CLIMATE
EVERYONE'S
BUSINESS

Climate Change:
Implications for Employment

Key Findings from the
Intergovernmental Panel
on Climate Change
Fifth Assessment Report

UNIVERSITY OF CAMBRIDGE
INSTITUTE FOR SUSTAINABILITY LEADERSHIP

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european trade union institute

The **Physical Science** of Climate Change

Rising temperatures:

The Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) concludes that climate change is unequivocal, and that human activities, particularly emissions of carbon dioxide, are very likely to be the dominant cause. Changes are observed in all geographical regions: the atmosphere and oceans are warming, the extent and volume of snow and ice are diminishing, sea levels are rising and weather patterns are changing.

Projections:

Computer models of the climate used by the IPCC indicate that changes will continue under a range of possible greenhouse gas emission scenarios over the 21st century. If emissions continue to rise at the current rate, impacts by the end of this century are projected to include a global average temperature 2.6–4.8 degrees Celsius (°C) higher than present, and sea levels 0.45–0.82 metres higher than present.

To prevent the most severe impacts of climate change, parties to the UN Framework Convention on Climate Change (UNFCCC) agreed a target of keeping the rise in average global temperature since pre-industrial times below 2°C, and to consider lowering the target to 1.5°C in the near future.

The first instalment of AR5 in 2013 (Working Group I on the physical science basis of climate change) concluded that by 2011, we had already emitted about two-thirds of the maximum cumulative amount of carbon dioxide that we can emit if we are to have a better than two-thirds chance of meeting the 2°C target.

Impact of past emissions:

Even if emissions are stopped immediately, temperatures will remain elevated for centuries due to the effect of greenhouse gases from past human emissions already present in the atmosphere. Limiting temperature rise will require substantial and sustained reductions of greenhouse gas emissions.

About this document

The Fifth Assessment Report from the Intergovernmental Panel on Climate Change is the most comprehensive and relevant analysis of our changing climate. It provides the scientific fact base that will be used around the world to formulate climate policies in the coming years.

This document is one of a series synthesizing the most pertinent findings of AR5 for workers. It was born of the belief that trade unions could make more use of AR5, which is long and highly technical, if it were distilled into an accurate, accessible, timely, relevant and readable summary.

Although the information presented here is a 'translation' of the key content relevant to this sector from AR5, this summary report adheres to the rigorous scientific basis of the original source material.

Grateful thanks are extended to all reviewers from both the science and business communities for their time, effort and invaluable feedback on this document.

The basis for information presented in this overview report can be found in the fully-referenced and peer-reviewed IPCC technical and scientific background reports at: **www.ipcc.ch**

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Key Findings

1. **The impacts of climate change on jobs and livelihoods are rarely obvious or direct.** Economic activity and jobs will be disrupted by the effects of climate change on specific sectors, but also by its effects on the infrastructure that helps the entire economy to function.

2. **Impacts will vary widely between regions and sectors.** Coastal regions, cities and rural areas are all at risk from different climate-related events. The sectors that will be most affected include energy, water, food production and agriculture, tourism and transport.

3. **Often the 'easiest' way to adapt to climate change is to move.** Migration will be one of the major responses to the disruption to livelihoods.

4. **Tackling climate change could create jobs.** Measures to cut emissions would stimulate sectors such as energy conservation, renewable energy, nuclear power and forest stewardship. Adaptation measures that make infrastructure and ecosystems more robust could also generate jobs.

5. **The exact impacts of climate change on livelihoods are hard to project with confidence.** Climate change is just one factor that will affect jobs and even where it is a primary cause of changes, it will create winners as well as losers.

Climate change poses a severe threat to future sustainable development and to livelihoods around the world. Impacts on livelihoods are at the end of long and complex chains of effects of climate change. Those chains start with impacts on land-based, freshwater and ocean ecosystems but they also include the direct impact of climate change on human health and productivity levels.

Rural livelihoods and incomes are increasingly at risk due to insufficient access to water, reduced agricultural productivity and food insecurity. In urban areas, jobs are threatened by food insecurity and the breakdown of food systems, along with the limited ability to adapt of poor urban residents. Developing countries are likely to be hardest hit by climate change. Climate change is an additional burden to the poor, acting as a threat multiplier.

