“Wild” foods and their potential for undernutrition prevention
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Cover photograph:

Sisan Yuyu – Edible Flowers – ACH Peru, 2011
ACKNOWLEDGEMENTS

This briefing paper is the output of three months of work on the subject: it will certainly not provide a full and complete picture on the subject, which has been widely researched in the last two decades by various specialists from different fields (human nutrition, sociology, anthropology, botanic…). The objective of this briefing paper is to provide the reader with a first view of what has been discussed on the subject and how an NGO like ACF could include “wild” foods within its approaches.

The document advocates for ‘wild foods’ not to be considered as such, but as part of the agro-biodiversity and of the local food systems and local knowledge associated to this agro-biodiversity. It argues that ‘wild food’ have a well-documented role to play for hunger and undernutrition prevention & reduction.

The document presents some key definitions and concepts, and introduces to some key international stakeholders and actions in this field. The first part presents a synthesis of the roles that ‘wild food” could play for undernutrition and hunger prevention. The paper then concentrates on ACF: what is ACF’s experience, how could ACF integrate ‘wild foods’ in its assessments and field projects. Finally, concrete research tracks are recommended before a general conclusion is drawn. At the end of the document, a glossary of key terms and a key bibliography are proposed.

The author wants to thanks here:

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# ACRONYMS

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<td>Action contre la Faim</td>
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<td>CBD</td>
<td>Convention on Biological Diversity</td>
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<td>GFP</td>
<td>Gathered Food Plants</td>
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<tr>
<td>CGIAR</td>
<td>Consultative Group on International Agricultural Research</td>
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<tr>
<td>CINE</td>
<td>Centre for Indigenous Peoples’ Nutrition and Environment</td>
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<tr>
<td>IRD</td>
<td>Institut de Recherche pour le Développement</td>
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<tr>
<td>IDRC/CRDI</td>
<td>International Development Research Centre</td>
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<td>IFAD</td>
<td>International Fund for Agricultural Development</td>
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<td>IFPRI</td>
<td>International Food Policy Research Institute</td>
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<tr>
<td>FAO</td>
<td>Food and Agriculture Organization of the United Nations</td>
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<tr>
<td>LTF</td>
<td>Local and Traditional Foods</td>
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<td>NTFPs</td>
<td>Non Timber Forest Products</td>
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<tr>
<td>NUS</td>
<td>Neglected and Underutilized Species</td>
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<tr>
<td>PPILDA</td>
<td>Projet de Promotion de l’Initiative Locale pour le Développement à Aguié</td>
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<tr>
<td>SCN</td>
<td>Standing Committee for Nutrition</td>
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<td>UNEP</td>
<td>United Nations Environment Programme</td>
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<td>UNICEF</td>
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<td>WEP</td>
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GLOSSARY

SOME KEY STAKEHOLDERS

BIBLIOGRAPHY
1 Concepts & definitions regarding “wild foods”

“Wild Foods” do not exist as such: if a plant or animal is considered as edible by a human group, the group will have in most cases a set of customs to protect the resource sustainability. There is a wide range of situations between wild fruits being gathered in a primary forest for instance, and cultivated crops.

Consequently, various terms are used by the scientific and/or development community, such as:

- Local and Traditional Foods (LTF)

The term Local and Traditional Foods refers to vegetal or animals (including insects) identified as edible in a particular culture, available from local resources and culturally accepted. The concept includes the sociocultural meaning and the local techniques and knowledge for acquisition, processing, and consumption of those food products. (Adapted from CINE 2006)

- Neglected and Underutilized Species (NUS)

Those species with under-exploited potential for contributing to food security, health (nutritional/medicinal), income generation, and environmental services. Neglected and Underutilized Species includes wild, managed and cultivated species. (Bioversity 2006).


Two other acronyms are widely found in the literature: WEP, for Wild Edible Plants, and GFP, for Gathered Food Plants, both referring only to vegetal food products. A last well known acronym is Non Timber Forest Product (NTFP), for all forest products (edible and not edible) out of timber production: many “wild foods” can be classified as NTFP in the literature.

Within ACF, the following definition has been used once: “Wild food is defined as anything edible that requires no human input to increase its production” ACF USA 2008): however this definition can be limiting, e.g. when a gathered food is protected by a community, do we consider that there is a human input?

In this document, we will concentrate on vegetal food products and use the term Gathered Food Plants (GFP).

The concept has been studied within different disciplines or schools, which comprise first the various fields of ethnology. Ethnobiology is the scientific study of dynamic relationships among peoples, biota, and environments (International Society of Ethnobiology)

Ethnobiology covers different related fields, such as:

- Ethno-nutrition, which describes the ways in which local peoples evaluate food and diet, and how diet is used to avoid or treat illness (E. Messer2, 1996)
- Ethnobotany, which is the systematic study of the botanical knowledge of a social group and its use of locally available plants in foods, medicines, clothing, or religious rituals. (Encyclopaedia Britannica)

Other research has been pursued, coming from nutrition as a function of the ecosystem. This field led to the definition of the concept of econutrition. Econutrition integrates environmental health and

1 The CINE and Bioversity definitions are provided in the Glossary at the end of this document.

2 In “Food Habits in Later Life”, p. 801
human health, with a particular focus on the interactions among the fields of agriculture, ecology, and human nutrition. (Deckelbaum & al., 2006)

Finally nutritional diversity comes from the general field of biodiversity. The concept of **agricultural diversity or agrobiodiversity has been defined within this field**. Agricultural biodiversity includes ecosystems, animals, plants and microorganisms related to food and agriculture. Today most crop species and domesticated livestock are the result of thousands of years of human intervention, including selecting breeding and other farm practices. Agricultural biodiversity provides food and raw materials. Moreover, every plant, animal and microorganism plays its part in the regulation of essential ecosystem services, such as water conservation, decomposition of waste, nutrient cycling, pollination, pest and disease control, climate regulation, erosion control, flood prevention, carbon sequestration and many other ecosystem-oriented factors (CBD 2010)

This concept relates to the variety and variability of animals, plants and micro-organisms that are used directly or indirectly for food and agriculture, including crops, livestock, forestry and fisheries. It comprises the diversity of genetic resources (varieties, breeds) and species used for food, fodder, fiber, fuel and pharmaceuticals. It also includes the diversity of non-harvested species that support production (soil micro-organisms, predators, pollinators), and those in the wider environment that support agro-ecosystems (agricultural, pastoral, forest and aquatic) as well as the diversity of the agro-ecosystems. (FAO 1999)

*Gathered Food Plants are part of agrobiodiversity and could be studied as such.*

### 2 What is done in the international community regarding wild food?

The first paragraph presented different terms and acronyms, which reflect the **various disciplines** that have shaped them. Some of them will be presented here, because of their interest with regards to ACF’s mandate and approach.

