

A photograph of a tropical beach scene. The foreground shows white sand and gentle waves. The middle ground is a clear blue ocean leading to a small, low-lying island with palm trees on the horizon under a clear blue sky.

Climate Change in the Pacific



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1

The world is warming faster than at any time in the last 10,000 years, with the 1990s being the hottest decade in the past millennium. As global warming tightens its grip, the effects are being felt from the highest mountain peaks to deep in the oceans, and from the equator to the poles...

From invisible gases to life and death reality:

Carbondioxide, an invisible **heat trapping gas** builds up in the atmosphere...

Trapping more of the Sun's energy causing **global warming, sea level rise** and other changes in the world's climate...

That creates more **extreme weather conditions**.

Droughts, heat waves, storms and floods spread misery and **disease**. Many plants and animals cannot keep pace with **rapid warming** and face possible extinction.

BUT

The influence of Climate Change will be felt in many aspects of our lives in the Pacific. Some are:

- The degradation of natural resources and ecosystems,
- The loss of species
- Extreme weather events

Impacts of Climate Change on Pacific Islanders

“...if nothing is done as a matter of urgency, Kiribati like other small island states and low lying coastal areas and other ecosystems will continue to suffer in silence the ongoing and increasingly unbearable adverse impacts of climate change and sea level rise...”

Government of Kiribati statement at UNFCCC COP6, 2000

Why should we be concerned about climate change?

Many of us have often heard the terms ‘climate change’, ‘global warming’ and ‘greenhouse effect’. But how often have we thought about what they really mean? And more importantly, why we in the Pacific should even be concerned about climate change?

Climate change is often thought of as an environmental problem, caused by larger industrial nations, such as the United States and Australia. In this context, it is easier to ignore the problem, as we all know that Pacific Island countries are not responsible for this problem. Unfortunately, while the countries of the Pacific contribute least to the causes of climate change, we will be amongst those most at risk from its negative impacts.



© Cynthia Power / WWF SPP, PNG, Sepik Project



© Jason Brown / WWF SPP, Cook Islands



© Cynthia Power / WWF SPP, PNG



© Roy Rindorindo / WWF Indonesia

Sea-level rise and other climate change impacts are already having an effect on the lives, traditions and cultures of South Pacific Islanders.

lives

Why are we so vulnerable?

- ▶ The Pacific region is made up of 22 small-island developing states and territories, many of which are low lying atolls with limited land space, and human and financial resources.
- ▶ We depend upon our limited natural resources for our very existence. Fishing, tourism and agriculture dominate the economies of the Pacific Islands and these sectors all stand to be affected by changes in the climate.
- ▶ Pacific Islands are already susceptible to natural hazards such as cyclones, storm surges, droughts and flooding. Scientists are predicting that climate change will see such extreme events happen both more frequently and more intensely.
- ▶ In Fiji, half of the population live within 60 kilometres of the shore with 90% of villages located on the coast. Sea level rise may threaten village livelihoods, and traditional settlement patterns, as people may have to move away from their customary land, to higher ground.
- ▶ On Upolu Island, Samoa 70% of churches and 60% of schools are located on coastal lowland.
- ▶ Many of our island people rely on fisheries as a source of food and income from coral reef and mangrove habitats that are threatened by warming ocean temperatures and sea level rise.

The Rock Islands, Palau.

