International Labour Organization

Tripartite meeting for consultations on
"Decent Work, Climate Change and Sustainable Development"
Monday 13 October 2014

BACKGROUND DOCUMENT

Climate Change and Employment:
Challenges and Opportunities in the Caribbean

Contents

This background document has been commissioned by the Green Jobs Programme of the ILO to the external consultant Ana Belén Sánchez. This final version benefitted from comments by Giovanni di Cola, Dagmar Walters, Kees Van der Ree, Florencio Gudiño, Guillermo Dutra and Gerardina González-Marroquín. The purpose of the document is to stimulate the debate during the tripartite consultation meeting on "Decent Work, Climate Change and Sustainable Development to be held in Lima on October 13th.

Geneva, September 2014

1. Introduction: Decent work and climate change in the Caribbean

This paper attempts to unpack the main links between climate change and employment in the Caribbean Region. It aims at providing information to governmental representatives of employment and enterprise development departments as well as to workers' and employers' organizations on impacts on employment of climate change and policies to address them.

The next year 2015 will witness three international events crucial for countries to achieve sustainable development. In the first place, the post-2015 process, where countries around the world give response to their commitments reached in Rio de Janeiro in 2012 negotiating a number of Sustainable Development Goals. The need to guarantee full employment and place decent work at the centre of an increasingly sustainable economy in social and environmental terms, the so-called green economy, is well recognized by all, countries and stakeholders.

A second process seeks to define the global climate change agenda. Countries are committed to reach a global agreement in 2015. Reducing current and future Greenhouse Gas emissions and providing the mechanisms and tools needed for countries to adapt to climate change will be among its main objectives. There is a growing acknowledgement that climate change and policies to address climate change will have an impact on employment. There is a growing civil society demand on more coherence between social and climate change policies. Many countries are already working to give decent work responses to this global environmental problem.

The third process will define the new framework post 2015 on disaster risk reduction following the Hyogo Framework for Action adopted in 2005 for a 10 years period, with the purpose of reducing the loss of human lives and the economic, social and environmental damages caused by disasters, as well as increasing the resilience of nations and communities to disasters as a condition for sustainable development.

These debates are very relevant to the Caribbean. Climate change poses a serious threat to sustainable development, impacting jobs, incomes, public and private infrastructures, health and productive sectors, reducing success in terms of poverty eradication and food security. These impacts are particularly important in the Caribbean due to the "biophysical and socio-economic characteristics of these countries" (ECLAC, 2011).

Many of these countries are members of the group of Small Island Development States (SIDS). This group met in Samoa in September 2014 at the Third SIDS Conference to show its commitment to sustainable development. Countries have called the international community to support them in their efforts to create inclusive and equitable economic growth with decent work for all, while achieving sustainable development and poverty eradication. Formal and non-formal education and training to create an environment that is sustainable for investments and growth, development of entrepreneurial and vocational skills, fostering entrepreneurship and innovation, creating green and decent jobs, enhancing gender equality and women's equal participation are among the needs identified by SIDS to meet this goal.

Countries gathered at the Conference agreed that economic growth prospects of their countries have been hindered by climate change, impact of natural disasters, high cost of imported energy and degradation of coastal and marine ecosystems and sea-level rise.

There were two particular recommendations made by the Conference: a) To conduct together with the International Monetary Fund (IMF) and the Member countries a review of the available facilities to deal with disaster response, in order to make them more inclusive and aimed at sustaining and or creating decent jobs; b) To build a skills/competences categories inventory related to climate change adaptation and share it among SIDS countries, as well as with regional training agencies such as the Caribbean Association of Training Authorities (CANTA).

Two of the socio-economic characteristics of the Caribbean States should be carefully considered when assessing the relation between climate change and employment: Firstly their productive sectors are dependent on their limited natural resource base (e.g., agriculture, forestry, fishing, tourism). The interdependence of the environment, employment and the real economy means that most part of their jobs are at risk due to climate change.

Secondly, more than half of the population, economic sectors and communication infrastructures are placed only 1.5 km away from the coast (Mimura and others, 2007 cited in UNEP, 2008). As a consequence, sea level rise, natural disasters, storms, salinization of fresh water, among other climate effects, will directly impact the backbone of the Caribbean countries.

Climate change, already underway, will continue to have negative effects on workers and their families, especially those whose livelihoods depend on agriculture and tourism. However, changing patterns of employment and investment resulting from efforts to reduce climate change and its effects are already generating new jobs in many countries. Action to tackle climate change as well as to cope with its effects is therefore urgent and should be designed to generate decent jobs (UNEP, 2008).

Is the world of work in the Caribbean ready for the challenge? A more integrated response linking together climate change adaptation and mitigation strategies and decent work agenda is needed and will benefit workers and employers, leading to more efficient adaptation results. This document presents some insights into the more relevant issues linked to this purpose.

2. Physical impact of climate change

The following bullet points summarize some of the physical consequences of climate change that are already being experienced in the Caribbean:

- The number of hurricanes of category 4 and 5 has increased around 56% between 1975 and 2004 (Webster and others 2005 mentioned in ECLAC 2011). The increased intensity of storm activity is causing direct damage of infrastructures. In

February 2014 the total cost of the damage and loss was EC$330 million[1], representing 15% of the gross domestic product of Saint Vincent and the Grenadines. Future hurricanes are likely to become more intense with larger wind peaks and heavier storm precipitation.

- Mean temperature in the region is expected to grow between 2.4 and 3.5ºC by 2090 (ECLAC, 2011) with greater increases in the future in countries like Guyana, where it could reach between 3.5-5.0ºC.
- Precipitation patterns are expected to change, with a total average rainfall reduction of between 14%-25% by 2090.
- Sea level is expected to rise between 1-2 meters by 2090, causing saline intrusion into freshwater aquifers as well as coastal flooding and erosion adversely affecting local resources, fisheries for example, and reducing the value of these countries as tourist destinations. In Suriname, one present-day problem is an increase in salinity of these freshwater aquifers, particularly in the northern part of the country, which is an indication of groundwater depletion. Increase in population and urbanisation will further exacerbate this condition (Suriname, 2nd Climate Change National Communication).
- Coastal impacts of floods, storms, loss of mangrove forest and coral reef (due to sea level rise) threaten vital infrastructure, settlements and facilities that are the base of employment and incomes of island communities, and may result in reduction of tourism.
- It has been estimated that the continued decline of coral reefs could cost the region between US$350m and US$870m per year by 2050 (CARSEA, cited in UNEP, 2008). Belize's live coral cover on shallow patch reefs decreased from 80% in 1971 to 20% in 1996, with a further decline from 20% in 1996 to 13% in 1999 (Belize 2nd National Climate Change Communication, 2011).
- Biodiversity loss, fresh water scarcity and droughts result in economic losses from reduced agricultural yields. Such impacts have been experienced by the agriculture sector of most Caribbean countries.
- Increased emergence of vector borne diseases is expected.

The economic and human cost of disasters in the Caribbean is enormous. For instance, Grenada's losses of 919 US$ million as a result of Hurricane Ivan in 2004 were equal to 2.5 times its GDP. In the same year, a flood devastated the agricultural sector in Guyana, destroying 60% of the country's GDP. This has led the CARICOM to develop several plans and strategies

Climate change will add yet another stress to those of environmental degradation and rapid unplanned urban growth, further reducing communities' abilities to cope with even the existing levels of weather hazards. Small Island States, including the ones at the Caribbean, are highly affected by cyclone wind damages. Investments in disaster risks reduction and adaptation to climate change are likely to reap the greatest benefits in Small Island States.

According to the 2013 Global Assessment Report, disasters directly affect business performance and undermine longer-term competitiveness and sustainability. Small and medium enterprises are particularly at risk. A single disaster may destroy a large part of their business capital, affecting the supply-chain. All sectors are at risk, from

[1] According to http://www.jamaicaobserver.com/columns/Climate-change-and-the-Caribbean_15975249

manufacturing and energy production to agriculture. However, most businesses (75% of business with less than 100 employees) do not have a disaster management plan.

