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Impact of climate change-induced natural disasters on intangible cultural heritage related to food: a review

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Abstract

The increased frequency of extreme climate-induced natural disasters (floods, cyclones, mud slides, heat waves, droughts), attributed to climate change, is causing stress to already vulnerable livelihoods by affecting both tangible and intangible cultural heritage (ICH) assets. There are limited studies that have established how the climate-induced disasters have impacted the ICH elements of food. As such, there is need to first establish the ICH elements or components of food and then how these ICH elements of food are being affected by climate change-induced disasters. This review was therefore aimed at identifying based on the literature the different ICH elements of food and how these can be affected by climate-induced disasters such as floods, cyclones, and droughts. This review paper shows that food is not only considered an ICH because of it being specific to a territory or ethnic group, but there are several dimensions or elements of food that makes it qualify as an ICH, which we grouped into six categories or domains. These domains of food as ICH are (i) food traditions and customs, (ii) food production, processing, and storage, (iii) dietary culture, (iv) eating and social practices, (v) culinary, and (vi) geographical indications. These ICH domains of food as ICH we created them based on the similarity of the different characteristics of the ICH elements are identified in the literature. This new insight is useful in assessing the impact of climate-induced natural disasters on intangible cultural heritage in food systems. More so, the identified categories of ICH elements of food can be viewed as constructs in a framework that can be used to assess the impact of climate-induced disasters on intangible cultural heritage in food systems and the ultimate impact on nutrition outcomes. Further research can be directed toward the development of a framework or tool to enable the assessment of the impact of climate-induced natural disasters on intangible cultural heritage in food systems.

Keywords: Cultural heritage, Climate change, Climate change-induced disasters, Intangible cultural heritage, Food

Introduction

Over the past years, climate change has resulted in an increase in natural disasters impacting both developed and developing countries [1]. More frequent and extreme climate-induced natural disasters might cause further stress to already vulnerable livelihoods by affecting both

tangible and intangible cultural heritage (ICH) assets like historical buildings, monuments, archeological sites, oral traditions, performances, and food systems [2]. These assets are important because they give local populations a sense of identity and well-being [3]. The ICH within food systems is also at an increased risk of being disrupted through the frequent occurrences of climate-induced natural disasters. These disruptions might occur through decreased availability of local foods, decreased occurrence of festivals centered around certain food

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items as well as altered local food preparation and storage practices [4].

Research aim

The purpose of this review is to provide insights into how the climate-induced disasters have impacted on the ICH elements of food. Particularly, this review was aimed at identifying based on the literature the different ICH elements of food and how these can be affected by climate-induced disasters such as floods, cyclones, and droughts. The significance of this review is in the new insights and knowledge on which elements of food can be identified as ICH and how climate-induced disasters impact on these ICH elements of food.

Climate change

Climate change refers to long-term shifts in temperature and weather patterns, and these swings may be natural or may be as a result of human activities [5]. Human activities such as burning fossil fuels like coal, oil, and gas are now perceived as the main drivers of climate change [5]. Global atmospheric temperature is predicted to rise by approximately 4 °C by 2080, which is consistent with a doubling of atmospheric carbon dioxide (CO₂) concentration [6]. These climatic changes have resulted in increased frequency and occurrence of climate-induced natural disasters.

Climate change-induced natural disasters include droughts, floods, storms such as cyclones and hurricanes, earthquakes, tsunamis, and volcanic eruptions [7]. These disasters can affect health, food systems and sustainability, structures, safety as well as livelihoods. Climate change can affect human development [8] as a combination of increased temperatures, and decrease in rainfall and unstable food production is expected to result in an increased risk of future low-birth-weight babies in sub-Saharan Africa [9]. Flooding can have both short- and long-term effects on child growth through changes in food consumption and infectious diseases burden [10].

