Indian J. Plant Genet. Resour. 29(3): 354-357 (2016)
DOI 10.5958/0976-1926.2016.00067.X

Rediscovering our Future: How Neglected and Underutilized Biodiverse Foods can Nourish the Planet

Gina Kennedy[1], Beatrice Ekesa[1], Danny Hunter[1], Stefano Padulosi[1], Jessica Raneri[1], Dandin Shankar[1] and Celine Termote[2]
[1]*Bioversity International, Rome, Italy*
[2]*Dandin Shankar: Bioversity International, Bengaluru, India*

The food systems we rely upon to feed the planet are under scrutiny and the results coming forth are not favouring continuing the status quo. Globally we rely on 12 crop and 5 animal species for the majority of our diet, while throughout the millennia humans have used thousands of species for nourishment. Dietary factors are the number one risk factor in the global burden of disease. These risk factors include low intakes of fruit, vegetables, nuts and seeds, and high intakes of processed meat, sodium and sugar sweetened beverages (Global Burden of Disease Study, 2015). Diet related diseases such as diabetes, high blood pressure and stroke are predicted to rise while two billion people worldwide are deficient in vitamins and minerals (IFPRI, 2016). The global food system is a major contributor to large environmental footprints, including biodiversity loss, greenhouse gas emissions, water shortages, ecosystem pollution, and land degradation (Tilman and Clark, 2014).

One approach that can help food systems better 'tap into food biodiversity' as a basis for healthier, diverse diets is to enhance the scientific evidence that demonstrates that biodiversity is important for improved dietary diversity and nutrition (Fanzo *et al*., 2013; Hunter *et al*., 2015). Increasing the scientific body of knowledge on the significant intraspecific differences in the nutrient content of most plant-source foods and other relevant food biodiversity (FAO/INFOODS, 2013a, b) is one example of how to do this. However, we still know so little about the nutritional value of most of the world's food biodiversity (Hunter *et al*., 2016). In order to address this gap countries such as Brazil, Kenya, Sri Lanka and Turkey and others are undertaking comprehensive nutritional analysis, as well as documenting associated traditional knowledge, of significant numbers of neglected and underutilized food crops and species in order to compile national food biodiversity information systems and which contribute to the global FAO/INFOODS Food Composition Database for Biodiversity (FAO/INFOODS), (2013b).

For example, Brazil is in the process of establishing the nutritional composition data of over 70 native species including baru (*Dipteryx alata*), buriti (*Mauritia vinifera*), cagaita (*Eugenia dysenterica*), mangaba (*Hancornia speciosa*) and pequi (*Caryocar brasiliense*), Umbu (*Spondias tuberosa*) from the Caatinga biome and cupuaçu (*Theobroma grandiflora*) and pupunha (*Bactris gasipaes*) among others. Kenya is focusing on indigenous leafy greens such as the Spider plant (*Cleome gynandra*), African nightshade (*Solanum scabrum*) and jute mallow (*Corchorus olitorius*) as well as fruits, insects, indigenous poultry, mushrooms and the small dried lake fish, known locally as omena (*Rastrineobola argentea*). Wild edible plants that are still widely consumed are being analysed in Turkey. Golden thistle (*Scolymus hispanicus*), chicory (*Cichorium intybus*), fennel (*Foeniculum vulgare*), wild radish (*Raphanus raphanistrum*), glasswort (*Salicornia europaea*), black-eyed and yellow-eyed cowpea (*Vigna unguiculata*) and red pine mushroom (*Lactarius deliciosus*) are being analysed for their macro- and micro-nutrient content. In Sri Lanka, seven traditional rice varieties (*Oryza sativa*)–Suwandel, Kalu heenaty, Kuruluthuda, Madathawalu, Pachchaperumal, Pokkali and Suduru Samba, five banana varieties (*Musa* spp.)–Ambul, Seeni, Kolikuttu, Anamalu and Rathabala, four varieties of yam (*Dioscorea* spp.)–Rajaala White, Rajaala purple, Kukulala and Walala, one variety of finger millet (*Eleusine coracana*), two varieties of eggplant (*Solanum melongena*)–Wambatu, and Talanabatu–and one variety of jackfruit (*Artocarpus heterophyllus*) have been selected as target species for food composition analysis largely for their food security and marketing potential.

