

# Major Areas of Long-term Uncertainty for NOAA

## What might our planet look like in 25 years?

The future of the Earth is uncertain. We know many of the challenges we face, but unanticipated events will arise.

Below are three alternative futures—from now until 2035—and how they compare across three major areas of long-term uncertainty.

How would you make a difference in each?



### Nature & Mix of Economy

### Governance & Decision-Making

### Environment & Society Interaction

## TOO LITTLE too late?

Despite smart economic growth based on alternative energy and sustainable production—and despite collaboration on environmental policy at all levels of government—it may be too late to stop abrupt climate change and its social, economic, and environmental impacts.

### SMART GROWTH

**2010–2020:** STRONG ECONOMIC GROWTH IS FUELED by alternative energy investments and global trade. New energy technology facilitates rapid economic development in developing countries. Sustainability as a way of life leads to comprehensive new fisheries management practices, sensible crop rotation, and more efficient water use.

**2021–2035:** SIGNIFICANT BENEFITS OF SMART GROWTH are achieved worldwide in less than 20 years, but it's still unknown whether they are forestalling "abrupt" climate changes. Some scientists are beginning to believe the policies were too late and always too little to halt abrupt climate change.

### COLLABORATION

**2010–2020:** A NEW COLLABORATIVE ETHIC TAKES hold at all levels of government (international, federal, state, and local). Substantial investments are made to build capabilities and reach effective multiparty agreements on the major environment, economic, and social issues. The U.S. forms a new Department of the Environment.

**2021–2035:** ECONOMIC IMPACTS ARE GREATEST outside the U.S. Tensions between governments in the East and West begin to fray as it is becoming clear that an entirely new level of commitment will probably be needed to address the relationship between people and the environment.

### DYSFUNCTION

**2010–2020:** AN EXPLOSION IN MARITIME TRADE has significant impact on the natural environment. Coastal populations grow, exposing more people to severe weather and climate effects. Severe geomagnetic storms wreak havoc. Water shortages around the world are exacerbated in many places by biofuels production.

**2021–2035:** CLIMATE CHANGE EFFECTS ARE everywhere. Antarctic ice sheets continue to lose mass. Arctic sea ice disappears in the summertime. Drought conditions are more frequent and severe. Ocean acidification is increasing. Ecosystem disruptions lead to territorial conflicts in Africa, the Middle East, and Central Asia.

## GREEN chaos

Environmental policy at all levels of government remains fragmented and disorganized, but a growing market for alternative energy and other sustainable products leads to smart economic growth and an increasingly harmonious relationship between humans and nature through the combined effects of societal demands and global commercial innovation.

### SMART GROWTH

**2010–2020:** GREEN MARKETS FLOURISH. MAJOR multinationals, venture capital firms, and state-owned enterprises in Alaska invest aggressively in sustainable development solutions. Carbon taxes in the U.S. spur innovation, and the adverse consequences of externality pricing and heavily regulating resource use do not materialize.

**2021–2035:** GLOBAL CONSUMERS ARE SOPHISTICATED and green, as are many new industries. Asian players control the biggest market share. Green goods and services in developed economies are slowly replacing energy intensive solutions, while green goods and services growth in developing countries occurs as a result of their rapid economic change.

### FRAGMENTATION

**2010–2020:** POLICY MAKERS ARE OVERWHELMED by the environmental and economic uncertainties, but a patchwork of regional and local policies succeeds. Poor coordination among U.S. agencies continues, while the private sector assumes more public functions. No nation shows leadership as politicians focus on domestic problems. No international standards for environmental data evolve.

**2021–2035:** THE ARCTIC NATIONS NEVER REACH agreement on sovereignty claims, development of the Arctic, and how best to protect the environment. Russia is constantly using its navy to try to resolve disputes over the seabed, navigation, and fishing, but lacks investment funds to pursue much industrial development. The United States, Canada, and Norway generally coordinate, but still largely go their separate ways.