The greatest effect can be felt through decreased crop yields and livestock productivity as well as decline in fisheries and agroforestry in areas already vulnerable to food insecurity, especially those in low-income countries [11]. There is strong evidence that climate change impacts on agriculture and livelihoods will affect food quality in terms of diversity, nutrient density, and food prices [4, 5]. There are projections that medium-to-high climate change is expected to result in an additional 4.8 million undernourished children by 2050 [10]. According to [4], about USD 3.16 billion in post-disaster recovery assistance to farmers between 2003 and 2013 is estimated to have been spent and about one-third of this investment was in response to disasters caused by natural hazards.

Consequently, these outcomes such as food shortages, coping mechanisms, poor nutritional status, and adverse health outcomes will have an impact on the way people live and, on the customs, and practices passed on from one generation to another. Therefore, climate change is considered as one of the severe threats to all forms of cultural heritage [12].

Cultural heritage

Cultural heritage constitutes the priceless assets of physical artifacts and intangible resources of communities inherited from past generations [13]. Physical artifacts are also known as tangible assets whilst intangible assets comprise of possessions which cannot be touched or moved. Tangible assets include movable cultural heritage, for example, paintings, historical artifacts, sculptures, and manuscripts [14]. Immovable heritage like monuments and underwater heritage are also part of tangible cultural assets and these include historical monuments, archeological sites, shipwrecks, and underwater ruins. Intangible cultural assets, also known as living heritage, comprise of among others oral traditions, performing arts, rituals, social customs, traditions, or spiritual beliefs [15].

Intangible cultural heritage (ICH) can be defined as the traditions and living expressions that are passed on from one generation to the next [16]. ICH provides a community with a sense of identity and continuity therefore promoting respect for cultural diversity and human creativity [17]. ICH is not static, but it continues to change and innovate with time. Living heritage represents the variety of immaterial and living heritage of communities, and it is the most important vehicle of cultural diversity through generations as it gives a community a sense of belonging [18]. The domains of ICH include oral traditions, social practices, performing arts, rituals, festive events, knowledge and practices concerning nature, climate change, coping strategies in extreme events, and the universe as well as the knowledge and skills to produce traditional crafts [19].

ICH is important in promoting peace and reconciliation, fostering community and individual well-being, and promoting human rights as well as sustainable development. It aids social cohesion and helps individuals to feel part of a community and of human society at large. Living heritage is also important in maintaining cultural diversity in the face of globalization. Understanding and preserving ICH contributes to intercultural dialogue and encourages mutual respect. Both intangible and tangible cultural heritage assets' knowledge and skills are transmitted from generation to generation which ensures that they are always remembered. It is therefore important that they are safeguarded and promoted [20].

Impact of climate change-induced natural disasters on intangible cultural heritage

Protecting cultural heritage is proving to be difficult due to the increased occurrence and frequency of climate-induced natural disasters. The disasters usually result in loss of oral traditions, languages, traditions, and beliefs and of the traditional food systems [21]. Traditional monuments, figurines, historical sites, and buildings are at risk of being destroyed by extreme climate events like floods, hurricanes, and floods, and some of these assets are irreplaceable. The stories and practices associated with these assets also disappear. Relocation of people to safer places due to climate change-induced disasters can result in communities parting ways with some traditional materialistic assets such as cemeteries, worshiping places, and sacred places that are specific to that community [22], as well as their associated practices. The intensity of the impact of a disaster on a specific culture mainly depends on the people in that culture and the strength and resilience of that culture. However, climate change-induced disasters are slowing down cultural development as well as causing irreversible damage to cultural heritage or destroying the entire areas of cultural heritage both tangible and intangible [23], and in the process some practices and stories around indigenous knowledge.

For example, indigenous knowledge systems such as traditional fauna and flora that can be used as medicines are perceived as an important part of the ICH [24]. Over the past decade, the frequency of extreme climate changes in sub-Saharan Africa has significantly increased and is increasingly affecting indigenous knowledge systems and the extreme weather events due to climate change are now also causing noticeable effects on the distribution of plant species like medicinal plants. Due to these extreme climate changes, medicinal plant species especially those along the riverine areas are being lost and some of the traditional medical practitioners have lost their lives [25]. This leaves those dependent on traditional medicines and having limited access to financial resources particularly vulnerable. Moreover, this great loss of vital medicinal species is very significant especially to numbers of vulnerable local communities whose populations rely greatly on traditional medicines for their primary healthcare needs [26].