Private investments are largely determined by disaster risks. In most countries, 70-85% of total investments are made by the private sector. Yet, anticipating risks in public and private investments remains a challenge for most governments.

According to the Stockholm Environment Institute (SEI), the annual cost of inaction on climate change in the Caribbean is projected to total $22 billion annually by 2050 and $46 billion by 2100, taken into account the following three impacts: increased hurricane damages, loss of tourism revenue and infrastructure damages. These costs represent respectively 10 % and 22 % of the current Caribbean economy (SEI, 2008).

The projected costs greatly differ among countries, reaching 75 % of GDP or more by 2100 in Dominica, Grenada, Haiti, St. Kitts & Nevis, and Turks & Caicos, and smaller, but still high levels for a number of others nations.

3. Climate change and employment: A sectoral approach

Climate change has consequences on the population in general, especially those most vulnerable. It affects economic sectors that directly or indirectly depend on natural resources affected by these impacts. That means that virtually all economic sectors in the Caribbean are affected in multiple ways: job losses due to natural disasters linked to climate change, reduction of productivity and decrease in tourist demand result of an increment of number and violence of hurricanes, etc. Destruction of public and private infrastructure may force businesses to shut and jobs to be lost.

However, positive impacts may also be experienced. Measures of adaptation to climate change may become significant sources of employment if the right approaches are taken and if workers, employers and governments are well informed and ready for the challenges. Adaptation measures have been carried out through employment infrastructure intensive programmes in many countries of the world resulting in various benefits to the world of work: workers have acquired new skills that have increased their employability and cooperatives and enterprises were created, leading to more and better jobs for many people.

Indirect positive impacts on jobs maintained due to these actions should as well be considered in sectors directly linked to coastal areas such as fisheries or tourism, both key to the Caribbean economies.

In addition, mitigation policies to reduce GHG emissions have proven to be strong engines of new jobs, related to renewable energy production, as well as the development of energy efficiency measures in buildings and industry.

Experiences from different countries suggest that social dialogue is crucial to ensure buy-in and engagement of workers, employers and communities at large. Workers and trade unions, business association as well as local authorities including vocational training institutions should be informed and consulted in the design and implementation phases of climate policies.

Although virtually all economic sectors will suffer some kind of impact due to climate change in the Caribbean, only the three most important in economic and employment terms (agriculture, tourism and fisheries) are analysed in this paper. A summary on climate change effects in the three sectors, its impact in the world of work and possible measures to address them are included in the annex (tables 1 to 3).

Other important sectors, such as transportation, construction and waste management, deserve in-depth investigation due to their role in GHG production and potential to create green jobs. In addition, the development of green industries linked to solar thermal energy, small scale wind energy production, recycling and biofuel production could be further explored for its development at regional level. A regional strategy for a low-carbon and climate resilient development could unlock the current potential to create green jobs in all these sectors.

3.1. Employment impact of climate change on agriculture

Agriculture is one of the most important sectors in many Caribbean countries. Agriculture employs more than 10%, getting closer to 20%, of total formal workers in the Caribbean. Significant share of the GDP depend on agriculture as well. In countries like Belize and Dominica agriculture accounts for more than 10% of the total GDP and it exceeds 20% in the case of Guyana. Countries with the largest share of agriculture employment include Guyana, Jamaica and Saint Lucia.

Agriculture is one of the sectors most impacted by climate change, because its dependence of natural resources for production. Due to these impacts a recovery period will be needed to regain productivity.

Climate change impacts on agriculture affect the world of work in different ways. Job losses that could be temporary or permanent due to interruption of agriculture production could be expected. Workers will be impacted as well through decrease of incomes and the need to acquire new skills to be able to undertake agriculture techniques necessary to keep production under new climatic conditions. Farmers and agriculture companies will be as well impacted, due to reduce in productivity, increasing costs linked to adaptation measures and increasing insurance costs. Occupational Safety and Health (OSH) may be affected due to extreme weather events and increasing temperatures. Negative impacts on crops' yields affect working demand. In addition, climate change may worsen already difficult working conditions of agriculture workers since they are frequently seasonal workers, part-time workers and workers with informal employments, with limited access to unionization and working conditions negotiations through collective bargaining.

An example of how climate change affects the world of work in agriculture can be found in Suriname, where farmers who produce in areas susceptible to flooding and salinization may no longer be able to produce their crops using existing farming systems and have to move to other, lower-risk areas or to adapt their livelihoods to the changed conditions (Suriname, 2nd Climate Change National Communication, 2013). In Saint Kitts and Nevis the climate would soon be too dry for rain-fed agriculture making it economically unfeasible, while productivity in Saint Vincent and the Grenadines is expected to decrease 20% (UNEP, 2008).

Social and economic consequences of such impacts might be very high, as agriculture remains a significant economic sector for the Caribbean countries providing employment and incomes to a large part of the labour force of the islands.

A number of actions could take place to address these impacts. Firstly, assessing labour vulnerability by climate change throughout all actors of the agriculture supply chain, based on their different adaptive capacity to such changes. Secondly, strengthening social protection programmes to ensure workers at risk, regardless temporary or permanently, will be appropriately protected. Social dialogue to identify both impacts and options to cope with them should also be explored. Finally, provision of new skills for workers, farmers and employers should be implemented. Producing a more sustainable agriculture will not only reduce the impact of climate change and improve the local environment, but it will also generate more jobs due to its higher labour content.

3.2. Employment impact of climate change on tourism

In 2004, more than 2.4 million people in the region were employed either directly or indirectly in travel and tourism, accounting for 15.5% of total employment, a proportion nearly twice as high as the global average. Tourism accounts for more than US$20 billion in visitor expenses (UNEP, 2008). The sector contributed US$28.4 billion to the GDP, 13% of the total (Caribbean Sea Ecosystem Assessment, 2007). Relative to its size, the population of the Caribbean is more dependent on income from tourism than any other part of the world (UNEP, 2008). The sector experienced set-backs due to the world economic crisis that broke in 2008 but it has been recovering ever since.

Impacts of climate change on tourism include direct damage to tourism infrastructures and tourism-linked natural resources (coral reefs and beaches), loss of attractiveness of the region as a destination and increased insurance costs for properties in vulnerable areas. Hurricanes in the Caribbean are expected to increase by 27% annually. As a result, tourism expenditures are expected to decrease by about 21.6% (Haites et al., 2002).

In addition, certain climate change response measures adapted by UNFCCC Parties may have negative impacts on the tourism industry in the Caribbean. This is the case of new taxation on air travel or carbon pricing. Since such measures may be translated into higher costs of flight tickets, different Caribbean countries have expressed their concern about the negative implications of such measures over the Caribbean economies, very much dependent on international tourism.

These climate change effects will impact as well the world of work. Altered tourism seasonality implies changes in employment demand, very likely increasing demand for casual-workers and reducing full-time contracts. Job loses may be expected. Increasing costs for cooling, insurance and disaster recovery will impact companies' profitability, forcing some of them (very likely family-run business, micro-enterprises and self-employed) out of business due to their lower capacity to assume these costs.

Measures to deal with these employment impacts include labour vulnerability impact assessment; the establishment of supporting programmes to businesses at risk, with special attention to those more vulnerable; bipartite and tripartite social dialogue to

explore alternatives to job losses and productivity decrease, based among others on economic diversification programmes (Box 1). Enterprise development and employment creation programmes linked to coastal-protection, water-infrastructure development and the strengthening of natural barriers to coastal erosion (coral-reef, mangroves) can be part of the response. Dialogue with fishing communities to collaborate in the protection of marine biodiversity could as well be explored, since this is very important for tourists. Finally, greening workplaces could help to reduce other stressors (water pollution, waste and other polluting emissions) that exacerbate climate impacts.

The Caribbean Carbon Neutral Tourism Programme

The general objective of this programme was to assist the Caribbean region to respond to climate change by enhancing its climate resilience, scaling-up low carbon investments in the tourism sector and reducing the sector's vulnerability to climate change.

