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Geography, society and development in a changing climate

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The Geography discipline and the importance of Geographers

Geography is perhaps the single most important discipline for the Caribbean and the world in the 21st century. This may sound like a bit of a bold statement but, while disciplines are also important, none have such breadth or scope as Geography or provide the holistic view that Geography does. This makes Geography a good choice for both undergraduate and postgraduate study. While other disciplines fill niches, Geography is the discipline which brings them all together, providing a broad and connected view of issues and their impacts on society. For almost every other discipline, you will find that there is a sub-discipline of Geography in which there is active research and teaching – for example, within *Human Geography*, for health care and medical research there is *health geography*; for economics and fiscal policies there is *economic geography*; for politics there is *geopolitics*; for development issues and urban planning there are *development geography* and *urban geography*. *Physical Geography* is also highly connected to other disciplines – *biogeography* adds the geographical context to biology and ecology; *geomorphology* incorporates physics and engineering in looking at processes of erosion, deposition and landscape change; *hydrology* is a discipline of engineering, but one which is also firmly in the geography camp.

As rich as they are, Geography is much more than its sub-disciplines – the real power of Geography lies in its ability to connect disciplines and gain new and deep insights into issues which are of utmost importance for society. This makes Geography uniquely placed to contribute to society by providing a balanced discourse and helping guide important policy developments over the coming century. Not only does that make Geography a fascinating and endlessly enthralling subject in which to dive ever deeper, but it also means that Geography graduates are highly sought after – not because they have a particular specialisation, but because they *don't*: graduates have both breadth and depth of knowledge and are adapt at thinking both critically and holistically, able

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to engage with multiple issues of relevance to society and contribute to solutions.

Over the coming years, these traits will lead to ever more career opportunities and options for graduates in areas extremely important for society. The discipline of Geography includes many of the important global issues facing our society today, from food security to water security to energy security; from biodiversity loss and environmental degradation to conservation and sustainable development; from globalisation to fair trade; Geography encompasses issues of democracy, governance and state surveillance; conflicts, refugees and migration; and also draws linkages between them.

Take, for example, climate change: this century, it will probably be the single most significant issue facing our society and the challenges and issues it presents are inherently geographical in nature. As a result of climate change, our societies will also have to change, through embracing both mitigation (i.e. reducing emissions to limit changes) and adaptation (i.e. developing ways to better cope with changes). The consequences of this, both at a local and an international level, are profound and must be assessed from the rounded viewpoint that a Geographer brings. For smaller, less developed nations such as those we have in the Caribbean, adaptation to climate change is likely to be a major challenge (e.g. UNEP, 2008).

Geography, climate change and development

Climate is an inherent part of Geography, since it plays a significant role in where and how societies came to exist – think about the importance of the availability of a reliable source of water, or the need for reliable rainfall for agriculture. Consequently, climate *change* (i.e. distinct changes in the average pattern and variation in meteorological conditions) is of fundamental importance to society since it affects its viability and security. While climate change does occur naturally due to variations in the Earth's orbit (e.g. Milankovitch cycles), changes in solar intensity and, on a short term, as a result of volcanic eruptions, it is now clear that our actions as humans are outweighing and outpacing natural changes (IPCC, 2013). We are *enhancing* the greenhouse effect, a natural atmospheric process which keeps our planet warm and liveable,

primarily through emissions of greenhouse gases such as carbon dioxide and methane – through increasing industry, transport, energy production and deforestation. Driving these increases is growth and development which, over the last century, has not been particularly focussed on sustainability. Human population is higher than it has ever been, at more than 7 billion global citizens and it is increasing exponentially. These factors place increased pressure on resources and we clearly have some way to go if we are to become sustainable.