Source: Office of Environment Response and Coordination, Palau

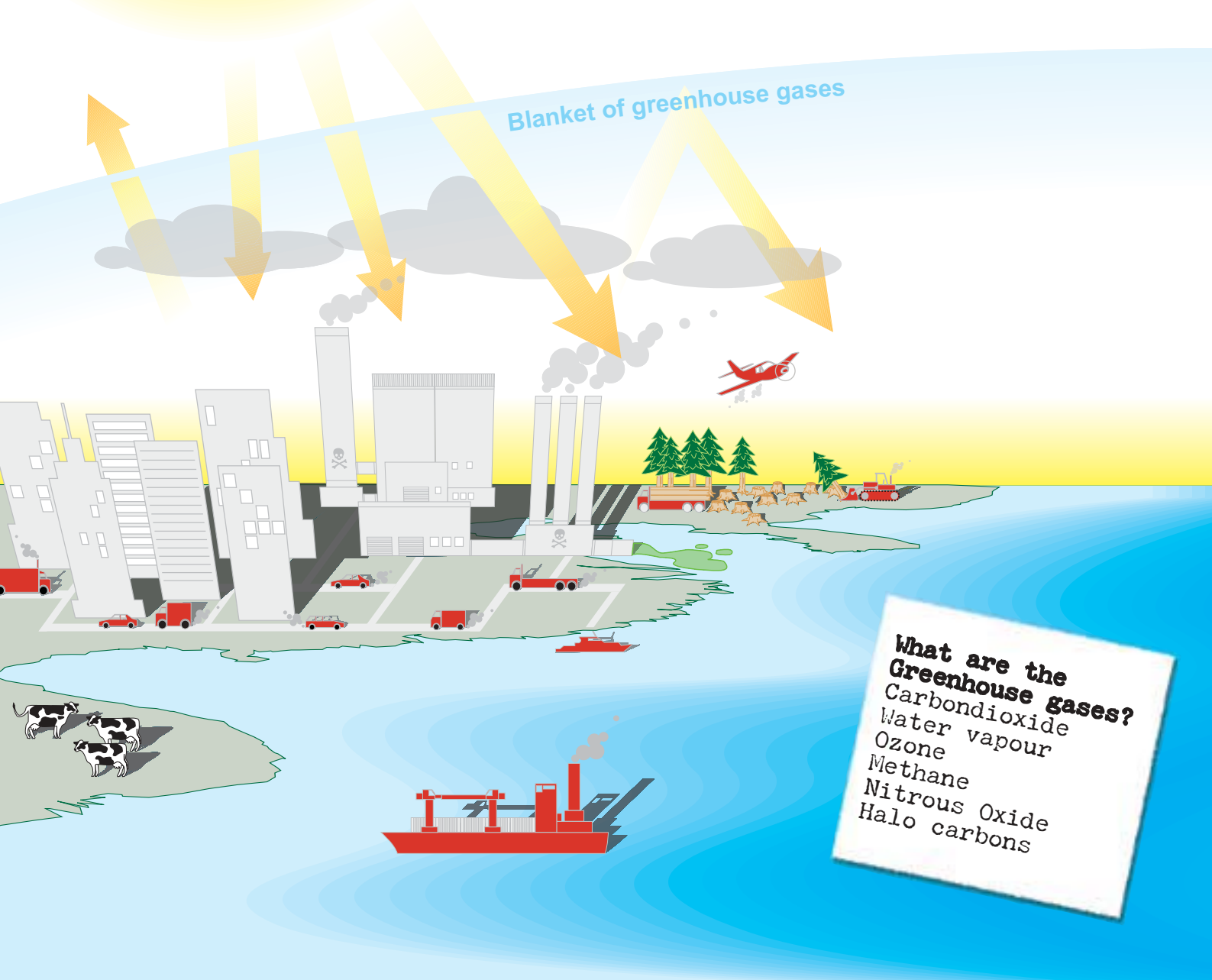


What is the Natural Greenhouse Effect?

Earth supports the life of humans, animals and plants by ensuring a constant temperature.

Earth's climate is driven by a continuous flow of energy from the sun, which we receive as heat through its rays. Some of this heat is absorbed by the earth's surface while the remainder bounces off the surface into the atmosphere, and out into space.

In order to prevent all this heat being lost into space, some of it is retained within the earth's atmosphere, by a blanket of gases. This blanket of gases acts as like a greenhouse by trapping the heat, keeping the earth at a temperature suitable for sustaining human, plant and animal life. This is sometimes called the Natural Greenhouse Effect.



What are the Greenhouse gases?
Carbon dioxide
Water vapour
Ozone
Methane
Nitrous Oxide
Halo carbons

Why is our climate changing?

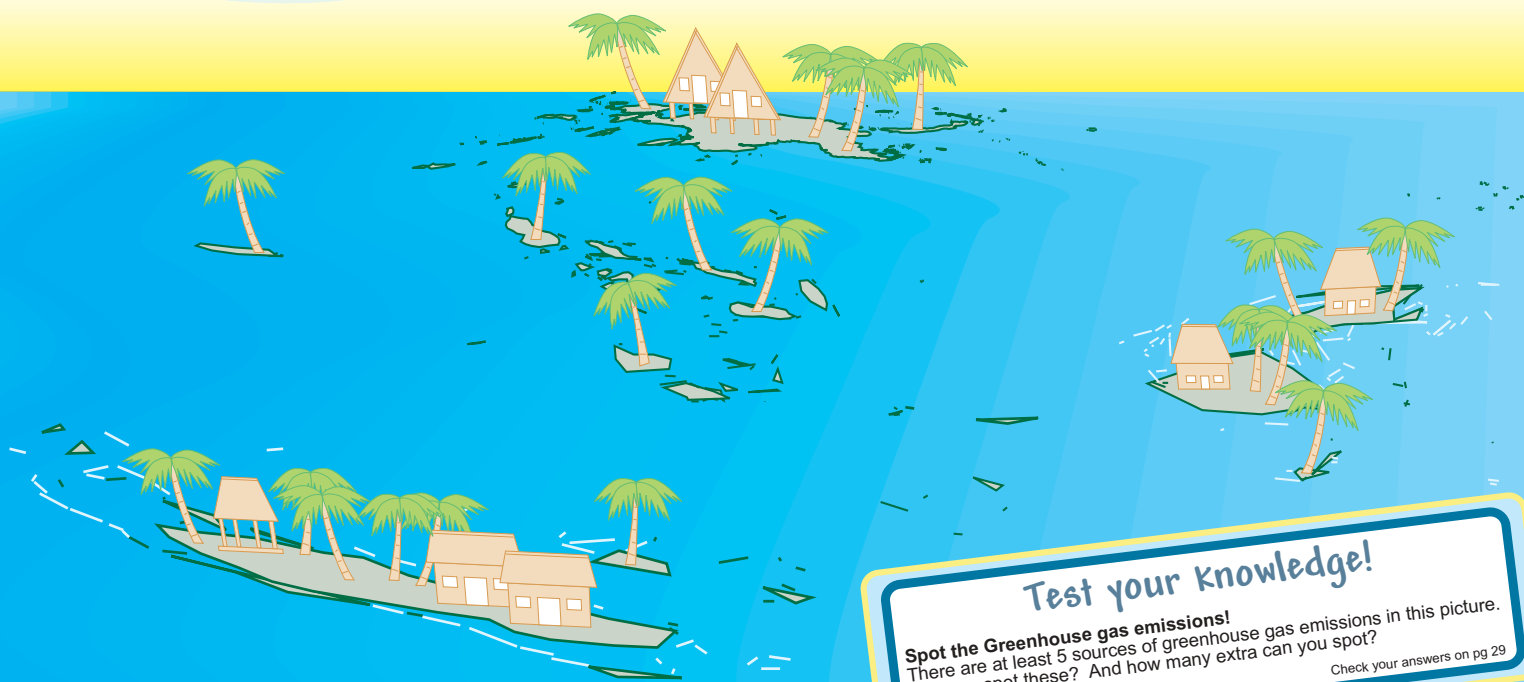
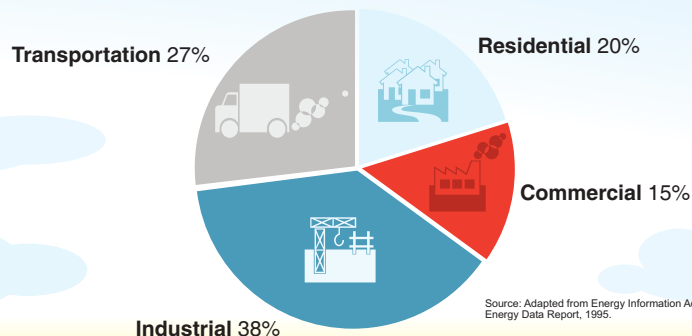
Greenhouse gases are all naturally occurring gases, and without them the earth would be too cold to sustain any forms of life.

