NWS Science and Technology Roadmap

Social Science

Team Composition

- Jennifer M. Sprague, NWS/SPP – Team Lead
- Douglas Hilderbrand, NWS/OSTPPD/SPB
- Peter Roohr, Fire Weather Science & Technology
- John Gaynor, OAR/OARO/OWAQ (Research)
- Jenifer Rhoades, NWS OCWWS Marine Services (Tsunami)
- Steve Pritchett, OST (Severe Weather)
- Daniel Meléndez, NWS/OST (Tropical)
- Paul Stokols, NWS/OCWWS/MSD/FPWSB (Winter Weather)
- Paula Davidson, NWS (Air Quality)
- Mike Gerber, OCWWS (Customer Outreach)
- Keelin Kuipers, NOS, Coastal Service Center
- Eli Jacks, NWS Chief, Fire and Public Weather Services Branch

Operational Definitions

Social Science: "*…the process of describing, explaining and predicting human behavior and institutional structure in interaction with their environments.*"

Vision/Benefits

- **Vision**
  - ***Integrate social science methodologies to elicit the most appropriate action to NOAA's products and services and to quantify their economic value to the Nation.***

- **Benefits**
  - Translation of weather (including water and climate) information to impact-based actionable decision support
  - Increased economic productivity/efficiency due to environmental decision support services to the public sector
  - Improved preparation/risk mitigation, response, and recovery during high impact events
  - Increased level of trust/credibility with general public, key partners, and decision makers
  - Americans are better informed about Weather, Water, and Climate Science and Impacts
  - Enhanced ability to capitalize on partnership opportunities for improved NWS services
  - Clearer, more definitive priorities for weather and water research and product generation.

Impacts

- **Impacts**
  - **Customers and partners make better decisions to mitigate losses and promote economic prosperity (i.e. lives saved, property protected, and money/resources saved)**
  - **Better understanding of NWS value to the nation**
    - Quantified value of NWS information:
      - Improved ice/snow forecasts for airports → saves >$600M/yr
      - Improved temperature/frost forecasts → saves $500M/yr (utilities), $6K/hectare/yr (fruit orchards)
      - More efficient use of resources (e.g., rerouting aircraft saves $100Ms)
      - Improved business practices (e.g., harvesting crops early before flood event saves $Ms)
  - **Better, informed decisions mitigate effects/costs of weather hazards**
    - Weather sensitive industries/agriculture change to maximize costs savings based on forecasts.
    - Better evacuation decisions save lives and reduce unnecessary evacuations.
    - Better everyday decisions such as staying home during dangerous road conditions.

Goals/Targets:
Customer Needs

Goal/Target	Outstanding Issues
Integration of social science: Social science methods ensure the correct interpretation and application of environmental information for better decision-making and determination of socio-economic impacts of NWS information.	Training of forecasters needed in using appropriate language, graphics, etc. to match sophistication of users, including all socio-economic groups. (Linked to DSS Goal 6)
Communicating impact-based information: Elicit appropriate action on the part of NWS customers by communicating how environmental information will impact users.	Products and services need to shift from meteorological to impact-based. Training and outreach is essential. Need for new tools to provide capability for forecaster to interact with gridded forecast information (Linked to DSS Goal 3)

Goals/Targets:
Customer Needs

Goal/Target	Outstanding Issues
Optimize communication and effective interpretation: Well articulated, clear explanations, and interpretation assistance between forecasters and users anytime/anywhere to ensure correct application and effective response to NWS information.	Needed social science research is expensive and local in applicability. Forecasters need tools to generate advanced graphics and visualizations taken from gridded forecasts. Need rapid iteration development between forecasters, developers, social scientists, and users. Link with Advanced Forecast Tools & Applications Team and Dissemination Team for the Interactive-NWS concept of mobile alerts, NWS Chat, social networking, Web 2.0/3.0. (Linked to DSS Goal 1, Severe Wx Goal 4, Tsunami and Fire Wx)

Goals/Targets:
Emerging Science & Technology

Goal/Target	Outstanding Issues
Communicate forecast uncertainty: Effective communication of uncertainty/probabilistic information as additional input into decision-making and not just based on most likely scenario. Eliminate "bad forecast → bad decision" syndrome. Decisions based on cost/loss models or risk mitigation.	Requires significant amount of training for NWS personnel as well as education of users. Probabilistic forecasts must be reliable operating under stable processes. Economic assessments (Linked to DSS Goal 5).
Performance Measures: Improved performance measures that utilizes social science methodologies and quantifies economic value.	Better understanding of socio-economic impacts and how to quantify those impacts.
Smart Systems: Build smart systems that utilize social science principles, including human factors and knowledge of societal impacts.	This Goal is being addressed by the Forecast team. No further breakdown of information will be provided in this roadmap, for this goal.

