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Report of the Special Rapporteur on the right to food

Note by the Secretariat

The Secretariat has the honour to transmit to the Human Rights Council the report of the Special Rapporteur on the right to food, pursuant to Council resolutions 6/2, 31/10 and 32/8. The report was written in collaboration with the Special Rapporteur on the implications for human rights of the environmentally sound management and disposal of hazardous substances and wastes. In the report, a clearer account is provided of global pesticide use in agriculture and its impact on human rights; the negative consequences that pesticide practices have had on human health, the environment and society, which are underreported and monitored in the shadow of a prevailing and narrow focus on "food security", are described; and the environmental and human rights regimes are examined to determine whether the constituent rules are sufficient to protect farm workers, consumers and vulnerable groups, as well as the natural resources that are necessary to support sustainable food systems.

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I. Introduction

1. The present report of the Special Rapporteur on the right to food was written in collaboration with the Special Rapporteur on the implications for human rights of the environmentally sound management and disposal of hazardous substances and wastes. Pesticides, which have been aggressively promoted, are a global human rights concern, and their use can have very detrimental consequences on the enjoyment of the right to food. Defined as any substance or mixture of substances of chemical and biological ingredients intended to repel, destroy or control any pest or regulate plant growth,[1] pesticides are responsible for an estimated 200,000 acute poisoning deaths each year,[2] 99 per cent of which occur in developing countries,[3] where health, safety and environmental regulations are weaker and less strictly applied. While records on global pesticide use are incomplete,[4] it is generally agreed that application rates have increased dramatically over the past few decades.

2. Despite the harms associated with excessive and unsafe pesticide practices, it is commonly argued that intensive industrial agriculture, which is heavily reliant on pesticide inputs, is necessary to increase yields to feed a growing world population, particularly in the light of negative climate change impacts and global scarcity of farmlands. Indeed, over the past 50 years, the global population has more than doubled, while available arable land has only increased by about 10 per cent.[5] Evolving technology in pesticide manufacture, among other agricultural innovations, has certainly helped to keep agricultural production apace of unprecedented jumps in food demand. However, this has come at the expense of human health and the environment. Equally, increased food production has not succeeded in eliminating hunger worldwide. Reliance on hazardous pesticides is a short-term solution that undermines the rights to adequate food and health for present and future generations.

3. Pesticides cause an array of harms. Runoff from treated crops frequently pollute the surrounding ecosystem and beyond, with unpredictable ecological consequences. Furthermore, reductions in pest populations upset the complex balance between predator and prey species in the food chain, thereby destabilizing the ecosystem. Pesticides can also decrease biodiversity of soils and contribute to nitrogen fixation, which can lead to large declines in crop yields, posing problems for food security.

4. While scientific research confirms the adverse effects of pesticides, proving a definitive link between exposure and human diseases or conditions, or harm to the ecosystem presents a considerable challenge. This challenge has been exacerbated by a systematic denial, fuelled by the pesticide and agroindustry, of the magnitude of the

[1] Food and Agriculture Organization of the United Nations (FAO) and World Health Organization (WHO), *International Code of Conduct on Pesticides Management: Guidelines on Highly Hazardous Pesticides* (Rome, 2016), p. vi. In the report, the authors examine only pesticides used in agriculture and not so-called "public health" pesticides used in disease control.

[2] Måns Svensson and others, "Migrant agricultural workers and their socio-economic, occupational and health conditions — a literature review", Lund University (1 January 2013).

[3] Lynn Goldmann, *Childhood Pesticide Poisoning: Information for Advocacy and Action* (Geneva, FAO, United Nations Environment Programme (UNEP) and WHO, 2004), p. 7.

[4] See www.fao.org/faostat/en/#home.

[5] Heinz-R. Köhler and Rita Triebskorn, "Wildlife ecotoxicology of pesticides: can we track effects to the population level and beyond?" *Science*, vol. 341, No. 6147 (16 August 2013), pp. 759-765; M. Allsop and others, *Pesticides and Our Health: A Growing Concern* (Exeter, United Kingdom, Greenpeace Research Laboratories, 2015), p. 3.

damage inflicted by these chemicals, and aggressive, unethical marketing tactics remain unchallenged.

5. Exposure to pesticides can have severe impacts on the enjoyment of human rights, in particular the right to adequate food, as well as the right to health. The right to food obligates States to implement protective measures and food safety requirements to ensure that food is safe, free from pesticides and qualitatively adequate. Furthermore, human rights standards require States to protect vulnerable groups, such as farm workers and agricultural communities, children and pregnant women from the impacts of pesticides.

6. Although certain multinational treaties and non-binding initiatives offer some limited protections, a comprehensive treaty that regulates highly hazardous pesticides does not exist, leaving a critical gap in the human rights protection framework.

7. Without or with minimal use of toxic chemicals, it is possible to produce healthier, nutrient-rich food, with higher yields in the longer term, without polluting and exhausting environmental resources.[6] The solution requires a holistic approach to the right to adequate food that includes phasing out dangerous pesticides and enforcing an effective regulatory framework grounded on a human rights approach, coupled with a transition towards sustainable agricultural practices that take into account the challenges of resource scarcity and climate change.

II. Adverse impact of pesticides on human rights

8. Hazardous pesticides impose substantial costs on Governments and have catastrophic impacts on the environment, human health and society as a whole, implicating a number of human rights and putting certain groups at elevated risk of rights abuses.[7]

A. Human health

9. Few people are untouched by pesticide exposure. They may be exposed through food, water, air, or direct contact with pesticides or residues. However, given that most diseases are multi-causal, and bearing in mind that individuals tend to be exposed to a complex mixture of chemicals in their daily lives, establishing a direct causal link between exposure to pesticides and their effects can be a challenge for accountability and for victims seeking access to an effective remedy. Even so, persistent use of pesticides, in particular agrochemicals used in industrial farming, have been connected to a range of adverse health impacts, both at high and low exposure levels.[8]

10. Pesticide poisonings remain a serious concern, especially in developing countries, even though these nations account for only 25 per cent of pesticide usage. In some countries, pesticide poisoning even exceeds fatalities from infectious diseases.[9] Tragic accidents involving poisoning include an incident in 1999 in Peru, where 24 schoolchildren died following the consumption of the highly toxic pesticide parathion, which had been

[6] International Assessment of Agricultural Knowledge, Science and Technology for Development, *Agriculture at a Crossroads: Synthesis Report* (Washington, D.C., 2009), p. 3.

