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Regional Resource Centre for
Asia and the Pacific

Climate Factsheet

Republic of the Marshall Islands (RMI)

People and Geography

» The Republic of the Marshall Islands (RMI) lies near the equator in the Pacific Ocean, between latitude 4.58199 – 11.34735 and longitude 162.33733 – 171.73502 with a total land area of 181 sq. km.^{1,2}

» RMI is a collection of 29 geographically dispersed coral atolls and five islands, spread across over 2,000,000 km² of ocean, of which 24 are inhabited atolls.³³

» The atoll islands are typically several km long and are rarely more than 200 metres (m) in width. The maximum height above sea level of almost all the land is rarely more than 2 m.⁴

» The Ratak (sunrise) chain is to the east.³

» The Ralik (sunset) chain is to the west.³

» Kwajalein atoll, in the Ralik chain, is the largest atoll on the planet.³

» Not one point in the country is farther than 1 km from the sea.⁵

» There are no rivers, streams, or lakes in RMI, and the number of small surface ponds is very limited.³³



The total estimated population of the RMI as of 2020 is⁷ 77,917

» The capital city of Majuro is the most populated atoll with 52% of the country's population.⁸

» The island city of Ebeye is the second largest settlement in the Marshall Islands, after the capital of Majuro, and one of the most densely populated locations in the Pacific.⁴

The RMI's population⁴

Marshallese

92.1%

mixed Marshallese

5.9%

non - Marshallese ethnicity

2%

» The two official languages are Marshallese, which is spoken by 98.2% of the population, and English is spoken by 1.8% of the population.¹⁵

» RMI has a constitutional government in free association with the United States of America; the Compact of Free Association entered into force 21 October 1986.⁴

» Per capita Gross Domestic Product (GDP) was 3,788.16 USD (2018).⁹

» Most of the outer islands population is a subsistence economy. On the urban atoll of Majuro, the government is the largest employer and is heavily dependent on US Compact and development partner inputs.⁴

» The U.S. Government provides annual payments to the Government of the RMI through FY 2023. The broad goal of the payments is to assist economic development towards "self-reliance." Payments include grants, trust fund contributions (for use after FY 2023 annual payments cease), and lease payments for U.S. Department of Defense (DOD) use of multiple islets in the waters around the Kwajalein atoll.⁴

» RMI has very scarce natural resources, necessitating the import of almost everything other than basic locally produced food (largely coconuts, taro and seafood), at mostly high prices.

» The largest exporting industrial sectors are fisheries and production and processing of copra, the dried kernel of the coconut, from which coconut oil is extracted. The rest of the economy largely relies on sales and services.⁴

» In 2017, one-third of the total population, and 30% of the population in major cities (Majuro and Ebeye) lived below the basic-needs income level.¹⁰

» As of 2019, RMI's rate of population was estimated to be growing at a rate of 0.645%.¹¹

» 60% of rural Marshallese live on less than \$13.60 per person each week and high unemployment, financial hardship, hunger, and poor nutrition are major issues.¹⁰

» Agricultural production in RMI is concentrated on the atolls away from Majuro and Kwajalein, with coconuts and breadfruit representing the major crops.⁵

» As of 2011 estimates, almost half of the land use in RMI is covered by agriculture (50.7%), followed by forest (49.3%).¹¹

» Within agriculture, the land-use is distributed between permanent crops (31.2%) permanent pasture (11.7%),



79% of the household depends on [rainwater](#)

9% on [groundwater](#) for their drinking water

supply but as climate change and climate variability continue it becomes critical to find a safe and secure water supply for the population.³⁵

» 26.18% of the flora and fauna found in the RMI are native, with the islands harbouring 57 endemic species.¹²

» RMI's species diversity includes over 300 species of fish, 27 marine mammals, 70 species of birds (including 31 seabirds), numerous turtles, crabs, butterflies, few arthropods, and land mammals.¹²

» The RMI is a matrilineal society, with children belonging to their mother's lineage and having rights to use land owned by their lineage group.⁴

» As of 2016, RMI's CO2 emissions equaled 2.477 metric tons per capita.⁹

Climate

» The climate is moist and tropical and is heavily influenced by the northeast trade wind belt.¹³

» In the RMI there is very little seasonal variation in monthly mean, maximum and minimum air temperature, with less than 1 °C difference between the coldest and hottest months.¹⁴

» The country has two distinct seasons:¹⁴

› Dry season from December to April – Temperatures are stable (28°C) and rainfall is moderate (except on the southern islands where the rains are high)

› Wet season from May to November – Temperatures reach 30°C (they lose five degrees at night) and rainfall (short showers) is abundant. Cyclones (heavy rains, strong winds) sometimes pass through the islands between July and November.