Unfortunately, human activities are releasing too many greenhouse gases into the atmosphere. This has been through increased industrial production, electricity generation and uses of transportation. For example, carbon dioxide emissions are now around 12 times higher than in 1900 as the world burns increased quantities of coal, oil and gas for energy. This has caused a thickening of the 'greenhouse blanket' with the result that too much heat is trapped into the earth's atmosphere. This causes global temperatures to rise, and is the reason for climate change.

Human activities have the most profound effect on this delicate balance.

Where do these high levels of CO₂ emissions come from?

Energy Consumption in the United States



What will happen with Climate Change and how does it affect you?



Aitutaki, Cook Islands. An atoll in the making.
© WWF SPP

- ▶ International scientists estimate that **the Earth's surface temperature will rise between 1.4°C and 5.8°C between 1990 and 2100.**
- ▶ The 1990s was the hottest decade in the past millennium, and 1998 was the warmest year globally since records began in 1860.
- ▶ 2002 was the second warmest year.
- ▶ For the Pacific, perhaps the most significant negative effect of these higher global temperatures is the rise in sea levels resulting from the thermal expansion of the oceans and melting of ice-caps. It is projected that sea levels will rise by as much as 5 mm per year over the next 100 years as a result of global warming.

“Sea Levels may rise to as much as .88m within the next hundred years”

Climate Change will have far reaching impacts upon many of our Pacific Island nations. These will be felt in many aspects of our lives, including:

- ▶ **Fresh Water**
- ▶ **Agriculture**
- ▶ **Forests**
- ▶ **Biodiversity**
- ▶ **Human Health**
- ▶ **Coastal and Marine Resources**
- ▶ **Economies**



Coastal village in Kiribati.
© Bernadette Masianini / WWF SPP

effects

In some extreme cases, a village may have to re-locate to higher ground therefore losing generations of experience in a particular environment. Relocation is not always possible for villagers whose customary land rights only provide them with access to land on coastal areas.

Kiribati



Children in Kiribati village.
© Bernadette Masianini / WWF SPP

In many Pacific Islands, communities are already beginning to observe changes to their natural environment, consistent with the types of changes international scientists say will occur with climate change. Communities are already starting to ask, are these changes a result of climate change?

Villagers have been forced to move houses to retreat from the rising sea.

Traditional burial grounds near the coastline have also come under increasing threat.

Flowers for garlands, an integral part of the traditional dances that tell the history of the islanders are becoming harder to find.

Traditional weather readers are finding it more difficult to predict the weather.

The motu of Tebua Tarawa, which used to be a landmark for fishermen, is now under water.

Samoa

In the Samoan village of Saoluafata in Samoa, community members have already noticed that their coastline has retreated by as much as 50 metres in the last decade, with the result that they have had to move houses further inland. Future storm surges and sea level rise from climate change may see these types of pressures on coastal land increased.

What can YOU do?

- ▶ Ensure that traditional customs are not lost. Listen to elders, and record and use traditional methods therefore passing them on to future generations.
- ▶ When planting gardens, do not just use exotic species, but plant more traditional plants – many of these are important for ceremonial occasions or for medicinal purposes, so it is important that they are kept alive.

Impacts of Climate Change on Fresh Water

Water resources remain critical for many of the Pacific island countries. For instance, most low-lying atoll countries like Tuvalu and the northern atolls of the Cook Islands rely almost entirely on rainwater with some storage capacity in the freshwater lens as in the case of Kiribati and Marshall Islands. Drought in Papua New Guinea and Fiji is a manifestation of variations in climatic and oceanic conditions.

One quarter to one third of the world's population is now subject to water scarcity.

Populations facing water shortages will more than double over the next 30 years.

What will happen to the water supply on Pacific Islands?

Atoll islands often have no surface water and rely on shallow groundwater lenses and rainwater for water supplies. Some are completely dependent on rainwater harvesting. High volcanic islands have abundant rainfall, but it usually runs off quickly and is often difficult to use and store effectively.

- ▶ **Saltwater intrusion** will have an impact on fresh water supplies as seawater seeps into the thin wedge of groundwater therefore affecting the quality and quantity of drinking water and damaging agriculture. This is caused by sea level rise and storm surges.
- ▶ **Flooding:** Climate change will lead to changes in rainfall patterns. In some areas, this will lead to **more rainfall** in the form of storms and downfalls. This leads to increased flooding and reduces the ability of the soil to absorb water.
- ▶ **Drought:** Some areas will receive less rainfall, and may experience more frequent droughts.
- ▶ The Pacific Islands are therefore particularly vulnerable to the effects of climate change on water supply. Proper water management for drinking, fisheries, tourism and agriculture is crucial for the socioeconomic well-being and economic development of island populations; particularly those that are experiencing rapid population growth.



Hand well, used for drawing water, Mangaia, Cook Islands.

Source: Cook Islands Environment Service



Chambri Lake, Sepik region, PNG.

© Bernadette Masianini / WWF SPP

What can YOU do?



Community education, posters.

Source: Cook Islands Environment Service



Water Tanks in Aitutaki.

Source: Cook Islands Environment Service



Open Cycle Ocean Thermal Energy Conservation (OC-OTEC) system located at the Natural Energy Laboratory of Hawaii Authority (NELHA) at Keahole Point on the Big island of Hawaii.

Source: www.pichtr.org/ocean_thermal_energy_conservation.htm

In order to protect ourselves against times of drought, we need to increase our water storage and use our existing supplies with care.

- ▶ Mend leaky water pipes.

It is estimated 50-70% of water supplies in the Pacific Region is lost due to leaking pipes and storage. (South Pacific Applied Geoscience Commission, SOPAC)

- ▶ Turning off taps when not in use and keeping gutters clean and clear.
- ▶ When building a house, consider adding a water tank for extra water storage.
- ▶ Water gardens in the morning or at night – watering when the day is warmest means that most of the water will be lost to evaporation.
- ▶ Protect water catchment areas.
- ▶ Recycle water – grey water used for washing can be reused in gardens.

What is grey water? Grey water that has been used to wash dishes, clothes or for bathing. This can be used again to water gardens.

New Technologies

Pacific Island countries are beginning to explore new technologies, such as desalination plants - which produce fresh water from salt water.