[7] For a discussion of some of these negative effects, see, e.g., UNEP, *Costs of Inaction on the Sound Management of Chemicals* (Geneva, 2013).

[8] Frank Eyhorn, Tina Roner and Heiko Specking, *Reducing Pesticide Use and Risks — What Action is Needed?*, Briefing Paper (HELVETAS Swiss Intercooperation, 2015), pp. 7-9.

[9] Michael Eddleston, "Pesticide poisoning in the developing world — a minimum pesticides list", *The Lancet*, vol. 360, No. 9340 (12 October 2002), pp. 1163-1167.

packaged so that it was mistaken for powdered milk. Other cases include the deaths of 23 children in India in 2013 after consuming a meal contaminated with the highly hazardous pesticide monocrotophos; the poisoning of 39 preschool children in China in 2014 from consumption of food containing residues of the pesticide TETs; and the deaths of 11 children in Bangladesh in 2015 after eating fruits laced with pesticides.[10]

11. Unfortunately, there are no reliable, global statistics on the number of people who suffer from pesticide exposure. Recently, the non-profit organization Pesticide Action Network estimated that the number of people affected annually by short- and long-term pesticide exposure ranged between 1 million and 41 million.[11]

12. Of grave concern are the impacts of chronic exposure to hazardous pesticides. Pesticide exposure has been linked to cancer, Alzheimer's and Parkinson's diseases, hormone disruption, developmental disorders and sterility. They can also cause numerous neurological health effects such as memory loss, loss of coordination, reduced visual ability and reduced motor skills. Other possible effects include asthma, allergies and hypersensitivity. These symptoms are often very subtle and may not be recognized by the medical community as a clinical effect caused by pesticides.[12] Furthermore, chronic effects of pesticides may not manifest for months or years after exposure, presenting a significant challenge for accountability and access to an effective remedy, including preventive interventions.

13. Despite grave human health risks having been well established for numerous pesticides, they remain in use. Even where pesticides have been banned or restricted, the risk of contamination can persist for many decades and they may continue to accumulate in food sources. In many cases, possible health impacts have not been extensively studied before pesticides are placed on the market. This is particularly true for "inactive" ingredients that are added to enhance the effectiveness of the pesticide's active ingredient and that may not be tested and are seldom disclosed on product labels.[13] Moreover, the combination effects of exposure to multiple pesticides in food, water, soil and air have not been adequately studied.[14]

14. Certain groups are at substantially higher risk of pesticide exposure, as detailed below.

Farmers and agricultural workers

15. Agricultural workers are routinely exposed to toxic pesticides via spray, drift or direct contact with treated crops or soil, from accidental spills or inadequate personal protective equipment. Even when following recommended safety precautions, those applying pesticides are subject to higher exposure levels. Families of agricultural workers are also vulnerable, as workers bring home pesticide residues on their skin, clothing and shoes.

[10] Pesticide Action Network, response to the questionnaire on pesticides and the right to food, pp. 3-4. The questionnaire and the responses are available from www.ohchr.org/EN/Issues/Environment/ToxicWastes/Pages/Pesticidesrighttofood.aspx.

[11] Pesticide Action Network, *Communities in Peril: Global Report on Health Impacts of Pesticide Use in Agriculture* (2010).

[12] Köhler, "Wildlife ecotoxicology of pesticides"; Eyhorn, *Reducing Pesticide Use*.

[13] See http://www.toxipedia.org/display/toxipedia/Effects+of+Pesticides+on+Human+Health.

[14] Eyhorn, *Reducing Pesticide Use*, p. 4.

16. Studies in developed countries show that annual acute pesticide poisoning affects nearly 1 in every 5,000 agricultural workers.[15] Globally, however, it is unknown what percentage of farmworkers experience acute pesticide poisoning owing to a lack of standardized reporting. Poor enforcement of labour regulations and lack of health and safety training can elevate exposure risks, while many Governments lack the infrastructure and resources to regulate and monitor pesticides.[16]

17. The exposure risk of children engaged in agricultural work is particularly alarming. Although little data are available, the International Labour Organization estimates that about 60 per cent of child labourers worldwide work in agriculture, and children often make up a substantial portion of the agricultural workforce in developing countries. Their increased sensitivity to the hazards of pesticides, the inadequacy of protective equipment and their lack of experience may leave them particularly exposed.[17]

18. Seasonal and migrant workers are also more vulnerable, as they may work temporarily at various agricultural sites, multiplying their exposure risk to pesticides. Language barriers may further prevent these workers from understanding labels and safety warnings, they may experience poor working conditions without access to adequate safety equipment and they may have difficulty accessing medical care and compensation for pesticide-related diseases. Workers may also have little control over the types of pesticides used.

Communities living near agricultural lands

19. Those living close to industrial agricultural lands and plantations may also be at grave risk of pesticide exposure. Aerial pesticide spraying is particularly dangerous, as chemicals can drift to nearby locations. Communities may be forced to reside closer to pesticide use areas owing to financial or other constraints, and the malnutrition that may accompany extreme poverty can exacerbate the adverse health effects of toxic pesticides. For example, low levels of protein, resulting in low enzyme levels, enhance vulnerability to organophosphate insecticides.[18]

20. Examples of exposure owing to proximity to plantations include Costa Rica, where children living close to banana plantations were found to be exposed to high levels of insecticides.[19] In India, inhabitants of the Padre village in the State of Kerala, located near cashew plantations, were found to suffer from high rates of illness and death that have been linked to the highly hazardous pesticide endosulfan; disability rates among inhabitants are reportedly 73 per cent higher than the overall rates for the entire state.[20]

21. During the 1970s, the pesticide DCBP was used extensively on banana and pineapple plantations around the world.[21] In Davao, the Philippines, where the pesticide was used in the 1980s, high levels of sterility were scientifically proven to have resulted from exposure. Other conditions, including cancer, asthma, tuberculosis and skin disease,

[15] International Panel of Experts on Sustainable Food Systems, *From Uniformity to Diversity: A Paradigm Shift from Industrial Agriculture to Diversified Agroecological Systems* (2016), p. 29.