Improving access to this kind of knowledge can make it easier for policy makers, researchers and

**Author for Correspondence: Email- g.kennedy@cgiar.og*

practitioners to facilitate change in food systems and diets in a variety of ways. For example in Brazil, it has helped realize the endorsement of a new public policy, Ordinance No. 163 'Brazilian Sociobiodiversity of Native Food Species of Nutritional Value', which for the first time formally and legally recognizes the economic and cultural value of 64 native species which are of importance to communities and family farmers. Such recognition can greatly facilitate the integration of these nutritious species into value chains, markets, public food procurement and school feeding programmes and contribute to more diverse diets. Likewise in Kenya, this kind of information has been used to mobilize the promotion of African leafy vegetables into school feeding programmes. Among the 10 priority actions identified by the Global Panel on Agriculture and Food Systems for Nutrition for transforming food systems and diets is the recommendation to institutionalize high-quality diets through public sector purchasing power including ensuring the provision of high-quality diets to schools, hospitals and prisons (Global Panel on Agriculture and Food Systems for Nutrition, 2016).

Such knowledge and information can also help add value and identify markets for food biodiversity. In Sri Lanka, under the brand name "Hela bojun – True Sri Lankan taste", nine market outlets, supported by the BFN Sri Lanka project, for the sale of traditional foods are serving freshly-prepared local food biodiversity and empowering rural women across Sri Lanka to earn a living while conserving and protecting biodiversity and making healthy food available at competitive prices. Whereas in Turkey, major supermarket companies such as Metro and Migros are exploring markets for wild food biodiversity species such as golden sow thistle as well as landraces of cultivated einkorn wheat.

Nutrition-sensitive landscapes (NSL) initiative is another example of promotion of biodiverse foods for improved nutrition. NSL is based within the context of systems research and focuses on the synergies, relationship trade-offs and feedback loops that exists between different food system factors and elements (Fig. 1). While the NSL approach brings attention between the nexus of human, landscape and ecosystem nutrition and health, it does not assume that a local food system or local food environment has the capacity to completely to satisfy all nutritional needs. However, it does allow emphasis on diversifying production systems within a landscape, while managing and supporting other ecosystems functions that directly contribute to both human health and environmental sustainability.

This multi stakeholder initiative, combining efforts from multiple CGIAR, International research and local expertise has been piloted in Kenya and Vietnam. In both sites a household surveys were undertaken that included agriculture production and nutrition dimensions and measured biodiversity and the source of all food consumed within each household. The nutrition survey was repeated over two seasons to capture seasonal variation in the diet.

Lists of locally available, yet underutilised (defined as being produced by less than 50% of surveyed households) species from the food groups that had low consumption in the diet were compiled. A key set of these crops were selected based on the community's preferences, and together barriers to production and consumption of these species were identified. Local communities then shared experiences about possible innovative solutions to overcome these barriers, in a way that empowered communities to produce and consume selected species and provide useful ecosystem services to the landscape, throughout the year. Local innovations on best-management practices, as well and adapted local recipes and nutrition education was delivered to communities through village level diversity clubs affiliated by local health workers. Local nutrition education material was adapted to integrate useful information about local agrobiodiversity that could directly contribute to improving the diversity of their diet, including seasonal availability and planting calendars, nutrition education, recipes and crop management practices. End line assessments for these sites are scheduled by December 2016 and mid-line evaluations have so far found that just over 70% of club participants are regularly implementing the new skills and knowledge gained during the clubs (including cultivating diverse foods in the homegarden, and preparing new recipes using these foods for the household).

