Living Links Connecting the United Nations Sustainable Development Goals: Small-scale Farmers and Agricultural Biodiversity

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ABSTRACT

The 17 Sustainable Development Goals (SDGs) and Agenda 2030 adopted by the global community in September 2015 are applicable to all countries with the commitment "that no one is left behind." As an agenda for "people, planet, prosperity, peace and partnership", Agenda 2030 provides a vision for people and planet-centered, human rights-based, and gender-sensitive sustainable development. It promises "more peaceful and inclusive societies" which are free from fear and violence.

Small scale farmers and agricultural biodiversity are critical to the achievement of aspects of most of the SDGs. In addition to being essential for the resilience and stability of agricultural production systems and our ability to adapt to climate change and other stressors; agricultural biodiversity is fundamental to the livelihoods, health and nutrition of billions Despite its importance to the health of both people and the planet, this broad understanding of what agricultural biological diversity is and the critical role played by its custodians, gets no explicit mention in the SDGs. In fact, awareness of this is low outside specialized institutions and agreements and explicit mention of both is rare in the context of sustainable development

This paper uses the example of small-scale farmers and agricultural biodiversity to illustrate how they are the living links amongst the SDGs as well as being critical components in their achievement and to the vision of Agenda 2030.

Keywords: Gender, Agrobiodiversity, Agriculture, Food Systems, Climate Change, Malnutrition, Hunger, Biodiversity, Small-scale Farmers, Sustainable Development Goals, United Nations

INTRODUCTION

The 17 Sustainable Development Goals (SDGs) and Agenda 2030 adopted by the global community in September 2015 apply to all countries with the commitment "that no one is left behind."[1] Both Agenda 2030 and the SDGs strongly reflect the human rights principles and standards. As an agenda for planet, people, peace, partnership and prosperity, Agenda 2030 provides a vision for people and human rights-based, gender sensitive and planet-centered and sustainable development.[2] It promises more peaceful and inclusive societies which are free from fear and violence.[3]

Each Goal has specific targets to achieve in the next 15 years.[4] In 2016, the United Nations Statistical Commission's Interagency and Expert Group on SDG Indicators agreed on 230 individual indicators to monitor the SDGs and its 169 targets.[5] These are a work in progress because roughly half of them lack a standard country coverage, agreed-upon methodologies, or both.

Target 17.14 of the SDGs commits all UN Member States to pursue policy coherence and a favorable environment for

[1] United Nations, General Assembly resolution 70/1, *Transforming our world: the 2030 Agenda for Sustainable Development*, A/RES/70/1, pmbl. (Oct. 15, 2015), https://sustainabledevelopment.un.org/post2015/transformingourworld.

[2] *Id.*

[3] *Id.* at ℙ 17.

[4] *About the Sustainable Development Goals*, United Nations, http://www.un.org/sustainabledevelopment/sustainable-development-goals/ (Last accessed Dec. 12, 2018)

[5] *230 Indicators Approved for SDG Agenda*, Ctr. for Global Dev. (Mar. 15, 2016), https://www.cgdev.org/blog/230-indicators-approved-sdg-agenda.

sustainable development by all actors and at all levels.[6] In other words, one problem cannot be solved by creating another now or in the future. It is no longer sufficient for a state, intergovernmental institution or treaty to assert that something is not their mission or responsibility, if what they do negatively affects one of the SDGs.[7]

The United Nations established a High-level Political Forum (HPLF) as a central platform for review and follow-up of the 2030 Agenda for Sustainable Development.[8] The HPLF met for the first time in July 2016 and meets annually in the summer.[9] It establishes a theme for each session, reviews voluntary national reports and starting its July 2017 session began considering the implementation of specific SDGs.[10]

Most goal areas are interlinked, and many targets may contribute to several goals. At the same time, if pursued separately, action to meet one target could have unintended consequences on others. So, for example, to achieve SDG 8 "Decent work and economic development" a country might choose to orient its agriculture sector towards exporting in a global market. Without complementary measures, this could have negative consequences on:

- SDG 2 *Zero Hunger*[11] by decreasing dietary diversity and hence the nutritional status of the producers, particularly in the exports are in non-food crops;
- SDG *3 Good health and well-being*[12]the focus on export production erodes both wild and domesticated biological diversity. These resources are relied upon by billions of people for health and nutrition.
- SDG 5 *Gender Equality* [13] when the economic opportunity results in male producers being displacing female producers (which also has an impact on the nutritional status of the household)
- SDG 13 *Climate Action* [14] because the erosion of agricultural diversity reduces resiliency and threatens the foundation for the ability to adapt climate change and other stressors;
- SDG 15 *Life on Land* [15] by eroding wild and domesticated biological diversity.

Small scale farmers [16] and agricultural biodiversity [17] are critical to the achievement of aspects of most of the SDGs. In addition to being essential for the resilience and stability of agricultural production systems and our ability to adapt to climate change and other stressors; agricultural biodiversity is fundamental to the livelihoods, health, and nutrition of billions.[18] (see box 1)

Regardless of its significance to the health of both humans and planet Earth, this comprehensive understanding of what agricultural biological diversity is and the critical role played by its custodians gets no explicit mention in the Sustainable Development Goals.[19]Awareness of this is low outside specialized institutions and agreements, and explicit mention of both is rare in the context of sustainable development.

This paper uses the example of small-scale farmers and agricultural biodiversity to illustrate how they are living links amongst the SDGs as well as being critical components in their achievement and to the vision of Agenda 2030. Current trends render the ambition of Agenda 2030 and its SDGs unachievable within the timeframe established by the Agenda.[20] According to the World Food Programme's Zero Hunger project 821 million people globally go to sleep on an empty stomach each night.[21] This statistic translates to one in nine people.[22] In 2005 the International Food Policy Research Institute began calculating a Global Hunger Index to analyze global hunger and draw attention to countries and regions that

[6] *17.14 enhance policy coherence for sustainable development*, Ctr. for Global Dev.,

http://indicators.report/targets/17-14/ (Last accessed March 30, 2019)

7 *Id*.

[8] *High-Level Political Forum, Introduction*, United Nations, https://sustainabledevelopment.un.org/hlpf (Last accessed Dec. 12, 2018).

[9] *Id.*

[10] *Id.* at *SDGs Follow-up and Review.*

[11] Each SDG has an abbreviated version and the longer title. *See About the Sustainable Development Goals, supra* note 4 (listing abbreviations for each SDG); *Sustainable Development Goals,* United Nations, https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals (Last accessed Dec. 12, 2018) (listing full titles for each SDG).

[12] *Sustainable Development Goals supra* note 11.

[13] *Id.*

[14] *Id.*

[15] *Id.*

[16] United Nations, Expert Group Meeting on Nutrition and SDSs Under Review in Preparation for the High-Level Political Forum 21 (2018). "Small-scale farmers," as used in this paper, includes family farmers, pastoralists, primary and small-scale producers, foresters, fisherfolk.

[17] "[Agricultural biodiversity] includes the variety and variability of animals, plants and micro-organisms at the genetic, species and ecosystem levels, which sustain the functions, structure and processes of production systems. It also includes crop varieties, fodder and tree species, animal breeds, aquatic and marine species, soil biota, pollinators and the great diversity of non-domesticated (wild) species used by people . . . [Agricultural biodiversity] is created and managed by farmers, pastoralists, forest dwellers and fishers, and remains essential to the lives of indigenous peoples and other small-scale food providers who produce and gather most of the world's food." Platform for Agrobiodiversity Research, Landscapes for Agrobiodiversity 2 (2016).

[18] *Id.*; *see also* Expert Group Meeting on Nutrition and SDSs Under Review in Preparation for the High-Level Political Forum 21–22 (2018).

[19] *See Sustainable Development Goals*, *supra* note 11.

[20] The State of Food Security and Nutrition in the World 2017, FAO, IFAD, UNICEF, WFP & WHO vi–vii (2017).

[21] Zero Hunger, World Food Program, https://www1.wfp.org/zero-hunger (Last accessed January 10, 2019)

[22] *Id.*

were struggling with these issues was more pronounced.[23] It's 2014 report focused on hidden hunger, also referred to as micronutrient deficiencies. The report states that hidden hunger afflicts more than 2 billion individuals.[24] This translates to one in three people, globally.[25] The 2017 State of Food and Nutrition Security in the World Report alerted the world community that 2016 saw the first increase in the number of hungry people in a decade.[26] The 2018 State of Food and Nutrition Security in the World Report confirms a continuing upsurge in global hunger: there has been a continuous growth, in the past three years, in the number of people who suffer from hunger, going back to levels from almost a decade ago.[27] Different forms of malnutrition have emerged in several countries: adult obesity is on the rise even as forms of under nutrition persist.[28]

The modern industrial food system that emerged after World War II has, in many ways, radically altered the way food is produced, processed, packaged, distributed, sold and consumed in many, and in increasing, parts of the world.[29] Industrial agriculture is an intensive, high-input, linear system focusing on improving production and yields without regard for the environmental, social or health costs.[30] The emphasis on production and yields leads to concentration on a smaller number of crops, decreasing not only dietary diversity but the nutritional value of the diminished number of crops grown.[31]

Furthermore, the environmental impact of these agricultural methods, in the long run, produces a more sizeable cost than can be sustained over time. Industrial agriculture is the single greatest user of freshwater resources on the planet and the most significant driver of biodiversity loss.[32] Given its dependence on fossil fuels and agro-chemicals, agriculture is well-known as one of the major contributors to climate and land-use change.[33]

Also, the modern industrial system undermines the food and nutrition security and the biological resources upon which it ultimately depends.[34] The loss of on-farm diversity depletes the very resources that are the foundation of the ability to adapt to global environmental change.[35] Moreover, the abandonment of diverse farm management practices associated with the arrival of industrial agriculture erodes small-scale farmers' capacity to innovate in response to ecological and socio-economic changes.[36]

To achieve the vision of Agenda 2030 requires constraining industrial agriculture. As this paper hopes to illustrate, the good news is supporting small-scale farmers in expanding agroecological principles, tools, and technologies and enhancing biological diversity can address these challenges and achieve better socioeconomic outcomes (see Box 2 for the 10 Elements of Agroecology developed through regional seminars by the Food and Agriculture Organization and published in 2018).[37] The elements are intended to guide countries towards a transformation of their food and agricultural systems, to mainstream sustainable agricultural practices in a considerable way and to achieve Zero Hunger as well as other multiple SDGs [38] and Six Principles of Agroecology published by the Alliance for Food Sovereignty for Africa. (AFSA) [39]

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[23] http://www.ifpri.org/publication/concept-global-hunger-index-1 (Last accessed January 10, 2019)

[24] Int'l Food Policy Research Inst., Global Hunger Index: The Challenge of Hidden Hunger 21 (2014) pg. 5. http://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/128360/filename/128571.pdf (Last accessed January 9, 2019)

[25] *Id.*

[26] The State of Food Security and Nutrition in the World 2017, *supra* note 20, at vi.