[16] Eddleston, "Pesticide poisoning in the developing world".

[17] Gaafar Abdel Rasoul and others, "Effects of occupational pesticide exposure on children applying pesticides", *Neuro Toxicology*, vol. 29, No. 5 (September 2008), pp. 833-838.

[18] Pesticide Action Network Asia Pacific, response to the questionnaire on pesticides and the right to food, p. 4.

[19] International Panel of Experts on Sustainable Food Systems, *From Uniformity to Diversity* , p. 29.

[20] Pesticide Action Network, response to the questionnaire on pesticides and the right to food, p. 1.

[21] Environmental Justice Atlas, "Farmworkers poisoned by DBCP (Nemagon), Philippines", available from https://ejatlas.org/conflict/philippine-farmworkers-poisoned-by-dbcp-pesticide.

were also detected, but a linkage was not scientifically proven. While local authorities banned aerial spraying following community protests, the Supreme Court of the Philippines reversed the ban, allegedly under pressure from banana corporations.[22] Further, suits brought by plantation workers have been dismissed, leaving victims without compensation. Twenty years on, despite a global ban on DBCP, soils and water sources remain contaminated.

Indigenous communities

22. In various countries, agribusinesses have taken over lands belonging to indigenous and minority communities and instituted pesticide-dependent intensive agriculture. As a result, communities may be forced to live in marginal situations alongside such farms, regularly exposing them to pesticide drift.

23. Traditional food sources of indigenous peoples are regularly found to contain high levels of pesticides. This is also true in the Arctic, because chemicals travel northward through long-range environmental transport in wind and water, bioaccumulating and biomagnifying in traditional foods such as marine mammals and fish.[23] Indigenous peoples in the Arctic are found to have hazardous pesticides in their bodies that were never used near their communities, and suffer from above average rates of cancer and other diseases.

Pregnant women and children

24. Children are most vulnerable to pesticide contamination, as their organs are still developing and, owing to their smaller size, they are exposed to a higher dose per unit of body weight; the levels and activity of key enzymes that detoxify pesticides are much lower in children than in adults.[24] Health impacts linked to childhood exposure to pesticides include impaired intellectual development, adverse behavioural effects and other developmental abnormalities.[25] Emerging research is revealing that exposure to even low levels of pesticides, for example through wind drift or residues on food, may be very damaging to children's health, disrupting their mental and physiological growth and possibly leading to a lifetime of diseases and disorders.

25. Pregnant women who are exposed to pesticides are at higher risk of miscarriage, pre-term delivery and birth defects. Studies have regularly found a cocktail of pesticides in umbilical cords and first faeces of newborns, proving prenatal exposure.[26] Exposure to pesticides can be transferred from either parent. The most critical period for exposure for the father is three months prior to conception, while maternal exposure is most dangerous from the month before conception through the first trimester of pregnancy.[27] Recent evidence suggests that pesticide exposure by pregnant mothers leads to higher risk of

[22] Pesticide Action Network Asia Pacific, response to the questionnaire on pesticides and the right to food.

[23] Alaska Native Health Board, "Traditional food contaminants testing projects in Alaska", July 2002; Gretchen Welfinger-Smith and others, "Organochlorine and metal contaminants in traditional foods from St. Lawrence Island, Alaska", *Journal of Toxicology and Environmental Health*, Part A, vol. 74, No.18 (September 2011).

[24] Beyond Pesticides, "Children and pesticides don't mix", Factsheet, available from http://www.beyondpesticides.org/assets/media/documents/lawn/factsheets/Pesticide.children.dontmix.pdf.

[25] Eyhorn, *Reducing Pesticide Use*, p. 9.

[26] Enrique Ostrea, Dawn Bielawski and N.C. Posecion, "Meconium analysis to detect fetal exposure to neurotoxicants", *Archive of Disease in Childhood*, vol. 91, No. 8 (September 2006).

[27] Pesticide Action Network, response to the questionnaire on pesticides and the right to food, p. 3.

childhood leukaemia and other cancers, autism and respiratory illnesses.[28] For example, neurotoxic pesticides can cross the placental barrier and affect the developing nervous system of the fetus, while other toxic chemicals can adversely impact its undeveloped immune system.[29]

26. Pesticides can also pass through breast milk. This is particularly worrying, as breast milk is the only source of food for many babies and their metabolism is not well developed to fight against hazardous chemicals. Pesticides are also found in baby formula, or in the water with which it is mixed.[30]

Consumers

27. Pesticide residues are commonly found in both plant and animal food sources, resulting in significant exposure risks for consumers. Studies indicate that foods often contain multiple residues, thereby resulting in the consumption of a "cocktail" of pesticides. Although the harmful effects of pesticide mixtures are still not fully understood, it is known that in some cases, synergistic interactions can occur that lead to higher toxicity levels. High cumulative exposure of consumers to pesticides is particularly worrying, especially with lipophilic pesticides, which bind with fats and bioaccumulate in the body.[31]

28. Traces may remain on fruits and vegetables that are extensively treated with pesticides before they reach the consumer. The highest levels of pesticides are often found in legumes, leafy greens and fruits such as apples, strawberries and grapes. While washing and cooking produce reduces residue levels, food preparation can sometimes increase these levels.[32] Also, many pesticides used today are systemic — taken up through the roots and distributed throughout the plant — and therefore washing will have no effect.

29. Pesticides may also bioaccumulate in farmed animals through contaminated feed. Insecticides are often used in poultry and eggs, while milk and other dairy products may contain a range of substances through bioaccumulation and storage in the fatty tissues of the animals. This is of particular concern as cow's milk is often a staple component of human diets, especially for children.

