

**IT'S GETTING HOT IN HERE:
SCIENTISTS SHARE
THEIR OPINIONS
ON CLIMATE
CHANGE**

PREPARED BY



**The Science
Advisory Board**

671 N Glebe Rd #1610 Arlington, VA 22203
703 778 3080

www.scienceboard.net
questions@scienceboard.net

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EXECUTIVE SUMMARY

The Earth has been through many climate cycles over time. However, the current trend in increasing global temperature is of interest due to a steep rise in carbon dioxide levels and numerous impacts on the environment and natural resources, especially water. Humans should be particularly invested in this issue because the natural changes will impact the way that humans live in the world and actions taken by civilizations and industrialization may be the cause behind this extreme rise in carbon dioxide and temperature rise.

To address this concern, international and national efforts have been pledged and implemented to find a common understanding of global impacts of climate change and steps to reduce the effects of civilization and industrialization. Many nations across the globe have developed plans to adapt to new climate norms and to mitigate the effects in their local environments. On this issue the world has come together to support each other, with developed nations financing climate adaptation and resiliency in vulnerable and developing countries. These countries are particularly susceptible to the effects of climate change and may lack the ability to adequately respond to changes in their environment and infrastructures.

Constant monitoring and evaluation of global climate change, conducted by national and international organizations such as the Intergovernmental Panel on Climate Change (IPCC), an arm of the United Nations, has recently revealed that despite targeted actions to prevent future climate change, extensive review of indicators (temperature, carbon dioxide) suggest that the Earth's current climate cycle continues to be exacerbated by human activity.

At **The Science Advisory Board®**, we decided to harness our research and analytical capabilities to learn more about *what scientists think about climate change and the impact it will have on the world*.

After surveying over 700 life scientists around the world, we gathered the significant to develop an understanding of where scientists stand on global warming. Through statistics, graphical images, and textual responses, we've attempted to connect the scientist's responses to global trends.

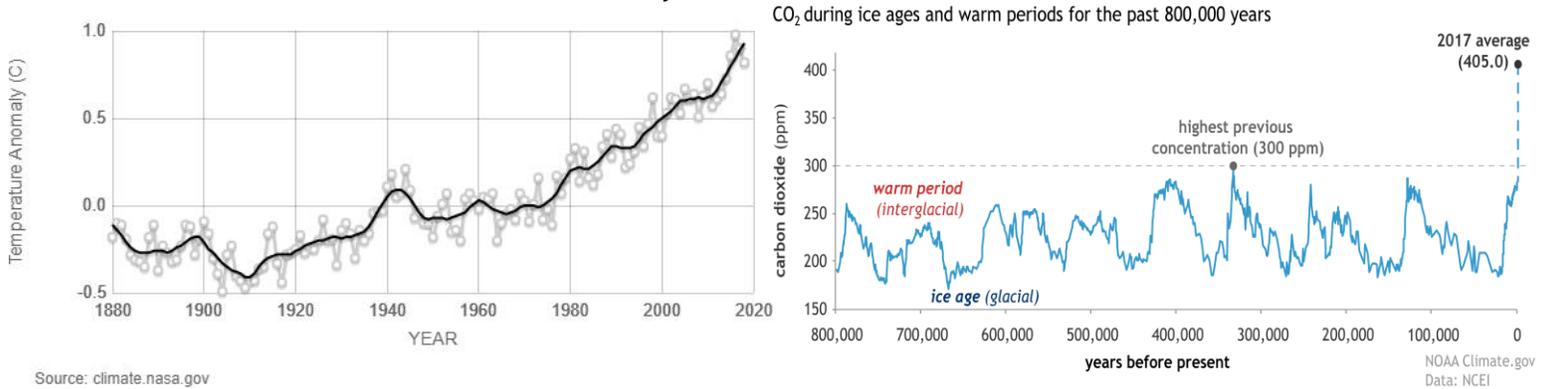
Important Findings

1. Most life scientists believe that in the next 50 years warming will cause increased instances of extreme weather, damaged ecosystems, extinction of certain species, and to a lesser degree increased illness in both humans and animals, and mass migration. Other scientists believe that there will be minimal effects on the environment, and yet more say that society will be negatively impacted by warming.
2. Life scientists are generally pessimistic about the ability of society to prevent warming and do not believe that life will adapt in the timeframe set by national and global decisionmakers.
3. Scientists do believe that technologies can be used to tackle warming, with a strong belief that solar will be the most effective tool. However, scientists seem to believe that a variety of technologies and strategies will need to be deployed to fight the effects of warming.

