

Sinking the Pearl of the Indian Ocean: Climate Change in Sri Lanka

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Abstract

This article analyzes the impact of climate change on Sri Lanka. It recognizes that climate change is a multidimensional phenomenon which does not only impact the environment but also Sri Lanka's economy, health and society. The article provides a literature review and some empirical background on Sri Lanka's greenhouse gas emissions before analyzing the gravity of climate change in Sri Lanka. Sri Lanka's options to reacting to this global phenomenon via mitigation and adaptation will also be addressed briefly.

I. Introduction

Nestled in the middle of the Indian Ocean, the island of Sri Lanka seems distant from the rest of the world. However, climate change is a phenomenon which affects us all. The United States (U.S.) Environmental Protection Agency (EPA) (2009, p. 3) defines climate change as “any distinct change in measures of climate lasting for a long period of time. In other words, climate change means major changes in temperature, rainfall, snow, or wind patterns lasting for decades or longer.”

Out of 149 countries, the Environmental Performance Index (EPI) 2008 ranked Sri Lanka as the 50th best country in terms of environmental health and ecosystem vitality.¹ According to most data, Sri Lanka's greenhouse gas (GHG) emission levels are one of the lowest in the world. Sri Lanka's Ministry of Forestry & Environment (2000, p. xi) states “Sri Lanka's contribution to the emission of green house gases is considered negligible. Nonetheless the adverse impacts of the anticipated changes arising out of global warming

¹ The EPI is compiled by Yale and Columbia University based on 25 performance indicators tracked across ten policy categories covering both environmental public health and ecosystem vitality. Climate Change is one of the ten policy categories and accounts for 10 percent of the EPI. Due to Sri Lanka's relatively low carbon dioxide emission, Sri Lanka ranks even higher if just looking at the climate change category. For further details, see: <http://epi.yale.edu/>.

are likely to be significant.”² Sri Lanka will be drastically affected by climate change. Rising water levels, shifting temperatures, eroding beaches, dying forests, increased weather anomalies, and natural disasters are just a few dreadful outcomes the island will soon come to face; some of which, it has already had its fair share of.

This article analyzes Sri Lanka’s GHG emissions and the impact climate change has on Sri Lanka. Climate change is a multidimensional phenomenon which does not only impact the environment. It also has a major impact on Sri Lanka’s agriculture, tourism, society, and health. These topics will be considered individually even though they are interrelated. For instance, when climate change affects the environment, it also affects the economy since a part of the economy is dependent on the primary sector such as agriculture and fisheries for instance. Furthermore, the article will summarize Sri Lanka’s proposed plans for reacting to this global crisis in relation to the various measures and proposals that have been adopted and discussed by the government of Sri Lanka.

The article is structured as follows. Following this introduction, the next section provides a brief review of the Sri Lanka specific literature. Section III provides some empirical background by reviewing Sri Lanka’s GHG emissions, while Section IV analyzes the effects climate change has on Sri Lanka. The fifth section summarizes some of Sri Lanka’s options to mitigate and adapt, while the last section provides some conclusions.

II. Literature Review

A particularly valuable news article, entitled “Sri Lanka: Climate Change Worse than Civil War – UN Expert” has been written by Samath (2007). It discusses in some detail the various impact climate change may have on Sri Lanka if conditions continue in the same manner. Samath writes that even though the civil war raged on for the battle of land, because of the dire consequences of climate change that very land they fought for might be underwater in a matter of time. The article goes on to bring numerous statistics and important information on the current situation and the future prospects of not only Sri Lanka but the impact on India as well. The article touches on health related issues, environmental impact, and even the economic sectors. It provides excellent points, statistics, and arguments.

Another source which has been considered is the official meteorological department website of Sri Lanka (<http://www.meteo.gov.lk>), which boasts a variety of information. The site documents various data relating to weather, climate, and geography. It uses this data to link different topics which have a relevant impact on Sri Lanka. Building on this, there is a myriad of information on the impact of climate change on Sri Lanka as well. The site provides over ten different papers by experts in their fields which explain impacts, adaptation strategies, and mitigation aimed at climate change. The papers deal with essays on topics such as health, agriculture, energy, industry, environment, and weather.