30. Certain pesticides, such as organotins, accumulate and magnify through marine food web systems. As a result, people who depend on or consume greater amounts of seafood tend to have particularly high concentrations in their blood, causing significant health risks.[33]

31. Pesticides also present a serious threat to drinking water, particularly in agricultural areas, which often depend on groundwater. While it can take several decades before pesticides applied in fields appear in water wells, high levels of herbicides in agricultural areas have already caused health problems for some communities.[34] For example, in the

[28] Council on Environmental Health, "Policy statement: pesticide exposure in children", *Pediatrics*, vol. 130, No. 6 (December 2012).

[29] Köhler, "Wildlife ecotoxicology of pesticides", p. 19.

[30] International Baby Food Action Network and Geneva Infant Feeding Association, response to the questionnaire on pesticides and the right to food, p. 4.

[31] Köhler, "Wildlife ecotoxicology of pesticides", p. 10.

[32] B.M. Keikotlhaile, P. Spanoghe and W. Steurbaut, "Effects of food processing on pesticide residues in fruits and vegetables: a meta-analysis approach", *Food and Chemical Toxicology*, vol. 48, No. 1 (January 2010).

[33] Köhler, "Wildlife ecotoxicology of pesticides", p. 11.

[34] Aviva Glaser, "Threatened waters: turning the tide on pesticide contamination", *Beyond Pesticides* (February 2006), available from http://www.beyondpesticides.org/assets/media/documents/documents/water.pdf.

United States of America, where over 70 million pounds of atrazine are used annually, runoff into water supplies has been linked to increased risk of birth defects.[35] While atrazine was banned in the European Union in 2004, some European countries still detect it in groundwater today.

B. Environmental impact

32. Pesticides can persist in the environment for decades and pose a global threat to the entire ecological system upon which food production depends. Excessive use and misuse of pesticides result in contamination of surrounding soil and water sources, causing loss of biodiversity, destroying beneficial insect populations that act as natural enemies of pests and reducing the nutritional value of food.

33. Pesticides contaminate and degrade soil to varying degrees. In China, recent studies released by the Government show moderate to severe contamination from pesticides and other pollutants on 26 million hectares of farmland, to the extent that farming cannot continue on approximately 20 per cent of arable land.[36]

34. Water contamination can be equally damaging. In Guatemala, for example, contamination of the Pasión River with the pesticide malathion, used on palm oil plantations, killed thousands of fish and affected 23 species of fish. This in turn deprived 12,000 people in 14 communities of their primary source of food and livelihood.[37]

35. While regulators are mostly concerned about health risks through pesticide residues, their effects on non-target organisms are hugely underestimated. For example, neonicotinoids, a commonly used class of systemic insecticides, are causing soil degradation and water pollution and endangering vital ecosystem services such as biological pest control.[38] Designed to damage the central nervous system of target pests, they can also cause harm to beneficial invertebrates as well as to birds, butterflies and other wildlife.[39]

36. Neonicotinoids are accused of being responsible for "colony collapse disorder" of bees worldwide.[40] For example, heavy use of these insecticides has been blamed for the 50 per cent decline over 25 years in honeybee populations in both the United States and the United Kingdom of Great Britain and Northern Ireland.[41] This decline threatens the very basis of agriculture, given that wild bees and managed honeybees play the greatest role in pollinating crops. According to estimates from the Food and Agriculture Organization of the United Nations (FAO), of some 100 crop species (which provide 90 per cent of global

[35] FindLaw, Atrazuine Lawsuit Overview (2016), available from http://injury.findlaw.com/product-liability/atrazine-lawsuit-overview.html.

[36] Caixin Online, "China's tainted soil initiative lacks pay plan", 6 August 2016, available from http://english.caixin.com/2016-06-08/100952896.html.

[37] See case GTM 4/2015 in document A/HRC/31/79.

[38] The Taskforce on Systemic Pesticides, *Worldwide Integrated Assessment of the Impacts of Systemic Pesticides on Biodiversity and Ecosystems* (9 January 2015).

[39] Peter Jenkins, *Net Loss: Economic Efficacy and Cost of Neonicotinoid Insecticides Used as Seed Coatings: Updates from the United States and Europe* (Center for Food Safety, 2016).

[40] Beyond Pesticides, "BEE protective: chemicals implicated", available from http://www.beyondpesticides.org/programs/bee-protective-pollinators-and-pesticides/chemicals-implicated.

[41] *Guardian*, "Pesticides linked to honeybee decline", 29 March 2012.

food), 71 per cent are pollinated by bees.[42] The European Union, unlike the United States, restricted the use of certain neonicotinoids in 2013.

37. Many of the pesticides used today, accounting for approximately 60 per cent of dietary exposure,[43] are systemic. Seeds treated with systemic pesticides are commonly used in soybean, corn and peanut production. Similarly, crops may be genetically engineered (so-called GMOs) to produce pesticides themselves. Proponents of systemic pesticides and genetically engineered crops claim that by eliminating liquid spraying, the risk of exposure to farm workers and other non-target organisms is greatly reduced. However, further studies of chronic exposure are needed to determine the extent of the impact of systemic pesticides and genetically engineered crops on human health, beneficial insects, soil ecosystems and aquatic life.[44] For example, transgenic corn and soybean varieties have been developed that are capable of producing *Bacillus thuringiensis* (*Bt*) endotoxins that act as insecticides.[45] While the use of *Bt* crops has led to a reduction in conventional synthetic insecticide use, controversy remains about the possible risks posed by these crops.

38. The prime example of controversy around genetically engineered crops is glyphosate, the active ingredient of some herbicides, including Roundup, that allow farmers to kill weeds but not their crops. While presented as less toxic and persistent compared to traditional herbicides, there is considerable disagreement over the impact of glyphosate on the environment: studies have indicated negative impacts on biodiversity, wildlife and soil nutrient content.[46] There are also concerns regarding human health. In 2015, WHO announced that glyphosate was a probable carcinogen.[47]

39. In Europe, genetically engineered crop regulations exemplify the precautionary principle. If an action or policy has a suspected risk of causing harm to the public or the environment, in the absence of scientific consensus, the burden of proof falls on those taking the action or policy to demonstrate that it is not harmful. In contrast, in the United States, the biggest producer of genetically engineered crops,[48] regulations have generally followed the concept of "substantial equivalence", whereby a novel crop or food is compared to an existing one and if judged adequately similar, it falls under existing

[42] UNEP, *Global Honey Bee Colony Disorders and Other Threats to Insect Pollinators* (Nairobi, 2010); Michelle Allsopp and others, *Plan Bee — Living Without Pesticides: Moving Towards Ecological Farming* (Amsterdam, Greenpeace, 2014), p. 9.