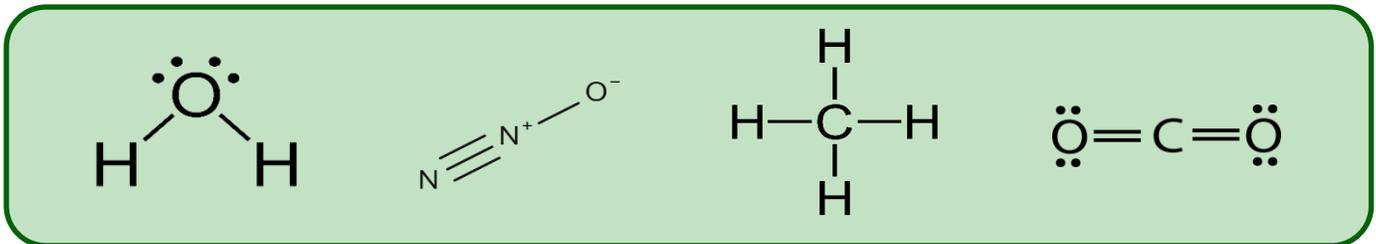
BACKGROUND

CLIMATE CHANGE BASICS

The Earth has been through seven cycles of climate changes in the last 650,000 years, attributed to very small variations in Earth's orbit that change the amount of solar energy our planet receives. The current trend of climate change is of interest because this warming cycle is paired with steep rises in atmospheric carbon dioxide levels since the mid 20th century.



- This increase is attributed to expansion of the **“greenhouse effect”** (warming as a result of heat trapped in the atmosphere from Earth towards space).



- Too much greenhouse effect results in increased surface temperatures, whereas too little greenhouse effect results in a thin atmosphere and decreased surface temperatures.
- Industrial activities that our modern civilization relies on have contributed to **increased carbon dioxide** levels.

More effects of a changing climate include: warming oceans, sea level rise, ocean acidification, shrinking ice sheets, glacial retreat, decreased snow cover, declining Arctic sea ice, increased number of extreme weather events



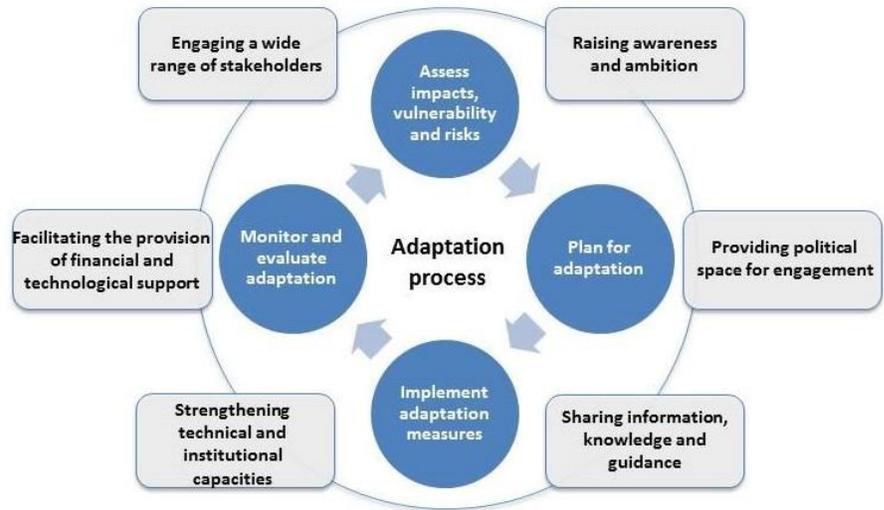
CLIMATE ADAPTATION & RESEILIENCE

According to the United Nations, *climate adaptation* encompasses efforts to implement projects that utilize biodiversity and ecosystem services, spreading vital knowledge through global networks, providing interface between researchers and decision-makers, and helping countries gain access to finance for building resilience and national capacity.

Many nations across the world have adopted national climate adaptation plans and/or strategies. For example, 185 parties entered into the Paris Agreement in December 2015.

Yet, developing countries are particularly vulnerable to climate change due to economic reliance on industries like agriculture and the limited ability to financially respond to the impacts of climate change. In these countries, climate adaptation strategies focus on planning for economic stability of cities, agriculture and water during climate change.

Conversely, developed nations' adaptation strategies include innovation, education and outreach, providing global financial assistance and protecting natural resources. A key component of most national adaptation efforts is partnership and shared responsibility between governments and private parties (individuals, groups, businesses).



Climate resilience is the ability of a community, nation or the world to absorb stresses and maintain function imposed by climate change and adapt, reorganize and evolve into more desirable configurations that improve sustainability, thereby better preparing for future impacts. The goal of climate resilience is to prevent permanent losses due to climate change.



BACKGROUND

A GLOBAL EFFORT TO TACKLE CLIMATE CHANGE

To address this global concern, a *collaborative network of various government agencies and intergovernmental bodies* has been developed. Efforts to combat climate change occur at the international, national, and local levels. Cooperation and collaboration are essential to successfully limit the current impacts and future effects of climate change.

This requires guidance and scope from international organizations such as **United Nations** programs and agencies.