Since ICH is associated with landscapes, a sense of place and attachment as well as identity, it should be an integral component of climate adaptation planning to safeguard and promote ICH in all its forms including the food systems [27].

Impact of climate change-induced disasters on ICH within food systems

Defining food systems

A food system is a structure that comprises of all the elements like the environment, people, inputs, processes, infrastructure, institutions, markets, and the activities that relate to the production, processing, distribution and marketing, preparation and consumption of food and the food outputs. The outputs include socioeconomic and environmental outcomes [28]. A food system is also regarded as a complex web of activities that start from the production, processing, transportation up to the consumption of food items [29]. Food systems operate within and are influenced by social, economic, political, and environmental contexts. The activities and practices within the food systems chain are susceptible to environmental conditions and climate change. More so, there are factors that can disrupt the chains in food systems such as the governance and economics of food production, sustainability, degree of food wastage, effects of food production on the natural environment, and the impact of food on individuals and population health [30].

A food system includes not only the basic elements of acquiring food from the farm to the plate, but it also involves all the processes and infrastructure involved in processing, storage, and feeding of a population. There are many structures in food systems to consider, for example, farming systems, agricultural ecosystems, economic systems, social systems, and within those structures are further subdivisions such as water systems, energy systems, financing systems, marketing systems, policy systems, and culinary systems. People are involved throughout the system as producers, information providers, policymakers, regulators, and as consumers. Traditional foods and the traditional means of obtaining and preparing the food are part of the food system, hence also part of cultural heritage. Therefore, food systems are associated with culture, personal identity as well as physical health [31].

Food as an intangible cultural heritage

Cultural heritage within food systems includes the tangible items like traditional dishes, landscape, and tools as well as intangible such as sensory awareness, ideology, cuisines, preparation, knowledge, and health [32]. In 2010, the United Nations Educational, Scientific and Cultural Organization's (UNESCO) included food on their representative list of the Intangible Cultural Heritage of Humanity. UNESCO acknowledged the link between food and intangible heritage by listing a range of diverse diets in its list of ICH. For example, in 2010, UNESCO decided to include the gastronomical meal of the French

in its Representative List of Intangible Cultural Heritage of Humanity (UNESCO 2005) [33], the Mediterranean diet as well as the traditional Mexican cuisine. As stated by [34], food and its cultivation, preparation, and communal consumption can be a form of ICH because, for example, a cuisine has both a natural and a cultural component that contributes to its authenticity, uniqueness, and cultural identity. The natural component includes the unique physical environment of a region, and the cultural part includes values and attitudes of the local community toward a specific food item. It also includes the way it is consumed and other practices around its consumption [34].

Linking traditional food products with territory and ethnic groups

Traditional food is specific to the geographic and cultural context in which it is found. A traditional food might be aligned to a place or ethnic group by the way the food is prepared, the ingredients which are found at a certain geographical location, the culture centered around the dishes prepared, or the significance the dishes or ingredients hold to a specific ethnic group or location [35]. For example, some ethnic groups in Vojvodina, like the Hungarians, are mostly known for caloric spicy food dishes. They pass on the knowledge to the younger generation so as to preserve their traditional food knowledge [36]. In Naban, the use of wild food plants such as *Dai*, *Lahu*, *Hani*, and *Mountain* is quite abundant, and knowledge on how to use these wild food plants is mostly passed on to young girls by older women [37].

In the southern Italy and Northern Lucania, there are ethnic Albanian communities that are known for their traditional use of non-domesticated food vegetables called *liakra* [38]. This vegetable is gathered mostly during the spring season, and it plays a central role as a traditional functional food. These communities are known to practice cultural ceremonies related to gathering, processing, cooking, and consumption of *liakra*. In Zimbabwe, tamarind is a tree indigenous to Africa and, specifically, found in the upper Zambezi Valley. It is called *musika* by the indigenous Tonga and Tokaleya

people. Tamarind can be consumed, while it is fresh in-season when the pulp is a balanced mix of sweet and sour. However, the indigenous people have a special way of processing it; for example, the sticky, russet-colored pulp encasing the seeds can be mixed with water and a little sugar, transforming it into a refreshing drink, and they even use it for medicinal purposes such as reducing fevers, relieving constipation, and treating inflammation because tamarind is high in tartaric acid, sugar, B vitamins, as well as calcium [39].

