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CHARACTERIZATION OF DIFFERENT FOOD SYSTEMS, INCLUDING TRADITIONAL FOOD SYSTEMS, IN RELATION TO BIODIVERSITY AND NUTRITION

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I. INTRODUCTION

1. Recent work has established that biodiversity is essential for sustainable diets and for food security and nutrition. Thus, food biodiversity must be contained and recognized in food systems that provision for populations. Understanding the cultural and ecosystem contexts of food systems is critical to develop necessary data to characterize food systems, which in turn includes species definitions, their nutrient composition, and patterns of human food consumption whereby all macro- and micronutrient requirements are met.

2. Throughout history, humans have adapted to the challenges of their local environments to generate food systems with suitable cultural attributes that provide healthy diets. However, in the world today nearly 900 million people live with chronic hunger, insufficient healthy food, and malnutrition of various forms (SOFI, 2012; He, 2010). It is recognized that the health of humans is closely linked to the health of the ecosystems in which they live, and that for food and nutrition security to be realized for everyone, the ecosystems of the planet must be safeguarded. One aspect of safeguarding ecosystems is to recognize and protect the biodiversity inherent to them, and to ensure that this biodiversity fully contributes to diets that are healthy and sustainable.

3. Creating the potential for universal sustainable diets for the world's peoples involves major effort to bring biodiversity universally into local food system realities. This requires creating databases that characterize food systems and the biodiversity within them, including the contextual factors of culture and ecosystems in which the food systems are grounded. Considered broadly, these factors include working relationships with local and national leaders, cultural food identities, factors that shape dietary patterns, factors influencing current food and nutrition security, and the current and possible changes to create more effective food systems.

4. Food systems vary by agroecological zones, climatic factors, cultural precepts, and local ecosystem realities. The benefits of conserving and sustainably using dietary biodiversity rest with knowing what these benefits are (e.g., micronutrient contents) and establishing processes at local, national and international levels to protect them. Data on the characteristics of food systems for biodiversity and nutrition can be systematically collected and managed for the purposes of planning food-based interventions to accomplish these goals.

5. This overview describes factors helpful in characterizing food systems so that they can systematically be applied to food-based interventions to improve human nutrition. Broad categories of food systems are introduced and the essential elements of the cultural and ecosystem contexts are outlined.

II. CATEGORIES OF CONTEMPORARY FOOD SYSTEMS

6. There are many differences in food traditions among the world's cultures. Evolving over many centuries, complex and diverse food systems have provided food and nutrition security while protecting natural resources. Traditional knowledge and management of cultivated and uncultivated foods have in many cases maintained food biodiversity. However, food biodiversity is threatened by environmental deterioration and socio-economic changes that compromise the quality of the food provided.[1]

7. For the purpose of characterizing current food systems, it is useful to consider general categories such as hunter-gather (foraging), pastoral, horticultural, smallholder agriculture, industrial agriculture and mixtures of these. In fact, all human societies today have embraced industrial agriculture and its food products to some degree, resulting in food systems that contain both local/indigenous food and imported industrially processed products. This section characterizes major

[1] The FAO has documented many agricultural heritage systems in its Globally Important Agricultural Heritage Systems (GIAHS) programme (www.fao.org/nr/giahs) with examples from ethnic groups, local populations and communities of indigenous peoples.

food systems that evolved before industrial agriculture, as well as what we term the "industrial food system," with focus on aspects of food biodiversity and nutritional contributions contained within them.

Hunter-gatherer or foraging food systems

8. In recent times, these systems have most been found in ecological areas that are unsuitable for agriculture, such as the Arctic, dense forests in Africa, South America and Asia, and the edges of the deserts in the Americas, Southern Africa and Australia (see Box 1). Wild animal and fish foods play key roles in dietary quality, as has been demonstrated for the Dene and Inuit cultures of the North American Arctic (Kuhnlein and Receveur, 2007). This is true today even with Arctic market food networks, which are expensive for those living in poverty. The traditional Inuit and Dene food systems each have more than 100 different species of wild animals and plants to harvest from within their local ecosystems. Hunter-gatherer food systems in tropical areas have more wild plant species available from the ecosystems, as well as a diversity of animals and fish.

Box 1. Examples of food biodiversity in hunter-gatherer food systems

Populations of Dene and Inuit cultures of Indigenous Peoples resident in the Canadian Arctic have access to extensive wildlife food species over broad territorial ranges. Denes know and use the following numbers of species – 17 land mammals, 16 birds, 20 fish and other seafood and 48 plants. Inuit living in the Northwest Territories, Nunavut and Labrador use the following numbers of species – 14 sea mammals, 14 land mammals, 70 birds, 48 fish and other seafood and 48 plants. The Awajun in northwest Peru know and use 94 plants (vegetables, fruits and tubers) and 113 species of fish, birds, and other animals.