We are already witnessing climate change, which we can see in the evidence of measurements collected by research scientists (including Geographers) the world over. The fifth assessment report of the Intergovernmental Panel on Climate Change (IPCC), released in late 2013, collates and summarises this evidence. Among many others, three key types of observation indicate real and present climate change (IPCC, 2013):

1. In observations of *surface temperature*: global average temperatures have increased by around 1°C over the twentieth century; night time temperatures have been observed to be increasing at a faster rate than those in the day time; land areas have tended to warm faster than ocean areas; winter months have warmed faster than summer months;
2. In observations of *precipitation*: there have been changes in the amount, intensity, frequency and type of precipitation (e.g. rainfall vs. snow), although there is considerable variability across regions; no *global* trend is present in precipitation observations with some areas increasing and others decreasing; and
3. In observations of *oceans and sea level*: the upper ocean has been observed to be warming; using satellite altimetry measurements, the rate of sea level rise since 1993 is observed to be around 3 mm per year and may be accelerating; melting of glaciers and ice sheets has been observed and, together with thermal expansion, accounts for about three quarters of observed sea levels rise.

Geographers have been among scientists at the forefront of such observation, from *glaciologists* who spend their times high in mountains monitoring and study glaciers by drilling ice cores to assess how they

change, to *hydrologists* who measure precipitation and its effects on river catchments, and they are at the centre of research efforts to assess how climate is likely to change over the coming decades. Geographers are also at the centre of efforts to assess the implications of these changes on society. It is important to realise that the observations summarised above relate to global *averages*; however, changes are also manifested in *extremes* which can cause a huge impact on society. For example, as a result of climate-related extreme events, we are facing natural hazards such as droughts and floods. A quick check of recent history provides an illustration of these impacts.

During 2014 in California, an extreme and prolonged drought led to an early and intense start to the wildfire season – in May rather than the usual July to October – and to a reduction in agricultural productivity in important crops such as citrus fruit[1]. Temperatures in California for the January-August period of 2014 were the warmest on record[2], exacerbating the situation. In the Caribbean too, droughts have a major impact on society. In 2009-2010 there was a widespread drought in the region which led to severe problems with water resources, a reduction in agricultural production and widespread bush fires causing land degradation[3]. Rainfall stations for some islands in the Lesser Antilles (eastern islands in the region) recorded their lowest ever 3-month total for January to March 2010[3].

We have also witnessed events at the other end of the hydrological extreme: flooding caused by heavy rainfall, storms and hurricanes, which bring not only strong wind but also extreme rainfall. Over the last few years, numerous hurricanes have caused record devastation for the region and beyond. The Caribbean islands have been badly affected. Between 2001 and 2010, Jamaica was hit by a total of 10 tropical storms or hurricanes, causing loss of life and substantial damage to infrastructure. Hurricane Ivan in September 2004 had a particularly high impact, causing wind damage and widespread flooding in the area around the capital city, Kingston – the total economic cost of Ivan was equivalent to 8% of Jamaica's total Gross Domestic Product (ECLAC, 2004).

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[1] http://ers.usda.gov/topics/in-the-news/california-drought-2014-farm-and-food-impacts.aspx
[2] http://www.ncdc.noaa.gov/sotc/national/2014/8
[3] https://www.wmo.int/pages/prog/drr/events/Barbados/Pres/4-CIMH-Drought.pdf

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There have been some very active hurricane seasons recently: the seasons of 2010, 2011 and 2012 each had a total of 19 named storms (only 1933 and 2005 had more), including devastating storms such as Hurricane Sandy, which crossed Jamaica, Cuba and the Bahamas before heading up the east coast of the United States before making landfall close to Atlantic City, New Jersey. Economically, Sandy was the second costliest hurricane to hit the United States in history (surpassed only by Katrina in 2005) (Blake et al. 2013).

We cannot take a single event and attribute its cause to climate change. But, we *can* say that climate change is altering the likelihood of such events occurring: all weather events are affected by climate change due to changing atmospheric conditions (Trenberth, 2012). Most nations in the Caribbean have been impacted by tropical storms and hurricanes, which are expected to become more intense in the coming decades (Holland & Bruyère, 2014). Combined with effects such as sea-level rise, the impact of events is likely to greatly increase and, with it our vulnerability.

Society's vulnerability to climate change results from multiple and diverse factors. For example, steep slopes and impermeable geology both increase surface runoff, leading to increased flood risk downstream. Increased likelihood of heavy rainfall events under climate change will also increase flood risk. But so will entirely human factors: urbanisation increases the impermeable surface area leading to increased runoff; urban drainage is designed to move water quickly downstream and may prevent flooding of the local area, but exacerbates flooding downstream. Building in floodplain areas leads to a higher impact on society; a person's resilience or ability to cope greatly affects their vulnerability and is influenced by their background and circumstances. This is the true responsibility of the modern professional Geographer: to take a holistic view of issues, understand them and contribute to more appropriate solutions. To be able to assess both the physical causes for natural hazards such as flooding and the human dimension of vulnerability. To be able to incorporate the potential impacts of climate change, understand their physical manifestations and their implications for society and development.

