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Climate Change and Natural Disasters Survey Module

The Pacific Community (SPC)

Statistics for Development Division (SDD)

Statistical Innovation and Capacity Building in the Pacific Islands Project (PACSTAT)

Literature Review

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Table of Contents

| Acronyms and abbreviationsiii |
|---|
| Acknowledgementsiv |
| I. Introduction |
| II. Background: The PACSTAT Project6 |
| 1. Characteristics of Climate Change and Natural Disasters in the Pacific Islands Countries and Territories9 |
| 1.1.Observed and projected trends in climate change risks for PICTs9 |
| 1.2. Observed and projected trends of the impact of climate change on households in PICTs10 |
| 1.3.Adaptation and resilience of households in the PICTs16 |
| 2. Collecting climate change data through household surveys |
| 2.1. The Global Consultation on the Global Set of Climate Change Statistics (UNSD) |
| 2.2. Population and Housing Censuses including environmental and climate change-related data |
| 2.3. Agricultural Censuses including climate change-related data21 |
| 2.4. Household surveys including climate change-related data25 |
| 2.4.1. The Living Standards Measurement Study – Integrated Surveys on Agriculture (LSMS-ISA) and its nexus with climate change data |
| 2.4.2. Climate change modules included in the national socio-economic surveys in forestry |
| 2.4.3. The 50x2030 Initiative |
| 2.5. Examples of climate change national household surveys |
| 2.5.1. The climate change household surveys in Bangladesh and Nepal |
| 2.5.2. Analysis of the questionnaires |
| 3. Recommendations for designing a Climate Change and Disaster Survey Module: preliminary conclusions and way forward |
| References |
| Annex 1. Climate hazard-based impacts on root crop production in Fiji46 |
| Annex 2. Climate hazard-based impacts on coffee production in Papua New Guinea |
| Annex 3. Climate change projections to inform the vulnerability of black pearl production in the Cook Islands |

Acronyms and abbreviations

| FAO | Food and Agriculture Organization of the United Nations |
|---------|---|
| FDES | Framework for the Development of Environment Statistics |
| GHG | Greenhouse gases |
| IPCC | Intergovernmental Panel of Experts of Climate Change |
| NAPs | National Adaptation Plans |
| NCCIS | National Climate Change Impact Survey |
| PACSTAT | Statistical Innovation and Capacity Building in the Pacific |
| PICs | Pacific Island Countries |
| PSMB | Pacific Statistics Methods Board |
| SDD | Statistics for Development Division |
| SIDS | Pacific Small Island Developing States |
| SLM | Sustainable Land Management |
| SPC | The Pacific Community |
| TYPSS | Ten-Year Pacific Statistics Strategy |
| UNECE | The United Nations Economic Commission for Europe |
| UNFCCC | The United Nations Framework Convention on Climate Change |
| UNSD | United Nations Statistics Division |
| WB | The Word Bank |

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I. Introduction

With a population of above 12.8 million in the Pacific Island Countries (PICTs) in 2019¹, the tangible impacts of extreme weather events on food security, nutrition and wellbeing have significantly increased the urgency to address the effects of climate change in the Pacific region.

Climate actions depends on the specific needs and capacities of people and communities in vulnerable situations. To respond to the growing short- and long-term climate challenges, the Pacific Community (SPC) aims to scaleup strategies to support the PICs governments and communities in their climate change actions in a holistic and integrative way, encompassing other critical socio-economic and environmental areas.

Reliable data is critical in informing climate change drivers, vulnerabilities and impacts. The effectiveness of National Adaptation Plans (NAPs), disaster risk reduction plans and other related targets and commitments on mitigation and adaptation measures depend on high-quality data. The Statistical Innovation and Capacity Building in the Pacific (PACSTAT) project, implemented by the Statistics for Development Division (SDD) of the SPC, aims to improve the quality of welfare data collection and accessibility to provide comparable welfare data in the Pacific Island Countries. One component of the PACSTAT project is the development of a Climate Change and Natural Disasters Survey Module. This component aims to strengthen the collection and use of climate change and natural disasters data sourced from population-based censuses and household surveys.

This Literature Review is elaborated as part of the development of the module. The document starts by presenting some climate change trends in the Pacific region and how climate change and natural disasters have been affecting livelihoods, economic sectors, food and water security, health, and stability of the communities in the Pacific Islands (Section 1) over the last years. The second part of the document presents an assessment of available methodologies, census and survey questionnaires that capture the impact of climate change and natural disasters at the household or community level and could be adapted to the Pacific census and survey context. Based on the findings of the previous sections and on an internal discussions held within SPC, the third section proposes methodological recommendations for designing a Climate Change and Disaster Survey Module ("Core Module") - to be included in household survey questionnaires to derive key indicators comparable across countries - and a broader "sourcebook", which can be used either as a "questionnaire bank" – with a bigger set of questions by topic that can be selected by countries based on their needs - or as a stand-alone climate change survey.

¹ Source: Pacific Data Hub <u>PICT Population Projections 2022</u>.

II. Background: The PACSTAT Project

The United Nations Framework Convention on Climate Change (UNFCCC, 1992) stated climate change is a change of climate attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable periods². This phenomenon represents a severe threat to human society and its economy, and consists in increasing mean temperature, altered seasonality, combined heat and drought stress, heavy rain events, water stress, changes in the occurrence of pests and diseases, sea level rise and ocean acidification.

According to the 2022 IPCC report on Climate Change: "Impacts, Adaptation and Vulnerability"³, vulnerability to climate change is more critical in locations with poverty, governance challenges, limited access to essential services and resources, violent conflicts and high levels of climate-sensitive livelihoods. In fact, increasing weather and climate extreme events have exposed millions of people to food insecurity and reduced water security. The economic sectors being more likely climate-exposed are agriculture, forestry and fisheries in global hotspots of high human vulnerability in West, Central and East Africa, South Asia, Central and South America, SIDS and the Arctic.

In addition, as indicated in the IPCC Special Report on the Ocean and Cryosphere⁴, the ocean has warmed since 1970 and has taken up more than 90 per cent of the excess heat in the climate system. Human communities in close connection with coastal environments, SIDS, polar areas and high mountains are principally exposed to ocean and cryosphere change and associated impacts, such as ocean acidification, sea level rise, extreme sea level events, marine heatwaves, shrinking cryosphere and permafrost thaw.

Many marine species have already undergone shifts in geographical range and seasonal variations in their biological cycle in response to ocean warming, sea ice change and biogeochemical changes to their habitats. This has resulted in shifts in species composition, abundance and biomass production of marine ecosystems from the Equator to the Poles. In many tropical regions, declines in fish and shellfish stocks due to direct and indirect effects of global warming and biogeochemical changes have already contributed to reduced fishery catches.

As presented, climate change significantly impacts the SIDS economic backbones, impacting the availability of food and water, the productivity of ecosystems and breeding grounds, reef and fisheries resources, and the effectiveness of natural coastal defenses (SPC, 2022). Based on the IPCC scenarios, the Pacific's high vulnerability could lead to widespread food and water insecurity, increased health risks, lack of access to social services and even forced displacements, in some cases.

To address the challenges of climate change, PICs governments should develop and improve local, national, and international policies that accelerate greenhouse gas mitigation, increase climate adaptation, mobilise new financial resources, and create inclusive, climate-resilient societies. To this aim, lack of data has been one of the most severe constraints preventing the development of informed policies.

Statistical Innovation and Capacity Building in the Pacific (PACSTAT) Project

National Statistics Offices (NSOs) and Agriculture, Forest, Environmental or related ministries and agencies in the Pacific region are central stakeholders in the production, compilation, organisation and dissemination of climate change data and statistics. The Pacific Community (SPC) is the principal scientific and technical organisation supporting development in the Pacific region. The SPC's Statistics for Development Division (SDD) plays a significant role as an extensive and comprehensive technical provider to NSOs. SDD is the main stakeholder in

² UNFCCC. 1992. Available at: https:// unfccc.int/files/essential _background/background _publications_htmlpdf /application/pdf/conveng.pdf. Accessed 26 July 2022.

³ IPCC. 2022. Summary for Policymakers. In: Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.). Cambridge, Cambridge University Press. https://report.ipcc.ch/ar6wg2/pdf/IPCC_AR6_WGII_SummaryForPolicymakers.pdf. Accessed 26 July 2022.

⁴ IPCC. 2019. Summary for Policymakers. In: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate. H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.). https://www.ipcc.ch/site/assets/uploads/sites/3/2019/11/03 SROCC SPM FINAL.pdf. Accessed 26 July 2022.

implementing the <u>Ten-Year Pacific Statistics Strategy (TYPSS</u>) and the Statistical Innovation and Capacity Building in the Pacific (<u>PACSTAT</u>) project.

The PACSTAT project is a World Bank International Development Association (IDA) funded project to be implemented from June 2020 to June 2025. The overall development objective of PACSTAT is to improve the quality of welfare data collection and accessibility to comparable welfare data in the Pacific Island Countries. The context for this project is that PIC populations live across vast areas of the Pacific Ocean and are vulnerable to climate change and natural disasters. Comparable data is needed to understand awareness of climate change, experiences of climate change and natural disasters induced impacts and adaptive measures taken by households over time and between countries to monitor regional trends.

A diagnosis done at the PACSTAT inception phase showed PICs could not produce national and global indicators due to the lack of sound methodologies (including questionnaire modules) to measure climate change and natural disasters socio-economic impacts through household surveys. In addition, NSOs in the Pacific region lack funding to meet the costs of data collection.

One of the assignments within the project is to provide information to help the <u>Pacific Statistics Methods Board</u> (<u>PSMB</u>) and other Pacific statistics decision-makers with information to guide decision-making on the collection and use of climate change and natural disaster data. For that, a research line for the "Development of a Climate Change and Natural Disasters Survey Module" was shaped, which aims to strengthen the collection and use of climate change and natural disasters data sourced from population-based censuses and household surveys.

The overall objective is to disseminate best practice recommendations from the PSMB to regional statistics stakeholders and provide capacity-building opportunities for Pacific Statistics Officers, SDD and other stakeholders. Specifically, the research aims to make recommendations to PSMB concerning measuring the impact of climate change and natural disasters on households' livelihoods, food security, migration, assets and mental health. While there is significant work climate change indicators at global level, there is little information on impact and adaptation strategies at household and local level. This is the gap that the climate change module aims to fill.

The activities included in the research line are the following:

- i. Conduct a literature review of available questionnaires and methodologies that capture the impact of climate change and natural disasters at the household or community level and could be adapted to the Pacific census and survey context.
- ii. Investigate the most relevant sectors and areas of interest for climate change according to the climate risk and vulnerability framework as defined by the IPCC and its three main dimensions of Vulnerability, Exposure and Hazards.
- iii. Develop a Climate Change module with a small number (6 to 8) of core questions to derive core indicators of the impact of climate change and natural disasters at the household level, covering the impact on household livelihoods, such as food security, mental health, migration and assets.
- iv. Develop a model questionnaire 'source book' that will be used to support Pacific governments in making decisions around what questions they should prioritise, based on national needs, and either included in nationally representative household surveys or used as a stand-alone questionnaire for household surveys specifically aimed at collecting data on climate change and natural disasters.
- v. Participate in internal SPC meetings with stakeholders to negotiate the core questions and content of the sourcebook.
- vi. Prepare a policy brief to support Pacific statistics stakeholders in making decisions concerning measuring the impact of climate change and natural disasters on Pacific households.

For the PICTs, developing the Climate Change and Natural Disasters survey module comes at a critical time. The information this module will produce is highly relevant to monitoring indicators proposed by the UNFCCC strategic objective two on improving the living conditions of affected populations by climate change, including poverty, income and access to drinking water measurements⁵. Household survey data derived from the module is also

⁵ And many other actions proposed in Article 2 of the Paris Agreement, recently reaffirmed in the COP 26. This Agreement aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty. In the COP 26, the

fundamental to monitoring progress towards SDG 1, mainly target 1.5: Build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters; and SDG 13, that in addition to climate measures, covers a wide range of social, economic and environmental aspects, and address fundamental global challenges, including poverty alleviation, food security and nutrition.

In addition, the survey module is indicated to support countries in reporting some of the indicators proposed in the <u>Framework for the Development of Environment Statistics (FDES 2013)</u> and the <u>Global set of Climate Change</u> <u>Statistics</u>. The module could also contribute to monitoring the socio-economic targets included in the Sendai Framework for Disasters Risk Reduction (DRR) 2015–2030.

Glasgow Climate Pact, countries reaffirmed the Paris Agreement's goal of limiting the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit it to 1.5 °C. And they went further, expressing "alarm and utmost concern that human activities have caused around 1.1 °C of warming to date, that impacts are already being felt in every region, and that carbon budgets consistent with achieving the Paris Agreement temperature goal are now small and being rapidly depleted." They recognised that the impacts of climate change would be much lower at a temperature increase of 1.5 °C compared with 2 °C.

1. Characteristics of Climate Change and Natural Disasters in the Pacific Islands Countries and Territories

1.1. Observed and projected trends in climate change risks for PICTs

According to the IPCC, PICTs are often characterised as being among those countries most severely impacted by climate change (Nurse et al., 2014)⁶, primarily because of their disproportionately high exposure to both slow-onset and extreme hydrometeorological events and the limitations of their economic and natural resources for mitigating such risks (Robinson 2015)⁷. Below is a summary of some of the key trends in the impacts of climate change on the Pacific region, taken from the IPCC's most recent report (IPCC, 2022)⁸.

Food production. Climate change is likely to lead to a significant reduction in species richness in the Pacific region generally comprises between 0.4 per cent and 2 per cent of total species, with localised peaks of close to 10 per cent in certain areas (2100 compared to 2006) (IPCC, 2022). Consequently, fish biomass will also be negatively affected, with projected reductions of -10 per cent to -30 per cent, with the most considerable reductions north of Papua New Guinea and in the Bismarck sea. The projected impact of climate change on crop production in the region is less marked, which may be explained by the fact that agriculture is already severely impacted by climate change.

<u>Freshwater-related challenges</u>. Climate change is also expected to negatively impact freshwater availability, with adverse effects anticipated for groundwater availability in Australasia (IPCC, 2022). Droughts are also expected to be more frequent and intense in this region, negatively impacting agriculture (e.g., soil salination). The impact on water quality is more uncertain in the IPCC's scenario.

Extreme events. IPCC (2022) also predicts that climate change will likely increase the frequency and intensity of disasters (IPCC, 2018)⁹. The region is already regularly impacted by extreme sea-level events. In the lowest scenario (+2.5 °C), IPCC estimates that these events will become even more frequent by 2100. An increase in the average sea level will lead to additional erosion in the shoreline, generally from 50 to 200 meters or more in certain areas (IPCC, 2022). The percentage of the population living in small islands of the Pacific exposed to coastal inundation will significantly increase, with shares of 30 to more than 50 per cent in many areas, according to one of the scenarios of the IPCC (+4.5 °C rise in global temperatures).

<u>The International Disasters Database</u> provides figures for the number of natural disasters¹⁰ globally. The number of natural disasters in the PICTs has increased in the past years: 121 events were recorded between 1980 and 2000, compared to 194 between 2001 and June 2022¹¹. The major climate-related disasters in the PICTs are storms, floods and droughts (EM-DAT, 2022).

⁶ Nurse LA, McLean RF, Agard J, Briguglio LP, Duvat-Magnan V, Pelesikoti N, Tompkins E, Webb A (2014) Small islands. In: climate change 2014: impacts, adaptation, and vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, USA.

⁷ Robinson S-A (2015) Climate change adaptation trends in small island developing states. Mitig Adapt Strateg Glob Chang 22:669–691. Available at: https://doi.org/10.1007/s11027-015-9693-5. Accessed 19 July 2022.

⁸ IPCC, 2022. Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, Löschke, V. Möller, Α. Okem, Β. Rama (eds.)]. Cambridge University Press. In Press. Available S. at: https://report.ipcc.ch/ar6wg2/pdf/IPCC_AR6_WGII_Annex-I.pdf. Accessed August 1 2022.

⁹ IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above preindustrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. World Meteorological Organization, Geneva, Switzerland, 32 Available at: pp. https://www.ipcc.ch/site/assets/uploads/sites/2/2018/07/SR15_SPM_version_stand_alone_LR.pdf. Accessed July 20 2022.

 ¹⁰ Disaster is defined as a situation or event, which overwhelms local capacity, necessitating a request to national or international level for external assistance (definition considered in EM-DAT); An unforeseen and often sudden event that causes great damage, destruction and human suffering. Though often caused by nature, disasters can have human origins (<u>https://www.emdat.be/Glossary</u>).
 ¹¹ EM-DAT. 2022. Available online: <u>https://www.emdat.be/</u>. Accessed on 2 August 2022.



Source: Author Elaboration based on data from EM-DAT, 2022

Human losses. Human losses due to adverse effects of climate-induced events are likely to increase: IPCC (2022) projects additional deaths of 15 to 45 per 1,000 inhabitants in the Pacific region. These losses may be due, among other factors, to an increase in the population exposed to extreme heat and humidity. In the IPCC scenario of +2.6 °C in global temperature, the Pacific region may face up to half of the year with these extreme conditions.

1.2. Observed and projected trends of the impact of climate change on households in PICTs

Pacific Island Countries are amongst the countries most vulnerable to climate change in the world due to severe weather and natural hazards, strong dependence on their natural resources and the limited diversification of their economies (SPC, 2022)¹². The following paragraphs present a synthesis of how climate change and disasters have affected main economic activities, livelihoods, food and health systems, water security, migration and gender in the PICTs.