According to Zulu et al. [40] and Moonga et al. [41], in Zambia and the Democratic Republic of Congo, there is a traditionally fermented, cereal-based beverage called *munkoyo* that is produced by hydrolysis of gelatinized starch of maize porridge and spontaneously fermented by microbes at ambient temperature. The beverage is consumed by both children and adults. The knowledge about processing practices and consumption patterns varies with the communities in Zambia and Democratic Republic of Congo [42]. In addition to the traditional foods above, Table 1 shows a few examples of other traditional food products linked to specific territory or ethnic groups.

It is, however, important to emphasize that the ICH elements of food are not only in the traditional food being specific to an ethnic group or territory. There are several other dimensions of food which can make it be considered as an intangible cultural heritage.

Elements or dimensions of food that make food qualify as an intangible cultural heritage

Based on a traditional literature review (Table 2), we grouped the identified ICH elements of food into six domains which are (i) food traditions and customs, (ii) food production, processing, and storage, (iii) dietary culture, (iv) eating and social practices, (v) culinary, and (vi) geographical indicators (Table 2). These proposed domains were created based on the similarity of the characteristics of the ICH elements identified in the literature.

Food traditions and customs domain consists of traditional cultures, rituals, festivals as well as taboos centered around food from its production, processing up

Table 1 Traditional food products specific to ethnic groups and territory identified from the literature

References	Traditional food/ingredients	Ethnic group	Location
Ghorbani et al. [37]	<i>Dai, Lahu, Hani, and Mountain</i>	Naban people	China
Grubor et al. [36]	Spicy food dishes	Vojvodina ethnic group	Northern Serbia
Hughes [39]	Tamarind/ <i>musika</i>	Tonga and Tokaleya people	Zambia and Zimbabwe
Mattalia et al. [43]	<i>Liakra</i>	The ethnic Albanian communities	Italy
Zulu et al. [40] and Moonga et al. [41]	<i>Munkoyo</i>	Not mentioned	Zambia and the Democratic Republic of Congo

Table 2 Categories of elements or dimensions of food that can make food be considered as an ICH

