One late winter afternoon in 2005 in the village of Arsaal in Northeast Lebanon, a meeting to discuss an upcoming project with the community members was wrapping up. An elderly lady from the community stood up to address the research team:

I thank you for talking to us about wild edible plants. I’m now able to eat this food without shame … Young people yearn after pasta and canned tuna and dismiss our food; I’m happy the university is talking about our local food.

The researchers from the American University of Beirut (AUB) found this statement intriguing.

Her statement summarizes a problem facing many people in the world. Much of the food they consume today is from foreign sources. More than 70% of the food consumed in Lebanon (a relatively developed country) is imported (Customs and Ministry of Trade of Lebanon 2009; Nasreddine et al. 2006), as is 92% of cereals, chiefly in the form of refined wheat flour for bread making (FAOSTAT 2004).
Likewise in Yemen (one of the poorest countries in the region), although only 13% of cereals consumed were imported in 1971, the figure rose to 61.5% in 1991 and 75.3% in 2002 and was coupled with a decrease in domestic cereal production (802 vs. 640 thousand tonnes in 1971 and 1991, respectively). These figures reflect an ever-increasing dependence on imports (FAOSTAT 2004).

Lebanon and Yemen are two countries in the predominantly arid Middle East that have markedly different human-development indicators. For example, the under five mortality rate (per 1,000 live births) was 30 in Lebanon and 102 in Yemen in 2005, and the two countries scored 0.772 and 0.508 on the human-development index (HDI), respectively (UNDP 2009). However, both are undergoing significant rural transformations that are affecting nutrition and health (Batal and Hunter 2007; Jumaan et al. 1989). Both countries have relied on agriculture for millennia and yet both are encountering changes to the availability and access to local traditional food (Al-Makhlafi 1999; Hamadeh et al. 2006; Hashim 1999).

Food production systems are different in the two countries. In the traditional agro-pastoral communities in the arid and marginalized region of Arsal in Lebanon, conflict over land has been ongoing for many years. This region is also experiencing climate change (less rainfall) and lost soil fertility. To survive, many Arsalis have switched from food crops to growing cherry trees. Some are engaged in more profitable stone quarrying rather than agriculture (Hamadeh et al. 2006). Others have abandoned the area altogether to seek jobs in the city. Why this is happening has not been thoroughly studied, but economic challenges associated with agricultural livelihoods may play a role.

In Yemen, rapid rural transformations began in the 1970s when water pumps were introduced to the lowlands and the lower to medium altitude plains (Varisco 1991). Like many other countries, Yemeni agriculture was transformed by irrigation, leading to expansion to previously uncultivated lands. This new water-supply practice encouraged the production of cash crops that consume significant quantities of water (World Bank 2007) and require chemical fertilizers and pesticides, which the poorer farmers cannot afford. Forty years of such practices have led to the depletion or salinization of groundwater resources. Rural transformations have also included expanded Qat production (a shrub whose leaves are widely chewed like tobacco to produce a mild euphoric effect), and fruit production for export (Aw-Hassan et al. 2000). As a result, the traditional rain-fed highland areas that used to produce subsistence food crops, such as sorghum and wheat, have dramatically changed: local foods traditionally grown in this area are disappearing.

Most food is being grown for the market, and poverty and food insecurity at the local level are on the rise. As food prices increase worldwide, poor farmers are challenged from two directions: they are unable to buy expensive food from the market and they are unable to grow enough food to feed their families. The very poor cope by eating less food or lower quality food (Al-Makhlafi 1999; Government of Yemen 2002). Yemen has the highest rates of child malnutrition and food insecurity in the
Middle East (Lofgren and Richards 2003) and problems of stunting and wasting are common (Raja’a et al. 2001). However, there are also signs that overweight and obesity are creeping in, particularly among certain socio-economic groups in the urban areas (Raja’a and Bin Mohanna 2005).