### HARMONY

**2010–2020:** CARBON TAX REVENUE IS RETURNED to individuals by contributing to their retirement accounts and health care insurance costs. There is a trend of counter urbanization, with cities losing population to rural areas because of better living conditions. Economic incentives are also used by states and federal agencies to change agricultural and fishing practices.

**2021–2035:** SCIENTISTS CAN'T AGREE ON whether abrupt climate change is taking place. While the changes are muted, they're still visible in a number of places. Water scarcity is getting worse around the world while demand for food is rising faster than anyone expected. Fish stocks improve because of new regulations and innovations by large commercial fishers.

## CARBON junkies

Environmental policy at all levels of government is collaborative, particularly in developing advanced environmental science and technology, but business-as-usual practices in industry and public focus on traditional metrics of economic success lead, ultimately, to extensive environmental degradation.

### BUSINESS AS USUAL

**2010–2020:** IN BOTH DEVELOPED AND DEVELOPING countries old economic systems continue to exploit energy for economic growth. Consumer products like cars and appliances are cheap due to global demand, global trade agreements, and massive energy- and water-development investments. GDP growth is the highest priority, but the U.S. economy falters and deficits rise.

**2021–2035:** ENERGY DEMAND RISES DRAMATICALLY, while supply is still mainly oil and coal. Marine transport activity is increasingly significant because of economic growth in developing countries and open trade policies around the world. Arctic waters open, and substantial industrial activity is occurring above the Arctic Circle.

### COLLABORATION

**2010–2020:** INSTITUTIONS AROUND THE WORLD cooperate on environmental and disaster-relief issues, but budgets are tight, environmental programs are cut, and governments struggle to respond to continued catastrophic events. In the Arctic, a resource race to stake claims on the seabed spawns new international agreements. The effects of climate change drive new international greenhouse gas agreements with binding commitments.

**2021–2035:** WHILE PROGRESS WAS INITIALLY slow in implementing the GEOSS vision, the U.S., EU, and China ultimately agreed to support the effort. A global environment information utility becomes available. Scientists agree that large-scale change in the climate system is taking place and the change cannot be reversed for decades, even with major mitigation efforts worldwide.

### DYSFUNCTION

**2010–2020:** WORLDWIDE ENERGY RESOURCE exploitation increases significantly. Hydrocarbon energy resources are further developed in the U.S. and nuclear generating plants also see major increases. Water shortages in the developing world are a problem as are major catastrophes from floods, earthquakes, and typhoons. Fish stocks around the world begin to disappear.

**2021–2035:** SEA LEVELS RISE, OCEAN ACIDIFIES, droughts persist, Arctic ice disappears in the summer, cropland disappears in many countries, migration patterns in Asia and Africa change rapidly. Adaptation becomes the most important issue. A cap-and-trade system, supported by new climate observations and models, provides incentive for utility companies to sequester CO<sub>2</sub>.

## NOAA's SCENARIOS FOR 2035: LONG-TERM TRENDS, CHALLENGES AND UNCERTAINTIES FACING NOAA

Scenarios are a powerful and widely used tool for helping organizations understand, respond to, and sometimes influence the complex economic, governmental, social, and environmental forces shaping the future. We cannot predict the future, but we can identify key forces and imagine how they might combine to form plausible alternative futures.

NOAA's scenarios are not necessarily the most likely alternatives for 2035—no one can begin to outline the full range of potential outcomes over this time frame. Rather, they are plausible combinations of real-world forces that allow us to evaluate, test, and refine NOAA's long-term strategy.

The scenarios conveyed in this document are derived from different combinations of outcomes at the extreme ends of three areas of uncertainty: the nature and mix of economic activity; governance and decision-making processes; and the interaction between society and the physical environment. The scenarios also include a range of forces that are fairly certain to occur and, consequently, appear nearly identically in each scenario, although their impacts may vary substantially.

Perhaps the most important constant across scenarios will be the continuing advances in computing and availability of new high-performance hardware and software. Another will be the ongoing occurrence of catastrophic events that will continue to be frequent, severe, and often surprising in their impacts.

