

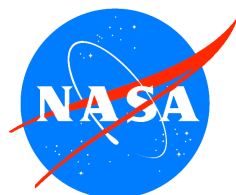
NASA SCIENCE MISSION DIRECTORATE

*Earth Science Division
Applied Sciences Program
Ecological Forecasting Program Element
FY2007-2011 Plan*



FINAL DRAFT

Date: 11/14/2006



*Expanding and accelerating the realization of economic and societal
benefits from Earth system science, information, and technology*

FINAL DRAFT

NASA Earth Science Division - Applied Sciences Program
Ecological Forecasting Program Element

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The Applied Sciences Program websites contain additional information about the program and this program element:

Applied Sciences Program:	http://science.hq.nasa.gov/earth-sun/applications
Ecological Forecasting Element:	http://science.hq.nasa.gov/earth-sun/applications/theme13.htm
Project Tracking & Reporting	http://aiwg.gsfc.nasa.gov

NASA Science Mission Directorate – Applied Sciences Program

Ecological Forecasting Program Element Plan: FY 2007 - 2011

I. Purpose and Scope

The NASA Applied Sciences Program collaborates with partner organizations to enhance the application of NASA Earth science research results to serve issues of national priority. The desired outcome is for partner organizations to use project results, such as prototypes and benchmark reports, to enable the sustained, operational use of Earth science products and enhance their decision support capabilities.

The Ecological Forecasting Program Element is one of twelve elements in the Applied Sciences Program. It includes projects in the areas of sustainable development and biodiversity conservation, which take advantage of a framework and the tools for ecological forecasting provided by NASA. NASA defines ecological forecasting as the use of observations and associated models to predict the impacts of environmental change on the ecosystems that support the existence of life on Earth. Ecological forecasting links the physical world of climate and geology to the living world of biology and ecology. As noted by the Committee on Environment and Natural Resources (CENR) of the President's National Science and Technology Council: "Ecological forecasts predict the effects of biological, chemical, physical, and human-induced changes on ecosystems and their components." Indeed, ecological forecasting requires a scientific synthesis across the domains of physics, geology, chemistry, biology, and psychology. The goal is reliable forecasts that allow decision makers access to science-based tools in order to project changes in living systems. These forecasts should incorporate knowledge of uncertainties and estimates of error and allow those making decisions to compare the outcomes of alternative policies. Analogues from the physical sciences include short-term weather forecasts and longer-term predictions of climate phenomena, such as El Nino Southern Oscillation events.

Observations and models are the tools behind ecological forecasts. From the perspective of the NASA Applied Sciences Program, ecological models ingest data resulting from NASA research observations and measurements and generate forecasts for decision support systems (DSS) developed by NASA's partners. These models may span spatial scales from molecular to global. They may also assimilate information across long time scales to hone and test the accuracy of predictions. There are limits to our forecasting ability but probing the sources of these limits enhances our overall understanding of the ecosystems involved. NASA is currently engaged in both international and domestic partnerships under the Ecological Forecasting Program Element.

This Program Element extends the benefits of NASA investments in research, flight systems, and data management to address the decision supports needs of our partners. It does so by promoting ecological forecasting in the service of sustainable development and biodiversity conservation.

Forecasts are central to attempts to promote economic growth while maintaining the natural ecosystems that provide us with cost-free services, such as clean air, fresh water, biodiversity, fertile soils, and the removal of waste products. Growth in tandem with the continuation and promotion of healthy ecosystems is the essence of sustainable development. Ecological forecasts allow planners, developers, and resource managers to project the ecosystem impacts of their actions, as well as to estimate the effects of other phenomena such as major storm events.

Building partnerships to support the conservation of biodiversity is the other priority for the NASA Ecological Forecasting Program Element. We define biodiversity in accordance with the 1995 Global Biodiversity Assessment as the total diversity and variability of living things and the systems of which they are a part,

including the ecosystem, species, and genetic levels of organization. From a practical standpoint, the focus on biodiversity conservation allows this Program Element to build directly upon the results of NASA's Research and Analysis Program activities in the field of biodiversity. Looking more broadly, one sees decision support tools for biodiversity conservation proliferating in the government, not-for-profit, academic, and private sectors. This proliferation is at least partly in response to concerns raised by researchers that extinction rates for many groups of organisms now equal those occurring during mass extinction events documented in the geologic record. The World Conservation Union (IUCN) has been tracking the status of species and populations threatened with extinction for the past four decades. Current summary statistics in the (IUCN) Red List of Threatened Species show growing numbers of threatened and endangered species in studied groups. Biodiversity loss is a global change of particular urgency as lost species and ecosystems cannot be recovered.

Under the overarching priorities of sustainable development and biodiversity conservation, the following criteria help establish which potential partnerships are appropriate for NASA support.

- Presence of a partner institution with an existing or planned decision support system, which is able to accept or adapt observations and forecasts resulting from NASA research
- Importance of the ecosystem services involved (e.g., priority locations might be those especially rich in biodiversity)
- Existence of a NASA research program that allows the extension of Earth science research results into DSS of particular user communities

Currently, the Ecological Forecasting Program Element focuses on supporting DSS for the following project activities:

- Regional-scale sustainable development and conservation, i.e.: ongoing work in Central America;
- Management of protected areas, such as national parks, reserves, and refuges; and,
- Management of marine fisheries.

In addition, this Program Element supports efforts to observe, monitor, and assess biodiversity through tasks contained within the 2006 Work Plan and 2007-2009 draft Work Plan of the international Group on Earth Observations (GEO).

II. Objectives: FY2007-2011

All National Applications Program Elements are aligned to the NASA Strategic Plan and the agency's objectives as expressed in the NASA Integrated Budget and Performance Document (IBPD) and the Performance Assessment Rating Tool (PART).

Ecological Forecasting addresses the goal of the Applied Sciences Program: to bridge the gap between Earth system science research results and the adoption of data and prediction capabilities for reliable and sustained use in decision support. The Ecological Forecasting Program Element draws upon the Science Mission Directorate's Research and Analysis Program for its Earth observation data. The models, which are the sine qua non of ecological forecasting, arise from the Research and Analysis Program, the efforts of our partners, and other research activities. The Applied Sciences Program supports the integration of observation data and models into decision support tools. The Ecological Forecasting Program Element works with NASA's partners to enable DSS that will prove useful to decision makers, resource managers, and members of the general public concerned with the impacts of natural and human-induced environmental changes on living systems.