Alwis (2004) wrote a meticulous paper entitled “*Sri Lanka: Its Industry and Challenges in the Face of Climate Change.*” Alwis discusses how Sri Lanka’s industrial sector is the real determinant of how Sri Lanka should react to climate change. He emphasizes that Sri

² See Ministry of Environment & Forest (2000), page 19.

Lanka's efforts to battle climate change needs to be crafted according to its own situation, not a policy adopted for/by any other country. The paper brings in detailed statistics and reasoning about industry while clearly linking it to climate change. This important link has been very useful for this article's subject matter as well.

Lastly, we turn to Sri Lanka's *Initial National Communication under the United Nations Framework Convention on Climate Change: Sri Lanka*. This report, prepared by Sri Lanka's Ministry of Environment & Forest (2000) spans 122 pages, and provides detailed information on many issues related to Sri Lanka and climate change. Data includes general figures of Sri Lanka's resources, geographical, and environmental information. It also includes various climate change related data on Sri Lanka, like GHG levels, temperature, rainfalls. Mitigation efforts and adaptive strategies are also discussed in depth in this report.

III. Empirical Background: Sri Lanka's Greenhouse Gas (GHG) Emissions

While there are a variety of GHGs, carbon dioxide (CO₂) is due to its high share in GHGs the most important one. CO₂ is also the GHG for which the data availability is the least limited. The following sub-sections concentrate therefore on CO₂ emissions. Given that most of the world's CO₂ emissions are due to human activities, a country's CO₂ emissions are determined mostly by its population size, its economic size (measured by a country's gross domestic product (GDP)), the sectoral shares of GDP, and what kind of energy a country uses. What kind of energy a country uses largely determines a country's carbon intensity (defined as CO₂ emissions per unit of energy use), with fossil fuels being the most carbon intensive energy. Related to income per capita and energy use are living standards and life styles.

Sri Lanka has a lot of poor people. Therefore, energy is rationed and people aim at cost effectiveness with minimal wastage. The same is true to some degree for India and China which are emerging economies, but still have a lot of poor people. Countries like the United States have relatively few poor people, and the average person is considered to be well off. Hence, people in the United States tend to use more energy.

To address some of these interrelated and complex issues, the first sub-section looks at Sri Lanka's total CO₂ emissions, the second sub-section looks at Sri Lanka's CO₂ emissions in per capita terms, the third sub-section reviews Sri Lanka's CO₂ emissions per GDP, while the last sub-section summarizes some the issues related to Sri Lanka's energy supply.

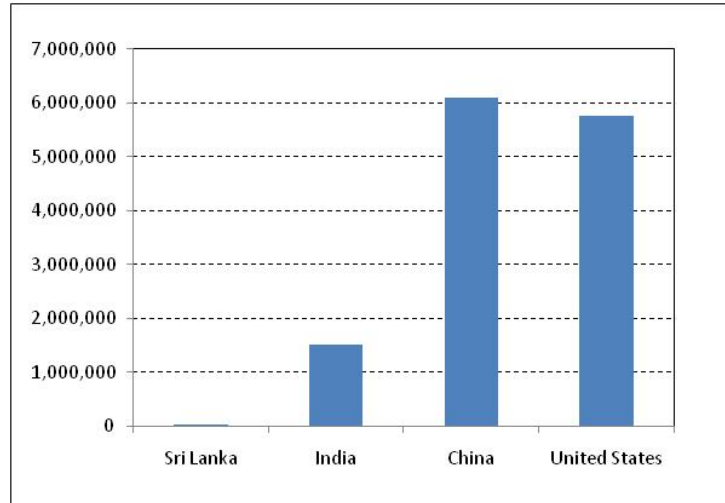
III.1. Sri Lanka's Total CO₂ Emissions

Figure 1 depicts the current CO₂ emissions of Sri Lanka and three other countries: India, China and the United States. India has been chosen since it is Sri Lanka's neighbor, and thereby ties in regional considerations of South Asia. China and the United States have been chosen in regard to the fact that they are the two biggest emitters of CO₂.