The third major constant will be that water supply issues will worsen. Finally, national population growth rates will not vary across the scenarios.

NOAA has developed these scenarios to stimulate thinking and discussion about how the world might evolve, what types of opportunities and challenges might emerge for NOAA and its partners and stakeholders, and how NOAA can best position itself to successfully execute its mission over the long term. We encourage readers to join in this discussion about our shared future.

What trends are most significant?

What challenges and opportunities might arise?

What potential responses should NOAA consider?

## ORGANIZATION & ADMINISTRATION

NOAA's managerial efforts provide the rest of the Agency with the staff, the infrastructure, and the financial capital needed to get the job done.

## OBJECTIVES

Diverse and constantly evolving capabilities in NOAA's workforce

A modern IT infrastructure for a scientific enterprise Modern, safe, and sustainable facilities

A high-performing organization with integrated, efficient, and effective business systems and management processes

## SCIENCE & TECHNOLOGY

Drawing upon its world-class research, observation, and modeling capabilities, NOAA is uniquely positioned to promote a holistic understanding of the interdependencies between human health and prosperity, and the intricacies of the Earth system.

## OBJECTIVES

A holistic understanding of the Earth system through research

Accurate and reliable data from sustained and integrated Earth observing systems

An integrated environmental modeling system

## STAKEHOLDER ENGAGEMENT

The best way for NOAA to meet the increasingly complex needs of its stakeholders is often to deliver data and knowledge to those who have not yet accessed it. NOAA must understand these needs at all levels—within the U.S. and abroad—and respond to them.

## OBJECTIVES

An engaged and educated public with an improved capacity to make scientifically informed environmental decisions

Integrated services meeting the evolving demands of regional stakeholders

Full and effective use of international partnerships and policy leadership to achieve NOAA's mission objectives

## NOAA'S MISSION:

Science, Service, and Stewardship

To understand and predict changes in climate, weather, oceans, and coasts, to share that knowledge and information with others, and to conserve and manage marine ecosystems and resources

## NOAA'S VISION

Resilient Ecosystems, Communities, and Economies

Healthy ecosystems, communities, and economies that are resilient in the face of change

This table illustrates the relation of NOAA's enterprises (what we do) to its goals (why we do it). Activities at the intersections align to strategy for both. Value is added at each step toward outcome-oriented goals.



NOAA will balance technology development, deployment, and relatively low-risk applied research and development with high-risk research that fosters radical innovation



NOAA will improve access to and interoperability of weather data to better integrate with decision-support systems

NOAA will successfully manage diverse investments in land, structures, satellites, ships, aircraft, unmanned systems, sensors, equipment, software, and IT



NOAA will maintain observation platforms to collect global, regional, and local ecosystem data

NOAA will place increased emphasis on hiring, developing, and retaining people with expertise in the social and economic sciences



NOAA will require and sustain resource monitoring networks that are capable of integrating across spatial and temporal scales to determine the effectiveness of local management actions

NOAA will calibrate climate sensors to maintain the integrity of climate data records over time, and integrate ground-based networks maintained by different domestic entities in the National Mesonet Program



NOAA will develop advanced technologies in sensors, computing and networking, and user interfaces to better observe, understand, model, and communicate knowledge of complex systems



NOAA will develop a comprehensive modeling backbone to link atmospheric, oceanic, terrestrial, cryospheric, ecological, and climatic models



NOAA will improve modeling and prediction capabilities within an Earth system framework for air and water quality, coupling air, land, water, and sea with biological, geological, chemical, and ecosystem processes



NOAA will coordinate internal and external research on the linkages among biological, physical, and human components of marine, estuarine, and riverine ecosystems and the goods they provide



NOAA will produce marine weather forecasts, nautical charts, surveying and mapping data, real-time oceanographic information, oceanographic predictions and forecasts, and an accurate national positioning framework

NOAA will aim to reduce loss of life, property, and disruption from and response to high-impact international weather events



NOAA will combat illegal, unregulated, and unreported fishing and bycatch of protected living marine resources in international fisheries



NOAA will support and collaborate with regional governance initiatives so they are better able to protect and restore coastal, ocean, Great Lakes, and other regional resources



NOAA will work to ensure continuous and sustained dialogue among partners in order to understand capabilities and identify climate-related risks that are of the most urgent concern to decision makers and the public.

