JOURNAL OF CRITICAL REVIEWS

ISSN- 2394-5125 VOL 07, ISSUE 19, 2020

Issues of Climate Change in the Latin America and the Caribbean Nations: Concerns and Challenges for the Sustainable Development

Dr. Mohd Tufail Chaudhary
M.Phil./PhD in Geography, Jawaharlal Nehru University, New Delhi
Post Doctorate, Jawaharlal Nehru University, New Delhi

Currently: Assistant Professor (Senior Scale), PG Department of Geography, Govt. Post Graduate College Rajouri, Jammu and Kashmir, India

Abstract

A rise in average global temperatures, changes in precipitation patterns, rising sea levels, the shrinking cryosphere, and changes in the pattern of extreme weather phenomena are all signs of climate change, which is primarily caused by human emissions. The average global temperature is expected to rise by between 1°C and 3.7°C during this century, with the increase amounting to between 1°C and 2°C by 2050 and extreme scenarios with temperature rises of up to 4.8°C by 2100. There is evidence that the average global temperature increased by 0.85°C between 1880 and 2012. Insofar as climate-changing greenhouse gases are emitted into the atmosphere with no cost to economic activity, climate change is arguably the ultimate negative externality from an economic perspective. Therefore, in order to address the market failures that either contribute to or exacerbate climate change, a variety of public measures are required. In terms of climate change, the region of Latin America and the Caribbean is asymmetrical. The area has historically contributed very little to climate change, but it is nonetheless extremely vulnerable to its impacts and will play a significant role in any potential remedies. Due to its geography, climate, socioeconomic status, and demographics, as well as the high sensitivity of its natural resources like forests and biodiversity to climate change, the Latin American and Caribbean region is extremely vulnerable to climate change. A worldwide agreement on climate issues built on the shift to sustainable development will be necessary to adapt to the changing climate circumstances and implement the mitigation strategies required to reach climate targets.

Greater social cohesion and equality result from sustainable development, which also includes a public-private mix that is congruent with this new paradigm. A society that is moving towards sustainable development is less susceptible to shocks caused by the climate and is better

equipped to implement adaptation and mitigation measures. In this regard, the problem of climate change is a problem of sustainable growth.

Introduction

One of the greatest problems of the twenty-first century is climate change, which has global yet unequal origins and effects. According to the evidence that is now available, there are major negative effects of climate change that are very certainly stronger in some regions of Latin America and the Caribbean than others (IPCC, 2014a; Stern, 2007, 2013). The implementation of adaptation processes (along with their financial costs and, in some cases, irreversible residual effects or damage) is essential because the current trend in emissions levels suggests that the symptoms of climate change will inevitably manifest during this century. In a world where most economies are strongly dependent on fossil fuels, it is believed that a concerted effort will have to be undertaken to cut the emissions level from slightly less than 7 to 2 metric tonnes per capita by 2050 in order to stabilize climate conditions. The economic and societal problem of figuring out how to reduce the impacts of greenhouse gas emissions while also dealing with the expenses and losses connected with climate change will determine the development model of the twenty-first century.

Since the middle of the 1970s, temperatures in Central and South America have increased by 0.7° to 1°C, with the exception of coastal Chile, where they have decreased by 1°C, and annual precipitation has risen in the southeast of South America while decreasing in Central America and the southern and central regions of Chile. Although many of these extreme occurrences are not necessarily related to climate change (Magrin and others, 2014; IPCC, 2013b), the region has undergone changes in climatic variability and major impacts from extreme climate events. The amount of deforestation caused by small farmers, who are primarily from migrant families looking for land, is quite low: Tropical and subtropical Latin America's deforested lands are primarily used for significant livestock raising (Wassenaar et al., 2007).

More than 610 million people reside in coastal states in Latin America and the Caribbean, with 7 5% of them living less than 200 kilometres from the coast (Guarderas et al., 2008).Large coastal populations are linked to the notable change that the area's marine ecosystems have been going t

hrough.Fish populations, tourist destinations, recreation areas, and pest and pathogen controls are all under stress (Guarderas et al., 2008; Mora, 2008).

