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Introduction

Earth observations data play a unique and critical role in supporting assessments and policy decisions related to global climate change. Space-derived Earth observations, the subject of this issue brief, have already figured prominently in understanding the science of climate change.[1] During the coming years, these data will become even more useful for informing not only science, but policy—helping decisionmakers to formulate policy, as well as understand the outcomes of climate-related policy decisions.

Earth observations data are information about natural and environmental resources, including Earth's processes and climate, collected from instruments on a variety of platforms such as aircraft, balloons, buoys, and satellites. The observations provide data not only on climate-related phenomena (for example, temperature and sea level) but on other resources as well—spatial and temporal changes in land use, air quality and aerosols, water quality and quantity, and ecosystems, to name a few.

1 See National Research Council 2007 and 2008 for summaries.

Existing Use of Earth Observations in Decision Support

Existing decision-support systems already make extensive use of Earth observations. Federal agencies operate large-scale, computer-based models that use a variety of data, including Earth observations, to carry out their statutory responsibilities. For instance, the U.S. Department of Agriculture (USDA) has long used data on land use, weather, soil moisture, and other resources to forecast worldwide crop production. The U.S. Environmental Protection Agency (EPA) maintains a model using a variety of Earth observations data to evaluate air quality. The U.S. Department of Energy (DOE) evaluates deployment of renewable energy technology based in part on Earth observations of solar, geothermal, biomass, and wind resources. Additional public- and private-sector decisions at the federal, state, and local levels are based on Earth observations information.

Elements of a Possible National Climate Policy

As U.S. climate policy is developed, these existing decision-support systems are likely to be the first to extend use of Earth observations to address climate-related concerns. The data will also be critical for other elements of national climate policy. For example, leading Congressional proposals include several provisions for which Earth observations will be useful (see Table 1).[2] These include:

- Use of a cap-and-trade system to reduce greenhouse gas (GHG) emissions. Cap-and-trade systems, which are conceptually identical to emissions taxes, establish a cap on the amount of GHGs that can be emitted throughout the country. An individual producer of emissions would have permits for a certain amount of emissions each year. Producers with fewer emissions could sell excess permits to those who exceed their limits. The intent is to reduce and eventually stabilize greenhouse gas emissions. Proposals vary in the total level of emissions allowable over time and the rules for trading permits.
- Use of a system of offsets, which allow producers and consumers to make payments or engage in other trade-like arrangements in lieu of reducing greenhouse gases. Examples include payments for afforestation, reforestation, or avoided deforestation to make use of the natural capacity of forests to store carbon.
- Development and deployment of new, less carbon-intensive technology. In some cases, proposals allocate revenues from a cap-and-trade program to energy research and development, including renewable energy.
- Strategies to address competitiveness issues. A key concern, particularly of U.S. industry, is the extent to which the expenses of greenhouse gas reductions increase the cost of U.S. exports of goods and services, placing them at a disadvantage relative to industry in other countries. Some proposals exempt certain industries from mandatory emissions reductions. Others include provisions for "border taxes," or tariffs on imports to adjust their price—for example, for the carbon content of imported goods.

The costs of these policies vary widely and some estimates are potentially large—most suggest at least several percent of GDP. Just as important as those potential cost increases is the fact that costs begin to be incurred immediately. However, benefits of GHG mitigation will occur much further into the future and can be very subtle in terms of tangible, visible effects. In addition, policies may not achieve their intended objectives or result in unintended consequences. Policies will also undergo constant evaluation and revision.

2 See Kopp and Pizer 2007, for further detail on these potential attributes of U.S. policy approaches to climate management.

Role of Earth Observations in Climate Policy

For these reasons—large, near-term costs and diffuse, long-run benefits, together with the unknown effects and interactions of policies—decisionmakers, regulated industries, and the public at large will naturally demand information to decide "Are these policies worth it? Are they working?" Earth observations provide a basis to help inform answers to questions such as these. (Moreover, Earth science itself will be in the spotlight to show useful results, particularly as the satellite-based and other infrastructure by which to collect data are funded under increasingly difficult national fiscal conditions—including the long-run challenges of funding social security and Medicare—and particularly if satellite missions encounter cost overruns.)