Specifically, the Ecological Forecasting program pursues the following short- and near-term objectives:

Short-term Objectives (FY07)

QI - II 2007

- Receive funds from U.S. State Department for expansion of SERVIR to the Dominican Republic
- Initiate development of a conceptual approach for working with USAID to take regional sustainable development projects to other parts of the world
- Complete sourcebook on uses of remote sensing for providing indicators of progress toward the Convention on Biological Diversity (CBD) 2010 Target
- Quality Assurance Testing of Vista 2.0
- Begin Marine Fisheries Forecasting (MFF) projects with NOAA
- Plan Intercomparison Workshop for NASA Activities in the Greater Yellowstone Ecosystem
- Plan Joint NASA-U.S. Fish and Wildlife Service (FWS) Speaker Series
- Plan and co-host the 2nd meeting of the North American Network for Remote Sensing Park Ecosystem Condition with the U.S. National Park Service (NPS), Parks Canada, Canada Centre for Remote Sensing, Canadian Space Agency, and (new to this meeting) representatives from the Government of Mexico
- Initiate Support for GEO Biodiversity Tasks

QIII - IV 2007

- Complete needs assessment of SERVIR products potentially useful to the Dominican Republic
- Implement TOPS Client at NPS site
- Carry out benchmark test of Vista 2.0 in the Middle Grey's Watershed of the Bridger-Teton National Forest
- Initiate 4 Decisions 05 projects
- Conduct Intercomparison Workshop for NASA Activities in the Greater Yellowstone Ecosystem
- Initiate NASA-FWS Speaker Series
- Receive reports from Large-Area Invasives Spread Network and Predicting Right Whale Distributions one-year awards/evaluation studies

Near-term Objectives (FY08-FY10)

- 2008
- Complete SERVIR REASON Project
 - Complete TOPS REASON Project
 - Complete NatureServe Vista REASON Project
 - Receive final reports from 2 MFF projects with NOAA
 - Conduct joint solicitation with NOAA for MFF projects
 - Support biodiversity monitoring activity within GEO
 - Develop conceptual approach for working with USAID to take regional sustainable development projects to other parts of the world
-

- 2009
- Implement SERVIR transition to Central American partners
 - Initiate regional management project(s) in South America, Africa, or South Asia
 - Receive final reports from other 2 MFF projects with NOAA
 - Complete Decisions 04 projects (Albertine Rift and Fire Information for Resource Management System)
 - Support GEO implementation of a biodiversity monitoring and assessment system
-

- 2010
- Complete Decisions 05 projects (NPS Monitoring and Forecasting, Large-Area Invasives Spread Network, Predicting Right Whale Distributions, and Ecological Forecasting of Peruvian Fishery)
-

2011

III. Ecological Forecasting Issues, Related Research, and Decision Support Tools

Potential Ecological Forecasting Issues: FY07-FY11

1. 1 FTE for SERVIR to support remote sensing analysis/web-based GIS and the management of the project at MSFC

Budget: \$136,000 for FY07

Lead Center: MSFC PI is Tom Sever

Deliverable: Ability to address additional, unforecasted work resulting from popularity of SERVIR and additional demands on investigators' time, includes additional requests from HQ

2. Project Manager for Protected Area Management

Budget: \$278,300 for FY07

Lead Center: JPL PI is Gary Geller

Deliverable: 0.85% of his time (plus travel) for overall coordination and management of this element of the program

3. Project Manager for MFF

Budget: \$75,000 in FY07

Lead Center: JPL PI is Ben Holt

Deliverable: Project support and management for the project

5. Workshops and symposia

Budget: \$50,000 in FY07

Lead Center: HQ PIs are TBD

Other Partners: FWS, NPS, TBD

Deliverable: Yellowstone Intercomparison Workshop, George Wright Society Sessions, FWS Speaker Series

Priority Decision Support Tools

The following represent priority Decision Support Tools the program focuses on in the near-term.

Regional Visualization and Monitoring System for Mesoamerica (SERVIR)

Since 1999, NASA has worked with Central American partners to support their development of the Mesoamerican Biological Corridor (MBC) and other activities focused on regional sustainable development. Located at the junction of North and South America and characterized by significant changes in elevation, Central America is a biological crossroads with seven to eight percent of the planet's biodiversity in less than one half of one percent of its land mass. In addition, off its shores lies the second largest system of coral reefs on the planet. In 1997, the leaders of the seven nations of Central America (Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama) announced an unprecedented multinational effort to integrate their conservation efforts across international boundaries and promote sustainable development throughout the region. The resulting MBC is a series of national parks, other protected areas, and lands subject to special management regimes extending from southern Mexico to the Colombian border. NASA has partnered with the U.S. Agency for International Development (USAID), the World Bank, the Central American Commission for Environment and Development (CCAD), the Water Center for the Humid Tropics of Latin America and the Caribbean (CATHALAC), and others to promote the development of a Regional Visualization and Monitoring System known as SERVIR. SERVIR is a web-based entity operating through a series of nodes. The primary node is at the CATHALAC facility in the City of Knowledge, Panama with other nodes located in each of the Central American countries. In addition, a development node exists at the NASA Marshall Space Flight Center in Huntsville, AL. Through these nodes, Central American managers and the general public use satellite imagery to detect wild fires and changes in land cover, track rainfall and weather patterns, and monitor coastal margins for red tide events. The incorporation of climate models helps users understand the poorly known connection between changes in land cover and climate variation while the integration of new numerical meteorological models improves weather forecasts. SERVIR's MesoStor system allows users to select and download satellite imagery and other datasets; while SERVIR's online maps enable the user to combine, view, and query satellite imagery from the TRMM, Terra, Aqua, Landsat, and other satellites together with other environmental and socioeconomic data. SERVIR also generates decision support products in the following areas: fires, red tides, climate change, land cover/land use change, short-term numerical weather forecasts, floods, a food security early warning system, hurricanes, earthquakes, and volcanoes. In addition, it offers software tools such as the NASA WorldWind-generated SERVIR-VIZ and Skyline Mesoamerica 3-D that produce visualization products for decision makers and the public. NASA is funding SERVIR through a five-year award under the Research, Education and Applications Solutions Network (REASoN) Cooperative Agreement Notice (CAN). In addition to NASA funding, USAID and other partners (e.g.: the U.S. Department of State) are contributing over \$3,000,000 to this effort.

Protected Area Management (PAM)

PAM is an umbrella designation covering several DSS under development by NASA's institutional partners. A shared focus on providing decision support tools for managers of national parks, wildlife refuges, and other protected areas links these DSS. World population is expected to increase 50 percent by 2050, resulting in escalating demands for ecosystem services by approximately 9 billion people. Protected areas will be increasingly important for the conservation of biodiversity. They are also vital for the maintenance of other ecosystem services, such as fully functioning watersheds. In addition, protected areas provide direct economic benefits to surrounding communities. The U.S. National Park Service (NPS) estimates that expenditures and job creation in and around U.S. protected areas have economic impacts equivalent to \$10.6 billion per year (estimate derived for 2001 from National Park Service Money Generation Model 2). For PAM, relevant U.S. operational agencies include the National Park Service (NPS), the U.S. Fish and Wildlife Service (FWS), and their research arm within the U.S. Geological Survey (USGS), as well as the U.S. National Oceanic and Atmospheric Administration (NOAA), which oversees the nation's marine protected areas. In addition to a focus on U.S. Federal agencies, PAM also works domestically and internationally through the efforts of conservation nongovernmental organizations (NGOs), research institutions, and USAID. A primary challenge for the Ecological Forecasting Program Element is to integrate into SERVIR (as appropriate) those DSS' being supported by PAM.

