

# ADAPTING TO CLIMATE CHANGE

In recent years the impact of climate change is being felt throughout Japan. Its effects include higher surface temperature, more frequent heavy rainfall events, declining quality of agricultural products, shifting plant and animal species distributions, and a higher risk of heat illness. There is a high probability that these effects will continue and become more severe over an extended period.

To cope with climate change, protect the lives and property of the nation's citizens now and in the future, and to enable the sustainable development of society and the economy, it will be necessary to “mitigate” climate change by reducing emissions of greenhouse gases, and also to “adapt” to the effects of climate change, both those that are already apparent and those that are expected in the future, so as to avoid or reduce the damage.

This chapter will introduce Japan's efforts to adapt to the effects of climate change.

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# EXTREME WEATHER DISASTERS IN 2018

## July 2018 severe rainfall

From late June through early July 2018, Japan was hit by record-breaking rainfall across wide areas, primarily in the western part of the country. These torrential rains claimed 237 lives (as of January 9, 2019) and caused extensive damage, destroying about 7,000 houses, mainly in Hiroshima, Okayama, Ehime Prefectures.



Aftermath of July 2018 severe rainfall

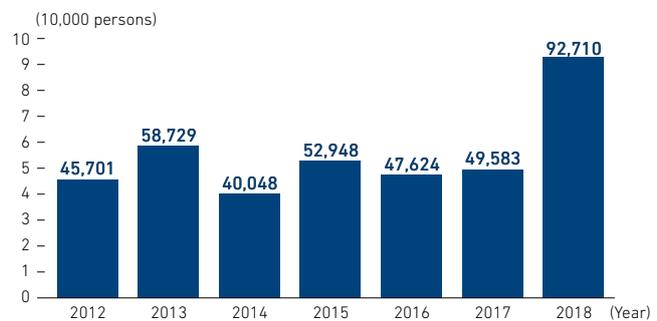
Source: Erosion Control Department, Hiroshima Prefecture

## Intense heat

In the summer of 2018 (June through August), eastern and western Japan experienced a record-breaking heat wave. Temperatures around the country were especially high in mid to late July. On July 23, the temperature in the city of Kumagaya, Saitama Prefecture reached 41.1°C, the highest temperature ever recorded in Japan, and many other locations around Japan experienced temperatures above 40°C. In eastern Japan, the average temperature in July was the highest record since 1946 when record keeping began.

From May through September of 2018, ambulances transported 95,137 persons suffering from heat illness, showing an increase of 42,153 persons over the 52,984 persons of the previous year.

### Persons transported by ambulance, by year (June through September)



Source: Fire and Disaster Management Agency

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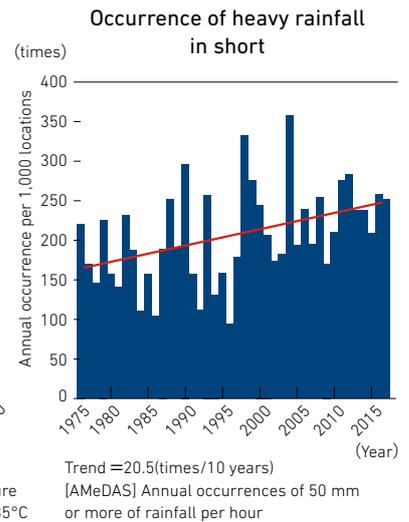
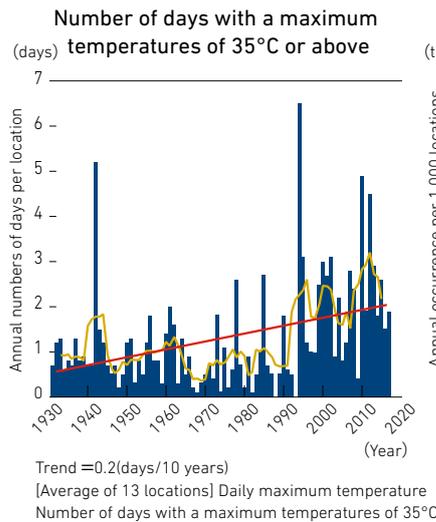
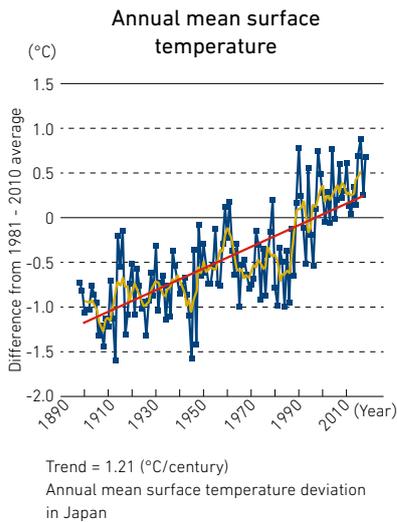
# CLIMATE CHANGE OBSERVATIONAL EVIDENCE IN JAPAN AND FUTURE PROJECTIONS