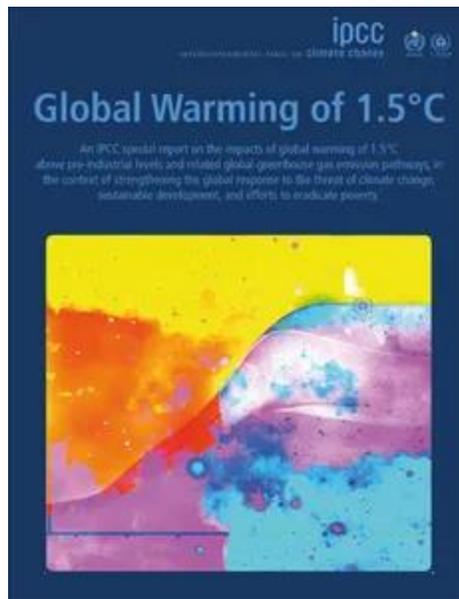


Moreover, commitment and action are required from member nations (examples on below). The United Nations Framework Convention on Climate Change (UNFCCC) is responsible for generating international agreements whereby parties commit to climate action and strategies. UNFCCC brings nations together with international agreements which provide the foundation for sustainable, low-carbon and resilient development under a changing climate. These include: The Convention (1992), Kyoto Protocol (1997), and most recently the Paris Agreement (2015). In the interim, many countries have entered the Copenhagen Accord (2009).

Region	Nation/Party	National Government Agencies & Organizations	Near-Term Efforts to Reduce the Effects of Climate Change (Copenhagen Accord 2020 Targets)	National Adaptation Strategy
North America	United States	United States Global Research Program, Environmental Protection Agency	Reduction of CO ₂ emissions with target of 17% below 2005 levels	“Preparing the U.S. for the Impacts of Climate Change (E.O. 13653) & U.S. Climate Resilience Toolkit
	Canada	Environment & Climate Change Canada	Reduction of CO ₂ emissions with target of 17% below 2005 levels	Pan-Canadian Framework on Clean Growth & Climate Change
Europe	European Union	European Commission on Energy, Climate Change, Environment	Reduction of CO ₂ emissions by 20-30% below 1990 levels	EU Adaptation Strategy
Asia	China	Ministry of Ecology & Environment of the People’s Republic of China	A) Reduction of CO ₂ emissions per unit GDP by 40-45% below 2005 levels by 2020 B) Increase the share of non-fossil fuels in primary energy consumption to around 15% by 2020 C) Increase forest coverage by 40 million hectares and forest stock volume by 1.3 billion cubic meters by 2020 from 2005 levels	National Strategy for Climate Change Adaptation
	Japan	Ministry of the Environment, Ministry of Trade & Economy	Reduction of CO ₂ emissions by 3.8% below 2005	National Plan for Adaptation to the Impacts of Climate Change
	India	National Action on Climate Change, Ministry of Power, Prime Minister’s Council on Climate Change	Reduce the emissions intensity of its GDP by 20–25% in 2020 below 2005 levels (does not cover emissions from the agricultural sector)	National Action Plan on Climate Change
Rest of World	Australia	Australian Government Department of the Environment & Energy	Reduction of CO ₂ emissions between 20-25% below 2000 levels	National Climate Resilience & Adaptation Strategy
	Brazil	Ministry of Environment	Reduce emissions of CO ₂ between 36.1-38.9% by 2020	National Plan for Adapting to Climate Change

*Finally, citizen partnerships within nations and personal responsibility will lead to successful implementation of climate action. Local governments play a crucial role in the implementation of environmental policy. Citizen preferences influence local government compliance with regulations. Therefore, if individuals acknowledge climate change and express a desire to act, then governmental policies and regulations will be more effective.

INTRODUCTION



On October 8, 2018, the **Intergovernmental Panel on Climate Change (IPCC)** released a special report detailing the potential impacts global warming of 1.5°C above pre-industrial levels would have on the planet (as opposed to the proposed 2.0°C limit set by the 2015 Paris Agreement). The IPCC concluded the following:

- In 2017, human-induced warming reached approximately 1°C ($\pm 0.2^\circ\text{C}$ likely range) above pre-industrial levels.
- If warming continues at the current rate, we will reach 1.5°C above pre-industrial levels by the year 2040 (or possibly sooner).
- While climate-induced impacts are projected to be higher at 2.0°C, there are still significant effects associated with a warming of 1.5°C. These include dangerous heat waves, rising sea levels, effects to marine biodiversity, largescale disruption to migration patterns, and risks associated with food security and water supplies.
- “Limiting global warming to 1.5°C would require ‘rapid and far-reaching transitions’ in land, energy, industry, buildings, transport, and cities.”

The numbers are in: according to independent analysis by NASA and NOAA, 2018 was the fourth warmest year on record, ranking behind 2016, 2017, and 2015.

At The Science Advisory Board, we set out to gather the scientific viewpoints and expectations of your fellow scientists based on the measures and actions designed to combat climate change. The following was the result.