Sri Lanka's CO₂ emissions amounts currently to about 12,000 kilo tons (kt), which is so marginal relative to the other three countries, that it is barely visible in Figure 1. Indeed, Sri Lanka's produces less than 0.1 percent of the world's CO₂ emissions. The United States

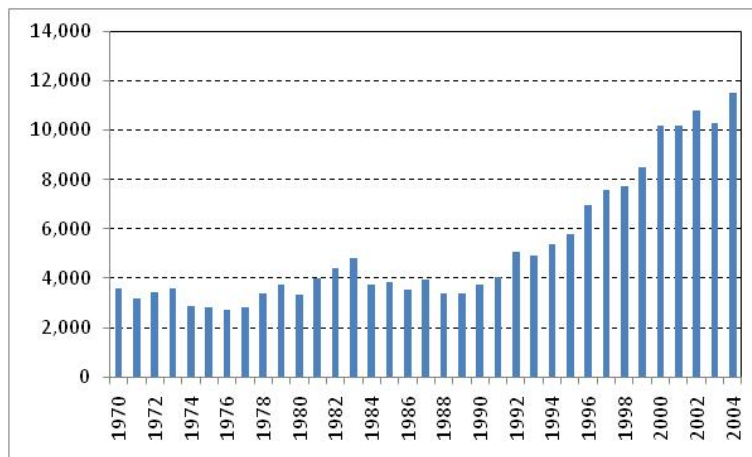
and China combined produce almost half (42 percent) of the world's GHG emission, while India accounts for 5.3 percent. Hence, Sri Lanka is not producing GHGs that induce global warming and climate change. Yet, as Figure 2 shows, Sri Lanka's CO₂ emissions have grown considerably over time. Indeed, the 2004 value is with 11,524 kt more than three times the 1970 value (3,593 kt). We will discuss some of the main reasons for this rapid increase in the following sub-sections.

Figure 1: CO₂ emissions (in 1000s on tons (kt)) in 2006



Source: Carbon Dioxide Information Analysis Center (CDIAC), as quoted on Wikipedia; available at: http://en.wikipedia.org/wiki/List_of_countries_by_carbon_dioxide_emissions.

Figure 2: Sri Lanka's CO₂ emissions (kt), 1970-2004

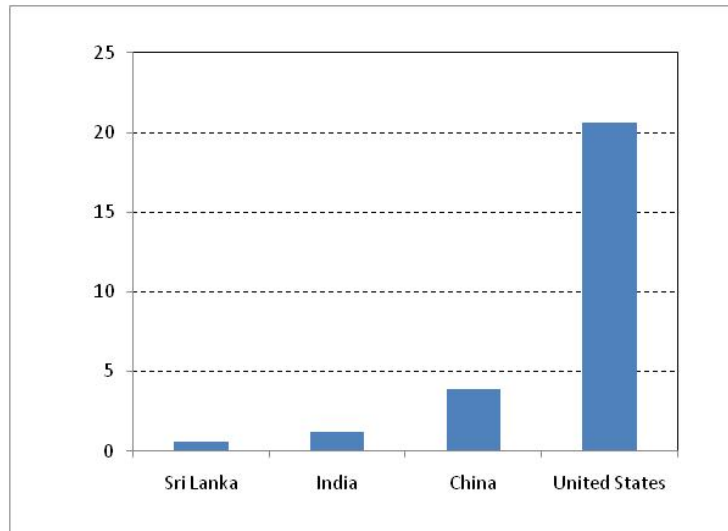


Source: World Bank (2008) *World Development Indicators 2008*, CD-Rom.

