Building a Landscape Level Understanding of Our Resources

The new USGS National Climate Change Viewer shows projected climate-driven challenges.... This information will be valuable to the work of scientists, water and land managers, farmers, and ranchers—as well as all interested citizens.

Sally Jewell, Secretary of the Interior
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The complexity of natural resource issues and changes in landscapes, both natural and human induced, are dramatically increasing in scope and impact. The Department of the Interior recognizes to effectively carry out its mission and priorities in the face of such widespread change, it must understand and make decisions at the landscape scale that balance conservation and development needs and enhance ecosystem and community resilience. Resource planning must consider the effects of management decisions across broader scales and multiple jurisdictions. To do this, Interior conducts applied and basic scientific research, collects data and monitors systems, and provides information and tools to help inform decisionmaking within the Department as well as in local, tribal, State, national, and international communities.

Interior develops the tools to analyze, visualize, translate, and apply science at multiple scales and across multiple landscapes to inform land and resource planning, policy, mitigation, and management. The U.S. Geological Survey and the scientists of the Department's land and resource management bureaus develop and provide baseline information regarding the health of ecosystems and the environment, natural hazards, and the impacts of climate change. This information and expertise is shared and leveraged with other Federal agencies, State and local governments, Tribes, academia, and communities.

With a changing climate, the Nation expects to face significant challenges, including a projected increase in the frequency and intensity of extreme events such as severe storms, wildfire, and drought. To reduce the costs these extreme events pose to communities and natural resources, the Department proposes investments in 2016 to increase the resilience of both coastal and inland communities that face these growing risks. Investments will focus on areas at high risk to climate challenges and will address vulnerabilities to extreme events in partnership with State, local, and tribal governments and other stakeholders.

Increasing landscape level understanding of the Nation's resources is critical to accomplishing Interior's responsibilities. In turn, Interior's scientific information, tools, and partnerships provide vital support to communities also working to address resource challenges and improve resilience. The most significant real world example is the Department's unprecedented coastal resilience effort in the aftermath of Hurricane Sandy. At the core of Interior's Hurricane Sandy recovery and resilience work are landscape level collaborative partnerships with regional stakeholders. As a result, real on-the-ground progress is underway to restore and strengthen coastal ecosystems, such as beaches and tidal marshes, which provide fish and wildlife habitat, storm risk reduction, and economic opportunities. The Department's implementation strategy for the Hurricane Sandy effort includes follow-on evaluations to identify the most effective measures to better promote community resilience.

The 2016 budget reflects the importance of community and ecosystem resilience and proposes to build on the Hurricane Sandy approach with targeted investments that help address vulnerabilities from factors such as flooding or drought in other landscapes. The 2016 budget also proposes investments throughout the Department to improve

scientific understanding related to resource management and expand access to and benefits from this important information.

PRIORITY GOAL
CLIMATE CHANGE

GOAL: Understand, communicate, and respond to the diversity of impacts associated with climate change across the various landscapes of the United States.

METRIC: By September 30, 2015, the Department of the Interior will demonstrate maturing implementation of climate change adaptation methodology as scored when implementing strategies in its Strategic Sustainability Performance Plan.

APPLYING SCIENCE AND ANALYSIS AT THE LANDSCAPE LEVEL

The Department's 2016 budget for research and development supports the Administration's science and technology priorities. Interior plays a pivotal role in collaborative research efforts with other agencies to address key priorities such as conservation, sustainable land management and resource stewardship, and clean and renewable energy development. In addressing global climate change, the Department provides science to help anticipate, monitor, and adapt to climate and ecologically-driven changes to lands, water, and other natural resources. Interior has significant research and development investments that inform policy making and management, including science in natural hazards, management of water resources, safe and responsible oil and gas development and production, rare earth elements, oceans, arctic, Landsat, and ecosystem restoration with critical work in invasive species, and wildlife and avian health.

