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

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I. INTRODUCTION

The seventeen Sustainable Development Goals (SDGs) and Agenda 2030, adopted by the global community in September 2015, are applicable to all countries committed to the principle "that no one is left behind."[1] Both the SDGs and Agenda 2030 strongly reflect human rights principles and standards.[2] As an agenda for "people, planet, prosperity, peace and partnership," Agenda 2030 provides a vision for people and advocates for a planet-centered, human rights-based, and gender-sensitive sustainable development.[3] It promises "more peaceful and inclusive societies," free from fear and violence.[4]

Each goal has specific targets to be achieved in the next fifteen years.[5] 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 their 169 targets.[6] The indicators are a work in progress, because roughly half lack acceptable country coverage, agreed-upon methodologies, or both.[7]

1. G.A. Res. 70/1, ¶ 2, U.N. Transforming our World: The 2030 Agenda for Sustainable Development, at 15 (2015).
2. *Id.*
3. *Id.* at 2.
4. *Id.* ¶ 17.
5. *About the Sustainable Development Goals*, U.N., http://www.un.org/sustainable development/sustainable-development-goals/ [https://perma.cc/ 3B76-MRCB] (last visited Nov. 17, 2019).
6. Casey Dunning, *230 Indicators Approved for SDG Agenda*, CTR. FOR GLOB. DEV. (Mar. 15, 2016), https://www.cgdev.org/blog/230-indicators-approved-sdg-agenda [https://perma.cc/S8WL-QKFX].
7. *Id.*

Target 17.14 of the SDGs commits all U.N. Member States to enhance policy coherence for sustainable development.[8] In other words, one problem cannot be solved by creating another problem, neither now nor in the future. It is no longer sufficient for a state, an intergovernmental institution, or a treaty to assert that something is not their mission or responsibility if what they do negatively affects one of the SDGs.[9]

The High-Level Political Forum (HLPF) was established as the United Nations central platform for "follow-up and review of the 2030 Agenda for Sustainable Development [and] the Sustainable Development Goals."[10] The HPLF met for the first time in July 2016,[11] and meets annually in the summer.[12] It establishes a theme for each session and reviews voluntary national reports; in July of 2017, it began reviewing implementation of specific SDGs.[13]

Most goals are intertwined, and many targets may contribute to several goals. At the same time, if pursued separately, actions taken to meet one target could have unintended consequences on others. For example, to achieve "decent work and economic development," the goal set in SDG 8, a country might choose to orient its agriculture sector towards exporting in a global market. Without complementary measures this could negatively affect the following SDGs:

- SDG 2 *Zero Hunger*[14] as it would decrease dietary diversity and thus affect the nutritional status of the producers, particularly for exports of non-food crops;
- SDG 3 *Good health and well-being.*[15] The focus on export production would erode both wild and domesticated biological

8. *Goal 17: Target 17.14: Policy Coherence. Enhance Policy Coherence For Sustainable Development*, U.N. CONF. ON TRADE AND DEV., https://stats.unctad.org/Dgff2016/index.html [https://perma.cc/4S22-U5V2] (last visited Dec. 12, 2019).

9. *Id.*

10. *High-Level Political Forum*, U.N., https://sustainabledevelopment.un.org/hlpf [https://perma.cc/95ZG-3XSB] (last visited Nov. 17, 2019).

11. *Id.* at year 2016.

12. *See also High-Level Political Forum 2019 Under the Auspices of ECOSOC*, U.N., https://sustainabledevelopment.un.org/hlpf/2019 [https://perma.cc/95ZG-3XSB] (last visited Sept. 6, 2019).

13. *SDGs Follow-up and Review*, U.N., https://sustainabledevelopment.un.org/hlpf [https://perma.cc/95ZG-3XSB].

14. Each SDG has an abbreviated version and a longer title. *See About the Sustainable Development Goals*, *supra* note 5 (listing abbreviations for each SDG).

15. *See id.*

diversity. These resources are relied upon by billions of people for health and nutrition;

- SDG 5 *Gender Equality*[16] would be affected if the economic opportunity results in female producers being displaced by male producers (the practice also impacts the nutritional status of the household);
- SDG 13 *Climate Action*[17] because the erosion of agricultural diversity would reduce resiliency and threaten the foundation for the ability to adapt climate change and other stressors; and
- SDG 15 *Life on Land*[18] by eroding wild and domesticated biological diversity.

Small scale farmers[19] and agricultural biodiversity[20] are critical to the achievement of most of the SDGs. In addition to being essential for the resilience and stability of agricultural production systems and for our ability to adapt to climate change and other stressors, agricultural biodiversity is fundamental to the livelihoods, health and nutrition of billions.[21]

Despite the importance of agricultural biodiversity for the health of both humans and the planet, the Sustainable Development Goals do not explicitly mention it or the critical role of its custodians.[22] In fact, awareness is low outside of specialized institutions and agreements, and explicit mention of both is rare in the context of sustainable development.[23]

This Article uses the example of agricultural biodiversity and small-scale farmers to illustrate their role as living links amongst the SDGs as well as critical components in their achievement of, and to the vision of, Agenda 2030. Based on current trends, the ambition of Agenda 2030 and

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16. *Id.*
17. *Id.*
18. *Id.*
19. "Small-scale farmers" as used in this Article "include[s] family farmers, pastoralists, primary and small-scale producers, foresters, fisherfolk." FAQ, SEEDSFORALL.ORG, https://www.seedsforall.org/faq [perma.cc/TBR6-YSVL].
20. 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. *Id*.
21. This Article will discuss each of these points when analyzing some SDGs.
22. *See About the Sustainable Development Goals*, *supra* note 5.
23. This Article will argue that raising awareness is key to successfully achieve the SDGs.

its SDGs will not be achieved in the timeframe the Agenda establishes.[24] According to the World Food Program's Zero Hunger project, 821 million people globally go to sleep with an empty stomach every night.[25] This translates to one in nine people.[26] 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 struggling with these issues.[27] Its 2014 report focused on hidden hunger, which is also referred to as "micronutrient deficiencies," and it found that more than two billion individuals are afflicted by hidden hunger.[28] This translates to one in three people globally.[29] The 2017 State of Food and Nutrition Security in the World Report alerted the world community to the fact that 2016 saw the first increase in the number of hungry people in a decade.[30] The 2018 State of Food and Nutrition Security in the World Report confirmed a rise in world hunger: the number of people who suffer from hunger has been growing over the past three years, returning to levels from almost a decade ago.[31] Multiple forms of malnutrition are evident in many countries; adult obesity is growing even as forms of undernutrition persist.[32]

The modern industrial food system that emerged after World War II has, in several ways, radically altered the way food is produced, processed, packaged, distributed, sold and consumed in many parts of the world.[33] Industrial agriculture is an intensive, high-input, linear system focused on increasing production and yields without regard for the environmental, social or health costs.[34] The emphasis on production and yields leads to a

24. Food and Agric. Org. [FAO], *The State of Food Security and Nutrition in the World* vi−vii (2017) [hereinafter SOFA].

25. WORLD FOOD PROGRAMME, *Zero Hunger*, https://www.wfp.org/zero-hunger [https://perma.cc/RHH8-7BZX] (last visited Nov. 17, 2019).

26. *Id.*

27. Int'l Food Policy Research Inst., 2014 GLOBAL HUNGER INDEX: THE CHALLENGE OF HIDDEN HUNGER 21 (2014) [hereinafter GLOBAL HUNGER INDEX].

28. *Id.* at 5.

29. *Id.* at 21.

30. SOFA, *supra* note 24, at 5.

31. *Id.* at 2018-xiii.

32. *Id.* at 13.

33. Susan H. Bragdon & Carly Hayes, *Re-conceiving Public-Private Partnerships to Eradicate Hunger: Small-Scale Farmers and Agricultural Biological Diversity as the Foundation of Global Food Security,* GEO. J. INT'L L. 1271, 1281 (2018).

34. ETC GROUP, WHO WILL FEED US? THE INDUSTRIAL FOOD CHAIN VERSUS THE PEASANT FOOD WEB 6, 10, 39, 42 (3d ed. 2017).

concentration on a smaller variety of crops, decreasing not only dietary diversity but the nutritional value of the diminished number of crops grown.[35]

Furthermore, the environmental impact of these agricultural methods creates a greater expense than can possibly be sustained over time: industrial agriculture is the single greatest user of freshwater resources on the planet and the greatest driver of biodiversity loss.[36] Given its dependence on fossil fuels and agro-chemicals, agriculture is well-known as a major contributor to climate and land-use change.[37]

In addition, the modern industrial system undermines the food and nutrition security and the biological resources upon which it ultimately depends.[38] The loss of on-farm diversity depletes the very resources that are the foundation of adapting to global environmental change.[39] Moreover, the abandonment of diverse farm management practices associated with the arrival of industrial agriculture erodes the capacity of small-scale farmers to innovate in response to environmental and socio-economic changes.[40]

Achieving the vision of Agenda 2030 requires constraining industrial agriculture. As this Article will illustrate, the good news is that supporting small-scale farmers in expanding agroecological principles, tools, and technologies as well as enhancing biological diversity can address these challenges and achieve better socioeconomic outcomes.[41] The elements

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35. 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).