Socio-economic impacts. Three-quarters of the PICTs population live in rural areas (FAO and SPC, 2018)¹³. Still, the urban population is predominant in some of the PICTs, e.g., Marshall Islands (75 per cent), Tuvalu (63 per cent), and Kiribati (53 per cent)¹⁴. Most development and settlement in atoll islands occur close to the coast, with 55 per cent of the Pacific's population (excluding Papua New Guinea) living less than 1 km from the sea (WB, 2016¹⁵ and SPC, 2022¹⁶). The proximity of households to the sea matters because it increases their exposure and vulnerability to natural events such as storms and floods. This proximity, combined with the increased frequency and intensity of extreme events, has increased economic losses since the 1980s. However, all PICTs have moved forward with Disasters Risk Reduction strategies. Early warning systems have significantly reduced the economic losses related to damages to critical infrastructure, basic services, and health and educational facilities (Gheuens, Nagabhatla & Perera, 2019)¹⁷. Graph 1, based on an analysis of data from EM-DAT, 2022, illustrates this effect, with economic losses in the region starting to decrease since the mid-1990s.

¹² Obtained from <u>https://www.spc.int/cces</u>

¹³ FAO & SPC. 2018. Pacific strategic plan for agricultural and fisheries statistics: strengthening the evidence base for the achievement of the sustainable development goals. Food and Agriculture Organization of the United Nations and Pacific Community, Bangkok.

¹⁴ Information taken from the food consumption reports, a series of reports elaborated between SDD, NSOs and FAO on food acquisition and consumption analyses based on national household income and expenditure surveys (HIES). Available at: <u>https://sdd.spc.int/food-systems</u>. Accessed July 25 2022.

¹⁵ The World Bank. 2016. Systematic Country Diagnostic For Eight Small Pacific Island Countries: Priorities For Ending Poverty And Boosting Shared Prosperity. World Bank. Available at <u>https://documents1.worldbank.org/curated/en/313021467995103008/pdf/102803-REPLACEMENT-SecM2016-0025.pdf</u>. Accessed July 25 2022.

¹⁶ Obtained from <u>https://www.spc.int/cces</u>

¹⁷ Gheuens, J., Nagabhatla, N., Perera, E. 2019. Disaster-Risk, Water Security Challenges and Strategies in Small Island Developing States (SIDS). *Water*. *11*(4), 637. Available at: <u>https://www.mdpi.com/2073-4441/11/4/637</u>. Accessed August 5 2022.



Figure 2 - Trends in economic losses due to natural disasters in PICTs (1980 – 2021; millions of USD)

Source: Author Elaboration based on data from EM-DAT, 2022

As illustrated in Figure 1, the frequency and intensity of natural disasters have led to substantial economic and asset losses in several countries of the PICTs. Between 1980 and 2022, natural disasters affected approximately 9.5 million people, causing 5,000 deaths and damage costs of around USD 7.4 billion cumulated over the period 1980–2022.

Natural disasters also cause disturbances in critical economic sectors such as fisheries, agriculture and tourism. For PICTs, agriculture (both crops growing and livestock rearing) is fundamental to the livelihoods of most people. It has broader connections to income, food security and health. However, climate change poses a significant threat to agriculture as it has implicated less predictable rainfall (most islands do not have the water storage or irrigation infrastructure to mitigate the impact of extended droughts), more extreme rainfall events (which can lead to substantial crop losses), and seawater intrusion and inundation during storm surges (resulting in the salinization of agricultural land and reduced productivity).

Regarding fishing, the natural resources, ecosystem services and biological diversity of the Pacific Ocean are indispensable to the economies and development of the PICTs. They are also of significant value to the international community. The oceanic fisheries provide public revenues, while coastal fisheries directly sustain rural livelihoods and contribute to food security and sometimes exports.

However, in some areas, the productivity of coastal fisheries and their sustainability have been undermined by factors such as habitat degradation or loss (resulting from coastal development, pollution, and sedimentation). In coral reef habitats, the increasing range of anthropogenic effects is compounding the disturbances caused by natural events, such as cyclones and outbreaks of the coral-feeding crown-of-thorns starfish (*Acanthaster planci*). Reduced seagrass and mangrove habitats and damage to complex coral reef ecosystems significantly reduced biological productivity in coastal waters (Pratchett et al., 2005)¹⁸.

Tourism is a growing economic sector in the PICTs, providing the region with great potential for economic development. Indeed, the few formal jobs available in these countries' private sectors tend to be derived more from tourism activities. However, climate-related disasters affect this sector by impacting ecosystems, resources and infrastructure, making fewer tourist arrivals after a disaster hits a country.

However, while tourism positively impacts the economy of PICTs, it can also increase its climate-related vulnerabilities. The development and use of coastal areas for tourism activities can further deteriorate and pollute sensitive ecosystems and their future tourism potential. Tourism can exacerbate the pressure on the already limited resource base, mainly freshwater resources. Proper environmental management in the tourism sector is key to preserving its sustainability.

Food security and livelihoods. The WB categorises Pacific Island Countries (PICs) as having a dual economy consisting of a small cash economy, and a subsistence economy focused on its traditional fishing and small-scale agriculture sectors (WB, 2016). Climate change has affected these countries' food production and diets.

¹⁸ Pratchett, M., Munday, P., Graham, N., Kronen, M., Pinca, S., Friedman, K., Brewer, T., Bell, J., Wilson, S., Cinner, J., Kinch, J., Lawton, R., Williams, A., Chapman, L., Magron F., & Webb A. 2005. Vulnerability of coastal fisheries in the tropical Pacific to climate change. In Sadovy Y (2005) Trouble on the reef: The imperative for managing vulnerable and valuable fisheries. Fish and Fisheries 6, 167–185. Available at: https://www.researchgate.net/profile/Johann-

Bell/publication/229913544_Vulnerability_of_coastal_fisheries_in_the_tropical_Pacific_to_climate_change/links/55362b490cf268fd00161531/Vul nerability-of-coastal-fisheries-in-the-tropical-Pacific-to-climate-change.pdf. Accessed July 28 2022.

To illustrate the previous statement, a recent study by Medina et al., 2020¹⁹ done in remote coastal villages of Fiji observed that households have become less reliant on local fisheries and agriculture for their dietary needs due to livelihood transitions and climate hazards (cf. Box 1).

Box 1 - Climate hazards affecting food systems in the Fiji Islands

The three main climate hazards affecting food systems are tropical cyclones (hurricanes), drought, and prolonged periods of heavy rain, with high temperatures affecting most agricultural production.

Cassava, breadfruit and cocoyam (Xanthosoma sagittifolium) are the products more resilient to climate variability and cyclones with the possibility of being produced and harvested all year round and not impacted by pests and diseases.

Other issues that have triggered production changes include the progressive reduction of soil fertility, the salinisation of soils, and the loss of soil coverage.

Climate change is recognised as a barrier to the intensification of agricultural production; farmers struggle to manage climate hazards like drought and excessive heat (as agriculture is rainfed); for farmers, there is less incentive to dedicate time and resources to agricultural activities.

Producers also complained about cyclones and storms disrupting market access because, during storms, boats are not able to re-stock local markets and farmers and fishermen are not able to sell their products, even when the cyclone path does not approach the islands directly.

Regarding fishing, it is likely that the decrease in fish catch experienced in the pacific region is caused by a range of interconnected factors, including overfishing of certain species, habitat loss, water pollution, and the increased presence of invasive species. All these factors can be exacerbated by climate change which is projected to induce significant reductions in reef fish availability throughout the Pacific (Bell et al., 2009, 2013, referenced in Medina et al., 2020).

Source: Medina et al., 2020.

Climatic factors were also linked to diet quality decrease in Fiji (Medina et al., 2020). For instance, households have perceived diet changes compared to the past 20 to 30 years and identified that the most relevant changes in diets could be related to climate change:

- Declined in the consumption of fruits and vegetables because people have stopped planting them locally: As low-lying atolls, tide floods properties situated in low lying-areas destroying household plantations and gardens. Households have moved food gardens and plantations on the island's slopes but getting there requires long strenuous walks. Most agricultural labour is done manually, making tasks like soil preparation, harvesting and transporting produce back to the village arduous. So, women have developed greater dependence on processed foods when men in the household are not available to oversee crop production or go fishing. At the same time, men of the family work in cash flow activities such as tourism or invest most of their time planting cash crops like yaqona.
- Reductions in the availability of fresh fish and shellfish led to the introduction of more accessible forms
 of consumption of animal protein sourced locally, such as canned meat and tuna, eggs and chickens;
- Climate change has discouraged people from planting as temperatures increase, and issues with water availability limit the capacity to produce more fruits and vegetables.
- Less availability of seeds and planting material limited the possibility of planting more diverse food items.

<u>Water security</u>. The freshwater supply in the PICTs is limited due to the decrease in rainfall, limited rainwater storage capacity, the salination of the groundwater lens and an increase in demand (e.g., population growth and tourism). These countries are already water-scarce with low groundwater volumes. For example, in 2011, Tuvalu had problems with water supply when it had no rain for six months, and 1500 of its population of 11,000 were left

¹⁹ Medina, D., Witten, I., Nunn, P., Burkhart, S., Bogard J., Beazley, H., Herrero, M. 2020. Sustaining healthy diets in times of change: linking climate hazards, food systems and nutrition security in rural communities of the Fiji Islands. Regional Environmental Change (2020) 20: 73. Available at: https://doi.org/10.1007/s10113-020-01653-2. Accessed July 20 2022.

with no access to fresh water²⁰. The freshwater supply in Tuvalu is limited to rainwater, desalinated water (available in emergencies only), and an underground freshwater lens (Gheuens, Nagabhatla & Perera, 2019).

To fully understand water security in the PICTs and climate change factors, contextual issues must be accounted for and can vary from state to state: political stability, unemployment, poverty rates or gender context. For example, in the Solomon Islands, access to improved drinking water decreased from 2000–2015 due to civil unrest and a devastating tsunami. In Papua New Guinea, 42 per cent of the population still relies on untreated surface water (Gheuens, Nagabhatla & Perera, 2019).

<u>Health.</u> Climate hazards have brought immediate harmful effects on the health of communities living in rural areas of PICTs. For instance, climate events have caused concern in Fijian communities as stomach aches and diarrhea caused by consumption of contaminated food and water, which happens when muddy water enters rainwater tanks after periods of heavy rain (Medina et al.2020). In addition, changes in dietary patterns have led to a higher prevalence of non-communicable diseases in the communities (e.g., diabetes and high blood pressure). The example of Fiji sheds light on the negative health impact of low dietary diversity in the households and the importance of including the increased consumption of fruits and vegetables and diversifying sustainable sources of animal protein in the strategies of adaptation to climate change and diet quality.

Climate change also represents a significant threat to mental health. Gibson, Barnett, Haslamb & Kaplan (2020)²¹ summarised the three pathways through which climate change-related mental health impacts can occur:

- Extreme weather events can adversely impact mental health among those directly or indirectly exposed, causing psychological distress and increased rates of psychiatric disorder;
- Observations of gradual environmental change can also impact mental health: Psychological distress can arise from observing modifications to one's environment over time and experiencing an associated sense of loss. This loss may be especially significant for individuals and communities with solid identity bonds to their environment. For example, the impact may be more important for indigenous communities in the case of increased competition for resources, the fracturing of communities, and displacement.
- Messages conveyed through public discourse about the predicted future impacts of climate change, or impacts occurring elsewhere in the world, can also affect individual mental health.

The impacts of climate change on the mental health of people most vulnerable to SIDS are widely recognised (Nurse et al., 2014). Among the very few published empirical studies that focus on these countries' mental health issues associated with climate change stressors, Asugeni, MacLaren, Massey, & Speare (2015)²² documented the effects of the worry related to sea-level rise in a coastal region of the Solomon Islands. In this study, nearly all participants reported that sea-level rise was affecting them and their families and was causing fear and worry on a personal and community level. Likewise, in Tuvalu, Gibson, Barnett, Haslamb & Kaplan (2020) determined the presence of psychological distress and associated impairment due to i) local environmental impacts caused or exacerbated by climate change or ii) cases of distress in people when hearing about climate change and its future implications. In this study, for example, the investigators interviewed 100 Tuvaluans from Funafuti atoll; 91.84 per cent reported distress in response to questions about local climate change stressors, and 75.56 per cent said consequent impairment in at least one area of daily life. Another relevant finding of this study was that climate change distress was high among persons who reported insufficient household income to meet their basic needs, confirming the intersection of two critical stressors: poverty and climate change, which is addressed in further detail in the 1.2.7 Section.

<u>Migration</u>. The movement of people from outer to central islands and urbanisation have been essential to overcoming the lack of opportunity and public services in remote islands in PICTs. However, urbanisation

²⁰ Found in <u>https://www.theguardian.com/world/2011/oct/17/tuvalu-drought-climate-change</u>

 ²¹ Gibson, K.E., Barnett, J., Haslamb, N., Kaplan, I. 2020. The mental health impacts of climate change: Findings from a Pacific Island atoll nation. Journal of Anxiety Disorders. Volume 73. June 2020. Available at: https://doi.org/10.1016/j.janxdis.2020.102237. Accessed July 26 2022.
 ²² Asugeni. J., MacLaren, D., Massey, P, & Speare. R. 2015. Mental health issues from rising sea level in a remote coastal region of the Solomon Islands: current and future. Australas Psychiatry. 2015 Dec; 23 (6 Suppl):22-5. Available at: https://pubmed.ncbi.nlm.nih.gov/26634663/. Accessed 28 August 2022.

processes have also generated a range of social problems, placed stress on essential services and alreadystretched ecosystems, threatened social cohesion and led to tensions.

The linkages between climate change and migration have been considered at the global level only in the relatively recent past, as is the case for the Pacific islands. Climate-induced migration will likely be a vital adaptation response to climate change and extreme future events (Cattaneo et al., 2019)²³.

Most PICTs have histories of both internal and external migration. Climate change has become an essential driver of migration from rural to urban areas within Pacific Island countries and from them to other countries (Campbell & Warrick, 2014)²⁴. To analyse the role played by climate change in migration, Campbell & Warrick (2014) presented three effects on the security of the inhabitants of various Pacific Island countries:

- Climate change effects (including sea-level rise) on the land security of some Pacific Island communities: This may result from, for example, coastal inundation or erosion or river plain flooding or erosion. In such cases, the physical sites for settlement are rendered marginal or incapable of supporting habitation in the worst cases.
- Climate change effect cash-based and subsistence livelihood: Although localities remained safe and secure in terms of shelter, they became less able to support the livelihoods of their inhabitants. Among other things, food security and opportunities for employment were threatened.
- Habitat conditions deteriorate: Despite settlement locations remaining physically secure and livelihoods sustainable, changing disease vectors, loss of water supply quantity or quality, increased incidence of exposure to, and intensity of, extreme events still represent a risk for communities.

While climate change-induced migration is expected to increase in the future (Marchiori et al., 2012)²⁵, peoples' movements will vary depending on the speed of climate events, other available adaptation opportunities, household access resources, etc. (Cattaneo et al., 2019).

Recently, Letta, Montalbano & Paolantonio (2022)²⁶ provided insights into five key facets of the climate–migration relationships, such as fast-onset vs slow-onset events, direct and indirect links, internal vs international migrants, liquidity constraints and migration as adaptation.

Regarding the former, the authors explain that fast-onset extreme weather events (such as hurricanes, heavy rains, floods, and landslides) related to climate change are usually sudden and direct, resulting mainly in temporary movements over short distances. In contrast, slow-onset changes are not regarded as sufficiently extreme to trigger migration since they have less of an immediate impact on people.

In addition, the authors found that climate-related hazards can cause or worsen liquidity constraints. Poor people, disproportionately affected by climate change, have more incentives to migrate but often cannot leave because they lack the necessary resources. In this perspective, migration is seen as a risk diversification investment that only wealthier households can undertake, while poorer families are "forced to stay" rather than "forced to move". A wide heterogeneity of outcomes can be expected depending on the interaction between the severity of the climatic event and household-specific characteristics. For example, Cattaneo et al. (2019) identified two different types of migration: low-income families responding to adverse shocks through low-return or even "survival" migration, taking the form of temporary movements across short distances, whereas wealthier families engage in risk management migration, which is typically costlier, semi-permanent and longer-distance migration.

²³ Cattaneo, C., Beine, M., Fröhlich, C.J., Kniveton, D., Martinez-Zarzoso, I., Mastrorillo, M., Millock, K., Piguet, E. and Schraven, B., 2019. Human migration in the era of climate change. Review of Environmental Economics and Policy 13(2): 189-206. Available at: https://www.semanticscholar.org/paper/Human-Migration-in-the-Era-of-Climate-Change-Cattaneo-

Beine/f7d294047f81c40fbd152e313d06626b1ed43f33. Accessed August 5 2022. ²⁴ Campbell & Warrick. 2014. Climate Change and Migration Issues in the Pacific. United Nations Economic and Social Commission for Asia and the

Pacific. Pacific Office. Fiji. Available at: <u>file:///C:/Users/acer/Downloads/ESCAP-2014-RP-Climate-change-migration-issues-Pacific.pdf</u>. Accessed August 5 2022.

²⁵ Marchiori, L., Maystadt, J.-F. and Schumacher, I., 2012. The impact of weather anomalies on migration in sub-Saharan Africa. Journal of Environmental Economics and Management 63(3): 355–374. Available at: <u>https://www.semanticscholar.org/paper/The-Impact-of-Weather-Anomalies-on-Migration-in-Marchiori-Maystadt/3cd2b8abd25264205543601795142a4528023aad</u>. Accessed August 5 2022.

²⁶ Letta, M., Montalbano, P., Paolantonio, A. 2022. Understanding the Climate Change-Migration

Nexus through the Lens of Household Surveys. An Empirical Review to Assess Data Gaps. Policy Research Working Paper No. 10082. The World Bank Group. Development Economics. Development Data Group. Available at: https://doi.org/10.1596/1813-9450-10082. Accessed 26 August 2022.

<u>Gender aspects.</u> The Word Bank (2016) identified gender gaps across PICTs in access to services, markets and value-addition activities, land tenure, employment and lack of voice and political participation.

In the PICTs, women are marginally more likely to live in poverty, but unequal gender roles, lack of voice and political participation, and violence against women perpetuate poverty and exacerbate women's hardship. For example, women are more likely to be unemployed than men since they are devoted to home duties or caring responsibilities.