[27] FAO, IFAD, UNICEF, WFP and WHO. 2018. The State of Food Security and Nutrition in the World 2018 Building climate resilience for food security and nutrition. Rome, FAO.

[28] *Id. Pg 13*

[29] Susan Bragdon and Carly Hayes. Re-conceiving public-private partnerships to eradicate hunger: recognizing small-scale farmers and agricultural biological diversity as the foundation of global food security, Georgetown International Law Review, Vol. 49, Issue 4 (2019 in press)

Gina Kennedy et al., *Globalization of Food Systems in Developing Countries: A Synthesis of Country Case Studies*, FAO (2004), http://www.fao.org/3/a-y5736e.pdf.

[30] The ETC Group, *Who Will Feed Us? Ths industrial food chain versus the peasant food web.* 3rd edition, 2017 at http://www.etcgroup.org/sites/www.etcgroup.org/files/files/etc-whowillfeedus-english-webshare.pdf (Last accessed January 7, 2019).

[31] Donald R Davis et al., *Changes in USDA Food Composition Data for 43 Garden Crops, 1950 to 1999*, 23 J. Am. Coll. Nutr. 669, 669–82 (June 18, 2013), http://www.tandfonline.com/doi/abs/10.1080/07315724.2004.10719409

[32] Id. Note 30 supra. Jonathan A. Foley et al., *Solutions for a Cultivated Planet*, 487 Nature 337, 337-42 (2011).

[33] *Id.*

[34] Olivier de Schutter, Special Rapporteur on the Right to Food, *Human Rights Council on Its Twenty-Fifth Session*, U.N. Doc. A/HRC/25/57 (Jan. 24, 2014).

[35] Frison, E.A.; IPES-Food. (2016) From uniformity to diversity: a paradigm shift from industrial agriculture to diversified agroecological systems. Louvain-la-Neuve (Belgium): IPES, 96

[36] Susan H. Bragdon and Chelsea Smith (2015), *Small-scale farmer innovation*, (Quaker United Nations Office, Geneva) pg 3-4. At https://quno.org/sites/default/files/resources/SSF%20Innovation%20WEB.pdf (Last accessed January 9, 2019)

Chelsea Smith et al. (2015), *Realizing the Right to Food in an Era of Climate Change: The Importance of Small-scale Farmers*, Quaker U.N. Org.. At http://quno.org/sites/default/files/resources/Realizing%20the%20right%20to%20food%20in%20an%20era%20of%20climate%20change.pdf. (Last accessed January 9, 2019)

[37] http://www.fao.org/agroecology/knowledge/10-elements/en/ (Last accessed January 9, 2019)

[38] http://www.fao.org/3/I9037EN/i9037en.pdf (Last accessed January 9, 2019).

[39] http://afsafrica.org/wp-content/uploads/2017/02/Agroecology-the-bold-future-of-farming-in-Africa-ebook1.pdf (Last accessed October 24, 2018)

While it is possible to establish a tie between all the SDGs and small-scale farmers and agricultural biodiversity, Section II of this Note explores the connections that are most direct and clear. These include: SDG 1 *End Poverty*, SDG 2 *Zero Hunger*, SDG 3 *Good Health and Well-being*, SDG 5 *Gender Equality,* SDG 6 *Clean Water and Sanitation,* SDG 7 *Affordable Clean Energy,* SDG 8 *Decent Work and Economic Growth,* SDG 11 *Sustainable Cities and Communities,* SDG 12 *Sustainable Production and Consumption,* SDG 13 *Climate Action*, SDG 15 *Life on Land* and SDG 16 *Peace, Justice and Strong Institutions*. The subsections contain varying degrees of detail reflecting the directness of the connection. As a conclusion, Section III discusses the challenges to the integrated implementation of the SDGs and the skills, expertise, and orientation that will be needed to make it a reality.

Text for a Box 1:[40]

- Most developing countries are agriculture-based economies where small-scale farmers account for 75% or more of agricultural production and over 75% of employment.[41]
- The world's 1.5 billion small-scale farmers produce at least 70% of the food we consume. In many developing countries the figure is higher; they locally produce between 75%-90% of staple food.[42]
- Agricultural biodiversity continues to evolve through the work of small-scale farmers. These serve as contributing factors to the stability and resilience of the systems of agricultural production.[43] They not only provide control mechanisms but also genetic security to be used in the adaptation to unpredictable changes in rainfall patterns and temperatures.[44] These communities and resources are particularly significant because of the role they play in being able to adapt production systems to the effects of climate change the instability it creates.
- Agricultural biodiversity and farmers' knowledge and innovative practices offer social and economic opportunities that contribute to livelihoods and social and cultural values.[45]
- Through its direct use, agricultural biodiversity contributes significantly to health and nutrition. According to The World Health Organization, approximately 80% of populations in most developing countries rely on genetic resources for primary health care."[46]
- Ecological processes like pollination, nutrient cycling, water maintenance, "soil fertility, seed dispersal, and pollination rely to a lesser or greater extent on agricultural biodiversity."[47]
- *In situ* agricultural biodiversity continues to be conserved and developed by farmers who maintain the associated traditional - and evolving - knowledge. These resources and information are integral to breeding and crop improvements that have potentially global implications.

Text for Box 2

The Food and Agriculture Organization's 10 Interlinked and Interdependent Elements of Agroecology

1. Diversity;
2. Co-creation and sharing of knowledge
3. Synergies
4. Efficiency
5. Recycling
6. Resilience
7. Human and social values
8. Culture and food traditions
9. Responsible governance
10. Circular and Solidarity

From http://www.fao.org/agroecology/knowledge/10-elements/en/

The Six Agroecological Principles by Alliance for Food Sovereignty in Africa

1. Enhance the recycling of biomass with a view to optimizing organic matter decomposition and nutrient cycling over time.

2. Strengthen the "immune system" of agricultural systems through the enhancement of functional ***biodiversity***, using natural enemies, antagonists, etc.

[40] *Focus on small-scale farming: food or jobs?*, Int'l Inst. for Env't & Dev. (May 31, 2012), https://www.iied.org/focus-small-scale-farming-food-or-jobs.

[41] Samberg, L., Gerber, J., Ramankutty, N., Herrero, M., & West, P. (2016). Subnational distribution of average farm size and smallholder contributions to global food production *Environmental Research Letters, 11* (12) DOI: 10.1088/1748-9326/11/12/124010

[42] A Viable Food Future, Utviklingsfondet/The Dev. Fund, Norway 42 (2011).

[43] T.C.H. Sunderland, *Food security: why is biodiversity important?*, 13(3) Int'l Forestry

Rev. 265, 267 (2011).

[44] *Id.* at 269.

[45] Nienke Beintema et al., *International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD) Global Summary for Decision Makers* 16, http://www.wecf.eu/download/2008/Global_SDM_130408_FINAL.pdf (Last accessed Dec. 12, 2018); *Food and Agriculture: The future of sustainability*, U.N. Dep't of Econ. and Soc. Affairs 43, http://www.un.org/esa/dsd/dsd_sd21st/21_pdf/agriculture_and_food_report.pdf (Last accessed Dec. 12, 2018).

[46] T.C.H Sunderland, *supra*, note 40, at 266 (citing C.N. Herndon & R.A. Butler, *Significance of Biodiversity to Health*, 42(5) BIOTROPICA 558, 558 (2010)).

[47] *Id.* (citing Lori Ann Thrupp, *Linking Agricultural Biodiversity and Food Security: The Valuable Role of Sustainable Agriculture*, 76(2) Int'l Affairs 265, 268 (2000); Tim G. Benton, *Managing Farming's Footprint on Biodiversity*, 315 Science 341, 341–42 (2007), http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.466.1109&rep=rep1&type=pdf).

3. Provide the most favorable soil conditions for plant growth, particularly by managing organic matter and enhancing soil biological activity.

4. Minimize losses of energy, water, nutrients and ***genetic resources*** by enhancing conservation and regeneration of soil and water resources, and agrobiodiversity.

5. ***Diversify species and genetic resources*** in the agroecosystem over time and space at the field and landscape level.

6. Enhance beneficial biological interactions and synergies among the components of ***agrobiodiversity***, thereby promoting key ecological processes and services.

Note: Agroecological principles take different technological forms depending on the biophysical and socio-economic circumstances of each farmer or region. [highlights/emphasis of agricultural biodiversity are the author's.]

From https://afsafrica.org/wp-content/uploads/2017/02/Agroecology-the-bold-future-of-farming-in-Africa-ebook1.pdf page 8

End of box 2

THE INTERRELATIONSHIPS AMONGST SMALL-SCALE FARMERS, AGRICULTURAL BIODIVERSITY AND THE SDGS

SDG 1: "End poverty in all its forms everywhere"[48]

Over 50% of people now live in urban areas, a proportion that is expected to increase to 66 percent by 2050.[49] Nevertheless, in the two regions with the highest rates of poverty – sub-Saharan African and South Asia – "57 percent and 60 percent respectively of the population will still be rural in 2025 with these rural populations continuing to grow for many years."[50]

In all regions of the world rates of poverty and hunger are higher in rural areas than in urban areas.[51] Many of these are small-scale farmers. The paradox is that while small-scale farmers contribute so much to global food security (see discussion under SDG 2 below), they are often poor or extremely poor, and food insecure themselves.[52] Small-scale farmers support the livelihoods of some 2.5 billion people and manage a large part of the world's natural resources, including agricultural biodiversity.[53] Agricultural biodiversity and the small-scale farmers who maintain and develop these resources contribute to improving livelihoods through providing a foundation for household food and nutritional security and offering opportunities for income generation.[54] Also, agricultural biodiversity can decrease both the probability of a non-poor household from sinking into poverty as well as the probability that a poor household will remain rooted in poverty[55].

While in most parts of the world, farming remains a private activity implemented by small-scale local farmers; their innovations, such as the progressive development of agricultural biodiversity through their practices, are in the public interest. If it is in the global public interest that small-scale farmers continue to manage and develop agricultural biodiversity *in situ* and on-farm, then incentives and support are needed. There is need for a change in the policies, institutional constraints, and other issues that destabilize small-scale farmers and farming communities and challenge the full deployment of agricultural biodiversity. Rural life must become an attractive option rather than a commitment to poverty.