36. *See* ETC GROUP, *supra* note 34; Jonathan A. Foley et al., *Solutions for a Cultivated Planet*, 478 Nature 337, 337−38 (2011).

37. Foley et al., *supra* note 36, at 337−38.

38. Olivier de Schutter (Special Rapporteur on the Right to Food), *The Transformative Potential of the Right to Food* ¶ 6, U.N. Doc. A/HRC/25/57 (Jan. 24, 2014).

39. *See generally* Emile A. Frison, *From Uniformity to Diversity: A Paradigm Shift from Industrial Agriculture to Diversified Agroecological Systems*, IPES-FOOD (June 2016), http://www.ipes-food.org/_img/upload/files/UniformityToDiversity_FULL.pdf [https://perma.cc/M4KE-7KMC].

40. Susan H. Bragdon & Chelsea Smith, *Small-scale farmer innovation*, QUNO (2015), (https://quno.org/sites/default/files/resources/SSF%20Innovation%20WEB.pdf) [https://perma.cc/464K-VKKR]; Chelsea Smith et al., *Realizing the right to food in an era of climate change: The importance of small-scale farmers*, QUNO (May 2015), (http://quno.org/sites/default/files/resources/Realizing%20the%20right%20to%20food%20in%20an%20era%20of%20climate%20change.pdf) [https://perma.cc/E9KP-SR3R].

41. The 10 elements of Agroecology are interlinked and interdependent, and they are divided into three main groups: (1) those with common characteristics of agroecological systems, fundamental practices, and innovation approaches, such as diversity, synergies, efficiency, resilience, recycling, co-creation, and sharing of knowledge; (2) context features, such as which are human and social values; and (3) those that enable the environment, such as circular and solidarity in economy, FOOD AND AGRIC. ORG. [FAO], THE 10 ELEMENTS OF AGROECOLOGY; GUIDING THE TRANSITION TO SUSTAINABLE FOOD AND AGRICULTURAL

are intended to guide countries into transforming their food and agricultural systems, mainstreaming sustainable agriculture on a large scale, and achieving several SDGs, including Zero Hunger,[42] and the Six Principles of Agroecology published by the Alliance for Food Sovereignty for Africa (AFSA).[43]

While all the SDGs are connected to small-scale farmers and agricultural biodiversity, Section II explores the most direct connections, including those with 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*. Section III concludes with a discussion about the challenges to the integrated implementation of the SDGs and the skills, expertise and orientation required to make it a reality.

Following is a list of points for a better understanding of the SDG analysis in this article:

- Most developing countries have agricultural economies where small-scale farmers account for 75% or more of the agricultural production and over 75% of those employed.[44]

SYSTEMS 3 (2018), http://www.fao.org/3/i9037en/I9037EN.pdf [https://perma.cc/TG3Y-ASUW].

42. *Id.* at 2.

43. Alliance for Food Sovereignty in Afr., *Agroecology; The Bold Future of Farming in Africa* 8 (2016). The six agroecological principles are: (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.; (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; and (6) Enhance beneficial biological interactions and synergies among the components of agrobiodiversity, thereby promoting key ecological processes and services.

44. *See* John F. Morton, *The Impact of Climate Change on Smallholder and Subsistence Agriculture*, 104(50) PROCEEDINGS OF THE NAT'L ACAD. OF SCI. OF THE U.S. 19680 (2007).

- At least 70% of the food we consume is produced by the world's one-and-a-half billion small-scale farmers.[45] In many developing countries the figure is higher, with between 75% and 90% of staple food locally produced by small-scale farmers.[46]
- Agricultural biodiversity continues to evolve through the work of small-scale farmers in their fields. They contribute to the resilience and stability of agricultural production systems.[47] They provide control mechanisms and genetic security to adapt to unpredictable changes in rainfall and temperatures.[48] This is particularly important today as the effects and uncertainties of climate change become increasingly manifest.
- Agricultural biodiversity, farmers' knowledge, and innovative practices offer social and economic opportunities that contribute to livelihoods and to social and cultural values.[49]
- Agricultural biodiversity is a major contributor to nutrition and health through its direct use. "The World Health Organization estimates that in many developing countries up to 80% of the population relies on genetic resources for primary health care."[50]
- Ecological processes such as the maintenance of water cycling, "soil fertility, pollination, seed dispersal, and nutrient cycling all rely, to a greater or lesser extent, on agricultural biological diversity."[51]
- *In situ* agricultural biodiversity continues to be developed and preserved by farmers who maintain the associated traditional knowledge. These resources and knowledge are integral to

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45. THE DEV. FUND, NORWAY, A VIABLE FOOD FUTURE 1, 44 (2011), https://www.utviklingsfondet.no/files/uf/documents/A_Viable_Food_Future_updated_web.pdf [https://perma.cc/SP9B-SXB2].

46. *Id.* at 42.

47. T.C.H. Sunderland, *Food Security: Why Is Biodiversity Important?*, 13(3) INT'L FORESTRY REV. 265, 267 (2011).

48. *Id.* at 269.

49. *See* 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 [https://perma.cc/PPP9-PUHN] (last visited Nov. 19, 2019); *Food and Agriculture: The future of sustainability*, U.N. DEP'T ECON. SOC. AFFAIRS 43 (2012), http://www.un.org/esa/dsd/dsd_sd21st/21_pdf/agriculture_and_food_report.pdf. [https://perma.cc/C8K4-ZVAC] (last visited Nov. 19, 2019).

50. *See* Sunderland, *supra* note 47, at 266 (citing C.N. Herndon & R.A. Butler, *Significance of Biodiversity to Health*, 42 BIOTROPICA 558, 558 (2010)).

51. Sunderland, *supra* note 47, at 266.

breeding and crop improvements that have potential global implications.

II. THE INTERRELATIONSHIPS BETWEEN SMALL-SCALE FARMERS, AGRICULTURAL BIODIVERSITY AND THE SDGS

A. SDG 1: End Poverty in all its Forms Everywhere

Over fifty per cent of people now live in urban areas, a proportion expected to increase to sixty-six per cent by 2050.[52] Nevertheless, in the two regions with the highest rates of poverty, sub-Saharan Africa and South Asia, "fifty-seven percent and sixty percent respectively of the population will still be rural in 2025 with these rural populations continuing to grow for many years."[53]

In all regions of the world rates of poverty and hunger are higher in rural areas than in urban areas.[54] Many of those affected are small-scale farmers.[55] Paradoxically, while small-scale farmers contribute so much to global food security,[56] they are often poor or very poor, and food insecure themselves.[57] Small-scale farmers support the livelihoods of some two-and-a-half billion people, and manage a large part of the world's natural resources, including agricultural biodiversity.[58] Agricultural biodiversity and the small-scale farmers who maintain and develop these resources contribute to improving livelihoods though providing a foundation for household food and nutritional security and offering opportunities to generate income.[59] In addition, agricultural biodiversity can decrease both

52. *See* U.N. Dep't of Econ. & Soc. Affairs, World Urbanization Prospects: The 2014 Revision, at 1 U.N. Doc. ST/ESA/SER. A/352 (2014).

53. Int'l Fund for Agric. Dev. [IFAD], *The IFAD Strategic Framework 2016-2025*, at 10 (2016), https://www.ifad.org/documents/38714170/39132730/IFAD+Strategic+Framework+2016-2025/d43eed79-c827-4ae8-b043-09e65977e22d [https://perma.cc/3VZ7-G8YZ] (last visited Nov. 19, 2019).

54. *See e.g.*, MICHAEL LIPTON, WHY POOR PEOPLE STAY POOR: THE URBAN BIAS IN GLOBAL DEVELOPMENT 13 (Harvard Univ. Press 1977) (discussing the problems associated with urban-bias and the hardships it has created for the rural poor).

55. U.N. Food & Agric. Org. [FAO], *Smallholders and Family Farmers* 1 (2012), http://www.fao.org/fileadmin/templates/nr/sustainability_pathways/docs/Factsheet_SMALLHOLDERS.pdf [https://perma.cc/C82A-7RLC] (last visited Nov. 19, 2019) [hereinafter *Smallholders and Family Farmers*].

56. *See infra* Section II.B.

57. *Smallholders and Family Farmers*, *supra* note 55, at 1.