More than 610 million people reside in coastal states in Latin America and the Caribbean, with 75% of them living less than 200 kilometers from the coast (Guarderas et al., 2008). For instance, Lacambra and Zahedi (2011) discovered that more than 30% of the population resides in coastal areas that are directly vulnerable to climatic events in the seven nations they studied in the region (El Salvador, Nicaragua, Costa Rica, Panama, Colombia, Venezuela, and Ecuador). Large coastal populations are linked to the notable change that the area's marine ecosystems have been going through. Fish populations, tourist destinations, recreation areas, and pest and pathogen controls are all under stress (Guarderas et al., 2008; Mora, 2008). One of the greatest challenges of the twenty-first century is climate change, which has global nevertheless unequal origins and effects. The information that is currently available suggests that the adverse effects of climate change are substantial and are almost certainly more severe in some regions of Latin America and the Caribbean than others (IPCC, 2014a; Stern, 2007, 2013). The Intertropical Convergence Zone, the North and South American Monsoon System, El Nio Southern Oscillation, Atlantic Ocean oscillations, and tropical cyclones are only a few of the climate phenomena that have an impact on the Latin American and Caribbean region (IPCC, 2013b). The sub regional climate is impacted by these phenomena, and changes to their patterns have substantial impacts on climate projections. Rising humidity levels are anticipated to exacerbate the El Nio precipitation variability, and the El Nio Southern Oscillation will likely continue to be the primary type of interannual variability in the tropical Pacific (at a high confidence interval) (IPCC, 2013a).

Based on climatologically research, the average temperature in Central America has been rising by about 0.54°C over the last 50 years (ECLAC, 2011c, using Climatic Research Unit, RCU). According to estimates based on new Representative Concentration Pathways (RCP) radiative forcing scenarios discussed in the fifth IPCC report, temperatures in Central America and Mexico could rise by up to 2081-2100 relative to temperatures in 1986-2005, ranging between 1.8°C and 3.5°C for the RCP 6.0 scenario and 2.9°C and 5.5°C for the RCP 8.5 scenario. The study that is currently available for Central America shows that environmental degradation and the loss of biodiversity are processes that are already well under way and that very likely will

become more pronounced as climate change advances. For instance, the potential biodiversity index (PBI) for Central America indicates that changes in land use (without climate change) will cause a loss of biodiversity of about 13% during this century. By the end of the century, climate change is predicted to increase this loss to a range between 33% and 58%.

According to the data, there are already sizable effects of climate change in Latin America and the Caribbean, and those effects are likely to grow in the future (IPCC, 2013b; Magrin and others, 2014). Although the long-term impacts are largely detrimental, the immediate effects are unevenly distributed, non-linear, and even positive in some circumstances and for short periods of time. For instance, there is proof that there have been significant effects on agriculture, water resources, biodiversity, sea levels, forests, tourism, population health, and the towns in the area (Magrin and colleagues, 2014). However, because most of this data is still fragmented and surrounded by doubt, it is impossible to combine it or use it as a basis for comparison.

On daily and seasonal timeframes, it is almost clear that there will be more hot and fewer extremes of cold temperatures over most geographical areas (IPCC, 2013a). Additionally, dry regions are going to get dryer, and humid parts will become more humid due to the warmer air's greater ability to hold water vapour (World Bank, 2013). Accordingly, over mid-latitude territories and wet tropical regions, extreme amounts of precipitation are extremely likely to become increasingly frequent and intense by the end of the century (IPCC, 2013a).

Future Scenario: Global Scale

Continued emissions of greenhouse gases will result in further changes to the climate's numerous components. Additionally, it is probable that the average global temperature for the years 2016 to 2035 will be 1 °C—but not more than 1.5%—higher than the average for the years 1850 to 1900 (IPCC, 2013b). Over the majority of land areas, on daily and seasonal timescales, it is essentially certain that there will be more hot and fewer cold temperature extremes (IPCC, 2013a). In addition, dry regions will tend to get dryer, while humid parts will be more humid as the warmer air can contain more water vapour (World Bank, 2013). Accordingly, extreme precipitation events are very likely to become more frequent and intense over mid-latitude land masses and wet tropical regions by the end of the century (IPCC, 2013a).