III.2. Sri Lanka's per capita CO₂ Emissions

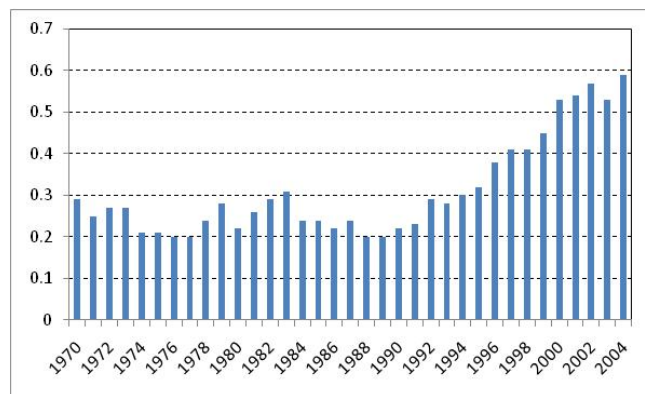
As is shown in Figure 3, taking population size into account, Sri Lanka's CO₂ emissions become a bit more significant, especially if comparing Sri Lanka to India. On the other hand, the figure also shows that correcting for population, China's CO₂ emission was less than a quarter of the U.S. emission in 2004. Figure 4 shows that while Sri Lanka's per capita CO₂ emissions remained—despite some volatility—at about the same level during the 1970s and 1980s, it has started to grow since the early 1990s. As will be shown in the next sub-section, this is at least partly due to increasing GDP growth.

Figure 3: Per capita CO₂ emissions (in tons) in 2004



Source: World Bank (2008) *World Development Indicators 2008*, CD-Rom.

Figure 4: Sri Lanka's per capita CO₂ emissions (in tons), 1970-2004

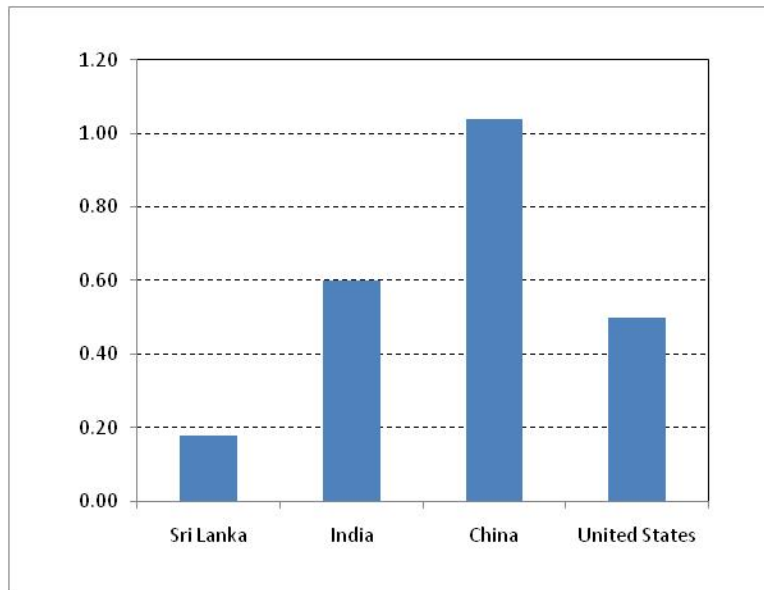


Source: World Bank (2008) *World Development Indicators 2008*, CD-Rom.

III.3. Sri Lanka's CO₂ Emissions per GDP

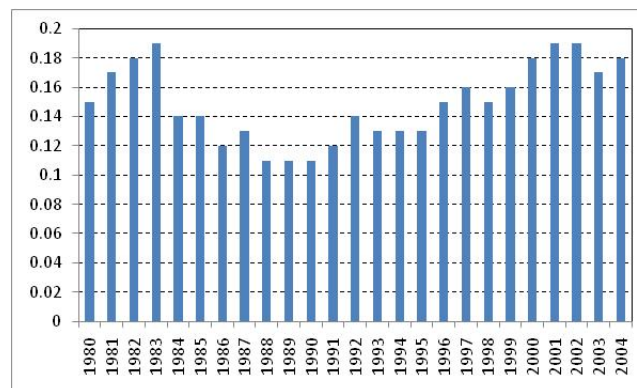
Sri Lanka is not an industrialized country; instead it falls into the category of developing nations. Within the last few decades, the country has seen shifting trends in relation to its industry. While Sri Lanka had previously a mostly agrarian economy, the service and manufacturing sectors dominate the present economy. However, as a whole the industrial sector has been neglected, at least partly due to the ongoing civil conflict and a lack of capital. Sri Lanka's relatively low share of industry is a main reason for Sri Lanka's low carbon emission per unit of GDP (shown in Figure 5) as well as over time (Figure 6).