The average surface temperature is rising faster in Japan than in the rest of the world (approx. 1.21°C per 100 years vs. a global average of approx. 0.73°C). Assuming that ambitious measures are taken to achieve a low greenhouse gas concentration level (RCP2.6 scenario), temperatures at the end of the 21st century are expected to be from 0.5 to 1.7°C higher than those at the end of the 20th century. If no measures are taken (RCP8.5 scenario) they are expected to be from 3.4 to 5.4°C higher.

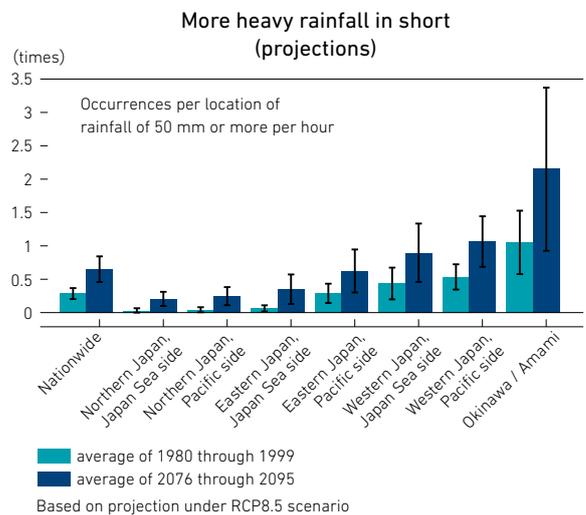
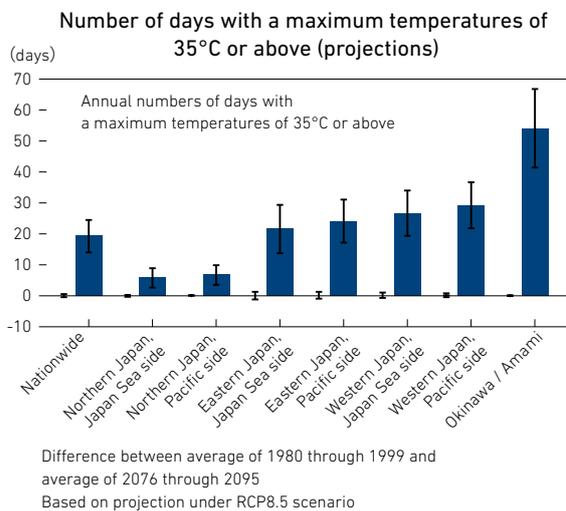
Days with temperatures above 30°C or 35°C have become more frequent, and are expected to become even more frequent in the future. While short heavy rainfall events have increased, the number of days without precipitation is increasing. Observational evidence and projection of future climate change effects include a further increase of events with extreme precipitation, even fewer days without precipitation, and increasing volume of precipitation during heavy rain events.