58. *Id.*

59. U.N. Food & Agric. Org., *supra* note 55, at 1.

the probability of a non-poor household from slipping into poverty and the probability that a poor household will remain poor.[60]

While farming is mainly a private activity implemented locally in most parts of the world by small-scale farmers, their innovative activities, including the ongoing development of agricultural biodiversity through their practices, are in the public interest. Because the global public interest benefits from small-scale farmers managing and developing agricultural biodiversity *in situ* and on-farm, incentives and support must be provided. Policies, institutional constraints and other issues that destabilize small-scale farmers and farming communities, and that challenge the full deployment of agricultural biodiversity must be changed. Rural life must be made an attractive option, not a commitment to poverty.

B. SDG 2: "Zero Hunger," i.e., End Hunger, Achieve Food Security and Improved Nutrition, and Promote Sustainable Agriculture

SDG target 2.5 directly addresses the conservation of agricultural biodiversity and calls for the maintenance of the "genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species."[61] We are losing biological diversity at an alarming rate,[62] and the most critical loss to humanity is the loss of agricultural biodiversity. Without agricultural biodiversity, we will eventually lose our ability to produce food and feed ourselves, thus directly affecting our survival.[63]

Agricultural biodiversity provides direct benefits for nutrition[64] and health, resilience and stability, and for important ecological functions such as

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60. *See generally* Jeffrey D. Michler & Anna L. Josephson, *To Specialize or Diversify: Agricultural Diversity and Poverty Dynamics in Ethiopia*, 89 WORLD DEVELOPMENT 214–26 (2017) (discussing how crop diversity reduces the probability that a non-poor household will fall into or remain in poverty).

61. U.N. High-Level Political Forum on Sustainable Dev., *2017 HLPF Thematic Review of SDG 2: End Hunger, Achieve Food Security and Improved Nutrition, and Promote Sustainable Agriculture* 11 (2017) [hereinafter *2017 HLPF Thematic Review*].

62. "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/ [https://perma.cc/6KH4-HN2V] (last visited Aug. 31, 2019).

63. *See How does Biodiversity loss affect me and everyone else?*, WORLD WILDLIFE FOUNDATION, https://wwf.panda.org/our_work/biodiversity/biodiversity_and_you/ [https://perma.cc/J4TZ-XTVB] (last visited Aug. 31, 2019).

64. *About the Sustainable Development Goals*, *supra* note 5. SDG 2 includes an ambitious target: to end all forms of malnutrition by 2030; *see also infra* Section II.C, discussing the relationship between agricultural biodiversity, health, and well-being in connection with SDG 3.

nutrient cycling, soil formation, water cycling and purification.[65] It functions as a source of genetic diversity. Genetic diversity, and the genetic adaptations species have for different environments and diseases, is the raw material for evolution; species do not go extinct when the last representative dies; instead, a species goes extinct when it loses its ability to evolve.[66] When rice and wheat lose genetic diversity they are already in the process of becoming extinct even if millions of acres planted in rice or wheat remain.[67] These resources are globally kept in seed banks: the International Maize and Wheat Improvement Center (CIMMYT), for example, has the largest collection of varieties of wheat and maize seed in the world with more than 175,000 stored in a climate controlled vault.[68] But farmers' fields, mainly in developing countries, hold much more material:[69] seeds in fields are adapting naturally or are being bred by farmer-breeders to adapt[70] to changes in temperature,

65. *2017 HLPF Thematic Review*, *supra* note 61, at 6, 11.

66. *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/ [https://perma.cc/LH4G-V8DH] (finding that when animals cannot evolve quickly enough to match the changing environment, they become extinct).

67. *Cf.* Susan H. Bragdon (2017), *The Foundations of Food Security: Ensuring Support to Small-Scale Farmers Managing Agricultural Biodiversity*, QUAKER U.N. OFFICE 7−8 (2017), http://quno.org/sites/default/files/resources/FS%20foundation_FINAL_UPDATED.pdf **[**https://perma.cc/7EHR-ADTV].

68. Laura Strugnell, *Seed Savers Celebrate "Doomsday Vault" Tenth Anniversary,* CIMMYT.ORG (Feb. 22, 2018), https://www.cimmyt.org/news/seed-savers-celebrate-doomsday-vault-tenth-anniversary/ [https://perma.cc/3CMF-97TB].

69. *See* BRUSH, S. B., FARMERS' BOUNTY: LOCATING CROP DIVERSITY IN THE CONTEMPORARY NEW WORLD 2 (Yale Univ. Press, 2004); Jarvis, D.I. et al., *On-Farm Management of Crop Genetic Diversity and the Convention on Biological Diversity's Programme of Work on Agricultural Biodiversity*, 138 PLANT GENETIC RES. NEWSL. 5−17 (2004); Bezançon, G. et al., *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*, 56 GENETIC RES. CROP EVOLUTION 223−26 (2008).

70. Barry, M. et al., *Implications for In Situ Genetic Resource Conservation from the Ecogeographical Distribution of Rice Genetic Diversity in Maritime Guinea*, 5 PLANT GENETIC RES. CHARACTERIZATION & UTILIZATION 46 (2006); Hajjar, R. et al., *The Utility of Crop Genetic Diversity in Maintaining Ecosystem Services*, 123 AGRIC. ECOSYSTEMS & ENV'T 262 (2008).

rainfall,[71] water availability, soil salinity,[72] pests, and diseases,[73] all conditions exacerbated, if not caused, by climate change.[74] For example, higher levels of sorghum and millet diversity in West Africa have allowed local populations to adapt to increased periods of drought.[75] The diversity in rice in Nepal and fruit in Uzbekistan has reduced risk of crop loss to small scale farmers.[76] Farmers' varieties and wild species related to now

71. *See* Gerard Duc et al., *Diversity Maintenance and Use of Vicia Faba L. Genetic Resources, in* 115 FIELD CROPS RES. 270 (Feb. 5, 2010), https://www.sciencedirect.com/science/article/pii/S0378429008002074?via%3Dihub [https://perma.cc/PV8A-PDMW]; Bharat Bhandari, Summer Rainfall Variability and the Use of Rice (Oryza Sativa L.) Varietal Diversity for Adaptation: Farmers' Perceptions and Responses in Nepal (2009) (unpublished master's thesis, Swedish Biodiversity Centre) (on file with CBM Swedish Biodiversity Centre) (Farmers select strongly adaptable seeds to survive heavy rainfalls and extreme temperatures).

72. *See generally* Anthony H.D. Brown & Toby Hodgkin, *Measuring, Managing and Maintaining Crop Genetic Diversity On-Farms*, *in* MANAGING BIODIVERSITY IN AGRICULTURAL ECOSYSTEMS 13−33 (D. Jarvis et al. eds., 2007) (mentioning wild species that provide shade, protection and groundwater regulation); M.J. Swift et al., *Biodiversity and Ecosystem Services in Agricultural Landscapes – Are We Asking the Right Questions?*, *in* 104 AGRIC., ECOSYSTEMS & ENV'T 113−34 (Sept. 2004), https://www.sciencedirect.com/science/article/pii/S0167880904000362 [https://perma.cc/EP55-33QC] (discussing an experimentation with land use and the effects of soil and climate on biodiversity).

73. Maria R. Finckh & Martin S. Wolfe, *Diversification Strategies*, *in* THE EPIDEMIOLOGY OF PLANT DISEASES 273−80 (B. Cooke et al. eds., 2006); T. Abate et al, *Pest Management Strategies in Traditional* Agriculture*: An African Perspective*, *in* 45 ANNUAL REVIEW OF ENTOMOLOGY 631 (2000) (discussing pest management practices in traditional agriculture); Richard N. Strange & Peter R. Scott, *Plant Disease: A Threat to Global Food Security*, *in* 43 ANNUAL REVIEW OF PHYTOPATHOLOGY 83 (2005) (discussing agricultural difficulties in managing pests and plant diseases).

74. *See generally* Dai Aiguo, *Drought Under Global Warming: A Review*, *in* 2 WILEY INTERDISCIPLINARY REVIEWS: CLIMATE CHANGE (Oct. 19, 2010) (reviewing recent literature on droughts and discussing global aridity changes from 19050 to 2008); Rajib Karmakar et al., *Potential Effects of Climate Change on Soil Properties: A Review*, *in* 4 Science International 51−73 (2016) (discussing how climate plays a major role in the formation and development of soil); *The Long Dry: Why the World's Water Supply is Shrinking*, SCI. DAILY (Dec. 13, 2018), https://www.sciencedaily.com/releases/2018/12/181213090004.htm [https://perma.cc/9Y8D-UWF4] (discussing the paradox of water supplies shrinking while we are experiencing more rains due to climate change); Pamela K. Anderson et al., *Emerging Infectious Diseases of Plants: Pathogen Pollution, Climate Change and Agrotechnology Drivers, in* 19(10) TRENDS IN ECOLOGY & EVOLUTION 535 (2004), https://www.sciencedirect.com/science/article/abs/pii/S0169534704002186 [https://perma.cc/H6PW-NPGE] (discussing the effects of climate change on soil fertility, crop survival, and droughts).