Figure 5: CO₂ emissions (kg per 2005 PPP \$ of GDP) in 2004



Source: World Bank (2008) *World Development Indicators 2008*, CD-Rom.

Figure 6: Sri Lanka's CO₂ emissions (kg per 2005 PPP \$ of GDP), 1980-2004

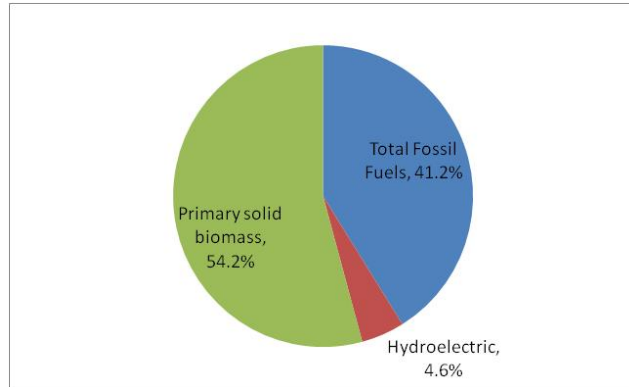


Source: World Bank (2009) *World Development Indicators 2008*, CD-Rom.

III.4. Sri Lanka's Energy Supply

As shown in Figure 7, most (59 percent) of Sri Lanka's energy comes from clean sources like biomass and hydro. Biomass is a popular option because Sri Lanka has a high rural population, amount to 85 percent (see World Bank, 2008). Biomass is cheap and easy to attain and is therefore viable for the mostly poor rural population.

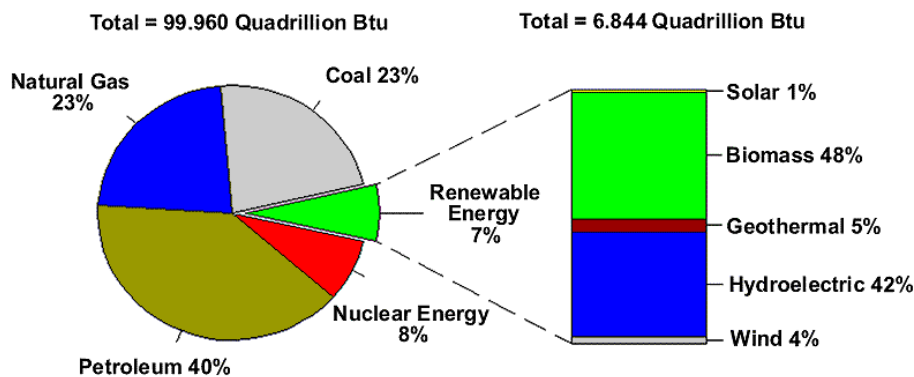
Figure 7: Energy Supply in Sri Lanka (in percent), 1999



Source: Compiled by author based on data provided in World Resources Institute (2003).

On the other hand, as is shown in Figure 8, in the United States, 86 percent of the U.S. energy supply comes from fossil fuels (comprising coal, oil, petroleum, and natural gas products), which emit high levels of GHGs (i.e., are energy intensive). On the other hand, renewable energy contributes to only 7 percent. This startling difference between Sri Lanka and the United States explains to some degree why the United States' GHG emission is so high. Based on World Bank (2008), the percentages of energy generated in 2005 from fossil fuels in Sri Lanka, India, China and the United States amounted, respectively, to 44, 68, 84 and 86 percent.

Figure 8: Energy Supply in the United States, 2006



Source: http://www.eia.doe.gov/cneaf/solar.renewables/page/prelim_trends/images/h1_08.gif, based on data provided by the U.S. Energy Information Administration (2007).

IV. Is Sri Lanka Feeling the Effects of Climate Change?

The short answer to this question is yes. The longer answer is to look at some tangible evidence in the form of long-term weather data and the climate change impacts on Sri Lanka's environment, agriculture, tourism, health, and society.