Economic activity will be disrupted by extreme weather events, such as droughts, flooding including coastal flooding, sea-level rise and storm surges. The disruption will be caused by the events themselves and by the cumulative impact of having to deal with a growing number of such events. These and other climate change effects will interact with population growth, increased urbanisation and the globalisation of supply chains to affect businesses – and therefore the people that work for them – around the world. Slower-moving impacts such as rising temperatures and changes in rainfall patterns will also change the economic viability of various sectors, from farming to tourism.

At the same time, many economic sectors are major contributors to climate change, such as energy production, agriculture and transport. Actions and policies to reduce greenhouse gas (GHG) emissions may threaten livelihoods in existing industries but should also create opportunities in new areas. These opportunities range from adaptation measures such as installing flood defences and strengthening other infrastructure to mitigation measures such as increasing the amount of renewable energy capacity.

Policymakers must balance adaptation and mitigation actions, whose benefits occur over different time frames. They must also consider the relative benefits of incremental changes and transformative approaches that will have different effects on employment. Finally, policymakers need to be aware that in some regions and in some sectors, climate change will generate some beneficial effects.

This summary looks at ways in which economic activity contributes to and is affected by climate change in rural and urban areas taking into account impacts on different economic sectors, infrastructure, poverty and migration. It further examines how adaptation and mitigation measures may affect jobs and livelihoods.

Executive Summary

Impacts of Climate Change

The impacts from climate change on employment are many and varied, direct and indirect. Threats to ecosystems such as forests and oceans will affect economic sectors like agriculture, fisheries, mining, energy production, pulp and paper and tourism. These threats come both from climate change itself and from how water, land and energy are managed as the climate changes. Trade in general is at risk because globally-interconnected supply chains and logistics are particularly vulnerable to extreme weather events and other climate impacts, while rising temperatures and disease will reduce labour productivity in many areas. However, for most economic sectors, the effects of other factors such as changes in population, age structure, income, technology, relative prices, lifestyle, regulation, and governance will be greater than the impacts of climate change. On aggregate across the 21st century, climate change impacts will slow economic growth and poverty reduction, further erode food security and trigger new poverty traps. But in some parts of the world and in some sectors, climate change will actually create some benefits, such as increased agricultural productivity and reduced demand for energy for heating (although this will be offset to an uncertain extent by an increased demand for cooling).

The Low Elevation Coastal Zone

The Low Elevation Coastal Zone (LECZ) constitutes just 2% of the world's land area but contains one in 10 of the world's population (600 million) and 13% of the world's urban population (360 million) based on year 2000 estimates. It also contains about 65% of cities with populations of over 5 million. As a result, the number of people exposed to a 1-in-100 year extreme sea level event (i.e. the sea level that has a 1% chance of being exceeded every year) has increased by 95% from 1970 to 2010 with about 270 million people and US Dollar (USD) 13 trillion of assets being exposed to a 1-in-100 year extreme sea level in 2010. The population and assets exposed to coastal risk will increase significantly in coming decades due to population growth, economic development, urbanisation and migration.

Between 2009 and 2050, **urban areas** are projected to account for the entire world's population growth while the rural population will begin to decline around 2020. By 2050, the urban population is projected to increase to 6.3 billion from 3.4 billion in 2009. Urban population growth will be concentrated in Asia (1.7 billion) and Africa (0.8 billion). Much of the effect on urban areas – and the jobs within them – will come from disruptions to infrastructure such as water supply, wastewater and sanitation, energy supply, transportation, telecommunications, built environment, and health and social services. The increasing concentration of people, assets and economic activities in urban areas in almost all countries will increase the concentration of climate-related risks for a growing proportion of the world's population, threatening economic development.

Rural areas, even after significant demographic shifts, still account for 3.3 billion people or almost half (47.9%) of the world's total population. Almost all the world's rural population (3.1 billion people, or 91.7%) live in less developed or least developed countries. Rural areas account for about 70% of the developing world's poor people and are subject to multiple non-climate stressors, including underinvestment in agriculture, problems with land and natural resource policy, and environmental degradation. The impacts of climate change are therefore at the latter stages of complex causal chains and often act as a threat multiplier. The major impacts of climate change in rural areas will be on water supply, food security and agricultural incomes. The fishing industry, and those who depend on it, are likely to see significant disruption, with fish stocks declining in the tropics and Antarctica and increasing in temperature latitudes.

