CLIMATE CHANGE AND THE FUTURE OF GLOBAL SOUTH LABOR MARKETS

Gregory Randolph

Gregory Randolph

IDRC GRANT / SUBVENTION DU CRDI : - SHAPING A RESEARCH AGENDA TO EXPAND ECONOMIC OPPORTUNITY IN A POST-PANDEMIC WORLD

This research was supported by

IDRC | CRDI
International Development Research Centre
Centre de recherches pour le développement international

Canada

JustJobs NETWORK

RED SUR
Red Sudamericana de Economía Aplicada

Climate Change and the Future of Global South Labor Markets

Gregory Randolph

October 2022

This research was supported by

IDRC | CRDI
International Development Research Centre
Centre de recherches pour le développement international

Canada

Climate Change and the Future of Global South Labor Markets

Gregory Randolph

October 2022

Published in October 2022 by JustJobs Network Inc.

Acknowledgements:

The JustJobs Network is grateful to IDRC for supporting this research. Our thanks to David O'Brien, Senior Programme Specialist, IDRC for his guidance and support throughout this project, and to other IDRC colleagues that provided helpful feedback during the consultation process. This brief was authored by Gregory Randolph, with inputs and comments from Sabina Dewan, Ramiro Albrieu, and Megan Ballesty.

Cover photo
"Saint Genix firemen intervention in Guiers. Savoie (73) - France"

Action to combat climate change has become a global imperative. Decisive and effective measures are crucial to counter rising global temperatures and reduce the threat of climate change-related disasters, chronic climatic disruptions to societies and economies, and the adverse impacts of pollution on health.[1] This issue brief explores the many dimensions of the challenges of tackling climate change, all related to its relationship with employment in the Global South: the expansion of renewable energy and its impact on Global South employment; the transition of workers out of fossil fuel industries; climate change's impact on agriculture, which still employs a third of workers in the Global South and nearly 60 percent in low-income countries;[2] and the relationship between climate change and migration.

The Energy Transition

Fossil fuels are currently the leading source of energy consumption and greenhouse gas emissions.[3,4] Driven by climate change's impact on health, weather-related disasters, and subsequent economic repercussions, many countries are adopting policies to advance and accelerate the transition away from fossil fuel energy.[5,6] As the era of fossil fuel nears its end and with more governments investing in renewable energy, the demand for fossil fuels is estimated to peak[7] and decline in the coming decades.[8] In the car industry alone, electric vehicles are becoming more commonplace, and manufacturers predict an end to the production of gas- and diesel-powered vehicles in the near future.[9]

Countries are seeking to make a shift from noxious industries to renewables, and investing in new energy forms can be advantageous to economies. Experts have estimated significant gains, upwards of $26 trillion in the worldwide economy and millions of jobs by 2030, in the transition from fossil fuels to renewable energy.[10,11] Even in this initial ramp-up, investment and capacity building in the renewable energy industries have already collectively outpaced all fossil fuel industries.[12,13] Much of the economic benefit from renewable energy development comes in the form of infrastructure investment, especially in low- and middle-income countries.[14] Notably, the cost-to-benefit ratio for investment in resilient infrastructure is high, with one dollar invested yielding four dollars in benefits.[15] Overall, infrastructure investment could create a net income benefit of $4.2 trillion over the resources' lifetime.[16]

Most significantly, investment in renewable energy has the potential to generate millions of employment opportunities. The International Labour Organization estimated that the transition to sustainable energy worldwide, based on

current commitments, would create nearly 25 million jobs[17,18] with some estimates near 70 million.[19] Both technical and non-technical occupations are indispensable to renewable energy industries. Engineers – civil, mechanical, electrical, and computer – are in high demand, as are other non-technical positions such as sales, inspectors, and auditors.[20]

Unfortunately, there is a shortage of workers with these skill sets.[21] Education and training are essential to addressing skill shortages, as is building the capacity of trainers and institutions of learning.[22] Doing so takes time, preparation, and good communication among industries and educational experts. Uniformity in education across institutions is also important. The ILO recommends cross-country initiatives to establish a consistent training curriculum and standardize competencies and qualifications for workers in renewable energy industries.[23]

Many jobs in the renewable energy transition are concentrated in male-dominated professions such as science, technology, and engineering. Education and training for women could address this gender disparity while also filling gaps in the workforce.[24] Addressing barriers to women's participation in STEM fields, like harassment, and creating support networks for women in STEM, could bolster their retention.[25] The training of women to work with solar panels in Tanzania and Bangladesh, for example, has had a positive impact on skill-building and women's employment.[26]

The transition from fossil fuels to renewables also comes with a price: that of anywhere between 7 and 71 million jobs, depending on how aggressively countries pursue sustainability goals.[27] Of those who lose their jobs, about 70% are expected to be able to use their skills to shift to another industry, but the rest will not be able to transition without significant efforts toward reskilling. Thus, for a successful changeover to renewable energy industries, millions of individuals would require additional labor preparation or need to be reskilled entirely.[28] However, fewer than half of the countries bound to the Paris Agreement have planned for skill training in their Nationally Determined Contributions.[29]

Training plans should address the educational needs of those who can upskill; retraining will be in high demand.[30] According to the ILO, core skills in areas like communication and customer handling will likely carry over from old to new industries regardless of the workers' sector of origin.[31] Problem-solving, project management, and collaboration will transfer to the green economy for those from technical fields.[32] Skills developed in declining mining, construction, manufacturing, and transport industries that could shift over include forklift operation, physical abilities, material handling, sales, and marketing.[33] A smooth position changeover process should emphasize strengthening transferable skills while building new skills.

Reskilling entirely poses its own set of challenges. In order to ensure equitable distribution of job opportunities[34], it is vital that the changeover be managed efficiently and its impact on people be taken into consideration. One of the most significant challenges to transitioning the labor

force to green jobs is the preparation of the workforce, but this also serves as an impetus to offer people more avenues in the workforce. A just transition minimizes negative impact and leverages and equalizes opportunities for those affected by changes to fossil fuel industries.[35] Countries must be careful to prevent the ripple effect of job loss or underemployment that could have unintended repercussions on the population's emotional health, personal identity, and potential subsequent substance misuse, especially in communities that are already vulnerable.[36]

Social support systems and safety nets are critical to successful and equitable change.[37,38] Planning for a considered transition must include identifying the regions in which jobs are lost and where they are gained.[39] For example, one of the successes of India's transition away from the coal-driven thermal energy industry was its support of numerous education opportunities dedicated to the green industry; those opportunities provided a bridge for workers from the old coal industry to embrace the emerging work in renewables.[40] However, the geographic location of the prospects in India did not align with the regions of job losses, resulting in social support needs.[41] Labor unions, for example, could have aided in the process of a just transition by identifying needs and assisting in formulating an acceptable transition plan and required safety nets.[42]

An ill-timed or poorly-paced fossil fuel transition could greatly impact the Global South. Policies that promote a gradual wind-down and fund reskilling will help support those displaced by the closing industry.[43] If countries move too quickly, they risk massive labor market displacement before educational and vocational institutions have had an opportunity to adapt to new needs. At the same time, too slow of a change to renewable energy could leave these countries stranded with $12 trillion worth of unusable fossil fuels in the future.[44] As such, a poorly timed or planned transition could hinder nations' entry into a growing industry, risk lack of proper energy diversification, and negatively impact jobs.[45] Planning for a low-carbon transition should include developing alternative sources of income prior to the change; global partners may even consider debt forgiveness for those fossil fuel-rich countries that choose not to extract.[46] India, again, offers an example of advantageous timing as their investment in renewable energy provided employment transition and economic benefits while the measured scale-down of coal use prevented stranded assets.[47] From another perspective, countries that have yet to fully realize their fossil fuel capacity could have an advantage over others since they have not yet fully invested in the fossil fuel infrastructure that would become obsolete in the changeover.[48] The New Climate Economy suggests that in bypassing declining energy industries, nations could accelerate their participation in cost-effective renewable energy and start anew with the training and education of workers.[49]

To aid in this transition, investment in the areas of education, reskilling, a safety net, and emotional health support is imperative. Funds realized from reforming subsidies on fossil fuels and carbon pricing are estimated at $2.8 trillion.[50] Increasing

the carbon production cost also incentivizes movement toward low-carbon industries.[51] Such moves will likely raise objections, so good communication about the reforms and getting buy-in from stakeholders are central to success. Egypt, for example, demonstrated successful transition, subsidy reform and other transformations in fundraising, as well as the adoption of social policies through good communication with the population, alignment of community beliefs, and building public support for economic and health goals.[52,53] In a similar situation, Ghana engaged stakeholders to reach a collective agreement on adjustments in fuel pricing during the nation's transition.[54] Another possible stream of revenue[55] to support a green transition is taxation on fossil fuels. However, as leaders plan for fundraising avenues, they should consider their impact on low-income individuals and not force those with the least capacity to shoulder greater tax burden than is fair. Once renewables are established, cost savings could free up financial resources to invest in safety nets in the future.