Palau is currently testing new Japanese technology called Ocean Thermal Energy Conversion (OTEC). This generates both fresh water and electricity by using the difference in temperature between the sea surface and the ocean depths.

Impacts of Climate Change on Agriculture

Increased temperatures will cause heat stress for many agricultural plants, and changes in rainfall patterns may lead to increased incidences of drought in some islands, and flooding in others.

How will climate change affect agricultural production of Pacific Islands?

Pacific Islanders rely on **subsistence farming for food and cash crop production for export**. Practically all crop agriculture is concentrated at or near the coast and on the high islands good land is intensely cultivated, therefore making it very vulnerable to the influences of the climate.

Climate Change threatens food security of all Pacific Island nations.

- ▶ **Seasonal Variations:** Changes in rainfall, winds and temperatures lead to changes in growing seasons.

Anecdotal evidence from farmers in the Pacific shows that the climate may already be changing with rainfall patterns now less predictable. Traditionally, farmers have followed set planting patterns, which take into account dry and wet seasons. Today, farmers have found that rain can fall out of season, or droughts last longer. This has resulted in some fruit bearing out of season. Farmers in the Cook Islands speak of breadfruit bearing out of season, while farmers in Fiji talk about mango trees bearing fruit for longer periods. As climate change causes more variation, it may require traditional planting calendars to be altered to take these changes into account.



Cultivation of sweet potato, staple food crop of Kabara, Lau, Fiji Islands.
© Francis Areki / Fiji Country Programme.

- ▶ **Sea-level Rise:** Salt water contaminates fresh water supplies therefore making it difficult to keep crops properly watered. Fields and crops are destroyed by inundation from storm surges.

Taro, a vital subsistence crop to Pacific islanders has a very low tolerance to salt water. This has already had an impact in some islands such as Tuvalu, where it has been reported that taro pits have been ruined by inundation from saltwater.

- ▶ **Floods and Drought:** Extended and more intense dry seasons caused by rising temperatures, changes to rainfall patterns and increased affects of El Niño leads to ruined crops.

The 1997- 1998 drought in Fiji resulted in F\$104 million loss in earnings for the sugar industry while in other agriculture, revenue loss was F\$15 million

- ▶ **Pests:** Rising temperatures and increased rainfall in some areas may lead to increased pests and weeds destroying crops.

- ▶ **Cyclones and Hurricanes:** Cyclones causing high wind, increased rainfall and storm surges are likely to have a negative effect on agriculture, particularly if they become more frequent giving crops less time to recover, this is especially true of tree crops such as coconut which have longer recovery time.



Bananas growing in Aitutaki, Cook Islands.

Source: Cook Islands Environment Service

What can **YOU** do?

- ▶ Improve water-management and conservation methods such as using grey water to water crops.
- ▶ Use new farming techniques such as irrigation systems and different planting schedules to take advantage of the changing climate.

Taro is now growing in dry areas like the west Viti Levu in Fiji due to more frequent rainfall. Yields are estimated to increase by 5% to 15%.

In Samoa it has been suggested that agricultural developments be shifted further inland to avoid saltwater intrusion.

- ▶ Multi-crop agriculture and drought and pest resistant crops provide more resilience to the possible impacts of climate change.
- ▶ Use more of natural fertilisers like green-mulch stops the spread of chemicals polluting the surrounding environment therefore making it more resilient to climate change.



Pacific Island Taro, In Mangaia, Cook Islands.

Source: Cook Islands Environment Service



Sugar cane cultivation along mangrove - fringed coastal plains in western Fiji.

© Ashvini Fernando

Impacts of Climate Change on Forests

Forests and their resources are vital to the environment in the Pacific particularly on higher volcanic islands.

How will Climate Change affect forests in the Pacific?



Forests in northern Papua New Guinea.

© Cynthia Power / WWF SPP, PNG, Sepik Project

Forests are natural regulators of the amount of carbon dioxide in the Earth's atmosphere. Forests act as sinks, trees absorb carbon dioxide from the air and store it.

The cutting down or burning of trees is responsible for the release of this stored carbon dioxide back into the atmosphere. Therefore, conserving forests and practicing sustainable forestry is vital for the balance of greenhouse gases in the atmosphere and limiting the impacts of climate change.

- ▶ Forests are an important ecosystem providing habitats for humans, plants and animals.

PNG forests constitute the third largest block of unbroken tropical forests in the world and one of the world's most varied bird populations with 740 species recorded, over two thirds of which depend upon the rainforests.

- ▶ Forests provide food, building materials and medicines for islanders in the Pacific. They are also important to the economies as forests provide timber for export markets.

What will climate change do to forests?



Wood resources from forests are important for cultural purposes. Wood carving is also important for income generation.

© Francis Areki / WWF Fiji Country Programme

- ▶ Climate change may see increased droughts, flooding and cyclones all of which will have adverse effects on forests.

In the last El Niño 1997/1998 in PNG 500-600 thousand hectares of forests were destroyed caused by fires from drought.

Human impacts make the effects worse. Why?

Clearing of forests for commercial logging, agricultural plantations and building all contribute to deforestation. This makes it easier for forest fires to spread and leads to soil erosion which increases the chance of flooding as the soil fails to absorb heavy rainfall.

What can **YOU** do?

- ▶ Governments, local communities and companies need to recognise the need for conservation and land management for both commercial and subsistence purposes.

WWF South Pacific works with local groups to encourage government and industry to manage forests for conservation and long-term, sustainable use. It supports community-based conservation and development projects throughout Melanesia. These projects work with community groups to manage and conserve their forests. The projects often assist village-based business enterprises.

- ▶ Replanting of natural forests is important. Plant a tree, and plant a local species, and not an introduced one.
- ▶ Lobby your traditional leaders, local governments and authorities for support for the conservation and land management of forests.



Impacts of Climate Change on Biodiversity

The islands of the Pacific are associated with rich biodiversity due to the unique habitats provided by coral reefs, forests, mangroves and wetlands.

It is expected that climate change will affect the plants, birds and animals of Pacific ecosystems throughout the region.

The impact on biodiversity on islands states is much greater than the impact on continental areas. This is largely due to the fact that a large number of species are endemic.