Sources: Kuhnlein and Receveur (2007) Creed-Kanashiro *et al*., (2009).

Pastoralist food systems

9. These systems depend on domesticated animal herds adapted to dry lands that are unsuitable for cultivation. Camels, cattle, sheep, goats, horses and reindeer are the primary species kept by pastoralists in desert areas of Africa, the Middle East, the Islamic Republic of Iran, the Mediterranean, Mongolia and northern Europe and Asia. A pastoralist group can be either fully nomadic, moving their herds to follow the grazing seasons, or partly sedentary, depending on water sources and social adaptation. Wild plant foods, in contrast to animal foods, provide minor amounts of energy in the diet of pastoralists. The Maasai pastoralists of East Africa have traditionally depended on fewer than 50 food species. Recent drought and land restrictions for their migrations have created greater dependence on food aid comprised primarily of donated grains. Another example is the impact of extended drought on pastoral activities in dryland areas of southern Iran, resulting in migration of tribal people into urban areas.

Horticulture food systems

10. These systems are created by peasant farmers who do not have access to mechanized agriculture. They generally produce food for the family, or within village units, and do not depend on commercializing their produce. Small animals (chickens, guinea pigs, etc.) or a few larger animals may augment the household diet, which is composed primarily of local grains, roots and wild plants and animals. Forested areas may be cycled into horticulture using swidden or shifting cultivation. Horticulture is practised in rural areas of Asia, Latin America and Africa. Depending on the region, a vast diversity of animal and plant foods are known and used by horticulturists. For example, among the Karen people of western Thailand, swidden cultivation of more than 25 varieties of rice is augmented with local cultivation and harvest of about 355 species of other grains, seeds, tubers,

insects, fish, other animals, vegetables and fruit, which give a rich diversity to the diet (Chotiboriboon *et al*., 2009).

11. Beyond horticultural food systems there is a wide range of agricultural systems ranging from those that use little mechanization to those that make extensive use of industrial equipment and large food-processing industries. It is useful in this overview to understand the sliding scale of reduced biodiversity in food animals and plant crops as the food system in a particular ecosystem changes to greater agricultural industrialization, where larger farms grow more volume but with fewer species/varieties/subspecies of crops.

Smallholder farmer food systems

12. These systems using intensive human labor along with animal and limited mechanical labor are practiced in most global regions where continuous crops can be grown and harvested year round, often using terracing, irrigation and animal or other fertilizers. The diversity in food species known and used by peasant farmers can be extensive, depending on the local environment. For example, Dalit farmers in the Zaheerabad district of India often grow mixed crops in fields without using mechanized implements. More than 320 species of plant foods, both cultivated and uncultivated, are harvested from fields (Salomeyesudas and Satheesh, 2009). Other notable diverse smallholder farmer food systems include those of the terraced and flooded rice ecosystems of Asia, which provide biodiverse aquatic food species (Halwart and Bartley, 2007).

Cash crop food systems

13. In these systems, smallholder or peasant farmers grow crops for sale in markets for cash. They may also grow some limited crops for the family unit or for sharing in the community. Generally, families who grow cash crops rely on purchased food, which may result in their diets being less diverse than they would be if the land used for cash crops were ecologically managed to provide food for local communities. Often, attention to the biodiversity in food plants is limited or lost as land is converted to agriculture for the production of crops for sale or to industrial agriculture. Cash cropping is routinely practised in areas adjacent to towns or cities, where transportation to markets is available.

Industrial food systems

14. These systems, which rely on large-scale agriculture, provide the majority of food energy in the world today, using a limited number of crops. In fact, only twelve crop species (eight grains and four tubers) are reported to provide an estimated 80 percent of the world's consumed food energy (Grivetti and Ogle, 2000). Relying on extensive use of fossil fuels, chemical fertilizers, irrigation and mechanized power, industrial food systems and large-scale food industries supply nearly all the food consumed in the world's cities, all of which must be purchased, and which contributes to a large profit-driven economic base. Industrial agricultural food systems contribute the loss of food-species biodiversity and have a heavy impact on the environment; they contribute significantly to global warming (FAO, 2011). In addition, post-harvest "ultra-processing" (Monteiro *et al*., 2012) means that food products lose their identity as specific food-species entities. Their contribution to the biodiversity of the diet is thus obscured.

Mixed food systems

15. These systems, in which traditional/local/subsistence food is combined with other food systems, are practised by most populations. In addition, market food is purchased and used everywhere to augment diets. For example, the very remote tropical villages of the Awajun in Peru (see Box 1) have a food system that mixes hunter-gatherer and horticulture, and is augmented with market foods such as sugar, oil and tea. The Maasai have a food system that mixes pastoral and small-holder agriculture, and is augmented with market foods.