FINDINGS

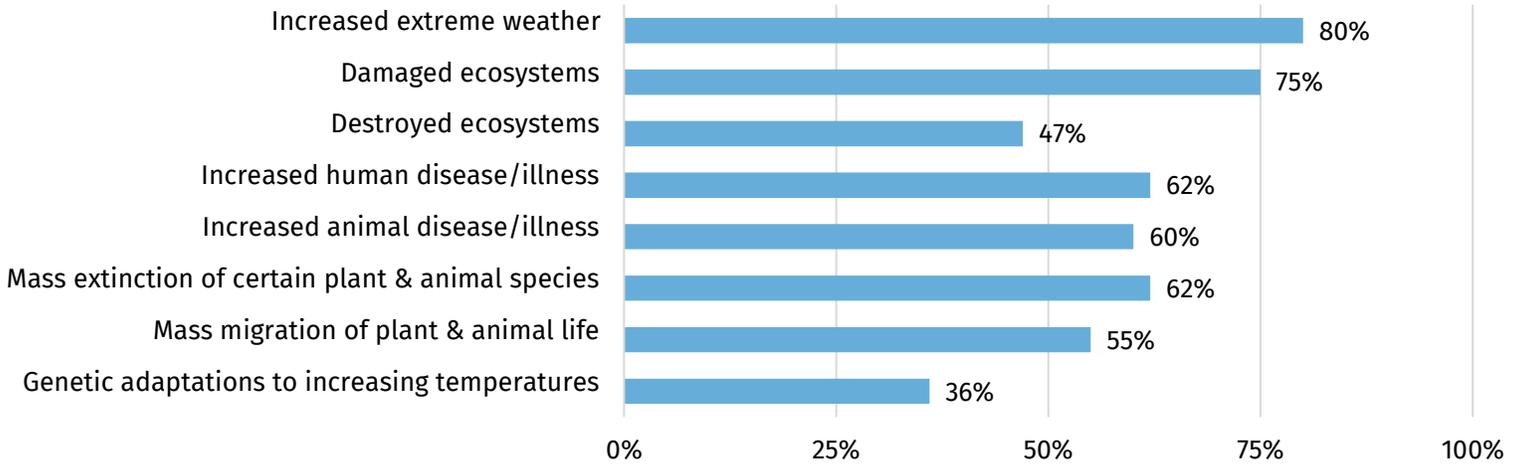
This section includes answers to the following questions:

1. What do scientists think will happen to the environment & society over the next 50 years due to warming?
2. How optimistic are scientists that the impacts of warming can be overcome?
3. What do scientists think can be done to overcome warming?
4. More thoughts concerning the IPCC 2018 Report

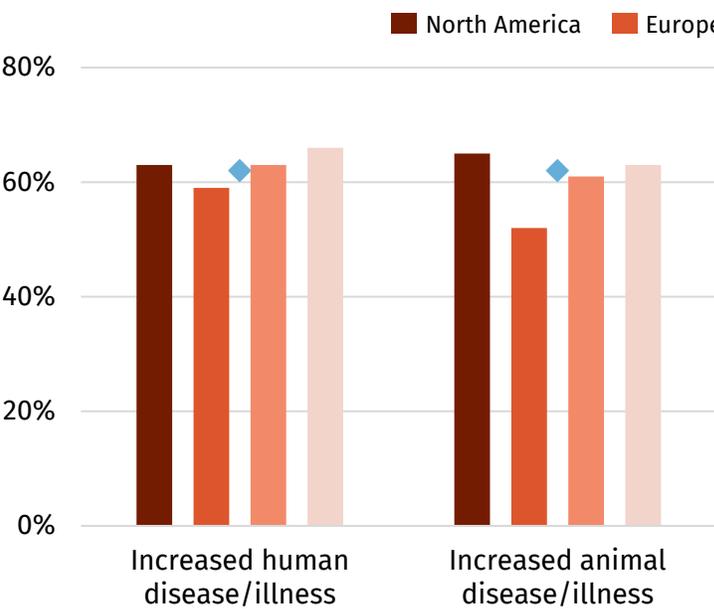
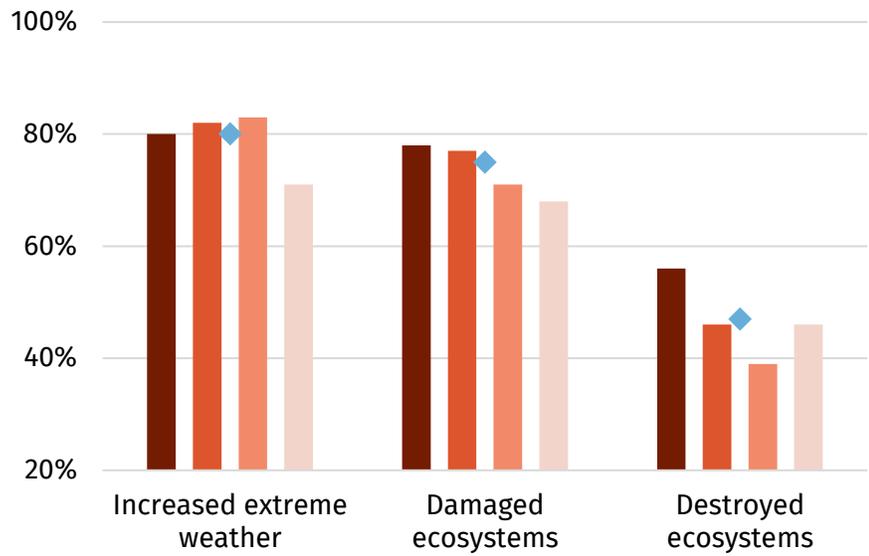