References	Title	Categories of food as ICH identified	Country
Aktürk [2]	Intangible cultural heritage: a benefit to climate-displaced and host communities	Food production, processing, and storage —(food, hunting, and farming) Food traditions and customs —(food traditions)	Bangladesh, San Diego, Argentine, Uruguay, Japan, Finland, Mexico, Alaska, South Pacific, the Caribbean, Barbuda
Bortolotto and Ubertazzi [44]	Editorial: Foodways as Intangible Cultural Heritage	Dietary cultures —(traditional dietary cultures, agro-food products) Culinary —(recipes)	Japan, Botswana, Mauritius, Croatia, Indonesia, Italy, South Korea, Turkey, Greece, Morocco, German, Spain
Di Giovine et al. [45]	Edible identities: Food as Cultural Heritage	Geographical Indicators —(landrace plants, landscape) Culinary —(traditional dishes, tools, cuisines, knowledge, techniques, ideology, sensory awareness, philosophies of food, health)	Italy
Teixeira and Ribeiro [52]	The lamprey and the partridge: a multi-sited ethnography of food tourism as an agent of preservation and disfigurement in Central Portugal	Food traditions and customs —(food taboo, cultural significance)	Central Portugal
Kapelari et al. [62]	Food Heritage Makes a Difference: The Importance of Cultural Knowledge for Improving Education for Sustainable Food Choices	Eating and social practices —(memories, senses, experiences, emotions, bonding) Culinary traditions —(botanical gardens)	Uganda, Italy, Germany, Greece, Belgium, Scotland, Edinburg
Freedman [46]	Food: The History of Taste	Dietary culture —(food preferences, food practices, food innovation, food technology)	Not mentioned
Vadi [49]	Food Wars: Food, Intangible Cultural Heritage, and International Trade	Food production, processing, and storage —(food preparation and associated cultural practices, food safety)	Italy, France, Mexico, Morocco, Spain, Greece, Japan
Almansouri et al. [65]	Exploration of heritage food concept	Culinary —(food dishes, agricultural products (raw materials), ingredients/compositions, dishes, preparation techniques, recipes) Food traditions and customs —(food traditions, table manners, the symbolic dimension and material aspects such as utensils and dishware)	Brazil, Malay, South Asia, Greek, England, Germany, Turkey, Canada, South Arabia, USA
Long et al. [47]	Food as Intangible Cultural Heritage	Food traditions and customs —(knowledge, skills, performances, attitudes, and beliefs) Eating and social practices —eating practices	Not mentioned
Santilli [51]	The recognition of foods and food-related knowledge and practices as an intangible cultural heritage	Food production, processing, and storage —(marketing, cultivation, hunting, gathering, preparation or processing)	Mexico, France, Japan, Croatia, Colombia, Morocco, Spain, Italy, Turkey, South Korea, Greece, Portugal, etc.
Maundu et al. [48]	Safeguarding Intangible Cultural Heritage: A Practical Guide to Documenting Traditional Foodways	Dietary cultures —(who prepares it when it is prepared) Culinary —(tools are used, who eats and where we eat from) Food traditions and customs —(traditions including taboos, beliefs)	Kenya

Bold indicates the categories of food as ICH established by the authors

to consumption [50]. Community identity relates to the cooking skills, knowledge, and techniques which are unique to a community, thereby giving it a sense of identity. The geographical indicator domain is related to or concerns foods or dishes that are identified by their locations or are specific to a certain location. The eating and social practices domain relates to the art of sharing food, thereby creating bonds within the family as well as the community. Food production, processing, and storage domain brings out the different traditional food acquiring, processing, and storage methods that communities have used. It also looks at the cultures and ceremonies done during these stages. Lastly, culinary entails the recipes and cuisines which are specific to communities. These proposed domains are explained in further detail below and graphically presented in Fig. 1.

Food traditions and customs Food systems are a representation of ritual, cultural, and social expressions of a community. According to [35], food culture is understood as ‘the set of representations, beliefs, knowledge that are inherited and/or learned practices that are associated with food and are shared by individuals from a given culture or a particular social group.’ [52] stated that before food reaches the table, there are several culturally relevant processes and practices that take place that represent the culinary heritage of a certain group of people, place, and culture. In religion, food is one of the most important parts of religious ceremonies. Food plays an important

role in religious culture as part of showing respect among communities and hence food is prepared in different ways. The food we consume, how we acquire it, who prepares it, and who eats first is a form of communication that depicts a rich cultural base [53].

Food preparation and even certain types of food can express the deeply held cultural practices and values of a community. Every community has their traditional foods that have been consumed over many generations and have been integrated into their culture. For example, the Maasai in Africa consume lots of milk, and occasionally blood [54]. Some of the traditional foods are allowed to be eaten exclusively during special events like ceremonies or are consumed only by certain people such as pregnant or lactating women. Food traditions and customs include the knowledge, practices, beliefs, and all cultural elements in relation to how a community produces, stores, prepares, and uses its food. The indigenous food varies a lot with the seasons, and it is governed by traditions which include taboos and beliefs. What people eat tells a lot about their culture, beliefs, and traditions [55].

Community identity Community identity is another important component of ICH within food systems. A diet alone shows the skills and knowledge on farming, harvesting, processing, and cooking techniques that are unique to a specific group, thus contributing to their community identity [56]. Moreover, food reflects histories of cultural identity, practices of social bonding, and cooperation at local level. Food is also important in connecting the past with the present. These elements together make food a form of cultural heritage. Food is considered to be something that shapes us as individuals, our identities, cultures as well as our society and it also signifies a meaning specific to a culture just as different clothes signify different occupations like how a white coat signifies a doctor [53].