IV.1. Impact on Sri Lanka's weather and environment

Let's consider first Sri Lanka's temperature, which relates to the most discussed aspect of climate change: global warming. According to the Department of Meteorology in Sri Lanka, annual mean air temperature has shown significant increases in recent decades (see Basnayake et al., 2007). The rate of increase of mean air temperature from 1961-1990 has been identified as 0.016 °C per year. Annual mean maximum air temperatures have shown increasing trends in island-wide monitoring stations. The maximum rate of increase has been about 0.021 °C per year at Puttalam. Colder areas in the country which are located in the more hilly regions seem to show greater increases than low lying areas.

Unfortunately, a similar trend is also noted when considering rainfall. Annual average rainfall over Sri Lanka has been decreased to an amount of 144 millimeters. This is a decrease of about seven percent. This data has been monitored once again, from 1961 to 1990 and has been compared to the period of 1931 to 1960. As mentioned in the introduction, climate change is only considered climate change when there is "significant change" which occurs for an "extended period." Weather anomalies compared on a year-to-year basis is irrelevant. However, this data has been compiled and analyzed on the basis of decades. The results clearly show that Sri Lanka is experiencing change in its climate.

Evidently, climate change also takes its toll on the environment. GHG emissions increase temperature levels and thereby melt ice caps. Islands like the Maldives and Sri Lanka face the brunt of this phenomenon. According to the Intergovernmental Panel on Climate Change (IPCC) (2008, p. 2), the global average sea level has risen since 1961 at an average rate of 1.8 millimeter/year and since 1993 at 3.1 millimeter/year (with contributions from thermal expansion, melting glaciers and ice caps, and the polar ice sheets). With a rise in sea level, Sri Lanka is impacted in many ways such as coastal erosion; natural habitat destruction; intrusion of salinity and of course the most dire consequence, shoreline retreat. Sri Lanka has been experiencing a staggering coastal erosion rate of 0.30-0.35 meter a year. This has been said to adversely impact almost 55 percent of the shoreline. The coastal belt is one of the major lifelines in Sri Lanka's economy. Geographically, it covers 24 percent of the total land area and 32 percent of the total population. This negative phenomenon will have catastrophic affects. Tourism, fisheries, human settlements and rich natural habitat are all at danger from rise in sea levels. Low lying areas of Sri Lanka like regions in the north and east will be the first to be affected. The coastal belt also houses 65 percent of the urban land area including the capital Colombo.

IV.2. Impact on Agriculture

Agriculture will be severely affected by climate change. This sector is impacted from various levels. The erratic weather is one such instance. Dr. B. V. R. Punyawardena, who is the Head of Agro-Climatology, Natural Resources Management Centre in Sri Lanka

says: “variability of both summer and winter monsoon rains and rains of convectional origin has increased significantly during recent decades. As a result, both extremes, i.e. water scarcity and excess water has become a recurrent problem in crop production in Sri Lanka”.³

Sri Lanka harvests crops according to ancient seasons which were determined over 2000 years ago by ancient kings. They are called “Yala” and “Maha.” Previously, these two seasons were always predicted for the same time and has been so for the thousands of years. However, recent decades have seen shifts in these seasons which are based on the timings of monsoons. This is creating a negative impact on farmers who are unable to harvest crops in their correct times and then fall into financial trouble as well apart from a low yield. What is even more frightening is that Sri Lanka’s Meteorological Department released a statement saying: “this (erratic weather) will result in paddy farming output falling by 20-30 percent in the next 20 to 30 years. The output will begin to drop gradually over the next few years.”⁴ Agriculture employs 35 percent of the working population in Sri Lanka. The consequences of such a negative impact will be disastrous.

IV.3. Impact on Tourism

Tourism is the main source of foreign reserves for the island. Sun, sea and sand have been an effective advertising campaign when Sri Lanka is considered. However, implementations of adaptation measures like buffer zones at the beaches will negatively impact the tourism industry. Coral reefs, which are another main attraction of the island, are also at risk with the increase in sea levels and sea water temperatures.