In Latin America and the Caribbean, there have been major changes in temperature and precipitation patterns. For instance, since 1960, the number of cold days has decreased while the number of hot days has increased. Mean temperatures have also increased by 0.1 degree celcious every decade. According to climate models for the area, the most optimistic emissions scenario projects an average temperature increase of about 1°C across all sub-regions from 1986 to 2100.

Climate change presents a paradox because, although it is a long-term phenomenon with consequences that will be more severe in the second half of this century than the first, immediate action must be taken to address it. According to climate models, greenhouse gas concentrations of 450 ppm are (with an 80% likelihood) consistent with an increase in the mean global temperature of 2°C compared to the pre-industrial era (Hepburn and Stern, 2008). According to the data, there are already sizable effects of climate change in Latin America and the Caribbean, and those effects are likely to grow in the future (IPCC, 2013b; Magrin and others, 2014). Although the long-term impacts are largely detrimental, the immediate effects are unevenly distributed, non-linear, and even positive in some circumstances and for short periods of time. For instance, there is proof that there have been significant effects on agriculture, water resources, biodiversity, sea levels, forests, tourism, population health, and the towns in the area (Magrin and colleagues, 2014).

The research that is now available suggests that rural poverty decreased across Latin America between the end of the 1990s and the end of the first decade of the new century, albeit trends varied greatly from nation to nation (ECLAC, 2013b). Between the late 1990s and the end of the first decade of the twenty-first century, it is estimated that the percentage of the rural population in Latin America and the Caribbean living below the indigence (extreme poverty) line decreased from 38% to 31%, while the percentage of the entire rural population living below the poverty line decreased from 64% to 54%.

Impact on the Agricultural Practices in Latin America and Caribbean Nations

Agricultural operations' net incomes and yields are influenced by a wide range of socioeconomic and technological aspects, as well as the soil's quality, but they are also extremely climate-sensitive. This is especially true for Latin America and the Caribbean, where in 2012 the agricultural sector contributed roughly 5% of the region's GDP, employed 16% of the labour

force, and generated about 23% of its exports. The agricultural sector plays a significant role in reducing poverty and is a major source of income for the region's rural population, which makes up 22% of the continent's population. It also plays a significant role in driving the region's economy and bolstering the trade balance.

The potential effects of climate change must be considered in light of the complex socioeconomic factors that affect agricultural activities in Latin America and the Caribbean, as well as the region's striking structural heterogeneity, poor infrastructure, water scarcity, generally low levels of productivity, the limited availability of funding for climatic adaptation, and the absence of certain types of financial and insurance structures in some regions. Another aspect to take into account is the timing of these climate change effects, which coincide with rising global demand for food and other agricultural goods in addition to initiatives to fight poverty and ensure the security of the region's food supply and energy supply (Vergara and others, 2013).

The research that currently exists indicates that, for Latin America and the Caribbean, as for the rest of the globe, the effects of climate change on agriculture are already being felt and will almost certainly get worse in the years to come. These effects differ by location and may even include localized net gains. Warmer areas of South America will be more severely affected than colder regions with abundant water supplies (Seo and Mendelsohn, 2008a, 2008b). Due to all the various variables that affect farm yields and all the presumptions used in the calculations, there is an enormous amount of uncertainty around the final net implications. For instance, losses for Brazil are projected to range between 0.62% and 38.5% (Timmins, 2006; Sanghi and Mendelsohn, 2008).

Impact on the Water Resources of Latin America and Caribbean Nations

The water supply in the countries of Latin America and the Caribbean is generally plentiful but poorly distributed (Magrin and others, 2007). The region's total supply is approximately 12.481 trillion cubic metres (m3), or 21,734 m3 per person. 254.5 billion cubic metres of water were used by various industries in 2011. 68% of it was consumed by agriculture, 21% by homes, and 11% by manufacturing and industry.