Reliable supplies of **energy** are crucial for the smooth operation of the economy and will be threatened by the impacts of climate change, including extreme weather events and sea-level rise. The main concern for thermal power plants will be the availability and temperature of cooling water. The economic importance of a reliable transmission and distribution network is highlighted by the fact that the economic damage from disruption tends to be much higher than the price of electricity not delivered (lost production, electricity-enabled commerce, service delivery, food spoilage, lost or restricted water availability).

Water scarcity and extreme weather may affect agriculture and manufacturing production and cause disruptions to transport infrastructure.

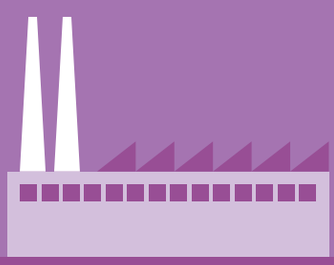
Mining and exploration for fossil fuels and other crucial raw materials could be hit by extreme weather events.

Water is central to a wide range of economic sectors, from agriculture to semiconductor manufacture. Climate impacts on the water sector include flooding and scarcity, which can lead to cross-sectoral competition. Flooding can have major economic costs, both in terms of impacts (capital destruction, disruption) and adaptation (construction, defensive investment). Water scarcity and competition for water may mean that water is not available in sufficient quantity or quality for some uses or locations.

The **transport** sector is essential to distributing goods around the economy and facilitating global trade, on which so many jobs depend. Climate change may hit transport infrastructure, which malfunctions if the weather is outside the design range – something that will happen more frequently as the climate continues to change. All infrastructure is vulnerable to freeze-thaw cycles. Paved roads are particularly vulnerable to temperature extremes, unpaved roads and bridges to extreme rainfall. In Arctic regions, higher temperatures will shorten the accessibility of ice roads that are critical for linking settlements and for the forestry and mining industries.

Recreation and tourism is one of the largest sectors of the world economy and one of its biggest employers. In 2011, it accounted for 9% of global expenditure, and employed more than 255 million people. For many regional economies, tourism is the dominant industry. Climate change will affect resorts, particularly ski resorts, beach resorts and nature resorts, and tourists may spend their holidays at higher altitudes and latitudes. While climate change will bring benefits to countries closer to the poles and at higher altitudes, those at lower levels and nearer the tropical regions will suffer.

In terms of **other sectors**, manufacturing will be affected by changes to price and quality as primary economic activities are disrupted. Labour productivity is likely to fall in hot regions, although exactly how is not well understood, and demand will be affected. Estimates of the effects of climate change on worker productivity, primarily through heat stress, have already shown a decline in productivity during the hottest and wettest seasons in parts of Africa and Asia. Although there may be a reduction in the future on reliance on manual labour, climate change is likely to have a substantial, but as yet unquantified, effect on economic growth.



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There are three channels through which **economic impacts** diffuse.

- Outputs of one sector are used as inputs to other sectors. For example, a change in crop yields would affect the food-processing industry.
- Products compete for finite budgets. If, for example, food becomes more expensive, consumers would shift to cheaper food but also spend less money on other goods and services.
- Sectors compete for the primary factors of production (labour, capital, land, water). If, besides more fertilisers and irrigation, more labour is needed in agriculture to offset a drop in crop yields, less labour is available to produce other goods and services.

As well as causing disruption to individual sectors, climate change will have profound effects on a broad spectrum of the **infrastructure** that is essential to the global economy today. These impacts will both affect sectors individually and interact with each other. Infrastructure affected will include water and energy supply, sanitation and drainage, transport and telecommunications, services including health care and emergency services and the built environment.

In both urban and rural areas, it will be people living in **poverty** who will be most affected, with climate change acting as a threat multiplier on other issues that keep people poor. Poverty reduces people's resilience and ability to adapt to climate change and other issues by slowing economic growth and poverty reduction, eroding food security and exacerbating inequalities.

The impacts of climate change may decrease productivity and economic growth, and make it harder for people to escape poverty. Climate-related hazards affect poor people directly through impacts on livelihoods, such as losses in crop yields, destroyed homes and food insecurity, and indirectly through increased food prices.