While the structure and scope of a national climate policy are not yet known, specific courses of action to make the best use of Earth observations for policymaking can be based on general themes described above (demonstrations of relevance to offsets, such as those for forest assessment; understanding and measuring renewable energy potential; changes in land use and air quality). Earth observations can serve as a basis for policy design by assisting in establishing baselines for emissions reductions and identifying what policy outcomes might be best measurable from the unique vantage point of space. In other words, policy can only be effective if its efficacy can be observed. Earth observations can help to supply information relevant to policy evaluation.

It is important to note that observations need not be limited to GHGs themselves or to climate-specific phenomena like temperature. On the contrary, observations of other natural and environmental resources, especially those affected by climate policy, are highly important. Understanding the effects of policies on nonmarketed resources, such as terrestrial and marine ecosystems and freshwater systems, and on specific sectors such as electricity and transportation, is imperative. So, too, is application of Earth observations data that can point to effects of climate and climate policy outcomes on public health, including effects among different demographic groups (such as the vulnerability of the elderly to heat stress). In addition, these data can help disentangle complicated effects of climate policy, such as reallocation of land to biofuels production and subsequent reduction in land functioning as a carbon sink. Possible specific applications of Earth observations for design, implementation, and assessment of policy include the following:

- Establishing baselines and periodic checkups and adjustments (not just operational information but research as well)
- Quantifying CO_2e (thus, greenhouse gases including CO_2, N_2O, CH_4, HFCs, PFCs, SF_6)
- Observing other climate variables and proxies for them (e.g., land use, tree cover, freshwater quality and quantity, and ecosystem status)
- Contributing to understanding effects of many types of mitigation policy
- Informing assessment of overall effects (costs) to the economy, various sectors (e.g. electricity, transport, agriculture), demographic groups, and managers of environmental and other nonmarketed natural resources
- Observing unintended effects (e.g. reallocation of land to agricultural production and its effects on carbon sequestration)
- Assessing effects of offsets
- Assessing effects of possible banking regimes (by consistently observing policy effects over time)

What About Adapting to Changes in Climate?

Far fewer congressional proposals address adaptation to a changing climate (see examples in Table 2). Adaptation is usually taken to mean the capacity of society to respond to or cope with changes in climate, both with respect to mean temperatures or rises in sea level, for example, and to increases in variability. For example, will physical infrastructure need to be built to withstand more rapid cycles of freezing and thawing, or greater chances of floods? To date, proposals on adaptation tend to be limited to calls for protection of specific resources (such as wildlife or coastal environments) or for studies to develop multiyear strategic plans. Some suggest establishing a National Climate Service under the auspices of the National Oceanic and Atmospheric Administration.

To the extent that climate change is gradual rather than abrupt, and variability of day-to-day or seasonal effects is predictable, consumers and industry may be able to adapt readily. Prices of goods and services will reflect changes in resource abundance, scarcity, and use. The insurance and reinsurance industries are also developing enhanced capacity to cushion risk. This is not to underestimate the challenge of adaptation, particularly for fragile ecosystems, or the effects on the distribution of adaptation's costs and benefits. In fact, the most pressure on government to respond to climate change may be in redistributing income to alleviate effects on lower-income groups or compensate other demographic or industrial sectors.

In addition to protecting ecosystems and providing compensation, another role of government in enhancing society's adaptive capacity is to mitigate the uncertainty associated with decisionmaking in the face of climate change. Fulfilling this role requires precisely the kind of information offered by applications of Earth observations. In identifying roles of government in adapting to a changing climate, for each of the following issues, the key question about Earth science applications is this: To what extent will the most important role involve provision of information, particularly those applications which anticipate effects on resources and help to interpret the effectiveness of mitigation and adaptation actions?

- To what extent will markets (price signals) fail to work? They may work well if adaptation requires gradual change rather than abrupt response. We may see very little role for government.
- To what extent will insurance provide the capacity to cushion risk for private goods? What information will insurers and reinsurers require about possible extremes in climate-related natural phenomena? Who should supply this information and who should pay for it?
- To what extent will equity concerns pressure government to redistribute income? A geographically targeted response calls for downscaled Earth science applications products.
- To what extent will nonmarket public goods, particularly natural resources and environmental goods, require public intervention? Stewardship of these resources has traditionally been a role of government and has required federal agency reliance on Earth science information.