Glacier melt is being accelerated by climate change, which also modifies precipitation patterns, soil humidity, and runoff. Although the implications differ from one area within the region to

another, all of this has an impact on the supply of drinking water as well as business activities like industry and agriculture. It is causing an increase in some situations in the population living in water-stressed areas (IPCC, 2008, 2014b). 11 In Latin America, the hydrological landscape has already changed. For instance, in Argentina, as precipitation levels have increased and evapotranspiration levels have decreased as a result of changes in land use, the volume of flow in various portions of the River Plate watershed has grown (IPCC, 2014b; Doyle and Barros, 2011; Saurral, Barros, and Lettenmaier, 2008). On the other hand, rivers in Central America are starting to dry up and water levels are decreasing in the main channels of the Magdalena and Cauca rivers in Colombia (Carmona Duque and Poveda Jaramillo, 2011; Dai, 2011).

The glaciers' decline will also be accelerated by climate change. In glacier-fed basins, this will disturb the water cycle by changing the water supply as a result (Agrawala and Fankhauser, 2008). There is evidence of the Andean glaciers receding quickly and melting in Latin America's Bolivarian Republic of Venezuela, Chile, Colombia, Ecuador, and Peru and the Plurinational State of Bolivia, which have both seen surface area losses of 20% to 50% due to rising temperatures, primarily since the late 1970s (Magrin and others, 2014; Bradley and others, 2009). According to Vergara and others (2009), the extinction of the Cotacachi glacier in Ecuador has already had an effect on agriculture, tourism, and biodiversity.

Glacier melt is accelerated by climate change, which also modifies precipitation patterns, soil humidity, and runoff. Although the consequences differ from one area within the region to another, all of this has an impact on the availability of drinking water as well as economic activity like industry and agriculture. It is contributing to an increase in some circumstances in the number of individuals experiencing water stress (IPCC, 2008, 2014b).

Urbanization and Climate Change

The importance of Latin America's urban centres for the region's overall economic growth and for the wellbeing of its population is increased by the region's cities' recent rapid urbanization. Additionally, it emphasizes the significance of cities in relation to the effects of climate change and attempts at adaptation and mitigation (IPCC, 2014b). Rapid urbanization has undoubtedly had positive effects on the economy and society, but it has also increased demand for other

goods and services, such as transportation and public utilities, and is putting increasing pressure on natural resources.

Since there are numerous factors that might affect the outcome, there is a lot of ambiguity about the extent to which the health effects of climate change will manifest through multiple pathways. In addition to altering the geographic distribution of diseases like dengue fever and malaria, rising temperatures will also increase fatality rates during heat waves (IPCC, 2014b; WHO/WMO/UNEP, 2008). Urban transportation in Latin America, which is more and more dependent on private transportation and the corresponding levels of gasoline consumption, is creating a complex web of negative externalities, including the costs of traffic accidents, congestion, and the building of certain types of infrastructure, all of which have a significant negative impact on health (Bell and others, 2006). Given the already high levels of air pollution in Latin American cities (which are frequently above the levels recommended for public health) and the fact that climate change will exacerbate these negative effects, the relationships between climate change and health, urban development, and localized air pollution are especially concerning (IPCC, 2013b).

Malaria, dengue fever, heat exhaustion, and cholera are the primary health-related effects of climate change in Latin America and the Caribbean (Magrin and colleagues, 2007). The area is extremely vulnerable to transmission hazards since outbreaks of malaria are brought on by changes in temperature and precipitation (Magrin and others, 2007), notably in the tropical and subtropical regions of South America (WHO/WMO/UNEP, 2008). While even modest temperature changes may substantially raise the chance of collecting dengue fever (WHO, 2004, Hales and others, 2002; Confalonieri and others, 2007).