Marine Fisheries Forecasting (MFF)

NOAA is exploring the integration of remote sensing data into marine fisheries models and NASA is funding research efforts along these lines. A decision support tool for forecasting marine fisheries must link physical oceanography and climate data with ecosystem models to understand the effects of climate oscillations on certain coastal and pelagic fisheries. Many fisheries around the world appear to be in decline. Fisheries managers can use knowledge of the drivers of marine productivity, gained from remote sensing, to improve stock assessments and promote ecosystems-based fisheries management. MFF leverages progress being made in several research projects funded under the Interdisciplinary Science in the NASA Earth Science Enterprise solicitation. Relevant research projects focus on modeling the impacts of climate events (e.g., El Nino), climate change, and other ecological disturbances on ecosystems and species distributions. This work is being conducted as a partnership between the Ecological Forecasting and Coastal Management Program Elements. As is the case with PAM, an important challenge is to integrate appropriate DSS supported under MFF into SERVIR.

IV. Projects and Activities

The Ecological Forecasting Program Element conducts projects to support the program's goal and objectives. The projects fall into three types: Solicited Projects, Directed Projects, and Congressionally-Directed Activities. The respective Project Managers and teams are responsible for developing project plans, managing the activities, and reporting issues and results. Generally, the projects involve the following activities:

- Develop and nurture partnerships with appropriate organizations;
- Identify and assess partners' ecological forecasting responsibilities, plans, and decision support tools and evaluate the capacity of Earth science results to support these efforts;
- Validate & verify application of Earth science results with partners, including development of prototypes;
- Cooperate with partners to document the performance and value of Earth science results relative to partners' benchmarks and to support adoption into operational use; and,
- Communicate results and partners' achievements to appropriate communities and stakeholders.

Plans, status, and results for each project are available through: <http://aiwg.gsfc.nasa.gov>.

A. Solicited Projects

All National Applications Program Elements select peer-reviewed projects to support each element's goal and objectives. To secure funding and authorization to undertake activities supporting NASA and the Applied Sciences Program, project teams are responsible for developing project plans and managing the activities. The project plans specify the Earth Science observations, models, and other research results to extend to decision support tools as well as the activities to produce appropriate deliverables. The plans integrate contributions from the partners, NASA Centers, and other contributors from the community of practice. Projects are expected to extend the benefits of NASA research results to the maximum extent possible, including the use observations from sensors on: Terra, Aura, Aqua, TRMM, NPP, NPOESS, Topex, Jason, OCO and Aquarius.

Following are some solicited projects under the Ecological Forecasting Program Element.

Project: NatureServe Decision Support Tool for Western Land Managers					Solicitation	
<p>The purpose of this project is to assess the potential for NASA research results to improve the performance of NatureServe's Vista used in decision support for land management.</p> <p>NatureServe is completing Version 2.0 of its Vista tool for use in the U.S. Forest Service National Forest planning process. The Bridger-Teton National Forest is the location for this work. Vista allows for the incorporation of NASA products into this planning process.</p>					<i>Budget (\$K)</i>	
					FY07	0
<i>Project Monitor and Center</i>		<i>Other NASA Centers</i>	<i>Timeframe</i>	<i>Partners</i>	FY08	0
Gary Geller JPL			FY03 - FY07	NatureServe	FY09	0
					FY10	0
					FY11	0
<i>Principal Investigator(s)</i>						
<i>Earth Science Products</i>		mission: Landsat, SRTM, AVHRR sensor: products: models: <i>Version 2.0 Vista Decision Support Tool</i>			<i>Other Apps.</i>	
					Carbon Management, Water Management	
<i>Deliverables</i>		<u><i>Description</i></u>		<u><i>End Date</i></u>	<u><i>IBPD Metric #</i></u>	
		Project Plan				
		Evaluation Report		6/30/2005		
		Design & Implementation		9/30/2005		
		Verification & Validation				
		Benchmark Report		4/30/2007		
		DST for Greater Yellowstone Area		6/30/2007		
Work Plan (Revised)		7/31/2006				
<i>Notes:</i>						

Project: Enhancement of TOPS				Solicitation	
<p>The purpose of this project is to assess the potential for NASA research results to improve the performance of National Park Service’s Inventory and Monitoring Program used in decision support for park management.</p> <p>The overall goal of this project is to develop a flexible ecological nowcasting and forecasting system that combines multiple distributed data sources and models to provide near-real-time answers to questions about the state of the Earth system. By providing a framework for ecological forecasting as well as the post-processing of model outputs needed to visualize the results, TOPS will facilitate rapid data exploration and what-if analysis. This capability will be essential to achieve fully the promise of a Sensor Web, in which multi-terabyte volumes of real-time data are used to support activities ranging from basic science to monitoring and tracking severe weather, natural disasters, and other critical events.</p>				<i>Budget (\$K)</i>	
				FY07	500
<i>Project Monitor and Center</i>	<i>Other NASA Centers</i>	<i>Timeframe</i>	<i>Partners</i>	FY08	0
Gary Geller JPL	ARC	FY03 - FY07	National Park Service	FY09	0
				FY10	0
<i>Principal Investigator(s)</i>				FY11	0
<i>Earth Science Products</i>	mission: Terra, Aqua sensor: MODIS products: TOPS Ecosystem, and TOPS-BGC Forecasts models:			<i>Other Apps.</i>	
				Carbon Management, Water Management, Invasive Species	
<i>Deliverables</i>	<u>Description</u>	<u>End Date</u>	<u>IBPD Metric #</u>		
	Project Plan	6/1/2006			
	Evaluation Report	1/15/2006			
	Design & Implementation	12/31/2006			
	Verification & Validation	9/30/2007			
	Benchmark Report	9/30/2007			
<i>Notes:</i>					

Project: Global Fire Information for Resource Management: Transitioning from a Research to an Operational System with an Emphasis on Protected Areas					Solicitation	
<p>The purpose of this project is to assess the potential for NASA research results to improve the performance of UN FAO's and UNEP's fire management tools used in decision support for fire management.</p> <p>The University of Maryland's Fire Information for Resource Management System (FIRMS) seeks to develop fire alerts for protected area managers around the world. The system will be served through the Food and Agriculture Organization (FAO), the United Nations Environment Programme, and Conservation International.</p>					Budget (\$K)	
					FY07	359
<i>Project Monitor and Center</i>	<i>Other NASA Centers</i>	<i>Timeframe</i>	<i>Partners</i>	FY08	370	
Gary Geller JPL	GSFC	FY05 - FY08	UMD, UN FAO, UNEP, Conservation Int'l	FY09	0	
				FY10	0	
<i>Principal Investigator(s)</i>				FY11	0	
<i>Earth Science Products</i>	mission: <i>Terra, Aqua</i> sensor: MODIS products: Rapidfire products models:			<i>Other Apps.</i>		
				Disaster Management, Carbon Management		
<i>Deliverables</i>	<u>Description</u>	<u>End Date</u>	<u>IBPD Metric #</u>			
	Project Plan					
	Evaluation Report					
	Design and Implementation					
	Verification and Validation	1/30/2007				
	Benchmark Report	1/30/2008				
	Annual report w/V&V, Benchmark	1/30/2007				
	Annual report w/V&V, Benchmark	1/30/2008				
<i>Notes:</i>						