Federal Agencies

While comprehensive national policy has yet to emerge, federal agencies are now beginning to consider the implications of climate change with regard to their legislative mandates. Several of the decision-support systems used by these agencies are identified above. A recent report by the U.S. Climate Change Science Program goes into more detail.[3] The report documents use of Earth observations data by various agencies and organizations, and how they may adjust their use to address climate issues. For example:

- In the case of USDA, the agency will need to consider the influences of climate change on crop productivity. USDA already monitors changes in agricultural practices in response to policy; such changes can themselves affect climate—for example, changes in land use alter natural sequestration capacity.
- The Tennessee Valley Authority in conjunction with the University of Colorado, Boulder and the Army Corps of Engineers operates a water management tool, RIVERWARE, which at present uses large amounts of Earth observations data and for which climate change has direct effects on reservoir management.
- The Hybrid Optimization Model for Electric Renewables (HOMER), operated by the National Renewable Energy Laboratory, provides guidance for renewable energy deployment and thus is directly influenced by climate policy. Some climate-related legislative proposals increase use of renewable energy, and others allocate revenue from a cap-and-trade system to energy research and development.
- Understanding the effects of a changing climate on public health is the focus of a decision tool operated by the Centers for Disease Control and Prevention and Yale University.
- EPA operates the Community Multiscale Air Quality model (CMAQ), linking climate directly to air quality and also linking climate-related responses in land and energy use to air quality.

What About the Rest of the World?

In all respects, U.S. climate policy is inherently carried out in an international context. In addition to the very real issue of climate as a collective public good requiring cooperation of all major GHG-emitting countries,[4] there are at least two additional and immediate issues of specific relevance to Earth science applications. One is the role of Earth observations in offset policy, as noted above. Much of the stock of forest carbon assets is in tropical countries, although boreal and temperate forests play a role as well.

An international carbon offset market will require forest assessment if the market is to function successfully.[5] The other issue is the role the United States will continue to play in the Group on Earth Observations/ Global Earth Observations Systems of Systems (GEO/GEOSS), in which climate-related activities are now beginning. It is a voluntary consortium of governments and international organizations coordinating development of a global system of Earth observations by combining the activities of member countries. GEO began as a result of recommendations by the G8 meetings in 2002 and now includes 74 countries, the European Commission, and 51 other organizations.

3 U.S. Climate Change Science Program 2008.

4 See Barrett 2006 and Aldy and Stavins 2007 for in-depth discussion.

5 See discussion of measuring and monitoring issues in DeFries et al. 2006.

Technological Advance Enabling Use of Earth Observations

Google Earth, Microsoft Virtual Earth, World Winds software, iPods, and G3 (new broadband technology) are all means of enhancing understanding of human relationships with natural and environmental resources. Looking to the future, continued innovation in information technology that allows both the use and an appealing visualization of Earth observations promises new opportunities for demonstrating and realizing the value of applications of these data.

Summary

Applications of Earth science data can inform and advance effective climate policy, beyond their already significant importance in understanding climate phenomena. Federal agencies are likely soon to incorporate climate-related concerns in the stewardship, management, and regulation of natural and environmental resources. In many cases, the agencies already include Earth observations in their decision-support systems and are thus primed for climate-related applications of these data. The use of these data made by agencies will remain problematic, however, as the question of who pays for data inevitably arises and the problem of free riding impedes the ability of Earth observations' managers to demonstrate the benefits.

The specific details of congressional policy proposals are still unclear but general themes include a possible cap-and-trade system, offsets, and emphasis on development and deployment of renewable energy. Earth science applications can inform design, implementation, assessment, and evaluation of all of these policy dimensions. Unfortunately, the congressional staff involved in climate policy scarcely, if at all, overlap with their counterparts in the committees overseeing Earth science and its applications. In fact, to ensure effective policy outcomes, a closer coupling of policy design with the capacity of applications of Earth observations is highly desirable.