## Climate change observations and future projections

### Climate change observations



### Projected climate change



# IMPACT OF CLIMATE CHANGE IN JAPAN

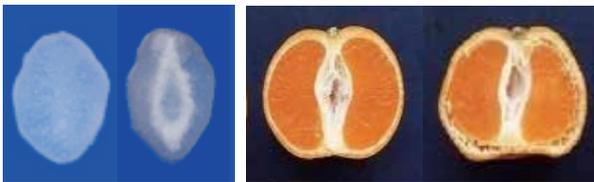
As information about climate change is collected and evaluated, more has become known about its impact in Japan. In February 2018, four government ministries (the Ministry of the Environment; the Ministry of Education, Culture, Sports, Science and Technology; the Ministry of Agriculture, Forestry and Fisheries; and the Ministry of Land, Infrastructure, Transport and Tourism) and the Japan Meteorological Agency published a joint

report entitled “Synthesis Report on Observations, Projections and Impact Assessments of Climate Change, 2018: Climate Change in Japan and Its Impacts”. The impact of climate is becoming apparent not only in the environment and ecosystems, but also in various ways throughout society and the economy, although the impact varies indifferent regions. There is concern that adverse effects will spread further in the future.

## Example of climate change impacts

### Agriculture, forests & forestry, fisheries

Decreased growth and lower quality due to high temperatures



White immature grain in paddy field rice

Peel puffing in mandarin oranges

### Natural ecosystems

Coral bleaching

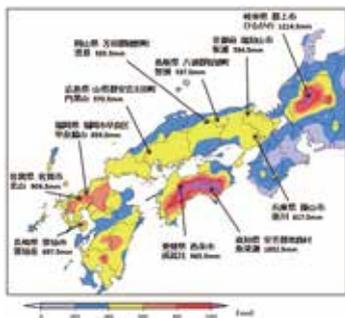


Shrinking areas inhabited by Japanese rock ptarmigan



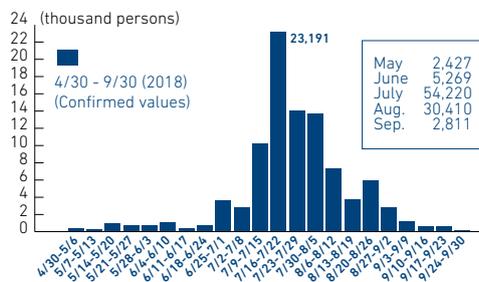
### Natural disasters & coastal areas

More frequent heavy rains



### Heat illness, infectious diseases

Increased risk of heat illness  
Ambulance transport for heat illness patients (2018)  
(Values for each week from start of survey)



Northward expansion of the Asian tiger mosquito, a transmitter of dengue fever



Sources: Ministry of Agriculture, Forestry and Fisheries; Japan Meteorological Agency; Fire and Disaster Management Agency; National Institute of Infectious Diseases

# LONG-TERM LOW GREENHOUSE GAS EMISSION DEVELOPMENT STRATEGY

In accordance with the Paris Agreement, Japan had been considering long-term low greenhouse gas emission development strategy. The Prime Minister has established a meeting made up of experts from finance, business, academia, and local government which was charged with discussing basic policy directions.

“Long-term Strategy under the Paris Agreement” was approved by the cabinet and submitted to the United Nations in June 2019. The strategy sets forth a vision of the achieving a “decarbonized society” as early as possible in the second half of this century. To enable it, realizing a “virtuous cycle of environment and growth” through business-led disruptive innovation is included as a basic concept.

