Climate Change 2022: Impacts, Adaptation and Vulnerability

Working Group II Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change

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Box 7.1 | Indigenous Peoples' Health and Well-Being in a Changing Climate

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The indigenous population worldwide is estimated at 476 million people spread across all geographic regions of the world (FAO et al., 2021). Indigenous Peoples globally represent a large heterogeneity of people in terms of living conditions and social determinants of health. There is no simple definition of who is indigenous. In this text, we refer to Indigenous Peoples as people self-identified and organised as indigenous, according to the principles of the International Work Group for Indigenous Affairs (IWGIA), an international non-governmental organisation (NGO) with observer status at the United Nations (UN). Indigenous Peoples are described as 'distinct social and cultural groups that share collective ancestral ties to the lands and natural resources where they live, occupy or from which they have been displaced' (World Bank, 2021). A common experience among Indigenous Peoples are historical traumas related to overseas and/or settler/industrial colonisation.

Studies on climate change as it affects the health of Indigenous Peoples generally focus on non-displaced indigenous groups; that is, Indigenous Peoples maintaining culturally important elements of a land-based traditional lifestyle. Here we use an eco-medicine perspective in which the impacts of climate change on health are divided into primary, secondary and tertiary effects, as discussed below (Butler and Harley, 2010). Many analyses of indigenous health in relation to climate change use the One Health concept (Mackenzie and Jeggo, 2019; see Section 7.1.5).

Current Impacts of Climate Change on Health and Well-Being of Indigenous Peoples

Primary health effects of climate change include the immediate physical effects on human health, such as health hazards due to high temperatures, extreme weather events or accidents from exposure to climate-related hazards. For example, in arid and semiarid areas, an increased frequency of severe droughts is associated with immediate health problems related to overheating and lack of water for drinking, sanitation and livestock (Hall and Crosby, 2020; Mamo, 2020; Rankoana, 2021). In many cases, the possibilities for Indigenous Peoples to apply traditional strategies to mitigate droughts by migration are limited by competing land use, environmental protection and national borders, with many examples across Africa (Mamo, 2020). In the Jordan River Valley, the second most water stressed area in the world, water resources are not equally distributed to Indigenous Bedouin people, amplifying their immediate health threat during predictable as well as unpredictable droughts (Mamo, 2020).

In Arctic and sub-Arctic areas, higher temperatures with increased numbers of freeze–thaw cycles during the winter means increased occurrences of transport-related accidents in indigenous communities due to weaker ice on travel routes that cross lakes, rivers and the sea, along with changes in the snow cover and increased risk of avalanches (Durkalec et al., 2015; Jaakkola et al., 2018). Impeded access to healthcare during extreme weather conditions is a primary health risk for Indigenous Peoples living in remote areas (Amstislavski et al., 2013; Hall and Crosby, 2020; Mamo, 2020).

Pastoralists in many regions may experience changes in livestock behaviour due to climate change, leading to increased mobility-related health hazards (Jaakkola et al., 2018; Mamo, 2020). Indigenous Peoples living in low-lying coastal areas and small island states face long-term risk of flooding and the stresses of resettlement (Maldonado et al., 2021; McMichael and Powell, 2021).

Extreme rainfall, flooding, storms, heatwaves and wildfires lead to individual health hazards that may include injuries and thermal and respiratory traumas (Mamo, 2020) There are many examples when emergency responses to extreme events have ignored the needs of displaced Indigenous Peoples (Mendez et al., 2020; Maldonado et al., 2021). Population-based quantitative studies documenting the direct effects of these events on Indigenous Peoples are rare. In Mexico, respiratory diseases are almost twice as common among Indigenous Peoples compared to non-Indigenous Peoples (de Leon-Martinez et al., 2020). In Alaska and northern Canada, alarming levels of respiratory stress and disease have been reported among Inuit and First Nation communities in relation to wildfires (Howard et al., 2021), as well as increased mould in houses due to flooding resulting from increased precipitation (Furgal and Seguin, 2006; Harper et al., 2015; Norton-Smith et al., 2016). Climate- and housing-related respiratory stress is also a risk factor for severe COVID-19 infection, which has been highlighted in recent literature from an indigenous health perspective (de Leon-Martinez et al., 2020).