SDG 2: "End hunger"[56]

SDG 2, target five directly addresses the conservation of agricultural biodiversity and calls for the "genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species" to be maintained.[57]

The world's 1.5 million small-scale farmers produce at least 70% of the food we consume.[58] In many developing countries, the number is higher with between 75%-90% of staple food being locally produced by small-scale farmers.[59]

[48] https://www.un.org/sustainabledevelopment/poverty

[49] *World Urbanization Prospects: The 2014 Revision*, U.N. DEP'T OF ECON. AND SOC. AFFAIRS, ST/ESA/SER.A/366 https://esa.un.org/unpd/wup/Publications/Files/WUP2014-Report.pdf (Last accessed Dec. 12, 2018).

[50] *The IFAD Strategic Framework 2016-2025*, INT'L FUND FOR AG. DEV. 10, https://www.ifad.org/documents/38714170/39132730/IFAD+Strategic+Framework+2016-2025/d43eed79-c827-4ae8-b043-09e65977e22d. (Last accessed Dec. 12, 2018).

[51] It will be important to shift the narrative away from the urban bias seen in development policy where the needs of the urban poor are prioritized over the rural poor. *See e.g.*, MICHAEL LIPTON, WHY POOR PEOPLE STAY POOR: THE URBAN BIAS IN GLOBAL DEVELOPMENT 13, 15 (Harvard Univ. Press 1977) (discussing the problems associated with urban-bias and the hardships it has created for the rural poor) https://www.foreignaffairs.com/reviews/capsule-review/1977-07-01/why-poor-people-stay-poor-urban-bias-world-development (Last accessed Dec.12, 2018).

[52] *Smallholders and Family Farmers*, U.N. FOOD & AG. ORG., http://www.fao.org/fileadmin/templates/nr/sustainability_pathways/docs/Factsheet_SMALLHOLDERS.pdf (Last accessed January 14, 2019).

[53] *Id.* See, also https://www.ifad.org/documents/38714170/39132730/IFAD+Strategic+Framework+2016-2025/d43eed79-c827-4ae8-b043-09e65977e22d pg 10

[54] *Id.*

[55] Michler JD, Josephson AL (2017) To specialize or diversify: agricultural diversity and poverty dynamics in Ethiopia. World Development 89:214 – 226.

[56] https://www.un.org/sustainabledevelopment/hunger/

[57] https://www.un.org/sustainabledevelopment/hunger/

[58] KARLA D. MAASS WOLFENSON, U.N. FOOD & AG. ORG, COPING WITH THE FOOD AND AGRICULTURE CHALLENGE: SMALLHOLDER'S AGENDA 22, http://www.fao.org/fileadmin/templates/nr/sustainability_pathways/docs/Coping_with_food_and_agriculture_challenge__Smallholder_s_agenda_Final.pdf (Last accessed Dec. 12, 2018).

[59] Staples production: efficient 'subsistence' smallholders are key to poverty reduction, development, and trade Michael Lipton, Research

We are losing biological diversity at an alarming rate[60]yet of all this loss the most critical to humanity is the loss of agricultural biodiversity. Without this diversity, we will eventually lose our ability to produce food and feed ourselves; hence it's very directly affects our survival.[61] As will be discussed under the SDGs that follow, agricultural biodiversity provides direct benefits for nutrition [62] and health, resilience and stability and significant ecological functions like nutrient cycling, soil formation, water cycling, and purification.[63] The aspect emphasized here is agricultural biodiversity as a source of genetic diversity.

Genetic diversity, and the genetic adaptations they have for different environments and diseases is the raw material for evolution. Species do not go extinct when the last representative dies: a species goes extinct when it loses its ability to evolve.[64] When rice and wheat lose genetic diversity, they are in the process of becoming extinct even if we have millions of acres planted in each crop.[65]

These resources are vital globally in seed banks. CIMMYT, for example, has the biggest collection of varieties of wheat and maize seed in the world; a climate controlled vault acts as storage for more than 175,000.[66] But much more material is found in farmer's fields mainly in developing countries, [67]here seeds are adapting naturally, or are being bred by farmer-breeders to adapt, [68] to changes in temperature, rain, [69] drought, more saline soils, [70] new pests and diseases, [71] all conditions exacerbated, if not caused, by climate change.[72] For example, higher levels of sorghum and millet diversity in West Africa has allowed local populations to adapt to increased periods of drought.[73] The diversity of varieties of rice in Nepal and apples in Uzbekistan have reduced the risk of crop loss to

Professor of Economics, Sussex University. Brighton, England UNCTAD Global Commodities Forum, Palais des Nations, Geneva, 18-19 March, 2013. Available at: http://unctad.org/meetings/en/Presentation/SUC_GCF2013_18-03-2013_Michael-LIPTON_Study.pdf (Last accessed January 21, 2019)

[60] "The rapid loss of species we are seeing today is estimated by experts to be between 1,000 and 10,000 times higher than the natural extinction rate . . . Unlike the mass extinction events of geological history, the current extinction challenge is one [human beings] appear to be almost wholly responsible." *How many species are we losing?*, World Wildlife Fund, http://wwf.panda.org/about_our_earth/biodiversity/biodiversity/ (Last accessed Dec. 12, 2018).

[61] *How does Biodiversity loss affect me and everyone else?*, World Wildlife Foundation, http://wwf.panda.org/our_work/biodiversity/biodiversity_and_you/ (Last accessed Dec. 12, 2018).

[62] SDG 2 has an ambitious target of ending all forms of malnutrition by 2030. *Sustainable Development Goals*, *supra* note 11. The relationship between agricultural biodiversity, nutrition, health and well-being is discussed, *infra*, in section II.C on SDG 3.

[63] 2017 HLPF Thematic Review, *supra* note 51, at 6–7.

[64] *See* Peter F. Gammelby, *Mammals Cannot Evolve Fast Enough to Escape Current Extinction Crisis*, Aarhus Univ. (Oct. 15, 2018), http://scitech.au.dk/en/about-science- and-technology/current-affairs/news/show/artikel/mammals-cannot-evolve-fast-enough-to-escape-current-extinction-crisis/ (finding that when animals cannot evolve quickly enough to match the changing environment, they become extinct).

[65] See, Susan H. Bragdon (2017), The *Foundations of Food Security: Ensuring support to small-scale farmers managing agricultural biodiversity* Geneva. Quaker United Nations Office. Available at: http://quno.org/sites/default/files/resources/FS%20foundation_FINAL_UPDATED.pdf Last accessed October 24, 2018)

[66] http://www.cimmyt.org/seeds-of-discovery/ (Last accessed October 24, 2018).

[67] Brush, S. B. 2004. *Farmers' Bounty: Locating Crop Diversity in the Contemporary World*, New Haven, NY, USA: Yale University Press. Jarvis, D. I., Zoes, V., Nares, D. and Hodgkin, T. 2004. On-farm management of crop genetic diversity and the convention on biological diversity's programme of work on agricultural biodiversity. *Plant Genet. Resour. Newsl.*, 138: 5–17. Bezançon, G., Pham, J. L., Deu, M., Vigouroux, Y., Sagnard, F., Mariac, C., Kapran, I., Mamadou, A., Gérard, B., Ndjeunga, J. and Chantereau, J. 2009. Changes in the diversity and geographic distribution of cultivated millet (*Pennisetum glaucum* (L.) R. Br.) and sorghum (*Sorghum bicolor* (L.) Moench) varieties in Niger between 1976 and 2003. *Genet. Resour. Crop Ev.*, 56: 223–236.

[68] Barry, M. B., Pham, J. L., Noyer, J. L., Courtois, B., Billot, C. and Ahmadi, N.2007. Implications for *in situ* genetic resource conservation from the ecogeographical distribution of rice genetic diversity in Maritime Guinea. *Plant Genet. Resour.*, 5: 45–54. Hajjar, R., Jarvis, D. I. and Gemmill, B.2008. The utility of crop genetic diversity in maintaining ecosystem services. *Agric. Ecosyst. Environ.*, 123: 261–270.
Sawadogo, M., Ouedraogo, J., Belem, M., Balma, D., Dossou, B. and Jarvis , D. I.2005. Components of the ecosystem as instruments of cultural practices in the in situ conservation of agricultural biodiversity. *Plant Genet. Resour. Newsl.*, 141: 19–25.

[69] Duc, G., Bao, S., Baum, M., Redden, B., Sadiki, M., Suso, M. J., Vishniakova, M. and Zong, X. 2010. Diversity maintenance and use of *Vicia faba* L. genetic resources. *Field Crop Res.*, 115: 270–278. Bhandari, B. 2009. *Summer Rainfall Variability and the Use of Rice (Oryza Sativa L.) Varietal Diversity for Adaptation: Farmers' Perceptions and Responses in Nepal*, Uppasala, Sweden: Master Thesis. CBM Swedish Biodiversity Centre.

[70] Brown, A. H. D. and Hodgkin, T. 2007. "Measuring, managing, and maintaining crop genetic diversity on farm". In *Managing Biodiversity in Agricultural Ecosystems.*, Edited by: Jarvis, D. I., Padoch, C. and Cooper, H. D. Rome, Italy: International Plant Genetic Resources Institute. Swift, M. J., Izac, A. M. N. and van Noordwijk, M. 2004. Biodiversity and ecosystem services in agricultural landscapes—are we asking the right questions?. *Agric. Ecosyst. Environ.*, 104: 113–134.

[71] Finckh, M. R. and Wolfe, M. S. 2006. "Diversification strategies". In *The Epidemiology of Plant Disease*, Edited by: Cooke, B. M. 269–308. NY, USA: Springer. Abate, T., van Huis, A. and Ampofo, J. K. O.2000. Pest management strategies in traditional agriculture: An African perspective. *Ann. Rev. Entomol*, 45: 631–659. Strange, R. N. and Scott, P. R. 2005. Plant disease: a threat to global food security. *Ann. Rev. Phytopathology*, 43: 83–116.

[72] Dai Aiguo. Drought under global warming: a review. *WIREs Clim Change* 2011, 2: 45-65. doi: 10.1002/wcc.81 Rajib Karmakar, Indranil Das, Debashis Dutta and Amitava Rakshit, 2016. Potential Effects of Climate Change on Soil Properties: A Review. *Science International, 4: 51-73*. University of New South Wales. "The long dry: Why the world's water supply is shrinking." ScienceDaily. ScienceDaily, 13 December 2018. Pamela Anderson et. al (October 2004) *Emerging Infectious Disease of Plants:Pathogen Pollution, Climate Change and Agrotechology Drivers.*TRENDS in Ecology and Evolution Vol 19, No. 10.

