Sciences to Programmatic Outcomes

Finding 6: The social sciences are essential for quantifying the monetary and human values of NOAA products and services. The social sciences can improve the design of NOAA products and services in light of user needs, adaptation, response, and utilization, and they can help NOAA prioritize future investments.

Recommendation 6.1 NOAA should use the social sciences to: (1) identify and measure social and economic outcomes; (2) achieve socially beneficial outcomes; (3) improve performance within the organization; and (4) set targets for future accomplishments.

Recommendation 6.2 NOAA should establish performance metrics to set targets for and evaluate progress toward improved social science capability within NOAA.

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Appendix A

Written Materials Reviewed by the SSWG

NOAA Cooperative and Joint Institute responses to SSWG request for information

NGI	D. Shaw
CICAR	Y. Kushnir
CICOR	B. Weller
CICS-UMD	P. Arkin
CICS-Princeton	J.L. Sarmiento, G.K. Vallis
CIFAR	S. Sugai
CILER	E. S. Rutherford
CIMAS	P. Ortner
CIMMS	
CIRA	S. Miller, M. McInnes-Efaw, H. Cochrane, T. Vonder Haar
CIRES	W. Lewis
JIMAR	T. Schroeder

NOAA Research Council response to SSWG request for information

Spinrad, R.

NOAA Research Council Social Science Committee responses to SSWG request for information

Bauer, M.B.	NOS	Ecosystems
Beller-Simms, N.	OAR	Climate
Carey, C.D.	NWS	Weather and Water
Curtis, R.	NMFS	Ecosystems
Fowke, M.	NWS	Weather and Health
Gaynor, J.	OAR	Weather and Water
Leveson, I.	PPI	
Ryan, T.	NOS	
Shea, E. & A. Smith	NESDIS/NCDC	
Wiley, P.	NOS	Commerce and Transportation

Line Office Responses to SSWG request for information

NWS

NESDIS

OAR

NMFS

NMFS Economics & Social Sciences Program

NMFS Economics Data Holdings

NMFS Economics & Social Science Research Budget (FY01-08)

Other Documents

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Appendix B

Presentations to the SSWG
Oct 4-5, 2007

Welcoming Remarks

Paul Doremus, Acting Assistant Administrator, Program Planning and Integration

Review of the SSWG Terms of Reference, the preceding SSWG's work and Committee timelines

Susan Hanna, Chair, SSWG

Main Findings and Recommendations

Susan Hanna with Len Pietrafesa and Lee Anderson, current SSWG members and members of the original Social Science Review Panel

Changes in NOAA Organizational Structure since 2003 (PPBES) and its Effects on Social Science and the 2003 Panel's Recommendations

Paul Doremus, Acting Assistant Administrator, Program Planning and Integration

NOAA Organizational Response to the Social Science Report:

Challenges and Opportunities facing the Research Council Social Science Committee

Rodney Weiher, NOAA Chief Economist and others on the Research Council Social Science Committee

Ecosystems

Rita Curtis, Economics and Social Analysis Division Chief, NMFS Office of Science and Technology, and Member, Research Council Social Science Committee

Climate

Nancy Beller-Simms, Program Manager, Sectoral Applications Research Program, NOAA Climate Program Office, and Member, Research Council Social Science Committee

Weather and Water

John Gaynor, Director, OAR Office of Weather and Air Quality, and Member, Research Council Social Science Committee

Commerce and Transportation

Mary Erickson, Chief, Coast Survey Development Lab, Office of Coast Survey, NOS, and Member, Research Council

Mission Support

Michael Crison, Lead, Satellite Sub-Goal

The Future of NOAA Social Science: Emerging Challenges, Opportunities, and Constraints

Mark Holliday, Director, NMFS Office of Policy

Measuring Programmatic Outcomes

Presentation

Example

Matt Hildebrandt, NOAA Program Analysis and Evaluation

Integrating Social Science into Decision making of NOAA and its partners

Avery Sen, NOAA Program Planning and Integration

Integrating Social and Natural Science into Decision making

Margaret Davidson, Director, NOAA Coastal Services Centers (Presentation/Discussion by phone) Pete Wiley, NOAA's Coastal and Ocean Resource Economics Program, NOS, and Member, Research Council Social Science Committee (Discussion segment)

Feb 12-13, 2008

Opening Statement of the Chair and Review of the SSWG Terms of Reference, the preceding SSWG's work and Committee timelines

Susan Hanna, Chair, SSWG

Other Federal Agency Models for Integrating Social Science

USDA Economic Research Service (ERS)

Robbin Shoemaker, Acting Associate Administrator for ERS

USDA Cooperative State Research, Education, and Extension Service (CSREES)

Siva Sureswaran, National Program Leader, SBIR Program

USEPA National Center for Environmental Economics (NCEE)

Al McGartland, Director NCEE, and Will Wheeler, Social Science Research Program

USFWS Division of Economics

Ted Mailett, Senior Economist

NOAA Models for Integrating Social Science

Internal Staffing Model: National Ocean Service (NOS)

Gary Matlock, Director, National Centers for Coastal Oceanic Science

Internal Staffing Model: National Marine Fisheries Service (NMFS)