From the wealth of neglected and underutilized plant species (NUS) recorded from every region (Padulosi *et al*., 2013; RBG Kew, 2016), research and development should strategically invest on 'low hanging fruits' crops where gap filling in knowledge and synergy building across isolated projects can lead to important outcomes in short time. To that end, important opportunities do exist across each major food crop category viz. cereals (fonio, minor millets), pseudo-cereals (Andean grains), pulses

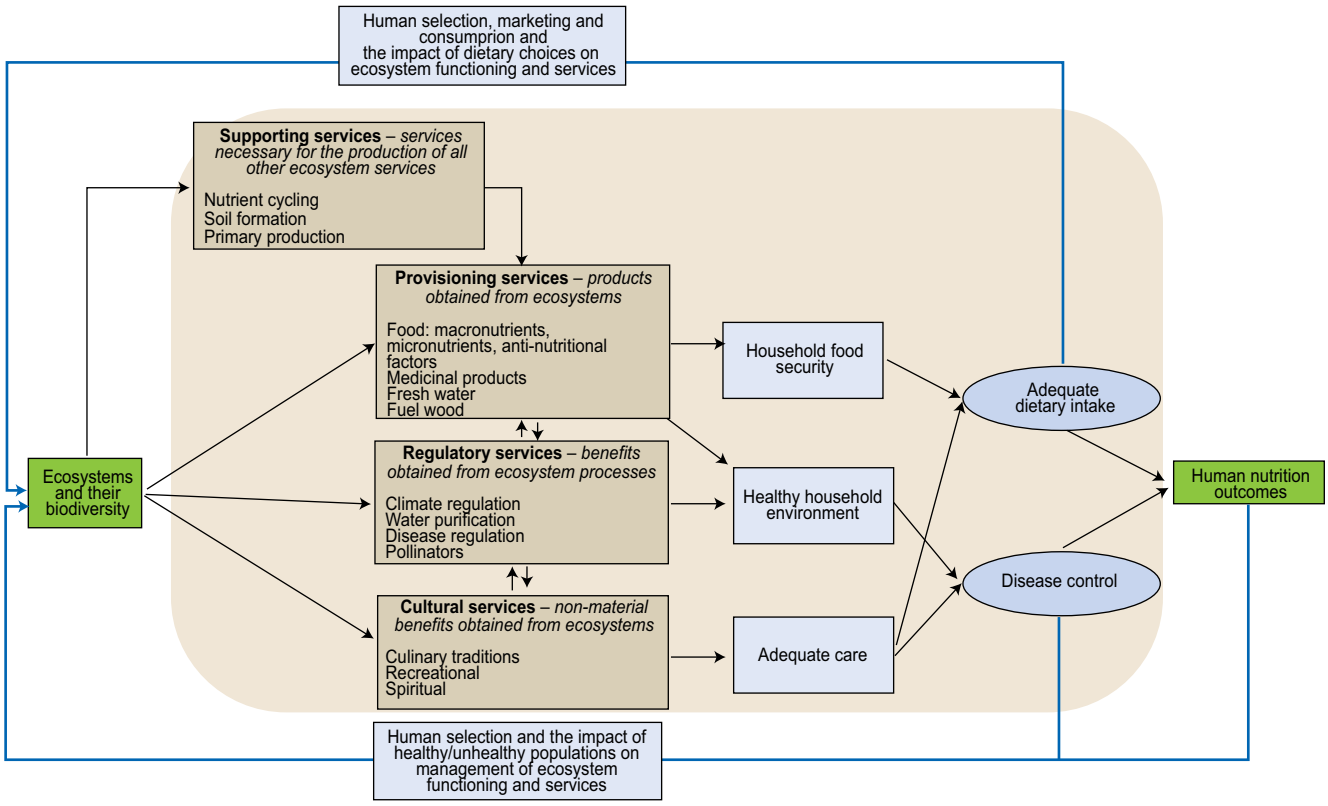

Fig. 1. Nutrition sensitive landscapes conceptual framework: a combination of the Millenium Ecosystem Assessment Framework and UNCIEF framework of nutrition determinants (Adapted from Remans and Smukler, 2013)