As renewable energy infrastructure is created, the demand for labor will ebb and flow.[56] It is vital, then, that a green energy transition consider the possibilities of surges and declines in labor demand. If countries rapidly expand the renewable energy industry, labor demand will rise but then decline quickly. This is because most of the labor demand comes from the construction of infrastructure and not its maintenance. Similarly, the transition from fossil fuels like coal will lead to a temporary boom in work retrofitting homes to accommodate other energy sources. Once the need has been fulfilled, however, labor demands will decline.[57] This points to the fact that a slower pace of infrastructure investment, while less aligned with ambitious carbon reduction goals, allows for more sustainable growth in green energy jobs.[58] This is one of the problematic tradeoffs countries face in designing their energy transition policies.

The Impact of Climate Change on Agricultural Livelihoods

Much of the impact of climate change will be felt directly in the agricultural sector, which employs nearly 1.1 billion people around the world.[59] The primary climatic changes that are adversely affecting agriculture include: increasing temperatures; weather variability; shifting geographies of agroecosystems; invasive crops and pests; and more frequent extreme weather events.[60] These environmental changes have direct effects on agriculturalists, increasing the likelihood of crop failure and growth in diseases and mortality among livestock. Additionally, the nutritional content of major cereals is affected by climatic changes.[61]

Climatic changes also have many spillover and feedback effects. For example, those who depend on agriculture are more likely to wind up in heavy debt; undertake precarious migration; sell their livestock or other assets in distress, at below-market prices; or adopt unsustainable farming strategies that, in the long run, lead to even more environmental degradation.[62] These pressures are felt most acutely among smallholder farmers in the Global South, who are not only located in regions that are the most vulnerable to climate change, but also lack the resources to adapt.[63]

The changes directly related to a warming planet are not the only ones putting pressure on agricultural livelihoods in the Global South. Population growth is driving the increasing fragmentation of land into smaller parcels, reducing overall agricultural income per household, and minimizing potential for economies of scale and technological investment.[64] Various forms of environmental degradation that are not directly related to climate change are also affecting soil quality. Agricultural protectionism in the Global North and increased emphasis on food safety and quality in both the North and South are putting pressure on farmers' ability to export and access certain markets.[65,66,67] More recently, the Covid-19 pandemic put enormous stress on both labor supply and global value chains, directly impacting agriculture.[68] In particular, smallholder farmers in the Global South face specific, and severe, threats to their livelihoods. Market access even within domestic markets is constrained for smallholders as many governments have withdrawn from direct involvement in regulating these markets, leaving them vulnerable to consolidation and middlemen.[69]

Climate change's effects on agriculture, especially when combined with the other structural factors noted above, should be viewed as an immediate threat to jobs in the farming sector. However, they also ought to be viewed as a broader problem affecting global economic growth, food security, and the potential for violent conflict. If the impact of climate change is the reduction of overall productivity growth in agriculture, one major issue with this is that GDP growth in agriculture is historically more effective in reducing poverty than growth in other sectors. For example, in Sub-Saharan Africa, agricultural productivity growth reduces poverty 11 times faster than growth in other sectors.[70] Moreover, food security will be significantly challenged as climate change and agriculture become increasingly intertwined, given that the world needs to produce 70 percent more food by 2050 to accommodate population growth.[71] Given these broader implications of the relationship between climate change and agriculture, developing agricultural adaptation strategies should be seen not only as necessary to save jobs but as a larger imperative for avoiding economic, social, and political crisis.

Climate Adaptation Strategies in Agriculture

With major changes in the climate already unfolding, the effects of which are felt first by those who depend primarily on agriculture, many communities in the Global South have already begun developing their own adaptation strategies. Social scientists sometimes distinguish between "coping" and "adaptive" strategies, with the former denoting strategies to manage climate impacts after the fact, and latter referring to ways

of reducing overall vulnerability to climate shocks. However, this distinction is often opaque on the ground, since a livelihood strategy adapted in one year as a reaction to a climate shock can eventually become a durable practice, year after year, for reducing overall vulnerability.[72] For this reason, we apply the term "adaptation strategy" broadly, to describe all kinds of responses to the impacts of climate change on agricultural livelihoods. Importantly, this term does not necessarily imply a sustainable response, or one that promotes the human and economic development of the agricultural household and community. In many cases, in fact, the opposite is true.

Based on a review of the literature, adaptation strategies among agricultural workers may be grouped into four categories:

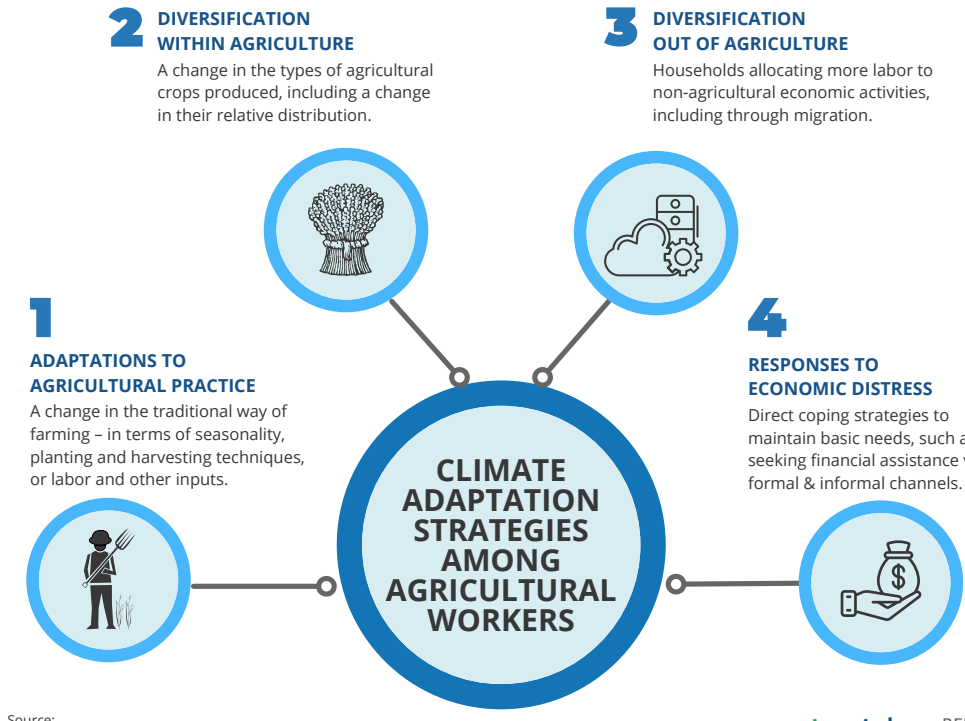
1. **Adaptations to agricultural practice:** These strategies involve a change in the way that farming or other forms of agriculture are traditionally practiced – in terms of seasonality, planting and harvesting techniques, or labor and other inputs. *Example:* In northern Nigeria, farmers have adopted the practice of "negotiating the rain" by allocating farm labor across the season in ways that follow unpredictable intra-season rainfall variations.[73]