Project: Integrating Earth Science Enterprise Results into Protected Areas Decision Support for the Albertine Rift					Solicitation	
<p>The purpose of this project is to assess the potential for NASA research results to improve the performance of UWA's and ICCN's MIST and SYGIAP used in decision support for protected area management.</p> <p>Under the Albertine Rift protected area management project, the Woods Hole Research Center, in collaboration with partners at the Wildlife Conservation Society, USAID, and managers in the Ugandan and Democratic Republic of Congo park organizations, will extend the benefits of observations and associated models for park management.</p> <p>Uganda Wildlife Authority (UWA) Congolese Institute for Nature Conservation (ICCN)</p>					Budget (\$K)	
					FY07	281
<i>Project Monitor and Center</i>	<i>Other NASA Centers</i>	<i>Timeframe</i>	<i>Partners</i>	FY08	301	
Gary Geller JPL		FY05 - FY08	WHRC, USAID, Wildlife Conservation Society, UWA, ICCN	FY09	0	
				FY10	0	
<i>Principal Investigator(s)</i>				FY11	0	
<i>Earth Science Products</i>	mission: <i>Terra, Aqua, Landsat</i> sensor: <i>MODIS, ASTER, TM, ETM+</i> products: models: <i>Niche models of species distributions for national information systems for protected area management</i>			<i>Other Apps.</i>		
				Carbon Management, Disaster Management		
<i>Deliverables</i>	<u><i>Description</i></u>	<u><i>End Date</i></u>	<u><i>IBPD Metric #</i></u>			
	Project Plan					
	Evaluation Report					
	Design and Implementation					
	Verification and Validation	2/28/2007				
	Benchmark Report	2/28/2008				
	Annual report w/V&V, Benchmark	2/28/2007				
	Annual report w/V&V, Benchmark	2/28/2008				
<i>Notes:</i>						

Project: SERVIR				Solicitation	
<p>The purpose of this project is to assess the potential for NASA research results to improve the performance of CCAD's SERVIR used in decision support for environmental management.</p> <p>SERVIR (known as the Mesoamerican Regional Visualization and Monitoring System) will operate a series of nodes located in the U.S. and each of the Central American countries. Through it, Central American managers can use observational spacecraft imagery to detect wild fires and major changes in land cover, track rainfall and weather patterns, and monitor coastal margins and coral reefs throughout the region. Models can help users understand the poorly known connection between changes in land cover and climate variation. SERVIR combines observational spacecraft imagery from the NASA TRMM, Terra, Aqua, OrbView-2, and Landsat spacecrafts with environmental and socioeconomic data by means of a geographic information system. It also generates visualization products for decision makers and the public. NASA is funding SERVIR through an award under the Research, Education and Applications Solutions Network (REASoN) Cooperative Agreement Notice (CAN).</p>				Budget (\$K)	
				FY07	506
<i>Project Monitor and Center</i>	<i>Other NASA Centers</i>	<i>Timeframe</i>	<i>Partners</i>	FY08	0
Daniel Irwin MSFC	ARC	FY04- FY08	USAID, World Bank, CCAD, CATHALAC, U. Alabama, Huntsville, URF, etc.	FY09	0
<i>Principal Investigator(s)</i>				FY10	0
				FY11	0
<i>Earth Science Products</i>	mission: <i>Terra, Aqua, Landsat, TRMM, GOES, POES</i> sensor: <i>MODIS, ASTER, ETM+, TM, etc.</i> products: models: <i>MM5, WRF,</i>			<i>Other Apps.</i>	
<i>Deliverables</i>	<u><i>Description</i></u>	<u><i>End Date</i></u>	<u><i>IBPD Metric #</i></u>	Disaster Management, Water Management, Carbon Management, Public Health, Coastal Management, Energy Forecasting, Air Quality Management, Agricultural Efficiency	
	Project Plan	10/1/2005			
	Evaluation Report				
	Design & Implementation (Red	8/31/2005			
	Verification & Validation	11/30/2006	5ESA6.F,10.B		
	Benchmark Report	11/30/2006			
Final Report	10/1/2008				
<i>Notes:</i>					

Project: Predicting Right Whale Distributions from Space: An Operational System for Marine Ecosystem Modeling					
<p>The purpose of this project is to assess the potential for MODIS and MM5 to improve the performance of NOAA NMFS's Dynamic Area Management processes used in management for protected marine mammals.</p> <p>This project focuses on use of Earth science observations and models to support dynamic area management (DAM) zones for closure when conditions conducive for presence of right whales exist. Project will incorporate near-real-time satellite data in a copepod growth model alongside a high-resolution atmosphere-ocean circulation model to predict northern right whale aggregation areas in the Gulf of Maine. In an effort to reduce northern right whale deaths, the project will incorporate MODIS/AVHRR water temperature data and phytoplankton concentration information into the coupled models to create right whale likelihood feeding maps. The right whale maps will minimize aerial survey time, allow further evaluation of future management options, and the maps will be used by the community to reduce northern right whale deaths caused by fishing gear and boat collisions.</p>				Budget (\$K)	
				FY07	199
<i>Project Monitor and Center</i>	<i>Other NASA Centers</i>	<i>Timeframe</i>	<i>Partners</i>	FY08	190
Ben Holt JPL		06 - 09	NOAA, Univ. of ME, Cornell, Univ. of MA	FY09 FY10	
<i>Principal Investigator(s)</i>				FY11	
<i>Earth Science Products</i>	mission: <i>Terra, Aqua, QuikSCAT</i> sensor: <i>MODIS</i> products: <i>chlorophyll-a, winds, SST</i> models: <i>MM5, FVCOM</i>			<i>Other Apps.</i>	
				Coastal Management	
<i>Deliverables</i>	<u><i>Description</i></u> TBD	<u><i>End Date</i></u>	<u><i>IBPD Metric #</i></u>		
<p><i>Notes:</i> This is a joint project with the Coastal Management Program Element and the annual budgets are split between the two program elements. The project received Decisions04-Augmentation funding in FY06.</p>					