What does endemic mean?

Endemic means that a plant or animal is unique to that habitat and cannot be found anywhere else.

How will climate change affect pacific island ecosystems and biodiversity?

- ▶ Habitat modification and destruction – ground-nesting seabirds on low islands are affected by more storm surges and sea level rise. Forests destroyed by fire and cyclones lead to loss of habitat and food.
- ▶ Temperature fluctuations and changes in rainfall lead to changes in habitat. Higher sea temperatures destroy coral and more rain over high islands increases the amount of silt being washed onto reefs which is also detrimental to coral growth.

The Brown Booby, Masked Booby and Red-Tailed Tropicbird have had ground nests damaged on the low lying atolls of the Northern Cook Islands.

- ▶ An ecosystem is made up of a set of interlinked components. A negative effect on one, impacts on all the others.

Perhaps the most obvious effect of climate change on the delicate ecosystems of the Pacific is coral bleaching. Corals live at or near their thermal limits – temperatures between 18°C and 28°C therefore a slight increase in temperature of the water causes bleaching. If temperatures do not decrease in time, the coral dies therefore affecting the population of reef fish, invertebrates and other marine animals, which rely on the reef for food and habitat.

Pollution, poor management and over-exploitation of resources

The effects of climate change are made worse by human impacts such as pollution on ecosystems. In order to limit these effects humans must limit their impact and help ecosystems to adapt.



Underwater scene, Fiji Islands. Fiji Is Famous throughout the world for spectacularly rich and vibrant soft coral reefs.

© WWF-Canon / Catherine Holloway

What can YOU do?



Hawksbill turtles live on coral reefs where their favourite food, sponges, are most plentiful. Fiji Islands

© WWF-Canon / Catherine Holloway



WWF South Pacific staff member releasing a rescued turtle in Fiji.

© Lissette Wilson / WWF SPP



The Golden Plover (*Pluvialis fulva*). Fiji's annual northern migrant from the northern hemisphere.

Courtesy of Tom Tarrant

Increase resilience to changes - healthy ecosystems are more likely to survive the stresses placed on them by climate change. For example, healthy reefs are more resilient to coral bleaching.

- ▶ Establishment of forest, marine and coastal reserves can help preserve endangered plants, birds and animals.

Across the region, WWF SPP helps to set up community based Marine Protected Areas (MPAs). These aim to get the local people involved in managing their local resources in relation to consumption to prevent, for example, over-fishing or over-farming land.

The Rau'i, Cook Islands

The Rau'i is a traditional marine environment protection system that involves traditional leaders banning the harvest of marine resources in designated areas to help regenerate population and habitat.

Corridors for Migration

Corridors for Migration are the set routes that animals follow when they migrate from one area to another with the changing seasons.

Climate change could alter these corridors for migration, as conditions in parts or the whole of the route may become less suitable for the animal.

Annual migrants, such as the Golden Plover, depend on coastal ecosystems such as those in Fiji, Tonga, Tuvalu and Samoa as winter feeding grounds. The imminent threat posed by climate change to these coastal ecosystems will inevitably disrupt the migratory patterns and life cycles for such species.

Golden Plover or "dilio" in Fiji is culturally significant as there is an old saying "kune kune vaka na yaloka ni dilio" meaning "a rare phenomenon; like finding the egg of a Golden Plover". There is truth in the saying as the egg of the "dilio" can only be found in nesting grounds in Russia and Alaska.

What can you do to help protect the Pacific's ecosystems?

- ▶ Support local managed Marine Protected Areas and traditional conservation methods.
- ▶ Help keep forests, reefs, wetlands and mangroves free of pollution, for example limit use of fertilisers.
- ▶ Report changes you see in your environment to local government offices and WWF.

Impacts of Climate Change on Health

SPREAD OF DISEASE

Malaria, Dengue, Cholera



Mosquitoes are responsible for spread of many diseases including Malaria and Dengue.

Source: World Health Organisation

What is Giardia ? Giardia is a parasite that can be found in contaminated water. It causes diarrhea and is highly contagious.

Flooding and the subsequent disruption to the water supply, contamination and rises in air and water temperatures have a direct impact on the health of the populations of the South Pacific Islands.

▶ **Increased vector-borne diseases:** Vector-borne diseases such as malaria and dengue are particularly sensitive to warming and flooding. Water provides a habitat for mosquitoes and warmer temperatures allows breeding in areas that were previously too cold. For example, malaria which is found in the western Pacific nations such as the Solomon Islands and Papua New Guinea could move as far east as Fiji.

▶ **Increased water-borne diseases:** Water-borne diseases are the result of flooding and contaminated water. Cholera outbreaks are pronounced after a heavy rainfall that causes flooding and disruption to sewage systems. This leads to contamination of the water supplies.

Other diseases such as giardia and amoebiasis are also thought to increase as result of damage to sewage and water systems by flooding.

▶ **Increased aquatic pathogens:** warmer waters lead to enhanced production of aquatic pathogens therefore jeopardizing the safety of seafood.

Ciguatera Fish Poisoning is a form of human poisoning caused by the consumption of subtropical and tropical marine finfish, which have accumulated toxins through their diet. A study carried out in Tarawa, Kiribati in 1999 identified a significant relationship between sea surface temperature and reported incidences of ciguatera. A model developed shows that a rise in sea temperature is expected to increase outbreaks from 35-70 per thousand people in 1990 to 160-430 per thousand by 2050.



Pacific Island Feast, Kiribati.

© Bernadette Masianini / WWF SPP

Threats to diet

▶ Sea level rise, droughts and floods all threaten our water supply, which may have a negative effect on traditional food crops. Without our traditional sources of food, this may lead to a heavier reliance on imported foods.

▶ Disruption to our marine ecosystems may reduce the availability of fish and other seafood. This can reduce our protein intake and also increase our reliance on more expensive and often less healthy substitutes.

What can YOU do?