2. **Diversification within agriculture:** These strategies involve a change in the types of agricultural crops produced, including a change in their relative distribution. *Example:* In Morocco, farmers plant legume crops late in the season when cereals fail due to drought.[74]

3. **Diversification out of agriculture:** These strategies involve households allocating more labor to non-agricultural economic activities, including through migration. *Example:* In South Asia in particular, climate shocks have led many households to straddle the farm and non-farm economy. The latter generally involves household enterprises in services or small-scale manufacturing.[75]

4. **Responses to economic distress**: These strategies are ways of directly coping with economic distress to maintain basic needs, including through seeking direct financial assistance via formal and informal channels. *Example:* Among pastoralist communities in southern Ethiopia and northern Kenya, intra-community sharing mechanisms distribute livestock products and the use of live animals to the most destitute.[76]

As noted previously, these adaptation mechanisms are not necessarily supportive of broader development aims. They often require communities to devote more labor to produce the same agricultural output, detracting from the time they can spend on other activities that promote human development, such as education and skill development. In northern Nigeria for example, researchers have found that farmers are putting in more labor per hectare of farmland while integrating more livestock, which also requires additional labor.[77] Similarly, the turn to irrigation in places like Mexico comes with its own economic and environmental vulnerabilities.[78] Cycles of indebtedness are also the result of coping strategies aimed at relieving immediate



Source:
Randolph, G. (2022). *Climate Change and the Future of Global South Labor Markets.* JustJobs Network and Red Sur.

economic distress. Finally, many of the shifts into non-farm work among farming households are into low-wage precarious, informal work that lags in both productivity and working conditions. Some of these occupations are themselves environmentally hazardous or polluting, such as charcoal production and brick kiln work.[79]

However, there are also positive examples of communities adapting to climate change using methods that are both economically and environmentally advantageous. For example, some Himalayan villages in India are developing a sustainable forestry sector based on planting biologically diverse forests to generate carbon credits,[80] and pastoralists in East Africa are turning to their own indigenous practices of livestock-rearing to manage diseases among their herds.[81]

In an effort to develop a comprehensive, coordinated strategy for adaptation in the agriculture sector that promotes the health and economic well-being of communities, meets the growing demand for food, and reduces the carbon footprint of agriculture itself, several foundations and multilateral organizations have coalesced around the concept of "Climate Smart Agriculture." The World Bank defines

Climate Smart Agriculture in terms of increased productivity, enhanced resilience, and reduced emissions. The Bill and Melinda Gates Foundation has thrown its weight behind Climate Smart Agriculture, and a partnership between the United States and United Arab Emirates, Aim for Climate, also endorses the concept. Rather than any specific policy or agricultural technology, CSA is a set of principles for governance. Projects that are thought to be aligned with CSA objectives include water-harvesting initiatives in India and farmer-managed regeneration of trees within agricultural fields in the Sahel.[82]

Scholars, however, have pointed to ambiguity in the concept of CSA: While a "triple-win" strategy would unarguably have a positive outcome for farmers, the environment, and the global food system, it is generally unclear how this is to be achieved. Taylor[83] critiques the CSA approach for its apolitical representation of agrarian social relations. He finds four tensions in the CSA framework: (i) missing metrics, as no rubric has been provided to judge one policy as more CSA-friendly than another; (ii) the depoliticized notion of "resilience," which in many agrarian societies is effected through the marginalization of groups that bear the brunt of climate shocks, including women and landless laborers; (iii) dubious "success stories" as evidence that triple-win strategies can work; and (iv) failure to consider how a global food system oriented around consumer demand rather than nutritional needs is responsible for lack of sustainability in agriculture. Fundamentally, Taylor[84] critiques the CSA approach for its underlying ideology that agricultural systems can be improved, even in the context of climate change, through "liberalization, technological advancement and the diffusion of modern production techniques to the developing world." He proposes an alternative framework of "climate-wise" agriculture, which would replace the "technical and productivist focus of CSA" with a foregrounded emphasis on "equity and sustainability" and acknowledge that there may be inherent tradeoffs between the three goals of productivity, sustainability, and the well-being of agricultural communities.

Climate Migration and Social Protection Portability

Among the most critical considerations related to climate change and the future of work is the prospect of large-scale involuntary migration induced by climate disasters and slow-onset climatic changes. The Food and Agricultural Organization found that between 2008 and 2015, an average of 26.4 million people were displaced annually by natural-hazard-induced and climate-related disasters.[85] A report by the World Bank estimates that by 2050, the impacts of climate change will induce 216 million people to migrate within their country of origin, in various regions of the Global South (Sub-Saharan Africa, South Asia, Latin America, East Asia and the Pacific,

North Africa, Eastern Europe and Central Asia).[86] These movements, which do not even include international migration, will be spurred by lack of water and low crop productivity as well as sea level rise and increasingly disruptive storm surges. A report by the International Labour Organization highlighted the combined impact of the Covid-19 pandemic and climate change, arguing that migrants first forced to move by climate change were especially vulnerable in the aftermath of the health crisis and the economic impact of safety measures implemented to combat it.[87]

Scholarly research on the relationship between climate change and migration, however, has yielded mixed and complex results, suggesting no linear, straightforward connection between out-migration and climate shocks – whether natural disasters or slow-onset climatic changes, such as gradually diminishing rainfall. For example, a six-country study in Africa found that temperature anomalies increased migration in Uganda, decreased migration in Kenya and Burkina Faso, and had no consistent effect on migration in Nigeria and Senegal. In the same study, there was no clear relationship between migration and precipitation levels.[88] Another study of eight South American countries found that monthly temperature shocks – that is, especially hot or cold months – were much more likely to spur migration than monthly rainfall shocks or gradual, multi-year climatic changes, and that climate-related migration was most likely to be towards urban areas.[89] A study in China covering the period of 1989 to 2011 found surprising results: prior to 2000, temperature anomalies increased permanent migration, but after 2000, this trend reversed. The authors attribute this to households becoming less vulnerable to temperature in the agriculture sector, leading them to retain migrants rather than send them during periods of adverse climate conditions.[90] These findings suggest that designing policies around anticipated climate-induced migration will require more research into the complex and evolving nature of human mobility on a warming planet.

A major obstacle to generating knowledge about the relationship between climate change and migration is the paucity of high-quality migration data in most countries of the Global South. The approaches that national statistical agencies employ to track migration vary widely on both spatial and temporal dimensions. Governments use widely divergent methods to track migration in terms of how movement is measured (i.e. who qualifies as a migrant, which moves are tracked in national sample surveys and censuses); the time intervals used to track migration; and the division of space and measurement of distance.[91] Aside from key definitional and methodological differences in migration data across countries, most official statistics are widely understood to be just a partial window into real mobility patterns, given the logistical difficulties involved in tracking short-term and temporary movements, such as seasonal migration and weekly commuting. Growing adoption of digital technologies offers possibilities of more detailed, harmonized migration datasets, with smart phones enabling unprecedented forms of surveillance.[92] But these approaches to data collection pose numerous ethical concerns—not only privacy issues around how these datasets are generated and to whom

they are available,[93] but also around who is excluded from them, most notably those who still lack access to digital technologies.

Climate researchers and migration experts agree on one aspect: the importance of flexible and portable social protection systems to accommodate future changes in migration behavior that are induced by climate change. With limitations to policymakers' ability to anticipate future climatic shocks, let alone the precise ways in which they will impact people's migration behavior, it is becoming increasingly important to ensure easy access to social safety nets from any location is growing. This is especially the case for many households in the Global South who straddle multiple locations and labor markets, with regular and frequent seasonal and temporary migration.[94] In fact, most countries in the Global South have a fragmented and decentralized system for delivering social assistance to vulnerable people; even when financed by central governments, social programs are often administered by state or local governments. Regardless of their promises on paper, they are not portable in practice, meaning that people who work in a location other than the one where they are registered often lack access to benefits.[95] Researchers in India, in particular, have highlighted the problem of inadequate access to social programs among vulnerable migrant workers. The Centre for Policy Research noted that, during the pandemic, "the vulnerability of migrants was substantially exacerbated by their inadequate incorporation in social protection mechanisms, which have consistently failed to recognize circular and seasonal mobility patterns".[96] The same issues are at play – and even more difficult to resolve – in the case of international migrants.[97]

Policy experimentation has begun to find mechanisms for enhancing the portability of social protection, particularly in the wake of the pandemic. For example, the Indian government has begun implementing a "One Nation One Ration Card" program, which uses a digital platform to link a universal identity (Aadhar) with ration cards and installs electronic point-of-sale devices at public ration shops.[98] To support international out-migrants, some countries of origin have also begun implementing migrant welfare funds, which are unilateral mechanisms that extend some social welfare benefits to migrant workers in countries of destination.[99] Further research on models and mechanisms for enhancing social protection portability are necessary in a warming world, where migration induced by climate change and other forms of social and economic instability is on the rise.