In addition, in many of the PICTs, women face constraints in the control of assets such as land, which is largely customarily owned and transferred through traditional cultural systems. In the Marshall Islands, Tuvalu, and Vanuatu, women are rarely able to own land independently, for example. In Tonga, where land is individually titled, women cannot legally own land, although they can hold leases. In other PICTs countries where land is communally held, asset control is often administered by a 'chief' or the national equivalent position of traditional authority. In all cases, such works are overwhelmingly held by men, although there are some cases of traditional female leaders, such as the female Matai in Samoa (WB, 2016).

Women in the PICTs are also seriously under-represented in parliament, with on average only around one in 30 seats held by women, compared to an average across all developing nations of one in five. Therefore, as only men can be nobles, the number of possible parliamentary seats available to women has been limited.

These gender differences minimise productivity and the capacity for addressing climate change issues. Some examples are provided:

- In some areas, men's migration from rural areas has left women to assume the spectrum of agricultural management roles, often without the resources or agency to do so successfully.
- In other cases, as mentioned in the 1.2.2 Section, women have developed greater dependence on processed foods when men in the household are not available to oversee crop production or go fishing.
 In this case, women's education, participation and empowerment in decision-making are critical factors in improving household nutrition and dietary diversity.
- The fact women have no control of land tenure excludes them from participating in climate change adaptation programmes that often include high-value tree crop systems (e.g., agroforestry); men often control these tree crops with high-medium commercial value.

Poverty and vulnerability. The population of PICTs face unique challenges in addressing poverty (WB, 2016). Poverty rates in these countries are high, with approximately a quarter of the population living below the poverty line (24 per cent, corresponding to the median poverty rate across PICTs). People with low livelihoods are more vulnerable and less resilient to shocks, such as natural disasters, which are likely to be more frequent and more intense in the coming years due to climate change. The impact of climate change on vulnerable households also tends to aggravate poverty levels, primarily due to losses in livelihoods and assets, perpetuating cycles of poverty.

Low-income families are disproportionately affected because they lack adequate financial means to deal with shocks and tend to have high-risk profiles by, for instance, living in higher-risk areas. Furthermore, as poorer groups repeatedly become affected by disasters and climate shocks, they have fewer chances of rebuilding their livelihoods and investing in human capital, thus becoming trapped in a cycle that sinks them further into poverty. In addition, poverty can increase disaster impacts due to potential linkages between poverty and the over-utilisation of natural resources.

In Tuvalu, Taupo, Cuffe & Noy (2016)²⁷ investigated the vulnerability of households to climatic disasters using data from household surveys and constructing poverty and hardship profiles and combining these with geographic and topographic information. They concluded poor households in urban areas were more vulnerable to adverse shocks because of their lack of resources to respond and because they resided in areas highly exposed to disasters (closer to the coasts and at lower elevations) and had less ability to migrate (between and within the islands).

In the same country, participants in a case study on climate change mental health stressors reported significantly more distress as having more significant financial hardship. Specifically, those who reported having the capacity

²⁷ Taupo, T., Cuffe, H., Noy, I., 2016. Household Vulnerability on the Frontline of Climate Change: The Pacific Atoll Nation of Tuvalu. CESifo Working Paper No. 6128. Available at: <u>https://link.springer.com/article/10.1007/s10018-018-0212-2</u>. Accessed July 23 2022.

to meet their basic household needs reported substantially less distress from local climate change stressors than those who reported not consistently being able to meet household needs (Gibson, Barnett, Haslamb & Kaplan, 2020)²⁸. These findings are consistent with a previous study done in the same country where participants reported financial hardship as a key determinant of distress in a context of increasing dependency on monetary income relative to subsistence-based activities - a change partly attributable to climate change (Gibson et al., 2019 referenced in Gibson, Barnett, Haslamb & Kaplan, 2020).

1.3. Adaptation and resilience of households in the PICTs

The UNFCCC has identified climate adaptation as a critical building block for a coordinated response to climate change. The IPCC (2007)²⁹ described adaptation as an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploit beneficial opportunities. Adaptation does not take place in response to climatic changes in isolation. Instead, it is a response to a series of events or to previously existing situations that are exacerbated through climate change. Consequently, it can be challenging to determine which aspects of adaptation are driven solely or partially by climate change, as opposed to other factors unrelated to climate change. This makes it difficult and challenging to measure adaptation to climate change accurately. In addition, few comprehensive studies exist on what adaptation to climate change entails and the costs and benefits of adaptation measures. Nonetheless, adaptation is an essential and necessary response to climate change and statistics and methodologies to assess adaptation should be developed.

Climate adaptation strategies adopted in the PICTs are increasingly based on local and community knowledge in combination with cutting-edge science. For example, there are several household agricultural practices and investments that contribute to both adapting to climate change and mitigating greenhouse gases (GHGs) related to Sustainable Land Management (SLM) practices; these include agro-forestry investments, reduced or zero tillage, use of cover crops, and various soil and water conservation structures. Communities also implement resilient networks of marine protected areas using the best available science and strengthening tribal governance to manage these networks, experimenting with salt and drought tolerant crops, revegetating coastlines with native salt-tolerant plants, revitalising traditional wells, and implementing climate-smart development plans (Mcleod, et al., 2019)³⁰.

There are several examples of adaptative actions implemented by the communities in the PICTs in response to climate change, for example:

- In river basins, when the adjacent populations perceive their water supply seriously affected due to climate change, declaring basins areas as protected provides fast recovery from droughts, forest fires and future and sustained provision of water. That was the case for the Tamil community on Yap Island in the Federated States of Micronesia, which in 2017 declared 320 acres of protected watershed. This community was affected by flooding, erosion and drought, saltwater intrusion into freshwater sources, and taro patches. Water security was further affected by poor water management, the high dependency of the population on the basin, and the lack of alternative water sources. All of this has lowered the health of corals and reduced fish populations due to increased sedimentation in the coastal environment and run-off from the pollution that caused algal blooms. Likewise, other communities have agreed to implement locally managed marine areas to reduce the threats facing coral reefs.
- Raising gardens above the ground and cementing around and under crops to prevent intrusion of seawater: For instance, in Papua New Guinea, some coastal fishing communities that historically relied on fishing for food security have constituted women's groups, and with local NGOs and government agriculture officers have planted household gardens. These include introducing growing food crops, including greens, tomatoes and cabbages, composting in very sandy soils, and local water collection in

²⁸ Gibson, K.E., Barnett, J., Haslamb, N., Kaplan, I. 2020. The mental health impacts of climate change: Findings from a Pacific Island atoll nation. Journal of Anxiety Disorders. Volume 73. June 2020. Available at: <u>https://doi.org/10.1016/j.janxdis.2020.102237</u>. Accessed July 26 2022.

²⁹ IPCC. 2007. Climate Change 2007: Impacts, Adaptation and Vulnerability, Fourth Assessment Report. Cambridge University Press. Available at: https://www.ipcc.ch/report/ar4/syr/. Accessed 5 August 2022.

³⁰ Mcleod, E., Bruton-Adams, M., Förster, J., Franco, C., Gaines, G., Gorong, B., James, R., Posing-Kulwaum, G., Tara, M., Terk, E. 2019. Lessons From the Pacific Islands – Adapting to Climate Change by Supporting Social and Ecological Resilience. Frontiers in Marine Science. June 2019. Available at: https://www.frontiersin.org/articles/10.3389/fmars.2019.00289/full. Accessed 26 July 2022.

drums and small tanks. These groups have led training on farming methods such as using organic fertilisers and pesticides, raised beds to improve soil quality and eliminate saltwater intrusion, and the diversification of crops.

- Revitalising traditional farming practices based on agroforestry: including shading crops with palm leaves or maintaining trees around plants to provide shade and inter-cropping (e.g., using cassava plants to provide shade to young taro and yaqona plants to overcome drought and heat stress).
- Changing planting dates for root and tubers to use the rainy season better to establish crops and leave them longer in the ground until harvest.
- Preparing vegetal material (e.g., yaqona) in nurseries where seedlings can be watered and sheltered from high temperatures while the root system develops.
- Implementing (rudimentary) irrigation when there had been too many days without rain.
- Implementing low-cost aquaculture projects, such as clam farming techniques adapted to local conditions to provide food security and reseed local reefs with clam larvae to re-establish the local wild population.
- Revegetating coastal areas vulnerable to erosion utilising traditional composting techniques and including food crops and plants (e.g., Nipa Palm).
- Relocating houses considering the suitability of the new site for establishing home gardens.
- Revitalising Traditional Wells. On Oneisomw Island, in the Chuuk State in the Federated States of Micronesia, people have been affected by coastal flooding during typhoons and high tides. This community supply of water from tanks, aquifers, streams and wells. But freshwater availability has decreased due to drought and saltwater intrusion. Human activities also impacted freshwater sources and the coastal environment. To reduce both problems, Oneisomw residents have rehabilitated traditional water wells by cleaning them and planting strips of vegetation around wells and streams to stabilise degraded banks and reduce siltation. They also installed concrete covers over the wells to reduce trash and other contaminants from entering the wells. In addition, they developed agreements with the owners of the wells' land to allow other community members to access the water during the drought. This approach was presented during a national summit of mayors in 2018, and other communities followed this water security approach in their municipalities.

To expand this Section of the Literature Review, three case studies conducted by the Australia-Pacific Climate Partnership (CSIRO & SPREP, 2022)³¹ on coffee plantations in Papua New Guinea, cassava and taro cultivation in Fiji Island, and black pearl production in the Cook Islands were analyzed and summarized. They are presented in Annexes 1, 2 and 3.

³¹ CSIRO and SPREP (2022). 'NextGen' Projections for the Western Tropical Pacific: Climate hazardbased impacts for root crop production in Fiji. Technical report by CSIRO and SPREP to the Australia-Pacific Climate Partnership funded Pacific NextGen Projectionsproject. Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Secretariat for the Pacific Regional Environment Program (SPREP). Melbourne, Australia. Available at: <u>https://doi.org/10.25919/z6a4-8270</u>; CSIRO and SPREP (2022). 'NextGen' Projections for the Western Tropical Pacific: Climate hazard-based impacts on coffee production in Papua New Guinea. Technical report to the Australia-Pacific Climate Partnership for the Next Generation Climate Projections for the Western Tropical Pacific project. Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Secretariat of the Pacific Regional Environment Programme (SPREP), CSIRO Technical Report, Melbourne, Australia. Available at: <u>https://doi.org/10.25919/5prg-cx10</u>; CSIRO and SPREP (2022). 'NextGen' Projections for the Western Tropical Pacific: Climate change projections to inform black pearl production vulnerability in the Cook Islands. Technical report to the Australia-Pacific Climate Partnership for the Next Generation Climate Projections for the Western Tropical Pacific project. Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Secretariat of the Western Tropical Pacific project. Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Secretariat of the Pacific Regional Environment Programme (SPREP), CSIRO Technical Report, Melbourne, Australia. Available at: <u>https://doi.org/10.25919/sr2h-8282</u>. Accessed 9 August 2022.

2. Collecting climate change data through household surveys

2.1. The Global Consultation on the Global Set of Climate Change Statistics (UNSD)

Climate change-related statistics refer to environmental, social and economic data that measure the human causes of climate change, the impacts of climate change on human and natural systems, and the efforts by humans to avoid and adapt to these consequences (UNECE, 2015)³².

The United Nations Statistics Division (UNSD) received a mandate from the UN Statistical Commission (UNSC) at its 47th session in 2016 to develop a <u>Global Set of Climate Change Statistics and Indicators</u> ("Global Set") applicable to countries at various stages of development. The Global Set provides a comprehensive statistical framework with statistics, indicators and metadata, designed to support countries in preparing their own sets of climate change statistics according to their concerns, priorities and resources. It also supports the reporting requirements of countries under the Enhanced Transparency Framework and the Global Stocktake of the Paris Agreement, as well as climate-related SDG indicators.

The Global Set is based on a systematic review of climate change statistics and indicators from 130 countries and identifies a draft set of the most repeated statistics and indicators (UNSD, 2022)³³. The Global Set is also based on: discussions held during several meetings of the Expert Group on Environment Statistics (EGES); bilateral consultations with specialised agencies; in-depth discussions with selected countries; and inputs from an extensive Pilot Survey. Before its adoption by the UN Statistical Commission (UNSC) in March 2022, the Core Set was submitted to a Global Consultation. More than 80 countries replied to this global consultation ^{34 35}; in most cases, responses were provided by a country's National Statistical Office (NSO) or equivalent institution directly to UNSD.

Our analysis focuses on two key questions of the Global Consultation investigating whether countries developed specialised climate change surveys (questions D5 and D6)³⁶. The results shows that climate-change-related data are collected in very few populations and housing censuses and surveys: "only twelve responses referred to an NSO's development of a specialised climate change survey or module within an existing census or survey. NSOs have therefore rarely incorporated measurement of climate change into their work programmes, although NSOs may be more closely involved in data collection on climate change statistics in future" (UNSD, 2022, p.20).



Illustration 1. Results of the Global Consultation's Question D5: Has the NSO developed any specialised climate change surveys or modules in existing censuses/surveys?

Source: UNSD, 2022

³² UNECE. 2015. Leaflet on climate change-related statistics. available at: <u>https://unece.org/DAM/stats/documents/ece/ces/2017/A5-leaflet on climate change EN New.pdf</u>. Accessed 11 August 2022.

 ³³ UNSD. 2022. Background Document to the Report of the Secretary-General on Climate Change Statistics (E/CN.3/2022/17). Available at: https://unstats.un.org/unsd/statcom/53rd-session/documents/BG-3m-GlobalConsultationontheGlobalSet-E.pdf. Accessed 11 August 2022.
 ³⁴ Australia and New Zealand participated for the Pacific Region.

³⁵ The report on the results of the consultation included the following sections: (A): Identification of institutions; (B): National policies/strategies; (C): Mandate and organization of climate change statistics; (D): Production and reporting of climate change statistics; (E): Inter-institutional collaboration; (F): Technical assistance and training; and (G): The way forward in climate change statistics. Additionally, a General Comments section allowed free entry comments from countries.

³⁶ Question D5: Has the NSO developed any specialized climate change surveys, or modules in existing censuses/surveys?

Question D6: If yes to Question 5, please list the names of these surveys and provide website links to the surveys and resulting reports.

Part of the analysis presented in the following sections of the document is based on the answers provided by countries to questions D5 and D6, shared by the Environment Statistics Section of UNSD. These responses were reviewed to confirm if they belonged to household surveys (or modules) or stand-alone climate change surveys: two corresponded to the latter case (Nepal and Bangladesh) and two to the former (Mexico and Switzerland). The responses also revealed that Tanzania and Saint Lucia had included environmental modules in the 2022 Population and Housing Censuses. The rest of the countries who reported to have developed climate change surveys or modules in existing censuses/surveys provided links to case studies or to the climate change statistics report elaborated periodically in the country. All these aspects will be further described in the following sessions.

2.2. Population and Housing Censuses including environmental and climate changerelated data

According to the 2020 World Population and Housing Census Programme, "the population and housing censuses are one of the primary data sources needed for formulating, implementing and monitoring policies and programmes aimed at inclusive socio-economic development and environmental sustainability." Population and housing censuses are described as an essential source for supplying disaggregated data needed for the progress measurement of the 2030 Agenda, especially in the context of assessing the situation of people by income, sex, age, race, ethnicity, migratory status, disability and geographic location, or other characteristics (UNSD, 2022)³⁷.

Censuses allow the construction of frames from which samples can be drawn for specific sample surveys that will aim to study topics directly related to and affecting households: incomes, health, gender, poverty, and environmental questions, such as climate change. Censuses can hence be an appropriate instrument to identify the most vulnerable population groups and help target the objective population of thematic surveys on climate change or household surveys that include modules on this topic.

A thorough analysis of the questionnaires used in the population censuses conducted between 2000 and 2022 was made to identify if and how environmental issues were addressed. The result shows that only four countries (Trinidad and Tobago, 2010, Belize, 2010, Kiribati, 2020 and Nauru, 2021) out of 143 which conducted population censuses during this period included questions on environmental aspects, including climate change.

Certain countries, especially those that are the most impacted by natural disasters/climate change, are starting to include questions that go beyond the usual scope of population censuses, for example, to cover aspects related to the environment (e.g., environmental issues concerning people, sources of environmental information, consumption of certain fish species, clearance of certain native tree species, waste disposal problems, climate change perception, natural disasters impacting the household in the last 10 years, preventive measures taken by the household, etc.).