Generally speaking, ‘wild foods’ have been documented from various angles:
- (1) Ecosystems’ services, nutrition being one of them. In this field appears the word ‘econutrition’, and actors as the Earth Institute (Colombia University) are particularly active in this field.
- (2) Food anthropology, ethnonutrition, nutrition transition: Mc Gill University (CINE) is especially active in this field, together with FAO & Bioversity International, while French schools have also developed their own research approaches (IRD, Museum d’Histoire Naturelle…). Ethnobiology in general deals with GFP.
- (3) Biodiversity, agrobiodiversity: Bioversity International (and other CGIAR research centers as IFPRI) in particular, with FAO and other UN agencies
- (4) Dietary diversity: FAO in particular, with support from various stakeholders (IRD in France, NGOs such as Save the Children…)

‘Wild food’ for nutrition requires an **interdisciplinary approach**!

With regards to concrete **policies and actions**, some interesting models for ACF can be enlightened.

- **Convention on Biological Diversity (CBD) Outputs**

The Convention on Biological Diversity (CBD) entered into force on 29 December 1993. It has 3 main objectives:
- The conservation of biological diversity
- The sustainable use of the components of biological diversity
- The fair and equitable sharing of the benefits arising out of the utilization of genetic resources

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4 Ref. to the CBD website for more information : http://www.cbd.int/
The CBD gave a legal framework to biodiversity, GFP being part of this global biodiversity. The CBD allowed the launching in 2006 of the UN ‘Cross-cutting initiative on biodiversity for food and nutrition’, which includes various UN agencies (FAO, WHO, UNEP, WFP, UNICEF, and IFAD), universities and research centers (Bioversity International & other CGIAR members, UNU), and the Standing Committee on Nutrition of the United Nations (SCN). It recognizes the importance and value of traditional food systems and the need for interdisciplinary approaches to document biodiversity for food and nutrition, and proposes a framework for action: 1) developing and documenting knowledge 2) Integration of biodiversity, food and nutrition issues into research and policy instruments, 3) Conserving and promoting wider use of biodiversity for food and nutrition, and 4) Public awareness.

As part of this initiative, key documents have been published, such as Nutrition Indicators for Biodiversity (FAO 2008 & FAO 2010), for food composition and food consumption. The document argues that “It is expected that these indicators will become an advocacy tool to promote awareness of the importance of food biodiversity, including wild, indigenous and traditional foods, while contributing to nutrition security and the conservation and sustainable use of food biodiversity” (FAO 2010).

This initiative has highlighted not only biodiversity as a large field of research but also concrete solutions. It is today mainstreamed largely within the UN system, with FAO leading, but is also found within the REACH initiative, WFP documents, etc. UN agencies and INGOs are beginning to take into account local foods and traditional food systems for food & nutrition security.

The Convention for Biological Diversity (CBD) has given a general framework for action, around which UN agencies, research centers and also NGOs organize themselves.

- Concrete actions and tools examples

Hereafter you will not find an exhaustive list of stakeholders and field actions, but concrete examples and potential tools.

- FAO is working on collecting all food products' nutrients composition: all details are available on the INFOODS website. They offer various tools for food composition determination, including self training tools, excel calculation tools, and excel data bases on various food products, including ‘wild foods’ (plants and insects). The data bases are still fairly incomplete, but present an opportunity for international capitalization.

- CINE (within Mc Gill University) has developed approaches for documenting traditional food systems, including ‘wild food’ and putting a special emphasis on local knowledge and local food products nutritional & health properties. They base their nutritional interventions on this local knowledge and local food systems with various successes around the world: see for instance CINE, FAO (2009). They concentrate mostly on nutrition transition and its impacts on overweight and associated chronic diseases (e.g. diabetes).

- Bioversity International (formally IPGRI) has field experience in documenting food systems and on preserving biodiversity (either through seeds banks or field conservation). Besides, they have experience in GFP domestication (e.g. in Latin America). They plan on developing their field research on the link between nutrition and biodiversity (ref. their Nutrition Strategy 2011 – 2021: Resilient food and nutrition systems: Analyzing the role of agricultural biodiversity in enhancing human nutrition and health*).

- Save the Children are integrating GFP in their well-known tool “Cost of Diet”: they are working in partnership with Bioversity International for this purpose.

- Multiple ethnobotanists & food systems specialists are each working in specific places, documenting the relationships of a human group and its natural environment for food and medicine collection and its impact on health and nutrition status. One example can be quoted here: In Lebanon, IDRC has supported a project aiming at promoting diet diversity with Wild Edible Plants5: based on a first extensive field research on the local knowledge regarding WEP and on an assessment of the nutritional and health status of the target communities, the project developed a network of community “Healthy Kitchen” to promote diet diversity based

3 What is ACF Experience regarding Gathered Food Plants (GFP) for undernutrition prevention?

One of ACF’s first experiences in the field of GFP came from Afghanistan in 2002, while a severe scurvy outbreak pushed for an immediate answer to the life-threatening risk. After an emergency Vitamin C tablets distribution, ACF sent an ethno-botanist to the field. The field research, in collaboration with Kew Gardens (U.K.) permitted the identification of local wild plants already locally used for herbal tea, which proved to be extremely rich in Vitamin C. The ethno-botanical approach proposed a middle- and long-term strategy which was implemented.

A similar approach is currently developed by ACF in Peru, with a population suffering from extremely high level of child anemia. As the “classical” food supplementation is not culturally acceptable, ACF has launched a field research including anthropologists, nutritionists and agronomists in order to determine local iron-rich foods which could be culturally acceptable for children alimentation. The field research is currently on-going, and the first results will be available in 2012 or 2013.

Other promising approaches have been developed with “low input gardens”. In Malawi & Zimbabwe, ACF has developed “low input gardens” for food diversification and to promote a better quality diet. The approach encourages and disseminates local vegetables and Neglected and Underutilized Species: culturally acceptable and adapted to the natural environment, they have proved a success.

Finally, ACF-NY has recently issued a report on wild food consumption in Uganda, to understand the amount & types of wild foods consumed in the Karamoja Region (vegetables, fruits, animals). Food analysis is currently on-going to support the recommendations of this preliminary work.

Generally speaking however, ACF is not taking such food products sufficiently into account. In many contexts the use of Gathered Food Plants is mainly analyzed as a crisis coping mechanism and not as an opportunity for diet diversification.