In Lebanon, research has shown how dietary habits over the years have changed: traditional healthy diets characterized by inherent diversity (Batal 2008; Batal and Hunter 2007; Issa et al. 2009; Jeambey et al. 2009) are fading away in favor of a more limited repertoire of food types, little of which is produced locally. A review of food consumption patterns from 1960 to 2002 (Table 6.1) reveals a decrease in cereal consumption and an increase in meat consumption, a typical indicator of economic development. Energy and protein availability have improved so much during that period than the Lebanese are now consuming a hyper-caloric diet, with an increased risk of cardiovascular diseases, obesity, and other noncommunicable diseases (Hwalla et al. 2005; Obeid et al. 2008; Sibai et al. 2003).

In the twentieth century, nutrition problems were linked to nutritional deficiencies (Hwalla (Baba) 1998), but today, 53 and 17% of Lebanon’s adults and 19.3 and 5.3% of its children are identified as overweight or obese, respectively (Sibai et al. 2003). Figure 6.1 (Batal et al. 2007) describes the rates of overweight and obesity expressed through the body mass index for adults 40–60 years of age in the rural communities participating in the Ecohealth project in Lebanon. These communities were deemed to be of low socio-economic status compared with the rest of the Lebanese population. Published data show that children from lower socio-economic strata exhibit both mild and moderate stunting, a good indicator of undernutrition (Baba et al. 1991, 1996). Research has also confirmed micronutrient deficiencies among these populations – iron deficiency in 33% of women and 25.2% of children (Hwalla et al. 2004). Analyzed together, the data show the extent of social inequality. The rich are few and eat too much, and the poor are many and either eat too little or eat poor quality food (Melzer 2002).

| Table 6.1 Consumption pattern of different food groups in Lebanon |
|------------------|---------------|------------------|------------------|------------------|---------------|
| Kcal             | 2,396         | 2,319            | 2,844            | 3,144            | 3,196         |
| Protein (g)      | 62.3          | 58.2             | 80.2             | 81.2             | 88.5          |
| Animal protein (%)| 29.8          | 32.6             | 37.5             | 31.6             | 39.1          |
| Energy source (%)|              |                  |                  |                  |               |
| Cereals          | 49.3          | 45.7             | 39.9             | 36.4             | 37.2          |
| Meats, fish, dairy, and eggs | 10.9 | 11.1             | 14.4             | 10.5             | 21.4          |
| Oils and fats    | 11.3          | 12.7             | 14.4             | 15.6             | 6.8           |
When the Local Environment is no Longer the Source of Food

Many of the health and nutrition issues in Lebanon and Yemen can be linked to the lack of dietary diversity. Diversity is a trait of many traditional food systems. The current trend in food consumption is to eat food that is purchased from stores – food that is often less diverse than the traditional diet. Purchased foods are often imported and processed, are usually high in fat and sugar, and are low in fiber. The current diet in Lebanon is now limited to only a few staple foods. According to the World Health Organization (WHO), the average daily consumption of bread in Lebanon per capita per day is 350 g (WHO 1998, p. 45), or in terms of total cereals 141 kg per capita per year (FAOSTAT 2004). This is indicative of an imbalance in diet quality, but not necessarily of quantity, and thus is not an adequate indicator for food security.

The situation in Lebanon contrasts significantly with that in Yemen, where prices of cereals and cereal products increased by 20% in 2007 and 23% in 2008. Due to these price increases, and because cereal consumption is estimated at 166 kg/year and imports constituted 61.5% of cereal consumption in 1991 (FAOSTAT 2004), an estimated additional 6% of all Yemenis have dropped below the poverty line, joining the 40% that were already considered poor.

The population of Yemen is presently estimated at 21 million and expected to double in the next 20 years. According to the 2003 Food Insecurity and Vulnerability Information Mapping System Survey (Government of Yemen 2003), half a million households in Yemen are food insecure, which represents 21.8% of all households.
nationally. Rural households are the most vulnerable, especially those with high child-to-adult ratios. Household size and the number of children were also found to be risk factors associated with food insecurity. Two-thirds of all agricultural holdings are smaller than 1 ha (Ministry of Agriculture and Irrigation 2007), which worsens food security.