However, poor people are poor for different reasons and thus are not all equally affected, while not all vulnerable people are poor. Wage-labour dependent poor households that are net buyers of food will be particularly affected by food price increases, especially in regions with high food insecurity and high inequality (particularly in Africa), although the agricultural self-employed could benefit.

Future impacts of climate change will slow economic growth and poverty reduction, further erode food security, and trigger new poverty traps, the latter particularly in urban areas and emerging hotspots of hunger. Women and indigenous peoples are particularly vulnerable.

Future impacts of climate change will slow economic growth and poverty reduction and further erode food security.

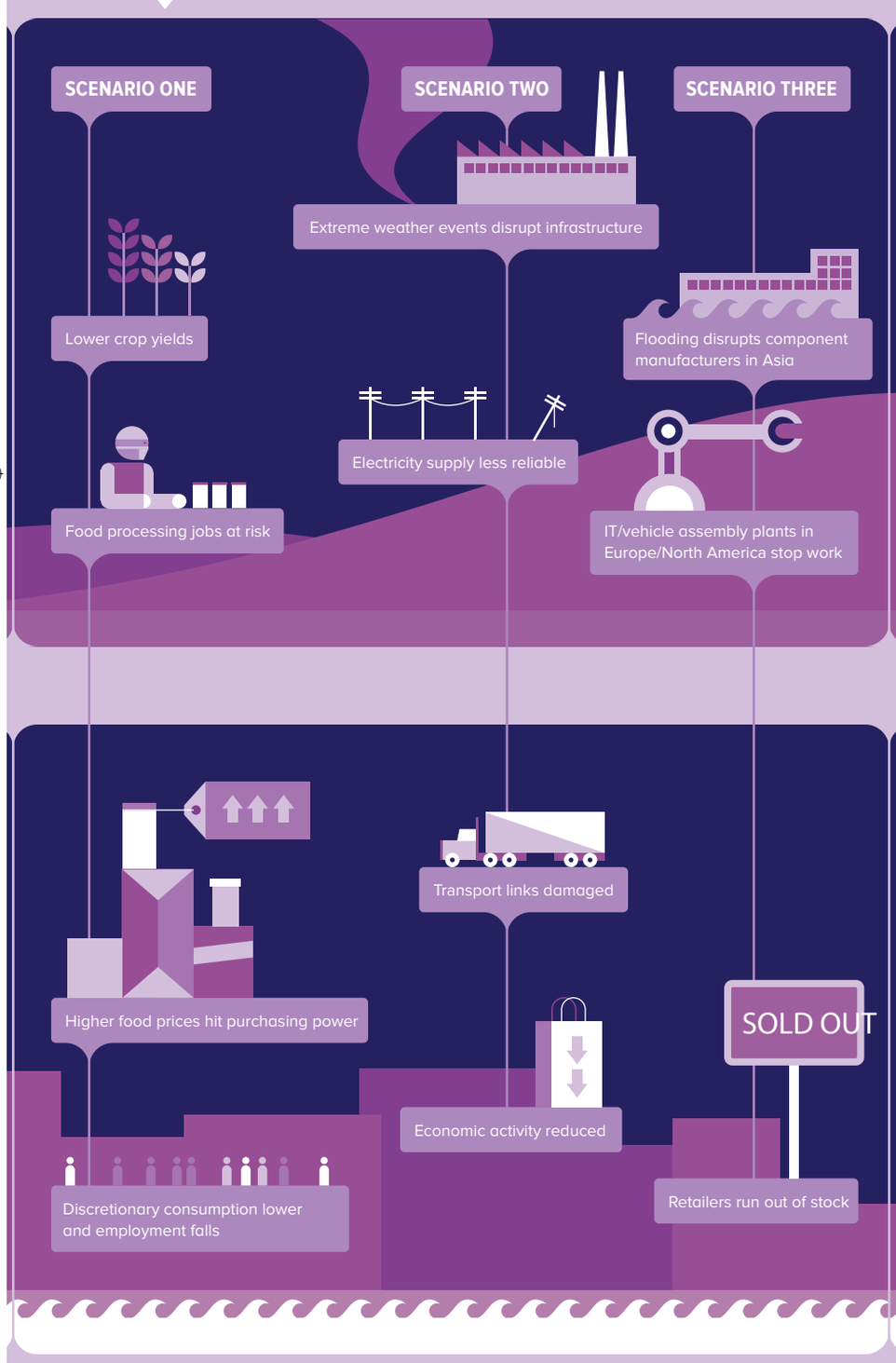
Redrawing the global employment map

Climate change is set to have profound impacts on employment worldwide. But impacts are rarely obvious or direct, and jobs will be created as well as lost. People living in poverty will be most affected.