4 How could wild food contribute to U5 undernutrition prevention? What is the link between wild food and nutrition?

Humans depend today mostly on agricultural production and domesticated species for their food intake, with 80% of their total energy intake obtained from 12 domesticated species: eight cereals (barley, maize, millet, rice, rye, sorghum, sugar cane and wheat) and four tubers (cassava, potato, sweet potato & yam). Apart for specific human societies (e.g. forest people), Gathered Food Plants represent a minor part of the total diet.

However, Gathered Food Plants (and other ‘wild foods’ such as hunted animals or gathered insects) play a crucial role in many food systems, which we could summarize in two points: (1) they improve the resilience of the food system and (2) they improve the diversity and quality of the diet.

4.1 Gathered Food Plants and food systems’ resilience

Rural populations most often have access to food resources from the environment in addition to agricultural and market resources: commons, forests and “wild” areas for instance, offer a biodiversity which can be accessible according to local rules and uses. E.g. in Sierra Leone, Makeni region, Bombali district, planted palm trees are private while naturally grown palm trees belong to all members

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6 MacLeod, 2012
of the community. Access to GFP will depend on the property status of the land, and the status of the plant.

GFP will most often be seasonal, and will complete the agricultural and market food resources. When the period is scarce (intra-annual hunger gap, difficult year, food crisis), GFP will provide additional food resources to the population and enhance their resilience to food insecurity. GFP will be locally classified according to their use: some are consumed normally (and their consumption can be increased when the period is scarce), while others are consumed only in case of acute food insecurity (e.g., their taste is not valued, or they may even have negative health impact — risk of diarrhea or stomachache for instance).

According to the local food system and the GFP typology, GFP consumption can be “normal” or analyzed as a coping mechanism to food insecurity.

4.2 Gathered Food Plants and diet quality improvement

4.2.1 Food science, diet quality and diet diversity

Gathered Food Plants are positively valued in various food systems for their perceived properties on nutrition & health status in the local community. This will be true in almost all food system (Northern as Southern), all counting a variety of GFP known and used for their health properties. The importance of GFP has been widely researched around the world⁷ for the role they play, as an important component of the food system and in terms of health and nutrition outputs.

Although the quality of a diet is difficult to gauge simply (research is largely at its beginnings in the field of food sciences), discoveries are being made on the role of newly documented nutrients that were not considered important until recently, as well as on the interactions (positive as negative) between nutrients (e.g., anti-nutrients or co-factors), which impact the bioavailability of those key nutrients (Nutrient bioavailability is defined as the fraction of a nutrient in a food that is absorbed and utilized).

We see a clear example of such interactions with Vit. A. Vit A is known for its benefit to the immune system. And a Vit A deficiency leads to an increase in infections (and other illnesses such as night blindness). The human body cannot synthesize Vit. A, and has to acquire it from its diet. Provitamin A carotenoids can be found in various foods, such as dark green leaves (spinach, amaranths, cassava leaves…). If these leaves are boiled, Vit A will be preserved (not destroyed by 100°C heat), while it will be destroyed if fried. Moreover, Vit. A is fat-soluble and for it to be bio-available (absorbable by the metabolism) fat as to be ingested together with the leaves⁸.

An example of anti-nutrient interactions is the well described impact of black tea on anemia. In societies where women are at risk of anemia (low iron intake), this risk is enhanced with an important consumption of black tea. It appears that the tannins of black tea (polyphenolic compounds) chelate

⁷ See CINE, FAO, 2009. For French publication, you can consult in particular the work of Edmond DOUNIAS (IRD) or Hélène PAGEZY (CNRS)

⁸ In other terms, “spinach with cream” is good in terms of Vit A while “fat-free spinach” will not permit your metabolism to use the Vit A.
iron and reduce its absorption. Too high a consumption of black tea reduces the bio-availability of iron.

Last but not least, nutrients’ other properties, such as antioxidant, anti-radical, anti-proliferative, or anti-estrogen, are increasingly documented. All these properties may have negative and/or positive impacts on human health and nutritional status.

As said in the introduction, much information is left to be discovered in the field. In consequence, the best nutritional advice that can be given is “eat diverse!” Diet quality tends to be assessed by diet diversity.

With regard to diet diversity, GFP could be key in many rural areas for improving diet quality, and should be considered crucial. It is significant that GFP are often underestimated in food security assessment, which focus on staple food and not on GFP, which will most often be used in the sauce/spices and in snacking.

Appropriate tools for integrating GDP in comprehensive food diversity assessments have yet to be developed.

4.2.2 Micro-nutrients deficiency, hidden hunger and GFP micro-nutrient content

Research has focused in the last decades on micro-nutrient deficiencies. Key micro-nutrient deficiencies (in Vit. A, iron, iodine, or zinc for instance) have been identified as having a dangerous impact. Potential solutions to these deficiencies are being researched, and some are widespread. Micro-nutrient deficiencies are also called “hidden hunger” in the literature, and have been proven to cause tremendous impact on public health: deficiency syndromes (e.g. scurvy for Vit. C deficiency), impact on the main metabolic functions (inc. immune, reproductive, or digestive), and may also lead to chronic undernutrition and/or acute undernutrition.

Generally speaking, three main options, or line of interventions, are available for programmatic answer:

1. Supplementation, where the micro-nutrient is taken as a supplement by the target population (e.g. iron tablets)
2. Fortification or biofortification: where the supplement is added to a “vehicle food”. For instance iodized salt has been widespread worldwide with great impact on cretinism prevention, or vegetable oil distributed by WFP is routinely fortified with Vit A. Biofortification is an agriculture-based strategy, consisting in selecting crop varieties specifically rich in the target nutrient. One example is that wheat cultivated today in Europe has a higher protein content than wheat grown two centuries ago; another example is that of biofortified orange-fleshed sweet potatoes that are promoted in various African countries (such as Burundi or Mozambique) for Vitamin A deficiency prevention.