Secondary effects relate to ecosystem changes, for example, the increased risk of the acute spread of air-, soil-, vector-, food-, and waterborne infectious diseases (Hueffer et al., 2019). Higher proportions of climate-related infectious diseases are reported among indigenous groups compared to their non-indigenous neighbours, with examples from Torres Strait, Australia, showing a greater proportion of tuberculosis, dengue, Ross River virus, melioidosis, and non-tuberculous mycobacterial infections (Hall et al., 2021) and in the Republic of Sakha, Russia, high levels of zoonoses (Huber et al., 2020a). Increasing levels of livestock and canine diseases are also reported (Mamo, 2020; Bogdanova et al., 2021; Hillier et al., 2021). Another secondary health effect is an increase in human–animal conflicts, for example

Box 7.1 (continued)

human–elephant conflicts in Namibia due to plant food scarcity (Mamo, 2020), human–bear conflicts in Arctic regions within Canada (Wilder et al., 2017), human–tiger conflicts in Bangladesh (Haque et al., 2015) and increased predatory pressure on Indigenous Peoples' livestock and game worldwide (Haque et al., 2015; Jaakkola et al., 2018; Mukeka et al., 2019; Mamo, 2020; Terekhina et al., 2021). Undernutrition and metabolic disturbances associated with overnutrition and obesity due to the decreased availability or safety of local and traditional foods and increased dependency on imported substitutes affect many Indigenous Peoples worldwide (Amstislavski et al., 2013; Zavaleta et al., 2018; Houde et al., 2020; Jones et al., 2020; Akande et al., 2021; Bogdanova et al., 2021; Bryson et al., 2021) and are especially severe for pregnant women and small children (Mamo, 2020; Olson and Metz, 2020; Bryson et al., 2021); these are amplified by the combination of warming and the COVID-19 situation (Zavaleta-Cortijo et al., 2020). Decreased access to wild plants and animals as food sources and medicine due to climate change is another threat to the health and wellness of indigenous communities (Greenwood and Lindsay, 2019; Mamo, 2020; CIAT and and, 2021; Rankoana, 2021; Teixidor-Toneu et al., 2021).

Tertiary effects relate to culture-wide changes, for example, all forms of malnutrition due to climate-driven changes in food systems and anxiety, mental illness and suicidal thoughts related to cultural and spiritual losses. A wide range of tertiary, culture-related effects of climate change have been documented for Indigenous Peoples. These include anxiety, distress and other mental health impacts due to direct and indirect processes of dispossession of land and culture related to the combination of climate change and other factors (Richmond and Ross, 2009; Bowles, 2015; Norton-Smith et al., 2016; Jaakkola et al., 2018; Fuentes et al., 2020; Mamo, 2020; Middleton et al., 2020b; Middleton et al., 2020a; Olson and Metz, 2020; Timlin et al., 2021). Increased risks of conflict and abuse, including violence and homicide against females, and/or conflicts resulting from environmental activism, are other tertiary health threats for Indigenous Peoples (Mamo, 2020). Between 2017 and 2019, close to 500 indigenous people were killed for activism in 19 different countries (Mamo, 2020). In Uganda, climate change drives indigenous men to increase their distance and time from home and their families in search of water and food, leading to an increase in sexual violence against indigenous women and girls in their communities (Mamo, 2020).

Gender inequities amplify the tertiary health effects of climate change (Williams, 2018; Garnier et al., 2020). In an Inuit community, for instance, women reported a higher level of mental stress related to climate change than men (Harper et al., 2015). Adverse pregnancy outcomes and altered developmental trajectories have also been associated with climate change (Hall et al., 2021). Indigenous Batwa women in Uganda reported experiencing more severe circumstances of food insecurity during pregnancy due to drought and unpredictable seasons negatively impacting agricultural practices (de Leon-Martinez et al., 2020). More studies with a gender perspective on climate change as a determinant of Indigenous Peoples' health are needed, along with the perspectives of indigenous children and youth, displaced individuals and communities in urban settings (Kowalczewski and Klein, 2018).