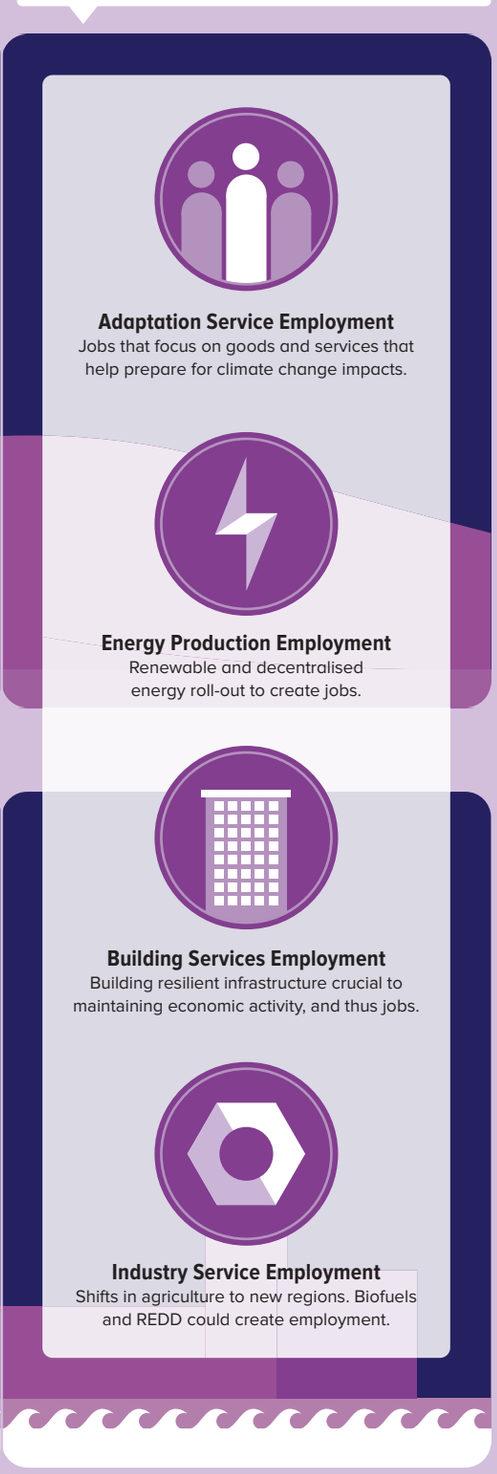
Where will climate change affect employment?	Who will be affected?	What employment sectors will be affected?
Rural Areas	**POOR** Rural areas account for about 70% of the developing world's poor people. They already face a range of challenges and vulnerabilities that climate change is likely to intensify.	The major impacts of climate change on employment in rural areas will be related to water supply, food security and agricultural incomes, although new energy crops, payments under REDD (Reducing Emissions from Deforestation and Forest Degradation) and improved forestry yields could benefit some areas. **TIMBER AND PULP** Changing yields, REDD could create jobs. **MINING** Lack of water and fears over water pollution could see mines close. **AGRI-CULTURE** Lower yields will affect incomes. **ENERGY** Biofuels could create employment
Urban/Coastal Areas	**POOR AND NEW MIGRANTS** Urban areas are set to absorb the world's entire population growth, placing pressure on job markets and potentially concentrating climate risks, particularly in the Low Elevation Coastal Zone.	Much of the impact on urban employment will come from disruption to infrastructure such as water and sanitation, energy supply, transport and telecommunications. Increased investment in more resilient infrastructure would create employment. Meanwhile, changes in distribution of fish stocks will affect fishing communities. **TOURISM** At risk from sea-level rise, storm surges and more frequent and intense extreme weather events. **CON-STRUCTION** Increased infrastructure spending likely. **MUNICIPAL SERVICES** Increased resources, jobs to adapt to climate change. **ENERGY** Power generation, energy conservation and low carbon mobility could create jobs

Climate change will influence both the economy and employment, making it almost impossible to accurately gauge the future. Direct impacts on land, freshwater and ocean ecosystems will affect employment dependent on those ecosystems, such as agriculture, forestry, fishing and some types of tourism. Climate change will also affect the infrastructure on which so much employment depends – particularly through extreme weather events. Energy, water, transport and telecommunications are all likely to face disruption from flooding, storm surges, drought and temperature extremes. However, efforts to mitigate climate change, and to adapt to its effects, will also create employment opportunities. Renewables and energy efficiency, biofuels and REDD markets, and more resilient infrastructure all promise net employment benefits.