WHAT DO SCIENTISTS THINK WILL HAPPEN TO THE ENVIRONMENT & SOCIETY OVER THE NEXT 50 YEARS DUE TO WARMING?

Life scientists believe that there will be a variety of impacts on the environment and life over the next 50 years, in agreement with the IPCC 2018 report:



Multidisciplinary life scientists across the world believe that the environment & ecosystems will be impacted by warming. Most scientists regardless of location believe that there will be increased extreme weather and ecosystems will be damaged due to warming. Generally, North American and European scientists are more likely to believe that these impacts will occur.



Over half of life scientists from across the world agree that there will be increased human and animal disease/illness in the next 50 years due to warming.

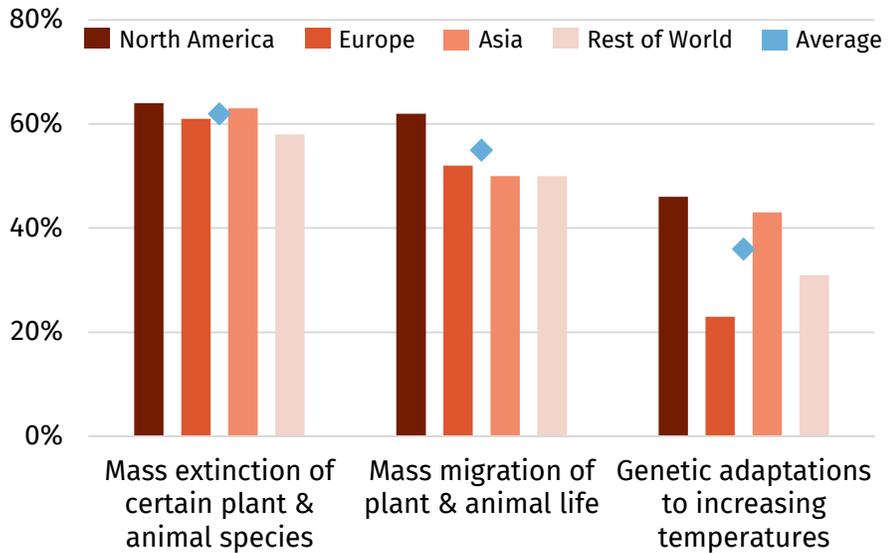
It is important to note that the risk of increased disease in human and/or animals will impact regions uniquely. The unequal distribution of effects may explain the variation in responses from scientists.

Q2. Which of the following effects would you expect to see in the next 50 years as a result? (check all that apply)

WHAT DO SCIENTISTS THINK WILL HAPPEN TO THE ENVIRONMENT & SOCIETY OVER THE NEXT 50 YEARS DUE TO WARMING?

Life scientists believe that mass extinction of certain plant & animal species will occur due to warming. North American and Asian scientists are equally as likely to believe that genetic adaptations will occur. They are also much more likely to believe this over European scientists.

Life scientists believe that mass extinction will occur in some species but also believe that migration and to a lesser degree genetic adaptation will occur. It is clear that warnings from international organizations are resonating with scientists.



The **World Health Organization (WHO)** states that direct impacts due to extreme weather on health are: storms, drought, flood, heatwave, temperature changes, and wildfires. Increased intensity and frequency of these events in the past 50 years have been reported globally. Moreover, the **Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (ISPPBES)** reports in their *Global Assessment for Policymakers* changes in terrestrial ecosystems will increase the risk of global extinctions.

According to the WHO, the most direct link between climate change and ill health is air pollution. The WHO also states that the rise in extreme weather events and increased capacity of disease vectors to spread infectious disease (due to ecological changes) are high-impact global risks to human health. Domesticated and wildlife species are susceptible to the effects of climate change with flare-up of novel pests and diseases. The **Food and Agriculture Organization (FAO)** states that risk management of emerging disease complexes will be extremely important in the future, particularly pertaining to food safety.

The **ISPPBES** reports in their *Global Assessment for Policymakers* that: “globally, local varieties and breeds of domesticated plants and animals are disappearing. This loss of diversity, including genetic diversity, poses a serious risk to global food security by undermining the resilience of many agricultural systems to threats such as pests, pathogens and climate change.” According to the results of this study, scientists tend to agree with this conclusion.