In the Yemeni highlands, the gradual deterioration of traditional food systems is intimately connected to the degradation of the natural resources on which communities have relied, and used sustainably, for centuries. Unsustainable water-supply policies, coupled with the degradation of the mountain terraces, increasing climate variability, and population pressure have pushed many poor families to adopt difficult coping strategies. For example, many men from the highlands have emigrated to neighboring Arab countries, where they are subjected to difficult work and living conditions, to be able to support their families in Yemen (Adra 1983).

In addition, to be able to cope with rising food prices and the threat of food insecurity, seed stocks are depleted to feed the family. Increased dependence on expensive market foods and consumption of unsuitable seeds are two of the main factors that increase household vulnerability in the rain-fed agricultural areas (WFP 2008). According to a World Bank study to understand women’s adaptation strategies to climate change in rain-fed highlands (Al-Hakimi and Ya’ni 2008), the social and economic changes linked to the decline of agricultural household income (until 2007) have forced men to leave in search of jobs in cities. The women have been left behind to farm, but they face severe culturally based restrictions on movement and access to information. In some districts, women are permitted to secure livestock feed, but are discouraged from becoming engaged in cereal production (Al-Hakimi and Ya’ni 2008).

The serious health and nutrition challenges facing the highlanders of Yemen and the drylanders of Lebanon require innovative solutions to address these complex and interlinked problems. Greater reliance on local nutritious foods can be part of such solutions. For innovations to be successful, the entire community – both young and old men and women and youth, religious, political, and other traditional leaders – must be involved in developing long-term strategies to protect their health, ensure themselves sufficient quantities of food, safeguard their environment, and provide themselves with dignified livelihood options.

**Linking Research and Action on Local Food Systems**

Two ecohealth projects in Lebanon and Yemen during 2004–2008 investigated how social, political, economic, and ecological transformations had affected dietary diversity and how these transformations affected health. The purpose of the studies was to improve dietary diversification through increased reliance on local food systems, such as wild edible plants and traditional foods, to combat health problems associated with poor nutrition.
Using complex system analysis, both teams hypothesized that the agro-ecosystems were deteriorating, negatively affecting nutrition and health, especially among the poor (Al Hakimi et al. 2008; Batal 2008; Batal and Hunter 2007; Issa et al. 2009, 2011; Jeambey et al. 2009). Multiple and interlinked factors were at play at various levels. As well as drawing on concepts of sustainable use of biodiversity, the researchers employed an ecosystem approach to health to address these links and try to resolve these problems.

Thus, separately, two multidisciplinary teams, from the AUB1 in Lebanon and from Sana’a University2 in Yemen, began working in close collaboration with their target communities and other local actors. Each team characterized many facets of these ecosystems, seeking associations between dietary diversity, food security, and ecosystem management and between dietary diversity and various risk factors for chronic disease. The hypothesis was that a reliance on local foods would improve nutritional intake and sustain biodiversity in the ecosystem, and contribute to both human and ecosystem health. Encouraging the consumption of wild edible plants and food grown locally would also draw the community back to their traditional diet and regain pride and interest in the ecosystems that produce this food, resulting in better management of key (and in some cases threatened) natural resources.

Focus group meetings and in-depth interviews were carried out with community members in Lebanon to better understand indigenous knowledge around the collection, consumption, preservation, and health benefits of wild edible plants. All key informants identified by community members as knowledgeable were above the age of 55, and most of them were women. They reported that the younger generations were uninterested in maintaining and using this knowledge (Jeambey et al. 2009).