The 2016 budget includes $1.1 billion for research and development activities throughout the Department, an increase of $140.2 million from the 2015 enacted level. Activities supported by this funding range from scientific observations of the Earth and its systems—including water, wildlife, and plants—to applied field research to better address specific problems such as sea level rise, invasive species, and drought. This research reflects and informs the expertise of Interior's land managers who are on the front lines of a changing climate and confronting the unpredictable nature of its impacts. Interior's science and applied research underpins effective delivery of the agency's mission. These activities are also a smart investment to better understand and predict a changing environment and help prepare and strengthen communities' ability to weather these changes.

The Department's top priorities include leveraging efforts across the bureaus to improve the Nation's understanding of its resources on a landscape level and to apply that understanding to better manage these resources for resilience in the long term. The concept of landscape level management is not new for Interior. For many years Interior implemented collaborative land acquisition, ecosystem conservation, adaptive management, climate mitigation, and resource management planning and monitoring on a landscape scale. More work remains to leverage these efforts to a greater degree, including: assimilating and making available data from these diverse efforts; integrating climate change data; consistently using information as the basis for decisions relating to development and conservation; and sharing tools with stakeholders to improve conservation efforts and reduce conflicts.

In 2013, Secretary Jewell issued her first Secretarial Order, calling for a Department-wide, landscape scale mitigation strategy to encourage balanced development and ensure landscape level planning. The Order calls for consistency and efficiency in the review and permitting of new energy and other infrastructure development projects, while also providing for the conservation, adaptation, and restoration of the Nation's valuable natural and cultural resources. The Order requires Interior's bureaus to use science and technology to create a better understanding of landscapes to advance important conservation goals and achieve development objectives.

The Department developed a strategy outlining the key principles and actions necessary to successfully shift from a reactive project-by-project approach to more predictable and effective management of the lands and resources that Interior manages on behalf of the American public. The strategy outlines four priority areas of ongoing and future work, including geospatial assessments, landscape level strategies, compensatory mitigation programs, and monitoring and evaluation.

RESEARCH AND DEVELOPMENT
(dollars in thousands)

	2015 Enacted	2016 Request	Change
Bureau of Land Management	20,226	31,019	+10,793
Bureau of Ocean Energy Management	70,481	69,256	-1,225
Bureau of Safety and Environmental Enforcement	27,083	26,703	-380
Office of Surface Mining Reclamation and Enforcemt	0	4,399	+4,399
Bureau of Reclamation	76,003	85,935	+9,932
U.S. Geological Survey	665,845	761,141	+95,296
Fish and Wildlife Service	32,476	49,718	+17,242
National Park Service	26,992	28,183	+1,191
Bureau of Indian Affairs	9,500	12,500	+3,000
Wildland Fire Management	5,990	5,990	0
DEPARTMENT OF THE INTERIOR TOTAL	**934,596**	**1,074,844**	**+140,248**

Extreme weather events, including severe storms, wildfire, and drought, are expected to increase in both frequency and intensity in the future. The Department proposes investments in two complementary programs, a Coastal Resilience Fund and a Challenge Cost Share program, to support projects that build both coastal and inland communities' resilience to the impacts of these events. The budget requests $80.0 million for these resilience programs in 2016. The Department will work with internal and external experts to identify focal geographic areas of high risk, natural infrastructure strategies to address vulnerabilities to extreme events in these geographies, and criteria for selecting projects submitted by State, local, or tribal governments or other stakeholders for implementing these strategies.

Coastal Resilience – Understanding and preparing for the impacts of a changing climate is an Administration priority, one in which Interior plays a critical role as both a land manager and as a partner to States, Tribes, and local governments. Interior proposes an investment of $50.0 million for planning and technical assistance to communities, and Tribes; and for projects to improve ecosystem and community resilience. Modeled after the Hurricane Sandy Competitive Grant program, Interior will fund coastal resilience projects that restore natural systems to support both ecosystem and community resilience and will focus on projects with a physical or ecological nexus to Federal lands. This program will incorporate monitoring and performance requirements and will help add to the growing knowledge base on the performance of natural approaches to reducing coastal risks.