» The Inter-Tropical Convergence Zone (ITCZ) brings rainfall throughout the year however it is strongest and furthest north during the wet-season.¹

» Annual rainfall varies considerably from north to south with the southern atolls receiving 300-340 cm/yr and the northern atolls receiving 175 cm/yr.¹⁴

» The main influence of year-to-year natural climate variability in the Marshall Islands is the El Niño Southern Oscillation (ENSO).¹⁴

» Temperatures are typically warmer during El Niño events and cooler during La Niña Events.¹⁴

» El Niño events are associated with drier conditions and occasional droughts while La Niña events are associated with wetter conditions and an increase in the number of tropical storms.¹⁴

» During the winter and spring months following an El Niño event droughts tend to be the most extreme.¹⁶

» During a severe El Niño, rainfall can be suppressed by as much as 80% in RMI.¹⁴

» Periods of very low rainfall and droughts of 1965, 1970, 1977, 1983, 1992 and 1998 correlate with the El Niño events of 1965-1966, 1969-1970, 1976-1977, 1982-1983, 1991-1992 and 1997-1998.²

» One of the strongest El Niño events recorded in history occurred during 2015-2016, which resulted in severe drought in RMI.¹⁷

» Droughts and storm waves are the main extreme events that impact the Marshall Islands.¹⁴

» As of 2015 there were 10 operational observation meteorological stations in the RMI.¹⁴

» Meteorological data availability of RMI: Multiple observations within 24 hours are taken at eight of these stations (Majuro, Utirik, Ailinglaplap, Jaluit, Wotje, Mili, Amata Kabua International Airport, and Kwajalein), and single-day observation is taken at Laura and Arno.¹⁴

» Tidal data for Majuro from 1993 to present are available through the South Pacific Sea Level and Climate Monitoring Project (SPSLCMP) maintained by the Australia Bureau of Meteorology as well as the University of Hawaii Sea Level Center (UHSLC) from 1968 to 1999.¹³

» The last severe drought hit the country in 2013, with 5000 Marshallese in the northern atolls enduring severe drought conditions and a further 11,000 suffering from food and water shortages.¹⁹

» In 1905, a strong typhoon caused to kill over 227 Marshallese. Then, high waves affected RMI frequently (1979, 1989, 1990 and 1991 to present).²⁰

» Although RMI can have a large amount of rainfall annually, storage capacity is limited, thus groundwater supplies are small.¹⁹

Global Climate Change



Sea Level Rise

» Global mean sea level has risen about 21–24 centimeters (8–9 inches) since 1880, with about a third of that coming in just the last two and a half decades.²¹

» The rate of sea level rise has doubled since 1993 compared to the 20th century average.²¹

» In 2019, the global mean sea level was 87.61 mm (3.4 inches) above the 1993 average—the highest annual average in the satellite record (1993-present).²¹

» From 2018 to 2019, the global sea level rose 6.1 mm (0.24 inches).²¹

» In 2019, the sea level rose with the global mean sea level reaching its highest value since the beginning of the high-precision altimetry record (January 1993).²²

» The average rate of rise is estimated at 3.24 ± 0.3 mm per year over the 27 year period, but the rate has increased over that time.²²

» The rising water level is mostly due to a combination of meltwater from glaciers and ice sheets and thermal expansion of seawater as it warms.²¹

Atmospheric Temperature

» As of 2019, the same year was the second warmest year in the 140-year record, with a global land and ocean surface temperature 0.95°C above the 20th-century average.²³

» This value is only 0.04°C less than the record high value of $+0.99^{\circ}\text{C}$ set in 2016. The third high value recorded in 2015.²³

- » The five warmest years in the 1880–2019 record have all occurred since 2015, while nine of the 10 warmest years have occurred since 2005.²³
- » As of 2019, Africa and Asia had their third warmest year, Hong Kong, Australia, and Oceania had their warmest year in 2019.²³

Extreme Precipitation and Drought

- » In 2019, extreme precipitation and drought were recorded across the world. Hurricane Dorian affected the U.S. and the Bahamas. Summer 2019 was particularly dry across parts of western and central Europe. The tropical cyclone, induced heavy rainfall over parts of Argentina, and eastern Africa.²³
- » Rainfall during India's summer monsoon season for 2019 was 10% above the 1961–2010 average.²³
- » Typhoon Wutip produced significant rainfall over parts of Micronesia in 2019.²³