Goals/Targets:
Emerging Science & Technology

Goal/Target	Outstanding Issues
Systems/Tools: Build systems and tools to aid forecasters in understanding and responding to customers needs.	This Goal is being addressed by the DSS team. No further breakdown of information will be provided in this roadmap, for this goal.
Improved Decision-Making: Improvised effectiveness of public response and EM decision-making to severe weather warnings	This Goal is being addressed by the Severe Weather team. No further breakdown of information will be provided in this roadmap, for this goal.
Service Metrics and Service Verification: Track performance measures of integration of social science into NWS products and services.	Currently no performance goals for social science.

Key Information Gaps

Gap	Solution Alternative	Impact
Gap #1: Most current NOAA information is not impact-based but rather science-based. Need to quantify societal benefits (Linked to DSS Gap 3, Tsunami Gap 4, Air Quality Gap 5 and Storm Surge Roadmap)	1.1 Develop expertise in social science. 1.2 Integration of social science into early formation stage of hydrometeorological products & services and communicate user impacts based on environmental information. 1.3 Rely on/Assess existing and planned social science studies and research. Partner with academia. 1.4 Rely on consultants, external research, in house specialists. 1.5 Design and fund scientific studies to quantify the impacts, benefits and costs.	User decisions will improve if based on impacts, not just environmental information. Better targeted investments for improving NOAA Products and Services. Meet customer driven decisional needs

Key Information Gaps

Gap	Solution Alternative	Impact
Gap #2: Limited knowledge of specific user needs/impacts (and their understanding our capabilities). (Linked to Severe Weather Gap 5, Winter Weather Gap 7, Tsunami Gap 4, and Tropical Weather Gap 8)	2.1 Assess local/national user needs (e.g. Ad-hoc customer surveys). 2.2 Conduct research on how public uses NWS information 2.3 Develop tools to aid the decision making process 2.4 Provide training for forecasters in understanding users' needs 2.5 Integration of decision support systems into NWS operations 2.6 Enhance interagency collaboration with other agencies and academia.	Forecasters will be able to communicate effectively with and provide pertinent weather information to federal, state, and local level decision makers Better targeted investments and decision support services Meet customer driven decisional needs

Key Information Gaps

Gap	Solution Alternative	Impact
Gap #3: Customers misinterpret NWS information which leads to poor decision making. (Linked to DSS Gap 1, Storm Surge Roadmap and Fire Wx)	3.1 Conduct research on how public uses NWS information. 3.2 Communicate using advanced graphics, animation, and visualizations (e.g., GIS fully integrated, Virtual Reality). 3.3 Formal DSS training of NWS personnel. 3.4 Two-way mobile device information sharing for remote interaction. 3.5 Provide on-location assistance or interact remotely using advanced remote collaboration tools (next-generation web-2.0/3.0), webinars.	Better application of NWS information leads to improved decisions. Greater customer confidence in applying NWS information into decision making Two-way communication anytime/anywhere minimizes chance of misinterpretation of NWS information

Key Information Gaps

Gap	Solution Alternative	Impact
Gap #4: Misapplication of environmental information occurs due to misinterpretation by users. (Linked to DSS Gap 6 and Tsunami Gap 4)	4.1 Integrate social science methods into communication of environmental information.	Improved decisions due to reduced misinterpretation.
Gap #5: Limited communication of uncertainty/probabilistic information for DSS purposes. (Linked to DSS Gap 5 and Storm Surge Roadmap)	5.1 Training of forecasters in uncertainty forecasting and two-way communication with customers on how to apply uncertainty information to improve decisions.	Decisions based not on incomplete information (i.e., most likely scenario) but on complete range of possible scenarios.