On the basis of recommendation from the meeting,

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# ADAPTATION INITIATIVES BY GOVERNMENT ORGANIZATIONS

## Initiatives in Japan

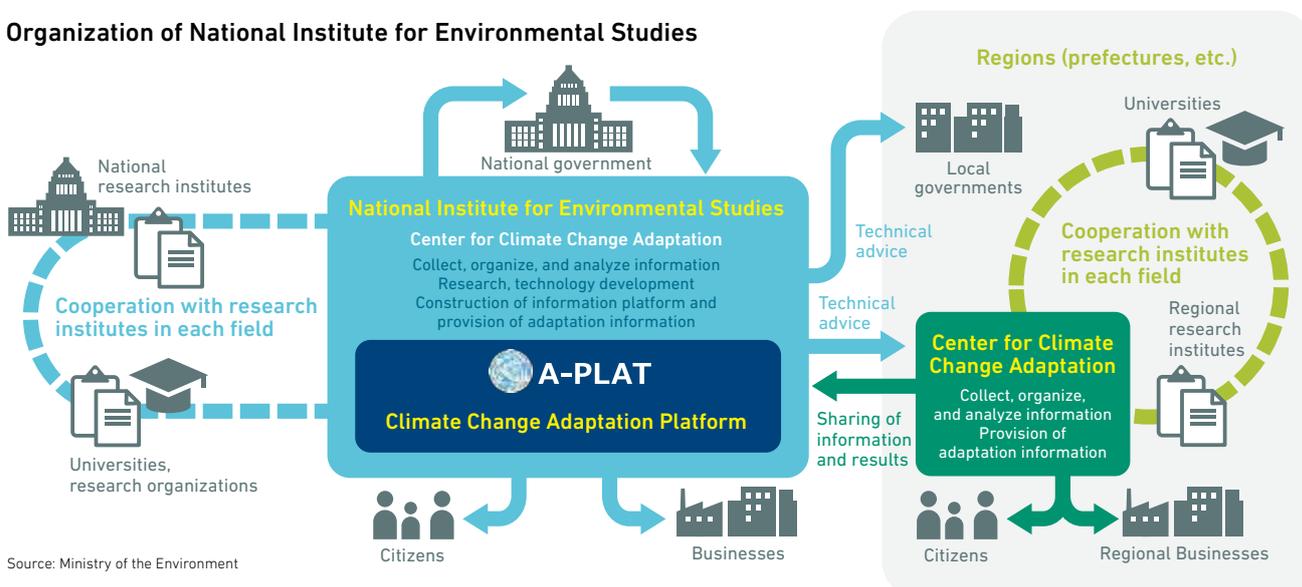
The impact of climate change is already evident in Japan. The government's National Adaptation Plan, formulated on the basis of the latest scientific findings, was approved as a cabinet resolution in November 2015. Since then, government agencies have planned and implemented adaptation measures in their various areas of responsibility, while the Ministry of the Environment has worked with other government agencies to implement basic policies. In June 2018, the Climate Change Adaptation Act was passed by a unanimous vote of the Diet. It came into force in December of the same year, clarifying the legal status of adaptation measures.

The Climate Change Adaptation Act 1) clarifies the roles that should be played by the national and local governments, businesses, and citizens in adapting to climate change; 2) prescribes that the government shall draw up a National Adaptation Plan to promote adaptation measures in agriculture, disaster prevention, and other fields; and 3) prescribes that the Ministry of the Environment shall evaluate the impact of climate change approximately once every five years, and amend the Plan as appropriate after a comprehensive review of the evaluation and other factors.

The government's role is to promote adaptation measures on the basis of the National Adaptation Plan in fields such as agriculture, disaster prevention, and heat illness prevention. To this end, the Act establishes a committee made up of related government agencies, chaired by the Minister of the Environment, to coordinate the promotion of adaptation measures. In December 2018, the Center for Climate Change Adaptation was established within the National Institute for Environmental Studies for the purpose of providing scientific support to actors involved in adaptation work, by collecting, organizing, analyzing and providing information related to adaptation.

Because the impact of climate change varies by region, it is also important to work in accordance with local conditions in the affected regions. The Climate Change Adaptation Act contains provisions to encourage regional and local governments to formulate their own climate change adaptation plans, and to establish local climate change adaptation centers, which will serve as centers to collect and analyze information related to local climate change impacts and adaptation.

### Organization of National Institute for Environmental Studies



Source: Ministry of the Environment

## International cooperation

Japan cooperates on a bilateral basis with other countries, mainly in the Asia-Pacific region, to support the assessment of climate change impacts and the formulation of National Adaptation Plans, according to the needs of each partner country. The government is working to establish a platform for the international sharing of knowledge about climate change and adaptation, with a special focus on developing countries in the Asia-Pacific region, with which Japan has close geographic and economic ties, to enable these countries to formulate and

implement National Adaptation Plans based on the latest scientific findings. On June 16, 2019, at the G20 Ministerial Meeting on Energy Transitions and Global Environment for Sustainable Growth held in the town of Karuizawa, Nagano Prefecture, it announced the launch of AP-PLAT (Asia-Pacific Adaptation Information Platform), to be administered by the National Institute for Environmental Studies. Companies in Japan will be able to use AP-PLAT to make their adaptation expertise more widely available overseas.