Why will an impact on one sector affect other sectors?



What new jobs will be needed to tackle and adapt to climate change?



Adaptation Service Employment
Jobs that focus on goods and services that help prepare for climate change impacts.

Energy Production Employment
Renewable and decentralised energy roll-out to create jobs.

Building Services Employment
Building resilient infrastructure crucial to maintaining economic activity, and thus jobs.

Industry Service Employment
Shifts in agriculture to new regions. Biofuels and REDD could create employment.

Resilience

Migration

One of the main options for adaptation to climate change will be migration. Moving is already a widely-used strategy for maintaining livelihoods in the face of social and environmental changes. Climate change will have significant effects on migration flows but these will be difficult to predict and may be caused by the changing climate itself or knock-on effects such as food or water shortages or violent conflict. Some groups lack the resources to be able to migrate to avoid the impacts of floods, storms, droughts, sea-level rise and loss of permafrost.

There are four possible pathways through which climate change could affect migration:

- Intensification of natural disasters
- Increased warming and drought that affects agricultural production and access to clean water
- Sea-level rise, which makes coastal areas and some island states increasingly uninhabitable
- Competition over natural resources, leading to conflict and displacement of inhabitants.

Migration can have both positive and negative effects. Societies from which people migrate can be boosted by remittances from migrants but they can also become more vulnerable if the burden of work increases, particularly for women. The decline in transmission of traditional knowledge can also increase vulnerability. Meanwhile, those places that receive migrants can experience excessive demographic growth and increasing pressure on scarce resources, as is being experienced in the semi-arid tropics.

Actions to improve climate resilience can also help to improve livelihoods and well-being; but while approaches to adapting to climate change continue to focus on incremental change, there is increasing evidence that transformative changes may be necessary. These cannot help but have disruptive effects on the economy. However, alongside significant public sector investment, the involvement of the private sector, from individual farmers and SMEs (small and medium-sized enterprises) to the largest corporations, will be critical to ensuring nations adapt to the effects of climate change. There are likely to be opportunities as well as negative impacts.

Companies are well used to managing business risk, but few are integrating the long-term risks of climate change into their systems. Nor are they ready to grasp the competitive advantages that are on offer to those that take early action, because they are unsure of the scale of both the threats and the opportunities, even though both could be substantial. However, economies that are disproportionately dependent on climate-sensitive sectors such as agriculture, forestry and fisheries may find it more difficult to adapt.

There is also a danger that private sector adaptation efforts will not align with government or community objectives without proper co-ordination and incentives. 'Maladaptation' is also a cause of increasing concern to adaptation planners, where intervention in one location or sector could increase vulnerability elsewhere, or increase the vulnerability of the target group to future climate change.

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Climate policies, such as measures to increase the supply of energy from renewable resources, encouraging cultivation of biofuels, or payments under REDD (Reducing Emissions from Deforestation and Forest Degradation), will have significant secondary impacts, both positive (increasing employment opportunities) and negative (landscape changes, increasing conflicts for scarce resources), in some **rural areas.**

Potential adaptation options exist across all food system activities, including food production, processing, packaging, transport, storage and trade, with a focus on food security and equity likely to have the most direct benefits on livelihoods. To make **agricultural** jobs more secure, market volatility could be reduced by making global agricultural markets more predictable and reliable. The **fishery and aquaculture** sector can maintain resilient ecosystems and develop early warning systems, while options in livestock include better-adapted breeds and improved access to credit for adaptation measures.

Action in **urban areas** will be crucial to global adaptation as they hold more than half the world's population and most of its built assets and economic activities. As well as containing a high proportion of the people and economic activities most at risk from climate change, urban areas are also responsible for a high proportion of global GHG emissions. Building resilient infrastructure (water supply, sanitation, storm and waste water drains, electricity, transport and telecommunications, health care, education and emergency response) will be crucial to the ability to maintain economic activity and support jobs.