Because cultural continuity is a recognised health factor (Lemelin et al., 2010; de Leon-Martinez et al., 2020; Middleton et al., 2020b), displaced Indigenous Peoples may suffer from climate change by worrying about impacts on non-displaced relatives and family and from traditional food staples turning into expensive commodified products. This is a knowledge gap with lasting implications not only on physical environments (Guo et al., 2018). Social connections and knowledge pathways are disrupted, leading to a decreased ability to share locally harvested and cultivated foods (King and Furgal, 2014; Neufeld et al., 2020).

Tertiary effects of climate change on Indigenous Peoples' health are primarily described in smaller case studies and not designed in a way allowing for systematic international comparisons, which represents an important and significant gap in our understanding of these often-complex associations and impacts (Middleton et al., 2020b).

Future Risks for Indigenous People's Health and Well-Being in a Changing Climate

Future risks for Indigenous Peoples' health and well-being in a changing climate will result foremost from exacerbations of observed impacts. Primary and secondary health risks are expected to increase as the frequency and/or severity of climate hazards grow in many regions. As one example, melting permafrost in the Siberian Arctic is projected to lead to more outbreaks of anthrax (Bogdanova et al., 2021). Tertiary health threats are expected to persist even with strong global initiatives to mitigate greenhouse gases (GHGs) (Butler and Harley, 2010). Climate change is expected to compound non-climatic processes that lead to social exclusion and land dispossession that underlay health inequalities experienced by Indigenous Peoples (Huber et al., 2020a).

Options and Opportunities for Reducing Future Risks and Building Capacity/Resilience for Indigenous Peoples' Health and Well-Being

Indigenous organisations worldwide stress the importance of applying a rights-based approach in responding to climate change (Mamo, 2020). Although Indigenous Peoples are often identified as being vulnerable to climate change, this framing does not always reflect the diverse responses and adaptations of Indigenous Peoples to these ongoing challenges (Nursey-Bray et al., 2020). An emerging body of

Box 7.1 (continued)

research is focusing on the strength and resilience of indigenous communities globally as they adapt to these complex changes (Whyte, 2018; FAO et al., 2021).

During droughts and water shortages, for example, indigenous pastoralists may face additional challenges if water supply assistance provides only for human needs and neglects water requirements of livestock (Mamo, 2020). Indigenous knowledge on how to adapt to drought through storing and sharing strategies, for example, is valuable (Fatehpanah et al., 2020; Mamo, 2020).

Indigenous Peoples have been adapting to changes in their environments since time immemorial by developing new practices and techniques (FAO et al, 2021). Their beliefs, value systems and principles include core elements and common values such as reciprocity, solidarity, co-responsibility and community that are expressed in the dynamism of their knowledge systems (Lewis et al., 2020; Schramm et al., 2020b). The relevance of these knowledge systems, which are holistic and tied to relationships between all living things, cannot be ignored at this critical time (Garnier et al., 2020).

The health and equity impacts of climate change for Indigenous Peoples make mitigation efforts critical (Jones et al., 2020), including policies and actions that consider the effects of colonisation. Colonisation constrains the design and diversity of potential climate and health responses through its historic and ongoing suppression of Indigenous knowledge systems that are critical in supporting community-led actions to reduce future risks (Billiot et al., 2019; Reid et al., 2019; Nursey-Bray et al., 2020).

Four Brief Case Studies to Illustrate the Innovativeness of Indigenous Peoples' Adaptation to Climate Risks

Bedouin Pastoralists' Grazing Practices Decrease the Risk of Wildfires in Israel and Increase Food Sovereignty

Wildfires are a main cause of deforestation in Israel, and in recent years climate stress has decreased the forest resilience to fires (Klein et al., 2019). The original landscape, a shrubland or maquis consisting mostly of oak and *Pistacia*, has been used since time immemorial as grazing land for goats, sheep and camels belonging to Indigenous Bedouin people (Degen and El-Meccawi, 2009). Competing land use has reshaped the landscape with pine monocultures and cattle farming, reducing the availability of land suitable for herding goats the indigenous way (Perevolotsky and Sheffer, 2011). In addition, since 1950, plant protection legislation has decreased Bedouin forest pastoralism in Israel by defining indigenous black goats as an environmental threat (FAOLEX, 2021). In nature reserves where no human interference has been allowed, these areas have regenerated into herbaceous shrublands susceptible to wildfires (Turco et al., 2017). Meanwhile, urbanised Bedouin exist on lower incomes and experience higher levels of unemployment compared to other citizens, and some keep non-pastoralised livestock in cities as a strategy for food sovereignty (Degen and El-Meccawi, 2009). In 2019, many severe wildfires occurred in Israel due to extreme heatwaves and, in response, plant protection legislation was repealed, allowing Bedouin pastoralists to graze their goats in areas from which they had been excluded. The amount of combustible undergrowth subsequently decreased, reducing the risk for wildfire and their related impacts, while simultaneously facilitating indigenous food sovereignty among the Bedouin (Mamo, 2020).