[43] Chuck Benbrook, "Prevention, not profit, should drive pest management", Rachel Carson Memorial Lecture, *Pesticides News 82*, December 2008.

[44] Jennifer Hsaio, "GMOs and pesticides: helpful or harmful", blog, special edition on genetically modified organisms (GMOs), Harvard University (10 August 2015); Andria Cimino and others, "Effects of neonicotinoid pesticide exposure on human health: a systematic review", *Environmental Health Perspectives* (6 July 2016); Greenpeace, "Environmental and health impacts of GM crops: the science", Briefing, September 2011.

[45] Matthew Niederhuber, "Insecticidal plants: the tech and safety of GM *Bt* crops", blog, special edition on GMOs, Harvard University (10 August 2015); Mike Mendelsohn and others, "Are *Bt* crops safe?", *Nature Biotechnology*, vol. 21, No. 9 (September 2003), pp. 1003-1009.

[46] Jordan Wilkerson, "Why Roundup ready crops have lost their allure", blog, special edition on GMOs, Harvard University (10 August 2015); Friends of the Earth Europe, *The Environmental Impacts of Glyphosate* (Brussels, 2013).

[47] International Agency for Research on Cancer, "Evaluation of five organophosphate insecticides and herbicides", IARC monographs, vol. 112 (20 March 2015); Daniel Cressey, "Widely used herbicide linked to cancer", *Nature News* (24 March 2015).

[48] For example, in 2013, 93 per cent of the soybeans, 90 per cent of the cotton and 90 per cent of the corn grown in the United States were genetically engineered for either herbicide tolerance or insect resistance. See https://www.loc.gov/law/help/restrictions-on-gmos/usa.php.

regulations.[49] Considering their probable grave effects on health and the environment, there is an urgent need for holistic regulation on the basis of the precautionary principle to address the genetically engineered production process and other new technologies at the global level.

III. Legal structure

A. Human rights law

40. The right to adequate food provides a guarantee for food that is necessary to achieve an adequate standard of living. In addition to the Universal Declaration of Human Rights, it has been codified in article 11 of the International Covenant on Economic, Social and Cultural Rights. The Committee on Economic, Social, and Cultural Rights, in its general comment No. 12 (1999) on the right to adequate food, substantiates the right to adequate food, stating that it must not be construed in a narrow or restrictive sense, and declaring that adequacy denotes not just quantity but also quality. The Committee further considers that the right implies food that is free from adverse substances, and asserts that States must implement food safety requirements and protective measures to ensure that food is safe and qualitatively adequate. Under even the narrowest interpretation of article 11 and general comment No. 12, food that is contaminated by pesticides cannot be considered as adequate food.

41. In its general comment, the Committee furthermore asserts that sustainability is intrinsically linked to the notion of adequate food, implying that food must be accessible for both present and future generations. As outlined in the present report, pesticides are responsible for biodiversity loss and water and soil contamination and for negatively affecting the productivity of croplands, thereby threatening future food production.

42. The right to adequate food embraces the notion that its realization must not interfere with the enjoyment of other human rights. Therefore, arguments suggesting that pesticides are needed to safeguard the right to food and food security clash with the right to health, in view of the myriad negative health impacts associated with certain pesticide practices.

43. Indeed, article 12 of the International Covenant provides a right to the highest attainable level of health and obligates States to take measures to improve all aspects of environmental and industrial hygiene. In its general comment No. 14 (2000) on the right to the highest attainable standard of health, the Committee embraces the notion that the right extends to the underlying determinants of health, such as safe food, potable water, safe and healthy working conditions and a healthy environment. It also notes that the obligation to improve industrial and environmental hygiene essentially entails the right to a healthy workplace, including the prevention and reduction of exposure to harmful substances, and the minimization of the causes of health hazards inherent in the workplace. With regard to pesticide exposure, human rights law underlines the obligation on States to ensure that people live and work in safe and healthy environments and have access to safe and clean food and water. As such, exposure to pesticides, whether at work, as a bystander or via residue found on food or in water, would violate a person's right to the highest attainable level of health.

44. Moreover, articles 11 and 12 of the Convention on the Elimination of All Forms of Discrimination against Women address women's right to protection of health and safety,

[49] National Academies of Sciences, Engineering and Medicine, *Genetically Engineered Crops: Experiences and Prospects* (Washington, D.C., 2016).

including the safeguarding of the function of reproduction, and call for special protections to be accorded to mothers before and after childbirth. The Committee on the Elimination of Discrimination against Women also calls on States to take appropriate measures to provide special protection to women during pregnancy. Such obligations clearly extend to minimizing the risks of maternal exposure to pesticides.

45. The Convention on the Rights of the Child also includes specific provisions to protect children from environmental contaminants and supports childhood development. Article 6 highlights the obligation of Governments, to the maximum extent possible, to ensure that children survive and develop in a healthy manner.

46. Appropriately, article 24 (2) (c) of the Convention makes the explicit link between food, water and the right to the highest attainable standard of health. States must combat disease and malnutrition through the provision of adequate, nutritious foods and clean drinking water, taking into consideration the dangers and risks of environmental pollution. In articles 24 (4) and 32 (1), the Convention also calls for international cooperation to help developing countries achieve this, and requires States to protect children from work that may be hazardous to their health or physical or mental development, such as work where they use or may otherwise be exposed to hazardous pesticides. It is clear that ensuring protection from pesticides falls within the parameters of the Convention.

47. Furthermore, the International Covenant on Civil and Political Rights, the United Nations Declaration on the Rights of Indigenous Peoples, the International Convention on the Rights of All Migrant Workers and Members of Their Families and other international human rights instruments all contain provisions that require States to provide adequate protection, information and remedies in the context of pesticide use.