For example, the Fish and Wildlife Service's living shoreline project will increase coastal resilience by restoring 337 acres of salt marsh and adjacent uplands on Delaware Bay. The bay was flooded during Hurricane Sandy, eroding salt marsh habitat that is important to wildlife and helps to reduce the impact of coastal storms.

The USGS launched a new Coastal Change Hazard Portal in 2014 to allow online access to information to help understand vulnerability to extreme storms, sea level rise, and shoreline change at local, regional, and national scales. The portal will help as communities seek to take action to increase the resilience of the Nation's coasts. In 2016, USGS will build on datasets, regional geologic studies, and models of coastal change and vulnerability developed and enhanced with supplemental funding in the aftermath of Hurricane Sandy.

Challenge Cost-Share – The Challenge Cost-Share program is a 50:50 partner matching program that funds projects mutually beneficial to public lands and the cost-sharing partner. The Department proposes $30.0 million—split evenly between the Bureau of Land Management, National Park Service, and FWS—to leverage non-Federal investments in projects that increase the resilience of landscapes to extreme weather events with a focus on inland challenges, including wildfire, flooding, and drought.

Tribal Land Resilience – Interior will provide government-wide leadership and funding to Tribes in support of climate preparedness and resilience. Criteria for tribal funding will be developed and prioritized in consultation with Tribes, Alaska Native Villages, and the interagency White House Council on Native American Affairs subgroup on Climate. Funds will be used to develop science tools and training, conduct climate resilience planning, and implement actions to build resilience into infrastructure, land management, and community development activities.

Insular Areas and Resilience – Interior will work with other Federal agencies serving the insular areas to support island communities in planning, preparing, and responding to the impacts of climate, including sea level rise. Climate change is an immediate and serious threat to the U.S.-affiliated insular areas. By their geography and mid-ocean locations, these island communities are on the frontline of climate change, yet among the least able to adapt and to respond to the expected far-reaching effects on island infrastructure, economic development, food security, natural and cultural resources, and local culture. An additional $7.0 million is requested to address needs in the insular areas related to sea level rise by supporting development of infrastructure and community resilience initiatives.

Water Resources Resilience – The Bureau of Reclamation supports resilience in water management through a number of initiatives, including expanded drought planning to effectively respond to severe drought conditions by incorporating a competitive process with prioritization criteria. Another initiative emphasizes Reclamation's efforts to prepare for the impacts of climate change to its infrastructure. It is essential that Reclamation proactively maintain and improve existing infrastructure for system reliability, safety, efficiency, and water conservation, particularly given the likely scenarios for disruption to normal operations due to drought, flooding, and perturbations in the weather patterns.

Ecosystem Services – Interior is a leader in advancing ecosystem services science and policies. The Department is implementing environmental capital recommendations of the President's Council of Advisors on Science and Technology, helping to develop a government-wide research agenda and to formulate Federal guidance on ecosystem services. Interior will continue to focus on standardizing methodologies and developing policies, practices, and tools to directly support the consideration of ecosystem services in decisionmaking across the Department's missions.

Sage Steppe Restoration – There is no greater example of the need to develop and implement a landscape scale understanding than the Department's efforts to restore the West's vast sage steppe ecosystem that supports significant economic activity, including recreation, ranching, and energy development, as well as an abundance of wildlife. More than 350 species call the landscape home, including sage grouse, elk, mule deer, and golden eagles. Federal and State partners are working in an unprecedented collaborative fashion to put a comprehensive plan and adequate protections in place to conserve this imperiled sagebrush landscape in the face of threats, such as fire, invasive species, expanding development, and habitat fragmentation. Many of these threats are only exacerbated by climate change. Conservation success will require effectively targeting conservation, restoration, and fire suppression activities across the landscape with informed planning, resource allocation, and management activities.