16. Many examples of food systems used by families worldwide are poignantly demonstrated photographically in Menzel and D'Aluisio's book *Hungry planet* (2005). Even the most locally grown diets are augmented with purchased market foods, as demonstrated by the case of a smallholder farmer in Bhutan who spends US$5.03 per week on such products. This contrasts with an Australian family portrayed in the book which spends approximately US$303.75 weekly on foods entirely from the industrial food system, with the exception of a few kitchen garden herbs. These two food profiles, and the others in the book, are not directly comparable because of the range of factors influencing food availability and access. However, the contrasts in types of foods, as illustrated in the book's photographs and by the differences in the money spent on a week's food, are compelling examples of the differences in the ways people access food for family diets.

Kitchen gardens

17. These small supplements to food systems used by families are small gardens in rural, suburban and semi-urban areas that produce herbs and other items important to the local cuisine and can provide some biodiversity in the diet.

III. AGRO-ECOLOGICAL ZONES

18. The world's farming systems can be superimposed on the many agro-ecological zones in order to identify categories of climate influence on food systems (see http://www.fao.org/farmingsystems/regions_en.htm). In addition, national identities and local cultures use the biodiversity of food systems in agro-ecological zones to create cuisines and dietary patterns.

19. The widely recognized "Mediterranean Diet" is practised in broad agri-ecozone areas of the Mediterranean basin, from North Africa, to the Middle East, Turkey and Southern Europe. It is recognized as a UNESCO Intangible Cultural Heritage.[2] The Mediterranean food systems found in this broad region are highly regarded for their biodiversity and sustainability and for their nutritional benefits. Importantly, social and cultural diversity are also among the benefits of the food system that are recognized to contribute to numerous health benefits (Gamboni *et al*., 2011). Local respect for the ecosystem territory and for local community activities such as fishing, conservation, crop harvest, processing and preparation, and meal consumption are essential components of the food system (Petrillo, 2011). The prevailing view is that there is a need for holistic views on what constitute sustainable food systems in the Mediterranean area and on dietary models that include local cultural contexts for the diets that emphasize plant foods.

IV. ESSENTIAL ELEMENTS FOR CHARACTERIZING A FOOD SYSTEM

Cooperative relationships for research and steps in interviewing

20. To develop research strategies to characterize food systems for their biodiversity, sustainability and nutritional potentials, a key first step is to develop cooperative relationships with the people directly involved in the food system. Box 2 lists several published guidelines on working with communities, including some that provide advice on the steps involved in conducting interviews to identify the species within a food system, and on how to derive scientific nomenclature, community knowledge of harvest, processing and use, and the local cultural acceptability of each species. Nutrition indicators for biodiversity in food composition and food consumption have been published (FAO, 2008; FAO, 2010).

[2] http://www.unesco.org/culture/ich/index.php?lg=en&pg=00011&RL=00394

Box 2. Published guidelines for conducting research on elements of food systems

- *Working with indigenous peoples*: (Sims and Kuhnlein, 2004) http://www.who.int/ethics/indigenous_peoples/en/index1.html
- *Procedures manual for documenting food systems*: (Kuhnlein *et al*., 2006) http://www.mcgill.ca/cine/resources/data
- *Improving nutrition with agricultural biodiversity*: (Fanzo *et al*., 2011) http://www.bioversityinternational.org/index.php?id=19&user_bioversitypublications_pi1%5BshowUid%5D=5357
- *Community assessment of natural food sources of vitamin A. Guidelines for an ethnographic protocol*: (Blum *et al*., 1997) http://www.idrc.ca/EN/Resources/Publications/Pages/IDRCBookDetails.aspx?PublicationID=294
- *Nutrition indicators for biodiversity. 1. Food composition* (FAO, 2008) http://www.fao.org/docrep/010/a1582e/a1582e00.htm
- *Nutrition Indicators for Biodiversity. 2. Food consumption* (FAO, 2010) http://www.fao.org/docrep/014/i1951e/i1951e00.htm

Biodiversity of food species

21. To characterize a food system it is obviously necessary to understand the biodiversity of food species available in the local environment, and to learn as much as possible about each of these species and their varieties/cultivars, before considering the composition of mixed dishes and cuisines. With taxonomic information by species, and accurate sampling and analysis, the nutritional characteristics can be reviewed and researched, and the nutritional properties of mixed dishes and cuisines can be derived (FAO, 2008).