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Table 1: Summary of Market-Based Climate Change Bills Introduced in the 110th Congress

Authors: Raymond Kopp, Joseph Aldy, and Daniel Hall. www.rff.org/climatechangelegislation

CURRENT AS OF DECEMBER 3, 2008

	WHO'S REGULATED	ALLOWANCE ALLOCATION	COST CONTAINMENT	OFFSETS	TECHNOLOGY	COMPETITIVENESS
Lieberman-Warner (S. 2191), as passed out of EPW	Economywide cap: coal and process emissions at emitters; oil refiners, NG processors, and oil/NG importers; and F-gas producers and importers. (Over 85% of U.S. GHG emissions covered.) HFC producers and importers have a separate cap.	33% free to industry (including electric generators), with phase out; 11% to energy customers; 26.5% auctioned (gradually increased to 69.5%) to fund technology deployment, transition assistance, and adaptation; 9% set aside for CCS and sequestration; 10.5% to states; 5% for early action.	"Climate Fed" with discretion to increase use of borrowing and offsets and temporarily expand cap. Borrowing: up to 15% of allowances, for no more than 5 years.	Up to 15% of compliance obligation can be met with domestic sequestration, and another 15% through international allowances and credits.	Technology deployment incentives for zero- and low-carbon generation, advanced coal, cellulosic biomass, and advanced vehicles (around 13% of allowance value). Plus 4% of allowances as bonus for CCS projects.	Bulk, energy-intensive imports from countries w/o comparable policy require "int'l reserve" allowances" (essentially a border tax) after 2020.
S. 3036, L-W substitute amendment	Adds coverage of NG produced in federal waters of Alaska Outer Continental Shelf. Otherwise identical.	32% free to industry w/ phase out; 13% to energy consumers; 28% used for federal programs, incl. technology, transition assistance, adaptation, and deficit reduction; 15% to states; 12% for CCS, sequestration, and early action.	Adds a reserve auction for 2012–2027 at $22–30 per metric ton. Establishes a floor price for regular auctions of $10/ton.	Domestic offsets for up to 15% of the annual cap; int'l offsets up to 5%; int'l forest carbon offsets up to 10%. Int'l allowances may be used if these limits are not met, but total offsets limited to 30%.	Similar provisions but decreased funding (now around 10% of allowance value). 3% for CCS bonus allowances.	Allowances required starting in 2014. More imports covered, both primary products and manufactured goods.
Dingell-Boucher (October 2008 draft)	Economywide cap: electric and industrial facilities at emitters; producers and importers of petroleum and F-gases; NG distributors. (Over 85% of U.S. GHG emissions covered.) Phase-in of coverage for industry (2014) and NG (2017).	Four proposed allocation schemes: all include appr. 10% each for EE, clean tech., and low income assistance. One focuses allocation on the electricity sector, a second on the industrial sector, a third on industry and federal programs, and a fourth on consumer rebates.	Reserve auction, with reserve price at $20–30/MT in 2012; rises to 30–100% above rolling spot price average. Borrowing: up to 15% of allowances, 5-year limit, 8% ann. interest.	Initially 5% of obligation can be met with domestic and international offsets; gradually increasing to 35% of obligation in 2025 (20% domestic, 15% int'l). Unlimited int'l emissions allowances from 2025.	National building codes increase efficiency; allowance revenues for state EE funds; bonus allowances for CCS and renewables; funds for deploying advanced vehicles and biofuels.	Importers of emissions-intensive goods from countries w/o comparable policy must buy int'l reserve allowances.
Waxman (H.R. 1590)	Economywide cap: point of regulation at discretion of EPA. (Coverage TBD by EPA.)	Discretion of the president with guidance from the EPA.	No provisions.	No provisions.	Vehicle emissions rules; efficiency & renewable standards for electric generation; additional bill-specific mandates.	No provisions.
Markey (H.R. 6186)	Economywide cap: electric and industrial facilities at emitters; producers and importers of petroleum and F-gases; NG distributors. (Over 85% of U.S. GHG emissions covered.)	6% free to industry w/ phase out, 94% auctioned. (100% auction by 2020.) Revenues: 50% to general fund; 25% to tech. RD&D; 17.5% to domestic transition assistance, adaptation, sequestration, and conservation; 7.5% to international projects.	Borrowing: up to 15% of allowances, for no more than 5 years with 10% annual interest rate.	Up to 15% of obligation can be met with domestic offset credits; an additional 15% can be met with international emissions allowances or offset credits.	Creates tech. fund w/ 4% of revenues to renewable & efficiency RD&D, 5% to commercial renewables, 2.5% to CCS, and 1% to tech. rebates. 12.5% to national energy efficiency fund.	Importers of energy-intensive primary goods from countries w/o comparable policy must buy int'l reserve allowances.