The risk of climate related disease is reduced at household and community level by following simple steps:

- ▶ Keep yards tidy, clearing up cans, bottles and other water catchment areas where mosquitoes can breed.
- ▶ Keep lawns trimmed and gardens tidy ,as mosquitoes love to hide in long grass.
- ▶ Cover up or wear repellent during the day, to avoid being bitten by mosquitoes.
- ▶ Boil your drinking water in times of heavy rainfall or flooding.
- ▶ Make sure you eat a balanced diet, a healthy body is more resilient to sickness.

Measures such as health education programmes can be implemented to reduce the severity of possible climate change related health threats.

How community campaigns can help?

An outbreak of dengue in 1997 saw 24 000 people fall ill and 13 die. The Ministry of Health in Fiji quickly established an outbreak response team, which met regularly to guide activities in the areas of surveillance, information dissemination, space spraying and case management. Container surveys showed that tyres, plants, drums and tins were the problem, not water containers. A major community campaign was initiated. This was supported by legislative, punitive measures, and public removal of garbage left at the roadside.



Community clean up campaign, Suva, Fiji
Photo courtesy of Department of Environment Fiji

Impacts of Climate Change on Coastal and Marine Resources

Pacific Islanders are dependent on marine and coastal resources for traditional practices and their livelihoods.

Coral reefs



© WWF-Canon / Catherine Holloway

are a source of food, beach sand, building materials and function as natural breakwaters along the coast. Reefs sustain Pacific coastal communities and have great economic, social and cultural importance to the entire region.

How will Climate Change affect coral reefs ?

Climate change is expected to increase incidences of coral bleaching.

The impact of increasing carbon dioxide concentrations in the ocean is thought to have an effect on the ability of reef plants and animals to make the limestone skeletons that build reefs. Climate change will have a negative impact upon coral reef growth.

Mangroves



© Bernadette Masianini / WWF SPP

protect against storms, tides, cyclones and storm surges. Mangroves are very important to plant and animal productivity as they provide protection for young fish and other animals. They also are a source of wood and fuel.

How will Climate Change affect mangroves?

Sea level rise may have a negative impact upon mangroves. With coastal erosion and increasing sea levels, mangroves will have to retreat inland, to ensure survival. This may not be an option in some areas, where coastlines have been altered to allow for infrastructure and development close to the water line. The cutting back of trees is likely to lead to reduced resilience to sea-level rise and wave surges. Increased sediment from more rainfall and flooding can affect growth.

Fisheries



© WWF - Canon / Catherine Holloway

are an important commercial and subsistence resource.

- ▶ In Fiji, in 1999, 17 800 metric tonnes of fish for subsistence purposes were caught, worth \$50million.
Domestic commercial catch of fresh and frozen fin-fish was 5 102 metric tonnes, worth \$16.9million.

How will Climate Change affect fisheries ?

Reefs and mangroves which provide habitats, breeding grounds and food resources to marine life face degradation due to climate change. This results in adverse effects on fish-stocks.

Human influences such as pollution, land development and over-fishing already affect these resources – climate change adds to the impacts.

What can **YOU** do?



Ono Harbour, Kadavu, Fiji Islands.

© WWF-Canon / Catherine Holloway

- ▶ Protect coral reefs as they provide buffers from storm surge.
- ▶ Reduce use of pesticides and fertilizers as they run off into lagoons and harm the reef.
- ▶ Plant more coastal trees like coconut trees.
- ▶ Do not build too close to coastline; leave a “buffer zone”.
- ▶ Protect mangroves – get involved in mangrove replanting projects unless we protect our mangroves, we will lose the protection that they offer our coastlines. Although they are a valuable source of firewood, mangroves must be harvested in a sustainable manner, to ensure they are not destroyed.

Organisation for Industrial, Spiritual and Cultural Advancement (OISCA) Fiji Agro-Forestry Development Project has trained young people on the Coral Coast how to plant mangroves and helped set up nurseries.



Mangrove nursery in western Fiji.

Photo courtesy of Ashvini Fernando



Mangrove ecosystems sustain a diverse array of terrestrial and marine organisms. Nasoata Island, Rewa, Fiji.

© Francis Areki / WWF Fiji Country Programme

Impacts of Climate Change on the Economy

Climate change, climate variability and sea-level rise are not just environmental problems; they are also likely to have serious economic impacts on the lives of Pacific Islanders.

The impacts are likely to have significant effects on the economic development of Pacific Islands as major economic sectors such as fisheries, tourism and agriculture are affected.

How Much Will Climate Change Cost?



Commercial fishing boats at Lami, Fiji.

© Penina Solomon / WWF SPP



Sugarcane plantation in western Fiji.

Photo courtesy of Ashvini Fernando

▶ Coastal and Marine Resources

A World Bank study (2000) has estimated that damages caused by sea level rise and coral bleaching due to climate change will cost Tarawa, Kiribati between US\$6.6-12.4 million annually.

▶ Water resources

Viti Levu, Fiji, is expected to incur costs of up to US\$50 million by the year 2050, due to drought resulting from climate change.

▶ Fisheries

The drought in Fiji had a serious impact on the commercial fishing industry. The catch composition of the long-line fleet changed markedly with few of the higher valued yellowfin and bigeye tuna being caught in 1998 while the catch of the lower value albacore increased dramatically. Most of the established operators were able to survive the change, but all suffered significant drops in profitability. By early 1999 the composition of the catch had returned to "normal" with a significant increase in the catch of yellowfin and bigeye. In the medium to long term it is likely that future events will trigger similar changes in catch composition.

▶ Agriculture

The 1997 - 1998 El Niño related drought caused devastating impacts on the Fiji Sugar Industry. There was a 5% drop in planted areas and 25% of standing crop was wiped out. It is estimated that there was a national production loss of F\$104 million.

► Tourism

Many island states depend heavily on tourism. Any damages to pristine ecosystems of the Pacific, such as coral reefs, may see a reduction in tourism numbers. Tourism infrastructure is often located along coastlines, making it vulnerable to the impacts of coastal flooding and extreme weather events.



Aitutaki Lagoon Resort on lagoon's edge.

Source: Cook Islands Environment Service

► Extreme Weather

Estimated costs of Extreme Weather Events in the Region during 1990s



Aftermath of Cyclone Ami, Kabara, Lau, Fiji Islands.