75. *See generally* Kouressy Mamoutou et al., *Adaptation of Malian Sorgums to Climate Variability*, *in* 17:2 CAHIERS AGRICULTURES 95 (Mar.-Apr. 2008) (discussing how Malian sorghums react and adapt to climate variability).

76. *See* Diwakar Poudel, et al., *An Analysis of Social Seed Network and Its Contribution to On-Farm Conservation of Crop Genetic Diversity in Nepal*, 2015 INT'L. J OF BIODIVERSITY 1, 4 (2015) (explaining that rice variety in Nepal creates a networking map among the farming community and maintains agrobiodiversity); *see* ORGANIC AGRICULTURE IN UZBEKISTAN:

domesticated crops are the dynamic pool of genetic diversity on which farmers and the global community will continue to rely for resistance, tolerance, and immunity to stresses.[77] Furthermore, small-scale farmers are not static holders of unchanging knowledge, materials or management practices; and the agricultural biodiversity they manage and develop in on farm and *in situ* is not a static collection of resources.[78] Farmers dynamically experiment and know how crop seeds grow.[79]

Promoting sustainable agriculture requires understanding the past and future production process and source of the food; agricultural models based on diversifying farms and farming landscapes, replacing synthetic chemical inputs, prioritizing biodiversity, and stimulating interactions across species are increasingly gaining support, as part of holistic strategies to build long term fertility, healthy agro-ecosystems, and secure livelihoods.[80] Small-scale farmers and agricultural biodiversity are key components of an agro-ecological approach to agriculture.[81] 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.[82]

Additionally, agricultural biodiversity involves more than merely genetic diversity and established international law defines agricultural biodiversity as diversity at the genetic, species, and ecosystem levels.[83] Achieving SDG

STATUS, PRACTICES AND PROSPECTS, FOOD AND AGRICULTURE ORGANIZATION OF THE U.N. xvi (2018) (outlining Uzbekistan's economic development through the investment in intensive horticultural production of fruits and vegetables).

77. *See* Memorandum from the Quaker U.N. Office on Input on the Right to Food in Humanitarian Contexts to Hillal Elver, Special Rapporteur on the Right to Food (Mar. 17, 2017) (on file with https://quno.org).

78. *See, e.g.*, Mamoutou, *supra* note 75.

79. *See, e.g., id.*

80. 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. Steve Gliessman et al., IPES Food, *Breaking Away from Industrial Food and Farming Systems: Seven Case Studies of Agroecological Transition* 12 (Oct. 15, 2018), http://www.ipes-food.org/_img/upload/files/CS2_web.pdf [https://perma.cc/AEH5-VTXY].

81. *See, e.g.*, discussion, *supra* Section II.A.

82. Bragdon & Hayes, *Re-conceiving Public-Private Partnerships*, *supra* note 33, at 1273.

83. Convention on Biological Diversity, art. 2, Dec. 28, 1993, 1760 U.N.T.S. 79. Article 2 of the Convention states, "'Biological diversity' means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic

2 requires to adopt this more encompassing view[84] and to connect it to other SDGs, including SDG 15 and its call to halt the loss of biological diversity.[85] SDG 2.5 reflects the classical view of agricultural biodiversity being considered as genetic diversity and as a source of traits for breeding and crop improvement.[86] However, agricultural biodiversity offers much more than traits for breeding, it provides the basis for dietary diversity, and as a major and direct contributor to nutrition and health (SDG 3), its wide scope should be acknowledged when implementing SDG 2.[87] Agricultural biodiversity also contributes to crucial ecological functions like nutrient cycling, soil formation and water cycling.[88] Moreover, agricultural biodiversity offers economic and social opportunities that contribute to livelihoods and maintenance of cultural and social values.[89] Therefore, agricultural biodiversity is critical to healthy diets, is critical to a healthy environment, and contributes to national development in diverse ways and cannot be reduced to genetic diversity.

C. SDG 3: Ensure Healthy Lives and Promote Well-Being

The quantity and quality of ingredients we eat and drink have a significant influence on our health, and our diet correlates to what is grown, what is available, and at what cost. Almost a billion people (805 million in 2014) around the world currently suffer from hunger and do not have enough

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ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems."

84. As opposed to the more classical view that defines agricultural biodiversity as genetic diversity.

85. *Compare* SDG 2 (whose objective is to end hunger while promoting sustainable agriculture), *with* SDG 15 (aiming at preserving the environment, and in particular calling to halt the loss of biological diversity).

86. SDG 2.5 states that "[b]y 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. UN Statistics Division, Sustainable Development Goals, SDG Indicators, https://sustainabledevelopment.un.org/sdg2 [https://perma.cc/GPH7-S5M7] (last visited Nov. 17, 2019).

87. Emile Frison, *Agricultural Biodiversity for Health and Nutrition*, SCI. ALERT (Nov. 30, 2010), https://www.sciencealert.com/agricultural-biodiversity-for-nutrition-and-health [https://perma.cc/C8NQ-AREV].

88. P. Smith, et al., *Biogeochemical Cycles and Biodiversity as Key Drivers of Ecosystem Services Provided by Soils*, SOIL J. , 665, 666 (2015).

89. *See* Beintema et al., *supra* note 49, at 16; *Food and Agriculture: The future of sustainability*, *supra* note 49.

calories to eat.[90] Even more suffer from "hidden hunger" (about two billion in 2014), which occurs when the micronutrient intake is insufficient for leading healthy, happy, active adult lives.[91] UNICEF, the World Health Organization and the World Bank Group reports that almost one in four children (22.2%) under five-years-old is stunted, a condition that results from poor nutrition and the inability for the body to absorb nutrients.[92] Two billion people are deficient in at least one nutrient essential for health and thus undernourished.[93] Iron deficiency alone causes approximately twenty percent of maternal deaths.[94] Today, more people are severely overweight than struggling with hidden hunger.[95] Something is clearly wrong when under-nutrition and over-consumption co-occur.

Since 1900, there has been a significant global trend towards dietary simplification.[96] Dietary simplification underpins both overconsumption and undernutrition: while modern high-input high-yield agriculture[97] and long-distance transport increased the availability and affordability of refined carbohydrates (wheat, rice, sugar) and edible oils, this agricultural system erodes dietary diversity, contributing to nutrient deficiencies, and increased rates of associated chronic disease.[98] 98% of the world's food needs revolve around twelve plant crops and fourteen animal species today, with wheat, rice, and maize alone accounting for more than 50% of the global energy intake.[99]

Dietary simplification relates to agricultural biodiversity erosion, which occurs when more modern, industrialized production systems and the

90. GLOBAL HUNGER INDEX, *supra* note 27, at 21.
91. *Id.*
92. United Nations Children's Fund, World Health Organization, World Bank Group, *Levels and trends in child malnutrition: Key findings of the 2018 Edition of the Joint Child Malnutrition Estimates* 1−2 (2018).
93. Frison, *Agricultural Biodiversity for Health and Nutrition*, *supra* note 87.
94. Meharun-Nissa Khaskheli et al., *Iron Deficiency Anemia Is Still A Major Killer of Pregnant Women*, 32 PAK J. MED. SCI. 630, 631 (2016).
95. Frison, *Agricultural Biodiversity for Health and Nutrition*, *supra* note 87.
96. Comm'n on genetic Res. for Food and agric. org. [FAO], *Second Report on the State of the World's Plant Genetic Resources for Food and Agriculture* 15 (2010) [hereinafter FAO, *Second Report*].
97. Known as industrial agriculture, for more information, see *infra*, discussion in Section II.D.
98. *Globalization, Diets and Noncommunicable Disease*, WORLD HEALTH ORG. (Geneva: WHO 2002).
99. Paul R. Ehrlich & Edward O. Wilson, *Biodiversity Studies: Science and Policy*, 253 SCI. 758 (1991).

cultivation of uniform, high-yielding varieties replace traditional production systems and cultivation of diverse landrace varieties.[100] Forces of globalization, commercialization, industrialization, population proliferation, and urbanization change patterns of food production and consumption in ways that profoundly affect human diets.[101] Farmers are financially incentivized to replace on-farm crop diversity with wheat, rice, maize, and potato varieties that are highly demanded on international markets.[102] This trend has been referred to the "homogenization" of the global food supply.[103]

The increasing dietary simplification has direct, negative repercussions on nutrition and, hence, on health and well-being.[104] Diverse healthy diets, and thus demand for diverse varieties, correlate with the diversity grown in farmers' fields; thus, reversing this trend to achieve SDG 3 requires supporting farmers and agricultural biodiversity.[105]

D. SDG 5: Achieve Gender Equality and Empower all Women and Girls

Locally varied food production systems and agricultural biodiversity, including local knowledge and the culture and skills of women and men farmers, are disappearing under threats from a number of changes and trends.[106] Consequently it affects interactions between men and women farmers: "[w]omen comprise, on average, forty-three percent of the agricultural [labor] force in developing."[107] Civil wars, AIDS, migration of men to cities in search of paid work constitute some factors that increase the numbers of female-headed households.[108] Known as "the feminization of agriculture," it is having profound and far-reaching effects, both positive and negative.[109]

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100. *See* FAO, *Second Report*, *supra* note 96, at 15−16.

