

# Climate Change and Small Islands

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## Introduction: The Climate Change Phenomenon

One of the greatest challenges to sustainable development in the 21st Century is climate change. When we speak of climate change on a global scale, we are referring to changes in the weather patterns of the Earth as a whole. Changes in average weather can be observed as variations in temperature, precipitation and wind patterns over time. Climate change has been taking place since the early days of the Earth's existence – there have been cold periods and warm periods.

Climatic changes are thought to be caused by natural factors such as geophysical activity like volcanic and solar activity; and anthropogenic (human-induced) changes resulting from human influence on the earth's atmospheric chemistry.

The debate as to which of these causes is actually contributing mostly to the recently observed climatic changes is an intense one, with a number of scientists supporting the natural cyclical causes as the main culprit, while others pointing to a correlation between recent increased human activity, that is significantly increased emissions of gases causing the greenhouse effect.

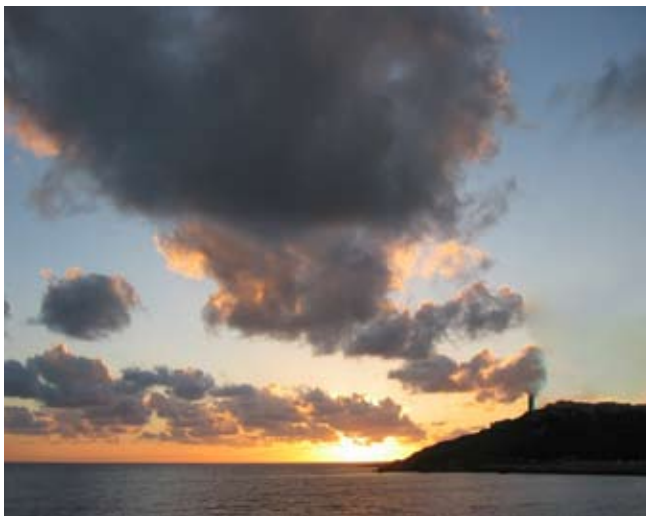
Many climatologists to date have formed international organisations and programmes to study climate across national boundaries. From the

1950s onwards, these expanded into even larger and more elaborately organised global programmes involving thousands of experts. It was scientists who sounded the alarm and drew international attention to the threats posed by global warming. In the 1960s and 1970s, evidence that concentrations of carbon dioxide in the atmosphere were increasing, led climatologists and others to press for action for the first time (Harasawa *et al.*, 2003).

## *The Greenhouse Effect*

Many scientists are convinced that climate could change gradually over many tens of thousand of years, but soon found evidence that some changes in the recent past had taken only a few thousand years (Weart, 2006). In the 1960s and 1970s other data and new theories emerged indicating new attitudes about human influences which reduced the time span, in which a change might occur, to hundreds of years, and not thousands. By increasing the amount of heat-trapping gases released through industrial activity, man has enhanced the warming capability of the natural greenhouse effect. It is this human-induced enhanced greenhouse effect that is of most concern for many.

Studies have proved that the average temperature of the Earth's surface has been on the increase during the past 100 years and it is predicted that it will rise by another 2°C by 2100 (IPCC, 2001). These indications



Emissions of gasses from motor vehicles, electricity generators and industrial activities create a greenhouse effect, leading to global warming.



pointed to the possibility of global warming and therefore raised a number of scientific questions. Today, global warming, the greenhouse gas effect and sea-level rise are the highlights of the debates and discussions on climate change worldwide.

### **Impacts on Small Islands**

These issues have led to assessments of the impacts on small islands. The IPCC Third Assessment Report on Impacts, Adaptation and Vulnerability has concluded that many small island states may be the hardest hit victims of the consequences of global warming, although emissions produced by many of the small island states are negligible when compared to those of big countries. The emissions of greenhouse gases is mainly the source of the highly industrialised countries and larger developed countries. At the same time, small island states are likely to experience major difficulties in adapting more than larger territories because of lack of financial, institutional, and technological capacity.

Climate change is of major concern for small island states because these are more sensitive to the impacts due to their small size and vulnerability. Climate is an integral part of the natural resource base of small islands. Marine resources, agriculture, tourism, freshwater availability, energy security and the natural environment are the backbone of the livelihoods of small island states all of which are highly dependent and vulnerable to climate and climate related hazards.

Besides the physical impact, climate change is also a threat to the economy of these small nations. The economic activity of small islands lies mostly on the coast, such as tourism, agriculture, fishing and other activities, and these are being affected badly by coastal erosion and more frequent storms and hurricanes some of which devastate whole islands. Due to their small size, geographical isolation, exposure to natural disasters, ecological uniqueness and fragility, limited resources, poorly developed infrastructure, high population densities, remoteness and peripherality, small islands states are more susceptible to natural hazards and more exposed to the impacts of climate change.

