

# UNDERSTANDING THE LINKS BETWEEN AGRICULTURE AND HEALTH

## Agrobiodiversity, Nutrition, and Health

TIMOTHY JOHNS, IFEYIRONWA FRANCISCA SMITH, AND PABLO B. EYZAGUIRRE

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**B**iodiversity provides essential components of healthy environments and sustainable livelihoods. One key component of biodiversity is agrobiodiversity—that is, the cultivated plants and animals that form the raw material of agriculture, the wild foods and other products gathered by rural populations within traditional subsistence systems, and organisms such as pollinators and soil biota.

Farming systems rich in agrobiodiversity are characterized by a range of crops, many of which may be represented by numerous traditional varieties even in the same field. Agrobiodiverse systems tend to comprise smaller quantities of multiple species for culinary, medicinal, and cultural uses. They often tolerate or encourage valuable wild plants within fields, on field margins, and in adjacent natural areas.

Before the emergence of modern industrial agriculture, farms everywhere were richer in biodiversity than they are today. Agrobiodiverse systems now tend to be found more in developing countries, among indigenous communities and small-scale farmers, and in extreme or marginal environments. Economic and social development often leads people to abandon these valuable assets, thus preventing agrobiodiversity from contributing to improving the health and livelihoods of disadvantaged populations.

### CONCEPTUAL LINKS BETWEEN AGROBIODIVERSITY AND HEALTH

The figure shows how biodiversity, nutrition, and health can support each other in a synergistic fashion. Agrobiodiversity used and conserved in a livelihood context can directly contribute to nutrition, health, and income generation. Health and prosperity linked to robust sociocultural institutions, in turn, help individuals and populations make healthy behavioral choices, and help institutions develop public policies that maintain the diversity and health of ecosystems. Utilizing and encouraging agrobiodiversity requires viable markets, which depend on demand from consumers, which in turn translates into opportunities for income generation and improved livelihoods for rural

farmers. Scientific research and entrepreneurial initiative can provide new products and markets from and for agrobiodiversity.

### THE POTENTIAL FOR AGROBIODIVERSITY TO PROVIDE THE NUTRIENTS ESSENTIAL FOR A HEALTHY LIFE

Agrobiodiversity could be more effectively utilized to improve diets and nutrition. Eight hundred million people in the world have diets insufficient in energy, and some 2 billion suffer from micronutrient deficiencies. Improving accessibility to a range of crops would offer nutritional benefits to the rural and urban poor. Farming systems that maintain and use agrobiodiversity have strong potential for improving this accessibility and thus improving nutrition, because they often produce indigenous, neglected, and underutilized food crops and gathered foods rich in nutrient quality.

In different parts of the world this potential has been recognized, and efforts made to build on it. For example:

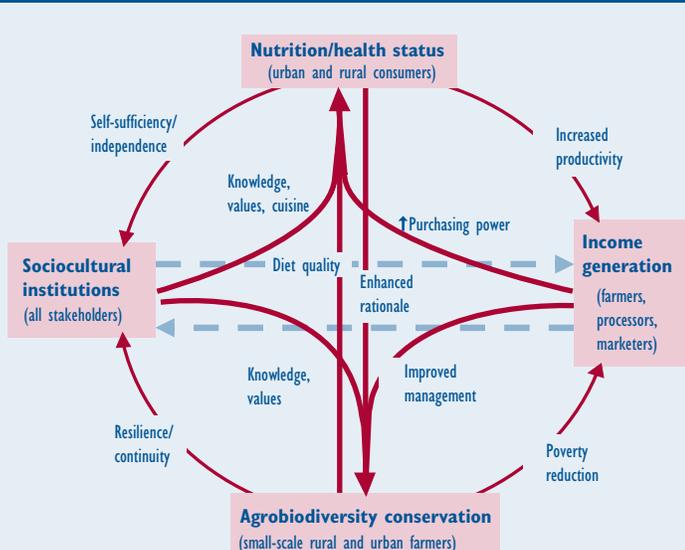
- In Brazil, buriti (*Mauritia vinifera*) and some other indigenous palm fruits are noted sources of beta-carotene (provitamin A). The Brazilian Ministry of Health promotes the consumption of these foods through national and local activities directed at sustainable small-scale production, product development, and marketing.
- In Sub-Saharan Africa, indigenous leafy vegetables are potentially rich sources of micronutrients and antioxidants. To promote production and consumption of African leafy vegetables, the International Plant Genetic Resources Institute (IPGRI), in collaboration with the World Vegetable Center (AVRDC) and national partners in eight countries, has combined research, public education, dissemination of information, support to small-scale producers, and facilitation of links to retail markets. Consequently, in Nairobi, Kenya, supermarket sales of leafy vegetables have increased 10-fold over a period of one to two years, and the informal market sector has grown.
- *Moringa oleifera* (drumstick tree) is a fast-growing, multipurpose tree whose leaves contain high levels of vitamins A and C, calcium, iron, and protein. There are now multiple efforts underway to incorporate *Moringa* into agricultural systems and the diets of people at risk of malnutrition in India, Sub-Saharan Africa, and other regions (see Brief 11).

In addition, agrobiodiversity is a potential source of genetic resources that plant breeders and scientists can use to add nutrients like beta-carotene and zinc to staple crops.

### LINKING AGROBIODIVERSITY TO DIETARY DIVERSITY

Dietary diversity increases the chances that individuals will meet their dietary requirements. Fruits, minor vegetables, and leaves used as condiments, spices, or sauce ingredients can be grown in small quantities and add variety and essential nutrients to diets otherwise dominated by carbohydrates. Agrobiodiversity is an under-explored avenue for giving both food producers and consumers access to greater dietary diversity. A recent study in a subsistence-oriented mixed farming system in an upland region of the Philip-

### Population-level synergies linking biodiversity conservation and human nutrition in developing countries



pinus showed that the diversity of agricultural production—comprising cultivated and gathered products such as fruits, vegetables, and multiple varieties of rice—was important to ensuring food security and reducing the risk of temporary food shortages.