101. *Cf. id.*

102. D. Nierenberg & B. Halweil, *Cultivating Food Security*, *in* STATE OF THE WORLD, REDEFINING GLOBAL SECURITY (W. W. Norton & Co., 2005).

103. Khoury et al., *Increasing Homogeneity in Global Food Supplies and the Implications for Food Security*, 111(11) PROCEEDINGS OF THE NAT'L ACAD. OF SCI. OF THE U.S. 4001, 4005 (2014).

104. 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).

105. *Id*.

106. *See supra* Section II.C.

107. *See* UN Women News and Events, *SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture*, UN WOMEN, http://www.unwomen.org/en/news/in-focus/women-and-the-sdgs/sdg-2-zero-hunger [https://perma.cc/ALT4-7RRC] (last visited Nov. 17, 2019).

108. INT'L. ASSESSMENT OF AGRIC. KNOWLEDGE, SCI. TECH. FOR DEV., AGRICULTURE AT A CROSSROADS GLOBAL REPORT 211 (2008).

109. *See id.* at 46, 203, 210.

Women play a critical role in agriculture and rural development and face challenges that men do not.[110] Women have less access to resources and services, including land, finance, training, inputs, and equipment.[111] In addition to their agricultural work, women are overburdened with domestic chores and caring tasks.[112] A direct relationship exists between women's empowerment, agricultural productivity and food and nutrition security at the household level.[113] Potential benefits for the agricultural sector and society can be realized by reducing the constraints women face, by establishing best practices and by implementing programs, and interventions aimed at closing the gender gap in agriculture.[114]

Women often manage, use, and control natural and agricultural resources differently.[115] "Women invest as much as ten times more of their earnings than men do in their family's well-being, in areas including child health, education and nutrition."[116] When it comes to choosing crops to grow, women and men have different priorities: women often try to safeguard the diversity of minor and forgotten crops that are resilient to climate change.[117] Moreover, women generally care for species and varieties grown near the homestead, which contribute to diverse diets and family health.[118] Furthermore, agricultural systems, and the roles, rights and responsibilities of men and women who farm, vary depending on the geographic and cultural context.[119] Rural women farmers are responsible for the growth and collection of food,

110. *See* FAO, U.N Doc. C 2011/2-Add.1 (2011) (summarizing U.N. Food and Agric. Org, The State of Food and Agriculture 2010−11).

111. *Id.* at 5.

112. *Cf. id.*

113. *E.g.*, E. Sraboni, et al., *Women's Empowerment in Agriculture: What Role for Food Security in Bangladesh?*, 61 WORLD DEV. 11, 11−12 (2014); *see generally* S. Harper, et al., *Women and Fisheries: Contribution to Food Security and Local Economies*, 39 MARINE POLICY 56−63 (2013) (finding that improved gender equality in fisheries linked to poverty reduction and development).

114. *Id.; see also* SOFA, *supra* note 24, at 65.

115. *See, e.g.*, E. Duflo, *Women Empowerment and Economic Development*, 50(4) J. ECON. LIT. 1051, 1064 (2012).

116. Sonia Akter et al., *Women's Empowerment and Gender Equity in Agriculture: A Different Perspective From Southeast Asia*, 69 FOOD POLICY 271 (2017).

117. Staff Member, *"Farming is not gender neutral"-Q&A with Ann Tutwiler*, FUTUREEARTH, (Mar. 18, 2015), http://www.futureearth.org/blog/2015-mar-18/farming-not-gender-neutral-q-ann-tutwiler [https://perma.cc/G9RY-675W]

118. H. Nguyen et al, *Understanding Gender and Power Relations in Home Garden Activities: Empowerment and Sustainable Home Garden Uptake*, 17-813 WORLD VEGETABLE CTR 21 (2017).

119. *See, e.g.*, Howard, *infra* note 122.

and for the integrated management and use of diverse natural resources to fulfill daily household needs.[120] Understanding the impact of gender on rural agricultural development is key to creating policies geared towards achieving gender equality and empowering the goals of SDG 5. In fact, ensuring women's equal opportunities to access resources, such as diverse seeds, extension services and land would strengthen their capacities to grow food, and overall would increase agricultural productivity and the diversity of what we eat.[121] Additionally, striving for gender equality would help achieving SDGs on poverty, hunger, and sustainable agriculture.

E. SDG 6: Ensure Availability and Sustainable Management of Water and Sanitation for All

Water is an irreplaceable resource for food security, nutrition, and health. Water of sufficient quantity and quality is an essential input in daily activities, such as hygiene and sanitation practices in households and health care facilities, food production, animal rearing, and fisheries, as well as for the production of fibers and plants for medicinal purposes. Agricultural systems are tightly linked to water and energy systems. Increasing interest in the nexus between food (SDG2), water (SDG 6) energy (SDG 7) 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 (SDG 13) and the negative impact of the industrial food and agricultural systems on human and planetary health generally. Industrial agriculture is very water intensive. It accounts for 70 percent of the water withdrawals worldwide. Global trade in agricultural products —and the freshwater it takes to produce these commodities and food products—can exert even more pressure on watersheds.[122]

The occurrence and manifestation of climate change is likely to intensify water-nutrition linkages. As noted by the Intergovernmental Panel on Climate Change in its reports of 2007 and 2012, malnutrition is perceived as one of the five most substantial health impacts of climate change.

Small-holder farmers managing agricultural biodiversity and a groecological approaches have been shown to support important ecosystems services including water cycling and purification. These approaches can confer

120. This includes crops and wild plants, tree products, wild and domesticated animals. PATRICIA L. HOWARD ET AL., WOMEN & PLANTS: GENDER RELATIONS IN BIODIVERSITY MANAGEMENT & CONSERVATION 244 (Patricia L. Howard ed., 2003).

121. G.A. Res. 70/1, *supra* note 1.

122. U.N. Standing Comm. Nutrition, *Expert Group Meeting on Nutrition and the SDGs Under Review in Preparation for the High-Level Political Forum*, at 20, 7 (June 19-20, 2018) [hereinafter *EGM on Nutrition*].

resilience, robustness, and stability to our food and water systems across the world.

Small-scale farmers and Indigenous Peoples have used holistic methods such as rainwater harvesting and crop rotation that increases water availability up to 20%. According to Pierre-François Pret of *Terre & Humanisme,* agroecological approaches require "3 to 4 times less water than the established requirement for a specific crop, as determined by the agricultural chamber" when using renewable energies.[123]

F. SDG 7: Ensuring Access to Affordable, Reliable, Sustainable and Modern Energy for All

Energy has always been essential for the production of food. Prior to the industrial revolution, agriculture's primary energy input was the sun: plants grew naturally from photosynthesis and then served as food for livestock, which in turn provided fertilizer (manure) and muscle power for farming.[124]

The industrialized food system from farm to fork is heavily dependent on energy derived from fossil fuels.[125] "The reliance on fossil fuels . . . and other forms of non-renewable energy makes this system of agriculture one of the largest contributors to greenhouse gas emissions, more than our systems of transport, more than our cities."[126] Climate instability and unpredictability put all food production systems at risk, but particularly vulnerable are the one-and-a-half billion small-scale farmers from low and middle income countries who are at the frontlines of climate change and currently produce upwards of 70% of the food consumed globally.[127] In this system, production tends to be measured by yield per hectare, not by energy-efficiency or nutrition density.[128]

123. *Id.* at 8.

124. FOODPRINT, AGRICULTURE AND ENERGY CONSUMPTION 1, https://foodprint.org/issues/agriculture-energy-consumption/ [https://perma.cc/DD3W-55PP] (last visited Nov. 17, 2019).

125. *EGM on Nutrition*, *supra* note 122, at 38.

126. *Id.*

127. Celia A. Harvey et al., *Extreme Vulnerability of Smallholder Farmers to Agricultural Risks and Climate Change in Madagascar*, 369 PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOC'Y OF LONDON 10 (2014); Morton, *supra* note 44, at 19682.

128. *Cf.* Jonathan A. Foley et al., *Solutions for a Cultivated Planet*, NATURE 2 (2011).

A production system fueled by energy speeds up planting and harvesting; it allows to utilize the land year-round and prevents crop rotation and thus food production diversification.