Project: Integration of a Large-Area Invasives Spread Network (LISN) with Climate Models for Decision Support					
<p>The purpose of this project is to assess the potential for MODIS, CERES, ASTER, AIRSAR, Landsat, and SRTM products to improve the performance of FWS's and USGS's decision support tools used in management for invasive species and threatened and endangered species.</p> <p>This project seeks to integrate a LISN into the USGS Invasive Species Forecasting System through the application of remote sensing-based ecological models, including the CASA model, and a Bayesian framework. This is a joint project with the Invasives Species Program Element. However, the budget is not shared.</p>				<i>Budget (\$K)</i>	
				FY07	346
<i>Project Monitor and Center</i>	<i>Other NASA Centers</i>	<i>Timeframe</i>	<i>Partners</i>	FY08	281
Gary Geller JPL	ARC, GSFC	06 - 09	USGS, FWS, Harvard University	FY09 FY10	
<i>Principal Investigator(s)</i>				FY11	
<i>Earth Science Products</i>	mission: <i>Terra, Aqua, AIRSAR, Landsat, SRTM</i> sensor: <i>MODIS, CERES, ASTER, TM, ETM+, radar</i> products: <i>land cover, NPP, etc.</i> models: <i>CASA, habitat suitability, invasives spread</i>			<i>Other Apps.</i>	
				Invasive Species	
<i>Deliverables</i>	<u>Description</u> TBD	<u>End Date</u>	<u>IBPD Metric #</u>		
The project received Decisions04-Augmentation funding in FY06.					
<i>Notes:</i>					

Project: Ecological Conditions of US National Parks: Enabling Decision Support through Monitoring, Analysis, and Forecasting					
<p>The purpose of this project is to assess the potential for NASA MODIS and Landsat observations and related models to improve the performance of NPS's Inventory and Monitoring Program used in determining status and trends for park management.</p> <p>This project with NPS will help select landscape-level indicators of NPS vital signs and incorporate products from the NASA TOPS into the NPS Inventory and Monitoring Program, focusing on four NPS Inventory and Monitoring Networks: Sierra Nevada, Rocky Mountain, Greater Yellowstone, and Eastern Rivers and Mountains.</p>				<i>Budget (\$K)</i>	
				FY07	291
<i>Project Monitor and Center</i>	<i>Other NASA Centers</i>	<i>Timeframe</i>	<i>Partners</i>	FY08	298
Gary Geller JPL	ARC	06 - 09	NPS, Montana State, Colorado State, Woods Hole Research Center	FY09 FY10	
<i>Principal Investigator(s)</i>				FY11	
<i>Earth Science Products</i>	mission: <i>Terra, Aqua, Landsat</i> sensor: <i>MODIS, TM, ETM+</i> products: <i>land cover, fire effects, biogeochemical cycling, NPP</i> models: <i>TOPS (Biome-BGC, RHESSys), SERGoM</i>			<i>Other Apps.</i>	
<i>Deliverables</i>	<u><i>Description</i></u> TBD	<u><i>End Date</i></u>	<u><i>IBPD Metric #</i></u>		
<i>Notes:</i>					

Project: Utilizing Remote Sensing, Modeling and Data Assimilation to Sustain and Protect Fisheries: Ecological Forecasting at Work						
<p>The purpose of this project is to assess the potential for TOPEX, Jason, QuikSCAT, SeaWiFS, Terra, Aqua data and a state-of-the-art coupled physical-biogeochemical 3D ocean model to improve the performance of NOAA’s stock assessment used in managing for marine fisheries.</p> <p>The projects seeks to integrate TOPEX, Jason, QuikSCAT, SeaWiFS, Terra, Aqua and state-of-the-art coupled physical – biogeochemical 3D model products into ecosystem management practices and fisheries forecasting. The project focuses on the Peruvian anchovy fishery as a testbed for use of tools in similar environments along the US West Coast. This project incorporates sea surface temperature and height, ocean wind vectors, chlorophyll data, and near real-time ocean color data sets into an ecosystem-modeling component. These data will be used in the fishing industry’s decision support tool to improve the long-term sustainability of fish stocks.</p>				<i>Budget (\$K)</i>		
				FY07	165	
<i>Project Monitor and Center</i>		<i>Other NASA Centers</i>		<i>Timeframe</i>		
<i>Partners</i>		FY08		166		
Ben Holt JPL		06 - 09		MBARI, Duke University, University of Maine, IMARPE, NOAA		
<i>Principal Investigator(s)</i>				FY09		
				FY10		
				FY11		
<i>Earth Science Products</i>		<p>mission: <i>TOPEX, Jason, QuikSCAT, SeaStar, Terra, Aqua</i></p> <p>sensor:</p> <p>products: <i>SST, SSH, ocean winds, ocean color</i></p> <p>models: <i>circulation, ecosystem, fishery</i></p>			<i>Other Apps.</i>	
					Coastal Management	
<i>Deliverables</i>		<u>Description</u>		<u>End Date</u> <u>IBPD Metric #</u>		
		TBD				
<p>This is a joint project with the Coastal Management Program Element and the annual budgets are split between the two program elements.</p> <p><i>Notes:</i></p>						

Project: Marine Fisheries Management with NOAA					
<p>The purpose of this project is to assess the potential for MODIS, Jason, QuikSCAT, SeaWiFS data and associated models to improve the performance of NOAA NMFS's stock assessment and species management tools used in managing for marine fisheries and threatened/endangered species.</p> <p>This project implements four project concepts identified at a joint NASA/NOAA Workshop in May 2006 Integrating Satellite Data into Ecosystem-Based Management of Living Marine Resources. The workshop selected four project concepts for funding:</p> <ul style="list-style-type: none"> - Reducing Uncertainty in Alaskan Sablefish Recruitment Estimates - Using Satellite Data to Improve Short-Term Recruitment Predictions for Georges Bank Cod and Haddock Stocks - Improving Rebuilding Plans for Overfished West Coast Fish Stocks through Inclusion of Climate Information - Integrating Environmental, Fisheries, and Electronic Tag Data to Characterize Essential Sea Turtle Habitat in Areas of Significant Bycatch <p>Workshop URL: http://www.pfeg.noaa.gov/events/workshops/NASAworkshop2006/</p>				<i>Budget (\$K)</i>	
				FY07	75
<i>Project Monitor and Center</i>		<i>Other NASA Centers</i>	<i>Timeframe</i>	<i>Partners</i>	FY08
Ben Holt JPL		GSFC	06 - 08	NOAA NMFS	FY09 FY10
<i>Principal Investigator(s)</i>				FY11	
<i>Earth Science Products</i>		mission: <i>Terra, Aqua, Jason, QuikSCAT, SeaWiFS</i> sensor: <i>MODIS, SeaWiFS</i> products: <i>SST, SSH, ocean winds, ocean color</i> models: <i>NMFS stock assessment, etc.</i>			<i>Other Apps.</i>
					Coastal Management
<i>Deliverables</i>		<u><i>Description</i></u>		<u><i>End Date</i></u> <u><i>IBPD Metric #</i></u>	
		Project Plan		11/1/2006	
		Assessment & V&V Status		6/1/2007	
		Demonstration		8/1/2007	
		Benchmark Report		9/15/2007	
This funding is shared with Coastal Management Program Element. Projects began in FY07 based on FY06 funding. <i>Notes:</i>					

B. Directed Projects

The program supports directed projects to serve issues of critical strategic and tactical importance, including near-term opportunities with potential for high-return in developing relationships with partner organizations and where timeliness is critical to maintain.