The Program comprised four components:
(1) An assessment of the carbon footprint of the tourism sector and evaluation of appropriate approaches and technologies to reduce it;
(2) Identification of financial mechanisms to establish carbon neutrality for the tourism sector in the Caribbean; and
(3) Preparation of the program to access available climate financing for integrating climate resilience within the tourism sector.

Other regional project in the Caribbean that should be highlighted by its importance is the Hotel Energy Efficiency Action Program (CHENACT) that addresses energy efficiency and renewable energy generation in the accommodation sub-sector.

Capacity building as one of the most important GHG mitigation measures for the Caribbean. Stakeholders with the knowledge of carbon accounting and the principles of low carbon tourism and economies are better able to identify approaches to reduce GHGs within the own operations. In addition, energy efficiency and renewable energy production together with use of efficient vehicles, use of biofuels and optimized land use planning, transportation, standards and code of practice are areas with the highest potential in the Caribbean to reduce carbon footprint of the tourism sector.

Source: Caribbean Community Climate Change Center (CCCCC)[2]

3.3. Employment impact of climate change on fisheries

Fishing is important in the Caribbean because it is a major source of employment and because fish is the main source of protein for many low-income households. Fisheries' communities live in low-lying areas thus their houses and assets are exposed to hurricanes, storms and sea-level rise.

It is estimated that more than 200,000 people in the region are directly employed, either full-time or part-time, in fisheries. In addition, some 100,000 people work in fish processing and marketing activities (Caribbean Sea Ecosystem Assessment, 2007). Recreational fishing and dive tourism are also major revenue sources.

Antigua and Barbuda identified the following factors that make adaptation to climate effects more difficult for fisher's communities: access to capital on reasonable terms, weak fisher folk organizations and consequently low bargaining power; lack of

[2] http://www.caribbeanclimate.bz/closed-projects/2009-2012-carbon-neutral-tourism-ccntp.html

insurance and other institutional support to enable the sector to rebound in the aftermath of extreme events.

"Predicted fisheries effects of climate change fall into two classes: those associated with the biological health and viability of fish stocks, and those that affect the safety or the social, cultural, and financial sustainability of fishermen and fishing communities" (Johnson T., 2012). Fishers, fish farmers and fishing communities, particularly those in coastal areas, are vulnerable to climate change effects (FAO, 2012). While climate change is not likely to have a major impact on global fisheries production it is recognized that a number of small-island States are likely to be affected.

In addition, exploitation of coral reef, mangroves and sea-grass beds, costal development and over-fishing exacerbate climate change effects creating overall major impacts on fisheries' resources.

In relation to fisheries, impacts of climate change are linked to warming waters that are a primary cause of coral bleaching, along with deterioration of mangroves and sea-grass beds, since fishes depend on them to survive. These ecosystems are important nursery areas and the habitat of most of the fishes exploited in the region. Adaptation measures are linked to their rehabilitation.

The severity of tropical storms is increasing and reaching high intensity more quickly[3], resulting in fishers having less time to secure their boats and gear. More severe storms could also accelerate coastal erosion and loss and put critical infrastructure at risk.

Impacts on fisheries of these effects include: reduced yields, increased yield variability, reduced profitability, increased risks, and increased vulnerability for those living near rivers and coasts. These impacts can be expected to be cumulative rather than separate components as well as being influenced by other non-climate related developments and trends.

Similarly to agriculture and tourism, there are important employment implications that result of climate change effects in the sector. Changes in fisheries productivity will be translated into different labour demand throughout the supply chain. Inability to cope with increasing costs due to the need to implement adaptation measures may force some companies to close and fishers to migrate and seek employment in other sectors and regions. Special attention should be paid to those most vulnerable along the fisheries supply chain. Fishers and fishing communities will be impacted twice by climate change, not only because of productivity loss but because of floods and hurricanes may damage their assets and habitats. In addition, suitable insurances may not be available to them. Hurricanes, storms and other extreme events will increase occupational risks. Part-time and occasional workers are exposed to even greater occupational risks than full-time workers in the sector.

Measures that could be implemented to cope with these impacts include the provision of appropriate OSH materials to meet increasing risks. In addition, economic diversification programmes should be established in those cases where high productivity loss is expected. Programmes to provide skills to fishing workers and

[3] There have been 8 Category 5 hurricanes reported in 2001–2010, compared with a total of 23 between 1928 and 2000 (Nurse, L.A., 2011)

fishers to be able to access these new employment opportunities could be part of an adaptation to climate change employment policy. Additionally, enterprise development programme to facilitate economic diversification and collaboration with the tourism community on measures to address coastal erosion and protect marine biodiversity could be a type of win-win approach towards economic diversification. There could be a role for cooperatives to facilitate access and reduce costs of adaptation measures. Finally, social protection programmes to address identified specific labour vulnerabilities could be part of the response.

4. Adaptation to climate change and employment

Adaptation actions are defined by the Intergovernmental Panel on Climate Change (IPCC) as the adjustment in natural or human systems in response to actual or expected climate effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory, autonomous and; planned adaptation.

Contributing less than 0.1% of global greenhouse gas emissions, the primary focus for the Caribbean's response to climate change has historically been adaptation. A series of separate, but strategically related, initiatives have served to rapidly advance the climate change adaptation agenda in the Caribbean (ECLAC, 2010). In this regard, most Caribbean countries are already well advanced in terms of both the analysis of coastal impacts, awareness raising among relevant actors and in the preparation of an institutional and planning framework. For instance, in the last two and a half decades, Barbados has undertaken three major coastal zone management projects that have included coastal vulnerability analyses and have culminated in a Coastal Zone Management Plan for the entire coastline (ECLAC, 2010).

The Caribbean community has worked over the last years on the issue of adaptation to climate change.[4] CARICOM-coordinated initiatives started in 1994, when Barbados hosted the Global Conference on the Sustainable Development of SIDS that resulted in the Barbados Programme of Action (BPoA). Since 2009 the number of projects undertaken by the region on the issue of climate change significantly increased. Although adaptation is still an important area of work for the region that keeps being further researched countries have expanded their agenda towards low-carbon development pathways.

Basically, all adaptation strategies imply effects on employment, both in a negative way (job losses and redundancy) and in a positive manner (new job opportunities and enterprise development). These impacts should be assessed well in advance as part of the so-called Just Transition Frameworks[5] that aim at minimizing negative impacts and maximizing the positive effects. Summary tables on adaptation strategies, its impact in the world of work and possible measures to address these impacts for agriculture, tourism and fisheries are included in the annex (tables 4 to 6).

[4] More information about CARICOM activities on climate change at: http://www.caribbeanclimate.bz/

[5] See more on Just Transition Frameworks in the 2013 Conclusions of the International Labour Conference (ILC) Committee on Sustainable Development, Decent Work and Green Jobs at: http://www.ilo.org/ilc/ILCSessions/102/media-centre/news/WCMS_216400/lang--en/index.htm

The ILO has identified[6] a number of areas of the Decent Work Agenda as very relevant to adaptation to climate change.