In support of this effort, BLM is amending more than 70 land use management plans to protect the habitat Federal and State experts have identified as most important to sage grouse and other wildlife, while steering economic development activity to those areas with less conflict. The BLM, USGS, and FWS have coordinated with State partners to develop decision tools that will focus fire prevention, suppression, and restoration activities on those areas most likely to deliver results. In 2016, BLM will implement the habitat restoration, conservation and monitoring commitments in these plans and new tools.

In 2015, Secretary Jewell issued a Secretarial Order calling for a comprehensive science-based strategy for preventing and suppressing rangeland fire and restoring sagebrush landscapes impacted by fire across the West, particularly in the Great Basin region of California, Idaho, Nevada, Oregon, and Utah.

The strategy will begin to be implemented during the 2015 fire season. Goals include reducing the size, severity, and cost of rangeland fires; addressing the spread of cheatgrass and other invasive species; and positioning wildland fire management resources for more effective rangeland fire response.

Wildland Fire Resilient Landscapes – The 2016 budget includes $30.0 million in a new Resilient Landscapes program within the Wildland Fire Management budget which will assist in providing additional resources to address this issue. This is an increase of $20.0 million above the 2015 enacted level for these activities. The funding will enable the Wildland Fire Management Program to leverage the shared goals of bureau resource management programs and treat large landscapes to achieve and maintain fire-adapted ecosystems that both reduce the threat of catastrophic wildfire and achieve restoration and other ecological objectives.

Department of the Interior Climate Science Centers – The Climate Science Centers provide science and technical expertise to help improve understanding of climate impacts on fish, wildlife, and landscapes. The CSCs provide meaningful linkages between research and specific decisions that Federal, State, Tribes, and local agencies make at a landscape scale. New projects started in 2015 include the Northwest evaluation of drought impacts on migratory waterfowl in California's Central Valley and southern Oregon. Additionally, the Southwest CSCs have begun research to understand the long-term effects of drought on western ecosystems and vegetation. In 2015, the Northeast CSC will begin work with tribal governments to ensure the latest climate information is available for use in adaptation planning on tribal land and waters. The CSCs are working closely with the Bureau of Indian Affairs to support placement of extension agents with the CSCs to support tribal adaptation planning. Work proposed in 2016 will build on relationships with BIA and help to develop capacity to manage climate impacts on the natural resources managed by the Tribes. In 2016, the Alaska CSC will begin work on estimating total glacier loss in Alaska and potential changes in freshwater input.

Desert Renewable Energy Conservation Plan – The recently released draft Desert Renewable Energy Conservation Plan is another example of Secretary Jewell's landscape scale management and mitigation philosophy. This plan was jointly developed by the Department of the Interior and the State of California to facilitate renewable energy development in the desert regions of southern California while still effectively conserving and protecting the desert's valuable ecological, cultural, and recreational resources. The draft plan, released for public comment on September 23, 2014, is the result of an extensive public participation process which included collaboration among BLM, FWS, the California Energy Commission, the California Department of Fish and Wildlife, and other stakeholders.

The draft plan evaluates 22.5 million acres of public and non-public land in the California desert and recommends designating a total of two million acres as appropriate for future solar, wind, and geothermal projects. Renewable energy developers in this area will benefit from improved permit timing and cost certainty from this up-front consolidated planning approach. Another 4.9 million acres managed by BLM will be set aside for conservation areas. The draft plan has three key components that support the Desert Renewable Energy Conservation Plan's goals: the BLM land use plan amendment will designate renewable energy development areas and set aside areas for wildlife, cultural, and recreational values across the ten million acres of public lands in the planning area; the FWS General Conservation Plan will allow FWS to streamline the permitting process for renewable energy applicants on non-Federal lands who agree to comply with the terms and conditions of the General Conservation Plan; and the California Department of Fish and Wildlife Natural Community Conservation Plan will identify and provide for the regional or area-wide protection of plants, animals, and their habitats, while allowing compatible and appropriate economic activity.