The overall result can increase the supply of diversified foods for diverse diets. Unfortunately, both between and within countries a differential effect exists depending on socioeconomic strata with those already advantaged more likely to see an increase in diversified diets and those less advantaged not having the same access or availability.[129] At the same time there is an increased supply of highly processed foods, with high levels of fats, sugar and salt, contributing to rising levels of overweight and diet related non-communicable diseases (NCDs).[130] And this does not account for the environmental impacts of using fossil fuels and other forms of non-renewable energy noted above.[131]

Agriculture is the original "solar technology."[132] Small-scale farmers managing agricultural biodiversity and using agroecological practices are actively demonstrating how food systems can run on a foundation of sunlight.[133] Industrial agriculture requires ten kilocalories (kcal) of energy to produce one kcal of food energy while small-scale farmers spend four kcal energy to produce one kcal of food energy.[134]

G. SDG 8: Promote Inclusive, Sustainable Economic Growth, Full and Productive Employment, and Decent Work for All

The importance of agriculture, food, and wider rural development is not directly mentioned in SDG 8, its targets or its indicators,[135] even though the agriculture sector is the largest single sector in terms of employment[136]

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129. Marie Ruel & James Garrett, *Features of Urban Food and Nutrition Security and Considerations for Successful Urban Programming*, *in* 83 GLOBALIZATION OF FOOD SYSTEMS IN DEVELOPING COUNTRIES: A SYNTHESIS OF COUNTRY CASE STUDIES 27, 29 (FAO Food and Nutrition Paper, 2004) [hereinafter FAO Food and Nutrition Paper].

130. Josef Schmidhuber, *The Rowing Global Obesity Problem: Some Policy Options to Address it*, *in* FAO Food and Nutrition Paper, *supra* note 129.

131. *Id.*

132. *See* Newsweek Staff, *How to Feed the World,* NEWSWEEK (May 10, 2008, 8:49 AM), https://michaelpollan.com/articles-archive/how-to-feed-the-world/ [https://perma.cc/WZP8-LBV2] (Michael Pollan describing agriculture as the "original 'solar' technology").

133. *Id.*

134. *See* DAVID PIMENTAL & MARIO GIAMPIETRO, FOOD, LAND, POPULATION AND THE U.S. ECONOMY II-9, tbl. 4 (1994).

135. *Progress of Goal 8 in 2019*, SUSTAINABLE DEV., https://sustainabledevelopment.un.org/sdg8 [https://perma.cc/T55Z-WBLV] (last visited Nov. 16, 2019).

136. Douglas Gollin, *Agricultural Productivity and Economic Growth*, *in* 4 HANDBOOK OF AGRIC. ECON. 3825, 3826 (Prabhu Pingali & Robert Evenson ed., 2010).

and small-scale farmers support the livelihoods of some two billion to two-and-a-half 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, and since we have to be able to feed ourselves. It is also distinctive as an economic sector because it directly affects many of the very assets on which it relies for success.[139]

Nevertheless, government policies are most often focused on the urban sectors despite the inability of cities to absorb and employ rural populations in the event they are displaced.[140] The inability of governments to initiate adequate capital projects in rural areas has increased rural-urban migration, leading to congestion, slums, and ever-increasing unemployment.[141]

Small-scale farmers are often poor and food insecure themselves.[142] Rural life needs to be an attractive option with support to small-scale farmers as entrepreneurs and agents of change. Moreover, understanding rural-urban linkages is important, and in particular understanding the opportunities for the rural sector in those linkages. Furthermore, an increased focus on rural livelihoods and on the quality of rural life in its own right is required in order to achieve SDG 8 for countries with agricultural economies and large rural populations.

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137. *Id*. at 3828; IFAD, *supra* note 53, at 13.

138. Gollin, *supra* note 136, at 3828; *see also generally* Alberto Valdés & William Foster, *Reflections on the Role of Agriculture in Pro-Poor Growth*, *in* 38 WORLD DEV. 1362, 1362−74 (2010) (assessing the importance of agriculture poverty reduction); Gerdien Meijerink & Pim Roza, *The Role of Agriculture in Economic Development*, MKTS., CHAINS AND SUSTAINABLE DEV., STRATEGY AND POLICY PAPER 1 (2007), http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.456.1498&rep=rep1&type=pdf [https://perma.cc/NEP8-V29B]; C. Peter Timmer, *Agriculture and Economic Development*, *in* 2A HANDBOOK OF AGRICULTURAL ECONOMICS 1488 (Bruce Gardner & Gordon Rausser ed., 2002).

139. *See* discussion, *supra* Sections II.B, E, F (discussing the nexus amongst food-nutrition-water-energy and small-scale farmers and agricultural biodiversity).

140. *See* Michael Lipton, *Urban Bias and Food Policy in Poor Countries*, 1 FOOD POLICY 41 (1975).

141. Imoisi A. Ilegbinosa, Olatunji L. Moses & Ubi-Abai Itoro Praise, *Population and its Impact on Level of Unemployment in Least Developed Countries: An Appraisal of the Nigerian Economy*, 5 ARTS SOC. SCI. J. (2014), https://www.omicsonline.org/open-access/population-and-its-impact-on-level-of-unemployment-in-least-developed-countries-2151-6200.100081.pdf [https://perma.cc/SPA7-GHER].

142. *See* discussion, *supra* Section II.A.

The rapid urbanization and the transformation of the rural space, while bringing new challenges and opportunities, are changing the traditional approaches to food security and nutrition. Food systems cut across rural and urban settlements, and the links between urban and rural, physical, economic, social, and political links, are crucial for ending hunger and malnutrition sustainably in both rural and urban areas.[143]

Urban growth increases food demand and spurs dietary changes in urban areas; new demand can create opportunities for rural producers to improve their livelihoods while producing nutritious, diverse food for rural and urban consumption.[144] Government policies often focus on urban sectors, but because of the important role small-scale farmers and agricultural diversity play in supporting livelihoods, for instance as producers of diverse healthy foods and in the provision of ecosystem services, policies related to food security and nutrition, which affect both rural and urban population, need to be global; these policies should include agriculture, rural development, urban planning, and social protection among the topics. In particular, "local producers all need to be considered"[145] to address issues such as how to link urban, rural, and regional markets while ensuring sustainable production of diverse healthy food, especially by small-scale farmers; how to help consumers navigate the urban food landscape to improve food choices and household diets; how to encourage vendors to provide diverse, nutritious foods and link back to sustainable.

The Guiding Principles of Urban-Rural Linkages describe how "territorial approaches to planning can enable governments to better address geographical or rural-urban inequalities to more effectively integrate the social, economic, and environmental dimensions of development with regard to populations and sectors in a given geographical area."[146] Territorial approaches facilitate coordinating and concentrating efforts to "address the spatial concentration of poverty and food insecurity in some less developed areas, reflecting vast spatial inequalities."[147] Territorial approaches can also be useful in bringing

143. *EGM on Nutrition*, *supra* note 122, at 11.

144. *See* Int'l Fund for Agric. Dev. [IFAD], *How Inclusive Rural Transformation Can Promote Sustainable and Resilient Societies* 3, 6–7 (Mar. 2018), https://www.ifad.org/documents/38714170/40253256/policy_brief_inclusive_rural_transf.pdf/b0d43331-3408-44b6-894e-f27e1c5296ca [https://perma.cc/W223-L4FM].

145. *Strengthening Urban-Rural Linkages and Promoting Integrated Territorial Development*, URBAN-RURAL LINKAGES (Feb. 2019), https://urbanrurallinkages.wordpress.com/ [https://perma.cc/FEW8-FVCL].

146. *Id.*

147. David Suttie & Karim Hussein, Int'l Fund for Agric. Dev. [IFAD], *Territorial Approaches, Rural-Urban Linkages and Inclusive Rural Transformation* 1, 4 (Dec. 11,

the rural dimension into the "New Urban Agenda" developed by the United Nations Conference on Housing and Sustainable Urban Development in 2016.[148] But this can only be achieved if the voices and interests of rural people, including smallholder farmers, are integrated into the planning.

Most future urbanization is expected in small towns and medium-sized cities.[149] And rural populations between towns and cities provide most water, energy, food, and fiber for human settlements.[150] Therefore, a focus on the rural dimension of urbanization –and on small-scale farmers and agricultural biodiversity– is critical for sustainable development.

I. SDG 12: Ensuring Sustainable Consumption and Production Patterns

SDG 12 aims to "ensure that current material needs do not lead to the over extraction of resources or to the degradation of environmental resources."[151] It is instrumental for reconciling economic, social and environmental objectives.[152] While it represents a self-standing goal, responsible consumption and production are closely associated with a wide range of SDGs and their targets.[153] For example, the system of agriculture that emerged after World War II[154] is a major contributor to climate change, the largest user of fresh water resources, the biggest driver of biodiversity loss, and the polluter

2015), https://www.ifad.org/documents/38714170/40253256/GER_internal_print.pdf/52c96da0-ac57-46be-a3cd-86eb445bd471 [https://perma.cc/UK56-6X2Y].