Insurance programmes, social protection measures, and disaster risk management may help the poor and marginalised to **maintain their livelihoods.**

Mitigation Potential

To constrain climate change, it will be crucial that economic growth is decoupled from an increase in GHG emissions. This will require large-scale transformations in the way the economy works, from how energy is produced and consumed to how land is used. The scale of this transformation will lead to disruptions in established industries and threats to existing jobs. However, mitigation efforts will also create new jobs in both existing and new sectors of the economy.

Delivering climate change mitigation will require particular skills. The development of a workforce capable of working in 'green jobs', in areas such as renewable energy, green buildings, decentralised energy and efficiency, will be crucial. Consideration of climate change impacts will also become an important part of employment more generally.

Yet just as there is a danger of maladaptation, mitigation measures can have long-distance or indirect impacts on biodiversity and/or human systems. For example, the development of biofuels as energy sources can increase food prices and affect distant land-use practices. Corn-based ethanol, for example, can be as GHG-intensive as petroleum in full life-cycle terms.

The **energy sector** is the largest contributor to global GHG emissions. In 2010, it was responsible for 35% of total emissions. As such, it is likely to be one of the main focuses of mitigation policies, which will have both positive and negative effects on jobs. A key challenge will be to deliver modern energy services with limited GHG emissions.

The main mitigation options in the energy sector include reducing demand, for example through increasing efficiency and behavioural change. Energy efficiency can be improved throughout the system, from power station through transmission and distribution networks to end-users such as buildings and individual appliances. Supply-side measures include increasing the use of renewable technologies, nuclear and carbon capture and storage (CCS). Only a small fraction of renewable energy's technical potential has been tapped so far.

Delivering climate change mitigation will require the development of a workforce capable of working in 'green jobs' in areas such as renewable energy, green buildings, decentralised energy and efficiency.

If heat production and transportation are to be decarbonised, through measures such as the increased use of heat pumps and electric vehicles respectively, much more low-carbon electricity generation capacity will be needed, along with a massively improved transmission and distribution infrastructure.

The wind and solar energy industries will benefit from mitigation efforts. The rolling out of renewable energy capacity and decentralised energy systems will create many jobs requiring new skills in areas ranging from research and development, engineering and consultancy through to installation and maintenance in sectors ranging from nuclear to CCS and renewable energy. In rural areas in developing countries, renewable energy can provide access to energy in places that lack a grid connection, creating economic opportunities as a result.

At the same time, there will need to be a shift in energy supply away from unmitigated fossil energy sources, particularly coal, which is likely to cause job losses in these sectors.

It is unclear exactly what the net effect on employment will be of these conflicting trends, with several studies reporting a net increase in jobs and others suggesting no change or a fall in employment. However, to make the most of the opportunities, nations will need strategies to develop the necessary human capital.

Mitigation opportunities in **buildings** can be large, cost-effective and labour-intensive. Up to 60% of baseline energy consumption can be saved in new and existing buildings. Energy efficiency measures generate between 0.7 and 35.5 job years per USD 1 million spent (2010 levels).

Mitigating emissions from **transport** will require significant policy interventions and infrastructure investments, in areas such as public transport, measures to encourage walking and cycling and promoting local sourcing practices. Makers of land, sea and air vehicles will also have to improve engine efficiency while there will be an increase in the production of biofuels and electric vehicles.

Energy efficiency measures generate between 0.7 and 35.5 job years per USD 1 million spent (2010 levels) and can reduce baseline energy consumption in new and existing buildings by up to 60%.

Regional Perspectives

In **Africa**, climate change will interact with other factors and amplify existing stress on water availability, which will add to the vulnerability of those working in agriculture, while the threats to the agriculture sector will also multiply existing threats to food, health and economic security for the wider working population.

In **Asia**, water scarcity is expected to be a major challenge because of higher demand and a lack of good management, and many areas will see a decline in food productivity and security. The multiple stresses caused by rapid urbanisation, industrialisation and economic development will be compounded by climate change, which will have an increasing effect on health, security, livelihoods and poverty.