- **Social Dialogue**: Social actors have first-hand information about how climate is increasing labour vulnerability, creating job losses or affecting business. Their active part in designing an adaptation programmes benefits all.
- **Employment-intensive disaster risk reduction**: Climate-related disasters are predictable, affecting the same areas and groups again and again. Preparedness and pre-disaster planning is, therefore, essential. This includes adequate information about the patterns of employment and income generation.
- **Displacement and migration**: There is increasing evidence of climate change becoming an additional driver of migration, both internal and across borders.
- **Social security and social protection**: Both can play an obvious and powerful role in reducing vulnerability, enhancing adaptive capacity and absorbing the residual impact of climate change not buffered by adaptation measures (Box 2). Social security and protection systems are not, however, automatically responsive to climate change and may have to adjust the functioning and funding mechanisms. The application of the relevant ILO Conventions and the efforts to extend coverage through a global social protection floor will make a significant contribution to adaptation.
- **Micro-finance and micro-insurance**: In the absence of, or perhaps as a complement to, social security, access to financial services, including savings, insurance, emergency loans and money transfer services is especially important for vulnerable populations.
- **Infrastructure investments**: Labour-intensive and local resource-based infrastructure investments, including on projects to prevent natural disasters and environmental protection can be a powerful engine of job creation and income, in particular to disadvantaged local groups.
- **Local markets and enterprise development**: Economic diversification away from activity exposed to climate risks is essential for adaptation. The ILO has extensive experience in local economic development and enterprise promotion, which can embed adaptation into broader socio-economic development strategies.
- **New sectors, occupations and green jobs**: Adaptation can bring new opportunities. Among the options for economic diversification are green jobs and green enterprises promoting adaptation technologies and services, which should be promoted when developing active labour market policies for areas affected by climate change.
- **Skills development** has great potential to reduce vulnerability and effective adaptation will require a host of new skills for workers. In addition, entrepreneurs need also to be better informed about climate change impacts and be prepared to undertake changes in their production processes to adapt to those changes if needed. Mainstreaming climate change within entrepreneurs, in particularly focusing on youth, is therefore important to increase climate resilience.
- **Standards and conditions of work**: The structural changes brought on by climate change will also impact on labour standards and working conditions. Especially in sectors that are vulnerable to climate change such as agriculture, fisheries and tourism, the risk of deteriorating rights is significant as these sectors are often already facing significant challenges in achieving the implementation of decent standards and conditions of work. The ILO and its constituents can devise strategies

[6] See Harsdorff H. et al. (2011) *Towards an ILO approach to climate change Adaptation*. Employment Sector. Employment Working Paper Nº 104. ILO, Geneva (Switzerland)

to achieve adherence to international labour standards as a tool for reducing vulnerability.

Box 2. Social Protection and climate change

Social protection plays a very important role in adaptation to climate change for at least four reasons:

- It can reduce vulnerability to employment climate impacts. For instance in Jamaica the winds of hurricane Ivan inflicted heavy damage to virtually the entire area devoted to banana plantations. Plantations could be resuscitated and full production was achieved within 6 to 9 months after the hurricane. However, during this period of time, the sector experienced significant productivity impacts that were translated into job loses and income decrease. Other than the limited labour required for the rehabilitation of the plants and farms, nearly 8,000 persons were out of work. As the new banana plants reached maturity and began production, workers were able to return in a staged fashion (Jamaica, 2nd Climate Change National Communication, 2011). Similarly coffee plants were destroyed. Insurance however did not cover the entire production loss and a number of farmers were forced to leave the sector due to the economic losses they faced that year.
- It can enhance the adaptive capacity of the vulnerable, for example by supporting their personal assets, nutrition, health and education. The Government of Dominica has provided assistance to marginalized persons and families for construction of low income but safe houses that are able to withstand the seasonal hurricanes. The houses are equipped with modern facilities that allow for adaptation to climate change (Dominica 2nd National Communication, 2012).
- These measures will be critical for addressing the residual impacts of other climate change adaptation measures and avoid affected workers to fall into poverty. For example, if adaptation measures involve supporting farmers to switch to less temperature-sensitive crops, social protection measures can form a safety net for those farmers.
- Social protection programmes act as automatic stabilizers of the economy leading to faster recovery.

Source: Towards an ILO approach to climate change adaptation, ILO Policy Brief, 2011

All the above elements of the Decent Work Agenda should be considered in the definition of adaptation needs phase as well as the implementing measures. However, very often, labour is kept aside from adaptation policies, or is only partially considered, mainly in the form of impacts on livelihoods and income-generating activities by affected local communities.

The Caribbean Community Climate Change Centre (CCCCC) has developed a "Vulnerability and Assessment Climate Methodology" that aims at "providing useable decision support information and tools to assist civic and business leaders in making critical decisions to mitigate climate hazards in regions and sectors of high consequence". These assessments are developed by the institutional bodies that are in charge of developing the climate change response policy. Although social impacts are generally assessed, labour issues are barely taken into account.

Additionally, preserving islands' biodiversity by investments in knowledge development and research to develop new products and opportunities derived from natural resources is another channel to create jobs and new enterprises while protecting rich islands' ecosystems that will help to increase climate resilience.

Natural resources act as a barrier or buffer to climate impacts (coral reefs and mangroves avoiding impacts of sea level rise and hurricanes, forestry avoiding erosion, landslides and water scarcity). If these natural ecosystems are strengthened, the services they provide will as well be maximized and climate impacts diminished. These actions are very labour intensive. Therefore, in addition to the environmental and economic

benefits, employment generation should add to the social positive impacts. Other social co-benefits include poverty alleviation through direct and indirect job creation and higher incomes (Box 3).

Box 2. Job creation impact of marine and coastal restoration

According to the US National Oceanic and Atmospheric Administration (NOAA) US$1 million invested in coastal restoration creates 17.1 jobs on average, 33 jobs if done through labour-intensive methodologies, that is between 3.7-2 times higher than job creation of industrial coastal activities, such as oil and gas development where $1 million of investment creates an average of just 8.9 jobs (Centre for American Progress, 2014).

Those jobs will mostly benefit low-income population in coastal communities. These programmes could serve as additional income activities to those fishers who know well the coastal ecosystem and could work during low fishing seasons.

Skills required will be different according to the restoration techniques employed. Training programmes for unemployed or underemployed workers along with enterprise development programmes focussed on local SMEs may be created to ensure labour force is ready to undertake the activities.

Job creation will range from environmental and marine engineers, water specialized workers, fishermen, biologists and other workers with deep knowledge about marine ecosystems, construction-related workers, forestry workers, landscapers, administrative position, to un-skilled workers.

Overall, almost 80 % of the occupations identified as being required by these projects have annual median wages above the national median wage.

Source: The economic case for restoring coastal ecosystems. CAP, 2014

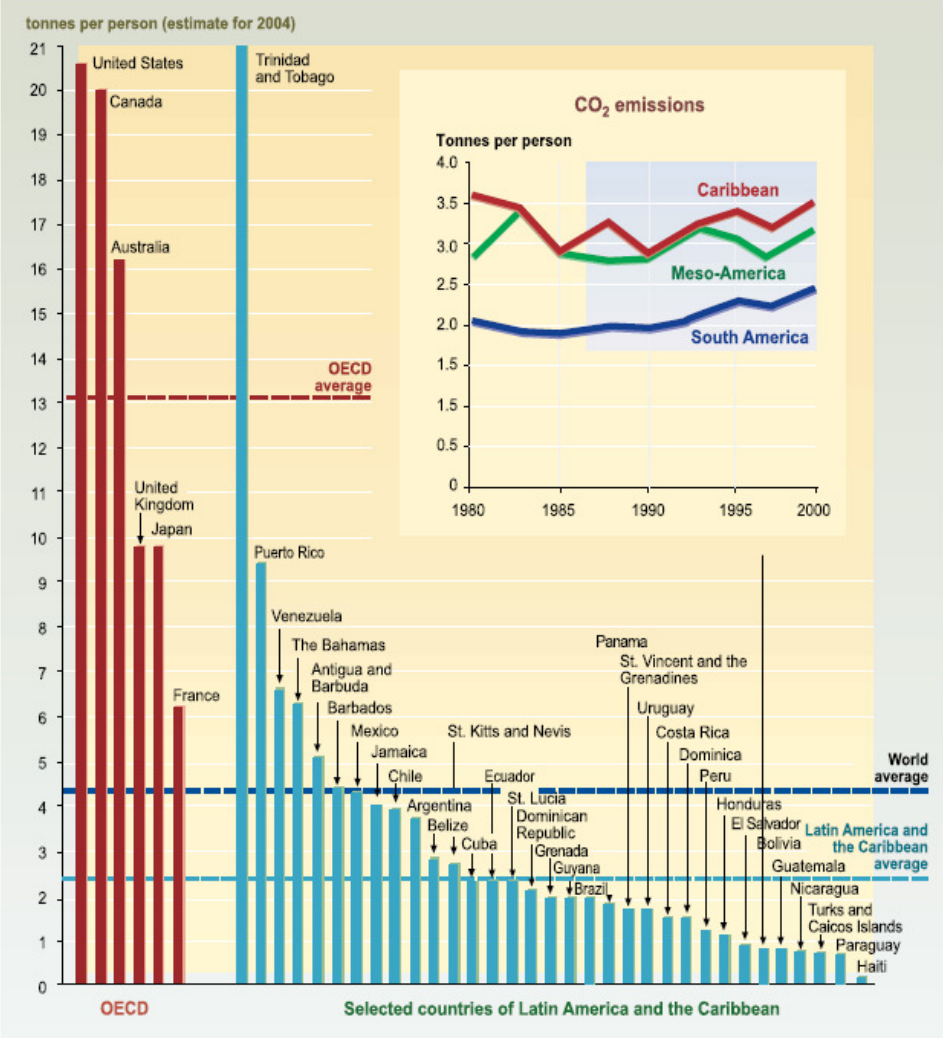
5. Climate change mitigation: Job creation in low-carbon sectors