IV.4. Impact on Health

Health risks are important factors to consider when looking at the impact of climate change. In Sri Lanka’s *Initial National Communication under the UNFCCC* (see Ministry of Forestry & Environment, 2000) the following health hazards are listed as a result of different aspects of climate change.

- As a result of temperature increase, people working in Sri Lanka may face various types of illnesses. With poor working conditions in this developing country, people according to their fitness levels will be more susceptible to dehydration and fatigue.
- The impacts of droughts will human health, sanitation, diseases with dirty water such as cholera, hepatitis, typhoid etc., while the collection of water in rock pools will encourage diseases like dengue from mosquitoes which Sri Lanka is facing even today.
- High intensity rainfalls will damage people houses and may culminate in floods which breed different diseases on. Heaps of human settlements may be dislodged creating a nationwide emergency. This occurred in May 2003 in the Ratnapura District where the whole town was submerged and the issue became a national emergency. It was only overshadowed by the December 2004 Tsunami.

³ Punyawardena (undated); available at:
http://www.meteo.gov.lk/Non_%20Up_Date/pages/CC%20&%20agriculture.pdf.

⁴ See Samath (2007).

Considering the various outcomes of climate change on Sri Lanka's health sector is alarming. The country already has an over taxed government dominated (majority) health care system which is struggling to meet growing demands. This oncoming crisis will only exacerbate and already waning health care system. In effect, it will strain essential funds of the country, which can be allocated for development of the country.

Though Sri Lanka has a youth bulge in its population pyramid, in the next 10-20 years there will be a higher ageing population than there is today. Older people are more susceptible to health hazards from climate change than the working population. Thus, this will be another additional burden on the Sri Lankan economy as a whole if efforts aren't taken to mitigate these negative effects.

IV.5. Social Implications

Another impact that climate change can have over society is creating conflict. Sri Lanka ended a civil war which has been raging on for the last 25 years. However, sea-level rises will mean that the northern and eastern areas of Sri Lanka which were fought over will be the first to be submerged. This is because geographically, the coastal areas in the northern and eastern parts of the island are flatter than the rest of the island. This also explains why these areas faced the brunt of the devastating Tsunami. Rajendra Pachauri, chairman of IPCC, said at a press conference in New Delhi that up to 60 million coastal people in the low-lying areas of South Asia could be displaced by global warming by the end of the 21st century.⁵ The necessary migration of people from the submerged areas is likely to make the civil conflict resurface in Sri Lanka.

V. Options for Sri Lanka's Mitigation and Adaptation Efforts

Sri Lanka's role in causing climate change is negligible. Hence, efforts to mitigate the process take a back seat in comparison to adaptive strategies. Nevertheless, this is not to say that Sri Lanka is not playing its role in being environmentally friendly. To the contrary, it has recently stepped up measures to increase healthy eco-friendly practices. Below are a few examples of the efforts Sri Lanka is turning to and already using to help reduce the occurrence and impacts of climate change.

V.1. Mitigation Efforts

Despite some deforestation,⁶ Sri Lanka still has enough forests that make Sri Lanka carbon neutral. Forests are a vital component in helping mitigate the negative impact of climate change. Sri Lanka is able to proudly boast that it is one of very few countries which function as a carbon sink. According to Responsible Tourism Partnership Sri Lanka (2008), Sri Lanka's 2 million hectares of forest store approximately 21 tons of CO₂ per hectare, for a total of about 40 million tons of carbon. In addition to Sri Lanka being a carbon sink, Sri Lanka's main mitigation efforts are concentrated on energy, industry, and agriculture.

⁵ See Samath (2007).

⁶ Based on the *World Development Indicators 2008*, Sri Lanka reduced its forests from 36 percent of its total land area in 1990 to 29 percent of its total land area in 2006.