Key Information Gaps

Gap	Solution Alternative	Impact
Gap #6: Need for ongoing training in societal impacts. (Linked to Winter Weather Gap 8, Tsunami Gap 4 and Storm Surge Roadmap)	6.1 Training in research to operations, sociological impact and benefits, and decision-maker needs.	Forecasters will understand societal impacts and provide more relevant forecasts to individuals and society in general.
Gap #7: Smart systems that utilize social science principles, including human factors and knowledge of societal impacts. (Linked to Forecast Gap 2)	7.1 Address assessments/ recommendations from social science-based studies (human factors and societal needs), and determine how best to implement changes from an S&T perspective. 7.2 Improved agency science and technology infusion processes to allow forecasters to rapidly take advantage of advances in science/technology	Maximizing the effectiveness of our human capital.

Key Information Gaps

Gap	Solution Alternative	Impact
Gap #8: Operational implementation of state-of-the-art tools for forecaster collaboration and consistency. (Linked to Forecast Gap 3, Winter Weather Gap 6, Marine Weather Gap 7, and Tsunami Gap 4)	8.1 Chat/collaboration tools fully integrated into operational workstation and used consistently across NWS 8.2 Incorporate social networking applications for sharing of information and situational awareness 8.3 Introduce research for development of advanced collaboration tools	Collaboration throughout forecast process will lead to improvements in forecast consistency. New Toolset and applications for the NWS forecasters to increase situational awareness of local high impact events

Key Information Gaps

Gap	Solution Alternative	Impact
Gap #9: Need for faster adaptation to Research-to-Operations and ability to experiment with new scientific methods and roles for the forecaster, in a pre-operational mode. (Linked to Forecast Gap 6, Outreach Gap 4, Winter Weather Gap 8, Tsunami Gap 3 and Fire Weather Gap 10)	9.1 Develop an approach to move societal research to operations to make our forecasts/ messages more consistent and effective. 9.2 Operational Proving Ground (OPG) interactive feedback loop connecting forecasters (and forecaster tools), developers, social scientists, and end users in a rapid iteration process. 9.3 Implement experimental forecast facility/test bed to experiment with new scientific methods and roles for the forecaster in a quasi-operational setting.	Clearer direction and path for Research-to-Operations. Reduce costs associated with refining scientific methods and forecaster roles. Ability to make key changes prior to nationwide implementation. Improved knowledge of customer requirements and where to concentrate influx of new technology/policies.

Key Information Gaps

Gap	Solution Alternative	Impact
Gap #10: Inadequate Outreach and Decision Support Systems (Linked to Outreach Gap 2, Tsunami Gap 4, and Marine Weather Gap 8)	10.1 Leverage Social Networks 10.2 Interactive Virtual Reality	High level of trust and credibility with general public, key partners, and decision makers. Outstanding partnerships. Fast and efficient collaboration and content sharing. Remote and targeted outreach to customers. Two-way communication with customers for best use of NWS information.
Gap #11: Service metrics and service verification do not exist.	11.1 Define social science performance metrics and economic impacts/benefits and costs.	Measure service performance and define future goals of customer satisfaction.