Regional Differences

Latin America and the Caribbean

The effects of climate change are expected to vary widely across Latin America and the Caribbean. Decreasing soil humidity because of rising temperatures is likely to transform the Amazon rainforest into savannah, leading to a decrease in the carbon dioxide absorption of the forest. While this trend represents a major blow to global efforts to combat climate change, it may also create new farmlands in South America. However, with all land in adjacent regions growing more arid, the productivity of cattle farming is also likely to decrease alongside declining soil productivity.[100] Meanwhile, sea level rise and a greater frequency of severe hurricanes will affect the countries in Central and South America that border the Caribbean Sea. These forces will bring increased flooding and salinization of the soil, with implications for agriculture.

While some of these effects are predicted with relative surety, their precise impact on the availability and productivity of agricultural land – and their consequent impact on the labor market in the primary sector – is difficult to anticipate. The Intergovernmental Panel on Climate Change offers a very wide range of possible net impact – finding that South America could lose between 1 percent and 21 percent of its arable land due to climate change and population growth.[101] There is also a significant chance that climate change will reduce agricultural productivity in some regions but lead to opportunities elsewhere. For example, there may be opportunities such as increasing rice yield in several countries and higher potential for fishing in the southernmost South American waters as a result of warming temperatures.[102] Tourism, a major source of employment in much of Latin America and the Caribbean, may alsobe severely impacted by climate change, as the prospect of coral reef bleaching events grows more likely toward the middle of the century.

As compared to countries in other regions, labor markets in Latin America and the Caribbean are relatively well positioned to withstand a global energy transition away from fossil fuels. In order to understand country stakes in global climate negotiations, Buys et al[103] constructed an "employment vulnerability index" (EVI) for a sample of countries. The EVI is essentially a function of how carbon-intensive a country's most employment-rich sectors are. LAC countries score lower on this index than many other countries in the Global South, meaning their labor markets are less carbon-intensive (see **Table 1**).[104] This lower vulnerability may prove influential as countries in the region plan their energy transitions.

South and Southeast Asia

The agricultural sectors of South and Southeast Asia are among the most vulnerable to climate change. Particularly in India, climate change will produce enormous variation in mean rainfall, with some parts of the country growing much drier (average annual rainfall dropping by over 40

Table 1

Employment Vulnerability Index

Latin American Countries	
Nicaragua	23
Ecuador	23
Trinidad and Tobago	18
Guatemala	16
Colombia	15
Peru	11
Brazil	9
Mexico	9
Dominican Republic	9
Panama	8
Argentina	5
Costa Rica	4
LAC regional average	*12.5*

Non-LAC Global South Countries	
Tanzania	100
India	43
Zimbabwe	43
China	29
Togo	27
Iran	26
Congo	24
Yemen	20
Oman	17
Egypt	17
Ethiopia	12
Philippines	11
Non-LAC Global South Country Average	30.8

Note: Table 1 figures are taken from Table 5 in Buys et al (2009).

percent by 2080, as compared to average levels in 2000) and other regions growing much wetter (average annual rainfall rising by over 30 percent by 2080).[105] The adaptation methods particularly relevant for South Asian agriculture include: increasing the organic matter in soil, improving cropland management, use of a diversity of local crops, improving livestock management, utilizing a mixed crop–livestock system, improving grazing land management, and preventing and reversing soil erosion.[106]

Disruptions to agriculture will be less severe in Southeast Asia, but lower-income economies will be affected the most: the Philippines, Indonesia, Thailand and Vietnam.[107] One of the specific threats to Southeast Asia is that some of the most severe impacts of climate change will be felt in rice-growing regions – through droughts, submergence, and sea-level rise (and associated salination). The Asian Development Bank predicts that, without adaptation measures, these countries will witness, on average, 50 percent drop in their rice yields.[108] The Philippines,

where 12 million people depend on rice for their livelihood, will be the worst affected.[109]

It is evident that interventions are not universally applicable and must be tailored to accommodate regional differences. As compared to Latin America, Southeast Asian regions host a much larger concentration of smallholder farmers in their agriculture sectors. This implies that adapting the agricultural sector to climate change requires a whole-of-government approach to reach households engaged in cultivation and livestock-rearing, as opposed to an approach more targeted to large agricultural firms.

Across South and Southeast Asia, reliance on coal energy remains a significant challenge when it comes to adopting a cleaner growth pathway. Countries in the region have been reluctant to rapidly shift away from utilizing coal to meet energy demand, which has been growing by 4.7 percent annually.[110] In Southeast Asia, the contribution of renewable energy to overall energy production in fact fell slightly between 1995 to 2015 (from 18% to 17%).[111] India, Indonesia, and Vietnam are especially dependent on coal. The number of people employed directly and indirectly in the coal industry also helps to explain the structural challenge of a faster energy transition. In India alone, 1.2 million people are dependent on the coal industry.[112] Nevertheless, countries in these regions are on track to add millions of jobs in renewable energy. IRENA estimates that renewable energy sectors will employ 1.7 million in countries of the Association of Southeast Asian Nations (ASEAN) by 2030, based on current policies, and 2.2 million with more ambitious deployment of renewable energy investments.[113] In India, researchers estimate that solar and wind energy investments could create 3.4 million short- and long-term jobs by 2030.[114]

Sub-Saharan Africa

As in South and Southeast Asia, the prevalence of smallholder farmers in Sub-Saharan Africa makes the region especially vulnerable to climate change. Predictions suggest that East Africa will experience wetter weather, Southeast Africa will become drier, and rainfall will become more unpredictable in West Africa. Overall, crop yields could decline by 10 to 20 percent in much of Sub-Saharan Africa, and by as much as 50 percent in West Africa.[115] These figures must also be viewed in light of the fact that Sub-Saharan Africa already hosts a high density of people who face instability in their livelihoods as a result of variable weather and climate patterns. Two-thirds of Africans are dependent on rain-fed agriculture; climate change enhances the variability and unpredictability of rainfall and will only exacerbate the inherent insecurity of these livelihoods.[116]

Climate change adaptation has been relatively slow among smallholder farmers. For example, one study in Kenya found that only 19 percent of farmers had deployed any adaptation strategies.[117] Researchers have identified several barriers to adaptation to climate change: financial (*e.g.* lack of credit to finance new technological investments), biophysical (*e.g.* lack of water resources to diversify crops), and informational (*e.g.* limited information on new farming techniques or alternative crops). Institutional barriers also play an important role. Insecure

land tenure may preclude farmers from making new investments in their land or from accessing government support for adaptation measures. In other cases, corruption and elite capture may mean that programs to support adaptation do not reach the most vulnerable.[118]

Meanwhile, when it comes to the imperative of developing a greener economy, Sub-Saharan Africa is expanding its energy grid at an opportune time, as the cost of renewable energies such as solar falls rapidly. In addition, research shows that investments in renewable energy would generate more employment than investment in traditional fossil fuels. As renewable energy costs continue to decline, new scenarios may be created for some Sub-Saharan African countries where renewables are the obvious policy choice – they are cheaper, more environmentally friendly, and more job-rich than alternatives.[119]

Middle East & North Africa

While many different regions around the world, especially those in the Global South, will see an increased risk of drought as climate change's impacts advance, the Middle East and North Africa is poised to face some of the most severe water stress. Temperature increases in most of the region will surpass global averages, with summer warming particularly severe along the Mediterranean coast. Drier conditions will accompany these increasing temperatures. The only countries in the region that could experience higher rainfall under the conditions of climate change are Oman and Yemen.