148. G.A. Res. 71/256 (Dec. 23, 2016).

149. Ram Avtar et al., *Population-Urbanization-Energy Nexus: A Review*, 8 RESOURCES 1, 10 (2019); *see 68% of the world population projected to live in urban areas by 2050, says the U.N.*, UNITED NATIONS: DEP'T. OF ECON. & SOC. AFFAIRS (May 6, 2018), https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html [https://perma.cc/AEX9-9XR9].

150. Avtar, *supra* note 149, at 5.

151. U.N. Secretary-General, *Special Edition: Progress Towards the Sustainable Development Goals*, § 2.33, U.N. Doc. E/2019/68 (May 8, 2019).

152. *One Planet Initiative*, U.N. ENV'T PROGRAMME, https://www.unenvironment.org/explore-topics/resource-efficiency/what-we-do/one-planet-network [https://perma.cc/56V5-YJUE] (last visited Nov. 17, 2019) ("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 consumption and production patterns.").

153. *Id.*

154. *See* discussion, *supra* Section I.

causing dead zones in our oceans.[155] In the long run, the environmental, social and economic impact of these agricultural production methods creates a greater cost than can possibly be sustained.[156] Yet SDG 12 only mentions food waste; no other elements of the food system from production, to consumption, to disposal are considered.[157]

Nutrition is both a production and consumption issue. The current food system has increasingly homogenized the food supply where at the global level, three cereal crops now provide close to fifty percent of all calories consumed.[158] What we produce affects what we consume. A healthy, diverse diets starts with growing nutrient-dense, diverse foods. Dietary diversity is one way to help support an adequate supply of essential micronutrients.[159] Diversity of diet, founded on diverse farming systems, delivers better nutrition and greater health, with additional benefits for human productivity and livelihoods, and it has the added value of being essential to cope with the predicted impacts of climate change.

An Expert Group Meeting on SDG Interlinkages convened by the United Nations Division for Sustainable Development in January 2018 produced a report that stated,

> [H]uman wellbeing is at the center of SCP[160]. . . 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.[161]

Although SDG 12 does not explain how to align the economic system, a shift away from economic models that value growth for growth's sake and towards a new mindset that respects planetary boundaries, including biodiversity loss, and that recognizes the economy as a subset of nature (reflected in SDG target 12.8) is essential.[162]

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155. *See* Bragdon & Hayes, *Re-conceiving Public-Private Partnerships*, *supra* note 33, at 1281.

156. *See id.*

157. G.A. Res. 70/1, *supra* note 1, at Goal 12.

158. FAO, *Second Report*, *supra* note 96, at 15.

159. *Id.* at 190.

160. SCP stands for Sustainable consumption and production. U.N. Dep't of Econ. Soc. Aff. [U.N. DESA], Rep. of the Meeting, *Advancing the 2030 Agenda: Interlinkages and Common Themes at the HLPF 2018* 30 (Jan. 25-26, 2018).

161. *Id.* at 31.

162. *Sustainable Development Goal 12.8*, DIV. FOR SUSTAINABLE DEV. GOALS. (Jan. 13, 2019), https://sustainabledevelopment.un.org/sdg12 (stating "[b]y 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature").

J. SDG 13: Take Urgent Action to Combat Climate Change and Its Impacts

Industrial agriculture simplifies diets with negative consequences for human nutrition and health.[163] It is also a major contributor to climate change producing more than thirty percent of the global greenhouse gas emissions.[164] As the title to a recent article in the Guardian states, "Modern agriculture cultivates climate change: we must nurture biodiversity."[165]

Agriculture, i.e. 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.[166] This article advocates that a viable alternative to industrial agriculture exists: diversified agroecological systems. This approach is about diversifying farms and farming landscapes, replacing synthetic chemical inputs, optimizing biodiversity and stimulating interactions between different species.[167] The International Panel of Experts on Sustainable Food Systems reviewed a growing body of evidence and concluded that these systems have huge potential to succeed in reconciling concerns such as food security, environmental and livelihood resilience, nutritional adequacy and social equity.[168] Small-scale farmers and agricultural biodiversity are at the heart of agroecological approaches[169] and hence key to achieve SDG 13.[170]

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163. *See* discussion, *supra* Section II.C.

164. Sonja J. Vermeulen, Bruce M. Campbell & John S.I. Ingram, *Climate Change and Food Systems*, ANNUAL REVIEW OF ENV'T AND RES. (July 30, 2012), https://www.annualreviews.org/doi/pdf/10.1146/annurev-environ-020411-130608 [https://perma.cc/P7TZ-5BH3].

165. Olivier de Schutter & Emile Frison, *Modern agriculture cultivates climate change—we must nurture biodiversity*, THE GUARDIAN (Jan. 9, 2017, 2:00 PM), https://www.theguardian.com/global-development/2017/jan/09/modern-agriculture-cultivates-climate-change-nurture-biodiversity-olivier-de-schutter-emile-frison [https://perma.cc/7T32-V7FV].

166. *The Nine Planetary Boundaries*, STOCKHOLM RESILIENCE, https://www.stockholmresilience.org/research/planetary-boundaries/planetary-boundaries/about-the-research/the-nine-planetary-boundaries.html [https://perma.cc/L3UA-4MJD] (last visited Nov. 17, 2019).

167. Emile A. Frison, *From Uniformity to Diversity: A Paradigm Shift From Industrial Agriculture to Diversified Agroecological Systems*, IPES-FOOD (June 2016), http://www.ipes-food.org/_img/upload/files/UniformityToDiversity_FULL.pdf [https://perma.cc/8CS3-B8D3].

168. *Id.*

169. The article has developed this concept through the analysis of some key SDGs.

170. *See* Michael Jahi Chappell & Liliana A. LaValle, *Food Security and Biodiversity: Can we have both? An Agroecological Analysis*, AGRIC. AND HUMAN VALUES 37(June 22,

K. SDG 15: Sustainably Manage Forests, Combat Desertification, Halt and Reverse Land Degradation, and Halt Biodiversity Loss

Agricultural biodiversity and its custodians are critical to achieve SDG 15, including to "[p]rotect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation, and halt biodiversity loss."[171] Yet SDG 15 makes no mention of agricultural biological diversity and no connection to SDG 2 in general, nor to SDG2's references to genetic resources.[172]

Agricultural biodiversity, and the communities that manage it, are key to achieving SDG 15. Nearly all the targets of SDG 15's "Life on Land" require agroecological pathways to agricultural production, the foundation of which is agricultural biological diversity.[173] Nevertheless, agricultural biological diversity is not mentioned in the following goals: SDG 15.1, which deals with conserving and restoring terrestrial and fresh water ecosystem services, SDG 15.2, which deals with implementing the sustainable management of forests, SDG 15.3 which deals with restoring degraded land and soil, SDG 15.4 which deals with restoring mountain ecosystems including the capacity to provide benefits that are essential for sustainable development, nor SDG 15.5 which deals with reducing the degradation of natural habitats and halting the loss of biological diversity.[174] The only reference to agricultural biological diversity is found in SDG 15.6, to "[p]romote fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources, as internationally agreed"; while important, it represents only a subset of agricultural biological diversity of relevance to the SDGs.[175]

The transformation called for in Agenda 2030 will require a shift in our understanding and action to support the conservation and sustainable use of agricultural biological diversity as defined and required by the Convention on Biological Diversity and the International Treaty on Plant Genetic Resources for Food and Agriculture. In particular, there needs to be greater recognition of the interlinkages between SDG 2 and SDG15 extending beyond genetic diversity and seeds, and that recognizes the important role of agricultural biological diversity as broadly defined in health and nutrition, in providing important ecosystem services and in nature conservation.

2009), https://www.researchgate.net/publication/226129118_Food_security_and_biodiversity_Can_we_have_both_An_agroecological_analysis [https://perma.cc/W8C2-XRWB].

171. *See About the Sustainable Development Goals*, *supra* note 5, goal 15.

172. *See id.*

173. *Id.*

174. *Id.*

175. *Id.*

SDG 15 needs to be seen and implemented holistically,[176] and this cannot happen where nature conservation and agricultural production are at odds.[177] For example, agricultural biological diversity can be maintained by increasing landscape complexity: it can protect natural habitats and develop ecological corridors for wild species such as trees, crop wild relatives, and pollinators. Maintaining traditional land-use systems while increasing diversity in production systems following agroecological approaches is important in addressing conservation concerns and supporting sustainable improvements in food production.

Industrial agriculture is a major cause of land degradation and the loss of forests.[178] Global forests in developing countries are being cleared to make way for soy and maize monocultures: while certainly not a sustainable management of forests, it also causes land degradation and the loss of carbon sinks with the implications for SDG 13.[179] Achieving SDG 15 requires recognizing the need to constrain this type of agriculture and to support small-scale farmers and agroecological approaches.