TABLE 1 CONTINUED ON PAGE 8

	WHO'S REGULATED	ALLOWANCE ALLOCATION	COST CONTAINMENT	OFFSETS	TECHNOLOGY	COMPETITIVENESS
Bingaman-Specter (S. 1766)	Economywide cap: coal and some industrial emissions at emitters; oil refiners, NG processors, and oil or NG importers; and F-gas producers and importers. (Over 85% of emissions covered.)	53% free to industry (with phase out); 24% auctioned to support R&D, transition assistance, and adaptation; 14% set aside for CCS and sequestration; 9% to states.	$12/metric ton CO_2 safety valve, rising at 5% per year above inflation.	Unlimited domestic offsets including methane and SF_6. Limits on international offsets (10% of cap) and domestic agricultural offsets (5% of cap).	Detailed technology development programs funded from allowance auction revenues (12-26% of auction revenues).	Bulk, energy-intensive imports from countries w/o comparable policy require permits after 8 years.
Doggett (H.R. 6316)	Economywide cap: coal and process emissions at emitters; oil refiners, NG processors, and oil/NG importers; and F-gas producers and importers. (Over 85% of US GHG emissions covered.)	15% free to industry (with phase out by 2020); remainder auctioned, with revenues used to reduce the deficit, provide tax rebates and consumer assistance (incl. money for health care), and fund adaption, transition assistance, and technology R&D.	Carbon Market Efficiency Board has discretion to increase use of offsets and temporarily expand the cap by up to 5%.	Up to 15% of compliance obligation can be met with int'l forest carbon offsets; up to 10% from domestic offsets (no more than 4% from domestic agriculture offsets).	Limited funding for basic renewable energy R&D. Bill also provides funding for domestic energy efficiency and overseas technology assistance.	Importers of emissions-intensive goods from countries w/o comparable policy must buy int'l reserve allowances from 2015.
Udall-Petri (May 2007 draft and staff talks)	Economywide cap: upstream fossil-fuel sources (e.g., producers and importers), along with industrial emissions. (About 80% of emissions covered.)	20% free to industry. 80% auctioned to support RD&D, developing country engagement, adaptation and dislocation aid, sequestration, and debt reduction.	$12/metric ton CO_2 safety valve, rising at 2–8% per year above inflation.	Unlimited geological sequestration offsets. 5% of allowances set aside to fund biological sequestration and 1% for CCS projects.	Establishes ARPA-E to fund technology advancement projects (24% of auction revenues).	Inaction by developing countries can justify delay in safety valve escalation.
Lieberman-McCain (S. 280)	Economywide cap: large downstream at emitter; transport emissions regulated at refinery. (Appr. 75% of emissions covered.)	Discretion of EPA, with guidance for some free allocation and an auction to fund R&D, transition assistance, and adaptation measures.	Borrowing: up to 25% of allowances, for no more than 5 years.	Up to 30% of obligation can be met with domestic sequestration projects and international offsets.	Revenues from some auctioned allowances used for RD&D.	No provisions.
Kerry-Snowe (S. 485)	Economywide cap: point of regulation at discretion of EPA. (Coverage TBD by EPA.)	Discretion of the president with guidance from the EPA.	No provisions.	USDA sets rules for domestic biological sequestration.	Vehicle emissions rules; efficiency & renewable standards for electric generation; additional bill-specific mandates.	No provisions.
Sanders-Boxer (S.309)	Economywide cap: EPA has discretion to implement a market-based allowance program to achieve cap. (Coverage TBD by EPA.)					No provisions.
Feinstein-Carper (S. 317)	Electricity-sector cap: power plants. (The electricity sector is 34% of US GHG emissions.) (S. 1168 also covers utility SO_2, NO_X, and mercury emissions.)	85% free to industry, based on generation (updated annually), and phased out by 2036.	Borrowing up to 10%, for no more than 5 years.	International offsets up to 25% of cap; extensive domestic biological offsets.	Distributes auction revenues to multitude of technology programs.	No provisions.
Alexander-Lieberman (S. 1168)		75% free to industry, based on heat input.	No provisions.	Domestic offsets in five categories, including methane, SF_6, efficiency, and forest sequestration.	NSPS for CO_2 emissions from new electric generation units.	No provisions.
Stark (H.R. 2069)	Economywide tax: fossil fuels taxed by CO_2 content at the point of production and import. (About 80% of US GHG emissions.)	100% revenues to U.S. Treasury.	$3/metric ton CO_2, rising $3 annually.	Tax refunds for sequestered carbon: CCS, plastics.	No provisions.	Tax applied to fossil fuel imports; fossil fuel exports are exempt.
Larson (H.R. 3416)		1/6 of revenues to R&D, 1/12 to industry transition assistance (with phase out), remainder to payroll tax rebates.	$16.5/metric ton CO_2, rising 10% plus inflation annually.	Tax refunds for domestic sequestration and HFC destruction projects.	1/6 of tax revenues (up to $10B annually) for clean energy technology R&D.	