Although MENA's labor markets are less reliant on agriculture as compared to those of Sub-Saharan Africa and South Asia, many of the region's poorer countries remain significantly dependent on agriculture, of which 70 percent is rain-fed.[120] For example, a third of Morocco's workforce is engaged primarily in agriculture.[121] Warmer and drier conditions are expected to reduce agricultural yields by 30 percent, as water discharge drops by 15 to 45 percent.[122] Livestock rearing, which is important to rural livelihoods in much of MENA, will also be significantly impacted by climatic changes – as evidenced by the major losses of livestock (up to 85%) that herdsmen suffered in northeastern Syria due to recurring droughts between 2005 and 2010.[123]

In a region that already faces various forms of political instability, climate change is thought to be a "threat multiplier" that will reinforce pre-existing and chronic development challenges. Researchers have found that the MENA region is particularly vulnerable to climate change-induced migration and conflict. Migration may be propelled, in particular, by water scarcity[124] and sea-level rise.[125] In a region in which unemployment, even among the highly educated, is already a grave concern, the political ramifications of climate change could worsen prospects for economic stability and job creation.[126]

When it comes to confronting the green energy transition, MENA is faced with both challenges and opportunity. On the one hand, the regional economy is highly dependent on fossil fuels, especially oil, and the global effort to transition away from these energy sources could have

negative long-term consequences for regional labor markets, in addition to limiting the fiscal space that governments have for the delivery of social protection and investment in education and training. At the same time, however, the region is ripe for investment in renewable energy. MENA's geography and climatic conditions are particularly well suited to wind and solar. Already, countries that are less oil-rich have invested heavily in solar; for example, a third of Morocco's power already comes from renewables.[127] Job creation potential is significant; researchers have estimated that if the region were to pursue an aggressive climate policy of reaching 60 percent renewable energy by 2050, it could create 155,000 direct jobs and another 115,000 indirect jobs.[128]

Recommendations for Research and Policy Action

1. Making "Climate Smart Agriculture" equitable and scalable

The theory underlying "Climate Smart Agriculture" (CSA) is that agricultural policies in the Global South can simultaneously strengthen farmers' ability to withstand climate shocks, increase agricultural productivity, and reduce the emissions generated by the agriculture sector. This framework would benefit from a stronger emphasis on employment conditions within the agriculture sector and an enhanced focus on equity. For the CSA framework to be just, productivity growth in the agriculture sector must benefit workers across agricultural supply chains. Women workers, for example, are systematically relegated to the lowest wage work within agriculture, even as most agriculture sectors grow increasingly feminized in the Global South.

Second, Climate Smart Agriculture is still too vague a framework to be useful to governments in developing climate-sensitive agriculture policies, as many researchers have noted. For the concept to be useful, scalable policy solutions that meet its guiding principles must be identified and evaluated by the policy research community. To the extent that achieving the "triple win" of CSA is not feasible in many situations, governments need more guidance from the policy research community on the relative benefits of different solutions, the tradeoffs involved, and how to ensure that the burdens of imperfect solutions are not borne disproportionately by groups marginalized within current agricultural labor markets, like women and the poor.

2. Community-based and gender-sensitive models of climate adaptation in agriculture

While some interventions to make agriculture more resilient and productive may come in the form of top-down measures by governments, other adaptation mechanisms may emerge from

community-level responses to climate change. Some of the barriers to climate change adaptation relate to the fact that programs implemented by national governments lack local institutional and cultural buy-in. Documenting community-based strategies and understanding their potential applicability to other contexts in the Global South would be major contributions by the research community.

Another major challenge in implementing models of adaptation in agriculture relates to the role of women. Evidence shows that women often face the most significant barriers to adaptation – especially due to their poor access to credit, land, forests, and other natural resources. Programs to address climate change in agriculture often exclude women in various ways due to existing social and cultural barriers to women's participation.[129] These findings suggest that models of climate adaptation in agriculture need to attend to the specific needs of women.

3. Models for origin and destination social protection agreements

Climate change is likely to result in significant growth in migration volumes, both between and within countries. Climate migrants will be motivated more by "push" than "pull" factors – fleeing environmental crises, as opposed to migrating to opportunity, implying that their access to social protection systems will be critically important. While there is great uncertainty surrounding the drivers, levels, and directions of climate migration, migration tends to increase along existing pathways. This suggests that origin and destination governments along current migration routes should step up their collaboration in anticipation of increased flows.

What might this collaboration on social protection look like? Researchers should explore various models and evaluate their effectiveness, but the essential principle is one of cost- and data-sharing. In this model, governments at origin and destination develop a system to ensure that whatever social welfare programs are available to the migrant in her origin location are also available at destination. It also involves ensuring that the migrant and her family have access to all the same public goods – such as education and health care – that are available to the destination's native population. These social protection collaboration agreements must be responsive and flexible – for example, with automatic enrollment – to accommodate the uncertainty associated with climate migration flows. Importantly, they need to be negotiated between national governments but also between state and local governments in countries like India, where implementation of social programs is decentralized. Contemporary technologies and the digitalization of program delivery, already underway in many Global South countries, will aid the portability of social protection.

4. Pacing the energy transition and ensuring sustainable employment in renewables

The job creation potential of renewable energy is frequently touted in policy discussions about the green economy and a just transition. However, a challenge emerges when considering the nature of this employment: most comes in the form of short-term employment in construction

activities. A much smaller share of renewable energy jobs is created by ongoing activities such as maintenance and operations. Moreover, much of the skilled workforce necessary for building and maintaining renewable energy infrastructure needs to be built through targeted investments in skills training.

In this context, policy thinking around the labor market implications of energy transition needs to be deeper. Governments must build workforce development into their plans to build energy infrastructure, and they need to prioritize the creation of sustainable employment, rather than relying solely on short-term labor. This could mean, for example, creating a mobile cadre of workers skilled in construction that can manage the building of renewable energy infrastructure across different locations within a country as these projects are being constructed over the next few decades. Alternatively, governments and training providers could create employment pathways through which the same workers employed in construction activities are trained to work in maintenance and operations – though it must be kept in mind that far more labor is required for construction than the subsequent activities. In all cases, the workforce development and job creation around renewable energy must prioritize access for women and other groups marginalized in current labor markets.

5. Policy frameworks for managing job displacement in the energy transition

If governments in the Global South are to find the political will to expedite their transition away from fossil fuels, they will need more carefully-designed policy frameworks aimed at managing the inevitable displacement of workers. This is especially true in countries like Tanzania, India, and Nigeria, where the existing labor market is heavily dependent, directly or indirectly, on fossil fuels. The familiar talking point in climate dialogues – that these workers can simply be retrained to work in renewable energy sectors – is too simplistic to be a useful policy position for most governments. For one, many of those dependent on fossil fuel industries are in the later stages of their working lives, when retraining is more difficult. Second, the geography of renewable energy investments frequently does not align with the geography of fossil fuel industries. The expectation that fossil fuel workers will move to new opportunities ignores the many migration barriers that many workers and households face.

In light of this, the research community can support a more robust examination of the labor market, social protection, and migration policies necessary to ensure that workers and households whose livelihoods depend on coal, oil, and other polluting industries are provided with realistic pathways toward economic stability in a greener economy. When governments are given practical ways of protecting these workers – beyond the "retrain them" refrain – they will be more likely to implement bold energy transition policies.

Endnotes

1 The New Climate Economy. (2018). *Unlocking the Inclusive Growth Story of the 21st Century: Accelerating Climate Action in Urgent Times*. The New Climate Economy.

2 International Labour Organization. (2021). Employment in Agriculture (% of total employment) Modeled ILO Estimate. *ILOSTAT Database*.