Contextual features of the local ecosystem and culture

22. In addition to understanding the species (and varieties/cultivars) available in a food system, the contextual features of the ecosystem and the local cultures and communities using the foods must be seriously factored in (Pelto *et al*., 2013). This is especially important when the ultimate goals are to devise, implement and evaluate intervention programmes using the local food system. Understanding local farmers and food processing and food preparation technologies within local culture gives important clues as to how to incorporate more biodiversity into family diets.

23. The following sections provide windows for investigating relevant contexts for characterizing food systems.

Subnational, national and regional food identities

24. Food systems, especially traditional food systems, are determined by the ecosystems that provide the food species and the cultures that use and manage them. Food identities to “place”, or to a culture, can be subnational (e.g., ooligan grease carries an identity to First Nations culture on the west coast of British Columbia, Canada), national (e.g., feijoada is specific to Brazil), or regional (e.g., olives of the Mediterranean region). Traditional foods and the dishes made from them form national or cultural cuisines. Defining biodiversity by species within traditional food systems is the first step in understanding the nutritional potential for healthy diets and the ecological potential for sustainable use of local foods. Understanding the cultural food identities of the region by species provides important information with which to ground studies in food composition and food consumption. This is the foundation for planning successful intervention efforts based on local foods.

Factors that shape local dietary patterns and the biodiversity in them

25. Strengthening biodiversity in diets depends on the local availability and accessibility of diverse food species. But it also depends on enhancing education and awareness of the cultural, nutritional and health values of a community's biodiversity. This happens by making the foods acceptable and desirable through habit and custom. Being able to influence food preferences and practices for growing, harvesting, preserving, processing and preparing food for the family table depends on understanding the background and the social and cultural contexts of the local region.

26. It is important to consider these influences before education and awareness building on the species in food systems and their properties and how they can affect nutrition and health.

i. **Local knowledge, practices and technologies.** Gaining understanding of local knowledge, practices and technologies for each species of food that undergoes manipulation (harvest, preservation, processing, and preparation) is essential information with which to guide food sampling and dietary data collection. This kind of information can be gathered through interviews within the local culture. The interviews are ideally conducted within specific cultural frameworks. Along with information on ecosystem *per se*, these practices are the backbone of local dietary patterns, which may vary with culture, religion or social structure, and which give information important to the nutritional contents and sustainability of diets.

ii. **Macro-influences on accessible food.** Food system characterization is also affected by macro-influences on the accessibility of food to the population, such as land access policies, climate events, political and social scenarios (migration history or refugee status, etc.), food aid, trade policies that affect particular local food species and employment opportunities. These influences should be briefly summarized.

iii. **Micro-influences on accessible food.** The micro-influences on the accessibility of food should also be summarized: household resources and equipment for reaching food harvesting areas; accessibility of markets for purchasing food; whether purchased food is locally produced or imported industrialized food; and the general availability of suitable food-processing and home food preparation equipment.

iv. **Social structure in the area.** Social structure in the local area should be identified, including the rough proportion of the local population by income and educational strata in rural and urban areas, and employment patterns. Social identities, ethnicities, and religious practices should be identified, with their attendant food taboos, symbolisms and preferred cuisines using diverse food species.

v. **Appetite and cultural taste preferences.** Appetite and cultural taste preferences and appreciation are important, as these affect local environmental impacts on food biodiversity and health. Age and gender differences that affect for the choice of foods given to infants and young children, school lunches and other food/meal patterns should be identified.

V. FACTORS INFLUENCING FOOD AND NUTRITION SECURITY WITHIN A FOOD SYSTEM

27. It is important to characterize food systems and the biodiversity of species within them for their potential to enhance food and nutrition security; that is, to have more food that is available, accessible, acceptable, sustainable, safe, and meets the nutritional needs for an active and healthy life (FAO, 1996). When food is locally grown with minimum processing and shorter time from harvest to consumption, it can be made available and accessible to the population that has the cultural knowledge to harvest, use and enjoy it. It is thus more likely to be acceptable within the culture as food suitable to members of all age and gender groups in the population, and to be part of the known cuisine.

28. Local knowledge of food species is also likely to include information on the conditions required for growing them, and techniques for their natural propagation or agriculture, so that the potential for the sustainability of the species can be ensured (Kuhnlein *et al*., 2006).

29. Further, if food is grown and processed near accession points for consumers, using methods based on established cultural knowledge, it is less likely to be subject to contamination or unsafe storage and food preparation techniques. Also, with less storage and processing time there is less waste and the nutritional value of food is maximized (Salomeyesudas and Satheesh, 2009).

30. Food systems with a diversity of species that have been used by population groups for decades or more should contain all nutritionally essential components for a viable population (Kuhnlein and Receveur, 1996). Recognizing the positive qualities of these food systems empowers communities to be self-sufficient, and not to rely on food aid or nutrient supplements promoted by pharmaceutical industries and their agencies.