[73]
Kouressy, M., Traoré, S., Vaksmann, M., Grum, M., Maikano, I., Soumaré, M., Traoré, P.
S., Bazile, D., Dingkuhn, M., Sidibé, A., Bazile, D. and Weltzien, E. 2008. Adaptation of Malian sorghums to climate variability. *Cah. Agric.*, 17(2): 95–100

small scale farmers.[74] The global community and farmers will continue to rely on crop varieties and wild species related to domestic crops because of their tolerance, resistance and immunity to stressors.[75] Furthermore, small-scale farmers are not static holders of unchanging knowledge, materials or management practices and more than agricultural biodiversity in their fields is a static collection of resources. Farmers have dynamic systems of experimentation and have knowledge associated with the growth of these crop seeds.

To promote sustainable agriculture means understanding the processes involved in the production of the food on our plates, where it came from, and future production strategies in terms of where and how. There are increasing calls for supporting models of agriculture based on diversifying farms and farming landscapes, replacing chemical inputs, optimizing biodiversity and stimulating interactions between different species, as part of holistic strategies to build long term fertility, healthy agro-ecosystems and secure livelihoods, i.e., diversified agroecological systems.[76] Small-scale farmers and agricultural biodiversity are fundamental components of an agro-ecological approach to agriculture. Hence, feeding and nourishing humanity in the face of climate change and doing so sustainably – the core of SDG 2 -- depends on the world's small-scale farmers maintaining and developing agricultural biodiversity.[77]

It is important to note that genetic diversity is only part of the meaning when we refer to agricultural biodiversity. Established international law defines agricultural biodiversity as diversity at the genetic, species and ecosystem levels.[78] Achieving SDG 2 requires this broader view and an explicit connection to other SDGs including SDG 15 and its call to halt the loss of biological diversity. SDG 2.5 reflects the classical view of agricultural biodiversity as genetic diversity and as a source of traits for breeding and crop improvement.[79] This reflection is true and fundamental, but in implementing SDG 2 as part of the package of SDGs, it is necessary to be clear that agricultural biodiversity offers much more than traits for breeding. In providing the basis for dietary diversity, agricultural biodiversity is a substantial contributor to nutrition and health in its direct use (SDG 3).[80] Agricultural biodiversity is a critical piece of essential ecological functions like nutrient cycling, soil formation, water cycling, and purification.[81] It offers economic and social opportunities that contribute to livelihoods and maintenance of cultural and social values. In these respects, agricultural biodiversity is much more than genetic diversity and is critical to healthy diets, a healthy environment and contributes to national development in diverse ways.

SDG 3: "Ensure healthy lives and promote well-being for all at all ages"[82]

What and how much we eat and drink has a significant influence on our health, and this relates to the availability and cost of what we consume. There are currently a billion people around the world suffering from hunger, and even more from 'hidden hunger' — sufficient caloric intake but

[74] Nuijten, E. and Almekinders, C. J. M. 2008. Mechanisms explaining variety naming by farmers and name consistency of rice varieties in The Gambia. *Econ. Bot.*, 62(2): 148–160.

[75] *See*, unpublished memorandum written by author March 31, 2017 to Special Rapporteur on the Right to Food, *"Input on the Right to Food in Humanitarian Contexts"* At: ult/files/timeline/files/2017/SR%20Elver%20QUNO%20Input%20on%20Right%20to%20Food%20in%20Humanitarian%20Context.pdf (Last accessed January 21, 2019)

[76] Diversified agroecological farming refers to models of agriculture based on diversifying farms and farming landscapes, replacing chemical inputs, optimizing biodiversity and stimulating interactions between different species, as part of holistic strategies to build long-term fertility, healthy agro-ecosystems and secure livelihoods. Quote From IPES http://www.ipes-food.org/images/Reports/UniformityToDiversity_KeyMessagesEN.pdf (Last accessed October 24, 2018). FAO created a new unit on agroecology in; the IPES from Uniformity to Diversity report; this one http://afsafrica.org/wp-content/uploads/2017/02/Agroecology-the-bold-future-of-farming-in-Africa-ebook1.pdf

[77] Susan Bragdon and Carly Hayes. *Re-conceiving public-private partnerships to eradicate hunger: recognizing small-scale farmers and agricultural biological diversity as the foundation of global food security*, Georgetown International Law Review, Vol. 49, Issue 4 (2019 in press)

[78] Article 2 of the Convention on Biological Diveristy states "'Biological diversity" means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems." At https://www.cbd.int/convention/articles/default.shtml?a=cbd-02 (Last accessed January 9, 209)

[79] SDG 2.5 states "By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed." Its focus and indicators are on seeds and specifically seed banks where genetic material can be accessed as a source of traits. The target and indicators do not mention the other aspects of biological diversity as legally defined. https://sustainabledevelopment.un.org/sdg2 (Last accessed January 9, 2019)

[80] Emile Frison, *Agricultural Biodiversity for Health and Nutrition*, SCI. ALERT (Nov. 30, 2010), https://www.sciencealert.com/agricultural-biodiversity-for-nutrition-and-health. Fanzo, J.; Hunter, D.; Borelli, T.; Mattei, F.(eds.). (2013) Diversifying Food and Diets Using agricultural biodiversity to improve nutrition and health. Routledge, the Taylor & Francis Group: New York. Available at:

http://www.bioversityinternational.org/e-library/publications/detail/diversifying-food-and-diets/ (Last accessed January 13, 2019). Hunter, D. et al (eds) (2018) *Biodiversity mainstreaming for healthy & sustainable food systems: A toolkit to support incorporating biodiversity into policies and programmes*. Bioversity International, Rome. 52 pgs At https://www.bioversityinternational.org/e-library/publications/detail/biodiversity-mainstreaming-for-healthy-amp-sustainable-food-systems-a-toolkit-to-support-incor/ (Last Accessed January 9, 2019)

[81] Devra I. Jarvis, Toby Hodgkin, Bhuwon R. Sthapit, Carlo Fadda & Isabel Lopez-Noriega (2011) An Heuristic Framework for Identifying Multiple Ways of Supporting the Conservation and Use of Traditional Crop Varieties within the Agricultural Production System, Critical Reviews in Plant Sciences, 30:1-2, 125-176, DOI: 10.1080/07352689.2011.554358

[82] https://www.un.org/sustainabledevelopment/health/

insufficient micronutrient intake for leading healthy, happy, active adult lives.[83] One in four children under the age of five is considered stunted- a state that arises from malnutrition and the inability to adequately absorb nutrients.[84] Globally, there are two billion people deficient in at least one essential nutrient, with iron deficiency implicated in one in five maternal deaths – these people are under-nourished.[85] A sizeable number of people today are obese as compared to those struggling with hunger. Something is wrong when poor nutrition and over-consumption co-occur.

Since 1900, there has been a significant global trend towards dietary simplification. [86] This simplification underpins both overconsumption and undernutrition as dietary simplification. While modern high-input high-yield agriculture (also known as industrial agriculture; see discussion under Section II.D below) and long-distance transport has increased the availability and affordability of refined carbohydrates (wheat, rice, sugar) and edible oils, this system has contributed to the erosion of dietary diversity, nutrient deficiencies and increasing rates of associated chronic disease. [87] Presently, 14 species of animals and 12 plant crops provide 98% of the world's food requirement with wheat, rice and maize alone accounting for at least 50% of the global energy intake.[88]

Dietary simplification is related to the erosion of agricultural biodiversity. This erosion is happening even as modern industrialized production systems and the cultivation of uniform, high-yielding varieties replace traditional production systems, and the farming of diverse landraces. [89] Forces of globalization, commercialization, industrialization, population increase, and urbanization change patterns of food production and consumption in ways that profoundly affect human diets. Farmers have financial incentives to replace on-farm crop diversity with wheat, rice, maize and potato varieties with high demand in international markets.[90] The term used to refer to this trend is 'homogenization' of the global food supply.[91]

The trajectory towards dietary simplification has direct, negative repercussions in terms of nutrition and hence health and well-being.[92] Diverse, healthy diets correlate with the diversity grown in farmers' fields. Farmers and accessible, locally adapted agricultural biodiversity need support to reverse this trend and contribute to achieving SDG 3.[93]

SDG 5 "Achieve gender equality and empower all women and girls"[94]

As noted in Section I, a variety of local food production systems and agricultural biodiversity, including information available locally and the culture and skills of male and female farmers, are disappearing under threats from some changes and trends. These drivers of change and trends are changing the interactions between men and women farmers. Women farmers, currently account for 60-80% of all food production in developing countries and 44 percent of the approximately 1.3 billion persons in the agricultural labor force[95] And the numbers of female-headed households is gradually increasing as a result of the AIDS epidemic, civil wars, the migration of men to cities in search of paid work, amongst other factors.[96] This phenomenon is referred to as 'the feminization of agriculture,' and it is having profound and far-reaching effects, both positive and negative.[97]

The report *"State of Food and Agriculture 2010-11, Women in agriculture: Closing the gender gap for development"*[98]details a

[83] von Grebmer, Klaus & Saltzman, Amy & Birol, Ekin & Wiesman, Doris & Prasai, Nilam & Yin, Sandra & Yohannes, Yisehac & Menon, Purnima & Thompson, Jennifer & Sonntag, Andrea, 2014. "**2014 Global Hunger Index: The challenge of hidden hunger**," IFPRI books, International Food Policy Research Institute (IFPRI), number 978-0-89629-958-0 edited by Sonntag, Andrea & Neubauer, Larissa & Towey, Olive & von Grebmer, Klaus & Yin, Sandra.

[84] Levels and Trends in Child Malnutrition. UNICEF / WHO / World Bank Group Joint Child Malnutrition Estimates Key findings of the 2018 edition. At https://data.unicef.org/wp-content/uploads/2018/05/JME-2018-brochure-.pdf (Last access January 13, 2019)

[85] FAO, The State of Food Insecurity in the World 2015: Meeting the 2015 International Hunger Targets: Taking Stock of Uneven Progress (Rome: FAO, 2015), 8, 44, http://fao.org/3/a-i4646e.pdf; World Health Organization, Childhood Stunting: Context, Causes, Consequences (Geneva: WHO, 2013).

[86] Comm'n on Genetic Resources for Food and Agriculture, Second Report on the State of the World's Plant Genetic Resources for Food and Agriculture, at 15 (2010). José Esquinas-Alcázar, *Protecting Crop Genetic Diversity for Food Security: Political, Ethical, and Technical Challenges*, 6 NATURE 946 (2005).

[87] World Health Organization. 2002. *Globalization, Diets and Noncommunicable Disease.* Geneva: WHO.