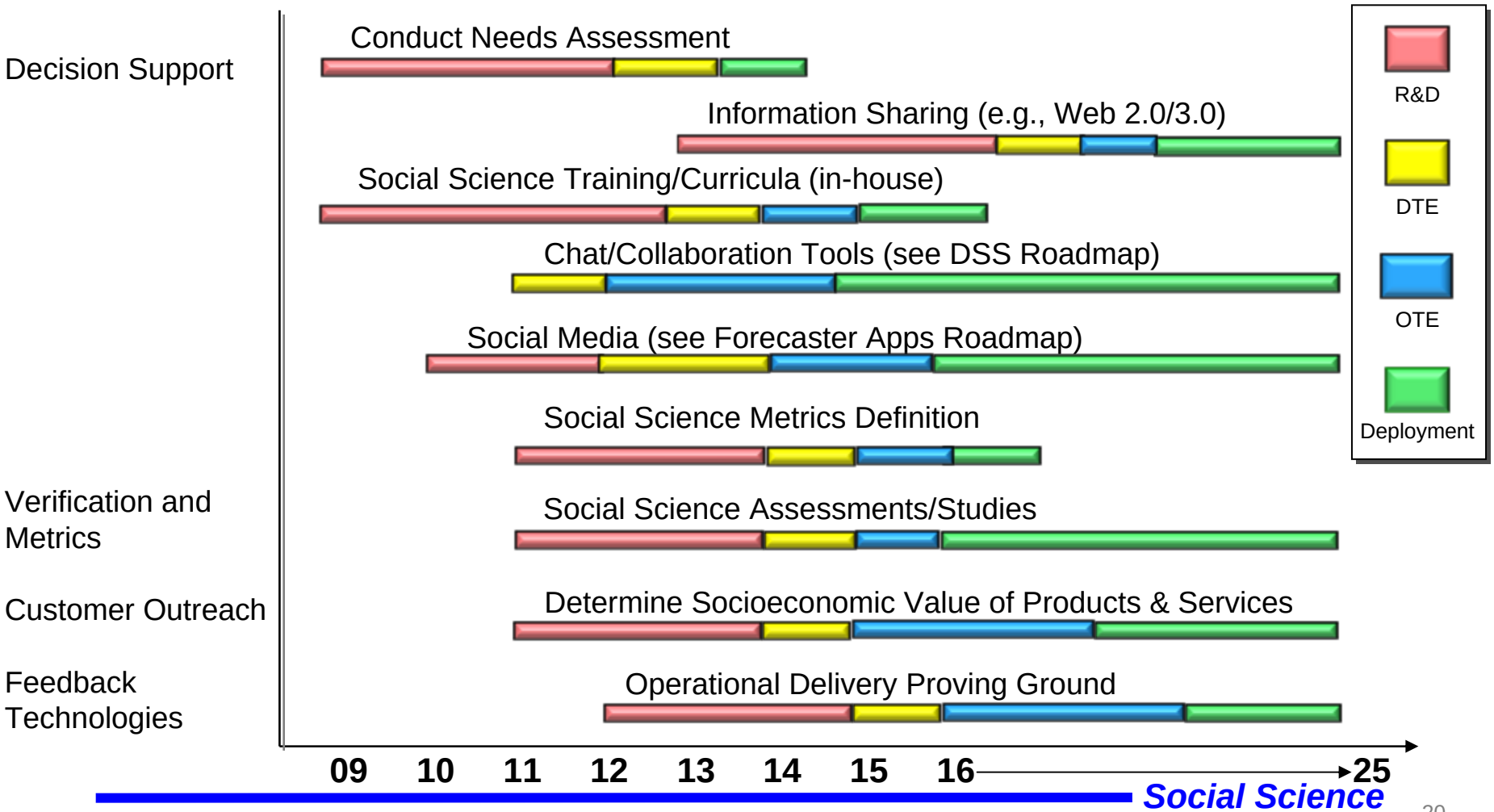
Research Needs and Opportunities

- **Near-Term**
  - Conduct needs/gaps analysis to identify science services and enabling capabilities with greatest impact of integrating social sciences methodologies
  - Conduct social science assessments/studies in those areas with identified gaps (See Forecaster Applications, Fire Weather & Marine Weather Roadmaps. Include Tsunami, Tropical Weather, Severe Weather, Winter Weather, etc.)
  - Conduct valuation analysis of sociologic and economic factors that drive response to weather, water, and climate information (See Decision Support, Outreach and Severe Weather Roadmaps)
  - Conduct analysis on NWS communication of information. (See Outreach Roadmap)
  - Determination of most effective uncertainty and probabilistic information for customers.