Community members reported that the problem of accessing local food was a major hindrance to its consumption. Traditional food suffered from an “image problem” – it does not have the prestige associated with foods advertised on television. The project helped to set up a Healthy Kitchen network in the villages of Arsaal, Kuakh, and Batloun. The working hypothesis was that improved image and perceived value of local food would lead to greater consumption of such foods both locally and in the city. Local food and traditional recipes passed down over generations were collected and tested by the Healthy Kitchen network. More than 25 women involved in the kitchens also collected wild edible plants. They shared and promoted recipes during income-generating catering events and trade shows, particularly in the city. They also became strong advocates for the natural

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1 In November 2004, the Department of Nutrition and Food Science in partnership with the Initiative for Biodiversity in Arid Regions (IBSAR) and the Environment and Sustainable Development Unit (ESDU) at the American University of Beirut (AUB) started the project Wild Edible Plants: Promoting Dietary Diversity in Poor Communities of Lebanon (WEP-DD).

2 Through partnership between the University of Sana’a, the Yemeni Genetic Resource Center, and IDDEALES, the project Health and Dietary Diversity in Yemen – Traditional Yemeni Rural Diets and Local Food Systems: Enhancing Contributions to Health and the Environment was started in winter 2005.
environment from which these wild plants were being collected, and they became involved in conservation activities.

Women involved in the project received training in good manufacturing practices as well as in organizing cooperatives, marketing, and accounting. The project produced a food-safety manual in Arabic and a website\(^3\) that contains extensive plant and recipe databases, a bilingual book that contains close to 40 local recipes, and records both indigenous and scientific information on the nutritional and health qualities of 15 wild edible plants (Batal 2008).

The network has played a key role in promoting wild plants and ecosystem protection. Village cooking festivals and catering events garnered national media coverage and contributed to the increased visibility of traditional foods. Traditional food appeared to be becoming more appealing to the urban elite. For example, the kitchens were asked to cater for more than ten events held in Beirut in 2007 alone. This phenomenon heightened the interest of the rural communities in their traditional knowledge and natural heritage. Many women were employed by this initiative, which enhanced their income but also, perhaps more importantly, empowered them in the community. In the words of one of the ladies involved with the Healthy Kitchen in Batloun:

> Women, who have been confined to their own homes within the borders of their villages are now traveling throughout Lebanon, meeting new people from different backgrounds, entering new markets, and taking responsibilities for business transactions.

In Yemen, the research used a similar participatory methodology because the intention was to foster scientific knowledge that integrated valuable indigenous experience. The systemic approach that addressed food production, rural community health, and environment connections in their socio-economic conditions was very new in the country and provided more holistic and dynamic knowledge on rain-fed agro-ecosystems. Scientific data were recorded and indigenous knowledge on local landraces, farming techniques, natural resources management, and cooking practices documented. Two neighboring communities, which lived under full rain-fed conditions 50 years ago but since then followed very distinct agricultural and food evolutions, were compared by using PRA (Participatory Rural Appraisal) tools, focus group meetings, formal surveys, medical consultations, and laboratory analysis.

The project produced maps of the agro-ecosystems (e.g., linking water and soil resources, topography, farming practices, rotation and intercropping systems, and cropping patterns). The results were shared widely to better understand the diversity of existing conditions and the way farmers have adapted decision making around crop choice and other practices to reflect this diversity in the fields and in their diets. Several booklets about traditional practices were produced and disseminated. Although farmers’ perceptions on local varieties were not directly “quantified,” communities reported that low productivity contributed to their negative

\(^3\)See: http://www.wildedibleplants.org.
image when compared with high-productive seeds, which supposedly required uniform and simplified work according to what they had heard. Yet, some farmers were eager to revive landraces in cropping patterns provided that productivity was increased. Through the Yemeni Genetic Resource Center, the project acted as a seed bank. It collected relevant indigenous seeds and selected seeds from other Yemeni highlands that were available in the Yemeni Genetic Resource Center and had potentially good adaptability to local conditions. Seeds were distributed to farmers along with information about their growing and nutritional qualities, cultivation, and seed-selection methods. Comparative experiments were conducted with communities. The project’s intention was to enhance the farmers’ pragmatic “agro-biodiversity reflex,” which has been used as an ancestral strategy to mitigate erratic changes in the environment and weather and to find the best solutions to current needs.