The Caribbean contributes with less than 1% of total GHG emissions responsible of climate change. However, emissions between countries significantly differ (Figure 1). Trinidad and Tobago and Jamaica are the ones with higher emissions while Dominica and Saint Vincent and the Grenadines are the countries with the lowest emission levels, more than 10-17 times less than the most emitting countries (CEPALSTAT, 2011).

The fear of negative impacts on the economy and jobs has been a major factor hampering strong and ambitious responses to climate change. Today, there is ample evidence to the contrary - that climate change action can preserve existing jobs while creating significant opportunities for new employment, leading to net jobs gains.

Green jobs are defined as decent jobs that reduce consumption of energy and raw materials, limit greenhouse gas emissions thus climate change, minimize waste and pollution and protect and restore ecosystems (UNEP, 2008). Green jobs therefore become the backbone of a low-carbon and climate resilient economy. Low-carbon sectors are those where emission of GHGs are deeply minimized or fully eliminated becoming an environmentally responsible alternative pathway to economic growth, social development and decent work creation (Box 4).

Figure 1: Greenhouse Gas (GHG) emissions per person (2004) of selected countries of Latin America and the Caribbean



Source: World Bank Indicators 2008 and US Energy Information Administration (EIA)

Box 4. Green Jobs initiatives in Trinidad and Tobago

The government of Trinidad and Tobago has identified the green enterprises sector as one of the important platforms for economic diversification, poverty alleviation and job creation. With respect to the creation of green jobs, attention will be paid to the importance of adequate policies, such as retraining of skills or employment services to facilitate the reallocation of labour, as green jobs span a wide array of skills, educational backgrounds and occupational profiles.

Initiatives that the Government intends to undertake to shift towards a greener economy in Trinidad and Tobago include the establishment of a Solar Manufacturing Complex, the creation of a National Wind Resource Assessment Programme, the utilization of green building technologies in the transformation of the Invader's Bay waterfront and investment in the provision of retail dispensing of compressed and liquefied natural gas for reducing the use of gasoline fuel.

Source: ILO, 2012[7]

[7] Announcement was made by Minister of Labour and Small and Micro Enterprise Development of Trinidad and Tobago, Errol McLeod, on the occasion of the workshop on "Developing Policies and Programmes to promote green jobs and green enterprises in Trinidad and Tobago" hosted by the same Minister with the technical support of the ILO on 7 May 2012.

Low-carbon sectors include production or energy based on renewable sources (wind, solar, geo-thermal, hydro, biomass and biogas); sustainable agriculture; sustainable forestry management; fisheries; building, transport and tourism; as well as four cross-cutting issues: waste, water, energy and land.

In order to maximize employment impacts of low-carbon development policies, governments, workers and employers should increase their understanding of the challenges and opportunities associated with developing responses at the workplace. Employment policies and enterprise development could focus on low-carbon sectors in particular on the energy saving and clean energy field (Box 5).

Box 5. Job creation on renewable energies in Jamaica

The Jamaican government has set a nationwide goal of 20% renewable energy use by 2030. Jamaica's petroleum power plants are highly inefficient. The average efficiency for oil- and diesel-fired steam generation is below 30%. Upgrades at existing plants are needed to reduce energy waste in the near to medium term and new investments to replace old plants are as well required.

If part of these investments were directed towards a rapidly scaling up rooftop solar photovoltaic (PV) systems, that would result in more electricity consumption at the point of production, reducing strain on the inefficient grid and offsetting some of the cost of investment to address inefficiencies. Although an accelerated expansion of renewables requires higher upfront investments, it reduces the total cost of electricity generation and can save the country up to USD 12.5 billion by 2030, freeing up public money to be spent on pressing social and economic concerns.

Renewable energy generation in Jamaica is currently 42% cheaper than the least-expensive operating fossil fuel power plant[8]. Large-scale solar PV is about half the price of electricity generated by coal.

The transition can also create up to 4,000 new additional jobs. Currently, Jamaica's electricity and water sectors contribute 3.1% to GDP but employ only 0.74% of the workforce, 8,100 people. Additionally, greenhouse gas emissions in the electricity sector will be reduced to 0.7 million tons of CO2-equivalent annually. With a 13.7% unemployment rate in the country, these are valuable job additions that come at no additional cost.

Jamaica would need to invest in capacity building and industrial production, including expanding its domestic manufacturing base to allow for production of renewable energy equipment and training a skilled labour force to install, operate, and maintain the new facilities

Source: Worldwatch Institute, 2013[9]

Social dialogue and active participation of social actors have proven to be the most appropriate mechanism to identify specific needs. Taking into account skills needs to address mitigation and adaptation policies are very similar among Caribbean countries, providing a coordinated response might be a good way forward. Skills programmes could be jointly developed by national Training Labour Institutions, following some national examples (Box 6). Such regional response will maximize use of resources as well as allow labour mobility among islands.

[8] Coal power is about 2.5 times the cost of wind power and five times that of hydropower. Small-scale solar PV is about 25 U.S. cents per kWh cheaper than oil combustion and 5 U.S. cents per kWh cheaper than oil combined-cycle generation.

[9] -Report available at: http://www.worldwatch.org/worldwatch-institute-launches-groundbreaking-sustainable-energy-roadmap-jamaica

Box 6. Barbados: Skills for solar energy

Barbados targets for renewable energy production are 30% of electricity production by 2012 and 30% of energy use by 2026 (Irena, 2013), with a particular focus on raising the number of household solar water heaters by 50 % by 2025. Solar water heaters are now a widely used renewable energy technology in Barbados, with installations in nearly half of the island's dwelling units (UNEP, undated).

At present, three Barbadian companies dominate the installation and manufacturing of solar water heaters on the island, and they are already expanding the Caribbean market potential in the nearby islands of Trinidad and Saint Lucia.

This result would have not been possible without the efforts devoted to training and provision of skills on solar energy undertaken by the government of Barbados. The Barbados Training Board has made available vocational opportunities for local skill enhancement in the sector, such as instructional training for prospective Solar Water Heater Technicians.

Source: IRENA (2013), UNEP (undated), IADB (undated) and Barbados Vocational Training Board (undated)

6. Concluding remarks

Undoubtedly climate change is one of the main priorities for the Caribbean region.

Caribbean countries are among the most vulnerable in the world to climate change effects, due to the geographical situation and the dependence of the natural resources for growth and development. All socio-economic structures in the Caribbean countries are sensitive to climate change impacts. Sea level rise, increasing temperatures, water salinization, hurricanes and storms are already impacting important sectors in terms of employment and economy that largely depend on natural resources, tourism, agriculture and fisheries among them.