Scientists also reported the following as additional expected outcomes due to warming in the next 50 years

“Very significant widespread breakdown of technological, industrial, social, manufacturing, economic, transport & communications.”
-European healthcare professional

“Increased social and political breakdown”
-North American government researcher

EFFECTS ON SOCIETY

“Inundation of coastal regions”
-European non-profit professional

“Scarcity of water in most of the countries due to high temperatures and unplanned utility of the water resources”
-Asian government researcher

LOSS OF COAST & AVAILABILITY OF POTABLE WATER

“Climate change is earth’s natural cycle”
-North American pharmaceutical professional

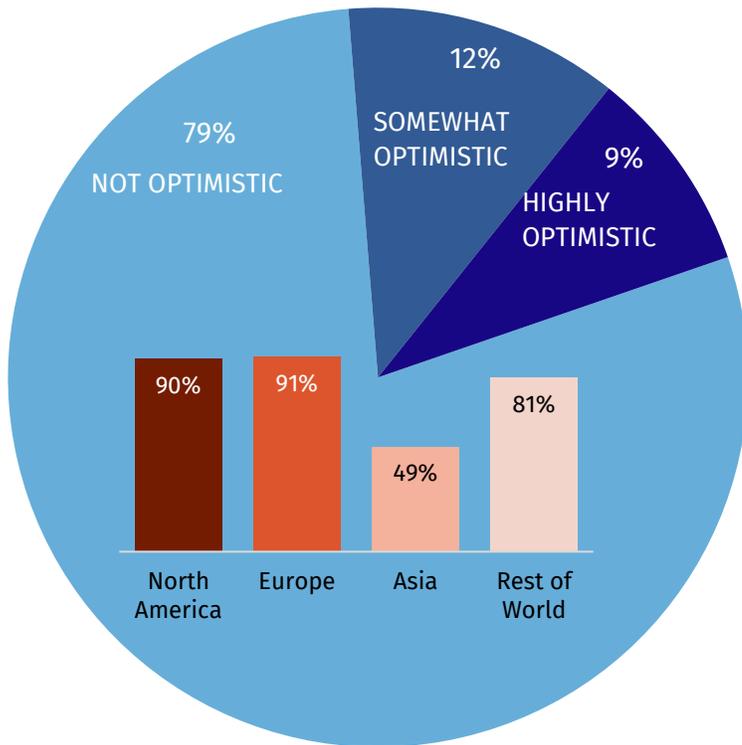
“No change that can be controlled”
-North American medical professional

“Effects are overestimated”
-European bio pharmaceutical

MINIMAL OR NO EFFECTS

HOW OPTIMISTIC ARE SCIENTISTS THAT THE IMPACTS OF WARMING CAN BE OVERCOME?

Scientists are generally optimistic, believing that they can make positive impacts on the world through the use of the scientific method and innovative thinking. However, the topic of climate change tends to be a polarized one for many life scientists, where most scientists are not optimistic and are concerned.



A majority of life scientists are not optimistic that enough action will be taken to prevent warming.

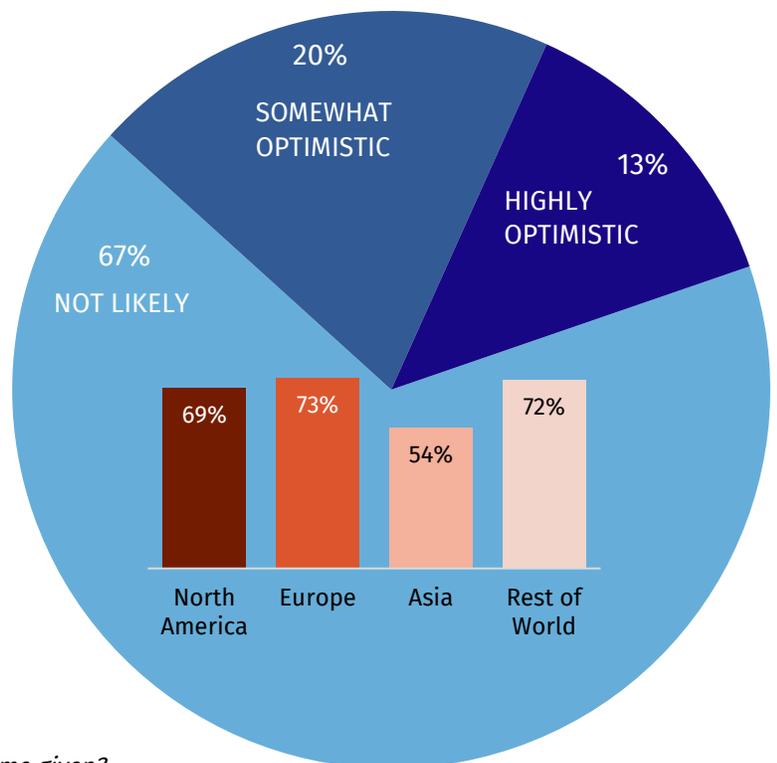
On a global scale, all regions with the exception of Asia are generally pessimistic about the meeting the goals of the Paris Agreement. Even in Asia, only 17% of life scientist are highly optimistic that enough action will be taken.