- **Energy** – Fuel switching with more fuels which emit less GHG to the environment; using efficient new technology which reduces power and enhances efficiency; energy conservation measures through florescent light bulbs and less wastage; investing in alternative renewable energy sources such as solar, wind and biomass.
- **Industry** – Change in industrial policies to encourage “soft industries” which are more environmentally friendly; enhancing productivity; pollution control through both monitoring and waste management; energy efficiency; emission control.
- **Agriculture** – Establishing forestry and vegetation on non-forested lands; promotion of mixed cropping to ensure fertile soil in the long-run; introducing changes I irrigation and fertilizers to reduce methane emissions from for instance wet rice cultivation.

Furthermore, it is worth to mention that Sri Lanka ratified the Kyoto Protocol⁷ when it signed the United Nations Framework Convention on Climate Change (UNFCCC) on November 23rd, 1993. It belongs to the Non-Annex 1 list of countries which do not have legally binding targets to where they have to reduce their GHG emissions, unlike most developed countries. However, every country has to submit an annual GHG inventory. Finally, the ability within the UNFCCC to trade carbon credit proves advantageous for countries like Sri Lanka since there is a form of revenue. Sri Lanka can trade its extra credits with an Annex 1 country that is looking for excess credits.

V.2. Adaptation Responses

Sri Lanka’s adaptation responses are concentrated mostly in the coastal zones, in the forest sector, health sector, education sector, and by building awareness.

- **Coastal Zone** – Accommodate sea level rise with new coastal structures; evaluation of engineering new engineering methods to counter threat; preparing back limits that take account of coastal erosion.
- **Forestry** – Identifying vulnerable areas and preparing contingency plans; promoting alternative timber such as rubber; ensuring conservation of natural forests and banning deforestation for commercial practices.
- **Health Sector** – Preparing with crisis management techniques before hand; enacting and introducing local standards for “hot” working environments; upgrading safe drinking water and sanitation facilities in the rural areas.
- **Education** – Educating school children and youth about the current climate crisis and encouraging healthy practices through all aspects of life.

⁷ On December 11, 1997, the United Nations Framework Convention on Climate Change (UNFCCC) was linked to what is known as the Kyoto Protocol in Kyoto, Japan. It is an international agreement that sets specific targets for 37 industrialized countries and the European community for reducing GHG emissions, roughly by about 5 percent. As of November 2009, 187 states have ratified this protocol. Surprisingly, this excludes the United States, the most noted polluter in the modern world.

- **Awareness** – Advocating for efforts which help reduce the negative impact of climate change. Awareness is created through various measures such as fundraisers, fairs, concerts, live events, seminars, and posters.

VI. Conclusion

“Resolving the present environmental crisis is not just a question of ethics but a question of our own survival” writes the Dalai Lama (2004, p. iii). This beautiful quote summarizes the gravity of climate change in a nutshell. Climate change hinders our survival in many ways as it has physical and psychological effects. Sri Lanka is in great need of change. It needs to adopt practices that will not only ensure reductions in GHG emission levels but more importantly, adapt measures to ensure a safe future. From this article, it can be assimilated that climate change is directly affecting Sri Lanka, whereby we looked specifically as the impact on Sri Lanka’s environment, agriculture, tourism, health, and society.

Sri Lanka is a developing nation which needs increased domestic and foreign investments to further its infrastructure and industry in order to hop on the band-wagon of rapidly developing nations such as Brazil, India and China. Climate change looks like it can hinder this process dramatically if efforts are not taken to reduce present day trends. Leading stakeholders in this issue like the United States, European Union, and China, along with most other developed nations have to consider the negative aspects of their industries and curb these industries in a way which will reduce the impact of climate change. It is the less developed nations like Sri Lanka which will suffer first and most.

Sri Lanka seems to be playing its role well in terms of environmental indicators but it still has a long way to go. There are a myriad of policies and measures the government of Sri Lanka and other international organizations are implementing to help reduce the negative impacts from climate change in addition to the points outlined, but were not mentioned in this article. The most effective way to deal with this crisis is that the top GHG emitting countries cut back their emissions and that Sri Lanka starts to adapt to climate change before it is too late. Even though Sri Lanka has an infinitesimal role in mitigating this global threat, Sri Lanka and the whole world will nevertheless have to face this challenge as one.

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