31. Food and nutrition security can also be derived in whole or in part from food purchased from markets, including industrial food markets. The key is that foods selected meet standards of safety and acceptability, i.e., that they are accessible to families and minimally processed and that they provide good nutrition that can be identified from their component parts (Monteiro *et al*., 2012).

32. Data gaps can result in food biodiversity not being utilized effectively. In many countries, local dietary biodiversity is used in school feeding programmes. However, it is often necessary for school dieticians to calculate the nutrient content of the school meals in order to ensure that one-third of the daily nutrient requirements for the children can be met with each meal. When the nutrient content of local food biodiversity is not known, these foods cannot be used for school meals. As part of its contribution to projects characterizing food systems, FAO through the INFOODS network is assisting in the nutrient analysis of local foods. Once the nutrient content is known, dieticians can calculate the contribution of local food biodiversity to the meals, ensuring that each child is receiving at least 30 percent of his or her requirement for dietary energy and a range of macro- and micronutrients.

VI. CHANGE IN FOOD SYSTEMS AND IMPACT ON BIODIVERSITY AND NUTRITION

Non-directed change

33. Change is continuous in all food environments. Characterization of food systems needs to take into account the recent impacts of non-directed change (e.g., natural disasters, political instability) that has occurred in the region and may affect its biodiversity.

34. Climate change affects all ecosystems and has unknown and unexpected effects on biodiversity in food systems. This change is unbridled and affects everyone. Similarly, natural and other disasters, some triggered by climate change, affect food resources. It is hoped that policies to control climate change will improve agricultural potential in climate-sensitive areas.

35. Environmental and ecosystem changes also include the impacts of industrial development that has secondary effects on local food systems. Deforestation, resource extraction, pollution, dams, the built environment, etc. all influence ecosystem quality and the potential to provide sustainable foods.

36. Political instability and war can affect agriculture, capacity to harvest, process and distribute food to populations and the availability of food biodiversity in local environments.

Directed change

37. Food systems need to be described within the context of current and potential directed change activities. Directed change that includes local and national action plans that focus on improving access to biodiversity in food supplies should be encouraged. Such plans should take into account the wide range of possible nutrition awareness and education activities, both formal and informal, at community

level. Directed changes also include agricultural and economic policies and marketing to enhance exposure to accessible biodiversity of local foods that require limited processing, with reduced emphasis on marketing and use of nutrient supplements.

38. Food-based strategies for directed change to improve nutrition and health include multiple possible activities. Several that have been successful in improving dietary diversity include stimulation of the production of local crop species with follow-up strategies to process and market these foods and promote their use in the local cuisine. Decision-making for interventions needs to be grounded in cultural and ecosystem foundations that resonate with local values. Once the evidence base to expand knowledge of nutrient and other food properties is available, action can be taken to improve education, awareness and the use of biodiversity to improve health and provide ecosystem benefits associated with sustainable diets. Box 3 presents some examples of food system change that encourages biodiversity from local crop agriculture.

Box 3. Examples of food system change that encourages biodiversity from local crop agriculture

- Improved access to fresh leafy vegetables in African urban areas (Shackleton *et al*., 2009)
- Improved dietary diversity and nutrition from locally produced crops in Micronesia (Englberger *et al*., 2012)
- Improving vegetable intake, vitamin A status and child health using a gardening approach (Faber and Laurie, 2011)
- Dietary diversity and nutrition increases by promoting community knowledge of the traditional food system and culture (Sirisai *et al*., 2012)

VII. CHARACTERISTICS USED TO DEFINE A FOOD SYSTEM FOR BIODIVERSITY AND NUTRITION

39. The references and guides listed in Box 2 point to the characteristics that can be used to define a food system for biodiversity and nutrition. The list below is a summary of characteristics that provide helpful information for creating a database for global food systems (Fanzo *et al*., 2011). Gathering the following information provides a broad description of communities as well as detailed data on available food biodiversity. Current information can be collected within a relatively short period of time and can best be done by a multidisciplinary team. The bottom line is to gather salient information that will inform the building of food-based interventions based in local cultures and ecosystems and foster greater biodiversity, nutrition and sustainable diets.

Global geographic location

Agro-ecological zone
- Climate
- Seasons and cropping patterns

National/regional area, with subregion if appropriate, and including:
- Cooperation/permissions required for data collection
- General geographical coordinates of the area
- Descriptions of altitude, rainfall, soil characteristics

Total population served, including:

- Rural/urban population structure
- Types of employment by age and gender
- Average household income, disaggregated by subregions/populations
- Literacy and education attainment, disaggregated by subregions/populations
- General health profiles, disaggregated by subregions/populations

Cultural identities in target areas, including:
- What are the cultural identities in the area named by population subgroups?
- How are ecosystems resources accessed and shared?
- What are the national and subnational food identities of these cultures?
  (Note: For ease in characterizing a specific food system, the ecosystem and cultures within it should not be very diverse. If so, it is better to characterize the food systems separately by culture.)