48. While international human rights laws provide substantive protections against excessive and unsafe pesticide practices, implementation and enforcement remain major challenges. Most commonly, a human right that contemplates the negative effects of pesticides is implicit in the right to health. For example, in the African system, which does not recognize the right to food, the African Commission on Human and Peoples' Rights has interpreted the right to health to require Governments to take action to prevent third parties from destroying or contaminating food sources.[50]

49. The Optional Protocol to the International Covenant on Economic, Social and Cultural Rights provides individuals with a grievance mechanism at the international level to claim violations of any of the rights set forth in the Covenant and to submit complaints to the Committee on Economic, Social, and Cultural Rights.

50. Certain voluntary guidelines and recommendations are also relevant in the context of human rights and pesticides. The Voluntary Guidelines to Support the Progressive Realization of the Right to Adequate Food in the Context of National Food Security, which provide non-binding guidance for States on operationalizing the right to adequate food, promote State action in the realm of food safety and consumer protection. For example, guideline 9 calls for States to develop food safety standards on pesticide residues. Guideline 4 advocates that States should ensure adequate protection for consumers against unsafe food and encourages the development of corporate social responsibility policies for businesses.

[50] Communication No. 155/96, *Social and Economic Rights Action Center and Center for Economic and Social Rights v. Nigeria*, decision adopted on 27 May 2012.

51. Businesses, whose decisions "can profoundly affect the dignity and rights of individuals and communities",[51] also have human rights responsibilities. Yet the State-centric nature of the human rights regime largely fails to account for the considerable role that the business sector plays in the violation of human rights. The inability of the regime to address non-State actors is particularly problematic given that the pesticide industry is dominated by a few transnational corporations that wield extraordinary power over global agrochemical research, legislative initiatives and regulatory agendas.

52. The responsibility of corporations is specified in the Guiding Principles on Business and Human Rights. In addition to setting out States' existing obligations to protect against business-related human rights abuse and ensure access to remedy for victims, the Guiding Principles specify the independent responsibility of businesses to respect human rights, that is to avoid and address adverse human rights impacts linked to their operations. While businesses are not directly bound by international human rights treaties, the Guiding Principles provide a broadly agreed normative basis to assess corporate activity.

53. Given the severe, negative impact of the use of hazardous pesticides on people and the planet, an international legally binding instrument to regulate, in international human rights law, the activities of transnational corporations would be important to strengthen the international accountability framework.

B. International environmental law

54. International environmental treaties have delivered limited success in enabling a transition away from hazardous pesticides in favour of safer alternatives. A good example of a global treaty that reduces the use of a hazardous pesticide is the phase-out and control of methyl bromide under the Montreal Protocol on Substances that Deplete the Ozone Layer to the Vienna Convention for the Protection of the Ozone Layer. The Protocol enabled an assessment of ongoing uses of methyl bromide, identification of viable alternatives and a schedule for orderly transition to such alternatives.

55. In addition, the Stockholm Convention on Persistent Organic Pollutants provides for global prohibitions and restrictions for a certain set of hazardous pesticides. However, while the treaty has expanded from banning or restricting the use of an initial set of 12 largely obsolete industrial chemicals and pesticides, its coverage is still limited and many highly hazardous pesticides do not fall within its scope.

56. Two other treaties cover a broader scope of hazardous pesticides, but only for specific international activities. The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade enables information sharing between States on the export and import of certain hazardous pesticides, while the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal regulates the international trade of hazardous pesticides as waste.

57. A major defect in the international regime for hazardous pesticides is the lack of an effective framework to regulate different types of hazardous pesticides throughout their life cycle. A toxic pesticide is only regulated if it meets the narrow criteria of the Stockholm Convention or the Montreal Protocol, which the vast majority of hazardous pesticides do not. Thus, hundreds of hazardous pesticides are not eligible for regulation under existing treaties to control critical stages of their life cycle. Another shortcoming of the Rotterdam

[51] Mary Robinson, "The business case for human rights", in Financial Times Management, *Visions of Ethical Business* (London: Financial Times Professional, 1998).

Convention is its consensus-based decision-making process, allowing one country to obstruct the listing of hazardous pesticides, such as paraquat. States have also delayed listing of hazardous pesticides under the Stockholm Convention, and they have the ability to accept or reject a global "ban" through opt-in and opt-out provisions.

Other relevant conventions

58. Although the Convention on Biological Diversity does not explicitly mention pesticides, it is still highly relevant in view of the negative impacts of pesticides on biodiversity. Article 6 of the Convention requires parties to create a national strategy for the conservation of biodiversity, promotes sustainable development and recognizes the need for food security. National legislation for the protection of biodiversity is increasingly being used in efforts to restrict the use of hazardous pesticides. For example, in the United States, several lawsuits are being brought under the Endangered Species Act to protect the loss of biodiversity from pesticides.[52]

59. The Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters is also relevant to the regulation of pesticides and derives many of its core obligations from human rights law. Article 1 sets out detailed obligations with respect to the matters covered by the Convention.

60. The Aarhus Convention has recently been invoked concerning confidentiality of information regarding glyphosate. In a recent case brought by non-governmental organizations to the European Court of Justice,[53] the Court ruled that health and safety information about the pesticide must be made available to the public. The case stems from the European Commission's refusal to grant access to such information (see A/HRC/30/40, paras. 46-47). The ruling further demonstrates the international consensus that health and safety information about pesticides and other hazardous substances should never be confidential.

C. International code of conduct and non-binding practices

61. The International Code of Conduct on Pesticide Management, established by WHO and FAO, is a voluntary framework that guides Governments, the private sector, civil society and other stakeholders on best practices in managing pesticides throughout their life cycle, particularly where there is inadequate or no national legislation to regulate pesticide management.[54] In 2013, the Code was updated to focus on the health and environmental impacts of pesticides to support healthy ecosystems and sustainable agricultural practices. It also emphasizes minimizing the use of pesticides, calls on countries to identify and, if necessary, remove highly hazardous pesticides and gives attention to vulnerable groups.