3 Corfee-Morlot, J., Westphal, M., & Spiegel, R. (2019). *4 Ways to Shift from Fossil Fuels to Clean Energy* (Insights). World Resources Institute.

4 U.S. Energy Information Administration. (2022). *Energy and the Environment Explained: Where Greenhouse Gasses Come From*. (Washington, D.C.).

5 Armstrong, C. (2019). Decarbonization and World Poverty: A Just Transition for Fossil Fuel Exporting Countries? *Political Studies*, *68*(3), 671–688.

6 International Institute for Sustainable Development. (2018). *Real People, Real Change. Strategies for Just Energy Transitions*. (Winnipeg, Manitoba).

7 International Energy Agency. (2021). *Global Energy Review: CO2 Emissions in 2021: Global Emissions Rebound Sharply to Highest Ever Level*. www.iea.org.

8 The New Climate Economy. (2018). *Unlocking the Inclusive Growth Story of the 21st Century: Accelerating Climate Action in Urgent Times*. The New Climate Economy.

9 Ibid.

10 Corfee-Morlot, J., Westphal, M., & Spiegel, R. (2019). *4 Ways to Shift from Fossil Fuels to Clean Energy* (Insights). World Resources Institute.

11 The New Climate Economy. (2018). *Unlocking the Inclusive Growth Story of the 21st Century: Accelerating Climate Action in Urgent Times*. The New Climate Economy.

12 Ibid.

13 Ferroukhi, R., Frankl, P., & Lins, C. (2018). *Renewable Energy Policies in a Time of Transition*. International Renewable Energy Agency, International Energy Agency, Renewable Energy Policy Network for the 21st Century

14 The World Bank. (2021). *Adaptation and Resilience: A Priority for Development and Poverty Reduction* (COP26 Climate Brief). The World Bank.

15 Hallegatte, S., Rentschler, J., & Rozenberg, J. (2019). *Lifelines: The Resilient Infrastructure Opportunity*. World Bank.

16 Ibid.

17 International Labour Organization. (2019). *Skills for a Greener Future: A Global View Based on 32 Country Studies* (ILO Global Report). International Labour Organization.

18 International Energy Agency. (2021). *Net Zero by 2050: A Roadmap for the Global Energy Sector.* International Energy Agency.

19 Ram, M., Osorio-Aravena, J., Aghahosseini, A., Bogdanov, D., & Breyer, C. (2021). Job Creation During a Climate Compliant Global Energy Transition Across the Power, Heat, Transport, and Desalination Sectors by 2050. *Energy, 238*, 1-11. https://doi.org/10.1016/j.energy.2021.121690

20 International Labour Organization. (2011). *Investment in Renewable Energy Generates Jobs. Supply of Skilled Workforce Needs to Keep Up*. International Labour Organization.

21 Ibid.

22 Ibid.

23 Ibid.

24 International Labour Organization. (2019). *Skills for a Greener Future: A Global View Based on 32 Country Studies* (ILO Global Report). International Labour Organization.

25 Trivedi, A., Walls, G., & Spiegel, R. (2019). *Will Women Build the Sustainable Infrastructure of the Future?* (Insights). World Resources Institute.

26 Ibid.

27 International Labour Organization. (2019). *Skills for a Greener Future: A Global View Based on 32 Country Studies* (ILO Global Report). International Labour Organization.

28 Ibid.

29 Ibid.

30 Masterson, V. (2022). *Upskill for Green Jobs of the Future*. World Economic Forum (Geneva).

31 International Labour Organization. (2019). *Skills for a Greener Future: A Global View Based on 32 Country Studies* (ILO Global Report). International Labour Organization.

32 Ibid.

33 Ibid.

34 The New Climate Economy. (2018). *Unlocking the Inclusive Growth Story of the 21st Century: Accelerating Climate Action in Urgent Times*. The New Climate Economy.

35 Gass, P., Gerasimchuk, I., Suharsono, A., Moerenhout, T., Oharenko, Y., Zinecker, A., & Purva, J. (2018). *Real People, Real Change. Strategies for Just Energy Transitions*. International Institute for Sustainable Development.

36 Ibid.

37 Ibid.

38 United Nations Framework Convention on Climate Change. (2021). *Just Transition of the Workforce and the Creation of Decent Work and Quality Jobs*. United Nations (New York, NY).

39 Gass, P., Gerasimchuk, I., Suharsono, A., Moerenhout, T., Oharenko, Y., Zinecker, A., & Purva, J. (2018). *Real People, Real Change. Strategies for Just Energy Transitions*. International Institute for Sustainable Development.

40 Ibid.

41 Ibid.

42 Ibid.

43 International Labour Organization. (2011). *Investment in Renewable Energy Generates Jobs. Supply of Skilled Workforce Needs to Keep Up*. International Labour Organization.

44 The New Climate Economy. (2018). *Unlocking the Inclusive Growth Story of the 21st Century: Accelerating Climate Action in Urgent Times*. The New Climate Economy.

45 Armstrong, C. (2019). Decarbonization and World Poverty: A Just Transition for Fossil Fuel Exporting Countries? *Political Studies*, *68*(3), 671–688.

46 Armstrong, C. (2019). Decarbonization and World Poverty: A Just Transition for Fossil Fuel Exporting Countries? *Political Studies*, *68*(3), 671–688.

47 Gass, P., Gerasimchuk, I., Suharsono, A., Moerenhout, T., Oharenko, Y., Zinecker, A., & Purva, J. (2018). *Real People, Real Change. Strategies for Just Energy Transitions*. International Institute for Sustainable Development.

48 Schaffartzik, A., & Fischer-Kowalski, M. (2018). Latecomers to the Fossil Energy Transition, Frontrunners for Change? The Relevance of the Energy 'Underdogs' for Sustainability Transformations. Sustainability. *Sustainability*, *10*(8), 2650. https://doi.org/10.3390/su10082650

49 The New Climate Economy. (2018). *Unlocking the Inclusive Growth Story of the 21st Century: Accelerating Climate Action in Urgent Times*. The New Climate Economy.

50 Ibid.

51 Ibid.

52 Gass, P., Gerasimchuk, I., Suharsono, A., Moerenhout, T., Oharenko, Y., Zinecker, A., & Purva, J. (2018). *Real People, Real Change. Strategies for Just Energy Transitions*. International Institute for Sustainable Development.

53 World Resources Institute. (2021). Egypt: Transitioning Away from Subsidizing Fossil Fuels. World Re-

sources Institute (Washington, D.C.).

54 Gass, P., Gerasimchuk, I., Suharsono, A., Moerenhout, T., Oharenko, Y., Zinecker, A., & Purva, J. (2018). *Real People, Real Change. Strategies for Just Energy Transitions*. International Institute for Sustainable Development.

55 Ibid.

56 International Labour Organization. (2011). *Investment in Renewable Energy Generates Jobs. Supply of Skilled Workforce Needs to Keep Up*. International Labour Organization.

57 Gass, P., Gerasimchuk, I., Suharsono, A., Moerenhout, T., Oharenko, Y., Zinecker, A., & Purva, J. (2018). *Real People, Real Change. Strategies for Just Energy Transitions*. International Institute for Sustainable Development.

58 International Labour Organization. (2011). *Investment in Renewable Energy Generates Jobs. Supply of Skilled Workforce Needs to Keep Up*. International Labour Organization.

59 International Labour Organization. (2014a). *Agriculture; Plantations; Other Rural Sectors*.

60 Morton, J. (2007). The Impact of Climate Change on Smallholder and Subsistence Agriculture. *Proceedings of the National Academy of Sciences of the United States of America*, *104*(50), 19680–19685. https://doi.org/10.1073/pnas.0701855104

61 The World Bank. (2021). *Adaptation and Resilience: A Priority for Development and Poverty Reduction* (COP26 Climate Brief). The World Bank.