Category/categories of food system(s) in the target areas, including:
- Description of food system and/or combinations of food systems within the area for each cultural group
- Household food insecurity and food diversity measures
- Household/individual nutritional inadequacies by season
- Average areas used by village(s)/households
- Average occurrence of kitchen gardens per ten households

Recent directed and non-directed changes occurring in the ecozone

Plant food species used (see below) – only those locally grown, including:
- Total number known in the ecosystem
- Total number with taxonomic identifications
- Number in propagation
- Number collected from uncultivated areas (forests, hedgerows, etc.)

Animal food species used (see below) – only those found locally, including:
- Total number known in the ecosystem
- Number with taxonomic identifications
- Number in each animal food type (mammal, fish, insect, etc.)
- Number in domestication, by type

For each food species provide:
- Taxonomy (including order and family) and local names by culture, including the different varieties/cultivars or breeds,
- Habitat
- Availability/seasonality
- Part(s) used
- If preserved and how (by part)
- Briefly describe/cite any political, economic or trade issues related to this species or group of species
- Identify species/preparation culturally used and preferred for infant/child feeding or for adults, and for specific illness by age/gender
- If nutrient composition is known, provide data separately with citation(s)

Names of key mixed dishes in the local cuisine, with major ingredients, identified by culture

Key dietary patterns (meal structure, etc.) by culture, with a note of frequently used species and their preparation

Dietary data from adults, with nutrient analyses

- Conduct dietary interviews with a random sample of adults, male and female
- Dichotomize each food item/species into local vs. purchased food
- Calculate the percentage of energy obtained from total local and from total purchased food and from specific species or groups of species of interest
- Calculate other nutrients of interest similarly

VIII. POSSIBLE LIMITATIONS AND CONSTRAINTS TO DATA COLLECTION FOR CHARACTERIZATION OF FOOD SYSTEMS

40. While the list of useful information appears long and somewhat daunting, it contains information that will be instrumental for building programmes to enhance biodiversity and nutrition. It is not possible to assume that there is one "best" food system model, because of the multiplicity of agro-ecological zones, ecosystems, food species and cultural patterns. Nevertheless, it is reasonable to assume that "more dietary biodiversity" from local sources will improve the nutritional profiles of populations' dietary patterns, especially as this implies more plant diversity, with the attendant micronutrients. It will also reduce greenhouse gas emissions from the use of fossil fuels. (Englberger *et al*., 2012).

41. Multidisciplinary teams accustomed to survey data collection should include a social scientist, an agrologist, a biodiversity specialist, a nutritionist and a health professional (Kuhnlein *et al*., 2006; Blum *et al*., 1997). If a large region is being assessed, a large pool of people with these expertises is required. However, diversity in expertise will ensure a rapid assessment – about six to eight weeks – for each cultural entity in an ecosystem. Because change is always happening, it is important to establish a baseline of information and keep abreast of revisions that need to be made to the database. With current data technologies, data management and periodic summaries, it is possible for the assessment team to ensure regular consultation with the people directly involved in using and accessing the local food system and planning for improvements.

IX. THE WAY FORWARD

42. The creation of large databases of food system information will enhance knowledge of the world's food supplies and resources. This information includes and interfaces with important indicators for biodiversity, food composition and food consumption, within cultural dietary patterns. Modelling can be initiated to understand similarities for potentially successful food-based interventions that include improved local crop biodiversity for small-holder farmers, and to provide pathways to develop programmes of education and action to increase dietary biodiversity and nutritional status.

43. Periodic conferences could be held by FAO and partners for capacity-building and for sharing information on strategic successes and limitations in interventions in different food systems at local, national and regional levels. Ministries of agriculture, health and others sharing in the national architecture for food and nutrition security would benefit from knowing how and what information is critical to collect and manage. Ideally, FAO would be the international repository of these data.

44. Throughout this process, it is essential to recognize the human rights aspects of food and nutrition security, and how food sovereignty interfaces with local biodiversity and its management. The key to successful interventions to improve food biodiversity and nutrition is to engage the local leaders and experts whose intimate knowledge of food system contexts is essential for data collection and subsequent planning, implementation and evaluation of programmes to ensure sustainable diets for the world's peoples.