Increasing biodiversity in home gardens is another way to promote dietary diversity among producers. In Bangladesh, Helen Keller International projects show that homestead food production focused on a wide variety of fruits and vegetables and integrated with animal husbandry enables households to diversify and increase the quality of their diet. A recent project promoting home gardens and income generation in the Terai area of Nepal through training, technical assistance, and seed distribution significantly improved nutritional knowledge and consumption of 16 types of micronutrient-rich vegetables and fruits.

Food consumers more broadly could also benefit. Information on the contribution of indigenous food species to people's diet and nutrient intake, however, is almost non-existent. Most food consumption surveys either underestimate or ignore indigenous and wild foods, as do the food balance sheets of the Food and Agriculture Organization of the United Nations, which are widely used to estimate global food supply.

### **AGROBIODIVERSITY AND THE EMERGING EPIDEMIC OF CHRONIC DISEASES**

There is growing evidence from the epidemiological literature that optimal health requires more than just essential nutrients. Specific plant foods also have so-called functional properties that are associated with reduced risks of chronic diseases and improved health overall.

Important examples of crops underutilized in modern farming systems are buckwheat and finger millet, which have blood glucose-lowering effects. Particular animal-source foods, such as many fish and marine species, as well as seeds such as flax, pumpkin, and walnuts, contain high levels of omega-3 fatty acids, which are highly protective against chronic diseases (see Brief 10). Leafy vegetables and other plant foods contain carotenoids such as lycopene and lutein, which, in spite of having no provitamin A activity, appear to reduce the risk of certain types of cancers. These carotenoids, as well as other widespread compounds called phenolics, act as antioxidants and prevent damage to the body's cells and tissues.

All these resources could be more effectively mobilized in farming systems to help control the rapidly emerging problem of chronic diseases. Although many of these foods, or supplements containing specific food constituents, can be purchased, local sources can be more accessible and affordable for people with limited resources. Moreover, these widely distributed species are components of nutritious food systems for which other potential benefits remain to be investigated. Considering the difficulty in precisely identifying optimal diets, a diverse and balanced diet provides an intrinsic buffer against the uncertainties of change and remains the preferred choice for human health.

### **BIODIVERSITY AND THE RECONSTRUCTION OF HEALTHY FOOD SYSTEMS**

Unfortunately, commercialization of markets potentially limits the opportunities of small-scale farmers to produce and sell minor crops or to compete against the produce of local or foreign commercial farms. Supermarket conglomerates prefer to sell commodities with greater volume, longer shelf life, and guaranteed delivery, while often dictating prices and terms of supply and payment that small farmers cannot operate with. Moreover, with cultural influences such as media and advertisement, novel processed foods often displace native foods and traditional cuisine, which become perceived as inferior or unfashionable.

Efforts to encourage farmers to grow a greater range of agrobiodiversity have had success when they simultaneously increase demand through promotion to consumers, provide technical and management support to farmers, and help create market opportunities. To build on these positive lessons and realize the full potential of agrobiodiversity for nutrition, research is needed on key questions:

- What is the nutrient composition of underutilized species and landraces?
- What is the contribution of native foods from agrobiodiverse food systems to food security, micronutrient nutrition, and health? How can these linkages be enhanced?
- What are the constraints and potential opportunities for greater use of agrobiodiversity in markets?
- What relevance do sociocultural factors in traditional food systems have to agrobiodiversity promotion?

Policy actions are also needed. Policymakers should incorporate agricultural biodiversity into existing global policy tools on nutrition and health. Legislators should introduce measures to use land and other natural production resources to enhance the ability of all to make use of agrobiodiversity. Policymakers should promote local markets and facilitate access to international markets for the products of agrobiodiversity. Finally, they should strengthen the links between human and ecosystem health for the conservation of agrobiodiversity. ■

**For further reading see M. Frei and K. Becker, "Agro-Biodiversity in Subsistence-oriented Farming Systems in a Philippine Upland Region: Nutritional Considerations," *Biodiversity and Conservation* 13 (2004): 1591–1610; E. Frison, O. Smith, and M. S. Swaminathan, *UN Millennium Development Goals Five Years Later: Agricultural Biodiversity and the Elimination of Hunger and Poverty, The Chennai Platform for Action* (Rome: International Plant Genetic Resources Institute [IPGRI], 2005), [http://www.ipgri.cgiar.org/publications/pubfile.asp?ID\\_PUB=1062](http://www.ipgri.cgiar.org/publications/pubfile.asp?ID_PUB=1062); and T. Johns and B. R. Sthapit, "Biocultural Diversity in the Sustainability of Developing Country Food Systems," *Food and Nutrition Bulletin* 25 (2004): 143–155.**

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*Timothy Johns (tim.johns@mcgill.ca) is a professor in the School of Dietetics and Human Nutrition, McGill University, Montreal, Canada, and an honorary research fellow at the International Plant Genetic Resources Institute (IPGRI), Rome. Ifeyironwa Francisca Smith (f.smith@cgiar.org) is an honorary research fellow at IPGRI. Pablo B. Eyzaguirre (p.eyzaguirre@cgiar.org) is a senior scientist, Anthropology and Socioeconomics, at IPGRI.*



**International Food Policy Research Institute**

2033 K Street, N.W. • Washington, D.C. 20006-1002 • U.S.A.

Phone: +1-202-862-5600 • Fax: +1-202-467-4439 • Email: [ifpri@cgiar.org](mailto:ifpri@cgiar.org)

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