According to [57], food ‘constitutes a basic element of the culture of people or of a community.’ The passing on of food practices from one generation to the other contributes greatly to constructing identity and memory of both individuals and communities as a whole. Nutrition plays a cultural role in shaping a community’s and an individual’s specific identity. [58] also notes that in certain cases, food preparation and consumption also constitute a form of intangible heritage through the inherited knowledge and practices around food in different communities. Moreover, local foods are very important for the sustainability of the food culture that is about to disappear so that its cultivation and production is sustained.

Geographical indications (GIs) Geographical indications (GIs) are pointers that are used to identify products which come from these locations and whose quality

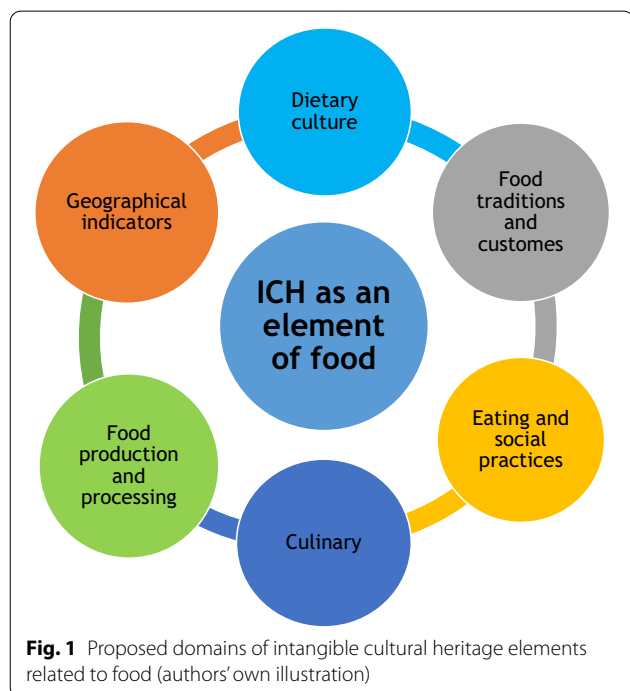


Fig. 1 Proposed domains of intangible cultural heritage elements related to food (authors’ own illustration)

reputation depends on these specific geographical sites, for example, Champaign from France and Gouda cheese of the Netherlands. This provides a connection between food, cultural practices, and intellectual property as well as giving these food items a sense of belonging. GIs can indirectly protect the ICH associated with the production of these goods by protecting these regional food products that have acquired a strong reputation among consumers due to their brand names. Through GIs, the culture of producing a given type of food, the culture of consuming certain foods, and the culture of identity whereby a food item is recognized as a representative of a group's cultural identity are all brought out and people strive to protect the quality of these food items so as to protect their reputable brand names [59]. Furthermore, food recipes and dishes can be used to identify the exact location that they are commonly found or used in such as tomato, basil, and mozzarella cheese on a pizza to bring out a taste of Italy [53].

Eating and social practices Cultural practice goes beyond the boundaries of food alone and acts as a cornerstone for other cultural practices like eating together, thereby promoting bonding within the family, hospitality, and neighborliness. Beyond merely nourishing the body, the food we eat and with whom we eat can inspire and strengthen the bonds between individuals, communities, and even countries. There is no closer relationship than with the one with whom you share food with; therefore, food plays a large part in defining family roles, rules, and traditions [53]. According to [60], cooking can reveal a society's soul meaning that simply by observation, the observer can learn a lot about a certain culture. This includes what foodstuffs are available, how they are prepared, how they are consumed, the spices that are tolerated, which foods are acceptable to eat, and which are taboo, when, where, and with whom certain foods are to be consumed, the manners that are to be observed when eating and who should eat first and the socio-economic system that sustains the production, preparation and consumption of food among other things. This shows that the act of eating goes far beyond simple nutrition. Eating is also an act filled with interacting layers of social, political, economic, ecological, and symbolic meanings that bridge nature and culture [61]. Eating food is said to bring about memories, incites senses, emotions and offers experiences that bind people together through space and time, and this creates local, regional, and ethnic identities [62].