APPENDIX I

GLOSSARY

A **food system** is defined as the many kinds of food contained within the diets of a population with a specific culture that lives within a particular ecological environment. The food system includes the diverse foods from the local natural environment as well as those which may be imported/purchased. Important to characterizing a food system are the sociocultural meanings attached to the foods, as well as techniques used to acquire and process the foods, how the foods are used, and the nutritional and health consequences for the population (Kuhnlein and Receveur, 1996).

Food biodiversity is the diversity of foods that covers the ecosystem, the species in the ecosystem, and the genetic resources within them (i.e., subspecies, varieties, cultivars, and breeds).

Indigenous Peoples' food systems are specific to the traditions of Indigenous Peoples, as they are defined by the United Nations Permanent Forum on Indigenous Issues (UNPFII, 2009). They contain diverse animal and plant species found within the particular ecosystems where they have historically lived, as well as the cultural and biological uses made of these species. Indigenous Peoples' food systems are thought to be nutritionally complete if the ecosystem is intact and contains sufficient amounts of the food biodiversity within it. Food systems of Indigenous Peoples today are usually a combination of the traditional, local foods of the ecosystems and foods purchased in markets.

Traditional food is that defined within a culture, including the biologically-defined species as well as mixed items forming dishes in the cuisine. **Indigenous food or endogenous food** is foods that originated ecologically from a particular natural area. **Market food** is defined as foods purchased in markets, whether as fresh products or industrially processed foods. **Local food** is a general term encompassing foods that have been produced and/or harvested from a locally defined area; it may also contain cultural mixed dishes.

Sustainable diets are those diets with low environmental impacts. They contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable, nutritionally adequate, safe, and healthy, while optimizing natural and human resources (FAO, 2010).

Biodiversity is the variability among living organisms from all sources, including terrestrial, marine and other ecosystems and the ecological complexes of which they are part. It covers diversity within species, between species and of ecosystems. Synonyms are biological diversity and ecological diversity (FAO, 2008). In this document we refer to human food biodiversity.

Food and nutrition security exists when all people at all times have physical, social and economic access to food, which is consumed in sufficient quantity and quality to meet their dietary needs and food preferences, and is supported by an environment of adequate sanitation, health services and care, allowing for a healthy and active life (Committee on World Food Security, 2012).

APPENDIX II

LIST OF REFERENCES

Blum, L., Pelto, P.J., Pelto, G.H. & Kuhnlein, H.V. 1997. *Community assessment of natural food sources of vitamin a: guidelines for an ethnographic protocol*. International Nutrition Foundation for Developing Countries, United Nations University. 139 pp.

Chotiboriboon, S., Tamachotipong, S., Sirisai, S., Dhanamitta, S., Smitasiri, S., Sappasuwan, C., Tantivatanasathien, P. & Pasamai Eg-kantrong. 2009. Thailand: food system and nutritional status of indigenous children in a Karen Community. *In* H.V. Kuhnlein, B. Erasmus & D. Spigelski, eds. *Indigenous peoples food systems: the many dimensions of culture, diversity and environment for nutrition and health*, pp.159–184. Rome, FAO.

Committee on World Food Security. 2012. *Coming to terms with terminology*. Thirty-ninth Session, 15–20 October, 2012, Rome.

Creed-Kanashiro, H., Roche, M., Cerron, I.T. & Kuhnlein, H.V. 2009. Traditional food system of an Awajun community in Peru. pp. 59-82. *In* H.V. Kuhnlein, B. Erasmus & D. Spigelski, eds. *Indigenous peoples food systems: the many dimensions of culture, diversity and environment for nutrition and health*, pp. 59–82. Rome, FAO.

Englberger, L., Lorens, A., Pedrus, P., Albert, K., Levundusky, A., Welsihter, H., Paul, Y., Moses, P., Jim, R., Jose, S., Nelber, D., Santos, G., Kaufer, L., Larsen, K., Petrick, M. & Kuhnlein, H.V. 2012. Let's go local! Pohnpei promotes local food production and nutrition for health. *In* H.V. Kuhnlein, B. Erasmus, D. Spigelski & B. Burlingame, eds. *Indigenous peoples' food systems and well-being. interventions and policies for healthy communities*, pp. 191–220. Rome, FAO.

Faber, M. & Laurie, S. 2011. A home gardening approach developed in South Africa to address Vitamin A deficiency. *In* B. Thomson & L. Amoroso, eds. *Combating micronutrient deficiencies: food-based approaches*, pp. 163–183. Rome, FAO.

Fanzo, J., Holmes, M., Junega, P., Musinguzi, E., Smith, I.F., Ekesa, B. & Bergamini, N. 2011. *Improving nutrition with agricultural biodiversity.* Rome, Bioversity International.

FAO. 1996. *Declaration on World Food Security*. World Food Summit, Rome.