Countries gathered at the Third Small Island Developing States (SIDS) Conference in September 2014 recognized "the adverse impacts of climate change compound existing challenges in small island developing States and have placed additional burdens on their national budgets and their efforts to achieve the sustainable development goals. Efforts to achieve a sustained and sustainable, inclusive and equitable economic growth with decent work for all of SIDS have also been hindered by climate change, the impact of natural disasters, the high cost of imported energy and the degradation of coastal and marine ecosystems and sea-level rise".

Climate change impacts are expected to increase over the next decades. Many of the islands have already experienced economic and human losses due to hurricanes, tropical storms, floods, droughts and other disasters, with direct implications to the world of work. Caribbean countries have devoted much attention to adaptation to climate change. CARICOM, through the Caribbean Community Climate Change Center, has developed multiple regional projects with the objective of better understand the extent of climate impacts in Caribbean societies and economies, identify actions needed to cope with these effects, especially at the coastal level, and provide capacity to Caribbean institutions and civil society to appropriately deal with this impacts.

New jobs and new companies will be created in the process of reducing greenhouse gas emissions and adapting to climate change effects. New jobs have been already reported

in Barbados and Trinidad and Tobago has developed its own green jobs policy to make the most of such opportunities. The priority number one in the Decent Work Country Programme of Guyana is about the creation of green jobs in the framework of its Low-Carbon Development Strategy. Jobs in sustainable forestry management, restoring mangrove's ecosystems and others are some of the initiatives already undertaken.

Social protection is also affected by climate change. Stronger social protection systems, well adapted to the specific labour vulnerabilities of each region of each island, will be needed. Providing unemployment benefits and other social protection measures are also key to ensure that the transition to a low carbon and climate resilient economy is feasible and affordable to all and does not leave anyone behind.

Skills shortages in low-carbon sectors have been identified by nearly all Caribbean countries as one of the main bottlenecks they are facing to address climate change. Labour departments in dialogue with workers and employers have the opportunity to work together to define vocational and training programmes to allow all to be part of the transition to a more sustainable country, both in environmental and in labour terms.

The international community is working in this direction. Countries committed to reach a global climate change agreement (UNFCCC Paris Agreement) by 2015. Sustainable development goals are being negotiated now with climate change and decent work creation for all among the objectives.

Despite the multiple initiatives being developed by CARICOM and other regional organizations on climate change, the labour dimension of this problem has not been fully assessed yet. A regional strategy in this direction would help the region to be better prepared for defining the best options for implementation of both the future Sustainable Development Goals (SDGs) and climate change international commitments.

This regional strategy should give response to the already identified barriers to achieve sustainable development and adapt to climate change effects, including:

- Assessing labour vulnerabilities due to climate change.
- Identifying job opportunities resulting from adaptation strategies and mitigation policies.
- Further investing in the development of entrepreneurial and vocational skills.
- Raising awareness and building capacity among workers, employers and labour departments.
- Engaging employers and labour departments in definition and implementation of climate change policies.

Through social dialogue, workers, employers and labour departments have a very important role to play to ensure climate action is a success and benefits all. By mutually exchanging information and experiences among countries, engaging in South-South cooperation, much can be done to promote the maintenance of existing jobs and create new jobs by implementing both adaptation and mitigation measures.

Bibliography

- Agard, J.B., and Cropper, A. (coord.) *Caribbean Sea Ecosystem Assessments, CARSEA* (2007). University of West Indias (Trinidad and Tobago).
- Barbados Vocational Training Board. Solar Water Heater Technicians: http://www.bvtb.gov.bb/apprenticeship_programme/solar_water_heater_technician/
- Bueno R.. Herzfeld C., Stantont E. A., Ackerman F. (2008) *Cost of Inaction to Climate Change.* Tufts University Published by the Stockholm Environment Institute.
- Caribbean Carbon Neutral Tourism Programme (2012) *GHG Mitigation Option Assessment for the tourism sector.* CCCCC. Belpoman (Belize).
- Conathan, M., Buchanan J., and Polefka S. (2014) *The Economic Case for Restoring Coastal Ecosystems.* Center for American Progress. Washington DC (USA)
- Downes A. (2006) *Caribbean Labour Market Challenges and Policies*. ECLAC. Santiago de Chile (Chile).
- Economic Commission for Latin America and the Caribbean (ECLAC) (2011) *The economics of climate Change in the Caribbean*, ECLAC. Santiago de Chile (Chile).
- Environment Coordination Unit. Ministry of environment, natural resources, physical planning and fisheries (2012) *Dominica 2nd National Communication on Climate Change* (2012). Roseau, Commonwealth of Dominica.
- Government of Antigua and Barbuda (2009) *2nd Climate Change National Communication.* Government of Antigua and Barbuda. St. John's (Antigua and Barbuda).
- Government of Belize (2012) *Belize 2nd Climate Change National Communication*. Government of Belize. Belmopan (Jamaica).
- Government of Guyana (2012) *Guyana 2nd Climate Change National Communication.* Government of Guyana. Georgetown (Guyana).
- Government of Jamaica (2011) *Jamaica 2nd Climate Change National Communication*. Government of Jamaica. Kingston (Jamaica).
- Government of Saint Lucia (2011) *Saint Lucia 2nd Climate Change National Communication*. Government of Saint Lucia. Castries (Saint Lucia).
- Johnson T. (2012) *Fisheries Adaptations to Climate Change.* Alaska Sea Grant Marine Advisory Program. University of Alaska Fairbanks. Anchorage (Alaska)
- Haites E. *(2002) Assessment of the Economic Impact of Climate Change on CARICOM Countries*. Margaree Consultant. Toronto(Canada)
- Harsdorff H. et al. (2011) *Towards an ILO approach to climate change Adaptation*. Employment Sector. Employment Working Paper Nº 104. ILO, Geneva (Switzerland).
- International Labour Office (2012) *Working Towards Sustainable Development. Opportunities for Decent Work and Social Inclusion in a Green Economy*. ILO. Geneva (Switzerland).
- ILO Regional Office for Latin America and the Caribbean (2013) *Labour overview Latin American and the Caribbean.* ILO Regional Office for Latin America and the Caribbean, Lima (Peru).
- ILO Department on Occupation Safety and Health (SAFEWORK) (2012) *Promoting Safety and Health in the Green Economy*. ILO, Geneva (Switzerland).
- ILO Tourism Department (2012) *Policy Paper on Decent Work through sustainable Tourism.* Prepared for the T20 meeting in Korea. Geneva (Switzerland).

- IPCC Working Group II (2014) *5th Assessment Report*. Chapter 27 Central and South America. IPCC publication. Geneva (Switzerland).
- International Strategy for Disaster Reduction (ISDR) (2008) *Climate Change and Disaster Risk Reduction.* ISDR Publication. Geneva (Switzerland).
- Ministry of Labour, Technological Development and Environment (2013) *Suriname 2nd Climate Change National Communication*, Paramibo (Suriname).
- Nurse L. A. (2009) *The implications of global climate change for fisheries management in the Caribbean.* Climate and Development. Volume 3, Issue 3, 2011
- Strietska-Ilina O. et all (2011) *Skills for green jobs.* International Labour Organization. Geneva (Switzerland).
- Shakuntala Makhijani, Alexander Ochs, et al., *Jamaica Sustainable Energy Roadmap: Pathways to an Afordable, Reliable, Low-Emission Electricity System* (Washington, DC: Worldwatch Institute, 2013).
- Shelton C. (2014), *Climate Change Adaptation in Fisheries and Aquaculture*. Compilation of Initial examples. University of East Anglia, UK. FAO Fisheries and Aquaculture Circular No. 1088.
- Sookram S. (2009) *The impact of climate change on the tourism sector in selected Caribbean countries.* Caribbean Development Report Number II, ECLAC Publications, Santiago de Chile (Chile).
- Success stories. Solar energy in Barbados: http://www.unep.org/greeneconomy/SuccessStories/SolarEnergyinBarbados/tabid/29891/Default.aspx
- Technical Centre for Agricultural and Rural Cooperation (2012) *Promoting smart agriculture in ACP Countries.* ACP-EU. Wageningen (The Netherlands).
- Tubiello F., Schmidhuber J., Howden M., Neofotis P. G., Park S., Fernandes E., Thapa D. (2008) "*Climate Change Response Strategies for Agriculture: Challenges and Opportunities for the 21st Century,* World Bank. Agriculture and Rural Development Discussion Paper 42
- UNEP Regional Office for Latin American and the Caribbean (2008) *Climate Change in the Caribbean and the challenges of adaptation,* Panama City (Panama)
- UNEP, ILO, ITUC, IOE (2008) *Green Jobs: Towards Decent work in a Sustainable, Low-Carbon World*. UNEP Publication. Nairobi (Kenya).
- UN World Tourism Organization, UNEP (2008) Climate Change and Tourism. Responding to global challenges. UN WTO. Madrid (Spain).
- Uyarra, M.C. et al, Coté M. I. a1, Gill J. A., Tinch R. T. R. , Viner D. and Watkinson A. (2005) *Island-specific preferences of tourists for environmental features: implications of climate change for tourism-dependent states* Environmental Conservation, March 2005, pp 11-19.