Q3. How optimistic are you that enough action will be taken to prevent a warming of 2.0°C from occurring?

Moreover, most life scientists think that there will be difficulty in adapting to new climate norms. Regardless of region, scientists generally believe that it is not likely that human, animal or plants will successfully adapt.

This pessimistic outlook is in spite of the efforts of policymakers and decision makers globally who have developed extensive national and international adaptation plans and resiliency preparation.

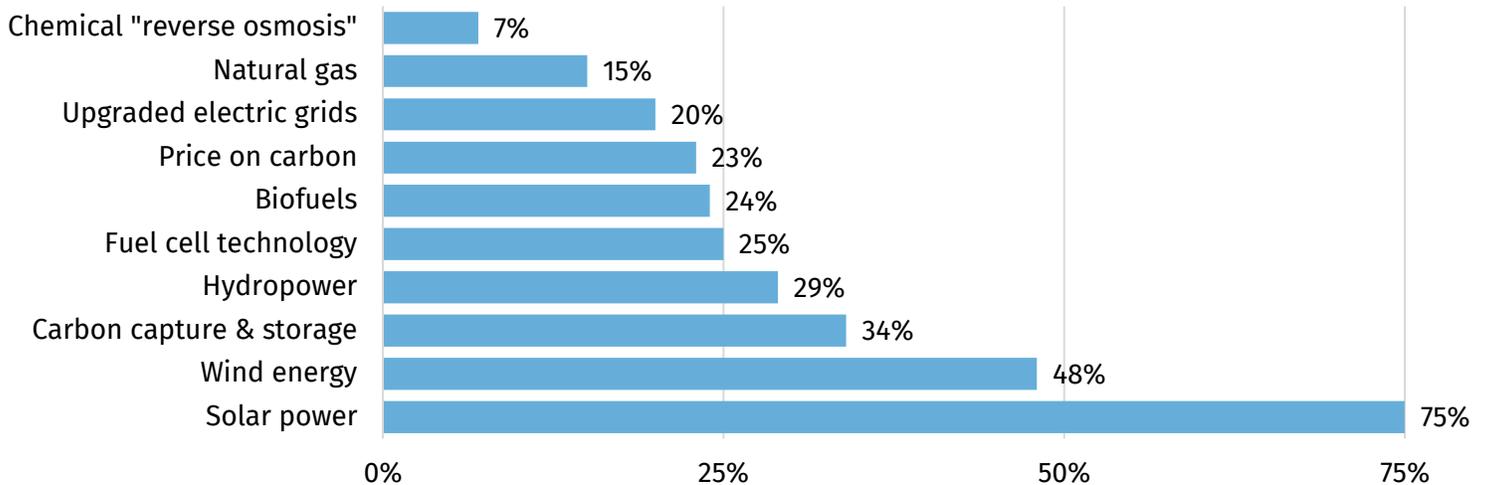
This indicates that there may be a disconnect between the scientific community and policymakers on course of action in terms of tackling climate change issues.



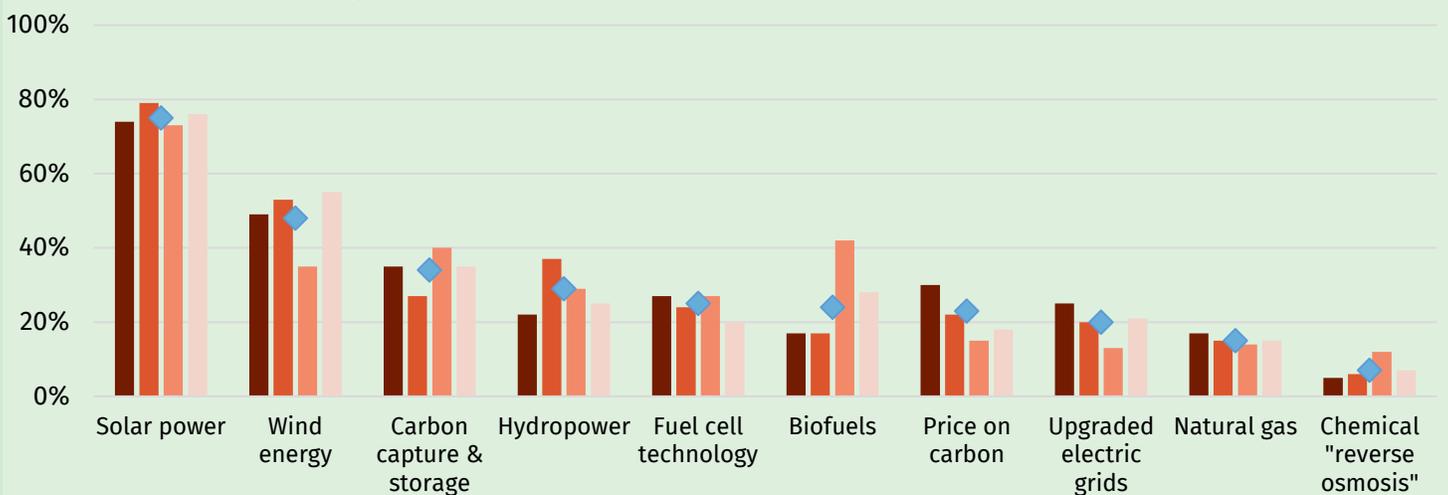
Q1. How likely is it human, animal and plant life will adapt in the time given?