© Francis Areki / WWF Fiji Country Programme

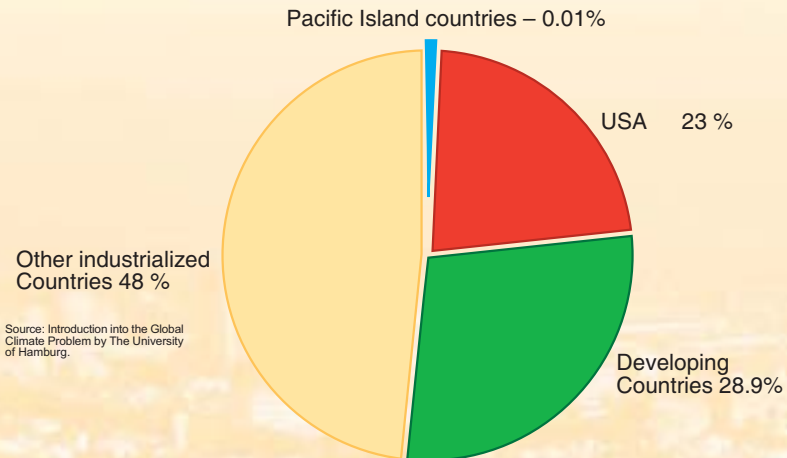
Event	Year	Country	Estimated Losses (US\$ millions)
Cyclone Val	1991	Samoa	300
Cyclone Kina	1993	Fiji	140
Cyclone Ami	2003	Fiji	104

A Global Problem requires a Global Solution

Climate change is an international problem, which is likely to have effects on countries around the world. Although Pacific Island countries are responsible for less than 1% of greenhouse emissions, they are most vulnerable to the adverse impacts climate change. This vulnerability is increased due to their fragile ecosystems and developing economies.

Over the last decade steps have been made to address climate change on an international level.

Global Carbondioxide Emmissions



What has been done?

- ▶ 185 countries have signed an international treaty known as the United Nations Framework Convention on Climate Change (1992).

The objective of the Convention is for all countries to reduce their human induced (anthropogenic) greenhouse gas emissions so that they do not reach dangerous levels. These reductions are to be done in a way that does not harm the national economic development of a country.

Pacific Island Signatories

Cook Islands
 Federated States of Micronesia
 Fiji
 Kiribati
 Marshall Islands
 Nauru
 Niue
 Palau
 Papua New Guinea
 Samoa
 Solomon Islands
 Tonga
 Tuvalu
 Vanuatu

It is vital that countries work together to limit the impacts of climate change.

Progress towards reaching this goal is monitored by:

All countries that have signed the agreement have the responsibility of submitting a national communications document. This should provide information on greenhouse gas emissions, vulnerability to climate change and programmes and measures, which are being implemented to nationally reduce emissions and address vulnerability.

To read your country's documents you can look on www.unfccc.int under national communications from non-Annex 1 countries or contact your government's department of environment.

What is the Kyoto Protocol?

The Kyoto Protocol sets out actual targets for developed countries to reduce their greenhouse gas emissions, within a set time frame. For example, at the end of the first commitment period (2012), New Zealand's emissions levels must be at the same level they were in 1990.

The Kyoto Protocol has yet to come into force. In order for it to come into force it requires 55 countries to sign it, and it must also be signed by countries making up 55% of total global greenhouse gas emissions.

Australia and the United States, although major emitters, have announced that they will not sign the Kyoto Protocol. This leaves Russia as the only country with enough emissions, who is yet to sign, and could bring the Kyoto Protocol into force.

12 Pacific Island Countries have ratified the Kyoto Protocol.

Developing countries (such as the Pacific Islands) do not have emission reduction targets but instead can participate in the Kyoto Protocol through the Clean Development Mechanism.

What is the Clean Development Mechanism?

This provision allows developed countries to undertake emissions reduction projects in developing countries. The developed country gains credits for the emissions reduced, while the developing country gains projects and help with capacity building and technology.

This provides opportunities for Pacific Island energy sectors to work with developed country partners to introduce more efficient ways of energy production, or new renewable technology.

Atiu hostel in the Cook Islands is testing a hot water heater, which uses a heat pump, and sources its energy from the air. A normal solar heater only heats water when the sun is shining. This heater, however, is capable of heating water 24 hours a day, even during rainy periods or the evenings because its energy is drawn from the air. As long as the air temperature is above 0°C, there is energy available in the air that can be transferred to heat water.

In Vanuatu, buses now use Coconut oil in place of diesel.

An early Pacific Island community Solar Project, Pukapuka, Cook Islands.

Source: Cook Islands Environment Service



What can YOU do to help the Kyoto Protocol?

The majority of global greenhouse gas emissions come from industrial countries. Unfortunately, the impacts of climate change are not confined to those countries who are responsible for their cause.

It is important to lobby Governments from industrialised countries who are responsible for this problem, to take action within their own countries to prevent further climate change.

- ▶ Call upon industrialised countries' governments to take action against climate change. For example, Australia and the United States should be lobbied to sign the Kyoto Protocol.
- ▶ Lobby our own Pacific Island Governments to make this an important political issue. This can be done by writing a letter to your national climate change officer, to ensure that the Pacific voice is heard in international climate change negotiations.

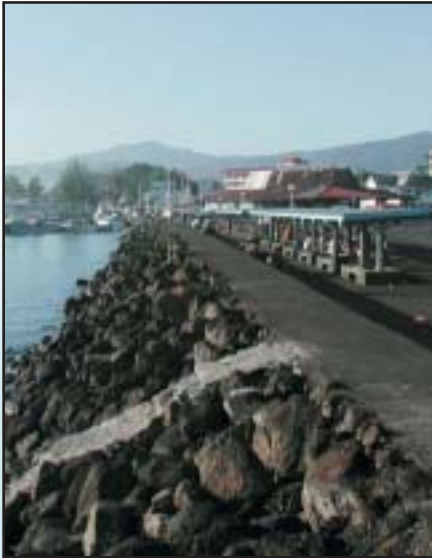
What can you do to conserve energy?