In parallel, ethnographic work was conducted with women in the communities to record more than 100 traditional recipes, along with local ingredients, and the utensils necessary for their production. These recipes were collated in a book published by the University of Sana’a Press (Ya’ni et al. 2008). The book is both an ethnographic and nutritional reference as it is the first cookbook on local recipes ever published in the country. Conserving traditional recipes requires the promotion of their diversity, quality, and particular tastes. Beside the first challenge of supporting local varieties in the field, a second one was found in the cooking pots. Elders’ preference and attachment to traditional meals based on diversified local cereals clashed with younger generations’ food habits who were partial to standardized preparations with white flour even in rural areas. Because young mothers were more and more attracted to easier and shorter food preparations, the cookbook was distributed primarily among them to raise awareness about the health virtues of traditional dishes and to disseminate the documented knowledge before it was lost.

As a result of these two projects, there is a renewed interest and pride in local knowledge about food in the community and beyond.

**Achievements**

The researchers and the community jointly developed a more complete picture of nutrition and health in rural villages in Lebanon and Yemen, and showed how these were linked to social, economic, political, and environmental factors at different levels and scales.

In Lebanon, project findings confirmed the high prevalence of overweight and obesity, dyslipidemia, and other chronic disease risk factors in the rural Lebanese population (Batal et al. 2007). The project identified, categorized, and documented wild plants and showed how they were linked to traditional rural diets and traditional cultural practices (http://www.wildedibleplants.org; Batal 2008). The project also identified some of the pressures exerted on the ecosystem, and noted the
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Degraded state of the once-rich biodiversity. Most of the collection sites for wild edible plants in the surveyed communities were located in semi-natural habitats or abandoned agricultural lands. The most important threat to these wild edible plant species were two practices, over-harvesting and over-grazing, commonly encountered on such lands. In all sites, and for all plant species of interest, density was low (Batal et al. 2007). This is possibly due to the marginal status of the semi-arid highlands in Lebanon. The findings point to the urgent need to manage grazing and harvesting activities in these fragile ecosystems. Most importantly, the study showed, through chemical and nutrient analysis, that traditional Lebanese food, if consumed regularly has the potential to improve diets (Batal and Hunter 2007; Issa et al. 2009). Through close collaboration with communities, the project increased the value of local food resources and developed a heightened respect for the ecosystem that provides both nutritional food and valuable income. In the words of a member of the Healthy Kitchen in Kuakh:

The kitchens have also allowed local suppliers from the agriculture and animal-farming sectors to sell their own products and increase their profits.

One of the most important outcomes of the Healthy Kitchen was bringing attention to our otherwise forgotten community through the media. Our village is now a focal point for large-scale development projects initiated by international NGOs. The establishment of the kitchen opened new windows of opportunities for the people, especially the women to work in different areas, develop new relationships, and widen experiences.

In Yemen, increasing childhood overweight and obesity problems were uncovered, sometimes coexisting with parasitic infections and malnutrition in the same communities (Al Hakimi et al. 2008). Whatever the context, both in intensified monoculture systems that produce potatoes and rain-fed farms that produce very low yields, insufficient cereal production has increased all households’ dependence on markets and shops. People buy food to meet rising needs for wheat and not to diversify food baskets with vegetables or fruits (with 93–57% of the inhabitants admitting buying wheat grains every year in both farming situations, respectively). Findings also confirmed that local wheat and barley varieties often had higher mineral, fiber, or protein contents than improved grains introduced in local systems or imported refined flours. However, in these very poor socio-economic conditions, degraded environments (garbage, unhealthy farming practices, polluted water), and weak domestic hygiene (including in kitchens) are common. Thus parasitosis (affecting more than 80% of the people in both communities) and new diseases due to chemicals are now local priorities that may diminish the potential positive effects of local grains and foods.