Annex: Summary tables

Table 1. Agriculture: Climate change effects, impacts on the world of work and measures to address them.

Climate change effects on agriculture	Impacts on the world of work	Addressing employment impacts
- Increased weeds, pests, and disease pressure - Increased vulnerability of organic carbon pools - Flooding and salinization may impede agricultural production - Adverse impacts from climate change can be expected to exacerbate soil loss, damage farm infrastructure and cause ecological disturbances - New crops, new cultivars, adapting agriculture techniques to new conditions	- Temporary and permanent job losses - Over-burden of social protection programmes - Decrease in income of workers and farmers and business' profits due to decrease in agriculture production, farm infrastructure damages and erosion of soil and water - Need of new investment linked to water availability and management - Low attractiveness for young workers due to its difficult working conditions, low salaries, and low prospects for personal development - Need to move production to other places with better conditions for production - Lack of insurance for farmers increase risks - Increase prices of agriculture products due to reduction of agricultural areas and producers - Lack of information about expected changes may prevent adaptation measures to take place - New skills are required for agriculture workers, farmers and business active in the sector - Other companies in the food production supply chain may be impacted thus generating additional job losses and production reduction	- Labour vulnerability assessments focusing on the agriculture supply chain including specific analyses of the capacity to adapt of the different actors - Strengthen social protection programmes to meet expected needs - Tripartite social dialogue to identify opportunities and challenges - Information programmes focusing on farmers and business on expected climate impacts on agriculture and how to cope with them - Supporting mechanisms for implementing adapting measures - Skills provision for agriculture workers on new techniques

Source: Author's compilation

Table 2. Tourism: Effects of climate change, impacts on the world of work and measures to address them

Climate change effects on Tourism	Impacts on the world of work	Addressing employment impacts
- Altered seasonality, heat stress for tourists, cooling costs due to warmer temperatures - Risk for tourism facilities, increased insurance costs/loss of insurability, business interruption costs due to increased frequency and intensity of extreme storms - Water shortages, competition over water between tourism and other sectors, desertification, increased wildfires threatening infrastructure and affecting demand due to reduced precipitation - Flooding damage to historic architectural and cultural assets, damage to tourism infrastructure, altered seasonality (beaches, biodiversity, river flows) due to increased frequency of heavy precipitation in some regions - Coastal erosion, loss of beach areas, costs to protect and maintain waterfronts and sea defences due to sea level rise - Increased coral bleaching and marine resource and aesthetic degradation in dive and snorkel destinations due to sea surface temperatures rise - Loss of natural attractions and species from destinations, higher risk of diseases in tropical-subtropical countries due to changes in terrestrial and marine biodiversity - Loss of natural attractions, flooding risk, damage to tourism infrastructure due to more frequent and larger forest fires	- Change in employment demand - Increase demand for temporary workers - Lower profitability due to increasing costs (cooling systems, insurance) - Companies out of business due to lack of insurance options; - Companies out of business due to decrease in tourism demand; - Job losses; - Conflicts between tourism and other sectors (agriculture) for water; - Demand decrease may force business to close;	- Labour vulnerability impact assessments - Supporting programmes to companies that maybe at risk of closure due to increasing costs; Access to low-interest credits and subsidies may be part of these programmes - Establishing a dialogue with the insurance community, business and government to find alternatives to lack of insurances options - Tripartite and bipartite social dialogue to find alternatives to job losses, based on economic diversification options and others - Employment creation programmes with the objective of creating water-related infrastructure, reducing desertification and coastal erosion and strengthen natural barriers to sea level rise - Diversification of natural attractions; Enterprise development programmes linked to this aim - Dialogue with fishers' communities to collaborate in protecting marine biodiversity - Promoting "Greening workplaces" type of programmes among hotels and tourism facilities to reduce other stressors that exacerbate climate change impacts (water pollution, waste management, sound use of chemical products, energy efficiency, etc).

Source: Source: WTO-UNEP-WMO (2008) Climate Change and Tourism: Responding to Global Challenges (Adapted to collect Caribbean effects) for the column on "climate change effects on tourism" and author's compilation for the other two columns.

Table 3: Fisheries: Effects of climate change, impacts on the world of work and measures to address them

Climate change effects on fisheries	Impacts on the world of work	Addressing employment impacts
- Changes in primary productivity - Changes in species composition within regions - Warm water increases stratification, decreasing productivity - Redistribution of stocks and species - Introduction or survival of invasive species - Emergence of harmful algal blooms and bacterial/viral diseases - Increased areas of oxygen-minimum zones where fish and shellfish cannot live - Elevated sea level, which may kill coral reefs and other living communities that constitute habitat for fish and shellfish, particularly in estuaries - Increased stream temperatures, lower water levels, episodic flooding, saltwater intrusion freshwater, all of which can reduce the productivity - Potential exacerbation of pollution effects	- Changes in fisheries productivity impacting throughout the supply chain - Increasing costs for all actors along the fishing supply chain due to the need to implement adaptation measures - Productivity loss - Damage to communities on shores - Flood communities and loss of valuable habitats - Fishing operations unprofitable or impossible due to increasing costs and reduction of supply - Decrease in food and water security - Increasing occupational safety and health risks	- Research about changes in species and how this may impact actors in the fisheries' supply chain - Facilitating mechanisms to undertake adaptation measures (subsidies, tax deduction, research, development and innovation, etc.) - Economic diversification programmes for those expected to be affected by productivity losses; Linked to this, dialogue with the tourism community to collaborate in coastal management activities, measures to address coastal erosion and protect marine biodiversity - Enterprise development programmes - Skills provision for those affected to be able to work in other sub-sectors - Programmes to protect communities from floods and other damages (insurance, building retrofitting programmes and others) - Social protection measures to those most affected and with less capacity to adapt, including fishery workers and SMEs and other fishery-linked companies - Development of specific insurance mechanisms

Source: Johnson T., 2012 (adapted) for first column and author's compilation for the next two columns.