Food production, processing, and storage Local knowledge on traditional food crops and related agricultural practices are a source of local community resilience which enable residents to sustain their livelihoods through their

culture thereby providing community resilience in a changing environment [63]. Indigenous knowledge such as social safety nets like 'the chief's granary' commonly known as *Zunde raMambo* whereby the general community contributes to a grain store to help needy families during times of hardship is being used as coping strategies to alleviate food shortage in the face of climate change. These traditional food storage and processing techniques are specific to communities, but climate-induced natural disasters are threatening their existence [64].

Culinary The sixth element is culinary. Culinary heritage involves the origins of food-related activities of a certain cultural group [65]. Each cultural group has a rich diversity of indigenous vegetables and herbs that are used in their dishes, and these define their identity. Factors like colonialism and relocation are perceived as violent processes which can alter the way of life of people as well as their culinary habits. Traditional knowledge was devalued with the shift in the education of children from tribal elders to the imperial powers [66]. For every tangible heritage, resource lost to climate change, local people, and communities with ties to those resources can experience a deep sense of loss. Culinary imperialism also affects food practices which people originally practiced and eventually they might lose their sense of identity and some of the indigenous knowledge might disappear. The impacts of colonization and modernization have also led to the undermining and neglect of local and indigenous knowledge [67].

Effects of climate-induced natural disasters on ICH in relation to food

The ICH domains of food identified and categorized in 'Food as an intangible cultural heritage' section (Table 1 and Fig. 1) are under threat from climate-induced natural disasters, such as floods, cyclones, hurricanes, droughts, and earthquakes, whose frequency and occurrence have been increasing over the past decade. A single incidence of a climate-induced disaster might impact on more than one ICH domain of food.

Disasters such as cyclones, hurricanes, and floods can lead to the erosion of the nutrient-rich topsoil leaving behind soil that is infertile. Erosion of the topsoil can be a drive to the extinction of some of the traditional food crops (*dietary culture*) that are particular to some specific locations (*GIs*) and consumed by specific cultural groups as well as being used in some traditional ritual processes (*food traditions and customs*) which are ICH domains of food. For example, hurricane Allen hit St. Lucia in the Caribbean and destroyed almost ninety percentage of the island's banana crops which by that time comprised of almost eighty-five percent of the country's agricultural

export [66]. Floods can submerge land used for agriculture, pastures, and livestock, which could in turn reduce crop yields and animal production. More so, some indigenous food crops might become extinct affecting the dietary culture of the local community. The disasters also destroy the storage infrastructure as well as the socioeconomic activities (*food production, processing, and storage*) which are linked to the agriculture sector, and this could greatly affect food production and eventually decrease food availability, accessibility, utilization and stability in the region [68].

Drought has a devastating effect on soil, vegetation, agriculture, and livestock because the water level will be below minimum to sustain plant, animal, and human life. Disasters like earthquakes can cause destruction of infrastructure that are used for storage of food. In some cases, these disasters can also cause landslides which can affect land that is used for agriculture (*food production and processing*). For example, Nepal was hit by a 7.5-magnitude earthquake in 2015 and it had a serious impact on the livelihoods of rural farmers as massive damage and losses occurred to crop lands, physical infrastructure, livestock shelters, agricultural tools, equipment, and machinery [69].

Traditional knowledge, values, and practices accumulated and passed on across generations as part of ICH have helped to guide human societies in their interactions with the surrounding natural environment. ICH is also important in the communities because it permits communities to better face natural disasters and challenges of climate change [70]. This information was usually passed on from generation to generation during eating and storytelling (*eating and social domain*) but due to climate-induced migration families have been separated; therefore, the opportunity to bond is lost [71].