There are no directed projects for the Ecological Forecasting Program Element.

C. Congressionally-Directed Activities

The program oversees Congressionally-directed activities associated with ecological forecasting issues. The project teams for Congressionally-directed activities are responsible for developing, managing, and reporting on technically-credible and appropriately-budgeted projects aligned with the NASA Applied Sciences Program objectives. The Ecological Forecasting program team interacts with the recipients to align their activities appropriately and facilitates interaction with the program's partners and other investigators.

There are no congressionally directed projects in the Ecological Forecasting Program Element.

V. Program Management & Crosscutting Solutions Support

A. Program Management Activities

The Ecological Forecasting program conducts activities that contribute to the overall management, advocacy, and success of the program. Activities include studies and assessments in informal planning, interagency working group participation, publications and journal articles, support for conferences and workshops, program team meetings, and other related endeavors.

Project: Studies				Program Management	
				<i>Budget (\$K)</i>	
				FY07	15
<i>Project Manager and Center</i>	<i>Other NASA Centers</i>	<i>Timeframe</i>	<i>Partners</i>	FY08	15
HQ		-		FY09	10
				FY10	10
				FY11	10
<i>Principal Investigator(s)</i>			<i>Other Apps.</i>		
<i>Earth Science Products</i>	mission: sensor: products: models:				
<i>Deliverables</i>			<u><i>Description</i></u>	<u><i>End Date</i></u>	<u><i>IBPD Metric #</i></u>

B. Crosscutting Solutions Support

The Ecological Forecasting program works with the Crosscutting Solutions Element within the Applied Sciences Program to develop project concepts and enable coastal management objectives. The program expects to pursue the following activities with the four Crosscutting Solutions sub-elements:

Integrated Benchmark Solutions

- Rapid Prototyping Center a proposed center at Stennis to support NASA and partners in testing and verification of Earth Science results in decision support tools
- Transition from Research to Operations Network (R2O) is a network that focuses on systematically transitioning the results of research to operational uses.

FY07:

FY08:

FY09:

FY10:

FY11:

Solutions Networks

The Ecological Forecasting program plans to work with the Solutions Network activity to identify research results that may be candidates for Integrated System Solutions and/or priorities for Rapid Prototyping activities. The program expects to meet with Solutions Networks representatives on a quarterly basis to review the results that the representatives have identified.

DEVELOP

DEVELOP is a student-based program for rapidly prototyping solutions for state and local applications and helping students develop capabilities related to applied Earth Science.

FY07:

FY08:

FY10:

GIO

The Earth Science Gateway is a "portal of portals" providing an access point through an Internet interface to all web-enabled NASA research results.

FY07:

FY08:

FY09:

FY10:

FY11:

VI. Budget: FY07-11

The following table lists the Ecological Forecasting Program budget for FY2007 - FY2011:

Project	FY07 (\$K)	FY08 (\$K)	FY09 (\$K)	FY10 (\$K)	FY11 (\$K)
SERVIR	506	0	0	0	0
PAM Project Management	278	280	285	285	290
Enhancement of TOPS	500	0	0	0	0
Global Fire Information for Resource Management: Transitioning from a Research to an Operation System with an Emphasis on Protected Areas	359	370	0	0	0
Integrating Earth Science Enterprise Results into Protected Areas Decision Support for the Albertine Rift	281	301	0	0	0
MFF Project Management	75	TBD	TBD	TBD	TBD
MFF (w.Coastal)(if no solicited)		150	150	150	
Habitat Characterization (FWS)	30				
Workshops (07 Yellowstone, NPS, Mon)	50	50	20	20	20
FWS Joint Speaker Series	15	TBD	TBD	TBD	TBD
ESSF/Rebecca Dickson	12	0	0	0	0
Integration of a Large-Area Invasives Spread Network (LISN) with Climate Models for Decision Support	346	281	0	0	0
Ecological Conditions of US National Parks: Enabling Decision Support through Monitoring, Analysis, and Forecasting	291	298	0	0	0
Predicting Right Whale Distributions from Space: An Operational System for Marine Ecosystem Modeling	199	190	0	0	0
Utilizing Remote Sensing, Modeling and Data Assimilation to Sustain and Protect Fisheries: Ecological Forecasting at Work	165	166	0	0	0
Total = \$	3107	2086	455	455	310

VII. Schedule and Milestones for Ecological Forecasting

<i>Project</i>	<i>Start Date</i>	<i>Deliverable</i>	<i>End Date</i>
SERVIR	FY03	Project Plan	10/1/2005
		Design and Implement (Red Tide)	8/31/2005
		V&V Report (Red Tide, Fire, Regional Climate)	11/30/2006
		Benchmark Report (Red Tide, Fire, Regional Climate)	11/30/2006
		Final Report	10/1/2008

<i>Project</i>	<i>Start Date</i>	<i>Deliverable</i>	<i>End Date</i>
NatureServe Decision Support Tool for Western Land Managers	FY03	Evaluation Report	6/30/2005
		Design and Implement	9/30/2005
		Revised Work Plan	7/31/2006
		Benchmark Report	4/30/2007
		DST for Greater Yellowstone Area	6/30/2007

<i>Project</i>	<i>Start Date</i>	<i>Deliverable</i>	<i>End Date</i>
Enhancement of TOPS	FY03	Project Plan	6/1/2006
		Evaluation Report	1/15/2006
		Design and Implement	12/31/2006
		V&V report	9/30/2007
		Benchmark report	9/30/2007

<i>Project</i>	<i>Start Date</i>	<i>Deliverable</i>	<i>End Date</i>
Marine Fisheries Forecasting		Project Plan	11/1/2006
		Assessment & V&V Status	6/1/2007
		Demonstration	8/1/2007
		Benchmark Report	9/15/2007

<i>Project</i>	<i>Start Date</i>	<i>Deliverable</i>	<i>End Date</i>
Global Fire Information for Resource Management: Transitioning from a Research to an Operation System with an Emphasis on Protected Areas		Verification and Validation	1/30/2007
		Benchmark Report	1/30/2008
		Annual report w/V&V, Benchmark	1/30/2007
		Annual report w/V&V, Benchmark	1/30/2008

<i>Project</i>	<i>Start Date</i>	<i>Deliverable</i>	<i>End Date</i>
Integrating Earth Science Enterprise Results into Protected Areas Decision Support for the Albertine Rift		Verification and Validation	2/28/2007
		Benchmark Report	2/28/2008
		Annual Report with V&V Report	2/28/2007
		Annual Report with Benchmark Report	2/28/2008

VIII. Program Measures

The Ecological Forecasting management team uses performance measures to track progress, identify issues, evaluate projects, make adjustments, and establish results of the program element. The program's Goals and Objectives state broadly what the program intends to achieve. These measures help monitor progress within and across specific activities to ensure the program meets its goals and objectives. The management team analyzes these measures retrospectively in order to make adjustments proscriptively to the program approach and objectives.