FAO. 2008. *Expert Consultation on Nutrition Indicators for Biodiversity. 1. Food composition.* Rome.

FAO. 2010. *Expert Consultation on Nutrition Indicators for Biodiversity. 2. Food consumption.* Rome.

FAO. 2011. *Save and grow*. *A policymaker's guide to the sustainable intensification of smallholder crop production.* Ebook. Rome.

Gamboni, M., Carimi, F. & Migliorini, P. 2011. Mediterranean diet: an integrated view. *In* B. Burlingame & S. Dernini, eds. *Sustainable diets and biodiversity. directions and solutions for policy, research and action.* pp. 263–272. Rome, FAO.

Grivetti, L & Ogle, B. 2000. Value of traditional foods in meeting macro- and micronutrient needs: the wild plant connection. *Nutrition Research Reviews*, 13: 31–46.

Halwart, M. &, Bartley, D. 2007. Aquatic biodiversity in rice-based ecosystmes. *In* D.I. Jarvis, D.Padoch & H.D. Cooper, eds. *Managing biodiversity in agricultural ecosystems*. pp. 181–199. Columbia University Press. 429 pp.

He, C. 2010. *Opening address. International Scientific Symposium. Biodiversity and Sustainable Diets United against Hunger*. Rome.

Kuhnlein, H.V., Smitasiri, S., Yesudas, S., Bhattacharjee, L., Dan, L. & Ahmed, S. 2006. *Documenting traditional food systems of indigenous peoples: international case studies. Guidelines for procedures.* Monteal, Canada, Centre for Indigenous Peoples' Nutrition and Environment, McGill University (available at http://www.mcgill.ca/cine/resources/data) **.**

Kuhnlein, H.V. & Receveur, O. 1996. Dietary change and traditional food systems of Indigenous Peoples. *Annual Review of Nutrition*,16: 417–442.

Kuhnlein, H.V. & Receveur. O. 2007. Local cultural animal food contributes high levels of nutrients for Arctic Canadian Indigenous adults and children. *The Journal of Nutrition*, 137: 1110–1114.

Menzel, P. & D'Aluisio, F. 2005. *Hungry planet. What the world eats*. pp. 31, 37. Material World Books (Napa) and Ten Speed Press (Berkeley), California.

Monteiro, C.A., Cannon, G., Levy, R.B., Claro, R.M. & Moubarac, J-C. 2012. The food system. processing. the big issue for disease, good health, well-being. *World Nutrition*, 3.12: 527–569 (available at www.wphna.org)

Pelto, G.H., Armar-Klemesu, M., Siekmann, J. & Schofield, D. 2013. The focused ethnographic study "assessing the behavioural and local market environment for improving the diets of infants and young children 6 to 23 months old" and its use in three countries. *Maternal and Child Nutrition*, 9(Suppl. 1): 35–46.

Petrillo, P.L. 2011. Biocultural diversity and the Mediterranean diet. *In* B. Burlingame & S. Dernini, eds. *Sustainable diets and biodiversity. Directions and solutions for policy, research and action*, pp. 224–229. Rome, FAO.

Salomeyesudas, B. & Satheesh, P.V. 2009.Traditional food system of Dalit in Zaheeerabad Region, Medak District, Andhra Pradesh, India. *In* H.V. Kuhnlein, B. Erasmus & D. Spigelski, eds. *Indigenous peoples food systems: the many dimensions of culture, diversity and environment for nutrition and health*, pp.185–208. Rome, FAO.

Secretariat of the Permanent Forum on Indigenous Issues. 2009. *State of the World's Indigenous Peoples*, pp. 4–7. New York, United Nations.
Shackleton, C.M., Pasquini, M.W. & Drescher, A.W. (eds.) 2009. *African indigenous vegetables in urban agriculture*. London, Earthscan. 285 pp.

Sims, J. & Kuhnlein, H.V. 2003. *indigenous peoples and participatory health research. planning and management. preparing research agreements.* Geneva, World Health Organization. 35 pp.

Sirisai, S, Chotiboriboon, S, Tantivatanasathien, P, Sangkhawimol, S. & Smitasiri, S. 2012. Culture-based nutrition and health promotion. *In* H.V. Kuhnlein, B. Erasmus & D. Spigelski, eds. *Indigenous peoples food systems: the many dimensions of culture, diversity and environment for nutrition and health*, pp. 159–175. Rome, FAO.

SOFI. 2012. *The State of Food Insecurity in the World 2012*. Rome, FAO (available at http://www.fao.org/publications/sofi/en/).

UNPFII. 2009. *United Nations Permanent Forum on Indigenous Issues* (available at: http://social.un.org/index/IndigenousPeoples.aspx).