Impact of Climate Change on the Coastlines

The coastal regions of Latin America and the Caribbean are experiencing the repercussions of climate change, according to the most recent IPCC assessment (Magrin and coauthors, 2014) as well as earlier studies (Nicholls, Hoozemans, and Marchand, 1999; Nicholls and Cazenave, 2010; IPCC, 2007, 2014a). Unquestionable evidence shows that sea levels gradually increased throughout the 20th century, and the average global trend at the moment is a rise of 3.3 mm per year. This rate of increase is going to rise in the twenty-first century, especially due to rising

ocean temperatures and the disappearing of the polar ice caps. However, the region's coastal towns are not just according to risk from rising sea levels. Changes in wave activity, water surface temperature, salinity, and tide-related meteorological factors can also pose serious risks. They can exacerbate coastal erosion, cause more severe coral bleaching, decrease the tourist appeal of certain areas, make it more difficult to protect beach areas, threaten maritime infrastructure, and raise the likelihood of flooding in certain areas. Studies that examined historical patterns of the changing environmental conditions in coastal regions have uncovered strong evidence that sea levels are rising all along the Caribbean and Latin American coasts. Sea level appears to have risen between 2 and 7 millimeters per year between 1950 and 2008, with Ecuador saw the least amount of growth, while northern Brazil and the Bolivarian Republic of Venezuela saw the most.

According to predicted patterns, the Atlantic coast, particularly in northern South America and the Caribbean islands, will continue to experience the biggest rises between 2010 and 2040, barring a significantly more rapid rise in world temperatures. According to ECLAC's 2011a projections, the average sea level will rise by up to 3.6 mm annually between 2040 and 2070. Although the height of sea levels is a fundamental factor, the complexity of the impacts involved and the vulnerability of all the countries' socioeconomic and ecological systems are increased when this factor is combined with other dynamic meteo-oceanographic and coastal variables, in addition to the dynamic of extreme weather events (hurricanes and the El Nio Southern Oscillation). Given that the region is so highly urbanized (80% of its people live in cities), so many of its residents reside in coastal areas, and it contains so many small island developing States, its physical, social, and economic characteristics present additional challenges that might worsen the effects of rising sea levels (ECLAC, 2012a). Given the region's exceptional vulnerability, along with the changes in marine dynamics brought on by climate change, it is likely that flooding, beach erosion, and damage to coastal and port infrastructure will be the primary effects of climate change. In the extreme case of a one-meter rise in sea level, the pattern of flooding would be uneven, and some population centres in the Caribbean and along the coasts of Brazil will be particularly heavily hit (ECLAC, 2012b).

Tourism is fraught with uncertainty because it's unclear how climate change will affect both the demand for and supply of tourism services. However, it is evident that beach erosion and other

extreme weather occurrences in a number of Latin American and Caribbean nations may have an important adverse effect on this industry. There is an obvious need to implement adaptation measures to lessen the region's susceptibility to climate change, given the looming effects of increasing sea levels on coastal regions of Latin America and the Caribbean. The projected rise in sea levels should be incorporated into land management plans in the region's coastal zones, and risk transfer mechanisms involving the insurance market and other means should be developed for dealing with the potential risks to port and coastal infrastructure. Public policy measures should be developed with a view to improving building regulations and ensuring that they address the impacts of climate change.

Biodiversity, Forests and Climate Change

The biodiversity stocks in Latin America and the Caribbean are abundant; in fact, the region is home to many of the few megadiverse nations in the world (Magrin and others, 2014; Guevara and Laborde, 2008; Mittermeier, Robles Gil and Mittermeier, 1997). It contains a sizable number of endemic plant and animal species, 21% of the world's eco-regions, 22% of its total freshwater supply, and 16% of its marine water resources (ECLAC, 2014b). In addition, it contains a wide range of diverse climates and ecosystems, 4 million square kilometers of which are in protected areas (20% of the total surface area of the globe is protected) (ECLAC/ILO/FAO, 2010; UNEP, 2010). Large forests are also present throughout Latin America and the Caribbean, where most of the region's biodiversity is found.