Gardening in the Ashes of Wildfires in the Pacific Northwest as a Strategy to Decrease Food Insecurity and Increase Connections With the Land

In the central interior of what is now known as British Columbia (BC), 2017 was an especially severe wildfire season, with over 1.3 million hectares of land burned and 65,000 people displaced (Timler and Sandy, 2020). The unceded and ancestral lands of the Tsilhqot'in, Dakelh and Secwépemc were impacted by two of the largest fires (Verhaeghe et al., 2017). Communities affected by the BC wildfires subsequently started indigenous gardens closer to home, to protect medicine and food plants and thereby sustaining relationships with these plants, the land and the community (Timler and Sandy, 2020). As there are cultural teachings for fire to cleanse the territory and the land, community members and plants previously isolated became better connected because of the wildfires. The regrowth of plants is part of the healing relationship between plants, people and other animals (Timler and Sandy, 2020). The wildfires were seen as events to catalyse action and emphasise the importance of relationships to support foodways and gardening as responsibility.

Widening our understanding of gardening in the face of climate change and colonialism can support health and healing for Indigenous and non-Indigenous Peoples. Gardening as a means of indigenous food sovereignty has long been utilised by a variety of indigenous groups within Canada and elsewhere to address circumstances of chronic food insecurity and support health and wellness (Johnson-Jennings et al., 2020; Timler and Sandy, 2020). The concept of gardening as both a Euro-Western agricultural practice and indigenous practice encourages an increased reverence and connection with the land and wider engagement with the natural world (Whyte, 2018). Much of this is because Indigenous knowledge and land management practices encompass processes that are known to be synergistic

Box 7.1 (continued)

and sustainable (Ottenhoff, 2021). Indigenous worldviews offer a different perspective on social resilience to environmental change, one that is based on moral relationships of responsibility that connect humans to animals, plants and habitats (Grey and Patel, 2015). These responsible practices not only ensure ecosystems are maintained for future generations; they centre the moral qualities necessary to carry out the responsibilities of consent, reciprocity and trust. Moral qualities of responsibility are the foundation for relying on each other when facing environmental challenges (Whyte, 2018; Miltenburg et al., 2021).

To restore these sustainable relationships, a resurgence is needed of community roles and responsibilities (Cidro et al., 2015) as well as a reconsideration of the concept of food security and the role of gardening within diverse indigenous contexts. Offering individual or community gardening as a solution to 'food insecurity', a Eurocentric measure of health, ignores colonial contexts and sovereignty (Borrows, 2019; Timler and Sandy, 2020). Indigenous communities have historic, ongoing and evolving gardening and food gathering practices, including a wide variety of land-based and aquatic foods (Turner and Turner, 2008; Mt. Pleasant, 2016). Euro-Western science is beginning to recognise these longstanding relationships (Kamal et al., 2015; Hatfield et al., 2018; Timler and Sandy, 2020). For many indigenous communities, reconnecting with ancestral foodways holds the potential not only to address food security but to provide the community cohesion, self-esteem and wellness (Gordon et al., 2018).

A New Food Composition Database in Uganda to Guide Local Policy in Healthy Eating Based on Indigenous Foods

In sub-Saharan Africa, climate change is an emerging risk factor for undernutrition, particularly in countries that rely on subsistence agriculture (Sorgho et al., 2020). In Uganda, negative health effects associated with climate change are being observed, including increased rates of food insecurity, with the highest rates recorded among the Batwa of Kanungu District, where 97% of households are severely food insecure (Patterson et al., 2017). For many Indigenous Peoples, food security in a changing climate is a growing concern (Guyot et al., 2006; Patterson et al., 2017). Locally harvested indigenous foods have been adversely impacted by climate change, while connection to land is being disrupted by the processes of colonisation, discrimination and lack of representation in decision-making groups, thereby restricting adaptive capacity for indigenous communities (Bryson et al., 2021). In Uganda, the Indigenous Batwa have experienced significant disparities resulting from the forced eviction from their territory, dispossessing them of their land and the ability to provide indigenous foods to their families (Patterson et al., 2017; Scarpa et al., 2021).