The measures are in two categories. Program Management Measures are internally focused to assess the activities within the program. Performance and Results Measures are externally focused to assess if the program activities are serving their intended purposes. In general, the Program Manager uses these measures to evaluate the performance of activities conducted and sponsored by the program, especially the projects. The Applied Sciences Program uses this information in preparing Integrated Budget & Performance Document (IBPD) directions and Program Assessment Rating Tool (PART) responses.

In addition to the stated measures, the Program Manager periodically requests an assessment of Ecological Forecasting's plans, goals, priorities, and activities through external review. The Ecological Forecasting team uses

these measures along with comparisons to programmatic benchmarks to support assessments of the Applied Sciences Program (e.g. internal NASA reviews and OMB PART). Specifically, the Program Manager uses comparisons to similar activities in the following programs (i.e., program benchmarks) to evaluate its progress and achievements:

- Environmental and Societal Impacts Group at the National Center for Atmospheric Research
- Global Monitoring for Environment and Security (GMES)

Appendix A: Program Element Partners

A. Program Management

Program Manager:

Mr. Woody Turner, NASA Headquarters

Responsibilities:

- Program development, including program plans and budgets
- Development and implementation of interagency agreements and partnerships with other organizations
- Development and implementation of solicitations for Ecological Forecasting Program tasks
- Primary responsibility for metrics, performance goals and other performance evaluation criteria
- Liaison for relevant U.S. Government interagency initiatives, e.g.: the U.S. Climate Change Science Program (CCSP), the Group on Earth Observations (GEO)—particularly its societal benefit areas of ecosystems and biodiversity, the Congo Basin Forest Partnership (CBFP), the President's Initiative Against Illegal Logging, etc.

Project Manager for SERVIR:

Mr. Daniel Irwin, NASA National Space Science and Technology Center (NSSTC)

Responsibilities:

- Coordination of activities of project partners
- Development of metrics for project success
- Development and implementation of interagency agreements and partnerships
- Meeting project milestones
- Management of development node at NASA NSSTC
- Coordination with primary project facility in Panama
- Presentations on project to audiences around the world

Project Manager for PAM:

Dr. Gary Geller, Jet Propulsion Laboratory

Responsibilities:

- Exploring and evaluating the remote sensing needs of protected area managers and other conservation practitioners in potential partner organizations
- Identifying solutions that leverage remote sensing to address the needs of protected area managers and other conservation practitioners
- Establishment of project goals, milestones, and other measures of success
- Coordination of various activities under this project

Project Manager for MFF:

Dr. Ben Holt, Jet Propulsion Laboratory

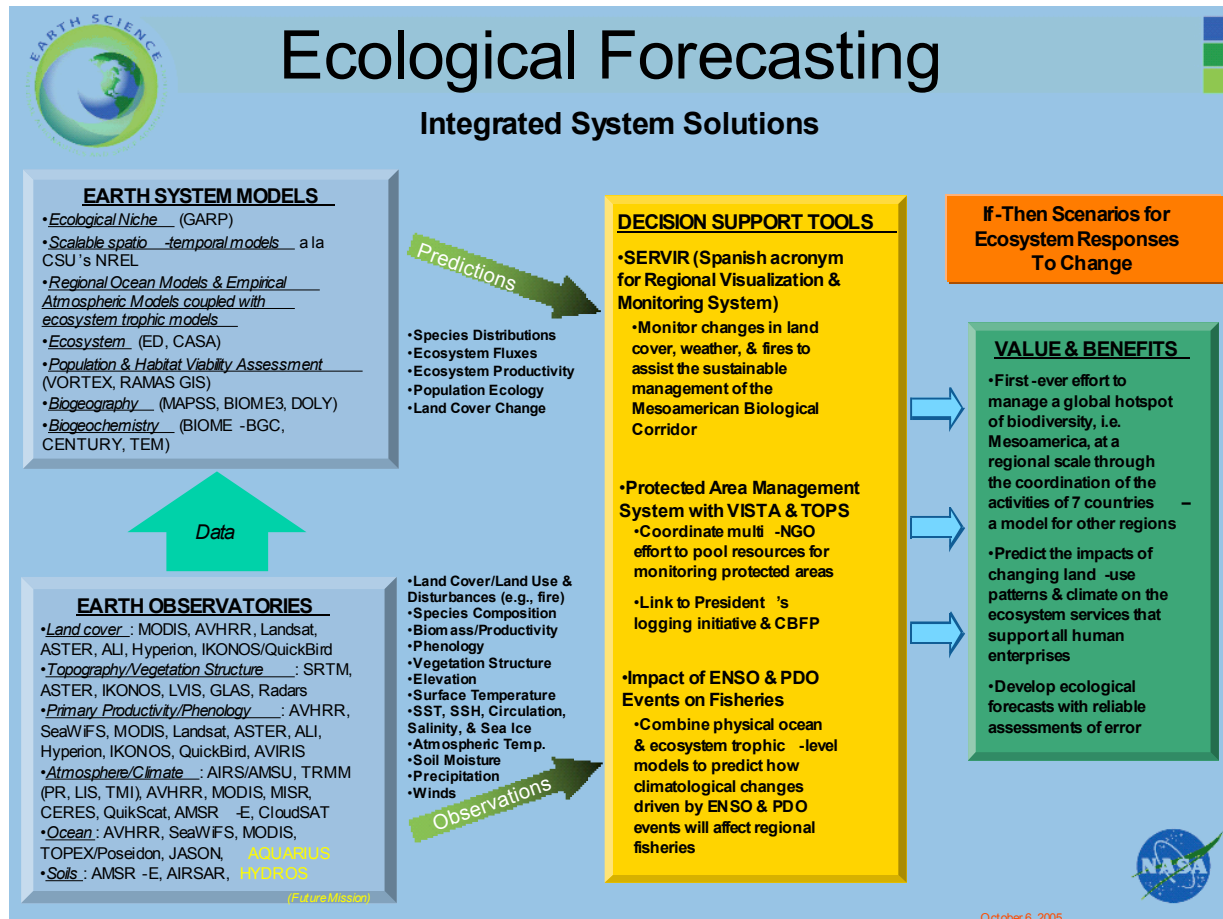
Responsibilities:

- Exploring and evaluating the remote sensing needs of marine fisheries managers and other organizations monitoring fisheries
- Identifying solutions leveraging remote sensing to address these needs
- Establishment of project goals, milestones, and other measures of success

Appendix B: Roadmaps

A. Integrated System Solutions Diagram

The figure below illustrates how Science measurements, model products, and data fusion techniques support the Ecological Forecasting Program's partners and their decision support tools and shows the value and benefits of Science to society.



B. Roadmap

This roadmap for the Ecological Forecasting Program Element brings together relevant space missions, resulting data sets, and the models required to generate outputs for decision support. It shows the steps along the path to reaching a major target for this Program Element - operational Ecological Forecasting systems supporting environmental and natural resource management for sustainable development. In doing so, it builds directly upon the roadmaps for the other Science Focus Areas. Of these, the Carbon Cycle and Ecosystems Focus Area roadmap is especially relevant as some of the technological advances called for here originate on that roadmap.