Today, we live in a globalised and technologically advanced world, allowing us to overcome issues which may have thwarted a past society,

by trading with other nations or by using innovative solutions. Yet, we are still vulnerable to a changing climate, particularly if those changes occur rapidly leaving limited time for adaptation. Small island states like many of those in the Caribbean are particularly vulnerable and are likely to be among the first and worst nations affected by climate change (Nurse et al. 2014). Many of our nations are highly sensitive to climate: they tend to be small with limited resources; many are low-lying and exposed to sea-level rise and the impacts of storm surges (e.g. Simpson et al. 2010); others are mountainous with steep slopes leading to increased flood risk during storm events (e.g. Ilorme et al. 2014); we have seasonality in our climate and livelihoods which depend on this such as agriculture, tourism and fishing; we have health issues affected by climate (e.g. tropical diseases such as dengue); critical sectors such as water and energy are also strongly linked to climate. As a region, our climate sensitivity can lead to significant vulnerability when combined with climate *variability* (e.g. too *much* or too *little* rain are both bad for agriculture). Our vulnerability is increasing; our future viability depends on responsible action today.

We need to adapt, but we need to avoid *maladaptation* measures – such as those which have a high environmental, social or economic cost relative to alternatives, or those which place burden on the most vulnerable in society disproportionately (Barnett & O'Neill, 2009). Instead, as a priority, we need to pursue *no-regret* measures – which have benefits to society with or without the threat of climate change; we should also pursue *low-regret* measures, which are relatively low cost but with large benefits; and also *win-win* measures, which contribute to adaptation but also have other social, economic or environmental benefits. Such measures include things like wastewater recycling or trickle irrigation, which reduce water consumption leading to a greater resilience to periods of low rainfall; or conversion from fossil fuels to renewables for energy supply and transportation, which has both environmental benefits and clear economic and geopolitical benefits too, especially in the medium to long term. Irrespective of climate change, it is clear that we still have many development challenges to overcome (Kelman, 2014): tackling these challenges will reduce our vulnerability to climate change, yet, in a rapidly changing climate the challenges become ever greater. These issues are complex

and are often intangible. The role of the Geographer in solving them must become ever more prominent.

Geographical research and its benefits to practitioners and society

As broad and important as the disciple of Geography is, it is *research* which is the driving force behind it. Research pushes the boundaries of Geography, developing new ideas and methods, proposing new solutions to societal challenges. Geography is such a far reaching, integrated and multi-disciplinary subject largely because of the efforts of Geography researchers to develop an understanding of our world and societies. In the latter part of the 20th century, new perspectives and technologies emerged and enable the development of new fields of the discipline. For example, spatial analysis and quantitative methods have been heavily influenced by the development of Geographical Information Systems (GIS), computer software which enables the integration and analysis of multiple layers of different types of spatial data; Earth observation using remote sensing has provided a wealth of data for geographical analysis and is now a discipline in its own right, encompassing physics, statistics, computer science and geography, among others; computational modelling has greatly extended our understanding of physical processes and their impact on society.

Large, complex computer models of the Earth-climate system have been developed – these apply well known physical processes at a global scale – and used to understanding of climate processes. These computer models are the *only* way in which a range of possible futures can be tested and assessed. Through extensive computer modelling of climate by multiple teams around the world, detailed predictions of future climate change have been made (see, for example IPCC, 2013). These are based on scenarios known as *Representative Concentration Pathways* (RCPs) which make some realistic assumptions about population growth, development, and sustainability options and so on, leading to different level of emissions for different scenarios (van Vuuren et al. 2011). The future climate projections presented in the fifth assessment report (AR5) of the IPCC were based in large part on the outputs of these models. In common with previous reports, the AR5 summarises a vast amount of scientific research into a comprehensive

assessment of the latest scientific thinking on climate change over the coming century – it represents as close to a consensus as we can get in science.