Given the highly sensitive nature of many of these ecosystems and species, as well as the difficulties that they have faced in adapting to changes in temperature, precipitation, and the concentration of carbon dioxide in the atmosphere, the wealth of natural resources in the Latin American and Caribbean region are under threat and are steadily declining as a result of a complex web of factors and interactions, including climate change (M). Latin America and the Caribbean comprise seven of the twenty countries with the most threatened plant species (Brazil, Peru, Mexico, Colombia, Jamaica, Panama, and Cuba), and five of the twenty countries with the greatest number of threatened animal species (Mexico, Colombia, Ecuador, Brazil, and Peru).

Deforestation and other processes that are driven by climate change have a significant knock-on effect on the biodiversity of Latin America and the Caribbean. In six crucial regions, including

Mesoamerica, the Chocó-Darién-western Ecuador corridor, the tropical Andes, central Chile, Brazil's Atlantic Forest, and the Cerrado tropical savannah, also in Brazil, changes in land use have resulted in biodiversity issues (Mittermeier, Gil, and Pilgrim, 2005). With rising temperatures and altered precipitation patterns, deforestation may cause the Amazon basin to cross a critical threshold, which might have an irreversible impact on biodiversity stocks (IPCC, 2014b).

This issue is made much more problematic by the abundance of endemic species found in Latin America and the Caribbean. Between 1990 and 2000 and between 2000 and 2010, Latin America and the Caribbean's total wooded area shrunk at a mean annual rate of -0.46 and -0.47, respectively. The use of forested lands for slash-and-burn agriculture, increased logging, misguided economic incentives, an increase in the demand for firewood, the expansion of infrastructure (particularly roads), population growth and increasing population density, unpredictable weather and natural disasters, the weakness of intellectual property institutions, and other factors are all contributing to this decline in the region's forested area (FAO, 2011; Brown and Pearce, 1994; Kaimowitz and Angelsen, 1998; Andersen and others, 2003; Rudel, 2005; Rudel and others, 2009).

Situations caused by Extreme Weather: Prevention and Mitigation

The continent of Latin America and the Caribbean is vulnerable to a variety of extreme weather events, which can have far-reaching effects on the economy, society, and the environment (IPCC, 2014b). The contribution of climate change to these meteorological occurrences is hotly contested (IPCC, 2013b). However, there is strong evidence that there is a connection between climate change and extreme weather events, including those that are simply brought on by an increase in mean temperatures, which may result in more hot days and fewer cold days throughout the year (Stern, 2013; IPCC, 2013b). A significant percentage of the population is still extremely vulnerable to the effects of extreme weather events, despite the region's recent economic and social advancements (Cecchini and others, 2012; Galindo and others, 2014). In the upcoming years, particularly in terms of extreme weather events, Latin America and the Caribbean must develop methods for lowering and controlling the risks that the region faces from natural catastrophes. If it doesn't, some areas in the region can see an adverse impact on the economy, society, and environment.

According to the evidence that is currently accessible, while extreme weather events typically have a negative impact on population well-being in the short term,15 that impact is not always directly reflected in a country's GDP, and their impact in the medium (from one to three years)16 and long terms is frequently weak or difficult to detect (Albala-Bertrand, 1993; Benson and Clay, 2003; Hochrainer, 2006; Loayza and others, 2009; Murlidharan and Shah, 2001). The consequences will vary depending on the size and type of the disaster, the industry concerned, the economy's structure and composition, and the amount of per capita income (the consequences are more severe in developing countries than in developed ones).

Climate Change Adaptations from the Inevitability to the Sustainability

The United Nations Member States' mitigation plans do not go far enough to reduce greenhouse gas emissions to the levels required for climate stabilization (UNEP, 2013). Due to a number of factors, including its geography, the distribution of its infrastructure and population, its reliance on natural resources, the scale of its agricultural activities, the size of its forests, and its biodiversity, the Latin American and Caribbean region is extremely vulnerable to climate change. Its limited ability to promote additional adaptive mechanisms and other economic, social, and demographic traits that cause many people to live in social conditions that expose them to higher levels of risk are additional factors that increase its vulnerability (ECLAC, 2013a, 2009a; Cecchini and others, 2012; Vergara and others, 2013). Therefore, it is essential that governments in Latin America and the Caribbean incorporate appropriate adaptation measures into their sustainable development plans.