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9 Tannins in black tea prohibiting heme iron (iron from plant sources) absorption. They form an insoluble bond with some of the iron molecules, making it non-absorbable.
10 Ref. recent development of new indicators based on diet diversity (e.g. IDDS): FAO guidelines 2011
11 See the Micronutrient Initiative for more information on micronutrient.org
3. Local resources: where target micronutrients are looked for in the food sources. Nutritional education for behavior change then should focus on local food sources, local food systems and local knowledge. A long preliminary work is necessary to identify local foods rich in the target micronutrient and to document the local food system. A multi-disciplinary approach is usually necessary (nutrition, ethno-botanic and/or ethno-ecology, agronomy, food science, food anthropology)

<table>
<thead>
<tr>
<th>Supplementation</th>
<th>Fortification or biofortification</th>
<th>Local resources</th>
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<tbody>
<tr>
<td>Supplementation of Vit. A to pre-school age children in Africa</td>
<td>Salt iodine fortification</td>
<td>ACF long term strategy in Afghanistan for scurvy prevention, based on Vit. C – rich GFP</td>
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<tr>
<td>Quick and efficient answer, e.g. Vit. C supplements in case of scurvy outbreak</td>
<td>Efficient when the target micronutrient is not present in the local foods (e.g. for iodine deficiency prevention)</td>
<td>long term approach, sustainability, adequacy to the local food system, acceptability, valorization of local resources and local knowledge</td>
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</table>
| -only considers a limited number of micronutrients | -does not consider multiple micronutrient deficiencies (single nutrient approach) | -needs long assessment and preliminary study (food anthropology, nutritional content, food sciences…)
| -lack of impact of Vit. A supplementation on children wasting and mortality | -no or limited impact on the general diet quality | -more complicated: dietary choices, consumption patterns… |
| -no impact on the general diet quality | -when the target micronutrient can be found in local food not cost-efficient |

The 3 lines of intervention are not exclusive, and in many contexts will be complementary. GFP are part of the local resource solution.

**GFP are a key local resource for micronutrients**, as it seems that their content in various micronutrients or food factors can be higher than the nutritional content of agricultural products. This could be caused by their secondary metabolism:

"**Secondary plant metabolism contains products that aid in the growth and development of plants, however they are not required for the plant to survive. Secondary metabolism facilitates the primary metabolism in plants. This primary metabolism consists of chemical reactions that allow the plant to live. In order for the plants to stay healthy however, secondary metabolism plays a pinnacle role in keeping all the of plants' systems working properly. A common role of secondary metabolites in plants is defense mechanisms. They fight off herbivores, pests, and pathogens. Although researchers know that this trait is common in many plants it is still difficult to determine the precise role each secondary metabolite plays. Some of the roles secondary metabolites play are deterrent/anti-feedant activity, toxicity or acting as precursors to physical defense systems. Secondary metabolites include, for example, tocopherols, sterols, vitamin C and polyphenols such as phenolic acids and their esters or flavonoids. These secondary metabolites exhibit antioxidant, anti-radical, even anti-proliferative or anti-estrogen properties, and are metabolic precursors for various key vitamins**" (Vit A, Vit P…).\(^\text{13}\)


\(^{13}\) As cited in [http://en.wikipedia.org/wiki/Plant_secondary_metabolism](http://en.wikipedia.org/wiki/Plant_secondary_metabolism)
As “wild plants” do not beneficiate from the help of the farmer for their defense, and as cultivated species have been selected by human beings for the qualities of their primary metabolism (e.g. capacity to produce starch or fat stocks) and not for their secondary system, it seems that secondary metabolism could be more active in wild plants.

Besides, it is proven that secondary metabolism is directly dependant on the environmental parameters of the plant, such as level & quality of the light spectrum, temperature, nitrogen nutrition, or soil properties.

The micro-nutrient content of a plant will depend on
- The genetic characteristic of the plant: iron content in the Irish potato can vary for as much as 10mg/100g when measured on the whole potato.14
- The soil content in the micro-nutrient: Brazil nuts are considered the richest ordinary dietary source of Selenium, but it is soil-dependant.
- The environmental stress of the plant (light, soil nutrients, temperature, pests and competitors etc), which leads to secondary metabolism expression.

In consequence,
1. The domestication of a GFP for its micro-nutrient content should be done with caution: the micro-nutrient content of the domesticated GFP can significantly differ from the ‘wild’ GFP.
2. The micronutrient content of any plant (gathered as cultivated) will differ greatly according to the environment, the variety, the part of the plant...

This last point explains the huge variability recorded in the food databases: if the macro-nutrient content is varying in the plants (according to their variety, their maturity…), the micronutrient value of a given plant is even more variable and will have to be cross-checked locally before any food-based intervention can be developed and implemented.

The micro-nutrient production of the agrobiodiversity (which includes cultivated crops diversity as well as GFP) has to be further researched and documented.

4.2.3 GFP as part of agrobiodiversity, food systems, and local knowledge

Gathered Wild Plant cannot be considered outside of the general agro-ecosystem: they are part of the general agrobiodiversity, and considered as such by the local communities. Besides, the huge majority of human communities are dependent on food markets for their food intake, which adds additional potential diversity to their diet. A household will consider the whole food availability before determining its diet.

A choice of food will be made according to a various factors; some of which are:
- Food preferences: each human group chooses according to its cultural food system, which determines which foods are convenient for each member of the population, according to her/his sex, age, social status, caste, religion, or health status for instance.
- Local knowledge on the food: what are the food products’ properties (for health and nutrition), how and where to gather them and how to prepare them (especially in the case of WEP).
- Access to the food product: economic (especially for food markets) and physical.

Most raw food products will be processed (storage, food preparation), and associated to other food products in the diet. This food preparation and association will have an impact on the final nutrient content and bioavailability of the food consumed, positive or negative.

Local knowledge is analyzed as a “cultural key”: the knowledge on the GFP, including how to gather it, protect its sustainability, or process it, is crucial. In particular, some food products need to be detoxified to be edible (e.g. cassava) or transformed to avoid diseases due to micro-nutrient deficiencies. For instance maize was disseminated from Latin America to the rest of the world after the

16th century and was associated with pellagra (dermatitis, diarrhea and dementia leading to death in 4-5 years time), due to niacin deficiency. Pellagra was not documented in Mexico, where maize was however the staple food: in Mexican communities, maize is softened in lime water prior to food preparation, which makes niacin bioavailable.\footnote{Nutrient bioavailability is defined as the fraction of a nutrient in a food that is absorbed and utilized.}

This whole process will lead to the final nutritional status of each member of the human community, but also on its food security & livelihoods, as on the sustainability of the environment. It can be schematized in the following figure, aiming at sustainable diets:

![Figure 1: Sustainable diets framework](image)


GFP should be considered within the spectrum of sustainable diets in assessments as well as in programmatic answers.

4.2.4 GFP, Climate Change and future food production challenges

GFP represent a large genetic pool where to find answers for tomorrow’s food production. This is particularly researched in the Climate Change context, to find potential future crops resilient to the foreseen impact (inc. the CO2 raise in the atmosphere).

GFP can also be wild varieties of cultivated crops: they can have in their genome solutions to problems faced by those crops: Malus sieversii\footnote{« L’origine de la pomme ou le jardin d’Eden retrouvé », video documentary, Catherine PEIX} (the sole ancestor of most cultivars of the domesticated apple) wild forests in Kazakhstan are currently considered as a promising solution for disease resistance introduction in their cultivated cousins: apple trees.