Ocean Acidification

- » Oceans are absorbing about 25% of the carbon dioxide emitted to the atmosphere annually and as a result, are becoming more acidic.²⁴
- » In recent decades, ocean acidification has been occurring 100 times faster than during natural events over the past 55 million years.²⁵
- » Ocean pH has decreased from 8.2 to 8.1 over the industrial period and corresponds to an increase in oceanic acidity of about 30%.²⁵

Ocean Warming

- » Higher ocean temperatures cause the oceans to have a larger volume.¹⁴
- » The world's oceans have absorbed about 93% of the excess heat caused by greenhouse gas warming since the mid 20th century.²⁶
- » Ocean heat content has increased at all depths since the 1960s.²⁶

Regional Climate Change

Sea Level Rise

- » Regional and local sea level trends may differ significantly from the globally averaged rate over multiyear to multidecadal time scales (since 1990 as low as 1.1 mm/yr. at the Honolulu tide gauge and as high as 5.4 mm/yr. at the Kwajalein tide gauge).²⁷
- » Between 1993 and 2017, there has been a rise in sea level of 3–6 mm/year for the Pacific islands. Marshall Islands have experienced a higher rate of sea level rise (up to 6 mm/year).²⁷
- » Over the past 100 years the sea level in Kwajalein has risen 21.9 cm.²⁷
- » Seasonal sea levels are significantly lower during El Niño conditions and higher during La Niña conditions.¹⁴
- » Near Majuro, the sea level has risen approximately 0.3 inches per year since 1993; nearly triple the global average.³³

Atmospheric Temperature

- » Averaged as a whole, as of 2019, Oceania had its first warmest year in the same year since regional records began in 1910.²³
- » RMI experienced a 128% increase in the number of heat stress days between 1982 and 2016.²³
- » Record warmest temperatures occurred in equatorial western Pacific encompassing the geographic area of containing the RMI.²³
- » In the Pacific region, land-surface temperatures have been rising at the rate of +0.17°C per decade since the 1980s, slightly ahead of the global trend. Since 2005, nearly all surface stations have seen annual temperature anomalies above the long-term average.²⁷
- » Warming trends of a similar magnitude are evident in both annual and seasonal mean air temperatures at Majuro (1956-2009). Annual and seasonal minimum air temperature trends are stronger than those for maximum air temperature.¹⁴

Extreme Precipitation and Drought

- » A statistically significant 15% decrease in annual rainfall was reported for RMI (1954-2011).⁸
- » In RMI, dry season trends in rainfall are negative and statistically significant and wet season trends are also negative but not significant.¹⁴
- » The 2015-2016 total rainfall at Majuro from October 2015 to July was the driest 10-month period in the 62-year historical record.⁵

Future Climate Projections

» Beyond 2035 the projected warming diverges depending on the greenhouse gas emissions pathway that humanity follows (In RMI; 1.4 - 3.5°C by 2090; Table 1). Climate projections have been derived for RMI by the Australian Bureau of Meteorology using the CMIP3 database for up to three greenhouse gas emission scenarios: B1 (low emissions), A1B (medium emissions) and A2 (high emissions).¹⁴

Table1: Projected change in surface air temperature (°C) for 2030 (2020–2039), 2055 (2046–2065) and 2090(2080–2099), relative to 1990 (1980–1999) base period for the three emission scenarios are shown below.¹⁴

Emission Scenario	2030 (°C)	2055 (°C)	2090 (°C)
Low: B1	+0.6 ± 0.4	+1.0 ± 0.5	+1.5 ± 0.7
Medium: A1B	+0.8 ± 0.4	+1.5 ± 0.6	+2.3 ± 0.9
High: A2	+0.7 ± 0.4	+1.4 ± 0.4	+2.8 ± 0.7

The CMIP3 scenarios are considered equivalent to the more recent CMIP5 scenarios. Regarding air temperature CMIP3 and CMIP5 have been shown to produce similar results and ranges of uncertainty by the end of the century.²⁷

- » Rainfall is projected with an increase over the course of the 21st century in RMI.¹⁴
- » Droughts are projected to become less frequent throughout this century in RMI.¹⁴
- » More extreme rainfall days are likely to occur in RMI.¹⁴