- ▶ Use lights, fans and air conditioning efficiently and turn them off when you go out of the room.
- ▶ Ensure fridge door and washing machine seals are clean and the door closes properly.
- ▶ Look for an energy rating label. The energy rating label has from one to six stars marked on it. The more stars an appliance has, the less energy it will use.
- ▶ Televisions, VCRs and stereos can generate between 20 and 85 kilograms of greenhouse gas per year when in 'standby' mode. Turn them off at the power point when you leave the house for long periods.
- ▶ Efficient cooking methods, such as putting lids on pots, simmering gently instead of boiling vigorously can save half the greenhouse gas generated during cooking.
- ▶ When out walking, collect littered containers (for example, bottles and aluminium cans): recycling a shopping-bag-full of such containers saves at least five kilograms of greenhouse gas and reduces litter.
- ▶ Recycle...containers, paper, old appliances, printer cartridges, used engine oil, building materials – everything you can't refuse, reduce or re-use. Paper that is left to decay in landfill generates greenhouse gas in the same way as garden waste.

Using energy efficiently not only saves the planet but also saves money.

Community responses to climate change

Funds for adaptation



Seawall protecting Apia, Samoa.

Photo courtesy of R. Thaman

As the impacts of climate change escalate, Pacific Island countries are going to be faced with increasing costs of adapting to climate change, climate variability and sea level rise.

Although climate change is largely a problem caused by industrial countries, it is unfortunate that Pacific Island countries, who have little or no control of the causes, are already beginning to bear the costs. National budgets are already having to take into account factors such as:

- ▶ Costs of Integrated Coastal Management and infrastructure.

The World Bank (2000) estimated that sea walls surrounding the Tarawa Atoll, Kiribati, would require capital investments of about US\$1.5-1.8 million.

- ▶ Costs of improved water facilities.
- ▶ Costs of risk and disaster management including how to limit impacts and appropriate responses.

WWF - community partnerships



Tikina wai villages practice community mapping, Fiji Islands.

© Penina Namata / WWF Fiji Country Programme

Although climate change remains an issue of priority on international political agendas, the reach of its impacts is not limited to governments. Climate change is already having an impact upon Pacific Island communities.

WWF Fiji has begun working in Tikina Wai, a coastal community along the Coral Coast of Viti Levu, Fiji, to develop community based adaptation plans. By building awareness of the impacts of climate change, WWF is able to work with communities to develop ways to increase their resilience against the negative impacts of climate change. For example, by working with the community to establish marine protected areas and sustainable harvesting practices, this will increase resilience of its marine resources.

WWF is also working in partnership with the Department of Environment in Fiji, on a national project titled "Capacity Building for the Development of Adaptation Measures in Pacific Island Countries". Funded by the Canadian Government, and managed regionally by the South Pacific Regional Environment Programme, this project extends the community based work into three Fiji communities.

This same project is also currently being run by environmental departments in the Cook Islands, Samoa and Vanuatu.

Useful websites:

WWF South Pacific has embarked on a regional climate change programme, which works at a variety of levels ranging from communities to governments.
www.wwfpacific.org.fj

WWF - World Wide Fund for Nature
www.panda.org

South Pacific Regional Environment Programme. SPREP has a Climate Change Programme.
www.sprep.org.ws

Website of the United Nations Climate Change Secretariat, based in Bonn, Germany, for information on climate change and climate change negotiations.
www.unfccc.int

Intergovernmental Panel on Climate Change. The IPCC is the worlds leading scientific body on climate change and is made up of 2000 internationally recognised scientists.
www.ipcc.ch

United States Geological Survey
Freshwater-saltwater interaction
<http://water.usgs.gov/ogw/gwrp/saltwater/salt.html>

Droughts, Climate Change and Groundwater sustainability
<http://water.usgs.gov/pubs/circ/circ1186/html/boxb.html>

World Energy Council
www.worldenergy.org/wec-geis

Small Islands Developing States Network. A global network for the Barbados Plan of Action.
www.sidsnet.org

System for Analysis Research and Training (START). Establishes and fosters regional networks of collaborating scientists and institutions in developing countries.
www.start.org

Asia-Pacific Network
www.apn.gr.jp

Climate Action Network – a global network of Non-Governmental Organisations working to promote governmental and individual action on limiting global change.
www.climatenetwork.org



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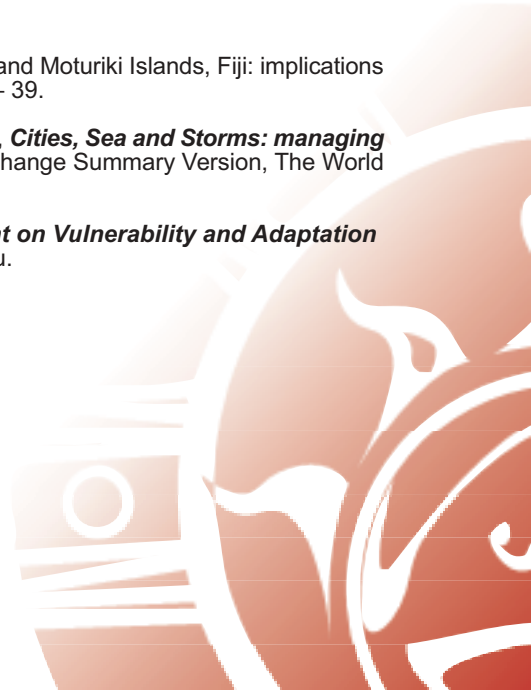
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Answers

from page 4: Greenhouse gas emission sources in the picture include:

cow - methane
airplane - carbondioxide
trucks - carbondioxide
felled trees - carbondioxide
cruise ship - carbondioxide
factories - carbondioxide







Sunset behind breaking waves.

© WWF-Canon / Anton Vorauer

WWF is the world's largest and most experienced independent conservation organization. It has 4.7 million supporters and a global network active in 96 countries.

WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by:

- conserving the world's biological diversity
- ensuring that the use of renewable natural resources is sustainable
- promoting the reduction of pollution and wasteful consumption.

WWF South Pacific Programme was established in 1990 to provide a base in the region to organise a strategic series of conservation field projects, policy reviews and campaigns in different Pacific Island Countries.

Let's leave our children a living pacific



www.wwfpacific.org.fj