In **Australasia**, recent floods, droughts and heatwaves have highlighted the vulnerability of both ecosystems and human development to climate variability and the situation is expected to get worse in many places, threatening economic activities ranging from mining to farming.

In **Europe**, there is an increased likelihood of systemic failures affecting multiple sectors. More frequent and intense heatwaves in southern Europe could hit agriculture, forestry, energy production, tourism, and the health and productivity of workers across the economy.

North America will see climate change increase the pressure on water resources that are already stressed by the effects of economic development. The region's agricultural sector will experience further variability in yields. Much of North America's infrastructure is vulnerable to extreme weather events and sea-level rise and will be more vulnerable as a result of climate change unless investments are made to strengthen it.

In **Central and South America**, the negative impacts of climate change are exacerbated by land use change for economic reasons. Agriculture and food security are threatened by changes to productivity, while sea-level rise threatens fish stocks, recreation and tourism. However, the effects vary widely depending on location.

In the **Arctic**, infrastructure and related services are under threat from thawing permafrost and changing precipitation patterns and communities will be severely affected, particularly where there are few adaptation choices because the local economy is so narrowly focused.

The world's **Small Island States** face climate risks including sea-level rise and cyclones. Given their physical characteristics, they are highly vulnerable to climate impacts and other factors, and they may face slower growth because they have to spend much time and effort dealing with the effects of extreme weather events. Adaptation efforts, which will often require international help, will create larger benefits when they are combined with other development activities such as disaster risk reduction.

COASTAL REGIONS, CITIES AND RURAL AREAS ARE ALL AT RISK FROM DIFFERENT CLIMATE-RELATED EVENTS.

Mitigation measures, particularly in power generation, energy conservation and low-carbon mobility, could have a positive impact on employment.

Conclusion

Climate change poses a *moderate* threat to sustainable development today and a *severe* threat to future sustainable development and thus to employment, livelihoods and jobs, although the exact effect is hard to quantify. While most of the effects on employment will be negative, in some regions and sectors, there will be positive effects. Significant numbers of jobs will also be created through efforts to adapt to climate change, such as flood relief measures, and mitigation activities such as the roll-out of renewable energy capacity and energy efficiency initiatives.

Glossary

ADAPTATION

The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects.

BIOFUEL

A fuel generally in liquid form, produced from organic matter or combustible oils produced by living or recently living plants.

CLIMATE CHANGE

Any significant change in climate that persists for an extended period, typically decades or longer.

CLIMATE IMPACT

The effects of climate change on natural and human systems.

DECENTRALISED ENERGY

Energy produced near to where it is consumed, rather than at large power plants whose output requires distribution via national transmission and distribution systems.

GREENHOUSE GAS

A gas in the atmosphere, of natural and human origin, that absorbs and emits thermal infrared radiation. Water vapour, carbon dioxide, nitrous oxide, methane and ozone are the main greenhouse gases in the Earth's atmosphere. Their net impact is to trap heat within the climate system.

LIVELIHOOD

A way of making a living, encompassing people's capabilities, assets, income and activities required to secure the necessities of life.

MALADAPTATION

Actions that may lead to increased risk of adverse climate-related outcomes, increased vulnerability to climate change, or diminished welfare, now or in the future.

MITIGATION

A human intervention to reduce the sources or enhance the sinks of greenhouse gases.

PERMAFROST

Ground that is frozen for two or more consecutive years.

PROJECTION

A potential future evolution of a quantity or set of quantities, often computed by a model. Projections involve assumptions that may or may not be realized, and are therefore subject to substantial uncertainty; they are not predictions.

RENEWABLE ENERGY

Any form of energy from solar, geophysical or biological sources that is replenished by natural processes at a rate that equals or exceeds its rate of use.

RESILIENCE

The capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure.

SUSTAINABLE DEVELOPMENT

Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

THREAT MULTIPLIER

A factor that exacerbates the negative effects of other drivers of change.

"Continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system. Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions."

IPCC, 2013

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About us:

The ETUI conducts research in areas of relevance to the trade unions, including the labour market and industrial relations, and produces European comparative studies in these and related areas. It also provides trade union educational and training activities and technical support in the field of occupational health and safety. The ETUI is financially supported by the European Union.

The University of Cambridge Institute for Sustainability Leadership (CISL) brings together business, government and academia to find solutions to critical sustainability challenges.

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