Nutrient-specific knowledge of indigenous foods is limited among many communities in Africa. A new food composition database in Uganda was constructed in dialogue with knowledge keepers from the Batwa and Bakiga Peoples to assess the nutrient density of these locally harvested foods (Scarpa et al., 2021). As in other lower resource settings, no food composition tables are available for southwestern Uganda. The only existing food database was designed for central and eastern Uganda; it does not include common recipes and local foods consumed by Batwa and Bakiga communities (Scarpa et al., 2021). Using a community-based approach and collaboration with local nutritionists, a list of foods was collected through focus group discussions, an individual dietary survey and market assessments. Including these locally familiar foods ultimately supports a focus on indigenous justice and the importance of valuing indigenous food systems and practices, which in many contexts have been found to have superior nutritional and environmental benefits for communities (Kuhnlein et al., 2013; Scarpa et al., 2021). This new and unique database including indigenous foods will not only guide local nutrition and health initiatives, but also contribute towards policies related to indigenous food sovereignty and resilience to climate change.

Decreased Fragmentation of Winter Grazing Increases Mental and Spiritual Well-Being in Reindeer Herding Sámi and Decreases their Dependency on Fossil Fuels

Sami are the Indigenous Peoples of northernmost Scandinavia and the Kola Peninsula of Russia, whose livelihoods have been traditionally sustained by reindeer herding, hunting, fishing and small-scale farming (Nilsson et al., 2011). Climate change is threatening core conditions for reindeer herding, with Sami pastoralists describing the situation as 'facing the limit of resilience' (Furberg et al., 2011). Sami pastoralists stress that an ability to continue reindeer herding is a prerequisite for their mental and spiritual health (Jaakkola et al., 2018).

In a pilot project for climate adaptation of reindeer herding run by the Swedish Sami Parliament, reindeer herding management plans (in Swedish, *renbruksplaner*) were used as a tool to develop strategies for climate adaptation (Walkepää, 2019). Four Sami reindeer herding cooperatives participated in the pilot study. They all agreed that climate change means that grazing patterns need to change. Traditionally, mountain reindeer graze in the Scandinavian mountains close to Norway in summer and in the coastal areas close to the Gulf of Bothnia in winter, representing a total migration route of up to 400 kilometres one-way. Rising temperatures are causing spring to occur earlier in the coastal winter grazing land before the calving areas in the summer land are suitable for grazing and free from snow. When the snow cover disappears, the herds are dispersed, so it is important to migrate while snow is still present (Walkepää, 2019). Migration

Box 7.1 (continued)

routes are being destabilised by weaker ice cover on water and by hazardous weather events. Competing land use due to infrastructure, extractive industries, tourism, and energy production makes it difficult to find alternative grazing land. Supplementary feeding and increased use of trucks to transport reindeer is one result. Herds that are dispersed due to bad snow conditions have an increased exposure to predators (Walkepää, 2019; Uboni et al., 2020). By working strategically to secure adequate winter grazing and reduce fragmentation of grazing areas more generally represents win-win strategies for achieving decreased mental stress levels while reducing herders' consumption of fossil fuels (Walkepää, 2019).

7.1.7.3.7 Vulnerability Experienced through Food Systems

Stresses and shocks associated with climate change are drivers of food insecurity, particularly in sub-Saharan Africa, Asia and Latin America (Betts et al., 2018). The most vulnerable groups include smallholder farmers, pastoralists, agricultural laborers, poorer households, refugees, indigenous groups, women, children, the elderly and those who are socioeconomically marginalised (FAO et al., 2018; IPCC, 2019b) *(high confidence)*. Men, women, children, the elderly and the chronically ill have different nutritional needs and these vulnerabilities may be amplified by gendered norms and differential access to resources, information and power (IPCC, 2019b). Extreme climate events have immediate and long-term impacts on food insecurity and malnutrition in poor and vulnerable communities, including when women and girls need to undertake additional duties as laborers and caregivers (FAO et al., 2018).