Any deliberate adjustment carried out in response to real or anticipated climatic changes is included in the idea of climate change adaptation. From an economic standpoint, adaptation processes are referred to as the extra expenses that are incurred by ecosystems and human activities in order to adapt to changing climatic conditions. These additional costs, which may include social, cultural, administrative, and process changes, behavioral modifications, the building of new infrastructure or the use of new technologies, structural transformations or modifications of products, inputs, or services, and the formulation of new public policies aimed at mitigating or maximizing new climatic risks, are not taken into account in the business-as-usual baseline (BAU).

Despite the significance of adaptation, there are still many unknowns and gaps in our understanding of how adaptive processes work, as well as their costs and financial advantages. This is because it can be challenging to establish a baseline and to distinguish, for instance, between processes that are improved as a result of business as usual and those that are implemented specifically to adapt to climate change from those that are improved risk management systems. The data that is now accessible from a variety of different adaptation processes indicates that any adaptation process is bound to have some inevitable—and, in many cases, irreversible—residual effects and that major inefficiencies and impediments of various kinds will be met. Agriculture, which has a long history of responding to shifting weather and climatic circumstances, offers one example of these adaptive processes. The research suggests that some farms in Latin America have adapted to climate change by growing fruit and vegetables instead of maize, wheat, and potatoes. Similar evidence of a switch from crop farming to stock-raising or a combination of the two has been found, and irrigation decisions have changed in line with this (Seo and Mendelsohn, 2008a and 2008b; Mendelsohn and Dinar, 2009).

Conclusion

There is already evidence of climate change, which is primarily the result of human emissions, in phenomena like rising global temperatures, altered precipitation patterns, rising sea levels, the shrinking cryosphere, and changes in the frequency of extreme weather events (IPCC, 2013a). There is proof that between 1880 and 2012, the average global temperature increased by 0.85°C [0.65°C to 1.06°C]. According to historical trends and forecasts, temperatures are expected to rise by 1°C to 3.7°C by the year 2100, with a strong possibility of a rise of over 1.5°C and up to 4.8°C in extreme scenarios. The world's ecosystems, social situations, and economic activities are all seriously affected by climate change. The many consequences on the economy, society, and environment as well as the channels via which they are being transmitted currently exist and are likely to get worse in the years to come. Due to its geography, climate, socioeconomic status, and demographics, as well as the high sensitivity of its natural resources like forests and biodiversity, the Latin American and Caribbean region is extremely vulnerable to climate change. Although there is a lot of uncertainty, preliminary estimates place the economic impacts of climate change in the region at 1.5% to 5% of current GDP by 2050. Due to the greenhouse gas emissions' current inertia, climate change seems inevitable in the twenty-first century.

Therefore, adapting actions must be performed to lessen the anticipated harm. However, there are some restrictions and difficulties with these procedures. They might not entirely stop any residual damage and they might be ineffective. It is obvious that the complex challenge of adjusting to new climatic conditions, implementing mitigation measures, and simultaneously realising the existence of shared but distinct responsibilities and varying capacities is a significant one that will influence the development of the twenty-first century. In actuality, the only way to successfully address the problem of climate change is to move towards a sustainable development route. Another fundamental paradox of climate change is that, although being a long-term occurrence, it need current action on both mitigation and adaptation.

More effectively social cohesion, better equality, and a public-private mix that is consistent with this new paradigm are all components of sustainable development. These elements will reduce vulnerability to negative effects and make mitigation more economical and less expensive. Additionally, sustainable development increases a country's capacity to conduct adaptation and mitigation measures and increases resilience to climatic shocks. As a result, achieving the objectives of sustainable development will help to address the climate change challenge.