NOAA will support sector-specific planning and decision making with environmental information through partnerships with other Federal agencies; the UN; and energy, communication, health services, and agriculture industries



NOAA will work to enhance coordination and cooperation among scientists, policy makers, and stakeholders to ensure that information is understood and incorporated in management practices



NOAA will develop and provide coastal decision makers with updated decision-support tools, technical assistance, training, and management strategies related to adaptation, risk communication, hazard response and recovery, and resource conservation



NOAA will produce new and improved data management and access systems that enhance the communication and dissemination of climate information and products



NOAA will continue its world-class observation, monitoring, research, and modeling efforts, and increase efforts to close gaps in understanding the climate system and the role of humans within the system

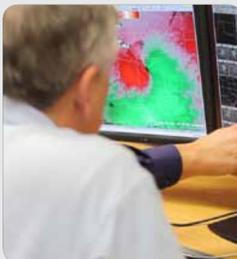


NOAA will work with partners to increase climate, weather, ocean, and coastal literacy through investments in extension, training, education, outreach, and communications

NOAA will reduce its carbon footprint and energy costs through the use of sustainable design of new facilities and investments in energy-efficient building systems



NOAA will develop, launch, and operate environmental observation satellites, and sustain and advance in situ climate observation networks



NOAA will work with partners to increase climate, weather, ocean, and coastal literacy through investments in extension, training, education, outreach, and communications



**LONG-TERM GOAL:**  
**Climate Adaptation and Mitigation**  
AN INFORMED SOCIETY ANTICIPATING AND RESPONDING TO CLIMATE AND ITS IMPACTS

- ### OBJECTIVES
- Improved scientific understanding of the changing climate system and its impacts
  - Assessments of current and future states of the climate system that identify potential impacts and inform science, service, and stewardship decisions
  - Mitigation and adaptation choices supported by sustained, reliable, and timely climate services
  - A climate-literate public that understands its vulnerabilities to a changing climate and makes informed decisions

**LONG-TERM GOAL:**  
**Weather-Ready Nation**  
SOCIETY IS PREPARED FOR AND RESPONDS TO WEATHER-RELATED EVENTS

- ### OBJECTIVES
- Reduced loss of life, property, and disruption from high-impact events
  - Improved freshwater resource management
  - Improved transportation efficiency and safety
  - Healthy people and communities due to improved air and water quality services
  - A more productive and efficient economy through environmental information relevant to key sectors of the U.S. economy

**LONG-TERM GOAL:**  
**Healthy Oceans**  
MARINE FISHERIES, HABITATS, AND BIODIVERSITY SUSTAINED WITHIN HEALTHY AND PRODUCTIVE ECOSYSTEMS

- ### OBJECTIVES
- Improved understanding of ecosystems to inform resource management decisions
  - Recovered and healthy marine and coastal species
  - Healthy habitats that sustain resilient and thriving marine resources and communities
  - Sustainable fisheries and safe seafood for healthy populations and vibrant communities

**LONG-TERM GOAL:**  
**Resilient Coastal Communities and Economies**  
COASTAL AND GREAT LAKES COMMUNITIES ARE ENVIRONMENTALLY AND ECONOMICALLY SUSTAINABLE

- ### OBJECTIVES
- Resilient coastal communities that can adapt to the impacts of hazards and climate change
  - Comprehensive ocean and coastal planning and management
  - Safe, efficient, and environmentally sound marine transportation
  - Improved coastal water quality supporting human health and coastal ecosystem services
  - Safe, environmentally sound Arctic access and resource management