[88] Paul R. Ehrlich & Edward O. Wilson, *Biodiversity Studies: Science and Policy*, 253 SCIENCE 758 (1991); Lori A. Thrupp, *Linking Agricultural Biodiversity and Food Security: The Valuable Role of Agrobiodiversity for Sustainable Agriculture*, 76 INT'L AFF. 265 (2000).

[89] FAO (2010). Second report on the state of the world's plant genetic resources for food and agriculture. Rome.

[90] D. Nierenberg and B. Halweil (2005). Cultivating Food Security, New York, W. W. Norton & Co.

[91] José Esquinas-Alcázar (2005). "Protecting crop genetic diversity for food security: political, ethical and technical challenges", Nature, 6: 946-953.

[92] Barry M. Popkin et al., *Now and Then: The Global Nutrition Transition: The Pandemic of Obesity in Developing Countries*, 70 NUTR. REV. 3, 9 (2012)

[93] *Id.* Frison and Fanzo et al, supra note 77.

[94] https://www.un.org/sustainabledevelopment/gender-equality/

[95] http://www.unwomen.org/en/news/in-focus/women-and-the-sdgs/sdg-2-zero-hunger Last accessed October 24, 2018. http://www.fao.org/publications/sofa/en/ Last accessed October 24, 2018.

[96] IAASTD, AGRICULTURE AT A CROSSROADS GLOBAL REPORT (2008), https://archive.org/stream/fp_Agriculture_at_a_Crossroads_Global_Report_English/Agriculture%20at%20a%20Crossroads_Global%20Report%20%28English%29_djvu.txt (Last Accessed January 12, 2019)

[97] *Id.* At pgs 46, 203, 210.

[98] Document C 2011/2 Add.1 presents a short summary of SOFA 2010-11. For more information, see the full publication at

vast body of evidence regarding the critical role women play in agriculture and rural development and the challenges they face that men do not. Women have less access to resources and services, including land, finance, training, inputs, and equipment.[99] In addition to their agricultural work, they are overburdened with domestic chores and caring tasks. There is a direct relationship between women's empowerment, agricultural productivity and food and nutrition security at the household level.[100] The report also stresses potential advantages that could be achieved by the sector and society through the reduction of constraints, and practical applications of lessons-learned from policies, interventions and programs focused on closing the existing gender gap in agriculture.[101]

Gender analyses show that men and women often manage, use and control natural and agricultural resources differently.[102] Women invest as much as ten times more of their income than men do in the well-being of their families, such as in child health, education, and nutrition.[103] In matters concerning the type of crops to grow, women and men tend to have different concerns; often, women are the ones who aim at safeguarding the diversity of forgotten and minority crops that exhibit resilience in the face of climate change.[104] Another general tendency is for women to take care of species and varieties grown near the homestead, which contribute to diverse diets and overall health of the family.[105] Additionally, agricultural systems and the rights, responsibilities and roles of men and women in agriculture, differ depending on the cultural and geographic context. The responsibilities of women farmers in rural areas include: growing and collecting food and use and management of different natural resources (wild plants, crops, tree products and domesticated animal) to meet household needs on a daily basis.[106] Understanding the gender [107]issues surrounding the biodiversity of plants and animals requires examining the roles and relations of men and women as part of their general livelihood systems that encompasses gardens and farms, common property resources such as pastures, forested lands and protected areas.

Ensuring equal opportunities for both men and women will make it possible for women to access essential resources such as extension services, diverse seeds, and land.[108] Studies by the United Nations posit that to enhance productivity and diversity in agriculture it is important to strengthen the capacities of women farmers.[109] This would also help meet the SDGs on hunger, poverty and sustainable agriculture. Understanding gender-based differences, and the gendered power relations behind them is necessary to shape agricultural programs and policies to better support women small-scale farmers and their management of agricultural biodiversity.

SG 6 "Ensure access to water and sanitation for all"[110]

Water is a necessary resource for nutrition, health and food security.[111] Adequate good quality water is essential in daily activities such as observing hygiene and sanitation in healthcare facilities and in households, animal rearing, food production, and fisheries as well as in the production of plants and fibers used as medication.[112]

Energy and water systems are strongly interconnected with agricultural systems. As noted by an Expert Group Meeting convened by the United Nations Standing Committee on Nutrition (hereinafter UNSCN EGM)

http://www.fao.org/docrep/013/i2050e/i2050e.pdf (Last accessed January 13, 2019).

[99] *Id*. pg 5

[100] E. Sraboni, H.J. Malapit, A.R. Quisumbing, A.U.AhmedWomen's empowerment in agriculture: What role for food security in Bangladesh? World Dev., 61 (2014), pp. 11-52. S. Harper, D. Zeller, M. Hauzer, D. Pauly, U.R.SumailaWomen and fisheries: Contribution to food security and local economies Marine Policy, 39 (2013), pp. 56-63

[101] *Id*. note 94 (SOFA footnote) supra, pgs 5-6.

[102] Quisumbing, A. R., editor. 2003. Household Decisions, Gender, and Development: A Synthesis of Recent Research.Washington, DC: International Food Policy Research Institute. At /http://ebrary.ifpri.org/utils/getdownloaditem/collection/p15738coll2/id/129647/filename/129858.pdf/mapsto/pdf. (Last accessed January 13, 2019).

[103] E. Duflo Women empowerment and economic development J. Econ. Lit., 50 (2012), pp. 1051-1079

Maertens, M. and E. Verhofstadt (2013) Horticultural Exports Female Wage Employment and Primary School Enrolment: Theory and Evidence from Senegal. Food Policy, Vol 43, pp 119-131. Duflo, Esther. "Women Empowerment and Economic Development." Journal of Economic Literature 50, no.4.

[104] http://www.futureearth.org/blog/2015-mar-18/farming-not-gender-neutral-q-ann-tutwiler (Last accessed April 1, 2019) see also https://www.bioversityinternational.org/news/detail/agriculture-is-not-gender-neutral-says-bioversity-international-director-general/ (Last accessed April 1, 2019)

[105] Nguyen H, Ly S, Biskupska N, Pravalprukskul P, Brown S, Ro A, Fielding M. 2017. Understanding gender and power relations in home garden activities: Empowerment and sustainable home garden uptake. World Vegetable Center, Taiwan. Publication number 17-813. 46 p.

[106] Howard P. 2003. Women and Plants: Gender Relations in Biodiversity Management and Conservation. Zed Books, UK

[107] *See*, http://www.fao.org/3/x0171e/x0171e03.htm (Last accessed April 1, 2019)

[108] *See*, https://ccafs.cgiar.org/blog/farming-needs-women%E2%80%99s-empowerment-gains-biodiversity-and-value-chains-will-follow#.XKJyOhOpE6g (Last accessed April 1, 2019)

[109] United Nations, 2015. Transforming our world: The 2030 Agenda for Sustainable Development. United Nations, New York, USA. At http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E (Last accessed January 13, 2019)

[110] https://www.un.org/sustainabledevelopment/water-and-sanitation/ (Last accessed April 1, 2019)

[111] https://www.unscn.org/uploads/web/news/EGM-Background-Document.pdf pg 20 (Last accessed April 1, 2019), *see also,*

http://www.un.org/waterforlifedecade/food_security.shtml (Last accessed April 1 2019)

[112] www.unscn.org/uploads/web/news/EGM-Background-Document.pdf pg 20 Last accessed April 1, 2019)

"[i]ncreasing interest in the nexus between food (SDG2), water (SDG6) energy (SDG7) systems is driven by the growing recognition that focus on gains in one specific area can inadvertently lead to losses in others, as well concerns about climate change(SDG13) and the negative impact of the industrial food and agricultural system on human and planetary health generally." [113]

Industrial agriculture is very water intensive. It accounts for 70 percent of worldwide water withdrawals.[114] The worldwide trade in agricultural products and the freshwater demand in the production of these commodities can increase the strain more on already overused watersheds.[115]

The effects of climate change are likely to escalate the existing linkage between water and nutrition. In its 2007 and 2012 reports, the Intergovernmental Panel on Climate Change identified malnutrition as one of the five most significant health effects of climate change.[116]

As noted by the UNSCN EGM "Agroecological approaches have been shown to support important ecosystems services including water cycling and purification. These approaches can confer resilience, robustness, and stability to our food and water systems across the world."[117] Small-scale farmers and Indigenous Peoples have used holistic methods such as rainwater harvesting and crop rotation that increases water availability by up to 20%.[118][119]Agricultural diversity can provide immediate safeguards against shocks caused by unstable rainfall and temperature patterns and other water system stressors associated with climate change. Different crops and varieties within crops are likely to respond in unique ways to water instability and stress and therefore represent a kind of 'risk insurance'.[120]

SDG 7: "Ensure access to affordable, reliable, sustainable and modern energy"[121]

Energy is a fundamental component in the production of food and the attainment of SDG 7 is essential for food and nutrition security.[122] Before the emergence of industrial agriculture, the primary energy input for agriculture was the sun. Photosynthesis enabled plants to grow; plants served as food for livestock, which provided manure as fertilizer and draught power for farming.

The industrialized food system is heavily dependent on energy derived from fossil fuels from farm to fork.[123] Relying on fossil fuels and other forms of non-renewable energy make this form of agricultural production one of the most significant contributors to greenhouse gas emissions, more than our cities or systems of transport[124]. The uncertainty and instability caused by climate change poses risks to all systems of food production. Nevertheless,

[113] *Id.*, at pg 7. *See, also* DeClerck, F.; Estrada-Carmona, N.; Garbach, K.; Martinez-Salinas, A. 2015. Biodiversity and Ecosystem Services of Agricultural Landscapes. Agroecology for Food Security and Nutrition. Proceedings of the FAO International Symposium, Rome, Italy, 2014. Rome, Italy, Food and Agriculture Organization of the United Nations. Pp. 140-157

[114] United Nations World Water Development Report, Water for a Sustainable World, March 2015, p. 11.

[115] Hoekstra, A.Y. and Hung, P.Q. 2005. "Globalisation of water resources: international virtual water flows in relation to crop trade." *Global Environmental Change*, Vol. 15: 45-56. UNESCO-IHE, Institute for Water Education. 2003. Session C1: Virtual Water Trade and Geopolitics, World Water Forum III, Monday, March 17, 2003, Kyoto, JapanHoekstra, A.Y. and Hung, P.Q. 2005. "Globalisation of water resources: international virtual water flows in relation to crop trade." *Global Environmental Change*, Vol. 15: 45-56. UNESCO-IHE, Institute for Water Education. 2003. Session C1: Virtual Water Trade and Geopolitics, World Water Forum III, Monday, March 17, 2003, Kyoto, Japan. *See also,* https://yaleglobal.yale.edu/content/hidden-global-trade-water ""In all the anguished discussion about the planet's water shortages, one often does not hear of the water traveling across oceans, locked in sacks and cartons of food. Food exports hide the significant global trade in water, which could be made transparent and reorganized to reduce water-stress and increase global food security. " (Last accessed January 13, 2019).