Table 4. Agriculture: Climate change adaptation strategies, impacts on the world of work and measures to address them

	Climate change adaptation strategies in agriculture	**Impacts on the world of work**	**Addressing employment impacts**
Technical aspects	- Crop selection - Altering cropping systems and timing or location of cropping activities - Using different varieties and species - Providing new irrigation system or changing amount and timing of irrigation - Tillage techniques, harvesting methods - Improving the effectiveness of pest, disease, and weed management practices through wider use of integrated management	- Farmers with no possibility to undertake these measures could be out of business - Temporal loss of profits and incomes until new crops enter production phase - Job losses due to lower labour needs of new crops - Job creation to build new irrigation systems; - New or different occupational health and safety risks	- Supporting cooperatives and other farmers' organizations - Engagement of trade unions and and employers in decision making - Providing temporal incomes to affected workers, as part of a broader social protection policy, prioritizing support to seasonal, part-time and informal workers - Skill development programmes - Low interest credits and other financial support mechanisms to farmers and agricultural business to be able to develop infrastructure needs
Land management	- Land use planning - Watershed planning - Soil conservation	- Job creation - Skills needed for these activities may not be available at local labour market - Farmers may not know specific land management strategies needed to meet their needs	- Employment Intensive Programmes to maximize job creation potential - Skills development programmes - Information and training programmes to farmers
Water management	- Building water harvesting infrastructures, - Water regulation - Use and transport water more efficiently - Drip irrigation - Conserve soil moisture through for example crop residue retention - Prevent water logging, erosion, and nutrient and sediment transportation resulting from more extreme waterfall events - Better drainage to cope with increased rains	- Job creation - Engagement of local governments and water institutions needed	- Dialogue between local governments, water management institutions, farmers, agricultural businesses and workers to identify needs and implement strategies - Employment Intensive Programmes to maximize job creation potential - Vocational training institutions and other learning organizations adapt programmes to include new skills - Information and training programmes for farmers

	Climate change adaptation strategies in agriculture	**Impacts on the world of work**	**Addressing employment impacts**
Financial mechanisms	- Saving schemes - Credits, insurance, tax exemptions	- Farmers with no access to financial mechanisms out of business - SMEs often have more difficulties to access financial mechanisms than large businesses - Cooperatives could play a facilitating role in accessing financial mechanism	- Assessing financial needs of farmers and agricultural business - Identify most appropriate options to local needs - Supporting programmes to help farmers and businesses to access them - Programmes focus on SMEs
Knowledge and communication	- Extension services providing information about expected impacts and how to cope with them - Using climate forecasting information to reduce production risk - Information networks	- Job creation	- Exchange information among members of employers and business community in agriculture - Exchange information among members of workers' organizations - Social dialogue between employers, workers and governments
Economic diversification	- Diversifying the livelihood strategy to include income from other farming and non-farming activities - Green jobs initiatives	- Job creation in alternative sectors - Additional incomes	- Identify local green jobs opportunities in sustainable sectors linked to local economic sectors (e.g., organic agriculture linked to local tourism; green jobs options in sustainable local food production value chain) - Enterprise development programmes focusing on the most vulnerable - Social dialogue

Source: Author's compilation

Table 5. Tourism: Climate change adaptation strategies, impacts on the world of work and measures to address them

	Climate change adaptation strategies in tourism	**Impacts on the world of work**	**Addressing employment impacts**
Technical	- Land management; slope contouring - Rain water collection and water recycling systems and desalination plants - Cyclone-proof building design and structure - Enable access to weather fore-casting early warning equipment (e.g. radios) to tourism operators - Require advanced building design or material standards for insurance - Extreme event risk exposure - Real-time webcams	- Job creation as a result of new water-related and land management infrastructures - Income generation - Companies not able to comply with insurances' requirements may be out of business	- Skills provision - Vocational training institution adapt their programmes - Local governments and departments of labour carry out employment intensive programmes - Cooperation and dialogue with engineering and civil works associations
Managerial	- Water conservation plans - Product and market diversification - Redirect clients away from impacted destinations - Promotion of alternatives to beach tourism taking advantage of resources in the community - Change location of business - Use of short-term seasonal forecasts for the planning of marketing activities - Training programmes on climate change adaptation - Impact management plans (e.g., "Coral Bleaching Response Plan") - Convention and event interruption insurance - Business subsidies (insurance or other costs) - Adjust insurance premiums - Restrict lending to high risk business operations - Monitoring programs (e.g., predict bleaching or avalanche risk, beach water quality) - GHG emission offset programs	- Job creation in alternative sectors - Companies in very risky areas may face restricted lending that force them out of business - Temporary job losses due to closure of business as a result of a natural disasters - Permanent job losses due to the need to change business location to avoid further impacts	- On the job training on water conservation to workers - Dialogue with and engagement of local communities to identify alternative tourism attractions to be supported - Enterprise development programmes (focus on the most vulnerable) - Training programmes on climate change adaptation - Identify potential job losses (temporary and permanent) due to climate impacts - Adapt existing social protection programmes to cover affected workers - Supporting programmes to business at risk, SMEs, in particular; link to alternative sectors development programmes - Social dialogue at workplace to identify options for adaptation - Greening workplaces initiatives

	Climate change adaptation strategies in tourism	**Impacts on the world of work**	**Addressing employment impacts**
Policy	- Hurricane interruption guarantees - Compliance with specific regulation to prevent future impacts (e.g. building code) - Early warning systems - Adaptation mainstreaming at policy level - Seek funding to implement adaptation projects - Coastal management plans and set back requirements - Consideration of climate change in credit risk and project finance assessments - Public education campaign on water conservation education; - Education campaigns for employees	- Temporary job losses during hurricane interruption - Business facing additional expenditures - Lack of professionals with the required skills to comply with regulations and to develop early warning systems (architects, engineers, etc) - Job creation	- Strengthen social protection programmes - Dialogue among governmental departments to mainstream adaptation into policy-making - Dialogue and awareness raising among employers and workers associations together with local governments and tourism departments to identify opportunities and challenges and how to address them - Adaptation to new skills requirement of education and training programmes - Creating facilitating mechanisms for affected business to access financial support to implement adaptation measures - Dialogue with coastal communities to jointly development coastal management plans
Economic diversification	- Promotion of alternative sectors - Promotion of local products - Extreme event recovery marketing	- Job creation	- Enterprise development programmes linked to organic food production, coastal areas management and other local economic sectors

Source: Adapted from UNWTO and UNEP, 2008 for first column; author's compilation for the next two.

Table 6: Fisheries: Climate change adaptation strategies, impacts on the world of work and measures to address them

	Climate change adaptation strategies in Fisheries	**Impacts on the world of work**	**Addressing employment impacts**
Technical aspects	- Reduce external stressors on natural systems - Identify and protect valuable areas - Investments in safer harbours and landings and measures to improve safety at sea due to increased storm severity as well as improved early warning and forecasting systems for severe weather events	- Safer working conditions - Job losses if fishing decreases due to the creation of protected areas - Job creation in protected areas if other economic uses different than fishing (e.g., tourism) is allowed - Fishers and fishing business may not have the capacity to invest in safety measures - Income reduction of local communities that depend on fishing	- Increase safety at sea for workers - Establishing supporting programmes for fishers and business to invest in safety measures through low interest credits and other financial mechanisms - Tripartite social dialogue to identify needs to increase safety at sea due to climate change - Special attention to seasonal workers and those working in the informal economy since they are hardly covered by social protection programmes
Policy	- Disaster risk management (including disaster preparedness) and protective infrastructure - Integrating fisheries and aquaculture sectors fully into climate change adaptation and food security policies at the national level - Link local, national and regional policies and programmes	- Job creation in infrastructure development - Cooperatives may have a crucial role in the promotion of disaster risk management measures	- Supporting programmes (information, technical advise, financial mechanisms) on disaster risk management for the sector - Engagement of cooperatives in decision making
Knowledge and communication	- Capacity building to civil society, employers, workers and government organizations	- Workers, employers and labour departments and related institutions better prepared to propose and implement adaptation measures - Job creation in research and monitoring	- Specific information programmes to workers, fishers and fishing business about climate change impacts and adaptation options
Financial	- New financial mechanisms and tools to create incentives and disincentives - Adjustments in insurance markets	- Fishers and fishing businesses (in particular SMEs) may be negatively impacted due to adjustment in insurance markets	- Assess impacts on fishers and fishing business incentives and disincentives along with changes in insurance markets according to, among other factors, their size.

Economic diversification	- Economic diversification and new opportunities that may become available, for example, the promotion of aquaculture based livelihoods where delta areas have been inundated and agriculture is no longer possible	- Temporary job losses and income reduction until alternative jobs are available - Job creation	- Identify green jobs options as alternative to fishing (e.g., coastal areas protection and mangrove restoration) - Integrate local communities (through local workers' and employers organizations and governments) in economic diversification programmes - Skills provision for alternative green jobs - Engagement of vocational training institutions - Enterprise development programmes

Source: Author's compilation based on Shelton C. (2014)