(bambara groundnut, tepary bean), vegetables (African leafy vegetables) and fruit species (tropical fruit trees). Issues hampering the satisfactory deployment of these species in local and national food systems range from limited availability of germplasm and lack of improved varieties, poor access to good quality seed, drudgery in cultivation and processing operations to dis-organized value chains, poor entrepreneurial skills of value chain actors, poor awareness among consumers over their nutritional benefits and absence of a supportive policy environment for their use enhancement (Padulosi *et al*., 2013, Sthapit *et al*., 2016). In the real world, crop diversification using locally adapted varieties is becoming increasingly vital to farmers to allow them to cope with climate change. Food systems offer ample opportunities for improving both supply and demand of nutrient-dense underutilized species leveraging also consumers' interest for healthier food which can connect them to cultures and territory identity. One of the strongest instruments for moving forward such a vision of resilient, diverse, healthy and sustainable food systems are Government policies on Agriculture and Food Systems for Nutrition (Global Panel, 2014; 2016) and to that regard worth of appreciation is the amendment made by India of its National Food Security Act in 2013 (Ministry of Law and Justice, 2013) aimed at including also coarse cereals (minor millets) in the National Public Distribution System.

Though different in scale and scope, these examples demonstrate how food biodiversity, or the rich and vast array of plant and animal species used for food, can be promoted in local and national programmes as the building blocks for diets that can sustain both human and planetary health.

References

FAO/INFOODS (2013a) *FAO/INFOODS Report on the Nutrition Indicator for Biodiversity – Global Progress Report*. FAO: Rome. Available at: http://www.fao.org/docrep/019/i3559e/i3559e.pdf

FAO/INFOODS (2013b) *FAO/INFOODS Food Composition Database for Biodiversity Version* 2.1 –BioFoodComp2.1. FAO, Rome.

Fanzo J, D Hunter, T Borelli and F Mattei F (eds) (2013) *Diversifying Food and Diets: Using Agricultural Biodiversity to Improve Nutrition and Health*. Issues in Agricultural Biodiversity, Earthscan, UK.

Global Burden of Disease Study (2013) Collaborators: MH Forouzanfar, L Alexander, HR Anderson, VF Bachman, S Biryukov, M Brauer, R Burnett, D Casey, MM Coates, A Cohen (2015) Global, Regional and National Comparative Risk Assessment of 79 Behavioural, Environmental and Occupational and Metabolic Risks or Clusters of Risks in 188 Countries, 1990–2013: A Systematic Analysis for the Global Burden of Disease Study 2013. The Lancet, 386, 2287-323, doi: 10.1016/S0140–6736(15)00128-2.

Global Panel on Agriculture and Food Systems for Nutrition (Global Panel) (2014) How Can Agriculture and Food System Policies Improve Nutrition? Tech. Brief, London, UK.

Global Panel on Agriculture and Food Systems for Nutrition (2016) *Food Systems and Diets: Facing the Challenges of the 21st Century*. London, UK.

Hunter D, B Burlingame and R Remans *et al.* (2015) Biodiversity and Nutrition. In: WHO/CBD. *Connecting Global Priorities: Biodiversity and Human Health: A State of Knowledge Review*.

Hunter *et al.* (2016) Enabled or diabled: is the environment right for using biodiversity to improve nutrition? Frontiers in Nutrition **3:** 1-6.

IFPRI (2016a) Global nutrition report 2016: From promise to impact: Ending malnutrition by 2030. IFPRI, Washington, DC.

Ministry of Law and Justice (2013) The National Food Security Act. The Gazette of India. New Delhi. 10 September 2013. http://indiacode.nic.in/acts-in-pdf/202013.pdf. Retrieved 6 October 2016.

Padulosi S, J Thompson and P Rudebjer (2013) Fighting Poverty, Hunger and Malnutrition with Neglected and Underutilized Species *(NUS): Needs, Challenges and the Way Forward. Bioversity International, Rome, 56 pp. ISBN 978-92-9043-941-7. http://bit.ly/1Pjg7AdKahane R, T Hodgkin.

RBG Kew (2016) *The State of the World's Plants Report-2016*. Royal Botanic Gardens, Kew.

Rockström J, WL Steffen, K Noone, Å Persson, FS Chapin III, E Lambin and J Foley (2009) Planetary boundaries: exploring the safe operating space for humanity.

Sthapit B, HAH Lamers, V Ramanatha Rao and A Bailey (eds) (2016) Tropical Fruit Tree Diversity. Good Practices for *in situ* and *On-farm* Conservation. New York: Routledge, 2016.

Tilman D and M Clark (2014) Global diets link environmental sustainability and human health. *Nature* **515(7528):** 518-522.