Traditional knowledge and cultural practices (*food traditions and customs*) are under the threat of being lost due to climate-induced migration. This stress on cultural heritage is likely to increase with relocation efforts of communities to safer places. As the number of displaced populations grows, the community's deep-rooted connection to their rituals, customs ancestral ties with the land as well as their cultural practices and any other intangible cultural heritage also become endangered. Loss of physical landscapes and the indigenous fauna and flora (*GIs*) results in discontinuation of cultural knowledge, traditions, customary as well as folkloric practices [72]. Since ICH is associated with landscapes, sense of place, attachment, and identity, it can be an integral component of climate adaptation planning [27]. The climate-driven loss of land, traditional economic practices like fishing, trade, and farming causes climate-displaced communities to lose aspects of their cultural practices (*food*

traditions and customs). Customs associated with food and the land such as celebrations, food festivals, hunting, and farming (*food traditions and customs*) are greatly affected when people relocate to other places. In addition to losing their sacred places, kinship, and networks (*eating and social practices*), the displaced people might also slowly forget or abandon their culture; thereby, cuisines and diets (*culinary and dietary culture*) specific to a tribe are also at risk of extinction [2].

Failure at restoring ICH assets has the potential to lead to loss of vital knowledge on traditional food processing, storage, and other beneficial processes to value addition of food in terms of nutritional content and food security. The Convention for the Safeguarding of the Intangible Cultural Heritage points out the 'Importance of the intangible cultural heritage as a mainspring of cultural diversity and a guarantee of sustainable development' [19]. Therefore, it has been recognized that ICH can effectively contribute to sustainable development in line with each of the three dimensions of the 2030 Agenda for Sustainable Development which are economic, social, and environmental. Intangible cultural heritage is thus vital to achieving food security. Traditional food systems knowledge and local farming, pastoral, fishing, hunting, food-gathering, and food preservation systems can be passed on from generation to generation through storytelling, craftsmanship, rituals, and traditions, and they can contribute greatly to food and nutrition security. Each community has gathered up considerable traditional knowledge which are based on a comprehensive approach to their specific community life and environment. This knowledge includes the nutritional value of diverse crops, animals and plants, and the natural environment. They have developed diversified food systems, production, and conservation systems that are adapted to these specific locations and environmental changes. Strengthening and protecting these systems is crucial to ensure food sufficiency, security, and quality nutrition for all [19].

Conclusion

This review paper presents the first study that explains why certain foods and their products are part of the intangible cultural heritage of a given population. In addition, this review paper shows that food is not only considered an ICH because of it being specific to a territory or ethnic group, but there are several dimensions or elements of food that makes it qualify as an ICH. Through a traditional literature review, the identified ICH elements of food from specific regions and ethnic groups were categorized into common domains. The overall objective of this review paper was to identify the elements and domains of ICH in relation to food. More so, the impact

of climate-induced natural disasters on the identified ICH domains of food as part of ICH is also explored. This literature review identified and categorized the ICH elements of food into six domains which are (i) food traditions and customs, (ii) food production, processing, and storage, (iii) dietary culture, (iv) eating and social practices, (v) culinary, and (vi) geographical indicators. All these domains are directly or indirectly affected by climate-induced natural disasters anywhere along the food systems chain from production to consumption. The significance of this study is that it helps standardize and analyze the different ICH domains of food and its products found or common in specific regions or ethnic groups across the globe. This enables comparison of ICH domains of food prominent in different regions or ethnic groups across the globe. This paper is part of a two-year study on food as ICH, and the next study is on analyzing how climate-induced natural disasters are impacting on the identified domains of food as ICH in specific regions and ethnic groups.

Abbreviations

AHRC: Arts and Humanities Research Council; GIs: Geographical indicators; ICH: Intangible cultural heritage; UNESCO: United Nations Educational, Scientific and Cultural Organization.

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Author contributions

All the authors equally contributed to writing the paper. V D led the writing of all the sections of the paper. P C and J M contributed to the writing of the introduction, body, and conclusion sections. L M read and edited all the sections of the paper and finalized the manuscripts. All the authors equally scrutinized all sections of the paper ensuring that the paper is of high quality. All authors read and approved the final manuscript.

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Declarations

Competing interests

The authors declare that they have no competing interests.

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