4.2.5 Have GFP an impact on the nutritional status?
Since the 1980s ethno-nutritionists and others have been studying the role and importance of wild foods in the diet of many populations and the role they can play in improving nutritional outcomes. According to some studies (O’dea et al., 1998; Shrimpton, 1989), nutritional impacts can be significant. For instance, populations in Brazil and Bangladesh who were regularly supplementing their diets with dark leafy greens and wild fruits were found to have lower rates of vitamin A deficiencies, a common micronutrient deficiency in many food insecure contexts. A last example could be a recent work in Western Kenya, where De Clerck and al. (2011) show a link between functional agrobiodiversity and anemia alleviation.

However, the impact of GFP on a person’s nutritional status can be non-significant. Termote & al. (2012) have recently published a study on the role of Wild Edible Plant in DR Congo, where they demonstrate that despite a precarious nutritional situation, the existing knowledge of the population on WEP and a highly biodiverse environment, the population was not consuming a significant amount of WEP (less than 4.8% of the energy contribution). The limits for WEP consumption could be
- The distance to walk to collect WEP in the forest
- The work load involved to prepare WEP (e.g. cracking some nuts)
- Many women reported that they do not know about the nutritional value of WEP

In other contexts, other limitations have been documented, such as
- Poor social value of GFP (“modern people eat modern food”)
- Loss of knowledge on GFP
- Environment degradation and GFP poor availability
- Land use, land rights and limited access to GFP
- GFP is not consumed by the target group (e.g. pregnant women, under five children)

Besides, as explained before, GFP micronutrient content can differ greatly from the final micronutrient intake according to storage and food transformation processes.

Food-based approaches have to identify local constraints for GFP consumption, and accordingly identify operational answers. Assessments should be cautious while documenting GFP consumption: knowledge on GFP or availability of GFP does not mean significant GFP consumption.

The link between GFP consumption and acute undernutrition or chronic undernutrition prevention will most probably be difficult to document, given the complexity of the causal factors involved (including health environment & care practices).

Field research should be pursued on the link between GFP consumption and nutritional outputs.

5 How could ACF integrate GFP in its needs assessment?

5.1 When to integrate GFP in food & nutrition security assessments?

Gathered Food Plants are almost never part of food & nutrition security assessments. In an emergency context in particular, they will not be the priority. However, they should be considered:

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18 Shrimpton, R. 1989, Vitamin A deficiency in Brazil: perspectives for food production oriented interventions, Ecology of Food and Nutrition
- In a food security assessment (e.g. food crisis context), where GFP should be analyzed as part of the food system. As seen before, they are more than simply a crisis coping mechanism, and can enhance a food system’s resilience.
- In an assessment aiming at undernutrition prevention, where, especially in the case of micronutrient deficiencies, GFP are part of a solution based on local foods, together with other potential options (supplementation and fortification, as seen above).

5.2 What methodology to follow?

**ACF does not have sufficient experience** to define methodological tools adapted to its specific mandate and actions to assess GFP. In this chapter some suggestions and external references are provided to help you define your field methodology. This does not prevent ACF from enhancing its competence in this field in the following years, on the contrary. It is also from field-based experiences that our expertise will grow.

5.2.1 Do not re-invent the wheel: go for a bibliography.

1. On the internet: with the following key words
   - Ethnic group
   - Geographical area
   - GFP, NUS, WEP, GFP, NTFP
   - Potentially: ethno-nutrition, ethno-botanic, econutrition, agrobiodiversity…
2. Meet researchers at local universities & research centers: in agronomy, forestry, geography, social sciences in particular. E.g. in Kenya or Ethiopia for instance you will find a lot of experts who can guide you.

5.2.2 Define the objectives of your assessment:

What are you specifically looking for? What are the expected outputs of your assessment?

5.2.3 Define your methodology.

**There is no appropriate methodology for documenting GFP adapted for ACF’s mandate and activities.** You can base your methodology on the following existing guidelines:

**Box 1: Some reference guidelines & manuals**


Some key questions should be put forward in ACF assessments:

- **WHO** consume GFP? Which population group (age, gender, social group, ethnic group…) consumes the food
- **WHEN** is the food consumed:
  - When the food security situation is normal? For special events (luxury consumption)?
  - In crisis/ food insecurity situation?
  - Seasonality of GFP?
- **Quantitative aspects**: what part of the energetic intake do GFP represent? Is consumption frequent? What part of the community does consume the GFP?
- **Knowledge**: who knows about GFP, including properties, how to gather it, how to prepare it. Is the knowledge disappearing in the community?
- What is considered as “wild food” locally?
- How is GFP consumption considered socially?
- How is the resource protected/enhanced?
- What is the availability of the resource locally? Is GFP endangered? What are the local rules and uses for GFP sustainable use?
- Is access to GFP easy? Secured in the future?
- How is GFP gathered? By which members of the community? Time needed? Is the process laborious or difficult?
- How is GFP prepared? By which members of the community? Time needed? Is the process laborious or difficult?
- Is GFP sold? Is GFP an important income source?
- Preference and why (taste, time to gather and prepare…)
- What are the properties of GFP (effects on health and nutrition according to the community)

Ensure you have a holistic vision: please refer to the sustainable diet framework [Figure 1 p.15] of this document

5.2.4 Collect your field information:

As for any ACF assessment, do not forget the basic rules21 (e.g. crosschecking the information; do not go for quantitative questionnaire before having qualitatively reliable information; …)
- Socio-anthropological information: key informants, focus groups…
- Information on a specific GFP: some tips in the following box.

Box 2: getting information on GFP

I want to identify a GFP

To identify a GFP, you will need to:
Take picture of the GFP in its environment, preferably with a scale to show its dimension. Do not hesitate to take several pictures of the different parts of the plant (inc. flower, fruit, roots, tuber, young and older stages…) Ask for the vernacular (local) name of the plant in the different local languages. Localize a structure or a botanist able to help you: either at the nearest university, or in Northern countries (Europe, US…). You can get support from your ACF HQ in this last case. NB: it could be useful to cross-check this identification with another botanist! Do not take samples without specific advice from a botanist: if s/he needs a sample in addition to the pictures you can provide, s/he will discuss clearly their specific requirements (which part of the plant, how to hold it…)

I have identified a GFP, I want to know more about it

Internet will provide you a lot of information, of unreliable quality. Several sites give cross-checked information:
PROTA (Plant Resources Of Tropical Africa) has a database for plant uses: http://www.prota4u.org/
PROSEA is the same network, but for South-Asian plants [http://proseanet.org/prosea/]. PROSEA offers e-Prosea with a lot of information on South-Asian plants, after one has registered on the site (free registration)
The PlantNet Network has also developed a specific wiki on the use of plants (including edible plants). [http://www.plantnet-project.org](http://www.plantnet-project.org) (in English and in French).