» For the northern Marshall Islands, the current 1-in-20-year daily rainfall amount is projected to increase by approximately 1 mm under RCP2.6 (very low emissions) and by 7 mm under RCP8.5 (very high emissions) by 2030. By 2090, it is projected to increase by approximately 6 mm for RCP2.6 and by 32 mm for RCP8.5.¹⁵

» The current 1-in-20-year daily rainfall event will become, on average, a 1-in-8-year event for RCP2.6 and a 1-in-5-year event for RCP8.5 by 2090 for northern Marshall Islands.¹⁵

» For the southern Marshall Islands, the current 1-in-20-year daily rainfall amount is projected to increase by approximately 4 mm under RCP2.6 and by 11 mm under RCP8.5 by 2030. By 2090, it is projected to increase by approximately 9 mm for RCP2.6 and by 30 mm for RCP8.5.¹⁵

» The current 1-in-20-year daily rainfall event will become, on average, a 1-in-9-year event for RCP2.6 and a 1-in-6-year event for RCP8.5 by 2090 for southern Marshall Islands.¹⁵

» Less frequent but more intense typhoons are projected for the region.¹⁴

» Global Sea Surface Temperature (SST) is projected to continue to increase through the 21st century under all emissions scenarios.²⁷

» Acidity levels of the ocean are expected to increase across RMI.¹⁴

» Mean sea-level is projected to continue to rise over the course of the 21st century.¹⁴

» Projections under RCPs 8.5 (very high emissions) and 4.5 (low emissions) indicate that the aragonite saturation state (a proxy for coral reef growth rate) will be around 3.5 till 2030. But after 2030, under RCP8.5 the aragonite saturation state continues to strongly decline to values where coral reefs have not historically been found (< 3.0), whereas under RCP4.5 the aragonite saturation plateaus around 3.2 i.e., marginal conditions for healthy coral reefs. While under RCP2.6 (very low emissions) the median aragonite saturation state never falls below 3.5.¹⁵

Sea level of RMI



By 2100 a rise of 0.5 m in sea level is very likely and a rise greater than 2.0 m is plausible for RMI.²⁷

» Projections for sea level rise in Hawaii and other tropical Pacific islands call for an additional 20%–30% above the global mean.²⁷

» Ocean oxygen levels are projected to decrease by as much as 3.5% by the end of the century under a low mitigation scenario relative to preindustrial levels.²⁶

Impacts of Climate Change

» RMI is one of four countries that consists entirely of low-lying atolls and islands, and which face perhaps the most urgent and daunting climate change challenges in the world.¹³

» The climate change threats of immediate concern include sea level rise in combination with storm surges causing flooding, accelerated coastal erosion and saline intrusion into freshwater lenses; periodic droughts associated with ENSO events and coral bleaching resulting from increased temperature and ocean acidification in combination with extreme low tides.¹³

**1 of 5
Countries**

RMI is among the top five countries that will be most impacted by sea level rise by the end of the century.²⁸

» Small island communities are at greater risk from sea level rise in comparison with other geographic areas because most of their population and infrastructure are in the coastal zone.²⁸

» In low-lying atoll nations such as RMI there is extremely high vulnerability to the impacts of climate change.¹³

» Sea level rise, coastal erosion, changes in rainfall patterns make climate change and environmental sustainability an issue, exacerbating development pressure and posing a threat to national security.¹³

» RMI's people are among the most vulnerable in the world to the impacts of climate change and many of these impacts are already occurring, inflicting damage and imposing substantial costs on the Marshallese Government and people.²⁹

- » More intense rainfall has the potential to increase flooding, damage crops, and move pollutants into coastal waters.¹⁴
- » The impact of increased acidification on the health of the reef ecosystem is likely to be compounded by other stressors including coral bleaching, storm damage, and fishing pressure.¹⁴
- » It is unclear whether climate change will lead to an increased frequency in storms, however there is a wide agreement that the intensity of storms will increase as ocean waters warm.²⁷
- » Climate change threatens Pacific island cultures to sustain their way of life.¹⁹

Climate-driven health risks from the spread of

Infectious disease

Loss of settlements

Infrastructure

Decline of ecosystems

that affect small island economies and livelihoods, and human well-being are under-researched.²⁸

- » Climate change-related migration is particularly relevant to low island communities in RMI and presents significant practical, cultural, and legal challenges.²⁴

- » A one m rise could result in the loss of 80% of the Majuro atoll, which is home to half the nation's population.²²