7.1.7.3.8 Health Vulnerability Experienced through Water and Sanitation Systems

Water and sanitation systems are particularly vulnerable to extreme weather events, and damage to such systems can lead to contamination of drinking water and subsequent adverse health impacts (Howard et al., 2016; Khan et al., 2015; Sherpa et al., 2014). In areas with only very simple traditional excreta disposal facilities (e.g., latrines) and traditional sources of water (e.g., unprotected wells), the repeated

Structure of chapter 07

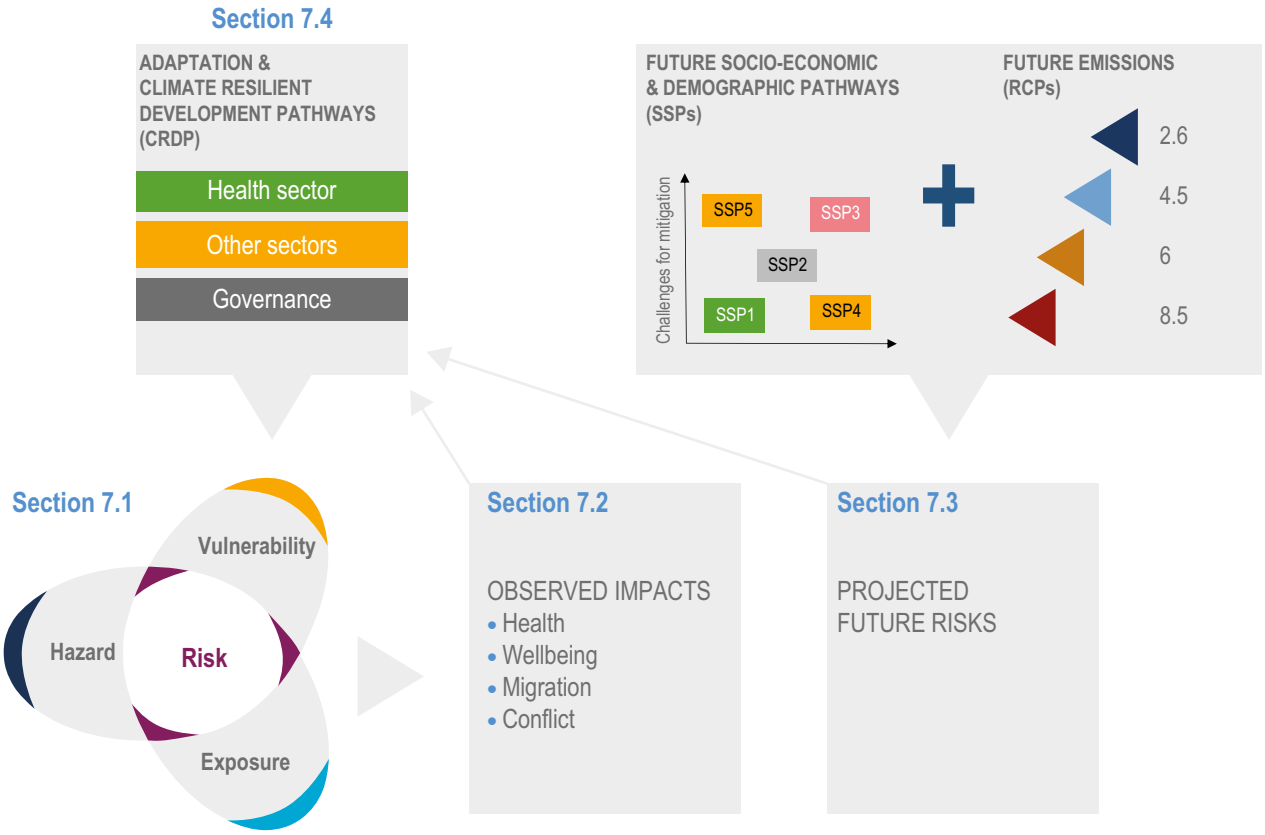

Figure 7.3 | Structure of the chapter following a pathway from hazard, exposure and vulnerability to the observed impacts, projected future risks, adaptation and climate resilient development pathways.