Road Map diagram being updated

Appendix C: Acronyms

AIRS	Airborne Infrared Sounder
ALI	Advanced Land Imager
AMSR-E	Advanced Microwave Scanning Radiometer-EOS (Japanese)
AMSU	Advanced Microwave Sounding Unit
ARC	Ames Research Center
ASTER	Advanced Spaceborne Thermal Emission and Reflectance Radiometer
AVHRR	Advanced Very High Resolution Radiometer
CAN	Cooperative Agreement Notice
CASA	Carnegie-Ames-Stanford Approach
CATHALAC	The Water Center for the Humid Tropics of Latin America and the Caribbean
CBD	Convention on Biological Diversity
CBFP	Congo Basin Forest Partnership
CCAD	Central American Commission for Environment and Development
CCSP	Climate Change Science Program
CENR	Committee on Environment and Natural Resources
CO ₂	Carbon Dioxide
DAAC	Distributed Active Archive Center (Data Active Archive Center)
DFRC	Dryden Flight Research Center
DHS	Department of Homeland Security
DOA	Department of Agriculture
DOC	Department of Commerce
DOD	Department of Defense
DOE	Department of Energy
DOI	Department of the Interior
DOT	Department of Transportation
DSS	Decision Support Systems
DST	Decision Support Tool
ENSO	El Niño - Southern Oscillation
EO-1	Earth Observing-1
EOS	Earth Observing System
EPA	Environmental Protection Agency
EROS	Earth Resources Observation System
ESA	Ecological Society of America
ESE	Earth Science Enterprise
ESMF	Earth Science Model Framework
ETM+	Enhanced Thematic Mapper Plus
EVI	Enhanced Vegetation Index
EVVB	evaluation, verification, validation, and benchmark
FAO	Food and Agriculture Organization of the United Nations
FEA	Federal Enterprise Architecture
FIRMS	Fire Information for Resource Management System
FPAR	Fraction of Absorbed Photosynthetically Active Radiation
FWS	U.S. Fish and Wildlife Service
GCM	Global Climate Model
GCOS	Global Climate Observing System

GEO	Group on Earth Observations
GEOSS	Global Earth Observation System of Systems
GIG	Global Information Grid
GIO	Geospatial Interoperability Office
GIS	Geographic Information System
GMES	Global Monitoring for Environment and Security
GOES	Geostationary Operational Environmental Satellite
GOS	Geospatial One Stop
GRC	Glenn Research Center
GRID	Graphic Retrieval and Information Display
GSFC	Goddard Space Flight Center
GYA	Greater Yellowstone Area
HYDROS	Hydrosphere State Mission
IABIN	Inter-American Biodiversity Information Network
IBPD	Integrated Budget and Performance Document
IUCN	World Conservation Union
IWGEO	Interagency Working Group on Earth Observations
JCSDA	Joint Center for Satellite Data Assimilation
JPL	Jet Propulsion Laboratory
JSC	Johnson Space Center
LaRC	Langley Research Center
LIDAR	Light Detecting and Ranging
LST	Land Surface Temperature
MBC	Mesoamerican Biological Corridor
MFF	Marine Fisheries Forecasting
MISR	Multi-angle Imaging Spectroradiometer
MM5	Mesoscale Model
MOA	Memorandum of Agreement
MODIS	Moderate Resolution Imaging Spectroradiometer
MOU	Memorandum of Understanding
MSFC	Marshall Space Flight Center
MSS	Multi-Spectral Scanner (Landsat 1)
NASA HQ	NASA Headquarters
NASA	National Aeronautics and Space Administration
NCAR	National Center for Atmospheric Research
NCSE	National Council for Science and the Environment
NDVI	Normalized Difference Vegetation Index
NGO	Nongovernmental Organization
NMFS	National Marine Fishery Service
NOAA	National Oceanic and Atmospheric Administration
NPOESS	National Polar-Orbiting Operational Environmental Satellite System
NPP	NPOESS Preparatory Project
NPS	National Park Service
NRA	NASA Research Announcement
NSF	National Science Foundation
NSSTC	NASA National Space Science and Technology Center
OES	Office of Earth Science

OMB	Office of Management and Budget
OSTP	Office of Science and Technology Policy
PAM	Protected Area Management
PART	Program Assessment Rating Tool
PI	Principal Investigator
QuikSCAT	Quick Scatterometer
R2O	Research to Operations Network
RAMS	Regional Atmospheric Modeling System
REASoN	Research, Education, and Applications Solutions Network
RS	Remote Sensing
SAR	Synthetic Aperture Radar
SBSTTA	Subsidiary Body on Scientific, Technical, and Technological Advice
SCB	Society for Conservation Biology
SeaWiFS	Sea-viewing Wide-Field-of-view Sensor
SERVIR	Regional Visualization and Monitoring System for Mesoamerica
SMD	Science Mission Directorate
SRTM	Shuttle Radar Topography Mission
SSC	Stennis Space Center
SSS	Sea, Surface, Salinity
SST	Sea Surface Temperature
SUNY	State University of New York
TERRA	1st EOS spacecraft
TM	Thematic Mapper
TOMS	Total Ozone Mapping Spectrometer
TOPEX/POSEIDON	Satellite from JPL with Five Instruments
TOPS	Terrestrial Observation & Prediction System
TRMM	Tropical Rainfall Measurement Mission
UCAR	University Corporation for Atmospheric Research
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
URF	University Research Foundation
USAID	United States Agency for International Development
USDA	US Department of Agriculture
USFS	US Forest Service
USGCRP	US Global Change Research Program
USGS	United States Geological Survey
V&V	Verification & Validation
VIRS	Visible Infrared Scanner
VIIRS	Visible/Infrared Imager/Radiometer Suite
WCMC	World Conservation Monitoring Centre
WMO	World Meteorological Organization
WSSD	World Summit on Sustainable Development
YERC	Yellowstone Ecological Research Center

NASA Science Mission Directorate
Earth Science Division - Applied Science Program
Ecological Forecasting Program Element

This document contains the Ecological Forecasting Program Element Plan for FY 2007-2011.

This plan derives from direction established in the NASA Strategic Plan, Earth Science Enterprise and Space Science Enterprise Strategies, Earth Science Applications Plan, and OMB/OSTP guidance on research and development. The plan aligns with and serves the commitments established in the NASA Integrated Budget and Performance Document.

The Program Manager and the Applied Sciences Program Leadership have reviewed the plan and agree that the plan appropriately reflects the goals, objectives, and activities for the Program Element to serve the Applied Sciences Program, Earth Science Division, NASA, the Administration, and Society.

William W. Turner
Program Manager, Ecological Forecasting
Applied Sciences Program
NASA Earth Science Division

Date

Lawrence Friedl
Lead, National Applications
Applied Sciences Program
NASA Earth Science Division

Date

Teresa Fryberger, PhD.
Director, Applied Sciences Program
NASA Earth Science Division

Date