62 Morton, J. (2007). The Impact of Climate Change on Smallholder and Subsistence Agriculture. *Proceedings of the National Academy of Sciences of the United States of America*, *104*(50), 19680–19685. https://doi.org/10.1073/pnas.0701855104

63 Ibid.

64 Sharma, S., & Shivakoti, G. (2017). Chapter 16—En Route to Effective Management of Natural Resources for Conservation and Livelihood Advances in Central Vietnam. In *Redefining Diversity & Dynamics of Natural Resources Management in Asia, Volume 3* (Vol. 3, pp. 237–248). Elsevier. https://doi.org/10.1016/B978-0-12-805452-9.00016-3

65 Morton, J. (2007). The Impact of Climate Change on Smallholder and Subsistence Agriculture. *Proceedings of the National Academy of Sciences of the United States of America*, *104*(50), 19680–19685. https://doi.org/10.1073/pnas.0701855104

66 Ortega, D., & Tschirley, D. (2017). Demand for Food Safety in Emerging and Developing Countries: A Research Agenda for Asia and Sub-Saharan Africa. *Journal of Agribusiness in Developing and Emerging Economies*, *7*(1), 21–34. https://doi.org/10.1108/JADEE-12-2014-0045

67 Unnevehr, L. (2015). Food Safety in Developing Countries: Moving Beyond Exports. *Global Food Security*, *4*, 24–29. https://doi.org/10.1016/j.gfs.2014.12.001

68 Organisation for Economic Cooperation and Development. (2020). *The Impact of COVID-19 on Agricultural Markets and GHG Emissions* (pp. 1–14). Organisation for Economic Cooperation and Development.

69 Morton, J. (2007). The Impact of Climate Change on Smallholder and Subsistence Agriculture. *Proceedings of the National Academy of Sciences of the United States of America*, *104*(50), 19680–19685. https://doi.org/10.1073/pnas.0701855104

70 Cervantes-Godoy, D., & Dewbre, J. (2010). Economic Importance of Agriculture for Poverty Reduction. *OECD Food, Agriculture and Fisheries Working Papers*, *23*, 1–27. https://doi.org/10.1787/5kmm9s20944-en

71 The World Bank. (2021). *Adaptation and Resilience: A Priority for Development and Poverty Reduction* (COP26 Climate Brief). The World Bank.

72 Morton, J. (2007). The Impact of Climate Change on Smallholder and Subsistence Agriculture. *Proceedings of the National Academy of Sciences of the United States of America*, *104*(50), 19680–19685. https://doi.org/10.1073/pnas.0701855104

73 Mortimore, M., & Adams, W. (2001). Farmer Adaptation, Change and 'Crisis' in the Sahel. *Global Environmental Change*, *11*(1), 49–57. https://doi.org/10.1016/S0959-3780(00)00044-3

74 Swearingen, W., & Bencherifa, A. (2000). An Assessment of the Drought Hazard in Morocco. In *Drought: A Global Assessment* (Vol. 1, pp. 279–286). Routledge.

75 Moench, M., & Dixit, A. (2004). *Adaptive Capacity and Livelihood Resilience: Adaptive Strategies for Respond-*

ing to Floods and Droughts in South Asia (pp. 1–83). Institute for Social and Environmental Transition.

76 Morton, J. (2006). Pastoralist Coping Strategies and Emergency Livestock Market Intervention. In *Pastoral Livestock Marketing in Eastern Africa: Research and Policy Challenges* (pp. 227–246). Intermediate Technology Publications Ltd.

77 Mortimore, M., & Adams, W. (2001). Farmer Adaptation, Change and 'Crisis' in the Sahel. *Global Environmental Change*, *11*(1), 49–57. https://doi.org/10.1016/S0959-3780(00)00044-3

78 Eakin, H. (2003). The Social Vulnerability of Irrigated Vegetable Farming Households in Central Puebla. *The Journal of Environment & Development*, *12*(4), 414–429. https://doi.org/10.1177/1070496503257733

79 Morton, J. (2006). Pastoralist Coping Strategies and Emergency Livestock Market Intervention. In *Pastoral Livestock Marketing in Eastern Africa: Research and Policy Challenges* (pp. 227–246). Intermediate Technology Publications Ltd.

80 Pratap, R. (2022, February 2). *Sheeba Sen: Lawyer-Turned-Conservationist Creating Income-Generating Forests for Local Communities*.

81 Morton, J. (2006). Pastoralist Coping Strategies and Emergency Livestock Market Intervention. In *Pastoral Livestock Marketing in Eastern Africa: Research and Policy Challenges* (pp. 227–246). Intermediate Technology Publications Ltd.

82 The World Bank. (2021). *Adaptation and Resilience: A Priority for Development and Poverty Reduction* (COP26 Climate Brief). The World Bank.

83 Taylor, M. (2017). Climate-Smart Agriculture: What is it Good For? *Journal of Peasant Studies*, *45*(1), 1–24. https://doi.org/10.1080/03066150.2017.1312355

84 Ibid.

85 Food and Agriculture Organization of the United Nations. (2017). *Migration, Agriculture and Climate Change: Reducing Vulnerabilities and Enhancing Resilience* (pp. 1–18).

86 Clement, V., Rigaud, K. K., de Sherbinin, A., Jones, B., Adamo, S., Schewe, J., Sadiq, N., & Shabahat, E. (2021). *Groundswell Part 2: Acting on Internal Climate Migration*. The World Bank.

87 International Labour Organization. (2021b). *Impact of COVID-19 on Nexus Between Climate Change and Labour Migration in Selected South Asian Countries: An Exploratory Study* (pp. 1–37). International Labour Organization.

88 Gray, C., & Wise, E. (2016). Country-Specific Effects of Climate Variability on Human Migration. *Climatic Change*, *135*, 555–568. https://doi.org/10.1007/s10584-015-1592-y

89 Thiede, B., Gray, C., & Mueller, V. (2016). Climate Variability and Inter-Provincial Migration in South America, 1970–2011. *Global Environmental Change*, *41*, 228-240. https://doi.org/10.1016/j.gloenvcha.2016.10.005

90 Gray, C., Hopping, D., & Mueller, V. (2020). The Changing Climate-Migration Relationship in China, 1989–2011. *Climatic Change*, *160*(1), 103–122. https://doi.org/10.1007/s10584-020-02657-x

91 Bell, M., Blake, M., Boyle, P., Duke-Williams, O., Rees, P., Stillwell, J., & Hugo, G. (2002). Cross-National Comparison of Internal Migration: Issues and Measures. *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, *165*(3), 435–464. https://doi.org/10.1111/1467-985X.t01-1-00247

92 Bonaccorsi, G., Pierri, F., Cinelli, M., Flori, A., Galeazzi, A., Porcelli, F., Schmidt, A. L., Valensise, C. M., Scala, A., Quattrociocchi, W., & Pammolli, F. (2020). Economic and Social Consequences of Human Mobility Restrictions Under COVID-19. *Proceedings of the National Academy of Sciences of the United States of America*, *117*(27), 15530–15535.

93 Li, X., Xu, H., Huang, X., Guo, C. A., Kang, Y., & Ye, X. (2021). Emerging Geo-Data Sources to Reveal Human Mobility Dynamics During COVID-19 Pandemic: Opportunities and Challenges. *Computational Urban Science*, *1*(1), 22.

94 Randolph, G. F., Storper, Michael,. (2022). Is Urbanisation in the Global South Fundamentally Different? Comparative Global Urban Analysis for the 21st Century. *Urban Studies Urban Studies*, 004209802110679.

95 Gelb, A., & Mukherjee, A. (2020, June 5). *COVID-19 Response Underlines the Need for Portable Social Protection Programs*.

96 Centre for Policy Research, & UNICEF. (2021). *Improving Social Protection Portability for Migration-Affected Children: Spotlight on Chhattisgarh* (pp. 1–8). Centre

for Policy Research & UNICEF.

97 Taha, N., Siegmann, K. A., & Messkoub, M. (2015). How Portable is Social Security for Migrant Workers? A Review of the Literature. *International Social Security Review.*, *68*(1), 95–118.

98 Centre for Policy Research, & UNICEF. (2021). *Improving Social Protection Portability for Migration-Affected Children: Spotlight on Chhattisgarh* (pp. 1–8). Centre for Policy Research & UNICEF.