WHAT DO SCIENTISTS THINK CAN BE DONE TO OVERCOME WARMING?

Life scientists believe that solar power will be the most effective technology to prevent warming. They also believe there are other viable technologies, and the solution may depend on a combination of technologies and strategies.



Overwhelmingly, life scientists believe that solar power will be the most effective technology to combat warming. Wind energy seems to have potential in the minds of scientists globally, although less so in Asia than in other regions. Asian scientists do believe more strongly than scientists in other regions that biofuels have merit as a renewable technology.



Scientists see the potential for increased use of a variety of technologies particularly solar and wind. In the U.S., only 11% of energy consumption was from renewable sources (primarily hydroelectric, followed by biomass, wind, solar) in 2017. Alternatively, in the EU over 25% of energy generation in 2016 was renewable with a similar trend in usage with hydroelectric first followed by wind and solar. In Southeast Asia, bioenergy and geothermal energy are major contributors to the energy capacity, however solar and wind power still account for only a small share of the energy grid mix as of 2016. India in particular has experienced growth between 2015-2017 in solar capacity. China remains the largest solar generator in the region, despite government defunding in the solar sector beginning in May 2018.

Q4. Which technologies and/or strategies do you think will be most effective in the prevention of warming?

■ North America ■ Europe ■ Asia ■ Rest of World ■ Average

MORE THOUGHTS CONCERNING THE IPCC 2018 REPORT

“We must all work together across the planet, across nations, across politics to stop the factors contributing to climate change.”
-North American academic

“Inflammatory reactions by politicians are detrimental to solutions and creating a polarized situation where people point the finger rather than address their own contribution. Climate change will impact people differently and those impacted the most perhaps contribute the least. Dealing with social issues is also fundamental to any solution.”
-North American academic

Politics

Alarmed

“Climate is an observational science, we are not sure of the reason of some of the claimed human-induced changes. Climate change is part of nature we had hot and glacial era...before the industrial revolution.”
-North American academic

“It is a fundamental fact that correlation does not equate with causation. As complex as the earth's climate actually is, much more caution needs to be taken in interpreting the data on climate change and the presumed future effects...”
-North American commercial scientist

Additional Human
Intervention

Based on
invalid data

“It is alarming to me the number of educated people that deny that global warming is actually occurring, despite the facts presented.”
-North American academic

“[The results] terrifying and disheartening.”
-North American agricultural biotech professional

“We must act quick otherwise we will leave a mess on this planet to our children.”
-European contract organization researcher

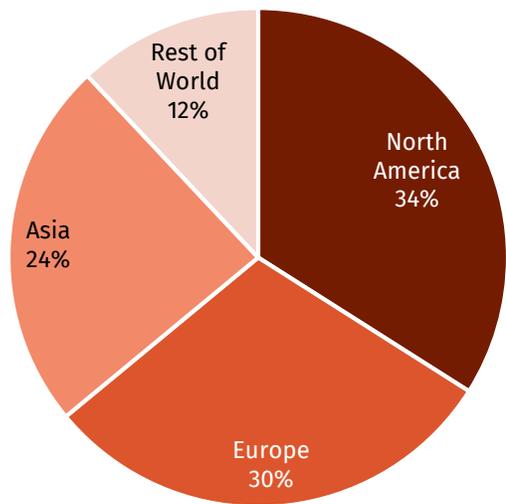
“Industrialized countries must accept to reduce the emission of harmful gases from factories and industries...”
-African academic

“There is extreme need of all of us on Planet Earth to do our bit.”
-Asian biopharmaceutical professional

“Individual responsibility for proper use of natural resources...”
-Asian pharmaceutical professional

Q5. Are there any other thoughts concerning the UN report findings that you'd like to share?

METHODOLOGY & REFERENCES



A total of 791 respondents completed the survey between April 9th and April 22nd, 2019. Respondents were from 55 different countries.

Likelihood was measured on an 11-point scale where 10=“Extremely Likely” and 0=“Not At All Likely”. Values of 9 and 10 were grouped to indicate “Highly Likely”, 7 and 8 to indicate “Somewhat Likely” and 0 through 6 to indicate “Not Likely”.

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