[116] IPCC 2007: Synthesis Report. Summary for Policy-makers at pgs 10, 13, 48, 50. At www.ipcc.ch/site/assets/uploads/2018/02/ar4_syr_full_report.pdf (Last accessed January 13, 2019). IPCC, 2012 – Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (Eds.).pgs 264, 309. At /https://www.ipcc.ch/site/assets/uploads/2018/03/SREX_Full_Report-1.pdf. (Last accessed January 13, 2019)

[117] *Id.*, note 109 supra at pg 8 [referring to UNSCN report

[118] Raymond Auerbach, Gunnar Rundgren and Nadia El-Hage Scialabba (Eds), Organic Agriculture: African Experiences in Resilience and Sustainability, Natural Resources Management and Environment Department, FAO, Rome, May 2013, p. 31

[119] IPES-Food, "From Uniformity to Diversity: A paradigm shift from industrial agriculture to

diversified agroecological systems," International Panel of Experts on Sustainable Food Systems,

June 2016, p. 35

[120] Altieri MA, Koohafkan P (2013) Strengthening resilience of farming systems: a key prerequisite for sustainable agricultural production. In: Wake up before it is too late: make agriculture truly sustainable now for food security in a changing climate. UNCTAD, TER13 Report, Geneva

[121] https://www.un.org/sustainabledevelopment/energy/

[122] www.unscn.org/uploads/web/news/EGM-Background-Document.pdf page 38 Last accessed October 24, 2018

[123] U.S. Energy Information Administration (October 17, 2014). Energy for Growing and Harvesting Crops is a Large Component of Farm Operating Costs At https://www.eia.gov/todayinenergy/detail.php?id=18431&src=email# (Last accessed January 13, 2019). Jonathan A. Foley et al., *Solutions for a Cultivated Planet*, 487 NATURE 337, 337-42 (2011). From the Grace Communications Foundation.Foodprint Project At https://foodprint.org/contact-us/about-foodprint/

(Last accessed January 14, 2019). Foodprint Issue:. Agriculture and Energy Consumption "The industrial food system relies on unsustainable fossil fuels - from producing fertilizer to packaging and more. ... From the production of fertilizers to the processing and transporting of food products to market, the industrial food system depends on fossil fuels to produce monocultures of commodity crops."

At https://foodprint.org/issues/agriculture-energy-consumption/ (Last accessed January 13, 2019

[124] *Id.*, to first reference to UNSCN background report (I wrote this hence the language issue) at pg 9

it is the 1.5 billion small-scale farmers from middle- and low-income countries who are particularly vulnerable. They are often poor and on the frontiers of climate change and most exposed to its effects.[125]

Arguably, an energy-intensive production system may allow for increased crop rotation and a possible diversification of food production[126]. The overall result has the potential to enhance the supply of diversified foods for diverse diet demands.[127] In reality, the increased supply of diversified foods is felt unevenly both within and between countries and depends on a socioeconomic stratum [128]. Affluent people from high to middle to even low income inclined to experience an increase in dietary diversity, while the less affluent continue to struggle with access and availability [129]. Furthermore, in the absence of other measures, this approach correlates with a worrying upsurge in the supply of highly processed foods, having high levels of sugar, salt and fat, contributing to the increasing cases of overweight people, and diet-related NCDs.[130] And this does not account for the environmental impacts of using fossil fuels and other forms of non-renewable energy noted above.

Agriculture is the original 'solar technology.'[131] Small-scale farmers managing agricultural biodiversity and using agroecological practices are actively demonstrating how food systems can run on a foundation of sunlight. Industrial agriculture requires 10 kcal of energy to produce 1 kcal of food energy while small-scale farmers spend 4 kcal energy to produce 1 kcal of food energy.[132] The industrial system of agriculture focuses mainly on production, on maximizing output or crop yield[133]. Under this system, the measure of production is dependent on the yield per hectare rather the energy-efficiency or nutrition density. A narrow production-only objective or metric impedes the necessary transformation of food production needed to ensure long-term sustainability, including recognizing the essential role of small-scale farmers and agricultural biodiversity to long-term sustainably are needed.

SDG 8: "Promote sustained, inclusive, sustainable economic growth, full and productive employment and decent work for all"[134]

The importance of agriculture, food, and enhanced rural development is not mentioned directly in SDG 8, its indicators and targets.[135] The lack of acknowledgement is in spite of the fact that the agriculture sector is the largest single sector in terms of employment. [136] Small-scale farmers support the livelihoods of some 2 billion to 2.5 billion people.[137]

The role of agriculture in economic development has been the topic of much debate.[138] Agricultural production is a distinct economic sector because it is not an optional one because we have to be able to feed ourselves. It is also distinctive because it directly affects many of the very assets on which it relies for success.[139] Small-scale farming and agricultural biodiversity are critical to sustainable agricultural production as an economic activity. Nevertheless, government policies most often are focused on the urban sectors despite the inability of cities to absorb and employ rural populations should they be displaced.[140] The incapacity of many governments to initiate adequate

[125] *See*, Chelsea Smith, David Elliott and Susan H. Bragdon (May 2015), Realizing the right to food in an era of climate change, Quaker United Nations Office, Geneva. "We need to raise the status of small-scale farmers from 'most vulnerable' to 'most valuable' and reorient investment in agriculture towards the needs of those on the frontline of climate change and food production." Pg 1.

[126] *Id.* to original UN SCN report at pg 39

[127] *Id.*

[128] *Id.*

[129] *Id. to* Susan Bragdon and Carly Hayes. Re-conceiving public-private partnerships to eradicate hunger: recognizing small-scale farmers and agricultural biological diversity as the foundation of global food security, Georgetown International Law Review, Vol. 49, Issue 4 (2019 in press) presently fn 30

[130] Gina Kennedy et al., *Globalization of Food Systems in Developing Countries: A Synthesis of Country Case Studies*, FAO (2004), http://www.fao.org/3/a-y5736e.pdf. (Last accessed January 14, 2019).

[131] Wonderfully put by Michael Pollan in his May 19, 2008 Newsweek article entitled "How to Feed the World" https://michaelpollan.com/articles-archive/how-to-feed-the-world/ Last accessed October 24, 2018

[132] David Pimentel and Mario Giampietro, Food, Land, Population and the US Economy,Carrying

Capacity Network, Cornell University and Instituto Nazionale delli Nutrizione (Rome), 1994

[133] DeLonge, M. and Basche, A., 2017. Leveraging agroecology for solutions in food, energy, and water. *Elem Sci Anth*, 5, p.6. DOI:http://doi.org/10.1525/elementa.211

[134] https://www.un.org/sustainabledevelopment/economic-growth/

[135] https://sustainabledevelopment.un.org/sdg8 (Last accessed January 14, 2019).

[136] Gollin, Douglas, 2010. "Agricultural Productivity and Economic Growth," Handbook of Agricultural Economics, Elsevier.

[137] *Id.* Note 52 supra

[138] Alberto Valdés, William Foster, Reflections on the Role of Agriculture in Pro-Poor Growth, World Development, Volume 38, Issue 10, 2010,Pages 1362-1374. Gollin, Douglas, 2010. "Agricultural Productivity and Economic Growth," Handbook of Agricultural Economics, Elsevier. Meijerink, G. & P. Roza. 2007. The role of agriculture in development. Markets, Chains and Sustainable Development Strategy and Policy Paper, no. 5. Stichting DLO: Wageningen. Available at: http://www.boci.wur.nl/UK/Publications/ (Last accessed January 14, 2019). Timmer, C.P., 2002. Agriculture and economic development. In: Gardner, B.L., Rausser, G.C. (Eds.), Handbook of Agricultural Economics. Agriculture and its External Linkages, vol. 2A. Amsterdam: Elsevier Science Publishers.

[139] *See*, discussion in sections II B, E and F above discussing the nexus amongst food-nutrition-water-energy and small-scale farmers and agricultural biodiversity.

[140] Michael Lipton,Urban bias and food policy in poor countries,Food Policy,

Volume 1, Issue 1,1975, Pages 41-52, https://doi.org/10.1016/0306-9192(75)90007-X At: http://www.sciencedirect.com/science/article/pii/030691927590007X

capital projects in rural areas has caused increased rural-urban migration leading to congestion, slums, and ever-increasing unemployment.[141]

As noted in Section II. A. small-scale farmers are often destitute and food insecure themselves. Rural life has to be an attractive option, with support to small-scale farmers as entrepreneurs and agents of change. Understanding rural-urban linkages is crucial, particularly the opportunities for the rural sector in those linkages. Nevertheless, there needs to be an increased focus on rural livelihoods and the quality of rural life in their own right to achieve SDG 8 for countries with agricultural economies with large rural populations.

SDG 11 "Make cities inclusive, safe, resilient and sustainable"[142]

Rapid urbanization and the transformation of the rural space, with their new challenges as well as opportunities, are changing the traditional approaches to food security and nutrition. Food systems intersect with urban and rural settlements. The economic, political, social, and physical connections between the urban and rural areas can play a crucial role in ending malnutrition and curbing hunger in both locales.[143]

The growth of urban areas increases the need for food and stimulates dietary changes in urban areas. New demand can equal new prospects for farmers in the rural areas to increase their means of support while producing diverse, nutritious food for rural and urban consumption. [144] Currently, government policies often are focused on the urban sectors, despite the inability of cities to absorb and employ rural populations should they be displaced. Given the crucial role small-scale farmers and agricultural diversity play in supporting livelihoods, as producers of diverse, healthy foods, in the provision of ecosystem services, coherence amongst policies related to food and nutrition security and nutrition in both rural and urban areas is critical. These include, for example, policy and law related to agriculture, rural development, urban planning, and social protection. Considering how urban-rural linkages can be exploited to support small-scale famers and on-farm diversity for the benefit of the populations in both areas (and the towns and peri-urban areas in between) raises complex issues that need to be explored, including for example:

- What policies and infrastructure best link regional, urban and rural markets while ensuring sustainability of production of diverse food, especially by small-scale farmers;
- How to ensure the needs of marginalized populations are part of the process of integrated territorial planning[145] including avoiding urban bias[146];
- Means to encouraging food vendors to avail to their customers a variety of foods and link back to local producers.