³⁷ From <u>https://unstats.un.org/unsd/demographic-social/census/index.cshtml</u>

Example 1. Environmental questions included in the Population and Housing Census questionnaire of Belize, 2022

| 4.1: To what extent do the following environmental issues concern you? 4.2: AND Does 1 = Not at all concerned 2 = Slightly concerned 3 = Somewhat concerned 9 = DK/NS 5 = Extensive physican concerned 5 = Extensive physican concerned 9 = DK/NS 1 = Yes 2 = No 9 = DK/NS 1. Waste disposal 0 2 6 0 0 2 0 1. Waste disposal 0 2 6 0 0 0 2 0 1. Waste disposal 0 2 6 0 0 0 2 0 2. Na pollution 0 2 6 0 0 0 2 0 1. Use of pesticide 0 2 3 5 0 0 2 0 0 2 0 0 2 0 0 2 0 0 2 0 0 2 0 0 0 2 0 0 0 2 0 0 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | | air, v | water, a | and la | nd. (S | how f | lashca | ırd) | | | |
|--|---|---|---------------------------------|--------------------|--------|-------|--------|------|-----------------------------|---|---------------|
| Waste disposal 0 2 3 6 5 0 0 2 0 | 4.1: To what extent do the followin 1 = Not at all concerned 2 = Slightly concerned 3 = Somewhat concerned | g environmental issu 4 = Moderately c 5 = Extremely co 9 = DK/NS | ies conc oncerne incerned | ern you ed d | 1? | | | | 4.2: A at 1 2 9 | ND Doe fect you = Yes = No = DK/N | s u? \S |
| Water contamination 0 2 0 6 5 0 0 2 0 Drainage 0 2 0 6 5 0 0 2 0 Air pollution 0 2 3 6 5 0 0 2 0 Air pollution 0 2 3 6 5 0 0 2 0 0 2 0 0 2 0 0 2 0 0 2 0 <th>Waste disposal</th> <th></th> <th>0</th> <th>2</th> <th>3</th> <th>(4)</th> <th>6</th> <th>0</th> <th>0</th> <th>2</th> <th>9</th> | Waste disposal | | 0 | 2 | 3 | (4) | 6 | 0 | 0 | 2 | 9 |
| Drainage ① 2 3 6 5 0 0 2 1 Air polution ① 2 3 6 5 0 0 2 1 Las of pesticide ① 2 3 6 5 0 0 2 1 Deforestation ① 2 3 6 5 0 0 2 1 Destruction of mangroves 0 2 3 6 5 0 0 2 1 Soli erosion ① 2 3 6 5 0 0 2 1 Floading ① 2 3 6 5 0 0 2 1 Integrity of protected areas ① 2 3 6 5 0 0 2 1 Integrity of protected areas ① 2 3 6 5 0 0 2 1 1 1 1 1 1 1 1 1 2 1 1 1 <td>Water contamination</td> <td></td> <td>1</td> <td>2</td> <td>3</td> <td>(4)</td> <td>6</td> <td>9</td> <td>0</td> <td>2</td> <td>9</td> | Water contamination | | 1 | 2 | 3 | (4) | 6 | 9 | 0 | 2 | 9 |
| Air pollution ① 2 3 6 5 0 0 2 0 | Drainage | | 1 | 2 | 3 | (4) | 6 | 9 | 0 | 2 | 9 |
| Use of pesticide ① 2 ① ① ① 0 | Air pollution | | 0 | 2 | 3 | (4) | 6 | 9 | 0 | 2 | 9 |
| Deforestation ① 2 ③ ⑤ ① 0 | Use of pesticide | | 1 | 2 | 3 | (4) | 6 | 9 | 0 | 2 | 9 |
| Destruction of mangroves ① 2 ③ ⑤ ① 0 2 0< | Deforestation | | 1 | 2 | 3 | (4) | (5) | 9 | 0 | 2 | 9 |
| Soli erosion ① 2 3 6 5 0 0 2 1 Squatting ① 2 0 <td>Destruction of mangroves</td> <td></td> <td>1</td> <td>2</td> <td>3</td> <td>(4)</td> <td>6</td> <td>9</td> <td>0</td> <td>2</td> <td>9</td> | Destruction of mangroves | | 1 | 2 | 3 | (4) | 6 | 9 | 0 | 2 | 9 |
| Squatting ① 2 ③ ⑤ ① 0 2 10 0 <td< td=""><td>Soil erosion</td><td></td><td>0</td><td>2</td><td>3</td><td>(4)</td><td>6</td><td>9</td><td>0</td><td>2</td><td>9</td></td<> | Soil erosion | | 0 | 2 | 3 | (4) | 6 | 9 | 0 | 2 | 9 |
| Floading ① 2 ③ ③ ③ ① ② □ ○ □ | Squatting | | 1 | 2 | 3 | (4) | 6 | 9 | 0 | 2 | 9 |
| Drought ① ② ③ ⑤ ③ ① ② □ ② □ ○ □ ○ □< | Flooding | | 0 | 2 | 3 | (4) | 6 | 9 | 0 | 2 | 9 |
| Integrity of protected areas ① ② ③ ⑤ ③ ① ② ○ <t< td=""><td>Drought</td><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>6</td><td>9</td><td>0</td><td>2</td><td>9</td></t<> | Drought | | 1 | 2 | 3 | 4 | 6 | 9 | 0 | 2 | 9 |
| Impacts of oil exploration ① ② ③ ⑤ ⑨ ① ② Noise ① ② ③ ⑤ ⑨ ① ② 0 ② 0 ② 0 ② 0 ② 0 ② 0 ② 0 ② 0 ② 0 ② 0 ② 0 ② 0 ② 0 ② 0 ② 0 ② 0 ② 0 ○ 0 ○ 0 ○ 0 ○ 0 ○ 0 ○ 0 ○ 0 ○ 0 ○ 0 ○ 0 ○ 0 ○ 0 ○ 0 ○ 0 ○ 0 0 ○ 0 0 ○ 0 0 ○ 0 | Integrity of protected areas | | 0 | 2 | 3 | (4) | 6 | 9 | 0 | 2 | 9 |
| Noise | Impacts of oil exploration | | 1 | 2 | 3 | (4) | 6 | 9 | 0 | 2 | 9 |
| Other (specify) O Yes O O O O O | Noise | | 1 | 0 | 3 | (4) | 5 | 9 | 0 | 2 | 9 |
| Other (specify) ○ No → SKIP TO 4.3 3: What are your sources of environmental information? MULTIPLE RESPONSES ALLOWED ○ Relatives/Friends ○ Relatives/Friends ○ Relatives/Friends ○ Relatives/Friends ○ Relatives/Friends ○ Robin Media ○ Internet ○ School/Library ○ Forkingmental information | | O Yes | 0 | 2 | 3 | (4) | 6 | 0 | 0 | 2 | 9 |
| 3: What are your sources of environmental information? MULTIPLE RESPONSES ALLOWED Relatives/Friends Reversa and the source of | . Other (specify) | ○ No → | SKIP | TO 4.3 | 3 | | | | | | |
| Government or local town, city or village council Othera (marife) | 3: What are your sources of er MULTIPLE RESPONSES Relatives/Friends Newspaper TV Radio Social Media Internet School/Library Environmental interest grou Government or local town, Other Generative | Invironmental inform ALLOWED JP city or village counce | mationa | • | | | | | | | |

Source: Statistical Institute of Belize, Data Dissemination Unit, 2022.

Note: Belize's Population and Housing Census of 2010 included the same environmental section.

Recent population censuses conducted in countries of the Pacific such as Kiribati and Nauru integrated several questions and modules on environmental and climate change issues. This allow them to collect relevant information from large household samples, but led to increase the length of the questionnaires and therefore the burden of respondents with potential negative effect of the quality of responses.

Example 2. Environmental questions included in the Population Census questionnaire of Kiribati, 2020

| E | MODULE K: ENVIRONMENT | | |
|----------|--|---|------------------|
| V1 M1 | K1. Has anyone from this household has eaten the following fishes in the last 12 months? self.xissing.Length = 0 All Yez/No categories have to be asked and filled | MURTISELECT: YES/NO 01 / Turtle 02 / Shark 03 / Bonefish | eat_fis |
| V1 M1 | K2. Has any Household member cut any of the following trees in the last 12 months to build local houses? self.Missing.Length = 0 AlYes/No categories have to be asked and filled | MLCTIALUC: YISNO 01 Te tongo 02 Te nii 03 Te nia 04 Te mao 05 Te mao 05 Te uri 06 Te kaina | cut_tree |
| | K3. Do you see waste as a problem on your Island? | SINGLE-SELECT 01 O Yes 02 O No | waste_proble |
| E | K4. State reason(s) of wastes being a problem? waste_problem=1 | MULTIFILIET 1 Unhygienic (source of illness) 2 Bad smell 3 Source of insects (including mosquitoes) 4 Bad sight 05 Other (specify) | waste_reaso |
| | K4_oth. Describe other reason of waste problem? | TEXT | oth_waste_proble |
| Е | waste_reason.Contains(5) | | |

Source: https://www.fao.org/fileadmin/user_upload/wca/docs/KIR_QUE_ENG_2020_PHC.pdf, 2022.

| CLIMATE CHANGE AND ENVIRONMENT | |
|---|--|
| 727. Does your houshold ever read / seen / heard about climate change? | MULTISELECT. VESMO Climate_change 01 // Magazine 02 // Brochures 03 // Internet 04 // Flyers 05 // TV 06 // Radio 07 // Film 08 // Community event 09 / Education Institution 10 / Outreach worker 11 // Family/ friends 12 // Other |
| 728. In the last 10 years, has your household/community been affected by? self.#tissing.Length=0 Ensure you'fil all categories | MULTISALLECT: VESNO affected_10yrs 01 |
| 728_oth. Other description of disasters? | τεκτ other_disaster |
| 728a. For those reason(s) selected, have you taken any preventative measures to prevent impacts of future hazards? affected_10yrs.Ves.Lengthv0 | sNGLE-SELECT prevent_measure 01 O Yes 02 O No |
| 728b. Why didn't you take any preventative measures in the last 10 years? prevent_measure2 | MULTISALLET no_measure 01 There was nothing we could do 02 Lack of money 03 Lack of skills/knowledge 04 Lack of other resources 05 We had other priorities 06 It's not our task 07 I don't know what I should have done 97 Other reasons |

Example 3. Climate change questions included in the Population Census questionnaire of Nauru, 2021

Source: SPC, 2022.

Population and household censuses can also be used to ask questions about climate change, its causes and consequences. For example, when asking about the cause of the death of household members: natural disasters, epidemics, etc. could be added as a response option. This would help characterise specific population groups, which could then be the object of thematic surveys, for example, on the human impact of climate change (on health, death rates, etc.). Similarly, when investigating migration in a census, an additional question could be asked on its causes, which could include natural disasters, climate change and other environmental phenomena.

In the census on housing section, questions related to water availability and quality could be linked to climate change (or other environmental aspects): for example, reduced water availability may be due to water scarcity, drought, etc., directly related to climate change. Finally, food security and nutrition are also a domain which is affected by climate change and affects the vulnerability of populations to climate change. Including some of the modules of the FIES in censuses, as it is done, for example, in the Marshall Islands, is insufficient to address the interlinkages between climate change and food insecurity and nutrition. Additional questions should be developed to understand the causes of food insecurity, directly or indirectly related to climate change, such as reduced production or yield due to adverse climatic conditions. These questions, however, are too detailed to be included in a census and should be covered ideally in a specific sample survey.

2.3. Agricultural Censuses including climate change-related data

The census of agriculture is a fundamental element of the national statistical system, especially in the least developed countries where agriculture is a major economic activity and represents a significant share of the country's gross domestic product. According to the World Programme for the Census of Agriculture - WCA 2020 (FAO, 2015)³⁸, "the basic objectives of the census of agriculture are:

³⁸ The World Programme for the Census of Agriculture 2020 (WCA 2020) are the latest guidelines developed by the Statistics Division of FAO and have been elaborated based on the compilation of experiences from different countries. It has considered new data demands, such as those raised in the 2030 agenda. The volume 1 and 2 of the WCA 2020 programme can be consulted at <u>http://www.fao.org/world-census-agriculture/en/.</u>

- To provide data on the structure of agriculture, especially for small administrative units, and to enable detailed cross-tabulations;
- To provide data to use as benchmarks for and reconciliation of current agricultural statistics;
- To provide frames for agricultural sample surveys" (p.4).

For the WCA 2020, climate change, environment, land and water use, and rural poverty data are new and emerging statistics crucial to measuring the impacts of development policies and programmes, including the interaction between agriculture and the environment.

In the current round of the census of agriculture, five countries included small modules related to **damages to** land or crop losses caused by natural disasters. Fiji and Benin had a more comprehensive section on Climate Change and Challenges.

In the left side of the slide we can see an screenshot of the Beinn census questionnaire, where the climate section has questions on climante change perceptios, and the questions proposed are more or less what is causing the climate variations, which are the characteristics of climate change?,

Example 5. Natural disasters- questions included in the Integrated Agriculture Census of the 2016 Federated States of Micronesia

| | Details | of land issu | es | | | |
|-------|--|---|---------------------------|---|-------|---|
| 100 | For the land your household operates: | | | | | 1 |
| | Description of issue | Affected by issue? 1 Yes 2 No if 2 ▶ next issue | Which Parcel Number(s) | What measures did you take to adapt to the situation? | Obs | |
| 26101 | 26102 | 26103 | 26104 | 26105 | 26199 | |
| In t | he past year | | | | | |
| 01 | Has any of your land been damaged by landslides? | | | | | |
| 02 | Has any of your land been damaged by rain flooding? | | | | | |
| 03 | Has any of your land been damaged by sea water? | | | | | |
| 04 | Has any of your land been damaged by drought? | | | | | |
| 05 | Has any of your land been damaged in other ways? | | | | | |
| 06 | Has any of your land been irrigated? | | | na | | |
| 07 | Has any of your land been burnt off to clear it (e.g. for planting or livestock)? | | | | | |
| At t | he current time | | | | | |
| 08 | Does any of your land have drainage or other water management (ditches, pumping out water)? | | | na | | |
| 09 | Does any of your land have invasive species problem? | | | | | 1 |

Source: WCA, 2022.

Example 6. Natural disasters questions included in the Census of commercial agriculture of South Africa, 2017

Q 22.3: During the financial year, did this operation experience loss due to: (Mark the appropriate box with an 'X')

| Natural disasters | | | Yes | | No |
|-----------------------------------|--|---|-------|------|----|
| Hail | | | | | |
| Drought | | | | | |
| Floods | | | | | |
| Frost | | | | | |
| Other natural disasters (specify) | | | | | |
| Fire (if 'Yes', indicate Yes No | | D | Hecta | ares | |
| hectares affected) | | | | | |
| Courses 14/CA 2022 | | | | | |

Source: WCA, 2022

Example 7. Natural disasters questions included in the third Census of agriculture of Lao People's Democratic Republic (2019/2020)

Part 11 Food security of the household

Q1. In the last 12 months, what kind of Natural disaster has your agricultural activities been affected by? (Multiple choices)

- 1. Flood
- 2. Drought
- 3. Storm
- 4. Pest
- 5. Other
- 6. No disaster

Q2. How much did your household lose agriculture productions in the last 12 years?

- 1. Not lose
- 2. Less than 20%
- 3. Between 20-40%
- 4. More than 40%

Example 8. Natural disasters questions included in the Census of Agriculture of Kenya, 2022/23

Q 80. Which of the following natural disasters did the household experience in the last 12 months?

If experienced, record the extent of loss of agricultural output due to the natural disaster in col.3.

| | Code | Extent of damage | |
|------------------------|---------------------|------------------|---|
| | | None | 1 |
| Natural Disaster | (Circle if disaster | Slight | 2 |
| | was experienced) | Moderate | 3 |
| | | Severe | 4 |
| Floods and tidal waves | | | |
| Drought | | | |
| Hailstorms | | | |
| Pests/diseases | | | |
| Erratic rains | | | |
| Other | | | |
| Man made | | | |
| Insecurity | | | |
| Other man made | | | |

Source: National Bureau of Statistics, 2022.

Additionally, the census on agriculture of Fiji 2020 included a more comprehensive section on Climate Change and Challenges, which contained ten questions on the understanding of climate change, changes observed on the farm due to climate change, farming practices adopted because of the changes, tree species used in agro-forestry and main challenges/risks for agricultural activities:

Q9.1 - Do you understand what climate change is?

Yes/No/Some

Q9.2 - Have you noticed or observed any of the following changes on your farm in the last 10 years?

Loss of soil fertility

Decline in crop yield New pest and disease Increased Soil erosion Reduced water quality and supply

Change in cropping season Increased weather uncertainty Increased Drought

Q9.3 - Have any of these occurred on your farm in the last 10 years?

| Waterlogging |
|----------------------|
| Salt water intrusion |
| Lack of Fresh Water |
| Bush Fire |
| Pest and Disease |
| Others |
| None |

Q9.3a - Others Please specify

Q9.3.1 - How often has _____ occurred in the last 10 years?

Once or twice/ Once or twice most years /Once or twice most months

Q9.4 - In the last ten years, have you adopted any of these farming practices used on your farm because of these changes?

| | Agro-forestry |
|---|--|
| | Planting climate resilient crop varieties |
| | Climate resilient livestock breeds |
| | Use of recommended agriculture inputs |
| | Crop rotation |
| | Planting of mucuna cover (nitrogen fixing) crops |
| | Contour Farming |
| | Waste Product Management |
| | None |
| - | |

Q9.5 - What species of trees are planted for agro-forestry?

| 1 | |
|---|-------------------|
| | Fruit Trees |
| | Medicinal Trees |
| | Timber & Firewo |
| | Nitrogen fixing T |
| | Other |

imber & Firewood Trees Nitrogen fixing Trees

Other

Q9.5a - Others Please specify

Q9.6 - What are the main challenges/risks to your agricultural activities?

| Pest/ disease |
|---|
| Availability/cost of planting materials/ seed for crops |
| Availability/cost of fertilisers/chemicals for crops |
| Availability of replacement livestock |
| Availability of drugs/drenches for livestock |
| Availability/ price of feed for livestock |
| Access to more land |
| Land tenure |
| Access to water |
| Access to markets |
| Access to finance |

Access to Labour
 Damage
 Weather
 Transportation costs
 Infrastructure (for storage, roads/shipping services)

Q9.6a - Others Please specify

Several countries included in their census questions on the causes of production failures in agriculture: pests, climatic events (drought, etc.). This is the case, for example, of the recent censuses conducted in <u>Tanzania</u> (2019/20) and <u>Bhutan (2019)</u>. While some of these causes may be related to a varying degree of climate change, the structuration of these modules, the formulation of the questions and the modalities of response are not sufficient to present these modules or set of questions as climate change modules.

Additional attempts at introducing climate change questions or modules also reflect the lack of standardisation. For example, reference periods for questions concerning climate change may vary from 1 year (Micronesia, FS) to 10 years (Fiji). In Micronesia, questions on the adaptation actions of households to climate change are entirely open, rendering the analysis of the results highly complex. The <u>2016 census report</u> does not present or discuss any of these results. In Fiji, the census collected information on the major risks to agricultural activities, with a long list of response options, several of them overlapping and difficult to relate directly to climate change. For example, response options include "damage", "weather", "land tenure", which are too general to allow for meaningful analysis and interpretation.

The prioritisation of climate change in censuses or surveys is also very variable among countries. For example, the <u>Cook Islands census of agriculture 2021</u> included questions on the consequences of Covid-19 on fishery activities but no questions related to potential implications of environmental and climate change challenges.