Institutions across the Caribbean region are an active part of this research effort. Climate models for the region are being run by colleagues on the three main campuses of The University of the West Indies (UWI) – Mona (Jamaica), St. Augustine (Trinidad & Tobago) and Cave Hill (Barbados), in collaboration with colleagues at organisations such as the Caribbean Community Climate Change Centre (CCCCC – or "5Cs") in Belize, the Caribbean Institute for Meteorology and Hydrology (CIMH) in Barbados, and the Instituto de Meteorología in Cuba. But researchers are also assessing the potential *impacts* of climate change. For example, in the Department of Geography at The UWI's campus in Trinidad & Tobago, we are working on the assessment of the potential impacts of climate change on terrestrial and coastal flood risk, using a range of computational modelling, remote sensing and GIS approaches. In one current research project, we are combining the methods of physical and human geography to assess flood risk under climate change for a river in Trinidad, and are directly involving residents and business owners in affected areas in the research using a community-based vulnerability assessment. We maintain close contact with practitioners across the region – for example, through the Global Water Partnership – Caribbean (GWP-C) network.

Postgraduate research students are the lifeblood of research in any discipline, providing the next cohort of researchers who may push back the frontiers of our understanding. Geography is no different in this respect and, as a relatively new Department at The UWI St. Augustine, this is especially the case: there is so much more to research in the Geography discipline in the Caribbean. Geography is a great domain in which to be a postgraduate student, and the Caribbean is a fascinating region in which to be based.

The future of Geography is bright, particularly in the Caribbean (perhaps it is the sunshine?). Graduates at both the undergraduate and postgraduate levels are able to contribute positively to society and assist with solving important issues of development. Graduates are highly employable with excellent transferable skills. Careers of particular relevance in the region include planning and development

sections of local and central governments, environmental consultation, cartography and GIS.

Further information: Geography at The UWI St. Augustine

The Department of Geography at The University of the West Indies, St. Augustine Campus was formed on 1 August 2012. Geography teaching on the campus began in 2005 in the Department of Food Production; Geography has been taught at the Mona Campus, Jamaica, since the 1960s. We maintain close links with our sister department, the Department of Geography & Geology, and transfer between programmes is possible.

In the Department, at the undergraduate level we currently run a BSc Geography degree, a Major in Geography and a Major in Environmental and Natural Resources Management. At the postgraduate level, we currently operate research degrees at the MPhil and PhD level and are in the processing of developing taught Masters level programmes.

For further information about the Department, please see our website:

http://sta.uwi.edu/ffa/geography/

For further information about undergraduate and postgraduate admissions to The UWI St. Augustine campus, please visit:

http://sta.uwi.edu/admissions/

Here you will also find information about a range of scholarships which are available to all students entering the first year of study, as well as the UWI Open Scholarship which is available to citizens of one of UWI's contributing countries. While studying at The UWI, opportunities are also available for exchanges at partner universities, for example, in Canada through facilities such as the Emerging Leaders in the Americas Program. At the Masters level and higher, scholarship opportunities exist through programmes including the Caribbean-Pacific Island Mobility Scheme.

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About the Author

Dr. Matthew Wilson is a Senior Lecturer and Head of the Department of Geography at the St. Augustine Campus of The University of the West Indies, Trinidad & Tobago.

Born on Ascension Island in the South Atlantic, Dr. Wilson was raised and educated in the UK, where he obtained his B.Sc. in Environmental Sciences in 1998 and a Ph.D. in Geography in 2004, both from the University of Southampton. Following academic posts at the Universities of Bristol and Exeter, he crossed the Atlantic to join the University of the West Indies in 2007.

Together with colleagues, since arriving he has been tasked with helping to develop undergraduate and postgraduate degree programmes in Geography at the St. Augustine campus. In addition to his teaching and academic duties, Dr. Wilson is active in research, with particular interests in the assessment of flood risk under climate change. He has published extensively and has co-authored 24 research publications and 21 technical reports in areas related to climate change and hazards. Current research projects include the analysis of flood risk, vulnerability, and the possible impacts of climate change for several communities in both Jamaica and Trinidad.

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