62. While several major pesticide companies have pledged to adhere to the Code through their membership of Croplife International, which states on its website that "leading companies of the plant science industry have agreed to abide by provisions in the latest revision to the Code",[55] civil society groups have recently made grave allegations regarding breaches of the Code by the pesticide industry. For example, a monitoring report

[52] See, e.g., https://www.epa.gov/endangered-species/endangered-species-litigation-and-associated-pesticide-limitations.

[53] Case C-673/13 P, *Commission v. Stichting Greenpeace Nederland and Pesticide Action Network Europe*, judgment of 23 November 2016.

[54] See article 1.1.

[55] See https://croplife.org/crop-protection/regulatory/product-management/international-code-of-conduct/.

submitted by several non-governmental organizations to the FAO Panel of Experts on Pesticide Management alleges that Bayer CropScience and Syngenta are involved in the manufacturing, distribution and sale of highly hazardous pesticides in violation of the Code. According to the report, in 2014, in Punjab, India, the companies failed to adequately inform farmers about the dangers of their pesticides or the necessary safety measures.[56]

63. Another non-binding policy framework is the Strategic Approach to International Chemicals Management, adopted by the International Conference on Chemicals Management, held in Dubai in 2006. The Dubai Declaration, which is part of the Strategic Approach, explicitly states the commitment to respect human rights. The International Conference also adopted a resolution in 2015 to encourage the use of alternatives to highly hazardous pesticides without, however, any specificity or obligation to phase them out any time in the future.[57]

64. The Responsible Care Global Charter is also a voluntary initiative of the chemical industry that major agrochemical companies, but not all, have signed.[58]

65. Conventions of the International Labour Organization on the protection of agricultural workers also provide some safeguards against dangerous pesticides. For example, article 12 of the Safety and Health in Agriculture Convention, 2001 (No. 184) is dedicated to the sound management of chemicals, while article 13 imposes regulatory obligations with regard to preventive and protective measures for the use of chemicals.

66. All major pesticide companies are members of the United Nations Global Compact, reporting yearly to the United Nations through the Global Reporting Initiative. While it is somewhat encouraging that they are willing to join corporate social responsibility schemes, such arrangements lack any enforcement or accountability measures and allow companies substantial freedom in choosing what they wish to adhere to.

67. Overall, while some of these initiatives have had some impact, the voluntary nature of soft law instruments clearly limits their effectiveness.

68. Meanwhile, the activities of certain non-governmental organizations have made a significant impact on recent policies. Pesticide Action Network International, for example, has developed a list of highly hazardous pesticides based on its own definition, which has been useful in advocacy efforts.[59] A recent civil society initiative, the International Monsanto Tribunal, held in The Hague in October 2016, dealt with human rights violations stemming from widely used hazardous pesticides. Eminent judges heard testimonies from victims and will deliver an opinion, following procedures similar to those at the International Court of Justice.[60] While these efforts are helpful to publicize the problem and help to develop laws in the future, they cannot provide remedy to victims.

[56] Ad hoc monitoring report by the European Center for Constitutional and Human Rights, Pesticide Action Network Asia and others, October 2015.

[57] See www.saicm.org/images/saicm_documents/iccm/ICCM4/Re-issued_mtg_report/K1606013_e.pdf.

[58] A list of company signatories to the 2014 Responsible Care Global Charter is available from https://www.icca-chem.org/wp-content/uploads/2016/05/2014-Global-Charter-Company-Signatory-List_April-5-2016.pdf.

[59] See http://www.panna.org/issues/publication/pan-international-list-highly-hazardous-pesticides.

[60] See http://en.monsanto-tribunal.org/.

IV. Challenges of the current pesticides regime

A. Divergent levels of protection at the national level

69. For the preparation of the present report, some Governments provided information on laws to regulate pesticide use and on authorization and testing requirements prior to registration as well as inspection and monitoring practices, including random sampling of agricultural products for residue levels and farm inspections. Training and awareness-raising initiatives for the general public, farmers, distributors and schoolchildren were also shared, as well as precautionary measures and labelling requirements. Finally, integrated pest management strategies and examples of practices promoting organic farming were provided.[61]

70. Countries have established significant national laws and practices in an effort to reduce pesticide harm; however, policies and levels of protection vary significantly. For instance, there are often serious shortcomings in national registration processes prior to the sale of pesticide products. It is very difficult to assess the risk of pesticides submitted for registration, particularly as toxicity studies often do not analyse the many chronic health-related effects. Further, reviews may not take place frequently enough and regulatory authorities may be under strong pressure from the industry to prevent or reverse bans on hazardous pesticides. Without standardized, stringent regulations on the production, sale and acceptable levels of pesticide use, the burden of the negative effects of pesticides is felt by agricultural workers, children, the poor and other vulnerable communities, especially in countries that have weaker regulatory and enforcement systems.

71. Many developing countries have shifted their agricultural policies from traditional food production for local consumption to export-oriented cash crops. Under strong pressure to maximize yields, farmers have become increasingly reliant on chemical pesticides. Yet the steep rise in the use of pesticides has not always been accompanied by necessary safeguards to control their application. Approximately 25 per cent of developing countries lack effective laws on distribution and use, while about 80 per cent lack sufficient resources to enforce existing pesticide-related laws.[62]

72. Most countries maintain a threshold maximum residue level, indicating the highest level of pesticide considered to be safe for consumption. Monitoring those levels can help protect consumers and incentivize farmers to minimize the use of pesticides. However, capacity for inspection is often lacking, or adequate systems are not in place to measure or enforce maximum residue levels. Moreover, as maximum residue levels are not uniform, food products banned in one country may still be permitted entry in countries that allow higher levels. Similarly, while foods produced locally containing high pesticide residue levels may not be permitted for export owing to stricter regulations abroad, they may still be sold domestically.

73. Lack of harmonized standards also results in more toxic, and even banned, pesticides being used extensively in developing countries because they are cheaper alternatives. In many cases, highly hazardous pesticides that are not or no longer permitted for use in industrialized countries are exported to developing countries. Some pesticide companies fail to register or reregister products intended for export to developing countries, or increase exports of products that have been banned or restricted to use up existing stocks,

[61] See the responses to the questionnaire on pesticides and the right to food.