L. SDG 16: Promote Peaceful and Inclusive Societies

A 17th century English proverb says, "A hungry man is an angry man."[180] Food insecurity can trigger conflict.[181] Since 2008, rapid increases in the global prices for major grains fueled outbreaks of civil unrest in more than forty countries.[182] Food insecurity is deepest in conflict-affected countries,

176. The same is true for the other SDGs.

177. *See* Dunja Mijatovic & Toby Hodgkin, *Agrobiodiversity Considerations in Land-Use Decisions: Reconciling agriculture and nature conservation will require greater consideration of agrobiodiversity*, PLATFORM FOR AGROBIODIVERSITY RESEARCH, http://agrobiodiversityplatform.org/agrobiodiversity-considerations-in-land-use-decisions/ [https://perma.cc/SY8A-9ZYU] (last visited Sept. 20, 2019).

178. *See* Hiroki Tabuchi, Claire Rigby & Jeremy White, *Amazon Deforestation, Once Tamed, Comes Roaring Back*, N.Y. TIMES (Feb. 24, 2017), https://www.nytimes.com/2017/02/24/business/energy-environment/deforestation-brazil-bolivia-south-america.html [https://perma.cc/5NV6-CFS7].

179. *Id.*

180. THE OXFORD DICTIONARY OF PHRASE AND FABLE, Encyclopedia.com (2016).

181. Cullen Hendrix & Henk-Jan Brinkman, *Food Insecurity and Conflict Dynamics: Causal Linkages and Complex Feedbacks*, INT'L J. OF SEC. & DEV. (June 17, 2013), http://doi.org/10.5334/sta.bm [http://perma.cc/KD4D-W8AY].

182. Emmy Simmons, *Harvesting Peace: Food Security, Conflict, and Cooperation*, 14 ENVTL. CHANGE & SEC. PROGRAM 1, 3 (2013), https://www.wilsoncenter.org/sites/default/files/HarvestingPeace.pdf [http://perma.cc/NJY3-TZHE].

where it can be both a cause and a consequence of violence.[183] Conflicts mainly affect rural populations, having a huge impact on food and agricultural production and on smallholder livelihoods.[184] Approximately one-and-a-half billion people live in conflict-affected, post-conflict, or fragile countries.[185]

Theoretical work and empirical analyses substantiate the many ways in which food insecurity can trigger, fuel, or sustain conflict.[186] Unanticipated food price rises frequently spark unrest.[187] Conflict among groups competing to control the natural resources needed for food production can catalyze conflict.[188] Social, political, or economic inequities that affect people's food security can exacerbate grievances and build momentum toward conflict.[189]

Achieving the SDGs, including food and nutrition security, requires peacebuilding and conflict resolution combined 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.[190] Resilience is central to any sustained response to food insecurity in crises or crises-prone situations.[191]

Furthermore, small-scale farmers are part of informal seeds systems that can provide positive social cohesion, an important ingredient to maintain peaceful and inclusive societies.[192] Support to small-scale farmers and to their activities that conserve and develop these resources is therefore directly related to peacebuilding and recovering from conflict.

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183. *Id.* at 5.

184. Memorandum from Quaker U.N. Office (QUNO) to the Special Rapporteur on the Right to Food, Hilal Elver, Input on the Right to Food in Humanitarian Contexts (Mar. 31, 2017), https://quno.org/sites/default/files/resources/SR%20Elver%20QUNO%20Input%20on%20Right%20to%20Food%20in%20Humanitarian%20Context.pdf [https://perma.cc/JXB6-E79P].

185. Simmons, *supra* note 182, at 3.

186. *Id.* at 4.

187. *Id.*

188. *Id.*

189. *Id.*; *see also* Ellie Roberts & Lynn Finnegan, *Building Peace Around Water, Land and Food: Policy and Practices for Preventing Conflict*, QUAKER U.N. OFFICE 1, 26 (Sept. 2013) http://www.quno.org [https://perma.cc/9NDL-LPVL].

190. Food and Agric. Org. [FAO], *FAO and Peacebuilding: Supporting Peace Through Food Security and Resilience* (2015), http://www.fao.org/3/a-i4348e.pdf [https://perma.cc/EZW5-F9SS].

191. *See* Schutter & Frison, *supra* note 165; *see also* Food and Agric. Org.[FAO], *Farmer Seed Systems and Sustaining Peace*, at 8, (2018), http://www.fao.org/3/ca1793en/CA1793 EN.pdf [https://perma.cc/8TAF-LVVE].

192. FAO, *Farmer Seed Systems and Sustaining Peace*, *supra* note 191, at 23.

III. CONCLUSION

Trade-offs will be necessary to achieve the goals and targets but they need to be explicitly known, in order to take the necessary complementary measures. The Report of the Expert Group Meeting on SDG Interlinkages[193] 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, achieving SDG 12 requires constraining industrial agriculture because of its negative impacts on other SDGs, including SDG 6, because it is the largest user of freshwater resources; SDG 2 and 15 because they are chief drivers of biological diversity loss; SDG 7 because of its dependence on fossil fuels; SDG 14 because of pesticide and fertilizer run-off polluting land and water and creating dead zones in the seas; and SDG 13 because it is a major contributor to greenhouse gas emissions.[194]

Furthermore, the success of the SDGs will depend on aligning targets and goals with existing international agreements and political processes.[195] Governments must therefore look at all their international legal obligations (as well as national actions) in terms of their impact on the SDGs and evaluate the impact of international agreements on issues like hunger, poverty, and environment.

In addition to international and intergovernmental institutions, other actors have an enormous impact in the international arena and need to be in alignment if the SDGs are to be achieved: private actors, such as transnational corporations, private foundations, industry associations, civil society and

193. U.N. DESA, Rep. of the Meeting, *Advancing the 2030 Agenda: Interlinkages and Common Themes at the HLPF 2018*, *supra* note 160.

194. *Id.*

195. Int'l Council for Sci. [ICSU] and Int'l Soc. Sci. Council [ISSC], *Review of Targets for the Sustainable Development Goals: The Science Perspective*, at 6 (2015), https://www.researchgate.net/publication/272355248_Review_of_Targets_for_The_Sustainable_Development_Goals_The_Science_Perspective [https://perma.cc/N26J-4H4Z]. In the intergovernmental world, the range will include, for example, the rules and initiatives coming from the World Trade Organization and other regional and bilateral trade regimes; the International Labor Organization; the Human Rights Council; the UNFCCC; the 2015 Addis Ababa Action Agenda Financing for Development; the Convention on Biological Diversity; the International Treaty on Plant Genetic Resources for Food and Agriculture; the World Committee on Food Security; the World Health Organization; the Food and Agricultural Organization, the United Nations Environment Program, the Development Banks; just to name just a few.

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 agreements and institutions ostensibly addressing the same topic struggle to be coherent and mutually supportive: for instance, various legal regimes are in place or being negotiated relating to small-scale farmers and agricultural biodiversity.[196] The breadth of seventeen SDGs increases the challenge. In addition to understanding the interlinkages, synergies and trade-offs, building capacity is required. 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.[197] The Model is not a substitute for detailed, sector-specific analysis, but rather is a complementary and overarching tool that pulls together and tests the coherence and impact of policies.[198] Moreover, the Stockholm Environment Institute's guide to SDG Interactions[199] 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.[200] Last, UNDP, UN-Habitat & the Global Task Force provide curating tools and guides to support governments in localizing the SDGs.[201]

Using these tools requires taking into account the importance of small-scale farmers and agricultural biological diversity, and the involvement of small-scale farmers in the policy process, to be efficient.

The efficacy of these tools depends on the value of the input and the extent to which all relevant actors are involved. Currently, the central role played by small-scale farmers and agricultural biodiversity in overcoming hunger and poverty, in supporting health, nutrition and ecosystem services, and in ensuring the resilience of our food systems in the face of climate is

196. Susan H. Bragdon, *The Evolution of Rights and Responsibilities over Agricultural Biodiversity*, QUAKER U.N. OFF., GENEVA, SWITZ. 1, 11 (Mar. 2017).

197. *iSDG: Policy Coherence and Integration to Achieve the Sustainable Development Goals*, MILLENNIUM INST., https://www.millennium-institute.org/isdg [https://perma.cc/FN3J-BQA4] (last visited Nov. 16, 2019).

198. *Id.*

199. Int'l Council for Sci. [ICSU], *A Guide to SDG Interactions: from Science to Implementation*, at 28 (2017), https://council.science/publications/a-guide-to-sdg-interactions-from-science-to-implementation [https://perma.cc/6G2E-TC4J].

200. *Id.*

201. *About*, LOCAL 2030, https://www.local2030.org/about-us.php [https://perma.cc/59EU-7CBA] (last visited Nov. 16, 2019).

neither acknowledged, nor integrated with national and global strategies for achieving the SDGs.

Therefore, understanding the interlinkages and increasing support to small-scale farmers in agrobiodiverse situations is a critical foundation to achieve the SDGs.

The conversation must include small-scale farmers and rural populations, not because excluding them is leaving certain segments of the population behind but because of their crucial role: small-scale farmers are agents of change at the forefront of the development.