2.4. Household surveys including climate change-related data

Household surveys are an important source of socio-economic data for households and individuals. Essential indicators to inform and monitor development policies are derived from these surveys (for example, in measuring poverty, employment, food security, access to health and public services, discrimination and violence, among other things). Household surveys therefore constitute a central component of National Statistical Systems.

Household surveys conducted by NSOs are generally multi-purpose, with different modules covering multiple themes, allowing to generate reliable statistics on a range of demographic and socio-economic characteristics of different populations. They are generally representative of the national population and of urban and rural areas, macro and micro-regions and, in some cases, lower administrative levels.

The Living Standards Measurement Study (LSMS) program of the World Bank's Development Data Group has been leading the methodological development and implementation of household surveys for more than 30 years. The LSMS programme has provided technical assistance to national statistical offices (NSOs) in designing and implementing multi-topic household surveys. It has developed a series of methodological documents with information on best practices related to survey design and implementation.

In the most recent guidebook produced by the LSMS programme, Oseni, Palacios-Lopez, Mugera, & Durazo, 2021³⁹ consolidated field-tested best practices to implement, improve, and modernise nationally representative multi-topic household surveys for monitoring welfare and poverty. According to the authors, the Climate Change and Natural Disasters survey module can be considered a special-focus household survey, with the following purpose/characteristics:

- Multi-topic survey focusing in detail on specific themes and/or demographic groups,
- Usually does not include detailed consumption or income modules,

³⁹ Oseni, G., Palacios-Lopez, A., Mugera, H.K. and Durazo, J. (2021). Capturing What Matters: Essential Guidelines for Designing Household Surveys. Washington DC: World Bank. Available at: <u>https://documents1.worldbank.org/curated/en/381751639456530686/pdf/Capturing-What-Matters-Essential-Guidelines-for-Designing-Household-Surveys.pdf</u>. Accessed 16 August 2022.

Regarding the household surveys' questionnaire modules, Oseni, Palacios-Lopez, Mugera, & Durazo (2021) grouped the modules usually included in a household survey, most of which are the proposed *Core Modules* from the World Bank's Household Survey Protocol⁴⁰ and are essential for a complete and thorough understanding of living standards and household welfare.

The modules presented in the guidelines include some questions that address some climate change aspects, for example:

- SECTION 1: HOUSEHOLD ROSTER. Q25 What was the main reason for moving to the current place of residence? Response category #3: drought, flood, or other weather-related reason.
- SECTION 2A: EDUCATION. Q25 Has [NAME] ever repeated any class during Primary, Junior Secondary, or Senior Secondary? Response categories: Yes, primary only 1 / Yes, secondary only 2/ Yes, both 3 /None
- SECTION 2A: EDUCATION. Q27 What was [NAME] 's main reason for repeating? / Response category #10: Natural disaster.
- SECTION 4: LABOR. Q23 Why did [NAME] not work during the last week? Response category #10: Natural disaster, etc.
- SECTION 11: HOUSING CONDITIONS. Q36 In the last 30 days, has there been any time when your household did not have sufficient quantities of drinking water when needed? Response categories: Yes 1; No 2.
- SECTION 14: SHOCKS COPING. Q2 During the last 12 months, was your household negatively affected by any of the following? Yes... 1 No... 2. Response category #9: Destruction of harvest by fire, #10: Dwelling damaged/demolished, #11: Irregular or poor rains that caused harvest failure, #12: Flooding that caused harvest failure or storage loss, #13: Pest invasion that caused harvest failure or storage loss, #14: 4 Loss of property due to fire or flood, #15: Loss of land, #16: Other natural disasters (landslides, earthquakes, etc.).
- SECTION 14: SHOCKS COPING. Q3 Rank the 3 most significant shocks you have experienced. Response categories: Most severe 1, Next most severe 2, Third most severe 3.
- SECTION 14: SHOCKS COPING. Q4 How did your household cope with [SHOCK]? (if shock happened more than once, ask about most recent. only ask for 3 most significant shocks ranked in Q3. Alternatives of response: #1: Sale of livestock, #2: sale of land, #3: sale of other property, #4: sent children to live with friends, #5: withdrew children from school #6: engaged in additional income generating activities #7: received help from friends & family, #8: borrowed from friends or family, #9: took a loan from financial institution, #10: members of the household migrated for work, #11: put purchases on credit, #12: delayed payment obligations, #13: sold harvest in advance, #14: reduced food consumption, #15: reduced non-food consumption, #16: relied more on collecting/foraging food items from forest/wild areas, #17: relied on savings, #18: took advanced payment from employer, #19: received assistance from NGO, #20: received assistance from government, #21: was covered by insurance policy, #22: did nothing, #23: other (specify).

However, these questions do not cover the full spectrum of possible impacts of climate change on households: the impacts on livelihoods, economic activities, food security and nutrition, health and many other relevant aspects are not covered at all in the survey instrument.

2.4.1. The Living Standards Measurement Study – Integrated Surveys on Agriculture (LSMS-ISA) and its nexus with climate change data

The LSMS studies can be focused on a precise objective. The LSMS team established the Living Standards Measurement Study – Integrated Surveys on Agriculture (LSMS-ISA) project in 2009 to improve the quality, relevance and sustainability of smallholder agricultural data in Sub-Saharan Africa. The project currently supports seven countries in the region: Ethiopia, Malawi, Mali, Niger, Nigeria, Tanzania and Uganda. LSMS-ISA surveys use different modules, with a core questionnaire and two auxiliary modules (one for agriculture and another for communities). The surveys collect essential information to improve the understanding of African economic development, particularly regarding agriculture and linkages between farm and non-farm activities. While each

⁴⁰ <u>https://documents1.worldbank.org/curated/en/848521606460880374/pdf/Household-Surveys-at-the-World-Bank-Protocol-for-Data-Collection-Quality-Assurance-and-Standard-Setting.pdf</u>

survey is specifically adapted to suit the local context in every country, essential indicators are comparable across the LSMS-ISA partner countries.

In 2011, the LSMS-ISA project developed a couple of sourcebooks on climate change: "Understanding Agricultural Households' Adaptation to Climate Change and Implications for Mitigation: Land Management and Investment Options" (McCarthy, 2011)⁴¹ and "Improving Household Survey Instruments for Understanding Agricultural Household Adaptation to Climate Change: Water Stress and Variability" (Bandyopadhyay et al., 2011)⁴².

According to McCarthy (2011), the LSMS-ISA surveys generated an ideal opportunity for creating knowledge on climate change as they relate to household-level adaptation choices and mitigation strategies. In the sourcebook, the author discussed some of the practices and investments associated with sustainable land management and reviewed the factors affecting the adoption of the practice. After describing some climate-change adaptative measures in agriculture (such as agro-forestry, soil and water conservation, and grazing land management), the sourcebook provided a list of variables collected in the LSMS-ISA studies that affect the adoption of adaptation and mitigation practices and investments. For example, variables include the knowledge about the type of soil on which the holding is located, the existence of crop insurance schemes and the access to information sources on weather and climate.

Complementing McCarthy's work, the manual "Improving Household Survey Instruments for Understanding Agricultural Household Adaptation to Climate Change: Water Stress and Variability" by the LSMS team. This manual, developed by Bandyopadhyay et al. in 2011, focused on smallholder adaptation responses to weather variability and the measurement of local water resources. It proposed to expand the existing LSMS-ISA modules to collect critical information related to household-level adaptation choices in response to local weather variability. The document analysed key features and gaps in the LSMS-ISA survey instrument and proposed "Adaptation modules" for LSMS-ISA surveys. These modules included farmers' perceptions of weather variability and household water-related adaptation to weather variability. In addition, the authors developed survey instruments for measuring village-level water resources, including rainfall, groundwater, and surface water.

According to Bandyopadhyay et al. (2011), the questionnaire modules of the LSMS-ISA surveys did not include sufficient questions for analysing household adaptation behaviour in response to short-term weather shocks and longer-term climate variability, particularly water resources stress and variability. During the review of questionnaires of the LSMS-ISA project countries, four data gaps were identified:

- Lack of data collection on farmers' perceptions of weather variability;
- Insufficient coverage of questions related to adaptation to weather variability and local water resource stress;
- No data collection on households' access to weather forecast information before planting seasons;
- Lack of survey instruments for collecting local water resource data.

After elaborating on missing questions on adaptation to water stress and variability, Bandyopadhyay et al. (2011) guided survey design for collecting adaptation questions and measuring local water resources by designing a specific water resources survey. In addition to the technical analysis, the handbook included two examples of "Adaptation modules" for LSMS-ISA in Niger and Nigeria.

The proposed household module covered the following sections and topics:

- A section on weather-related risk management and adaptation questions: Includes topics such as water use, fodder cultivation, different varieties of the same crops, use of alternative land management practices, livestock practices and fodder banks and investment in soil and water conservation.
- A section on access to weather information,

⁴¹ McCarthy, N. 2011. Agricultural household adaptation to climate change: Land investment and management. Washington, DC, World Bank. available at https://documents1.worldbank.org/curated/en/362521587051000386/pdf/Understanding-Agricultural-Households-Adaptation-to-Climate-Change-and-Implications-for-Mitigation-Land-Management-and-Investment-Options.pdf. Accessed August 18 2022.

⁴² Bandyopadhyay, S., Wang, L. & Wijnen, M. 2011. Improving household survey instruments for understanding agricultural household adaptation to climate change: water stress and variability. Washington, DC, World Bank. Available at

https://openknowledge.worldbank.org/bitstream/handle/10986/12764/702310ESW0P12400Change0Water0Stress.pdf?sequence=1. Accessed August 18 2022.

- A section on weather variability perceptions,
- A section on farmers' recall of weather during planting season.

Examples of key questions include details on irrigation practices such as type of irrigation system used, area irrigated, duration and intensity of irrigation. Under Livestock practices, the module had questions on the access to communal fodder banks and the changes in grazing locations due to fodder or water scarcity. Regarding access to weather information, questions included forecasts of the rainy season, the source of information received (government agricultural extension service, NGO, etc.), and the media used (radio, television, etc.).

Despite its comprehensive coverage of water-related issues for the agricultural sector, this module was not fully implemented in the different LSMS-ISA surveys in Niger and Nigeria. Possible explanations for this include the high level of detail requested, the length of the questionnaires, and the limited capacity of small-scale farmers to respond to highly complex questions.

In addition, LSMS-ISA have a distinct advantage over traditional LSMS surveys when it comes to studying issues specifically related to climate change, as its strong focus on agriculture allows to study the impacts of weatherand climate-related events on household welfare and to identify possible factors that trigger or prevent migratory flows, as well as exploring farmers' adaptation responses that complement migration as coping strategies in the face of climatic shocks.

However, Letta, Montalbano & Paolantonio (2022) concluded that the data collected in the existing LSMS-ISA is insufficient to characterize the nexus between migration and climate change properly. The authors propose different ways to address these information gaps: from a survey perspective, they propose to carry out "only slight modifications to the current questionnaires, such as short modules on adaptation and intention to migrate, the collection of migration histories or associate modules, and the integration of face-to-face surveys with phone surveys to increase the frequency of the longitudinal information". From an analytical perspective, they also call on researchers to combine LSMS-ISA with other surveys to enhance the quality and quantity of the information collected without necessarily conducting new data collection operations. These combined analyses would help investigate key but still unclear topics such as the role of immobility, the complementarity or substitutability between migration and other adaptation strategies, and the migration potential of cumulative slow-onset events (see Section 1.2.5 for more details on these concepts).

2.4.2. Climate change modules included in the national socio-economic surveys in forestry

How forests adapt to climatic change and how forests contribute to climate change adaptation was one of the forest roles analysed by FAO, CIFOR, IFRI, the World Bank and PROFOR when developing the National socioeconomic surveys in forestry in 2016⁴³. The handbook, which included dedicated climate change modules, consists of an established set of "forestry modules" and wild products that can be appended to existing sections of household surveys (LSMS or non-LSMS-type surveys).

According to the manual, for LSMS-type surveys, the information can be collected in four questionnaires:

- Standard Community Questionnaire,
- Standard Household Questionnaire,
- Extended Household Questionnaire,
- Extended Community Questionnaire.

The Extended Community and Extended Household Questionnaires dedicate complete modules on Perceptions/Adaptation to Climate Change. However, few questions on climate change can be found in the Standard Household and Standard Community Questionnaires (see Table 2).

Regarding the Perceptions of Climate Change module, it starts with questions on how the focus group feels climate change is affecting their community (questions 1 and 2), including steps taken to combat or protect against changes (questions 3 and 4). It also derived perceptions on the effectiveness of implementing activities to

⁴³ FAO, CIFOR, IFRI and World Bank. 2016. National socioeconomic surveys in forestry: guidance and survey modules for measuring the multiple roles of forests in household welfare and livelihoods, by R.K. Bakkegaard, A. Agrawal, I. Animon, N. Hogarth, D. Miller, L. Persha, E. Rametsteiner, S. Wunder and A. Zezza. FAO Forestry Paper No. 179. Food and Agriculture Organization of the United Nations, Center for International Forestry Research, International Forestry Resources and Institutions Research Network, and World Bank.

overcome adverse climate-change effects (question 5) and the perceived usefulness of continuing such actions (question 6).

The module on Climate Change and Variability aims to understand household members' observations about environmental/climatic changes in their villages that negatively affect the forest, the collection of forest products or their household condition. The module ends with questions about the household's perception of threat welfare in the future.

The module on Adaptation Strategies investigates households adopting climate change adaptation strategies, major challenges for adoption and the effectiveness of the activities implemented in reducing the harmful effects of climate change.

| Modules | Question | Alternatives of response | | | | | | | |
|---|--|---|--|--|--|--|--|--|--|
| Standard community questionnaire | | | | | | | | | |
| B. Most important forest and wild products | 9. If the availability of most important forest and wild products [MIPs] has increased, what are the reasons? | 9 = climate change, (e.g., changes in rainfall) | | | | | | | |
| Standard household questionnaire | | | | | | | | | |
| C2. Shocks and crises | 2.1 During the past 12 months, has your household been severely negatively affected by any of the following events? | 101 drought 101 floods 109 severe water shortage 110 loss of land 118 dwelling damaged, destroyed | | | | | | | |
| | 2.2 Rank the three most significant shocks you experienced | 1 = most severe 2 = second most severe 3 = third most severe | | | | | | | |
| D1. Forest changes | 1.1 Has there been any change in areas of natural forest cover in your village in the past five years? | 0 = no change >> [next module] 1 = increased 2 = decreased | | | | | | | |
| | 1.2. What is the main reason for the change in natural forests? | 3 = climate change/natural disasters | | | | | | | |
| Extended community question | onnaire | | | | | | | | |
| | 1. We hear much in the news about how climate change is affecting people in rural communities. Please can you tell us the main signs of climate change that you have observed in your village, if any? | Write brief description of climate changes observed in this village: LSMS-type surveys are unsuitable for open-ended questions. Users are encouraged to develop a coded set of answers/options to reflect the specificity of the setting where the survey is being implemented. | | | | | | | |
| | 2. Please can you describe the specific ways, if any, that climate change is affecting people in your village? | LSMS-type surveys are unsuitable for open- ended questions. Users are encouraged to develop a coded set of answers/options to reflect the specificity of the setting where the survey is being implemented. | | | | | | | |
| F1. Perceptions of climate | 3. Are people in your village taking any steps to combat or protect against these changes? | CODES: 1 = yes 2 = no | | | | | | | |
| change | 4. If yes, can you describe up to three main activities that people in your village are doing to protect against negative effects of climate change? | Write brief description of main activities: | | | | | | | |
| | 5. Up until now, how helpful have each of these activities been in helping your community to overcome the negative effects of climate change? | 1 = very helpful; 2 = somewhat helpful; 3 = no difference at all; 4 =somewhat unhelpful (works somewhat against our objectives); 5 = very unhelpful (has an opposite or negative effect from what we intended) | | | | | | | |
| | 6. In the future, beyond five years from now, do you think these activities will help your community to better overcome the negative effects of climate change? | 1 = very helpful; 2 = somewhat helpful; 3 = no difference at all; 4 =somewhat unhelpful (works somewhat against our objectives); 5 = very unhelpful (has an opposite or negative effect from what we intended) | | | | | | | |
| Extended household questio | nnaire | | | | | | | | |

| | | | | | | - | |
|----------|------------|-------|-----------|-------------|-------|----------|---------|
| Table 1. | Climate cl | hange | questions | included ii | n the | Forestry | Modules |

| Modules | Question | Alternatives of response |
|------------------------------------|---|--|
| Standard community question | onnaire | |
| | 1.1 In the past five years, have you observed any changes in [EFFECT] in your village? EFFECT: temperature precipitation frequency and severity of floods frequency and severity of fires frequency and severity of drought availability of natural water bodies in forest other, specify: | 0 = no change 1 = increased 2 = decreased |
| | 1.2 In your opinion, has this change in [EFFECT] negatively affected the forests where you normally collect forest products? | 1 = yes 2 = no |
| F1. Climate change and variability | 1.3 What major changes to your household condition, if any, have you experienced as a result of this change in [EFFECT]? Please describe the two most important changes in your household condition. | Enumerators: write brief description of change, then add corresponding code(s) below (multiple codes per effect is OK). HOUSEHOLD CONDITION codes: 0 = no major change to household condition 1 = increase in availability of food 2 = decrease in availability of food 3 = increase in income 4 = decrease in income 5 = increase in assets 6 = decrease in assets 7 = increase in health 8 = decrease in health 99 = other change, specify: |
| | 1.4 Has your HH collected or harvested any forest or wild products to help with this change in [HOUSEHOLD CONDITION]?1.5. In your opinion, do you think that a change in | 1 = yes often 2 = no, not at all 3 = yes, sometimes 1 = yes, strongly 2 = yes, somewhat |
| | [EFFECT] will be a threat to your household's welfare in the future? | 3 = no opinion 4 = no, not very much 5 = no, not at all 99 = don't know |
| F2. Adaptation strategies | 2.1 In the past 12 months, has any member of your household done any of the following [ACTIVITY]? ACTIVITY planted trees reduced the amount of forest land that your household clears protected trees on your farm practiced agro-forestry or silvipasture changed or expanded the types of different ways your household gets income from forests changed the harvesting time of forest products other, specify: | 1 = yes >> [2.4] 2 = no |
| | 2.2. Does your household want to do [ACTIVITY] | 1 = yes; |
| | 2.3. What is the main constraint for not being able to do [ACTIVITY]? | 1 = lack of money 2 = lack of knowledge 3 = lack of labour 4 = lack of land access 5 = lack of technology/tools/infrastructure 99 = other, specify: |
| | 2.4. In your opinion, has your household condition improved as a result of doing this [ACTIVITY]? | 1 = yes 2 = no |
| | 2.5. In your opinion, to what extent has this [ACTIVITY] helped your household to reduce any | 1 = it has not been helpful until now 2 = somewhat helpful until now 3 = very helpful until now |

| Modules | Question | Alternatives of response | | | | | | | |
|----------------------------------|---|---------------------------------|--|--|--|--|--|--|--|
| Standard community questionnaire | | | | | | | | | |
| | negative effects from climate change that you feel your household has experienced? | | | | | | | | |
| | 2.6. In your opinion do you consider this [ACTIVITY] in general to be an effective strategy to reduce the effects of climate variability mentioned above (1.1)? | 1 = yes 2 = no 3 = partly | | | | | | | |

The forestry modules have been implemented nationally in Turkey, Georgia, Sao Tomé e Principe, Armenia and Liberia. In general terms, the main objective of the surveys was to analyse forest contributions to livelihoods, households' dependence on forest resources and linkages with poverty. Surveys were also designed to reflect the countries' forest context and may have varying scopes and objectives. For example, in Liberia, the survey also focused on the contribution of forests to disaster and shock management. Still, the modules on climate change perceptions/adaptations in Liberia's survey questionnaire were not included.