Bibliography

Albala-Bertrand, J. M. (1993), Political Economy of Large Natural Disasters: With Special Reference to Developing Countries, Clarendon Press.

Agrawala, S. and others (2010), “Plan or react?: Analysis of adaptation costs and benefits using integrated assessment models”, OECD Environment Working Papers, vol. 23, No. 23

Benson, C. y E. J. Clay (2003), Disasters, Vulnerability, and the Global Economy, Washington, D.C., World Bank.

Bell, Michelle L. and others (2006), “The avoidable health effects of air pollution in three Latin American cities: Santiago, São Paulo, and Mexico City”, Environmental Research, vol. 100, No. 3, March.

Brown, Katrina and David W. Pearce (1994), The Causes of Tropical Deforestation: The Economic and Statistical Analysis of Factors Giving Rise to the Loss of the Tropical Forests, Vancouver, University of British Columbia.

Cecchini, Simone and others (2012), "Vulnerabilidad de la estructura social en América Latina: medición y políticas públicas", Revista Internacional de Estadística y Geografía, vol. 3, No. 2

Guarderas, A.P., S.D. Hacker, and J. Lubchenco, 2008: Current Status of Marine Protected Areas in Latin America and the Caribbean. Conservation Biology, 22(6), 1630-1640.

Guevara, S. and J. Laborde (2008), "The landscape approach: designing new reserves for protection of biological and cultural diversity in Latin America", Environmental Ethics, vol. 30, No. 3.

Hales, Simon and others (2002), "Potential effect of population and climate changes on global distribution of dengue fever: an empirical model", Lancet, vol. 360, No. 9336.

Hepburn, Cameron and Nicholas Stern (2008), "A new global deal on climate change", Oxford Review of Economic Policy, vol. 24, No. 2

Mendelsohn, Robert and Ariel Dinar (2009), Climate Change and Agriculture: An Economic Analysis of Global Impacts, Adaptation and Distributional Effects, Edward Elgar, October

Magrin, Graciela and others (2014), "Chapter 27. Central and South America", Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

Nicholls, Robert J. and Anny Cazenave (2010), "Sea-level rise and its impact on coastal zones", Science, vol. 328, No. 5985. Nicholls, Robert J., Frank M.J. Hoozemans and Marcel Marchand (1999), "Increasing flood risk and wetland losses due to global sea-level rise: regional and global analyses", Global Environmental Change, vol. 9

Seo, Niggol and Robert Mendelsohn (2008a), "A Ricardian analysis of the impact of climate change on South American farms", Chilean Journal of Agricultural Research, vol. 68, No. 1, March.

Stern (2007), The Economics of Climate Change: The Stern Review, Cambridge University Press, January

Stern, Nicholas (2013), "The structure of economic modeling of the potential impacts of climate change: grafting gross underestimation of risk onto already narrow science models", Journal of Economic Literature, vol. 51, No. 3, September

Timmins, Christopher (2006), "Endogenous land use and the Ricardian valuation of climate change", Environmental and Resource Economics, vol. 33, No. 1, January

V.R. Barros and others (eds.), Cambridge, Cambridge University Press. (2007), "Latin America", Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry and others (eds.), Cambridge, Cambridge University Press.

Vergara, Walter and others (2013), The Climate and Development Challenge for Latin America and the Caribbean: Options for Climate-Resilient, Low-Carbon Development, Inter-American Development Bank (IDB), April. (2009), "The potential consequences of climate-induced coral loss in the Caribbean by 2050–2080", LCR Sustainable Development Working Paper, No. 32, Washington, D.C., World Bank. (2002), "Assessment of the Economic Impact of Climate Change on CARICOM Countries".

Wassenaar, T., P. Gerber, P.H. Verburg, M. Rosales, M. Ibrahim, and H. Steinfeld, 2007: Projecting land use changes in the Neotropics: The geography of pasture expansion into forest. Global Environmental ChangeHuman and Policy Dimensions, 17(1), 86-104.