I specifically want to get nutritional information about a GFP

Get the information from a bibliography: as said before, the nutrient content of a plant can vary greatly according to the variety, cultivar, and environment, and this is particularly true both for micronutrients and for GFP. If you find the nutrient content of a GFP in the literature, consider it as indicative only! You can have composition tables from numerous stakeholders, unfortunately with variable quality/ adhesion to international standards and mostly unpublished. INFOODS is a FAO initiative for food composition tables completion and sharing, and their composition tables are accessible on [http://www.fao.org/infoods/](http://www.fao.org/infoods/)

I want to do laboratory analyses to determine the nutrient content of a GFP

Do not hesitate to go to the INFOODS website, to ensure you are following the international standards for those analyses. You could contact the INFOODS team to ensure that your analyses’ planning is convenient. When you get the results, please copy them to INFOODS to ensure proper capitalization.

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5.3 Urgent needs for ACF assessment tools

Assessment tools are clearly lacking for ACF to be able to integrate GFP and more largely agrobiodiversity in its answers for undernutrition prevention.

To define those tools, the most appropriate way would be to become partners with Biodiversity International and to work with their support in order to produce something field based (pilot project). Biodiversity International are the most advanced in this field (and will be in the following decade), and are benefitting for the best network (e.g. FAO, McGill…).

6 How could ACF integrate wild foods within its programmes?

6.1 Constraints for enhancing Gathered Food Products consumption: adapting the programmatic answer

Approaches will depend on the local situation, and on the specific constraints for GFP consumption. Below are some common blockages described in the literature.

1) The knowledge about GFP is lost

The knowledge regarding GFP (their nutritional and/or medicinal properties, when and how to find them, how to gather them while protecting the sustainability of the resource, how to prepare them, how to store them, how to consume them…) can disappear in a human group. This loss happens in particular when the population has been displaced for a long period, or when family members have been separated (in the case of a civil war for instance).

In this situation, the only approach will be to find key informants having kept this knowledge and able to share it with their community.

2) The resource is scarce

The availability of GFP can be limited, for instance when an ecosystem has suffered from desertification, deforestation, brutal erosion… In many contexts (Cambodia, Latin America), the survival of a GFP ecosystem is at stake as its use has been changed or is about to be changed (e.g. the use rights of a forest ecosystem have been sold to a private company for timber exploitation or intensive wood / agricultural production).

According to the specifics of the situation, various options can be considered

- To promote a sustainable stewardship of the land: you will need a complete analysis of the ecosystem with appropriate specialists for a long term planning of the agrobiodiversity management. The main constraint will be to secure the land rights: if the local forest is sold for timber exploitation, promotion of NTFP will be illusory…

- To promote wild plants domestication: you will need a complete analysis of the agronomical specificities of the plant, e.g. best density for...
sowing, water needs, fertilization needs, pests and diseases... the process will take several years in order to have all necessary information for the domesticated plant promotion.

**Before any GFP promotion, an assessment of the resource availability and sustainability as to be made systematically!**

3) The GFP are underestimated

The GFP tend to be poorly considered in many food systems, e.g. being "modern" is valued, and "modern foods" are preferred socially while GFP are for "savage people" or "ancient people". Besides, occidental food is often easier to prepare and consume (ready-to-use food preparations), and can be cheap and easy to access. In consequence traditional food systems and their associated GFPs tend to evolve and to incorporate more industrialized foods, which can be low-quality.

This process is named “nutrition transition” in many publications:

**Nutrition Transition**

Increase consumption of unhealthy foods compounded with increase prevalence of overweight in middle-to-low-income countries is typically referred to as Nutrition Transition. It occurs in conjunction with the Epidemiological Transition and has serious implication in terms of public health outcomes, risk factors, economic growth and international nutrition policy. Nutrition transition may result in undernutrition not simply from a need for food, but from the need for a high-quality diet. Foods rich in vitamins and minerals such as fruits, vegetables and whole grains have been substituted by foods heavy in added sugar, saturated fat, and sodium. This trend, which began in developed, industrialized countries, has spread to developing countries. These developing countries are now stressed with the double burden of undernutrition – hunger alongside the health problems associated with overnutrition, such as obesity, diabetes and stroke. (CINE)

**Nutrition transition is not “bad” as such:**

- People have the right to choose, and to decide their food preference by themselves. Food systems have never been static, and have been evolving since the beginning of times
- Nutrition transition can give positive results on the nutritional status. For instance in Sierra Leone, chronic undernutrition for children under 5 tends to be around 50% in rural areas, and around 30% in the cities where their parents have recently migrated. The hypothesis for explaining this nutritional trend is 1) access to primary healthcare in town and 2) access to a more diverse diet in an urban context.

Various programmes and approaches tend to value “traditional” foods with various successes. If some projects have changed the way GFP is seen locally, and value their consumption and even promote trade chains and transformation, other projects have had limited impacts. One of the main constraints is the time and energy needed to gather and prepare those GFP. These time constraints are not always compatible with local societies’ evolutions (e.g. women having monetized employment).

### 6.2 Integrating GFP in ACF’s “traditional” approaches

1) GFP and food production diversification

A classical ACF Project for food & nutrition security is a crop diversification project. Hypotheses are:

- The diet is not sufficiently diversified (which has to be proven)
- The best way to diversify the food intake is to diversify the food production (as well, this has to be proven as a market approach could be more relevant)
- The diversified food which is going to be produced will be consumed by the target population (which has also to be assessed: could be sold on the market, could be consumed by another group, e.g. men, could be poorly considered socially, etc.)
- The new introduced food will have a nutritional added value (again, not always the case: a recent ACF project for crop diversification introduced one single crop – Irish potato – which is not a high quality food with regards to its nutritional content)
GFP could be an excellent basis for crop diversification:

- Low inputs gardens in Malawi & Zimbabwe included “Local and Traditional Foods” (LTF), such as baobab fruits, with success
- The PPILDA Project (“Projet de Promotion de l’Initiative Locale pour le Développement à Aguié”) funded by IFAD in Niger, Maradi Region) introduced various LTF as new crops, inc. *Moringa oleifera* and *Cassia tora*, known in neighboring communities. Those LTF were successfully introduced, and increased green leaves consumption and incomes (from the sales) for many of the benefiting households.

2) GFP and nutrition & health education

Nutrition & health education consists in giving key messages for improving knowledge, attitudes and practices regarding nutrition and food habits.