2.4.3. The 50x2030 Initiative

This initiative is a multi-partner program that seeks to bridge the global agricultural data gap by transforming country data systems in 50 countries in Africa, Asia, the Middle East and Latin America by 2030. The initiative improves country-level data by building strong nationally representative survey programs.

The 50x2030 Initiative's survey system with its two programs – the Agricultural Program and the Integrated Program – consists of a package of tools composed of the CORE-AG tool and additional specialized instruments that may be added according to the country's needs and demands. Regarding the questions included in the 50x2030 Section 12 and 13, these cover the following questions:

Section 12: GHG & Environmental issues:

- Q1: Was the agricultural area utilized in the past 12 months by the farm located partially or totally in an officially protected area? Yes...1/No...2
- Q2: What is the name of this protected area? Name:
- Q3: Were there any contaminated sites on the farm in the past 12 months? Yes...1/No...2
- Q4: Was the farm involved in any organization(s) (cooperative, association, etc.) for environmental protection programs in the past 12 months? Yes...1/No...2
- Q5: What was (were) the main area(s) of environmental concern for the farm in the past 12 months? Lack of water (drought)...1/Floods...2/Air pollution...3/Soil pollution...4/Extreme temperature (cold or heat)...5/Other (specify)...999 /None...0 - Did the farm pay any fines for environmental pollution in the past 12 months?

Section 13: Climate/Environmental Shocks & Adaptation Strategies:

- Q1: During the past 12 months, did this farm put in place any of the following adaptation practices? Multicropping...1/Shifting cultivation...2/Use of traditional heritage practices and knowledge...3/Use of traditional crop/animal varieties...4/Use of seeds adapted to local conditions and stresses...5/Use of new practices or technologies...6/Other (specify)...999/No adaptation practice put in place...0
- Q2: Did the farm experience shock in the past 12 months? SHOCK TYPE: Drought or erratic rainfall/ Floods or heavy rainfall/ Landslides/ Heavy winds/ Extreme temperatures (too hot or too cold)/ Tsunamis/ Earthquakes/ Unusually high level of crop pests/ Unusually high level of livestock diseases/ Unusually high food prices/ Unusually low food availability/ Other (specify).
- Q3: How many times did the farm experience [SHOCK TYPE] in the past 12 months?
- Q4: Due to this(these) shock(s) that hit the farm in the past 12 months, how many people in the farm were... a. killed/ b. injured/ c. rendered homeless/ d. evacuated.
- Q5: How severe was the impact of [shock type] on the livelihood of this farm? (if shock occurred multiple times, ask about the most severe occurrence) No impact...1/ Slight impact...2/Moderate impact...3/Strong impact...4/Worst ever happened...5
- Q6: Thinking about the most severe occurrence of [shock type] in the past 12 months, which of the following physical impacts did the farm experience as a consequence of [SHOCK TYPE] occurrence? Loss of land...1/Crop losses...2/ Livestock losses...3/ Aquaculture losses...4/ Biomass losses/damages...5/

Loss/damage of house...6/ Loss/damage of farm buildings/facilities...7/None of the above...0/Other physical impact (specify)...999

- Q7: How severe were these impacts? Small losses/damages...1/Significant losses/damages...2/Almost total or total losses/damages...3
- Q8: Which of the following economic impacts did the farm experience as a consequence of [shock type] occurence? Loss of income due to disruption of production...1/Loss of revenues...2/Reduction in the earnings of salaried household member(s)...3/Loss of employment of salaried household member(s)...4/None of the above...0/Other economic impact
- Q9: How severe were economic impacts? Small losses...1/Significant losses...2/Almost total or total losses...3
- Q10: During the past 12 months, did this farm had access to any of the following mechanisms for protection against [shock type]? Household had access to or availed formal credit for protection against the shock...1/Household had access to or availed informal credit for protection against the shock...2/Household had access to or availed insurance for protection against the shock...3/Neither the holding had access to nor availed any of the above mechanisms for protection against external shocks...

2.5. Examples of climate change national household surveys

2.5.1. The climate change household surveys in Bangladesh and Nepal

Bangladesh is a country heavily impacted every year by natural disasters. In 2016, the Bangladesh Bureau of Statistics (BBS) implemented the Impact of Climate Change on Human Life (ICCHL) Programme: a household survey-based programme aimed at generating information on the socio-economic characteristics of the communities living in the twelve main natural disaster-prone areas of the country (BBS, 2021)⁴⁴. The survey name is: "The Bangladesh Disaster-related Statistics: Climate Change and Natural Disaster Perspectives"; it pursues the following objectives:

- To measure the socio-economic characteristics of households and populations living in disaster-prone areas;
- To assess the loss of agricultural production due to natural disasters,
- To calculate the damage and loss of cultivable land and useable land in disaster-prone areas,
- ⁻ To measure the damage and loss of residence (dwelling), cowshed, and kitchen in disaster-prone areas,
- To collect data on health and sanitation conditions from natural disaster-prone areas,
- ⁻ To assess the vulnerability of the women, children, aged persons and persons with disability, and
- To collect information on the perception and knowledge about climate change, the impact of climate change, the environment and disaster management.

The 2016 survey questionnaire consisted of 126 questions distributed in 14 modules, covering a six-year period beginning in 2009 and ending in 2014. Data was collected in paper questionnaires in a field operative lasting 45 days, with 1800 enumerators and 80 field supervisors. The survey's final report contains 76 statistical tables. The survey was repeated in 2021 by the BBS, covering a six-year period from 2015 to 2020, and with a sample size of about 130 000 households.

<u>Nepal</u>

In 2016, the Central Bureau of Statistics (CBS) conducted a National Climate Change Impact Survey (NCCIS) to complement the Government of Nepal's sustainable development and adaptation initiatives (CBS, 2017)⁴⁵. The objectives of the survey were the following:

 Understanding and acquiring knowledge on the effects and impact of climate change from socioeconomic and environmental perspectives;

⁴⁴ BBS. 2021. Report on Bangladesh Disaster-related Statistics 2021. Climate Change and Natural Disaster Perspectives. Available at: <u>https://bbs.portal.gov.bd/sites/default/files/files/bbs.portal.gov.bd/page/b343a8b4_956b_45ca_872f_4cf9b2f1a6e0/2022-06-19-13-40-</u> <u>ddf8d0fd849e94d733a06d2d38dcd90b.pdf</u>. Accessed August 15 2022.

⁴⁵ CBS, 2017. National Climate Change Impact Survey 2016. A Statistical Report. Central Bureau of Statistics, Kathmandu, Nepal. Available At: <u>https://cbs.gov.np/national-climate-change-impact-survey-2016-report/</u>. Accessed August 15 2022.

- Exploring how the respondents are developing or making adaptive capacity to confront the implications of climate change;
- Establishing a linkage between climate change and environment-related indicators, from one side, and the SDG Goal 13, on the other, to take urgent actions to combat climate change and its impact.

The survey provides indicators on the impact and effect of climate change, demography, household income, level of education, knowledge and perception about climate change, climate-induced disasters and socio-economic impacts, natural resources and biodiversity, climate change and health, and adaptation practices adopted by households to cope with the adverse situation created due to changing climate.

The 2016 survey covered the whole country, including rural and urban areas, and enumerated 5,060 households. The questionnaire consisted of 18 pages, with 169 questions distributed in 12 modules. For this first round, the data collection was undertaken between July and December of 2016; data were collected in tablets by a team constituted of 36 enumerators distributed through 33 Statistics Offices. Nepal will conduct the second round of this survey in 2022.

2.5.2. Analysis of the questionnaires

The Nepal and Bangladesh climate change survey questionnaires are structured as follows:

 Table 2. Questionnaires structure of the Nepal and Bangladesh climate change surveys

| The Nepal National Climate Change Impact Survey (NCCIS) | The Bangladesh Disaster-related Statistics: Climate Change and Natural |
|--|--|
| Module 1: Introductory Information | Introduction |
| Introduction: Questions from A01 to A06 | Information of the respondent |
| Information of the respondent: Questions from A07 to A12 | Module 1: General information of household 2014 |
| | Questions from 1 to 11 |
| Module 2: Personal and Household Information | |
| Sub-Module 2.1. Personal information | Module 2: Information of household members |
| Questions from B01 to B09 | Questions from 12 to 29 |
| Sub-Module 2.2. Household Information | |
| Questions from B10 to B18 | |
| Module 3: Land Holding Information of Households | Module 3: Household property (based on 2014 economic valuation) |
| Questions from C01 to C02 | Questions from 12 to 29 |
| Module 4: Household Access to Socio-economic Services Questions from D01 to D011 | Module 4: Impact of climate change and natural disasters on livelihoods |
| | Questions from 34 to 40 |
| Module 5: Household Income Information (over the past 12 months) | Module 5: Loss of agricultural products of the household level due to |
| Questions from E01 to E05 | natural disasters (2009-2014) |
| | Questions from 41 to 49 |
| Module 6: Knowledge and Perception about Climate Change, | |
| Reasons and Impact | |
| Sub-Module 6.1. Basic Information | |
| Questions from F01 to F05 | Module 6: Loss of agricultural products (livestock, poultry and fisheries) |
| Sub-Module 6.2: Information on Temperature | at household level due to natural disaster (2009-2014) |
| Questions from F06 to F08 | Questions from 50 to 61 |
| Sub-Module 6.3: Information on Rainfall | |
| Questions from F09 to F011 | |
| Sub-Module 6.4: Information about Impact of Climate Change | |
| Questions from F12 to F017 | |
| Module 7: Impact of Natural Disasters or Events | Module 7: Damage of land at household level due to natural disaster |
| Questions from GO1 to G23 | Questions from 62 to 67 |
| <u>Module 8: Disease and Health Impacts</u> | Module 8: damage and loss of residence kitchen, cowshed and |
| Sub-iviolatie 8.1. Impact on crops and investock | |
| Sub Module 8.2. Impact on human health | $\frac{2014j}{2014j}$ |
| Questions from H07 to H10 | |
| Module 9: Impact of Climate Change on Water Resources (over the | |
| nast 25 years) | Module 9: Heath concernst injury and disability and numbers of death |
| Sub-Module 9.1. Current State of Water Resources | household members due to natural disasters (2009-2014) |
| Questions from I01 to I10 | Questions from 73 to 83 |
| Sub-Module 9.2: Reasons of Chanaes on Water Resources | |
| Questions from I11 to I12 | |
| Module 10: Impact of Climate Change on Bio-diversity Over the Past | |
| 25 Years | Module 10: Impact of climate change and natural disaster on children |
| Sub-Module 10.1. Changes in the Various Species | (2009-2014) |
| Questions from J01 to J07 | Questions from 84 to 90 |
| Sub-Module 10.2. Infestation Over the Past 25 Years | |
| Questions from J08 to J14 | |

| The Nepal National Climate Change Impact Survey (NCCIS) | The Bangladesh Disaster-related Statistics: Climate Change and Natural |
|---|---|
| | Disaster Perspectives |
| Sub-Module 10.3. Changes in the Floristic Behavior Over the Past 25 | |
| Years | |
| Questions from J15 to J23 | |
| Module 11: Impact of Climate Change on Tourism Over the Past 25 | Module 11: Preparedness to tackle natural disasters (based on lessons |
| Years | from previous disasters) |
| Questions from K01 to K05 | Questions from 91 to 99 |
| Module 12: Farm Based Coping Strategies/Action Adopted by | |
| Households Due to Impact of Climate Change Over the Past 25 Years | Module 12: Disaster preparedness measures during the period of natural |
| Sub-Module 12.1.Farm-Based | disaster (till the situation gets normal) |
| Questions from L01 to L25 | Questions from 100 to 110 |
| Sub-Module 12.2: Off-farm Based | |
| Questions from L25 to L31 | |
| | Module 13: Health and sanitation condition of the household affected by |
| - | natural disaster |
| | Questions from 111 to 120 |
| | Module 14: Knowledge and perceptions about climate change, climate |
| - | change impacts, disaster and disaster management |
| | Questions from 121 to 126 |

2.5.2.a Introductory modules

The survey questionnaires begin with household identification pages and respondent information. In Nepal, to get reliable information on climate change, households with respondents aged 45 or above living in the same locality for at least 25 years were only considered eligible for the survey. For this reason, two questions are added to the questionnaire: respondent age and length of stay in the community.

Both surveys collect basic information (Modules 1 to 3 in Bangladesh, Modules 1 to 5 in Nepal) on the household, its income, livelihoods and assets that are useful to analyse the data from the other modules, which focus on the impact of climate change. For example, both surveys include general household information on residence ownership, type of infrastructure, and agricultural land operated by the family. Additional questions aimed at assessing the household's income, for example, whether the household receives remittances and income from agricultural and non-agricultural activities. This information may help determine the household's vulnerability and potential resilience to climate change-related events. Similarly, the data collected in Nepal on households' access to socio-economic services (e.g., savings cooperatives, organisations, agricultural or livestock services) is helpful from a vulnerability analysis perspective: questions on the household's conditions and access to basic services, the primary source of drinking water, the main source of energy for cooking and lighting, and the kind of toilet available are also important in this perspective.

2.5.2.b Climate change modules

The following themes are described in the order they are presented in the Nepal survey questionnaire:

Knowledge and perception about climate change, reasons and impact

Both questionnaires include a module on "Knowledge and perception about climate change, reasons and impact". In the Nepal survey, this module opens the survey questionnaire, while in the Bangladesh survey it closes the questionnaire.

The two questionnaires, however, provide a different approach to this theme. In Nepal, it is inquired whether the respondent has heard about climate change and the information means through which he received this type of information. Also, the respondent's perception of climate variation in his locality compared to the last 25 years is investigated, and the reasons to which the respondent attributes these changes. While the respondents may have difficulties answering this question given the complexity of the topic, which is reflected in the response options provided (urbanisation, industrialisation, over-exploitation of resources, etc.), the question is rather straightforward and well-formulated. In Bangladesh, in contrast, questions on the characterization of the phenomenon of climate change go beyond asking the household whether the climate has changed or not in its locality and response options are much more detailed and less clearly formulated. For example, in Q 121. What do you know or your perception of climate change? One of the alternatives of response provided is "Climate

change is long-term changes of climatic conditions, due to variation in natural processes or due to human activities".

The analysis of these two questionnaires reflects the lack of uniformity in the way questions on the perception of climate change by households. The quality and comparability of the results would be significantly improved if the structure of this module followed a common pattern and if it were systematically placed at the beginning of the survey. Given the complexity and subjectivity of this topic, it is also crucial that the questions be formulated in a clear and straightforward way. The Forestry Modules (see Section 3.4.2) give a possible example of a module on climate change perceptions.

Module 6: Knowledge and Perception about Climate Change, Reasons and Impact 6.1. Basic Information

| Description | Code | Description |
|--|------|--|
| F01. Have you heard about climate change? Yes1 No2 If no, go to question F03 | | F02. If yes, what is your main source of information about climate change? Radio1 Television2, Newspaper/publications3 Awareness campaign4 Local bodies/authorities5 Neighbor and friends6 Family member7 Others8 |
| F03. Do you think climate of this place is different than it was 25 years before? Yes1, No2,go to section 6.2 | | F04. What may be the main reason of the climate change? Deforestation1 Natural reason2 Industrialization3 Urbanization4 Over exploitation of resources5 God wish6 Earthquake7 Others8 Do not know9 (Please select 3 options based on priority) |

Figure 4.a - Nepal

Module 14. Knowledge and Perception about Climate Change, Climate Change Impacts, Disaster and Disaster Management

| Ques. 12 | 1. What do you know or your perception | about Climate | Ques. 122. What are the possible impacts/effects of climate | | | | |
|----------|---|--------------------------|---|--------------------------------|----------------------|--|--|
| Sl.No. | Description | Code (write only one) | Sl.No. | Description of Disaster | Based on priority | | |
| 1 | Long-term changes of climatic | | 1 | Sea Level Rise1 | | | |
| 1 | processes or due to human activities | | 2 | Drought/Dryness2 | | | |
| 2 | Regional variation in temperature and rainfall | | 3 | Flood/Water logging3 | | | |
| | Extreme events that cause colossal and | | 4 | Salinity4 | | | |
| 3 | sudden loss of human life and infrastructure | | 5 | Storm/Tornado/Hailstorm5 | | | |
| 4 | Others (specify) | | 6 | Tidal surge/Cyclone/Hurricane6 | | | |
| 5 | Do not know | 1 | 7 | Others (specify)7 | | | |
| | | | | | | | |

Figure 4.b - Bangladesh

Figure 4. Knowledge and perception questions included in the climate change surveys of Nepal and Bangladesh

Questions on temperature

Within the module on "Knowledge and perception about climate change, reasons and impact", the Nepal survey includes the sub-module "6.2. Information on temperature" that asks the respondent about their perception of temperature variations in the summer and winter seasons compared to the previous 25 years and the duration of these seasonal periods 25 years ago and today (with specific questions for start dates per month and week). Similarly, sub-module 6.3 on "information on Rainfall" contains three questions regarding the volume of rainfall for the Monsson season and the Winter rain compared to the previous 25 years and today. The information needed to answer these questions, however, is difficult to retrieve, given the long recall period (past 25 years): the quality of the answers provided to these questions is likely to be low, and the results imprecise. More generally, these questions could be better addressed through physical measurements and monitoring systems at local and international levels.