Arctic Science Strategy – Although the arctic experienced warming and cooling cycles over millennia, the current warming trend is unlike anything previously recorded and is affecting the region faster than any other place on Earth, bringing dramatic reductions in sea ice extent, altered weather, and thawing permafrost. Implications of these changes include coastal erosion that threatens villages and critical infrastructure, changes in fish and wildlife habitat, increased greenhouse gas emissions, threat of invasive species, and impacts to subsistence activities and cultural resources. In 2016, Interior bureaus will take a whole system approach to study the many dimensions—physical, biological, social, and economic—of sea ice, permafrost, and glacial loss. This approach will be driven by near-term defined needs of stakeholders and will build cross-disciplinary teams of scientists using a blend of monitoring and modeling within a collaborative

framework. This research will directly inform the Administration's interagency approach to managing natural resources in the region, known as Integrated Arctic Management. The IAM is the arctic expression of a landscape level approach to management, and provides a framework for multiple jurisdictions to work together on larger scales to manage common resources and values.

A significant portion of the Nation's undiscovered oil and gas potential, and a vast portion of the Nation's wildlife, biodiversity, and wild places can be found in the U.S. arctic. But the arctic is not simply a place of ice, oil, and wildlife—it is also a place where people live. Alaska Native communities require sustainable economies and infrastructure as well as thriving ecosystems to support their subsistence ways of life and other culturally important practices. Tribal communities increasingly face pressures that threaten their traditional and spiritual vitality, including land use change, altered water availability and quality, bioaccumulation of contaminants in food webs, vector-borne and zoonotic diseases, and environmental threats to fish, wildlife, and human health.

The USGS will focus work in geographic areas where ice loss and impacts to arctic ecosystems and northern communities is the greatest. These areas include the Beaufort and Chukchi Sea, coastal regions and associated North Slope river basins, and important glaciated regions of Alaska. Efforts will focus on science to inform sustainable development of resources in the right places and the right ways and will balance required mandates to conserve the Nation's unique marine, coastal, and terrestrial arctic ecosystems under Interior's stewardship. Whenever possible, local traditional knowledge will be integrated with analytical approaches to develop joint learning through emerging models and tools.

Landscape Conservation Cooperatives – The Department's adaptive management and climate research activities require a landscape level approach to address climate-related land management efforts. The vision of resource management at the landscape scale began with the creation of an innovative partnership with other land and resource managers in the Southeast. Drawing from this vision, Interior and its Federal, State, and tribal partners created a network of 22 Landscape Conservation Cooperatives to support and enhance on-the-ground conservation efforts. The Department is working to incorporate climate change assessments into agency program management plans to ensure a long-term approach in the management of land, water, and species for the Nation.

The budget request for LCCs accelerates engagement with partners to leverage base program efforts and generate more information to help Interior and stakeholders adaptively manage lands and wildlife. As the LCC network is maturing, more public and private decisionmakers are using the tools and information LCCs generate by entering into partnerships with the LCCs to promote adaptive management of fish and wildlife, and providing additional support, including funding and in-kind support.

Developing And Sharing The Scientific Data And Tools For Landscape Level Understanding

The Department's science programs provide an array of data and tools to analyze management and resource trade-offs and to identify the long-term impacts of decisions. Interior is incorporating the use of tools such as geospatial data, remote sensing, predictive modeling, scenario development, forecasting, and simulation into land management activities. The following examples are but a few of the many landscape scale data sets, research, and tools supported by Interior.

Land and Water Resources Data Collection, Monitoring, and Analysis – In 2016, the USGS Mineral Resources Program will significantly expand research on the interactions of mineral resources with the environment, both in terms of natural interactions and those resulting from resource extraction. In 2014, USGS released the first ever soil landscape geochemistry study of the conterminous United States, which is built on 4,860 sampling sites across the Nation. The product of the study is an atlas of maps showing the distribution of 45 major and trace elements and major mineralogical components. Continued efforts in 2015 will analyze the causes and implications of these soil variations, including examination of identified anomalies for elements—such as arsenic, mercury, and lead—to determine possible sources and geochemical vectors for mobility. Combined with the program's six new environmental impact projects underway in 2015 and continuing in 2016, the soil landscape study will foster better understanding among stakeholders of emerging environmental health challenges for future mining.