As reflected in the discussions on Guiding Principles of Urban-Rural Linkages, [147] territorial approaches to planning can assist governments in more effectively addressing existing geographical or urban-rural inequalities and to integrate the social, environmental and economic dimensions of development with regard to populations and sectors in a given geographical area. They can help coordinate and concentrate efforts to address the spatial concentration of food insecurity and poverty in the less developed localities that may exhibit a range of spatial inequalities. [148] Territorial approaches can also be useful in bringing the rural dimension into the "New Urban Agenda" established by the United Nations Conference on Housing and Sustainable Urban Development in 2016.[149] This can only be attained if the voices and interests of rural people, including small-scale farmers, are integrated into the planning.

With the expectation that small towns and medium-sized cities will experience urbanization, and since the rural farmers occupying the localities between cities and towns provide most food, energy, fiber for human settlement and water, a focus on the rural dimension of urbanization – and small-scale farmers and agricultural biodiversity -- is critical for sustainable development.

SDG12 "Ensuring sustainable consumption and production patterns"[150]

SDG 12 plays a crucial role in reconciling economic, social and environmental objectives.[151] While it represents a self-

[141] Ilegbinosa IA, Moses OL, Praise UA (2014) Population and its Impact on Level of Unemployment in Least Developed Countries: An Appraisal of the Nigerian Economy. Arts Social Sci J 5:081. doi:10.4172/2151-6200.100081

[142] https://www.un.org/sustainabledevelopment/cities/

[143] www.unscn.org/uploads/web/news/EGM-Background-Document.pdf page 43 Last accessed October 24, 2018

[144] From IFAD, Policy Brief, *How inclusive rural transformation can promote sustainable and resilient societies.* March 2018, pg 5.

[145] Leading Change: Delivering the New Urban Agenda through Urban and Territorial Planning https://www.uclg.org/sites/default/files/leading-change.pdf

[146] Michael Lipton, Urban bias and food policy in poor countries, Food Policy, Volume 1, Issue 1, 1975, Pages 41-52, ISSN 0306-9192, https://doi.org/10.1016/0306-9192(75)90007-X.

[147] https://urbanrurallinkages.wordpress.com/ (Last accessed October 24, 2018)

[148] https://www.ifad.org/documents/38714170/40253256/GER_internal_print.pdf/52c96da0-ac57-46be-a3cd-86eb445bd471

[149] http://habitat3.org/wp-content/uploads/NUA-English.pdf (Last accessed October 24, 2018).

[150] https://www.un.org/sustainabledevelopment/sustainable-consumption-production/

[151] From the UN Environment One Planet Intiative on sustainable consumption and production (SCP) :"SCP should be seen as an enabler for the implementation of a range of other goals and many of their targets. Actions and policies required to achieve the objective of SDG 12 aim to decouple economic growth from resource use and range of other impacts on the environment and their associated effects on poverty eradication and shared prosperity – this is the enabling effect of the shift to sustainable

standing goal, responsible consumption and production is closely associated with a variety of SDGs and their respective targets.[152] For example, as noted in Section I of this paper, the system of agriculture that emerged after World War II contributes to climate change, uses the highest quantity of fresh water resources, and is the biggest polluter and driver of biodiversity resulting in dead zones in the oceans. Over time, the social, economic and environmental impacts of these methods of agricultural production produces a greater cost than can be sustained. SDG 12 only mentions food waste and no other elements of the food system from production to consumption to disposal.[153]

Nutrition is both a production and consumption issue. The present food system has progressively homogenized the supply of food such that at the global level, only three cereal crops provide close to 50 percent of all calories consumed.[154] What we produce, affects what we eat. Ultimately, healthy, diverse diets start with growing nutrient dense, diverse foods. One way to support an adequate supply of essential micronutrients is through dietary diversity.[155] When diet diversity is founded on diverse systems of farming, the result is better nutrition and health, with additional advantages for human livelihoods and productivity. It also has an added value of being an essential strategy for coping with the predicted climate change impacts.

An Expert Group Meeting on SDG Interlinkages convened by the United Nations Division for Sustainable Development (UN DESA) in January 2018 produced a report that stated "…. human wellbeing is at the center of SCP, and food systems are at the center of human wellbeing. An overhaul of food systems to feed the world must also ensure good nutrition that is sustainable and uses resources efficiently. The overhaul begins with support for agro-ecological methods of production where agricultural biological diversity and small-scale farmers are of central importance."[156]

SDG 12 targets fail to provide clear direction on ways to align the economic system. There is, however, a clear need to shift from economic models that values growth for its own sake, toward an approach that values planetary boundaries, including stemming the loss of biodiversity, and recognizing the economy as a part of nature as reflected in SDG target12.8.[157]

SDG 13: "Take urgent action to combat climate change and its impacts"[158]

As mentioned in Section II. C above, industrial agriculture simplifies diets with negative consequences for human nutrition and health. It also contributes significantly to climate change, producing more than 30 percent of the global greenhouse gas emissions.[159] As the title to a recent article in the Guardian states: "Modern agriculture cultivates climate change: we must nurture biodiversity."[160]

Agriculture -- producing food -- is not optional, but we cannot continue to follow an industrial model that harms both people and the planet. Food must be produced sustainably and in ways that respect planetary boundaries.[161] As noted, a viable alternative to industrial agriculture exists in diversified agroecological systems. This approach is about diversifying farms and farming landscapes, replacing synthetic chemical inputs, optimizing biodiversity and stimulating interactions between different species.[162] The International Panel of Experts on Sustainable Food Systems[163] reviewed a growing body of evidence and concluded that these systems have great potential to succeed in reconciling concerns such as food security, environmental and livelihood resilience, nutritional adequacy and social

consumption and production patterns." https://www.unenvironment.org/explore-topics/resource-efficiency/what-we-do/one-planet-network (Last accessed January 13, 2019).

[152] *Id.*

[153] SDG 12.4 At https://sustainabledevelopment.un.org/sdg12 (Last accesssed January 13, 2019).

[154] Comm'n on Genetic Resources for Food and Agriculture, Second Report on the State of the World's Plant Genetic Resources for Food and Agriculture, at 15 (2010).

[155] *Id.* Note 77 supra.

[156] Advancing the 2030 Agenda: Interlinkages and Common Themes at the HLPF 2018 (January 2018) An expert group meeting in preparation for HLPF 2018: Transformation towards sustainable and resilient societies. Final Report. Pg 31 At https://sustainabledevelopment.un.org/content/documents/18777Interlinkages_EGM_Summary_Report_2018.pdf (Last accessed January 14, 2019)

[157] *Id. See,* also SDG 12.8. "By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature "

At https://sustainabledevelopment.un.org/sdg12 (Last accessed January 13, 2019)

[158] https://www.un.org/sustainabledevelopment/climate-change-2/

[159] Sonja J. Vermeulen, Bruce M. Campbell, John S.I. Ingram (2012) Climate Change and Food Systems Annual Review of Environment and Resources 37:1, 195-222

At: http://www.annualreviews.org/doi/abs/10.1146/annurev-environ-020411-130608 (Last accessed Janaury 13, 2019).

[160] The articles authors are Olivier de Schutter and Emile Frison (January 2017) Available at: https://www.theguardian.com/global-development/2017/jan/09/modern-agriculture-cultivates-climate-change-nurture-biodiversity-olivier-de-schutter-emile-frison (Last accessed January 14, 2019).

[161] https://www.stockholmresilience.org/research/planetary-boundaries/planetary-boundaries/about-the-research/the-nine-planetary-boundaries.html (Last accessed January 14, 2019)

[162] IPES-Food. 2016. From uniformity to diversity: a paradigm shift from industrial agriculture to diversified agroecological systems. International Panel of Experts on Sustainable Food systems.

www.ipes-food.org. At http://www.ipes-food.org/_img/upload/files/UniformityToDiversity_FULL.pdf (Last accessed January 14, 2019)

[163] http://www.ipes-food.org/ (Last accessed April 1, 2019)

equity. [164] As shown in Box 1 of this Note, small-scale farmers and agricultural biodiversity are at the heart of agroecological approaches and hence achieving SDG 13.[165]

SDG 15: "Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss"[166] [167]

Agricultural biodiversity and its custodians are critical to the achievement of aspects of most of the SDG 15 yet there is no mention of agricultural biodiversity or a connection between SDG 15 and SDG 2 in general. There is also no reference to genetic resources which forms a part of SDG 2.[168]

Agricultural biodiversity and communities managing it, are integral to achieving SDG 15. Most of the SDG 15 targets need agroecological pathways to agricultural production. Underpinning these pathways are small-scale farmers and agricultural biodiversity. It is therefore a significant gap that agricultural biodiversity is not mentioned in the call:

- SDG 15.1 on restoring and conserving fresh and terrestrial water ecosystem services,
- SDG 15.2 on implementing a sustainable forest management plan,
- SDG 15.3 on restoring degraded soil and land,
- SDG 15.4 on restoring mountain ecosystems such as the capacity to provide benefits that play a crucial role in sustainable development,
- SDG 15.5 on reducing the degradation process of natural habitats and stopping the loss of biological diversity.[169]

The only reference is found in SDG 15.6" Promote fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources, as internationally agreed."[170] Genetic resources are significant but nevertheless only a subset of agricultural biological diversity of relevance to the SDGs.[171]

The transformation championed by Agenda 2030 requires a conversion in our understanding as well as support for the conservation and sustainable use of agricultural biodiversity as required and defined by the International Treaty on Plant Genetic Resources for Food and Agriculture and the Convention on Biological Diversity.

In particular, the interlinkages between SDG 2 and SDG 15 that goes beyond seeds and genetic diversity and acknowledges the crucial role of agricultural biodiversity in health and nutrition, in providing ecosystem services and in nature conservation is urgently needed.

SDG 15 needs to be seen and implemented holistically, not where nature conservation and agricultural production are at odds. [172] For example, we can maintain agricultural biological diversity by increasing landscape complexity. This can further act as a means of protecting natural habitats and assist in the development of ecological corridors for species in the wild such as wild relatives of crops, trees, and pollinators. Embracing diversification in production systems using agro ecological approaches and maintaining traditional land-use systems is crucial in addressing conservation concerns and supporting sustainable improvements in food production.

Industrial agriculture is one of the main causes of land degradation and the loss of forests. Global forests in developing countries are being cleared to make way for soy and maize monocultures. This is not sustainably managing forests and it also causes land degradation and the loss of carbon sinks with the implications for SDG 13 discussed in Section II. J above.[173] Achieving SDG 15 requires recognizing the need to constrain this type of agriculture and to support small-scale farmers and agroecological approaches.