The questionnaire of Bangladesh does not include any questions related to these perceptions.

Questions on the impact of climate change

The Nepal survey investigates the most important natural disasters or climatic events that occurred in the locality in the last 25 years, asking if there have been changes in their occurrence (increases or reductions) and the degree to which these events have affected households, and the main reasons explaining its occurrence. As discussed in

the previous section, the high complexity of the topic and the very long recall periods (past 25 years) are likely to lead to low-quality responses and little value and usability of the results. These phenomena, their frequency of occurrence and intensities can be better assessed through information collected by monitoring stations, early warning systems and other relevant platforms or organizations, including the private sector (e.g. insurance industry). The questionnaire of Bangladesh does not include any questions related to these perceptions.

Impact of natural disasters or events

In Nepal, the questionnaire asks for additional information on the natural disasters that occurred in the last five years, such as infrastructure damage, persons who were unable to work or were unemployed, food shortages, and human casualties. These questions are highly relevant, but because questions are referred to the past 25 years, it is likely that the quality of the results would be reduced.

The Bangladesh survey asks similar questions with slight differences. It provides a list of disasters for the respondent to identify when the household was affected for the first time by the event in the last five years. Next, it is investigated how many times this type of event has hit the household in this same period and when was the last time the family was affected by the event. In addition, it is asked whether the household members were unavailable for work or unemployed because of the event, whether they received any forecast of the event, by which means they received this early warning, and whether they took any preparatory measures before the event. All these questions are highly relevant, well-structured and formulated.

| SLNo. (Code) | Type of Natural disaster (Please keep in mind that a HHI may be affected by different types of disaster, the enumerator may make the respondent understand the differences between disaster types and then gather data) | 34. In which year your household was first affected by any of the following disasters? | | 35. How many times were you affected by the following disasters during 2009- 2014? | 36. When were you last affected by the following disasters between 2009 and 2014? | 37. How many days on average your household members were not able to work/ unemployed due to the following disasters | 38. Did you get/ receive any advance notice or forecast? Yes1 No2 (if answer is 'NO' then go to Module 5) | 39. How did you get the early warning information? Radio | 40. Did you take any prior preparation? Yes1 No2 | | |
|-----------------|---|--|---|---|--|--|---|--|--|---|---|
| 1 | 2 | | | 3 | - | 4 | 5 | 6 | 7 | 8 | 9 |
| 1 | Drought | 0 | 0 | 0 | 0 | | | | | | |
| 2 | Flood | | | | | | | | | | |
| 3 | Water logging | | | | | | | | | | |
| 4 | Cyclone | | | | | | | | | | |
| 5 | Tornado | | | | | | | | | | |
| 6 | Storm/Tidal surge | | | | | | | | | | |
| 7 | Thunderstorm | | | | | | | | | | |
| 8 | River/Coast erosion | | | | | | | | | | |
| 9 | Landslide | | | | | | | | | | |
| 10 | Salinity | | | | | | | | | | |
| 11 | Hailstorm | | | | | | | | | | |
| 12 | Others (specify) | | | | | | | | | | |

Module 4: Impact of climate change and natural disasters on livelihood

Figure 5. Natural disaster questions included in the Bangladesh climate change survey

Impact on household and business

The Nepal survey investigates whether the household experienced agricultural, land, non-agricultural and infrastructure losses in the last five years. The Bangladesh module delves more into this aspect, examining losses of agricultural products in the last five years due to the natural disasters identified by the respondent in the previous module. The questionnaire asks for highly detailed information on losses by type of product (agricultural, livestock, poultry and fisheries), area affected, amount of product lost, quantity and value. The Bangladesh questionnaire also includes two additional modules to record damages to land, loss of residence, kitchen, cowshed and homestead forestry at the household level due to natural disasters.

| | 41. Did you lose any agricultural product due to natural disasters? Yes – 1, No – 2 If 'Yes' please give answers to the following, if 'NO' then go to Module 6 | | | | | | | | | | | | |
|-------|--|------------------------------------|-----------------------------------|---|-----------------------------------|--------------------------------------|---|------------------------------------|-----------------------------------|---|-----------------------------------|-----------------------------------|---|
| | Type of Natural Disaster | | 43. Potat | 0 | 44. | Lentils/Ce | ereals | 45. Maize/Corn | | | | | |
| Sl.No | 1 | | 2 | | | 3 | | | 4 | | | 5 | |
| | | Affected land area (decimal) | Amount of product lost (kg) | Market price of product lost (Tk.) | Affected land area (decimal | Amount of product lost (kg) | Market price of product lost (Tk.) | Affected land area (decimal) | Amount of product lost (kg) | Market price of product lost (Tk.) | Affected land area (decimal | Amount of product lost (kg) | Market price of product lost (Tk.) |
| 01 | Drought | | | | | | | | | | | | |
| 02 | Flood | | | | | | | | | | | | |
| 03 | Water logging | | | | | | | | | | | | |
| 04 | Cyclone | | | | | | | | | | | | |
| 05 | Tornado | | | | | | | | | | | | |
| 06 | Storm/ Tidal surge | | | | | | | | | | | | |
| 07 | Thunderstorm | | | | | | | | | | | | |
| 08 | River/Coast erosion | | | | | | | | | | | | |
| - 09 | Landslide | | | | | | | | | | | | |
| 10 | Salinity | | | | | | | | | | | | |
| 11 | Hailstorm | | | | | | | | | | | | |
| 12 | Others (specify) | | | | | | | | | | | | |

Module 5: Loss of agricultural products at household levels due to natural disasters (2009-'14)

Figure 6. Impact questions included in the Bangladesh climate change survey

Disease and health impact

In the Nepal survey, it is investigated whether, in the last 25 years, the respondent has noticed the appearance of new diseases at the level of crops and livestock, requesting the names of these diseases, insects or parasites. The high level of detail of the question (e.g., name of the disease), the very long recall period (past 25 years) and the increased complexity of the topic are likely to lead to low-quality results and are challenging to interpret. The Bangladesh survey does not investigate these aspects.

On the impact of climate change on human health, the Nepal survey proposes general questions on the increase in the incidence of diseases in the family members and what new diseases (from a list of mixed diseases noncommunicable and viruses) are more prevalent in humans compared to the last 25 years. Also, questions about the family's incidence of vector and water-borne diseases over the past 25 years. The Bangladesh survey, for a reference period of 5 years, inquires if any family member was affected by any illness or had any injury or disability due to a natural disaster. In the same way, it is investigated if any family member perished due to this type of event. Additionally, this survey includes questions aimed at analysing the impact of natural disasters on children, counting the affected children, health services that attended these groups, the household expenditure on prescribed medical treatments, affectation on attendance at the school and the reasons for the absence from school. In addition, the Bangladesh survey explores the major diseases household members suffer in the predisaster, disaster and post-disaster period and the probable reasons for the registered diseases (e.g., temperature variation, rain variation, water pollution, etc.). While some of these questions may be difficult to answer, they are all useful in assessing the impact of climate change on human health.

In Bangladesh, the questionnaire contains questions about the provision of drinking water during natural disasters and the impact on health caused by the lack of drinking water. The major diseases associated with the lack of drinking water, the measures adopted by the household for its supply and the organisations supporting the household to receive medical care in case of illness are also investigated. These questions are crucial to assessing households' resilience to climate-related natural disasters.

Impact of climate change on water resources

In Nepal, a module investigating changes in the quantity and quality of the water resource in the last 25 years coming from rivers, rivulets, springs, wells, etc., was included. It also investigates changes in the duration of piped water flow and the leading causes attributable to these changes. The survey questions go beyond the impact of climate change on water resources to cover the potential effect of human development, economic activities and

other phenomena not directly linked to climate change, such as road construction, urbanization and population increase.

Impact of climate change on biodiversity, fauna and flora

The Nepal questionnaire includes a module on the impact of climate change on biodiversity. The respondent is requested to provide his knowledge on changes in trees, shrubs, medicinal and non-timber forest products, grass/fodder, aquatic animals, aquatic plants, wildlife, birds and insects. If possible, the respondent should provide the names of the species that have increased, decreased, or disappeared and the name of new species. The Nepal survey also investigates whether the household identified the appearance of new invasive species by type, name, location, cause and the three most significant impacts on households' daily life (e.g., income reduction, loss of fodder, loss of animal bed material, etc.). Likewise, the questionnaire includes a module on "Changes in floristic behaviour over the past 25 years" for trees, shrubs, fruits, herbs or medicinal species. Also, one question about changes in the flower or fruit size is included. Addressing these highly complex and scientific topics in a households' perceptions regarding the impact of climate change on biodiversity and ecosystems.

Impact of climate change on tourism

The Nepal survey examines whether the locality has any significant tourist sites, the changes in the number of tourists visiting the area, and possible reasons for a drop in the number of tourists. Also, the survey investigates changes in the length of stay of tourists and the reasons for possible changes. Therefore, these questions are not connected to climate change causes or impacts and are of little use in a climate change survey and analysis system.

Farm-based coping strategies/actions adopted by households due to the impact of climate change

The Nepal survey provides a list of 25 possible farm-based adaptation actions that households may have used to adapt and cope with the effects of climate change in the last 25 years. The survey also lists off-farm coping strategies such as changing food consumption habits, family member(s) temporarily migrating, etc. While the topic is relevant, the questions may help identify and characterize adaptation strategies. Some of the adaptation actions may also not be relevant given the recall period used and the many other factors that may have motivated the adoption of this practice: for example, leaving land fallow, changing cropping patterns, etc.

The Bangladesh survey does not include a section on adaptation measures adopted by households, which constitutes a gap in the survey given the importance of adaptation for reducing the impacts of climate change.

Preparedness to tackle natural disasters and measures taken during natural disasters

The Bangladesh survey asks for the preventive measures taken by the household in the face of a possible natural disaster. Among the alternatives of response are included: the construction of brick/semi-brick houses, strengthening infrastructure, setting tube well on high ground for drinking water, etc. The questionnaire also includes preventive measures households take during natural disasters, such as preserving drinking water, drying food, keeping seeds, moving cattle to safer places, taking shelter on high land, and sending pregnant women to safer places. This section is highly relevant to addressing preparation and mitigation strategies adopted to confront natural disasters. The questions also help to reflect the action of local and national governments and the response of local authorities. It may also be interesting to add questions on the cost of these measures for households to assess their cost-effectiveness.

Module 11: Preparedness to tackle natural disasters (based on lessons from previous disasters)

Ques. 91: Did members of your household took measures for natural disaster preparedness during 2009-'14? YES – 1, NO – 2 If 'YES' answer the following questions. If 'NO' then go to Module 12.

| Sl. No (Code) | Name of Natural Disaster | 92. Brick Built house | 93. Semi Brick Built house | 94. Strengthen infra- structure | 95. Setting tube well on high ground for drinking water | 96. Improve sanitation facility | 97. Raise road for communication | 98. Send school- going children to safe place | 99. Increase security measures of family food storage area |
|------------------|-----------------------------|--------------------------------|-------------------------------------|--|---|--|--|---|--|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 01 | Drought | | | | | | | | |
| 02 | Flood | | | | | | | | |
| 03 | Water logging | | | | | | | | |
| 04 | Cyclone | | | | | | | | |
| 05 | Tornado | | | | | | | | |
| 06 | Storm/ Tidal surge | | | | | | | | |
| 07 | Thunderstorm | | | | | | | | |
| 08 | River/Coast erosion | | | | | | | | |
| 09 | Landslide | | | | | | | | |
| 10 | Salinity | | | | | | | | |
| 11 | Hailstorm | | | | | | | | |
| 12 | Others (specify) | | | | | | | | |
| | NB: If | answers to | Module 11 | Questions 92 | - 99 is 'YES' v | write 1 in the | box, if 'NO' then | write 2. | |

Figure 7. Preparedness questions included in the Bangladesh climate change survey

3. Recommendations for designing a Climate Change and Disaster Survey Module: preliminary conclusions and way forward

The purpose of the present chapter is to present concise recommendations for developing the Climate Change and Disasters Module derived from the findings of previous Chapters of the Literature Review. Describing climate change trends, its socio-economics impacts, and key adaptation practices was the first step in determining what is needed to measure with a new survey module.

Livelihoods, characteristics of building materials, and availability of drinking water and productive land, among other things, are key aspects of sustainable socio-economic systems. The proposed climate change survey Module should hence include questions to monitor these aspects, the module, however, should keep the number of questions to a minimum, to reduce the costs and complexity of its implementation.

The next step of this component of the PACSTAT project involves developing the core Climate Change and Natural Disasters Module, with a small set of questions on the impacts of climate change at the household level, and a broader sourcebook to cover the gaps identified in the present literature review. A following step will consist in field-testing the proposed methodology, with the aim to include it in the Tuvalu Long Form Population and Housing Census, planned to be implemented in the coming years (the initial timeline indicates 2022).

What follows is a summary of the main findings of the literature Review:

- 1. IPCC's (2022) report for PICTs indicates that climate change will likely increase the frequency and intensity of disasters, leading to additional erosion in the shoreline and significantly increasing the exposure of the population to coastal inundations. The main consequences, which should be reflected in the Climate Change and Natural Disasters modules, include adverse effects on:
 - <u>Human impacts</u> such as injuries, disabilities, diseases and deaths;
 - <u>Households' assets</u>, such as infrastructure, equipment and agricultural land;
 - <u>Food production</u> (fish biomass and agriculture, both crops and livestock),
- Freshwater availability, in particular groundwater,
 - Households' livelihoods, income, employment;
- 2. A thematic analysis highlighted the pivotal issues for the development of the Module:
 - <u>Population characteristics</u>, such as households' proximity to the coast, availability and access to basic services, households' proximity to educational and health centres and other types of critical infrastructure. Information on these dimensions would shed light on disaster risk reduction strategies and possible economic losses related to natural disasters.
 - <u>Economic sectors</u> significantly threatened by natural disasters and climate change are fisheries, agriculture and tourism, with implications on income, food security and health.
 - <u>Freshwater supply</u> are affected by the decrease in rainfall and exacerbated by limited rainwater storage capacity, salination of the groundwater lens and an increase in demand for freshwater.
 - <u>The health</u> of communities living in rural areas, including mental health, is threatened by climate hazards.
 - <u>Migration</u> from rural to urban areas is more and more driven by climate change.
 - <u>Gender-related</u> challenges exacerbate difficulties in coping and adapting to climate change. For example, women seldom have control over land tenure, which prevents them from effectively participating and contributing to climate change adaptation programmes.
 - <u>Prevalence and levels of poverty</u> are aggravated by climate change.
 - <u>Climate adaptation strategies</u> and their connection to Sustainable Land Management (SLM) practices, such as agro-forestry, reduced or zero tillage, implementation of resilient networks of marine protected areas, etc.
- 3. <u>Lack of data on the effects of climate change</u>, vulnerability and adaptation has been the most severe constraint for better policymaking and measurement challenges are widely recognized. A Global Set of Climate Change Statistics and Indicators has been adopted in 2022 to support countries in determining their own sets of climate change statistics.

- 4. <u>Censuses should help identify vulnerable population groups</u> and target the objective population of thematic surveys on climate change or household surveys that include modules on this topic. In the Population and Housing Censuses programme, climate change is mentioned as a cross-cutting and emerging theme.
- 5. The usual scope of Population and Housing Censuses can also be broadened to environmental themes (climate change perception, natural disasters, preventive measures, etc.). This is the case, for instance, of recent censuses conducted in countries heavily impacted by natural disasters, such as Kiribati, Nauru and Belize. This is also often the case in countries that combine agricultural, population and housing censuses. Although not recommended by the guidelines, censuses can indeed be an instrument to collect data on climate change. For example: when asking about the cause of the death or migration of household members, natural disasters, epidemics, etc., could be systematically added as an option; questions related to water availability and quality could be linked to climate change (or other environmental aspects); etc. The drawback is that censuses become lengthier and the burden on respondents heavier, negatively affecting the quality of the responses.
- 6. The World Programme for the Census of Agriculture 2020 recommended countries to include questions to address climate change mitigation and adaptation in relation to agriculture and agricultural households. In the current round of the census of agriculture, four countries (Federated States of Micronesia, South Africa, Lao and Kenya) included questions on damages to land or crop losses caused by natural disasters (landslides, droughts, floods, hailstorms, etc.). Fiji had a more comprehensive section on Climate Change and Challenges.
- 7. <u>The coverage of climate change in censuses and surveys should be better standardized</u>. For example, reference periods for questions concerning climate change may vary from 1 year (Micronesia), 5 years (Bangladesh), 10 years (Fiji) and up to 25 years (Nepal). In Micronesia, questions on the adaptation actions of households are entirely open, rendering the analysis of the results highly complex.
- 8. The Living Standards Measurement Study (LSMS) programme considers that climate change modules fit into special-focus household surveys. The proposed core modules presented in the last guidelines for LSMS-type surveys include some climate change questions and alternatives of response related to natural disasters. Still, these questions do not cover the full spectrum of possible impacts of climate change on households.
- 9. The Living Standards Measurement Study Integrated Surveys on Agriculture (LSMS-ISA) propose relevant data collection approaches on household-level adaptation choices and mitigation strategies. Two manuals were developed: one related to adaptation measures and Land Management and investment options adopted by farms in LSMS-ISA countries and the other on climate change impacts on water resources and water management. This second handbook included two examples of "Adaptation modules" for LSMS-ISA tested in Niger and Nigeria that covered sections and topics related to weather-related risk management and adaptation questions, access to weather information, weather variability perceptions and farmers' recall of weather during planting season. These are good examples that could be reflected in the Climate Change Module.
- 10. <u>The climate change-migration nexus is not well captured in the existing LSMS-ISA programme</u>. But these gaps could be easily filled, for example, through the inclusion of shorth modules on adaptation, intention to migrate and migration histories. The climate change-migration nexus could also be better addressed by a combined analysis of LSMS-ISA with other surveys, without necessarily having to conduct new data.
- 11. <u>National socio-economic surveys in forestry have dedicated climate change modules.</u> These modules cover community and household perceptions and adaptation to climate change, and are well-structured and formulated, with adequate response options. These are good examples of the Climate Change and Natural Disasters module.