Moreover, small island states are affected adversely by climate change because they have very limited

potential to cope with the impacts, to recover and adjust. Low-lying islands are the most affected especially by sea-level rise, so much so that their very existence may be threatened if the sea level rises as predicted. A lot of migration to nearby islands is already taking place in some of the low-lying islands in the Pacific. A single extreme weather event can have devastating implications for a small island. One hurricane is capable of destroying whole communities as in the case of Niue in 2004 (World Meteorological Organisation, 2006).

### **Study on Experts' Attitudes towards Climate Change**

The present author conducted a survey to study the views regarding climate change and its possible impacts on small islands, held by climatologists and others with related expertise (Vella, 2006).

A number of climatologists, meteorologists, environmental scientists, and scholars with related expertise were consulted. The research was carried out by means of questionnaires.

#### *Results of the Survey*

There were 70 respondents out of which, 35 were climate experts, 21 were environmental scientists or geographers, 3 were economists and 2 were planning officers. The remaining nine respondents included an agricultural scientist, a research officer, an information officer, a surveyor, 2 were planning officers, a Programme manager, a general manager, and a tourism officer. Thirty of these respondents came from Climate Research Institutes, Meteorological Offices or Climate Observatories, twelve came from Government Departments and twenty from other Environmental Agencies. The remaining seven came from Academic Institutions. Of these, about a third reside in small island states, mostly located in the Caribbean, South Pacific and Indian Ocean regions.

#### *Major Impacts of Climate Change*

Experts were asked whether they agree that the climate is changing. There was consensus among the respondents that climate is definitely or probably changing.

The respondents were requested to identify three impacts of climate change that would affect their



Increased frequency of extreme weather and climate events, such as cyclones, heavy precipitations and storms, are associated with climate change.



country as a whole. According to the experts' views, the greatest impact deriving as a result of climate change was sea-level rise. Changes in precipitation patterns were considered as being the second greatest impact. Temperature change was identified as the third greatest impact.

Other major impacts identified which included - more frequent extreme weather events, followed by loss of biodiversity and finally impacts on health. It can be argued that loss of biodiversity and human health are related to the first, second and third impacts identified by the group.

Other impacts mentioned by seven respondents which included – effects in thermohaline circulation, land degradation, salinisation of groundwater and other different impacts.

#### *Anthropogenic or Natural Causes*

Experts were then asked to give their opinion as to whether climate change was attributable mostly to human activities or caused by natural causes. 80 percent of the responses to this question indicated that climate change was mostly attributable to human activities rather than to natural causes.

Experts were asked as to what type of human activities were inducing climate change. As expected, the highest number of respondents identified GHG emissions as being the most important human activity in this regard. The other factors mentioned were deforestation, agricultural processes, change in land use, and waste generation, in that order of importance. Other human activities identified

included population increase, and inefficient use of energy.

The natural factors that can induce climate change in the opinion of respondents included earth activities, such as earthquakes, volcanic eruptions, ocean currents, water vapour, and changes in the rotation of the earth. It was interesting to note that almost 4 percent of the respondents believe that astronomical elements feature as a major cause.

#### *Reducing Impacts*

In the responses as to whether mitigation measures (that is the reduction of emissions of greenhouse gasses) were more important than adaptation measures (that is taking steps to reduce the impacts before, after or as they happen), most of the respondents' thought that mitigation measures were more important than adaptation measures, because they address the root of the problem.

#### *Climate Change Knowledge and Concern*

Most respondents thought that the Environmental NGOs and the scientific community are the most knowledgeable about climate change. The majority of the political leaders, top civil servants, social sciences academics and other NGOs were ranked as being moderately knowledgeable. In general religious leaders and the business community were considered by most experts as not being very knowledgeable in this regard. As regards 'concern', the same results were obtained, having the scientific community and the environmental NGOs as being the most concerned, and the political leaders,

top civil servants, social sciences academics and other NGOs as being moderately concerned. The business community and the religious leaders are not very concerned.

There seems to be strong correlation between 'knowledge' and 'concern' with the most knowledgeable being the most concerned and the moderately or not very knowledgeable as being moderately or not concerned.

### *The Role of Governments*

In terms of the role of governments, most respondents were of the view that governments should take active measures to mitigate the effects of climate change by imposing reductions to emissions of greenhouse gases, with about two thirds of respondents stating that this should be done, no matter how much it costs. The rest also agreed, provided that this does not unduly harm the economy of the country.

Eighty percent of the respondents were of the opinion that governments should take anticipatory measures to help the population adapt to the possible effects of climate change, notably sea-level rise, even if this harms the economy. The remaining also agreed that governments should take anticipatory measures, as long as it does not unduly hurt the economy of the country.

### *Impacts on Small Island States*

When asked whether small island states will be impacted by climate change more than larger countries, almost all respondents agreed that small islands will definitely or very probably be more impacted than larger countries, stating that the greatest impact is likely to be sea-level rise, followed by extreme weather events and fresh water problems. Other impacts identified by these experts were change in the eco-system, impacts on the economy, health problems through vector-borne diseases and population dispersion.

When asked to identify which small island states are the most vulnerable to climate change, respondents identified the Maldives followed by Kirabati, Tuvalu and Seychelles. In fact the Maldives have three quarters of the land area less than a metre above sea level and the highest point not rising more than about three metres above sea level. However

many other islands located in different regions were also mentioned.