Table 2. Summary of Climate Change Adaptation-Related Bills in the 110th Congress

Author: Daniel Morris and Molly Macauley

CURRENT AS OF AUGUST 22, 2008

	ADAPTATION ACTION	AUTHORITY/ CONSULTATION	FUNDING	LAWS AFFECTED	SCOPE OF PROGRAM
Climate Change Adaptation Act (S. 2355) Cantwell	Amends National Climate Program Act to require the President to develop a 5-year national strategic plan to address impacts and implement adaptation strategies to be updated every 5 years. Each Executive dept. and agency must develop detailed plans for adaptation.	President, with state and local governments and NGOs, must develop national strategic adaptation plan. Sec. of Commerce, with state and local governments, must assess vulnerability of coastal areas and develop regional adaptation plans.	Appropriation of $10 million for FY 2009-2013 for Nat'l Strategic Plan; $35 million for FY 2009-2013 for Coast and Ocean Adaptation Plans and Grants.	National Climate Program Act (1978, 2000)	National strategic plan coupled with regional vulnerability assessments and adaptation plans for coastal and ocean areas.
Investing in Climate Action and Protection Act (H.R. 6186) Markey	Establishes National Climate Change Adaptation Council, consisting of at least 16 federal agencies and chaired by NOAA. Requires NOAA to spearhead national adaptation program and provide President with a national vulnerability assessment by 2012. Includes international adaptation program in USAID.	Most authority rests with Sec. of Commerce acting through NOAA. National program is under NOAA, as well as National Climate Service to distribute info to state, local and tribal gov'ts. Each federal agency must design adaptation plan.	Establishes National Climate Change Adaptation Fund: for FY 2010-2050, 15% for national adaptation program, remaining funds become available for state, local, and tribal projects. Also takes funds from National Resources Conservation Fund.	None, as related to adaptation activities. Uses funds from National Resource Conservation Fund established by Clean Air Act and channels funds through funds generated by other acts.	Multiple national programs and assessments combined with regional assessments and some international focus. Funding made available specifically for wildlife and ecosystem adaptation.
Climate Stewardship and Innovation Act of 2007 (S. 280) Lieberman	Instructs Director of Office of Science and Technology Policy (DOC) to establish adaptation technology program and to conduct regional estimates of potential costs of adaptation. Secretary of Commerce must generate a national adaptation plan and research impacts of climate change on the world's poor.	Director of Office of Science and Technology Policy, consulting with DOI, DOE, DOC, and other necessary federal agencies and relevant state governments for cost assessments. Secretary of Commerce for national plan and poverty studies.	No funding specified for adaptation studies. $2 million for research of effects on world's poor.	None	National cost assessment couple with six regional cost assessments. Technology needs assessments to be done regionally. National adaptation plans, no regional component.
Lieberman-Warner Climate Security Act of 2008 (H.R. 2338)	Requires President to develop national strategy to help natural populations and systems adapt and establish a science advisory board. States also develop adaptation plans. Makes funds available to programs assisting wildlife and ecosystem adaptation. International adaptation program established in USAID. Instructs EPA to generate regional assessments of costs related to adaptation.	President, with state and local governments and NGOs, must develop national strategic adaptation plan. Sec. of Commerce, with state and local governments, must assess vulnerability of coastal areas and develop regional adaptation plans.	Adaptation Fund established with money collected from auctioning of CO2 emissions allowances.	None specifically amended, but is subject to multiple acts through funding adaptation projects related to wildlife, coastal system, wetlands and other natural systems.	National and state programs focused mostly on vulnerable wildlife and ecosystems. International programs focus more on social and national security implications of adaptation.