The USGS has 42 years of high resolution Landsat data used to document natural phenomena over

ARCTIC COLLABORATIONS

Interactions between permafrost degradation, hydrology, and vegetation are key for understanding climate change impacts in arctic Alaska. In collaboration with a variety of State and Federal agencies and Alaska Native groups, the USGS Alaska Climate Science Center is combining field measurements, ecosystem modeling, and downscaled climate projections to predict how and where permafrost will change over coming decades. This research produced novel results, including insights into how fire might actually slow permafrost melt in some high-latitude forests, and how subsidence after permafrost loss could significantly alter water availability at local to regional scales. In turn, these findings are being applied to a wide array of resource management challenges, ranging from providing access to mineral deposits to wildland fire management, to improving human health and basic services, such as water and sewer, in Native communities.

The Jago, Okpilak, and Hulahula Rivers in the arctic are heavily glaciated watersheds that are important for fish and wildlife, subsistence, recreation, and potentially resource extraction on the coastal plain. A research project funded by the Alaska Climate Science Center will improve understanding of how inputs from glacier dominated arctic rivers differ from unglaciated rivers and will, in turn, improve the ability of resource managers to plan for potential changes in downstream ecosystem responses that may be different from region to region along the Arctic Ocean coast.

Coastal temperate rainforests along the Gulf of Alaska are experiencing high rates of glacier mass loss, primarily due to changes in climate. A research project funded by the Alaska Climate Science Center will develop methods to quantify runoff from watersheds along the Gulf of Alaska, thereby allowing an assessment of impacts on coastal ecosystems.

time, such as drought, wildfire, and human activities like agriculture and urban development. The USGS uses Landsat data to examine land use and land cover change with significant benefits to resource managers. In 2015 and 2016, USGS will release important Landsat science products for climate and natural resource assessments. Included in these are product datasets that illustrate wildfire burned areas, surface water, and snow covered areas for monitoring current and predicting future drought and fire conditions. The new Landsat datasets will enable near real time land cover change detection and analysis and will be accompanied by enhanced data access and delivery services. These capabilities will enable users to retrieve thematic or quantitative information for prescribed areas of interest and periods of time in a format more readily useable in models and decision support systems.

Data Access, Integration, and Application – The Geospatial Platform, a collaborative Internet-based "one stop shop," facilitates landscape level planning by integrating various data from Federal agencies and partners, such as universities, private organizations, and tribal, State, and local governments. As the managing partner for the Geospatial Platform, Interior leverages 21st century geographic information system tools to transform vast amounts of data on landscapes and resources into useful information to inform land use decisions to help power the future, ensure healthy landscapes, and achieve sustainable supplies of water. Decisions affecting the siting of energy development, water resource allocations, recreation, conservation of habitat, identification of transmission line rights-of-way, mitigation for development activities, and other land uses are increasingly interconnected on an ever changing,

climate impacted landscape. This open data integration effort increases the applicability and value of the information to identify potential land use conflicts earlier, saving time, resources, and litigation expenses. In addition to informing government decisionmakers and geospatial experts, the user community for this information includes emergency response planners, non-governmental organizations, scientists, entrepreneurs, innovators, transit authorities, and meteorologists, to name a few. For example, the GeoPlatform site hosts a map showing the projected rise in sea level along the New York and New Jersey coastlines. This map and related tools could help communities, civic planners, residents, and other stakeholders consider risks from future sea level rise as they plan for reconstruction following Hurricane Sandy.

Biodiversity Information Serving Our Nation is a national integrated resource for Federal and non-Federal biological occurrence data managed by USGS. The BISON includes more than 168 million records of species occurrences that cover every State, county, and congressional district in the United States. The BISON serves as the U.S. connection to the Global Biodiversity Information Facility and is the biodiversity hub of the EcoINFORMA informatics capability recommended in the July 2011 report on sustaining environmental capital by the President's Council of Advisors on Science and Technology.