### **Segmenting the Respondents**

The respondents to the questionnaire were segmented in two, with the first segment representing purely climate experts and the second segment representing other experts. This segmentation was carried out in order to examine whether climatologists differed significantly in their views from the other experts. As noted, half of the respondents were authentic climate experts and the remaining 35 were experts in other related fields. In general the overall findings reported by the whole group were very similar between the two groups. The major differences occurred with regard to the type of major impacts, the type of human activities and the most vulnerable small island states.

With reference to the major impacts, from the deliberations of both groups of respondents together, it emerged that 'sea-level rise' is the major impact with 'changes in precipitation patterns' as the second greatest impact and 'temperature change' as the third greatest impact. When segmented, climate experts claimed that 'changes in precipitation patterns' was the major impact with 'sea-level rise' declared as being the second greatest impact and 'temperature change' as the third greatest impact.

### **Implications for Gozo**

The findings of the survey have direct implications for Gozo. Like many other small islands, Gozo depends heavily on coastal activities, including tourism, fishing, and entertainment. Although the island is hilly, the beaches, which serve to attract tourists, are low lying and with half a meter of sea-level rise, many of Gozo's beaches will be heavily impaired. A study by Briguglio and Cordina (2003) has shown that climate change will lead to major economic losses in the Maltese Islands.

Gozo may also experience shortage of water at times, a situation which already exists in most Mediterranean Islands, but could possibly be exacerbated as a result of global warming. With an increase in temperature, there may also be the risk of intrusion by foreign species, including some that are risky to health, such as certain types of insects which are currently mostly found in tropical areas.





Sea level rise is likely to have a negative impact on tourism infrastructures and inundate low lying areas including beaches.

The increase in temperature may also give rise to risks related to cardiovascular diseases. There are also risks of more frequent extreme weather events. These are all possibilities, and cannot be predicted with 100 per cent certainty, but scientific studies on climate change are pointing in this direction.

Like many other small islands, the island of Gozo contributes very little to global warming, however the island could be very strongly affected negatively. The residents on the island of Gozo could however do many things to avoid or reduce the negative impacts just mentioned. There are many adaptation procedures that can be put in place in anticipation of sea-level rise, water shortages and extreme weather events (Klein, 2003; Briguglio and Cordina, 2003). In many cases, adaptation measures, such as building infrastructures that withstand strong winds, clearing valleys to avoid floods in case of extreme weather events, preparing for eventual retreat from the beaches, withholding building permits on low lying areas, and putting in place early warning systems, can be mainstreamed in development policies, so that their benefits can be enjoyed, even if climate change predictions do not materialise (Huq and Reid, 2004; and Munasinghe, 2003).

### Conclusions and Implications

The survey conducted by the present author showed that there was a high degree of agreement among experts that:

- (a) the climate is changing
- (b) the change is brought about mostly by human activity,
- (c) it will highly impact small island states; and
- (d) sea-level rise is a major negative impact on small islands.

One important conclusion that emerges from the responses to the survey described in this article is that there seems to be a consensus that small island are being and will be more impacted by climate change than larger countries. In small island states most economic activity and settlements are on the coastal area and sea-level rise will obviously have a relative large impact in this area. This of course raises an ethical issue namely that these islands are least contributing to climate change and are probably those that will suffer most from its impacts.

It is worrying to note that respondents thought that in general political leaders were only moderately knowledgeable and concerned about climate change. The reason for this is that, as the respondents to the survey remarked, governments have a major role in adopting and promoting mitigation and adaptation strategies.

According to comments by some of the respondents, it appears that the degree of knowledge and concern are higher in small island states than in larger territories. Some respondents from the Pacific region remarked that in the Pacific Islands, children



Even locations at high altitude may be affected by climate change due to increased frequency of extreme weather events.

and older people are very concerned about this phenomenon and are interested in knowing and doing more to prevent global warming.

Regarding adaptation strategies, some respondents commented that since small island states often do not have adequate resources to build strong infrastructures to protect them from the relatively large impacts of climate change, the adaptation possibilities in these states tend to be more limited when compared to larger states.

In terms of mitigation measures, small island states should adopt strategies to reduce GHG emissions, but, as many respondents remarked, the contribution to global warming by small island states is negligible.

In general the results of the survey shed light on a number of issues which are of importance not just for small island states, but for the global community in general:

- Awareness, knowledge and concern about climate change are essential everywhere, especially where the impacts of climate change are not as obvious as they are in small island states.
- The role of governments in fostering mitigation and adaptation measures is also a global requisite

However, given that the focus of this article is on small island states, it is important to stress that small island states will probably be the worst off as a result of climate change, when compared to other groups of countries. The ethical issue, referred to above, namely that countries who are contributing least to climate change will likely be those that will suffer most, needs to be seriously addressed by the international community, especially when it comes to donor support for developing adaptation measures and mitigation measures to decrease greenhouse gases.

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