99 UN Women. (2022). *GCM Objective 22: Establish Mechanisms for the Portability of Social Security Entitlements and Earned Benefits*.

100 Jat, M. L., Dagar, J. C., Sapkota, T. B., Govaerts, B., Ridaura, S. L., Saharawat, Y. S., Sharma, R.K., Tetarwal, J. P., Jat, R. K., Hobbs, H. & Stirling, C. (2016). Climate Change and Agriculture: Adaptation Strategies and Mitigation Opportunities for Food Security in South Asia and Latin America. *Advances in Agronomy*, *137*, 127-235.

101 Ibid.

102 Reyer, C. P., Adams, S., Albrecht, T., Baarsch, F., Boit, A., Trujillo, N.C., Cartsburg, M., Coumou, D., Eden, A., Fernandes, E., Langerwisch, F., Marcus, R., Mengel, M., Mira-Salama, D., Perette, M., Pereznieto, P., Rammig, A., Reinhardt, J., Robinson, A., Rocha, M., Sakschewski, B., Schaeffer, M., Schleussner, C.F., Serdeczny, O. & Thonicke, K. (2017). Climate change impacts in Latin America and the Caribbean and their implications for development. *Regional Environmental Change*, *17*(6), 1601-1621.

103 Buys, P., Deichmann, U., Meisner, C., That, T. T., & Wheeler, D. (2009). Country stakes in climate change negotiations: Two dimensions of vulnerability. *Climate Policy*, *9*(3), 288-305.

104 Ibid.

105 Ahmed, M., & Suphachalasai, S. (2014). *Assessing the Costs of Climate Change and Adaptation in South Asia*. Asian Development Bank.

106 Aryal, J. P., Sapkota, T. B., Khurana, R., Khatri-Chhetri, A., Rahut, D. B., & Jat, M. L. (2020). Climate Change and Agriculture in South Asia: Adaptation Options in Smallholder Production Systems. *Environment, Development and Sustainability*, *22*(6), 5045-5075.

107 Zhai, F., & Zhuang, J. (2012). Agricultural Impact of Climate Change: A General Equilibrium Analysis with Special Reference to Southeast Asia. *Climate Change in Asia and the Pacific: How Can Countries Adapt*, 17-35.

108 Redfern, S. K., Azzu, N., & Binamira, J. S. (2012). Rice in Southeast Asia: Facing Risks and Vulnerabilities to Respond to Climate Change. *Build Resilience Adapt Climate Change Agri Sector*, *23*(295), 1-14.

109 Ibid.

110 International Renewable Energy Agency. (2018). Renewable Energy Market Analysis: Southeast Asia. IRENA, Abu Dhabi. Available at: https://www.irena.org/publications/2018/Jan/Renewable-Energy-Market-Analysis-Southeast-Asia

111 Ibid.

112 Lahiri-Dutt, K. (2016). The Diverse Worlds of Coal in India: Energising the Nation, Energising Livelihoods. *Energy Policy*, *99*, 203-213.

113 International Renewable Energy Agency. (2018). *Renewable Energy Market Analysis: Southeast Asia*. IRENA, Abu Dhabi. Available at: https://www.irena.org/publications/2018/Jan/Renewable-Energy-Market-Analysis-Southeast-Asia

114 Tyagi, Akanksha, Charu Lata, Jessica Korsh, Ankit Nagarwal, Deepak Rai, Sameer Kwatra, Neeraj Kuldeep, and Praveen Saxena. 2021. *India's Expanding Clean Energy Workforce.* New Delhi: Council on Energy, Environment and Water, Natural Resources Defense Council, and Skill Council for Green Jobs.

115 Connolly-Boutin, L., & Smit, B. (2016). Climate Change, Food Security, and Livelihoods in Sub-Saharan Africa. *Regional Environmental Change*, *16*(2), 385-399.

116 Ibid.

117 Bryan, E., Ringler, C., Okoba, B., Roncoli, C., Silvestri, S., & Herrero, M. (2013). Adapting Agriculture to Climate Change in Kenya: Household Strategies and Determinants. *Journal of Environmental Management*, *114*, 26-35.

118 Shackleton, S., Ziervogel, G., Sallu, S., Gill, T., & Tschakert, P. (2015). Why is Socially Just Climate Change Adaptation in Sub-Saharan Africa so Challenging? A review of Barriers Identified from Empir-

ical Cases. *Wiley Interdisciplinary Reviews: Climate Change*, *6*(3), 321-344.

119 Cantore, N., Nussbaumer, P., Wei, M., & Kammen, D. M. (2017). Promoting Renewable Energy and Energy Efficiency in Africa: A Framework to Evaluate Employment Generation and Cost Effectiveness. *Environmental Research Letters*, *12*(3), 035008.

120 Waha, K., Krummenauer, L., Adams, S., Aich, V., Baarsch, F., Coumou, D., Fader, M., Hoff, H., Jobbins, G., Marcus, R., Mengel, M., Otto, I.M., Perrette, M., Rocha, M., Robinson, A. & Schleussner, C. F. (2017). Climate Change Impacts in the Middle East and Northern Africa (MENA) region and their implications for vulnerable population groups. *Regional Environmental Change*, *17*(6), 1623-1638.

121 World Bank Development Indicators (2019). Employment in Agriculture (% of Total Employment) (Modeled ILO Estimate). Available at: https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS

122 Waha, K., Krummenauer, L., Adams, S., Aich, V., Baarsch, F., Coumou, D., Fader, M., Hoff, H., Jobbins, G., Marcus, R., Mengel, M., Otto, I.M., Perrette, M., Rocha, M., Robinson, A. & Schleussner, C. F. (2017). Climate Change Impacts in the Middle East and Northern Africa (MENA) region and their implications for vulnerable population groups. *Regional Environmental Change*, *17*(6), 1623-1638.

123 Ibid.

124 Wodon, Q., Burger, N., Grant, A., Joseph, G., Liverani, A., & Tkacheva, O. (2014). Climate Change, Extreme Weather Events, and Migration: Review of the Literature for Five Arab Countries. *People on the Move in a Changing Climate*, 111-134.

125 Kumetat, D. (2012). Climate Change on the Arabian Peninsula–Regional Security, Sustainability Strategies, and Research Needs. In *Climate Change, Human Security and Violent Conflict,* 373-386. Springer, Berlin, Heidelberg.

126 Ibid.

127 The Economist Magazine. (2020). Arab States Are Embracing Solar Power. *The Economist*. https://www.economist.com/middle-east-and-africa/2020/05/07/arab-states-are-embracing-solar-power

128 Van der Zwaan, B., Cameron, L., & Kober, T. (2013). Potential for Renewable Energy Jobs in the Middle East. *Energy Policy*, *60*, 296-304.

129 Shackleton, S., Ziervogel, G., Sallu, S., Gill, T., & Tschakert, P. (2015). Why is Socially Just Climate Change Adaptation in Sub-Saharan Africa so Challenging? A review of Barriers Identified from Empirical Cases. *Wiley Interdisciplinary Reviews: Climate Change*, *6*(3), 321-344.

JustJobs

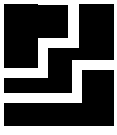
WORKING FOR SHARED PROSPERITY

JustJobs Network is an applied research institute finding evidence-based solutions to one of the most pressing challenges of our time: How to create more and better jobs worldwide. We produce research on good job creation and workforce development, focusing our work on the critical knowledge gaps in the employment landscape.

JJN convenes a network of diverse stakeholders — including policy shapers, private sector players, academics, and grassroots leaders — to deepen the practical implications of our research and amplify its impact. Through the combination of cutting-edge research and global knowledge sharing, we aim to forge a fresh, dynamic channel for policy dialogue and instigate practical change to improve employment opportunities and outcomes for more people. Our team members are based in New Delhi and Washington, D.C.

For more information visit **www.justjobsnetwork.org** or write to us at **info@justjobsnetwork.org**

Report design by



Whitespace35
www.whitespace35.com
venkatesh@whitespace35.com
+91 97414 51309