- 12. The questionnaires of the 50x2030 initiative propose a solid set of questions on the environment and climate change for the agricultural sector. These questions could be used as a basis for developing a section of the Climate Change and Natural Disasters module on economic losses in the agricultural sector attributed to disasters (income and assets).
- 13. <u>Nepal and Bangladesh are the only two countries that have conducted national household surveys</u> <u>on climate change</u>. These surveys aimed at characterizing populations located in natural disasterprone areas, assessing the impacts of climate change on economic activities (mainly agriculture), assets, health, and vulnerability and characterizing climate change perceptions and adaptation measures. At the same time, some topics and the level of detail requested are probably not appropriate for a household survey (for example, questions related to biodiversity and ecosystems in the questionnaire of Nepal), these modules can be used to a large extent as a starting point for a Climate Change and Natural Disasters module.

Page 42 of 51

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Annex 1. Climate hazard-based impacts on root crop production in Fiji

This case study applied by NextGen investigates the impacts of current and future climate change on root crops in Fiji. Cassava and taro are the most important crops in terms of yield and cropping area. Based on a recent consultation conducted by PHAMA plus (APCP and PHAMA Plus, 2020) with Fijian tuber farmers and industry bodies, several climate-related impacts were identified. Continuous increases in global greenhouse gas emissions will cause further warming and would lead to global warming of 4.4°C with significant impacts on Fiji.

The suitable temperature range for Higher minimum root production is 24 to 34 °C. A change in this range would threaten root production. Night temperatures can lead to the appearance of "Taro Leaf Blight (TLB)" which is a potential danger to these crops. Extreme temperatures and extreme rains and floods may affect these crops due to waterlogging, erosion and landslides, thus affecting access to transportation. Drought reduces the growth, yield and quality of crops. Tropical cyclones and sea salinity are other possible threats in this case study. The Pacific Program Horticulture and Agriculture Market Access Plus (PHAMA Plus), the Fiji Department of Agriculture (regional offices), and Fijian root farmers identified an interest in improving their understanding of the impacts of current climate variability and projected climate change to root crop production. (Taylor et al. 2012). Producers have noticed changes in the crop seasonality, for example, the harvest date. This could possibly be related to warmer average temperatures, with night-time temperatures rising faster (Australian Bureau of Meteorology and CSIRO 2014, McGree et al. 2019).

By 2050 (2036-2065), in the 'best case scenario', that is, a low emissions pathway and minimal warming model, some areas that are currently too cool for root crops will become suitable. This finding is supported by other studies, with Taylor et al. (2016) indicating that in this century, the adequate average temperature conditions will not even be exceeded. In fact, modelled cassava yields are reported to increase, even with temperature increases of 3°C, and taro yield is unaffected by temperature increases of up to 2°C (Crimp et al. 2017).

A minimum night-time temperature of 21°C and 100 per cent relative humidity have been shown to provide optimal conditions for TLB; Fungal spread is not favoured when relative humidity is less than 90 per cent (Misra et al. 2008, Taylor and Iosefa 2013). Regions with average annual minimum temperatures above 21 °C were defined as regions with the highest risk of fungal spread. With projected warming, the highest risk areas most suitable for fungal spread increase slightly in the best case scenario and to a greater extent in the worst case scenario. By 2050 (2036-2065), the area with the highest risk of TLB occurrence increases from the current 74% to 83% for the best case and 97% for the worst case

The impacts of extreme hot days and heat waves could be as important or more important for root crops production than changes in average temperature (Taylor et al. 2016). With an increased frequency of extreme heat events, growers will need to manage crops to ensure their exposure to direct sunlight is reduced by introducing natural or artificial canopy shade to the west (Webb et al. 2009).

It is known that extreme precipitation events are likely to increase in the future (CSIRO and SPREP, 2021) and that all roots studied here are vulnerable to flooding. Projected increases in annual maximum daily precipitation could help crop production by recharging dams and water catchments. However, the increasing impacts of flooding, erosion and landslides could have a negative effect on crop production.

While sweet potatoes are not typically adversely affected by tropical cyclones (TC), possibly due to their low growth habit, taro, cassava, and yams are vulnerable (Taylor et al. 2016). Chand et al. (2017) found that around a group of small island nations (e.g., Fiji, Vanuatu, the Marshall Islands, and Hawaii, including Tuvalu) in the late 21st century, TCs could become more frequent (ÿ20–40%) during "El Niño" events and less frequent during "La Niña" events.

Root crops are reasonably tolerant of dry periods, although droughts can reduce yields and nutritional quality (Vandegeer et al. 2013), and root crops do not compete well with weeds (Taylor et al. 2016). Also, in the case of cassava, tuber cyanogens can rise to high levels when soil moisture is low, which is a major health and food safety issue. Toxicity is greater at high temperatures.

Cassava is sensitive to low to moderate salt concentrations, particularly in the early stages of development, and is, therefore not suitable for planting in salt-contaminated regions. Since alternative tuberous crops such as sweet potatoes are even more sensitive to salt than cassava (Shannon and Grieve 1998), salt-tolerant varieties need to be improved if cassava is to continue to expand its role as a staple food. in a more saline world due to rising sea levels (Gleadow et al. 2016).

There are several ways that root crop farmers can become more resilient to these challenges, including introducing new farm management practices. Other options to increase the resilience of root crop production include incorporating agro-forestry, or farming on higher ground to avoid flood-prone areas (APCP and Phama Plus, 2020).

Changing crops to include more tolerant and/or resistant varieties, as well as diversifying the farming system to incorporate other crops or products, are also important options to explore. Therefore, continued planning for the cultivation of TLB-resistant taro varieties is a good strategy to improve the resilience of the industry (Taylor and Iosefa 2013).

Annex 2. Climate hazard-based impacts on coffee production in Papua New Guinea

Coffee has been identified by PNG Coffee Industry Corporation Ltd (CIC), the Papua New Guinea Department of Agriculture (PNG), by coffee growers and by the PNG National Weather Service as a product with potential for economic development in the region. Arabica coffee (Coffea arabica L.) is the second most important agricultural export in PNG, after palm oil (Bourke and Harwood 2009), with PNG being the main coffee producing centre in the Oceania region (FAO 2019). Several projected Impacts based on climate threats on coffee in PNG were identified in this case study. Projected temperatures could affect the suitability of production. The emission of greenhouse gases is a factor that might impact coffee production. Future temperature change is another possible threat to this crop. Changes in minimum temperature can result in the spread of pests and diseases. The change in the altitude profile, as well as changes in current precipitation and drought conditions that may occur as a result of climate change, are other hazards that may affect coffee production in PNG.

By 2050 (2036-2065), the 'best case scenario' (a trajectory of low emissions and minimal changes in temperature and precipitation) indicates that some currently suitable areas may become too warm, but most areas are not adversely affected. By 2050 (2036-2065), in a 'worst case' scenario (a high-emissions pathway and most changes in temperature and rainfall), some areas that are currently suitable will get too warm compared to the climate. Some areas currently too cold may become more convenient.

Continuous exposure to more extreme temperatures, up to 30°C, causes stress in coffee plants, manifested in depressed growth and abnormalities, such as yellowing of leaves and growth of stem tumours (Taylor et al. 2016). In the PNG Highlands area, projected temperature changes could become a major limiting factor for coffee cultivation in some regions by 2050, and certainly by 2090 if a high emissions path is followed. On the contrary, this model indicates that under a low emission road, the suitability is not so affected.

An upper threshold temperature of 24°C is projected (Harding et al. 1986, Teketay 1999, Davis et al. 2012, Taylor et al. 2016). At temperatures above 23°C, fruit development and ripening are accelerated, often leading to loss of beverage quality; although in some places, higher temperatures (24–25°C) still can produce satisfactory yields of beans, as in northeastern Brazil. (Davis et al. 2012). In regions with a mean annual temperature below 17–18 °C, growth is depressed (Davis et al. 2012), and 17 °C is used as the lower temperature threshold in determining production suitability for this assessment.

One of the main concerns regarding coffee production is the coffee berry borer which has caused yield losses of up to 50% in the coffee growing regions of Indonesia, South America and Southeast Asia. Pest problems are exacerbated by warming. Jaramillo et al. (2009) analysed data from Colombia, Kenya, Tanzania and Ethiopia, estimating that for every 1°C increase in average temperature, there would be an 8.5 % increase in the pest (Taylor et al. 2016). Coffee leaf rust (Hemileia vastatrix) (CLR) is a fungal disease that has had a major impact on coffee production globally over the last 200 years, with a greater impact in warmer places.

The elevation level of 1400m corresponds well with the minimum temperature limit of 15°C in January under current climatic conditions. By 2050, NextGen analysis showed that the area most at risk of fungal spread is invading more than 1,400m above sea level. In addition to this argument, Jaramillo et al. (2011) predict that for every 1°C rise in average temperature, coffee will need to grow about 150 m taller to avoid damage from CBB, an emerging pest in PNG.

In general, 'best case' average precipitation changes indicate little change, however, 'worst case scenarios' indicate that many areas may become too wet for optimal production (defined for this study as greater than 3000 mm) of coffee in PNG. It is worth noting that the year-to-year variability of rainfall in PNG is much larger than the projected change, except in the upper range of the models in the highest emissions scenario for 2090. It is important to note that there is still there will be wet years (increased fungal pressure or drainage problems) and dry years (reduced crop growth), and natural decadal variability. Any effect of climate change on average precipitation may not be evident in short to medium term due to this great natural variability. Extreme rainfall is also associated with flooding that can cause problems with drainage, soil erosion, and accessibility to farms. Drainage is a critical

component for the selection of suitable sites for coffee farms (Harding et al. 1986).

Droughts associated with "El Niño" can have major impacts on agriculture. The 2015-16 drought reduced food security in PNG (lese et al., 2021). The drought and frost affected about 700,000 people, and about 450,000 people faced critical food shortages, affecting people's health, diet, and access to water (lese et al., 2021). Future changes in rainfall variability for PNG are affected by "El Niño" Southern Oscillation (ENSO), the Indian Ocean Dipole (IOD), and the Interdecadal Pacific Oscillation (IPO). An increase in strong El Niño and La Niña events is projected (Cai et al., 2014), along with more extreme positive phases of the IOD (Cai et al., 2018), but possible changes in the IPO are unknown (ESCC, 2020).

There are several ways that coffee farmers can become more resilient to these challenges. Introduction of new farm management practices to minimise exposure to extremely high daily temperatures or extremely high daily rainfall e.g., canopy management and soil management, is an alternative to follow. It is suggested to diversify the agricultural system to incorporate other crops or products more suitable for a warmer crop. It is important to identify whether coffee production in the PNG Highlands could expand further up the adjacent slopes of the catchment to follow the change in optimum growing temperature. Of course, an incursion into forested areas is subject to considerations of ongoing sustainability practices.

Changing aspects, e.g., less west facing, to reduce exposure to afternoon sun, is a recommended adaptation strategy for vines in Australia (Webb et al. 2009). Introducing more shade trees will help reduce heat stress (Teketay 1999, Taylor et al. 2016). Change research through selective breeding of crop variety could develop higher temperature tolerant coffee varieties for production in existing agricultural areas of PNG (DaMatta and Ramalho 2006).

Mulching practice reduces soil temperature, reduces soil erosion, and conserves soil moisture (Teketay 1999). Where rain or moisture is adequate, it may be beneficial to plant cover crops with coffee (Teketay, 1999). Cover crops help protect the soil from erosion, reduce soil temperature, accumulate organic matter in the soil, and fix atmospheric nitrogen if they are legumes (Teketay 1999).

Annex 3. Climate change projections to inform the vulnerability of black pearl production in the Cook Islands

In the Cook Islands, black pearls are originally harvested through free diving for the black-lipped pearl oyster, *Pinctada margaritifera* (Linnaeus). Over the last 20 to 30 years, a pearl farming industry has been established, becoming the main product of aquaculture in the Cook Islands and the world's second-largest supplier of black pearls from the South Sea (Ponia 2010). The main pearl farming area in the Cook Islands is in Manihiki Lagoon, a coral atoll located 1,200 kilometres northwest of Rarotonga. Pearl farming is a critically important employer for the atoll (Brown 2019), supporting local livelihoods in fishing and tourism.

The viability of pearl oysters is affected by various threats shown below. Lagoon water temperatures above 34°C and recent warming trends in sea surface temperature (SST) are of potential concern. Marine heat waves (MHW) are becoming more frequent in the region over the last decade, affecting pearl production. Farmers are noticing problems with oysters. Shells are thinner, and pearl deformities have become common in recent years. Climaterelated changes in ocean chemistry, known as ocean acidification, can negatively affect shell growth and pearl oyster quality. The coral reefs that currently protect the atoll may be affected with severe associated impacts on fisheries and other marine ecosystem-based livelihoods. Manihiki Lagoon is exposed to tropical cyclone activity, with Cyclone Martin (1997), for example, causing devastating destruction.

In one study, Gueguen et al. (2016) found that the optimal temperature for somatic growth and reproduction of P. margaritifera was 28.7 °C under experimental conditions. Temperatures above this level cause heat stress, which induces an energy deficit (Le Moullac et al. 2016a). Farmers tend to stop the planting operation when the water temperature is above 29 °C. °C (Ian Bertram pers. comm.) Since Manihiki Lagoon is a coral atoll; it is also essential to understand the impacts of ocean warming on coral viability. As the ocean warms, the risk of coral bleaching increases. If severe bleaching events occur more than once every five years, the long-term viability of coral reef ecosystems, and thus the integrity of coral atolls, is threatened (Australian Bureau of Meteorology and CSIRO 2014).

The most intense MHW event occurred from December 3 to 7, 2006, reaching an area-averaged maximum intensity of 2.7 °C and a cumulative intensity of 8.3 °C per day. The longest MHW event occurred in 2019, with a duration of 101 days (from March 12 to June 20, 2019) and a cumulative intensity of 102.0°C days. Under the high emissions scenario, the region could experience MHW conditions almost all year round by the end of the century, with more than two-thirds of the year in the "Extreme" category. In contrast, the impact of following the low-emissions trajectory is clearly evident, with MHW days projected to be mostly less than 200 days per year on average, even by 2100, with most remaining in the "Moderate" category. With "extreme" MHW conditions still a rare event.

Global ocean surface waters have absorbed ~30% of the additional carbon dioxide (CO2) introduced into the atmosphere by anthropogenic greenhouse gas emissions (Gruber et al., 2019). This changes the chemistry of the oceans, with a reduction in pH and carbonate ions, affecting a wide variety of marine species and ecosystems. It is particularly relevant to animals that produce calcium carbonate shells and skeletons, such as shellfish and corals. Seawater concentrations of calcium carbonate ions (aragonite and calcite) are important because they are necessary for pearl oyster shell formation. The projected pH through at least the end of the century is likely to be less of a concern for pearl oyster production than other stressors, such as projected temperature changes.

As carbon dioxide concentrations in the atmosphere continue to rise, the oceans will warm and acidify. These changes will affect the health and viability of mariculture systems and other marine ecosystems, including coral reefs that provide many key ecosystem services, such as food, livelihood resources (e.g., tourism), and coastal protection (Office Australian Bureau of Meteorology and CSIRO 2011, Australian Bureau of Meteorology and CSIRO 2014). However, perhaps the greatest potential impact on pearl farming in the region is the combined effects of higher water temperatures, changes in lagoon water quality affected by flushing regimes, and ocean acidification in pearl quality (Bell et al., 2013). Sea level rise may affect pearl oyster farming in Manihiki Lagoon through impacts on housing and infrastructure due to erosion and storm surge flooding and may also affect pearl oyster farming and production by modifying the circulation and exchange of water between the open sea and the lagoon (known as lagoon flushing).

There are several ways that pearl collectors can be more resilient to these challenges. New pearl farming technologies must be implemented: new seed collection methods, different conditioning times, shell cleaning, etc. Potential future culture locations, predation issues, and oyster nutrition driven by nutrient availability should be identified (MMR and SPC 2012). However, there may be scope to identify new areas.). Selective breeding is also likely to provide an important mitigation strategy to provide greater resilience to long-term changes in ocean chemistry (Fitzer et al., 2019).

The design of all pearl farm infrastructure should be evaluated to increase durability during severe cyclones. Placing pearl oysters in deeper water to reduce the adverse effects of higher SST on nacre quality should also reduce storm damage. The pearl industry is in a reasonable position to adapt to some of the expected effects of climate change.

Any effect of higher TSS and ocean acidification on seed collection can probably be overcome by increasing the proportion of seed produced in hatcheries under controlled temperature and pH conditions, albeit at a higher cost. Pearls can also be harvested during the cooler months of the year (Pickering et al., 2011). Relocation of pearl farming operations to southernmost atolls in the Cook Islands region may also provide a long-term adaptation option.