TABLE 2 CONTINUED ON PAGE 10

	ADAPTATION ACTION	AUTHORITY/ CONSULTATION	FUNDING	LAWS AFFECTED	SCOPE OF PROGRAM
Climate Change Drinking Water Adaptation Research Act (S. 2970) Reid-Feinstein	Requires EPA to establish funding program through non-profit foundation to support research on effects of climate change on drinking resources.	EPA Administrator, working with Secretaries of Commerce, Energy and Interior.	$25 million each year for FY 2009-2013.	None	Distributes grants for research nationwide based on 10 research areas critical to drinking water supplies and drinking water utilities.
Coastal State Climate Change Planning Act of 2008 (H.R. 5453) Capps	Amends Coastal Zone Management Act of 1972 to assist coastal states in voluntarily developing coastal adaptation plans and provide financial and technical support. Separate grants are available for states developing adaptation plans and those implementing approved plans.	Secretary of Commerce, NOAA; Must consult with coastal states when designing grants programs to take effect 6 months after bill is passed.	Secretary may make grants to planning programs and project subject to availability of appropriations made under Coastal Zone Management Act.	Coastal Zone Management Act of 1972	National policies affecting coastal and marine waters and ecosystems. Grants available to coastal and Great Lakes states covered by Coastal Zone Management Act.
Global Warming and Acidification Coastal and Ocean Resiliency Act (S. 2211) Whitehouse-Boxer	Requires Sec. of Commerce to establish and implement national federal policy to plan for and mitigate the effects of climate change on coastal and ocean ecosystems and to increase their resiliency. Establishes an advisory board of scientists recommended by Nat'l Academy of Sciences to assist Sec. of Commerce. Great Lakes states are included in all of the statues.	Secretary of Commerce. Must consult with EPA, DOI, Regional fishery mgmt councils, coastal state fish and wildlife agencies, local gov'ts, tribes, conservations orgs and scientists.	Funds are to be made available for the act, though there are no specific allocations. Of the available grant money, 40% is to be spent to implement federal policy and 60% is to be available to coastal states in the form of grants	Coastal Zone Management Act of 1972	National policies affecting coastal and marine waters and ecosystems. Grants available to coastal and Great Lakes states covered by Coastal Zone Management Act.
Global Warming Wildlife Survival Act (S. 2204) Whitehouse-Boxer	Requires Sec. of Interior to develop and implement a national strategy to help wildlife populations and habitats on federal lands adapt to climate change. Establishes both an advisory board and a National Global Warming and Wildlife Science Center to inform Sec.'s decisions. Empowers Director of USGS to research effects of climate change on threatened and endangered species.	Secretary of Interior is in charge of establishing national strategy, but must consult w/ USDA, DOC, EPA, local gov'ts, conservation orgs and scientists. Sec. of Ag. must implement on Forest Service lands and Sec. of Comm. must implement in coastal areas.	No specific allocations or budget, though appropriations are authorized. 60% is allocated to DOI to establish the National Global Warming and Wildlife Science Center, to implement adaptation and resiliency policies on Interior lands and to protect endangered species; 10% is allocated to USDA to implement policies on Forest Service lands; 30% is available for grants to states and tribes.	Title II is essentially the same as the Global Warming and Acidification Coastal and Ocean Resiliency Act, thus amends parts of the Coastal Zone Management Act of 1972. No other statues are directly affected, but limits of the Act are based on language in the Endangered Species Act and other acts.	National policies affecting terrestrial and marine wildlife and ecosystems found on federally-managed lands. Grants available to all states and tribes.