Today, a lot of criticisms are raised regarding these approaches:

- *Content of the messages*: the content of the messages is not always sufficiently checked, and wrong or even dangerous messages can be disseminated, e.g. unbalanced recipes in cooking demonstration, poor quality recipes for infants’ supplementation food, etc.
- *Suitability to the local context*: communication tools are not adapted to the specificities of the context, including the agro-ecological context (e.g. oranges are not grown in the Sahel and not available locally, while they are drawn on the image box for vitamin promotion in Niger) and the economic context (e.g. tomatoes are often extremely expensive in Niger and should not be inserted in cooking demonstration locally).
- *Ethnocentrism and patronizing approach*: nutrition & health education mostly values “Northern” knowledge, while local knowledge and local food systems are under-valued, if not ignored. Such an attitude is ethically questionable, and proved to be poorly efficient: basing nutrition and health education on local knowledge and local food system has proven to be more efficient, and more sustainable.

*GFP and their nutritional value should, together with the associated local knowledge, be valorized in nutrition & health education if they part of the local food system.*

6.3 Advocating for a holistic approach

Whatever is developed by ACF should be done using a holistic approach: the sustainable diet framework proposed in this paper (p.15) could guide programmes. GFP can participate to undernutrition prevention as part of a 'local food' solution, promoting local resources and the associated local knowledge on food production/ gathering, transformation and consumption for long term diet diversity and positive nutritional outputs.

GFP should not be considered as ‘a ‘magical solution to hunger and undernutrition’: any food product, taken alone, is by definition unbalanced and insufficient to ensure good nutrition, and domestication of fancy GFP such as *Moringa oleifera* or *Spirulina* is a protracted failure.

7 A word on edible insects
For approximately 2.5 billion people, mainly in Africa, Asia and Latin America, eating insects is part of the common diet, in a similar way as eating meat or fish. There are about 1800 edible insect species. Edible insects are traditionally gathered from the wild, but the international community is showing increasing interest in their domestication:

- They constitute a nutritionally interesting food for humans: they are an excellent source of protein, fats and micronutrients
- They constitute as well an interesting feed for livestock
- Insects have a high conversion ratio, which means that they produce cheaper protein than traditional livestock. For instance, crickets need six times less feed than cattle, four times less than sheep, and twice less than pigs and broiler chickens to produce the same amount of protein (FAO).
- A recent study (Ooninc & al., 2010) has showed that insects’ production emissions of greenhouse gases and of ammonia are lower compared with pigs and cattle production (for the same protein production)

Insect production (at farm or industry level) is outside of the range of this paper, documenting “wild foods”, but is nevertheless an important subject abundantly discussed in the international community.

An expert consultation was organized in January 2012 on the subject by Wageningen University & FAO. If you want to know more about edible insects, the output of this consultation is available on internet:

http://fors.fao.org/preview/31654-08b9c12f60eda84d122b1ad454c381bb4.pdf

You can also find many resources (including bibliographies, list of edible insects) from Wageningen University WebSite (Laboratory of Entomology):

http://www.ent.wur.nl/UK/Edible+insects/

8 What concrete research should be done within ACF Network re. GFP?

This paper has shown the potential significance of GFP as part of agrobiodiversity and local food systems to ensure sustainable diets. It has also put forward some existing limitations for the development of field programmes by ACF: if ACF has a sound knowledge of acute and chronic undernutrition (definition, symptoms, treatment) and an excellent field experience in food security and livelihoods (including food security assessments, market approaches), ACF is crucially missing additional tools in the fields of food science and human nutrition on one hand, and ethno-nutrition, food anthropology and ethno-biology on the other hand. At last, ACF’s competence in ecology and sustainable ecosystem is poor. We could illustrate this using the Sustainable Diet Framework:

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22 List compiled on the Wageningen University Website by Mr Yde Jongema, http://www.ent.wur.nl/UK/Edible+insects/Worldwide+species+list/

23 In animal husbandry, feed conversion ratio (FCR), feed conversion rate, or feed conversion efficiency (FCE), is a measure of an animal’s efficiency in converting feed mass into increased body mass.

24 http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0014445
ACF does not have the competence internally for the lacking fields, and should go for a partnership with the adequate research center. The obvious choice should be Bioversity International: they have the appropriate network (with FAO, Mc Gill University), and they plan to work on the subject in the coming ten years. Besides, their fields of competence appear to be clearly complementary with ACF’s:

This gross schematization is based on the Bioversity field Manual and has to be discussed with them!

Besides those complementary competences, ACF has field programmes and teams, while Bioversity International has expertise in field research and the appropriate network (Mc Gill & FAO in particular).

This partnership should permit to launch pilot programmes in the field, supported and nourishing together formal research in fields as vast as social sciences or food sciences. The most urgent outputs should be:

- ‘ACF adapted assessment methodologies’ and more largely, field methodologies to assess agrobiodiversity adapted to humanitarian actors and undernutrition prevention
- Adapted programmation for ‘local resources & knowledge’ as a tool for undernutrition prevention and sustainable diet promotion.

We should notice that a first collaboration has been launched/: ACF-Peru and Bioversity International submitted a proposal together at the beginning of 2012.
In addition, ACF should participate in the food science research currently on-going, with potential partnerships with IRD for instance. It appears clearly that a lot is still to be learnt in the field and ACF should review all its nutritional messages in this regard (including cooking demonstration recipes, complementary porridges recipes for children aged 6 months – 3 years, etc.). Beside the fact that those actions are likely to have a minimal impact as they are not based on local food systems & knowledge, messages delivered can reveal counter-productive, or even dangerous.

**Conclusion: are ‘wild foods’ a solution to hunger and undernutrition?**

At this point, the reader should clearly states “certainly not”. No ‘wild food’, especially taken alone, will be a magic solution to undernutrition as no food product will cover all nutrient needs, not speaking about the social needs covered by food in a human society. However, wild foods have definitely a role to play, as part of the general agrobiodiversity, and because they offer a food “buffer” in difficult times, reinforcing food systems’ resilience.

“While wild foods cannot entirely bridge the existing supply and demand gaps, without them it would be much wider.”

ACF is today ill-equipped to integrate wild food in its assessments and actions for hunger and undernutrition prevention & mitigation. This could be greatly improved through appropriate partnerships, applied research and pilot approaches. Moreover, ACF will need to force its own ‘culture’ to evolve, in order to enter the world of ‘local food systems for sustainable diets’: “A reductionist approach works fantastically well (and is required) for the treatment of severe undernutrition, nutrition surveys, and food distribution interventions, but not for agro-biodiversity for food and nutrition. Each traditional food system has its own tempo-spatial, cultural and agro-ecological domain, and no two are the same.”