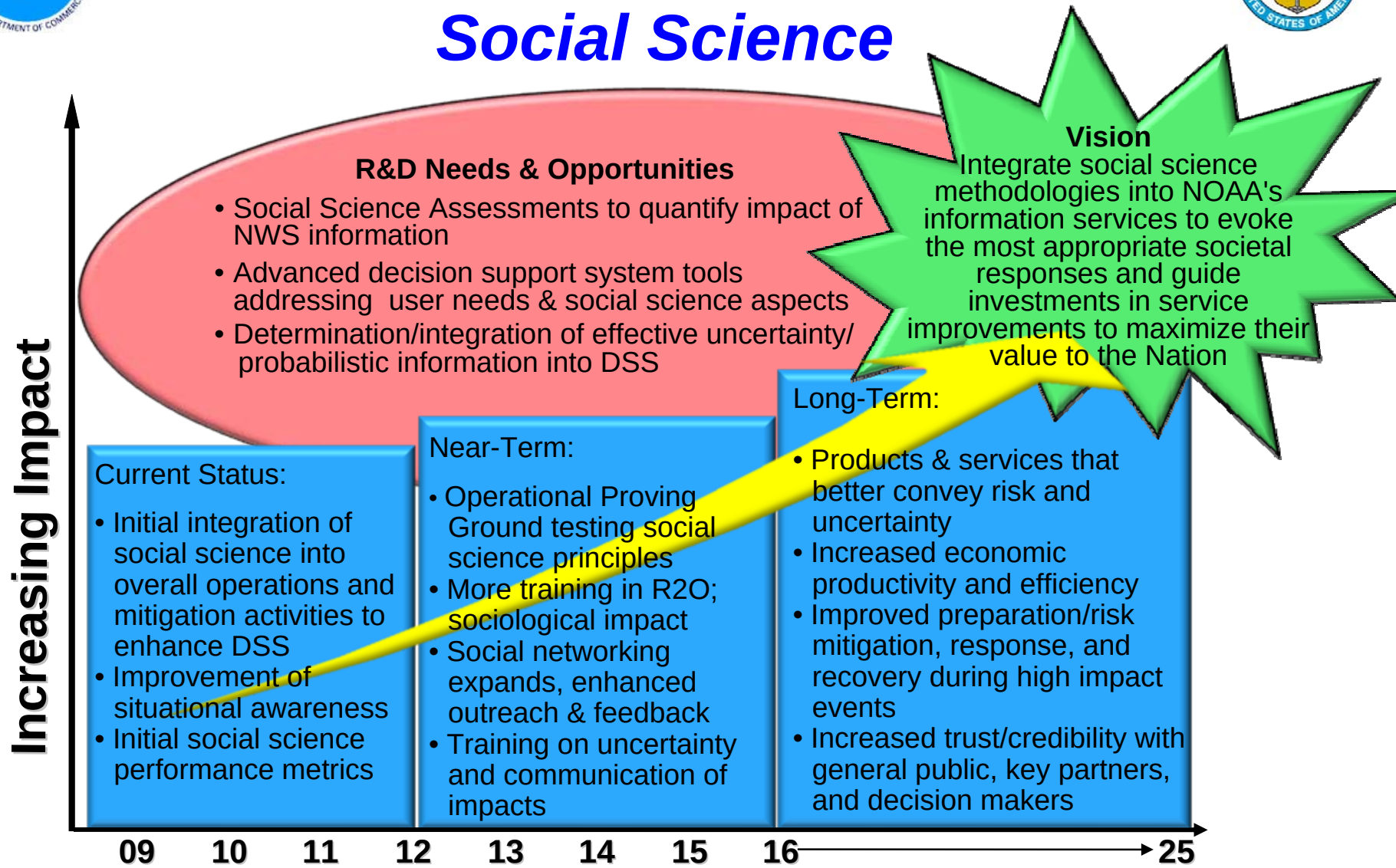
Research Needs and Opportunities

- **Long-Term**
  - Determination/integration of effective uncertainty/probabilistic information into DSS
  - Continuing assessments/studies, including economic benefit assessments to more effectively communicate information in a manner that is easy to understand and elicits appropriate action among NWS constituents.
  - Incorporate human factors expertise to maximize the effectiveness of the production of our products.
  - Advanced decision support tools that allow for integration of probabilistic and uncertainty information, and local needs specific forecasts and warnings.

Social Science
Alternative Solution Advances



Focus Area Team Summary: Social Science



NWS Science and Technology Roadmap

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Background Slides & Additional Information

Performance Measures: Social Science

Proposed	Current (2009)	FY 2016 Target Example	FY 2025 Target Example
Number of NWS products and services that utilize social science methodologies.	Few	50%	85%
Number of information products for which value has been assessed.	Few	50%	85%
Number of communication tools that utilize social science methodologies to effectively communicate uncertainty and risk.	Few	50%	85%
Credible societal outcomes (lives saved and economic savings) as a result of products and services integrating social science.	None	50%	85%