The project identified several advantages of local food sources. Traditional farming and cropping systems usually include several local wheat, barley, sorghum, or millet varieties and are based on crop rotation and intercropping that protect local genetic diversity and support local food habits. They also allow for the production of secondary crops such as legumes (lentils, fenugreek, and beans), which in turn contribute to more dietary diversity into a cereal-based diet. The research revealed that farmers reserved local landraces for use on rain-fed fields and in extensive organic farming because they would get optimal yields even when
the season was drier than usual. Farmers also noticed that irrigated or intensified practices negatively affected the taste and nutritional quality of local seeds. Although less used than in the past, local bread recipes still use different wheat, as well as barley and sorghum varieties, and remain popular and valued for reasons of health, energy, and taste. The research discovered that there was still a wide range of traditional recipes from rural areas dedicated to diverse ways of consuming local food products. These recipes showed varied practices between regions and enhanced the demand for, and cultivation of, a diversity of local landraces. By using a systemic approach, the project highlighted interrelations between the main three elements of rural food systems: traditional agricultural practices; local varieties; and traditional dishes. They are intimately connected so that the loss of any of these elements leads to the deterioration of the others, and results in environmental degradation and diet simplification. Therefore, the project collected local seeds, recorded ancestral agricultural practices, and documented traditional Yemeni recipes.

The research in both Lebanon and Yemen characterized complex problems in a systematic fashion. Using an ecohealth approach, the complexity of the links at different scales and levels was better understood. Both projects showed how ecosystem health and human health are interconnected. The projects demonstrated the link between nutrition and livelihoods, created stronger markets for local food, and influenced changes among the practices of producers and consumers. These results have the potential to encourage more sustainable agro-ecological practices and local agro-biodiversity to avoid jeopardizing the sustaining ecosystem, improve nutrition and health, and increase national food security. However, there is still scope for both projects to make the links more explicit and to produce the evidence that policymakers and other actors require to make long-lasting positive changes for the benefit of the poor. Though strong efforts were made to seek policy attention in workshops and through policy briefs, no significant policy influence was achieved by either project. In both countries, weak political institutions are typical. Civil strife, war, and poverty constrain governance structures in these countries from acting on evidence from research and initiating change. In both contexts, these issues challenge not only development and poverty-alleviation initiatives, but also efforts that support the sustainable and equitable use of scarce resources.

For improved food security, there is a need to evaluate agricultural and trade policies and assess current subsidies on bread, including the need to examine the impact of cereal imports on health and social equity. The rich traditions, local biodiversity, and indigenous knowledge in both Lebanon and Yemen are resources for local people, and may contribute to developing strategies for food security, nutrition, and sustainable development.

One issue that remains to be researched is the change in the lifestyle of rural communities. Research on lifestyles may have potentially important contributions to address health problems encountered in both countries. An ecohealth approach would help take into account the role of physical activity (work and leisure) and their relationship with both the environment and improved health for all.
Acknowledgments  We thank the communities of Batloun, Kfarnabrakh, Warhaniyeh, Arsaal, and Kuakh in Lebanon and Al-Arafah, Ribat al Qalaa, Masyab, and Saber in Yemen for welcoming us in their midst. We also acknowledge the support of all of the researchers and other project stakeholders. The following people contributed to the material used in this paper: Anhar Yaani, Sadeq Sharaf, Adnan Al-Qubati, Mokhtar Dael, Ahmed Al-Samawi, Darine Barakat, Salma Talhouk, Shadi Hamadeh, Beth Hunter, Cynthia Farhat, Zeinab Jeambey, and Nader Kabbani. IDRC support for this research was provided through the projects 102692 and 103153.

References


Part II

Natural Resources, Ecosystems,
Pollution, and Health