Mark Holliday, Director, Office of Policy, NOAA Fisheries Office of the Assistant Administrator

Outside Contracting Model: Program Planning and Integration (PPI)

Rodney Weiher, NOAA Chief Economist, PPI, Chair, Research Council Social Science Committee

Virtual Centers Model: NCAR and NSSL/NWC brief overview

Jeff Lazo, Director of Weather and Societal Impacts Group, National Center for Atmospheric Research, Research Applications Laboratory, member SSWG

Integrating Social Science with PPBES

Paul Doremus, Acting Assistant Administrator, PPI

May 8-9, 2008

Findings and Recommendations from the 2003 Social Science Review Panel Report

Susan Hanna, Chair, SSWG

Summary review of the SAB Research Review Team Report

Len Pietrafesa, SSWG

Summary review of the USWRP PDT #6 - "Societal Aspects of Weather" May 1997

Len Pietrafesa, SSWG

Summary review of the Prospectus of Grand Challenges for the Social, Behavioral and Economic Sciences NSTC 2007

Len Pietrafesa, SSWG

Summary of SSC Input

Hauke Kite-Powell, SSWG

June 9-11, 2008

Presentations:

Integrating Social Science with PPBES (From February SSWG Meeting)

Paul Doremus, Acting Assistant Administrator, PPI

Appendix C: 2003 Social Science Review Panel Findings and Recommendations

The 2003 report's findings and recommendations related to the adequacy of social science at NOAA are listed in abbreviated form below. The general finding of the 2003 Review Panel is that the capacity of NOAA to meet its mandates and mission is diminished by the underrepresentation and underutilization of social science. The Panel found that Assistant Administrators are open to opportunities for enhancing social science within their line offices. It recommended that NOAA dedicate \$100 million to a five-year social science program expansion. Specific budget recommendations were included in each area.

3.1 Social Science Literacy

Findings

Throughout NOAA, there is a lack of formal understanding of what social science is and what its contributions can be, leading to an organizational culture that is not conducive to social science research. Two general categories of social science research are critical to the accomplishment of NOAAs mission: programmatic (mission-driven) and organizational (institutional).

Recommendations

NOAA leadership should establish goals and objectives for achieving social science literacy within the agency, and a social science workshop should be conducted for NOAA Assistant Administrators and senior management.

3.2 Social Science Research

Findings

Overall, NOAA's social science research effort is small and unbalanced across disciplines. Social science staffing is insufficient to meet the mission of each of the line offices. There are few programmatic opportunities targeting internal or external social science research. Cost-benefit analyses of programs may meet short-term political needs, but a longer-term focus on social science would enhance NOAA's processes for prioritizing research and effectively connecting the results of that research with its stakeholders.

Recommendations

Line offices and Headquarters should develop social science research plans and strategies. Line offices should establish specific targets for social science research. The National Sea Grant College Program should accept a larger role in supporting social science research. Expenditures on external cost-benefit analyses conducted to justify programs should be documented.

3.3 Social Science Data

Findings

The lack of appropriate data limits the contribution of social science to NOAA.

Recommendations

NOAA should inventory, document and archive its economic data holdings. NOAA Administrators should seek congressional support to rescind the prohibition on collecting economic data under the current MSFCMA Sections 303(b)7 and 402(a).

3.4 Social Science Staffing and Senior Representation

Findings

Throughout NOAA, social science staffing is inadequate. This problem is exacerbated by the lack of functional representation of social science in line office directorates.

Recommendations

Headquarters and line offices evaluate adequacy of social science staffing relative mission and overall organizational needs and jointly develop a plan to build core social science capacity. Headquarters and each line office should investigate opportunities for improving planning, communication and networking among its existing social scientists. Each line office should create a chief social scientist position.

3.5 Education and Outreach

Findings

NOAA Assistant Administrators recognize the need to better understand their constituents and communicate with them, but the lack of expertise in social science survey methodology and perceived obstacles to conducting surveys limits their ability to do this.

Recommendations

Line offices should evaluate their public education and outreach needs. NOAA organize a center of excellence to conduct constituent surveys.

3.6 Strategic Planning

Findings

There is almost no long-term strategic planning for social science at NOAA (OGP and NMFS are exceptions). Except at NMFS, social science objectives in line office strategic plans do not track into a long-term research agenda influenced by the social sciences.

Recommendations

Line offices should develop strategic plans and annual operating plans that incorporate explicit social science data, staffing, research objectives and performance measures. Each line office should develop a social science research plan and ensure that it is integrated into the NOAA strategic plan

3.7 Performance Evaluation

Finding

The application of social science is a necessary component of program effectiveness measurement and monitoring in the FY2003-FY2008 Strategic Plan.

Recommendations

NOAA should use social scientists to lead the development of performance metrics. NOAA should invest \$2M in development of performance metrics and strengthening measurement of economic and social benefits and costs associated with program implementation and performance.

3.8 Economic Valuation

Finding

NOAA has immediate needs for data and research directed at environmental assessment and stewardship.

Recommendations

NOAA should invest \$2M in a virtual NOAA Center for Economic Valuation that would coordinate, sponsor and disseminate research, data collection, survey methods, and derive and apply analytical models of the market and non-market values associated with environmental assessment and environmental stewardship policies.