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# ADAPTATION WORK BY BUSINESSES

## Adaptation for risk management

Climate change can affect businesses in many ways, such as by flooding, supply chain disruption, crop failures, and drought. This makes it important for businesses to understand the risks they face. They need to know how to manage the risks, and how to introduce the right climate change adaptation strategies for their business operations.

National Adaptation Plans call for businesses to ensure that their operations can proceed smoothly as they prepare for climate change adaptation plans that suit the character of their business. Businesses can also contribute by cooperating with the climate change adaptation programs of national and local governments.

### Stone-like water-retentive asphalt

From FY2012 through FY2017, the city of Kyoto implemented a project to bury utility lines along Ogawa-dori, a street running from north to south in the central part of the city. As part of this project, which improved the streetscape and strengthened disaster preparedness, the street was paved with stone-like water-retentive asphalt.

This pavement was created by pouring liquid cement (cement milk) over porous asphalt, then stripping off a surface layer, and finally incising a decorative pattern into the surface with a cutter. The water-retentive properties of the paving were improved by adding a mineral material that allows water to be easily absorbed and evaporated. The pavement absorbs

rainfall and water sprinkled directly onto it on hot days, and keeps temperatures on the street surface down by evaporative cooling.



Ogawa-dori streetscape

Source: Kyoto City Government

## Adaptation as a business opportunity

Climate change adaptation provides business opportunities through the development of adaptation technologies, products, and services. Companies involved in the adaptation business in Japan and abroad, especially in developing countries, can contribute to the climate change adaptation work of national and local governments, citizens, and other companies.

The adaptation business is the business of providing products and services to assist in the

adaptation efforts of others. It can include disaster detection and warning systems, technology and products to deal with heat, and technology to help conserve water or make use of rainwater. Some Japanese companies are already helping to support mainly overseas farmers with new adaptation technologies and services. They include the use of satellite and aerial photos to help farmers to understand and analyze the state of their crops in real time, and weather index insurance for rice farmers.

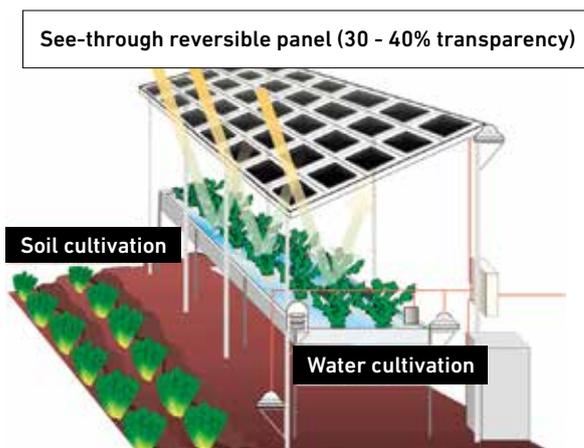
### Adaptation through next-generation agricultural technology and farm management systems

The Farmdo Group has introduced a high-tech agricultural system involving the generation of power by solar panels and the reclamation of abandoned fields. The system can increase yields and increase farm income through revenues from the sale of electricity.

This "Solar Farm" system installs patented translucent solar panels on greenhouses. The panels allow enough light through to grow crops underneath, and generate electricity at the same time. The system adjusts the ratio of light reaching the crops by adjusting the translucency

of the solar panels. Panel adjustments are controlled automatically by IoT technology, along with temperature, moisture, and fertilizer in the greenhouse environment. The system also automatically manages the effects of the weather, enabling environmentally controlled agriculture that is not overly dependent on the climate. By giving farmers a double income, the system can help put farms on a firmer financial basis. The system has already been partially implemented in Mongolia and other overseas regions.

Solar Farm system



Source: Farmdo Holdings Co., Ltd.

Solar Farm greenhouse high bench water cultivation