If more or less standardized methodologies and tools can and should be developed in this field, the final output will always need to be locally tailored to the specificities of the local resources (including agrobiodiversity and local knowledge).

Today there is still a gap between undernutrition (e.g. acute and chronic undernutrition, micro-nutrient deficiencies and hidden hunger) and agro-biodiversity, and food systems approaches and documentation. ACF is well placed to bridge the gap. Its integrated approach for undernutrition prevention gives the organization a view from the social sciences (food security & livelihood teams are sensitized, if not fully trained in social sciences) together with knowledge of nutritional outputs: if very few people around the world are trained in micro-nutrients and food anthropology, at least ACF has experts in both fields internally.

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25 Bharucha & Pretty 2010
26 Rory Mc Burney, pers. Com.
Glossary

Agricultural biodiversity or Agrobiodiversity
Agricultural biodiversity includes ecosystems, animals, plants and microorganisms related to food and agriculture. Today most crop species and domesticated livestock are the result of thousands of years of human intervention, including selecting breeding and other farm practices. Agricultural biodiversity provides food and raw materials. Moreover, every plant, animal and microorganism plays its part in the regulation of essential ecosystem services, such as water conservation, decomposition of waste, nutrient cycling, pollination, pest and disease control, climate regulation, erosion control, flood prevention, carbon sequestration and many other ecosystem-oriented factors (CBD 2010)

Agro-ecosystems
Agro-ecosystem describes a conceptual model of an agricultural system (crop, farm or whole economy), which relates its functions to its inputs and outputs. An agro-ecosystem encompasses land used for crops, pasture, and livestock, the adjacent uncultivated land that supports other vegetation and wildlife, the associated atmosphere, and the underlying soils, groundwater and drainage networks. Ecosystems services are ecological processes and functions that sustain human wellbeing (Daily 1997).

Bioavailability
Nutrient bioavailability is defined as the fraction of a nutrient in a food that is absorbed and utilized.

Econutrition
Econutrition integrates environmental health and human health, with a particular focus on the interactions among the fields of agriculture, ecology, and human nutrition. (Deckelbaum & al. 27, 2006)

Ethnobiology
Ethnobiology is the scientific study of dynamic relationships among peoples, biota, and environments (International Society of Ethnobiology)

Ethno-nutrition
Ethno-nutrition describes the ways in which local peoples evaluate food and diet, and how diet is used to avoid or treat illness (E. Messer 28, 1996)

Ethnobotany
Systematic study of the botanical knowledge of a social group and its use of locally available plants in foods, medicines, clothing, or religious rituals. (Encyclopaedia Britannica)

Local and Traditional Foods (LTFs)
There is no universally accepted definition of local foods or traditional foods. Traditional foods are generally from a particular culture, available from local resources and culturally accepted. Other aspects that have to be factored in to a consideration of traditional foods include sociocultural meanings, techniques for acquisition and processing, use, composition and nutritional consequences (CINE 2006).

The term local and traditional foods to refer to plants and crops, fruits, non-timber forest products, livestock, fish, hunted game, wetland species, wild or gathered foods and insects (Bioversity 2011)

Neglected and Underutilized Species (NUS)
Those species with under-exploited potential for contributing to food security, health nutritional/medicinal), income generation, and environmental services. (Bioversity 2006).

NUS are often called ‘minor’ because of their small total economic value in commercial production and trade compared with staple crops and agricultural commodities. A wide range of terms are used for

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28 In “Food Habits in Later Life”, p. 801
underutilized plant species, including ‘minor’, ‘neglected’, ‘local’, ‘traditional’, ‘underexploited’, ‘underdeveloped’, ‘orphan’, ‘lost’, ‘new’, ‘niche’, ‘promising’ and ‘alternative’ (Padulosi et al. 2002). Bioversity International (formerly IPGRI) defines these species as neglected and underutilized plant species, not crops, since wild, managed and cultivated species are taken into consideration. These plant species may belong to any category, from fruit and nut trees to leafy vegetables, from functional herbs (or medicinal and aromatic plants [MAPs]) to cereals, from legumes to forest trees, from forages to roots and tubers. Bioversity classifies these species as underutilized since in the past they were grown more widely or intensively but are now falling into disuse for a variety of agronomic, genetic, economic and cultural reasons. Some species may be widely distributed around the world but tend to occupy special niches in the local ecology and in local production and consumption systems.

Nutrition Transition
Increase consumption of unhealthy foods compounded with increase prevalence of overweight in middle-to-low-income countries is typically referred to as Nutrition Transition. It occurs in conjunction with the Epidemiological Transition and has serious implication in terms of public health outcomes, risk factors, economic growth and international nutrition policy. Nutrition transition may result in undernutrition not simply from a need for food, but from the need for a high-quality diet. Foods rich in vitamins and minerals such as fruits, vegetables and whole grains have been substituted by foods heavy in added sugar, saturated fat, and sodium. This trend, which began in developed, industrialized countries, has spread to developing countries. These developing countries are now stressed with the double burden of undernutrition – hunger alongside the health problems associated with overnutrition, such as obesity, diabetes and stroke.

Secondary metabolism
Secondary plant metabolism contains products that aid in the growth and development of plants; however they are not required for the plant to survive. Secondary metabolism facilitates the primary metabolism in plants. This primary metabolism consists of chemical reactions that allow the plant to live. In order for the plants to stay healthy however, secondary metabolism plays a pinnacle role in keeping all of plants' systems working properly. A common role of secondary metabolites in plants is defense mechanisms. They fight off herbivores, pests, and pathogens. Although researchers know that this trait is common in many plants it is still difficult to determine the precise role each secondary metabolite plays. Some of the roles secondary metabolites play are anti-feedant activity, toxicity or acting as precursors to physical defense systems. Secondary metabolites include, for example, tocopherols, sterols, vitamin C and polyphenols such as phenolic acids and their esters or flavonoids. These secondary metabolites exhibit antioxidant, anti-radical, even anti-proliferative or anti-estrogen properties, and are metabolic precursors for various key vitamins (Vit A, Vit P…).

Sustainable Diets
Sustainable diets are diets with low environmental impact and which contributes to food and nutrition security as well as to a healthy life for present and future generations. Sustainable Diet are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable, nutritionally adequate and safe and healthy while also optimizing the use of natural and human resources (Bioversity 2011)
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Some documented experiences on the link between wild food & nutrition


Econutrition & GFP


**ACF Experiences**

**In Peru**


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**In Uganda**

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**Field Manuals**


**On GFP domestication**

**On Moringa**


**On wild fruit trees**