- » Rainfall has declined over the last 45 years and the 2015 – 2016 drought was the worst on record.³³
- » In the Marshall Islands, the aragonite saturation state has declined from about 4.5 in the late 18th century to an observed value of about 3.9 by 2000.¹⁵
- » Erosion of the coastline of Majuro is occurring at a considerable rate leading to falling over of coconut trees and coastal vegetation as the soils are washed away.¹⁵
- » The Pacific Catastrophe Risk Assessment and Financing Initiative in 2011 estimated the average annual loss related to cyclones and tsunamis/ earthquakes to be around 1.7% of gross domestic product (i.e., USD 3 million). Further, in the next 50 years, RMI has a 50 % chance of experiencing a loss exceeding USD 53 million and a 10% chance of experiencing a loss exceeding USD 160 million.³³

Mitigation and Adaptation to Climate Change

- » RMI's contribution to climate change has always been marginal (<0.00001% of global emissions).²⁹
- » Almost 90% of the national energy needs are currently satisfied by imported petroleum, although biomass remains important for cooking and crop drying on outer islands.²⁹
- » Since 2008 there has been a rapid expansion of solar investment to add renewable energy generation to the existing diesel-powered grids on urban islands.²⁹
- » In 2011, the RMI Government adopted the National Climate Change Policy Framework (NCCPF), which sets out the RMI's commitments and responsibilities to address climate change.⁴

RMI has made a commitment to reduce 28% of GHG emissions by 2025 below 2000 levels.²⁹

- » Additional reductions up to 35% below 2000 levels are subject to the availability of additional financial, technical and capacity building support from the international community.²⁹
- » Resource management and conservation are essential for healthy and stable communities on islands with limited resources because overexploitation could damage or permanently destroy natural resources.¹⁹

» RMI considers that adaptation action will have mitigation co-benefit, with efforts such as Mangrove and agriculture rehabilitation programs likely to enhance carbon sinks as well as assist with protection of water resources and health of the RMI people.²⁹

» The Joint National Action Plan (JNAP) for climate change Adaptation and Disaster Risk Management provides a detailed strategy for historically and co-operatively addressing risk in the RMI.³⁰

The National Strategic Plan outlines an overarching development strategy³¹

Social development
Human resource capacity development
Infrastructure development
Sustainable economic development
Good governance
Environment
Climate change and resiliency

» At the 44th Pacific Islands Forum in Majuro in 2013, RMI endorsed the Majuro Declaration. A call to action on climate change and an expression of political will to lead on climate change issues nationally and internationally and committed to strengthen its approach to climate protection, and to transition to renewable, clean, and sustainable energy sources.³¹

» The RMI government has developed several national and sector policies to help address key priorities (resilience to disaster, climate change, and water securities) which includes:³³

- › The 2050 Climate Strategy: Lighting the Way (2018)
- › Water and Sanitation Policy and Proposed Action Plan (2016)
- › The National Strategic Plan 2015 – 2017 (NSP) (2020-2030)
- › National Climate Change Policy Framework (NCCPF) (2011)

» In 2018, RMI became the first country to submit their second Nationally Determined Contribution (NDC), where the nation:³²

- › committed to a quantified economy-wide target to reduce its emissions of greenhouse gases (GHGs) to at least 32% below 2010 levels by 2025 and at least 45% below 2010 levels by 2030;
- › communicated an indicative target to reduce its emissions of GHGs by at least 58% below 2010 levels by 2035;
- › reaffirmed its aspiration to achieve net-zero GHG emissions by 2050 at the latest
- › committed to producing a National Adaptation Plan (NAP) by the end of 2019 at the latest that sets out short, medium, and long-term milestones to adapt to the impacts of climate change and transition to climate resilience, suggests implementation measures, and includes a plan to generate the necessary financing;
- › committed to submitting an Adaptation Communication to the UNFCCC by 2020 at the latest;
- › committed to a gender-responsive and human rights-based approach in all NDC- related planning, programming, and implementation
- › committed to using the latest Intergovernmental Panel on Climate Change (IPCC) guidelines in the future.

» The RMI second national communication has identified six priority areas, consistent with the Joint National Action Plan (JNAP) for Climate Change Adaptation (CCA) and Disaster Risk Management (DRM) goals to promote disaster risk resilience and climate change adaptation which includes:³³

- › Strengthening the capacity of the National Emergency Management and Coordination Office

- › Developing an information management system
- › Enhancing community-based awareness and education to change attitudes and behavior toward effective risk reduction
- › Climate-proofing new water supply developments
- › Reviewing and revising draft building codes
- › Testing early warning response

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