SDG 16: "Promote just, peaceful and inclusive societies"[174]

A 17th-century English proverb says, "A hungry man is an angry man." [175] Food insecurity can trigger conflict. [176] Since 2008, rapid increases in the global prices for dominant grains helped to trigger outbreaks of civil unrest

[164] *Id.*

[165] Chappel MJ, Lavalle, LA. (2009.) *Food Security and Bioversity: Can we have both? An Agroecological Analysis.* Agricultural and Human Values. DOI: 10.1007/S10460-10009-12251-10464. At https://s3.amazonaws.com/academia.edu.documents/30483660/food-security-and-biodiversity-chappell-lavalle.pdf?AWSAccessKeyId=AKIAIWOWYYGZ2Y53UL3A&Expires=1547510237&Signature=oiNR8R2oL9gxnaQGjIN2J7Ozr0s%3D&response-content-disposition=inline%3B%20filename%3DFood_security_and_biodiversity_can_we_ha.pdf (Last accessed January 14, 2019).

[166] https://www.un.org/sustainabledevelopment/biodiversity/

[167] This section draws upon the author's written contribution of Annex 5 *Linking Nutrition to SDG 15 Life on Land* in the Background document prepared for the Expert Group Meeting on Nutrition and the SDGs under Review in Preparation for the High-Level Political Forum held 19-20 June 2018 at United Nations Headquarters, New York. https://www.unscn.org/uploads/web/news/EGM-Background-Document.pdf (Last accessed April 1, 2019)

[168] *Id.*

[169] *Id.*

[170] https://www.un.org/sustainabledevelopment/biodiversity/

[171] *Id. To note 166*

[172] Mijatovic, D and Hodgkin, T. *Reconciling agriculture and nature conservation will require greater consideration of agrobiodiversity"* http://agrobiodiversityplatform.org/agrobiodiversity-considerations-in-land-use-decisions/ (Last accessed October 24, 2018)

[173] Hiroki Tabuchi, Claire Rigby, Jeremy White. New York Times. February 24, 2017 "Amazon deforestation, once tamed, comes roaring back." Available at: https://www.nytimes.com/2017/02/24/business/energy-environment/deforestation-brazil-bolivia-south-america.html (Last accessed March 22, 2017).

[174] https://www.un.org/sustainabledevelopment/peace-justice/

[175] "hungry man is an angry man, a." The Oxford Dictionary of Phrase and Fable. . *Encyclopedia.com.* 22 Mar. 2017 <http://www.encyclopedia.com>. Available at: http://www.encyclopedia.com/humanities/dictionaries-thesauruses-pictures-and-press-releases/hungry-man-angry-man (Last accessed March 23, 2017).

[176] Hendrix, C. and Brinkman, H.-J., 2013. Food Insecurity and Conflict Dynamics: Causal Linkages and Complex Feedbacks. *Stability: International Journal of Security and Development*, 2(2), p.Art. 26. DOI: http://doi.org/10.5334/sta.bm

in more than 40 countries.[177] Food insecurity is intense in conflict-affected countries, where it can be both a cause and a consequence of violence.[178] Conflicts mainly affect rural populations, having a tremendous impact on food and agricultural production and smallholder livelihoods.[179] An approximated 1.5 billion people live in war-torn, post-war, or fragile countries.[180]

Empirical analysis and theoretical work substantiate the variety of ways through which food insecurity can fuel, trigger or sustain the event of conflict.[181] As noted above, unexpected rises in food prices can result in unrest. Conflict among groups competing to gain control of the available natural resources required for the production of food can catalyze the occurrence of war. Social, economic and political factors that affect people's food security can exacerbate grievances and build momentum toward conflict.[182]

Achieving the SDGs, including food and nutrition security, requires peacebuilding and conflict resolution to combine with efforts to restore and support resilient rural communities. The rehabilitation of agriculture is critical to build and consolidate peace while contributing to food security and rural development.[183] Resilience is central to any sustained response to food insecurity in crises or crises-prone situations.[184]

Furthermore, small-scale farmers are often integral actors in informal seeds systems which can provide positive social cohesion, a significant ingredient for peaceful and inclusive societies. Support to small-scale farmers and for their activities that conserve and develop these resources is therefore directly related to peacebuilding and recovering from conflict.

CONCLUSION

Trade-offs are likely to be necessary among some goals and targets. To take the requisite complementary measures, the relationships and trade-offs need to be made explicit. The Report of Expert Group Meeting on SDG Interlinkages referred to in section II above, illustrated many of the connections amongst agricultural biodiversity and the SDGs holding that with "proper policy support, growing diversity is the foundation for dietary diversity and hence health and nutrition (SDG 2, 3), for resilience to biotic and abiotic stressors (SDG 13 and 15) and should further decent employment (SDG 8) and rural livelihoods (SDG 1). Furthermore, to achieve SDG 12 it is necessary to constrain industrial agriculture because of the negative effects it has on other SDGs such as SD6, which is the largest consumer of freshwater , SDG 2 and 15 which are the main drivers of loss of biodiversity, SDG 7 which is dependent on fossil fuels, SDG 14 which is behind the fertilizer and pesticide pollution in water bodies and on land resulting in dead zones in the seas, and finally SDG 13 which contributes significantly to greenhouse gas emissions.[185]

Furthermore, the success of the SDGs will depend on aligning targets and goals with existing international agreements and political processes. For effectiveness, the alignment will need to include a diversity of systems and instruments each with different constituencies, interests, knowledge, expertise, cultures and even use of language. In the intergovernmental world, the range may include the rules and initiatives established by the World Trade Organization as well as other bilateral trade regimes; the World Health Organization; the Human Rights Council; the International Treaty on Plant Genetic Resources for Food and Agriculture; the International Labour Organization; the United Nations Environment Programme; the 2015 Addis Ababa Action Agenda Financing for Development the Human Rights Council; the UNFCCC;[186] the Convention on Biological Diversity; the World Committee on Food Security; the Food and Agricultural Organization, and the Development Banks just to name a few.

Governments must, therefore, look at all their international legal obligations (as well as national actions) in terms of their impact on the SDGs. All the agreements and institutions noted above – regardless of their stated purpose -- must be evaluated in light of real or potential consequences on issues like hunger, poverty, and environment.

Additionally, there are other actors with an enormous impact in the international arena and hence will also need to be in alignment for the achievement of the SDGs. These include, for example, transnational corporations, private foundations, industry associations, civil society, and non-governmental organizations. Governments individually and collectively will need policies, regulations, and the capacity to take action to ensure the activities of non-state actors align with Agenda 2030 and the SDGs.

Even amongst agreements and institutions ostensibly addressing the same topic, coherence and mutual support

[177] Simmons, Emmy. (2013). *Harvesting Peace: Food Security, Conflict, and Cooperation* (Environmental Change & Security Program report vol. 14, issue 3). Washington dC: Woodrow Wilson international Center for Scholars. Pg 3

[178] *Id.* Note 157 supra.

[179] FAO and Peacebuilding: Supporting Peace through Food Security and Reslience. *FAO 2015 I4348E/1/01.15.*

[180] Simmons, Emmy. (2013). *Harvesting Peace: Food Security, Conflict, and Cooperation* (Environmental Change & Security Program report vol. 14, issue 3). Washington DC: Woodrow Wilson international Center for Scholars pg 5

[181] *Id.*pg4

[182] *Id. See*, also Ellie Roberts and Lynn Finnegan (2013) *Building Peace around Water, Land and Food: Policy and Practices for Preventing Conflict.* Geneva. Quaker United Nations Office.

[183] *Id.* Note 161 supra.

[184] *Id. See,* also FAO. 2018. Farmer seed systems and sustaining peace. Rome. 52 pp. Licence: CC BY-NC-SA 3.0 IGO pg 8.

[185] *Id. Note 140 supra*

[186] https://www.un.org/esa/ffd/ (Last accessed January 14, 2019)

has proven difficult to achieve. This difficulty can be seen with the various legal regimes in place or subjects to negotiations that relate to small-scale farmers and agricultural biodiversity.[187] The breadth of 17 SDGs increases the challenge.

Recognizing the need to understand the interlinkages, synergies, and trade-offs, there is also a need to build capacity. Some tools to help national governments with an integrated approach to the SDGs are being developed and piloted. The Millennium Institute and Biovision have developed an Integrated Sustainable Development Goals Model to support policy-makers in ensuring policy coherence across areas of interventions and facilitate the alignment of SDG strategies with other national development plans.[188] It is not a replacement for detailed, sector-specific analysis. Rather, it is an overarching and complementary tool that pulls together and tests the impact and coherence of policies.[189] The Stockholm Environment Institute has published *A Guide to SDG Interactions: From Science to Implementation* which uses a scoring system to map the interactions between the SDGs and targets to help policy-makers engage with relevant actors and have a deliberative process to make trade-offs explicit and support policy coherence.[190] UNDP, UN-Habitat & the Global Task Force is curating tools and guides to support governments in localizing the SDGs.[191]

With any of these tools, there needs to be an awareness of the importance of small-scale farmers and agricultural biological diversity and the involvement of small-holder farmers in the policy process.

The efficacy of these tools depends on the value of the input and the extent to which all relevant actors are involved. At present, the central role played by small-scale farmers and agricultural biodiversity in overcoming hunger and poverty, in supporting health and nutrition, ecosystem services and ensuring the resilience of our food systems in the face of climate is not widely realized and integrated with national and global strategies for achieving the SDGs.

Awareness must, therefore, be raised of the critical role of small-scale farmers and agricultural biodiversity in the fight against hunger, poverty, malnutrition and to the resilience of our planet in the face of climate change. Equipped with an understanding of the existing interlinkages, governments and individuals must collectively make a commitment to support small-scale farmers in agrobiodiverse situations as a critical foundation for achievement of the SDGs.

The conversation must be broadened and made more inclusive of small-holder farmers and rural populations. It does not only revolve around leaving behind certain segments of the population even though this is important. It is because small-scale farmers are agents of change at the forefront of the development.

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How to Cite this Article

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[187] Susan H. Bragdon (2017), The Evolution of Rights and Responsibilities over Agricultural Biodiversity, (Quaker United Nations Office, Geneva). http://quno.org/sites/default/files/resources/Evolution%20of%20Rights%20and%20Responsibilities_1.pdf (Last accessed January 14, 2019)

[188] https://www.millennium-institute.org/isdg (Last accessed January 14, 2019)

[189] *Id.*

[190] https://www.icsu.org/publications/a-guide-to-sdg-interactions-from-science-to-implementation (Last accessed July 18, 2017)

[191] http://localizingthesdgs.org/about-us.php (Last accessed October 24, 2018)