[62] Donald J. Ecobichon, “Pesticide use in developing countries”, *Toxicology*, vol. 160, Nos. 1-3 (2001), pp. 27-33.

fully aware that they would not be authorized for sale in the country where the company is based.[63] To subject individuals of other nations to toxins known to cause major health damage or fatality is a clear human rights violation.

74. Finally, international trade deals threaten to lower standards of protection from toxic pesticides while increasing the risk of harm to the environment and to citizens. The European Parliament has expressed concern that regulatory convergence through the Transatlantic Trade and Investment Partnership risks aligning common standards at the lowest common denominator. The Parliament further contends that the pesticides industry consistently considers protective regulations as "trade irritants" that obstruct trade.[64]

B. Other challenges

75. In addition to the legal gaps and dual standards noted above, there are other challenges derived from excessive or inaccurate use of pesticides, accidents, and dissemination of misinformation and misconceptions by producers.

Personal protective equipment and labels

76. Pesticide companies and Governments often argue that exposure risk to pesticides is generally low if personal protective equipment is properly used. Yet in reality, compliance with recommended personal protective equipment practices is generally low, for a number of reasons.

77. Personal protective equipment may be unsuitable for local working conditions, for example extreme heat and humidity, steep terrain and thick vegetation. Other factors may include pressure to work as fast as possible, lack of training on the health risks of exposure or trainings conducted in non-native languages, coupled with high turnover of workers.

78. Warning labels on pesticides may also be ineffective owing to the small size of print used on container labels, failure to translate instructions into local languages and low literacy rates among pesticide users. While pictograms and other creative labelling tactics may try to address some of these problems, without training, agricultural workers may still have difficulty deciphering colour codes or warning symbols.

79. The repackaging of pesticides into smaller amounts for retail is also of grave concern. Pesticides are often transferred from labelled containers that meet safety standards into unlabelled, mislabelled or inappropriate containers, such as old water bottles, to be sold alongside foodstuffs.

80. The industry frequently uses the term "intentional misuse" to shift the blame onto the user for the avoidable impacts of hazardous pesticides. Yet clearly, the responsibility for protecting users and others throughout the pesticide life cycle and throughout the retail chain lies with the pesticide manufacturer. This is reflected, for example, in the Guiding Principles on Business and Human Rights on "business relationships", which set a precedent by requiring businesses to have producer responsibility for certain products even

[63] For example, paraquat has been banned in Switzerland and Europe for years. However, Syngenta, based in Switzerland, continues to distribute the product overseas. In the United States, the Environmental Protection Agency restricts but does not prohibit the export of unapproved or unregistered pesticides to third countries. See Paulo Prada, "Paraquat: a controversial chemical's second act", Reuters, 2 April 2015.

[64] Erica Smith, David Azoulay and Baskut Tuncak, *Lowest Common Denominator: How the Proposed EU-US Trade Deal Threatens to Lower Standards of Protection from Toxic Pesticides* (Centre for International Environmental Law, 2015), pp. 2-3.

after they are sold. It is imperative that such responsibility be extended to pesticide producers.

Managing the complete life cycle of pesticide impacts

81. From the production of pesticides to their disposal, the impacts of pesticides go beyond their application to crops and exposure through food and water.

82. One of the most catastrophic incidents involving pesticides occurred in 1984 in Bhopal, India, where approximately 45 tons of methyl isocyanate gas leaked from a Union Carbide plant as a result of negligence, immediately killing thousands of people and resulting in serious health issues and premature deaths for tens of thousands living in the vicinity. Epidemiological studies conducted soon after the accident showed significant increases in pregnancy loss, infant mortality, decreased fetal weight, chromosomal abnormalities, impaired associate learning and respiratory illnesses.[65]

83. The tragedy led to the worldwide development of major reforms, including the above-mentioned Responsible Care initiative. Such initiatives, however, have not succeeded in halting continued disasters related to the manufacture of pesticides worldwide.

84. Pesticide waste is also a major challenge. There are thousands of tonnes of obsolete pesticides around the world, some of which are nearly 30 years old, presenting a major health hazard, particularly in developing countries.[66] Existing data indicate that more than 20 per cent of obsolete pesticide stockpiles consist of persistent organic pollutants, which are highly toxic and made up of organic compounds that are resistant to environmental degradation.

85. Unused pesticides may accumulate and deteriorate for a variety of reasons. For example, purchased or donated pesticides may be unsuitable to local conditions or quantities received may exceed demand. This can occur because of pressure from agrochemical industries and corruption, leading to more pesticides being procured than needed. Also, when pesticides are banned, managing existing stocks is a problem. According to FAO, "good practice requires regulatory authorities to allow a phase-out period when products are banned or restricted so that existing stocks can be used up before the restriction is fully applied".[67] This is, of course, a highly problematic suggestion.

Pivotal role of the private sector

86. The oligopoly of the chemical industry has enormous power. Recent mergers have resulted in just three powerful corporations: Monsanto and Bayer, Dow and Dupont, and Syngenta and ChemChina. They control more than 65 per cent of global pesticide sales. Serious conflicts of interest issues arise, as they also control almost 61 per cent of commercial seed sales. The pesticide industry's efforts to influence policymakers and regulators have obstructed reforms and paralysed global pesticide restrictions globally. When challenged, justifications for lobbying efforts include claims that companies comply with their own codes of conduct, or that they follow local laws.[68]

87. Companies often contest scientific evidence of the hazards related to their products, with some even standing accused of deliberately manufacturing evidence to infuse scientific uncertainty and delay restrictions. There are also serious claims of scientists being

[65] Pesticide Action Network, response to the questionnaire on pesticides and the right to food.
[66] See http://www.fao.org/agriculture/crops/obsolete-pesticides/where-stocks/en/.
[67] See http://www.fao.org/agriculture/crops/obsolete-pesticides/why-problem/pesticide-bans/en/.
[68] Kari Hamerschlag, Anna Lappé and Stacy Malkan, *Spinning Food: How Food Industry Front Groups and Covert Communications are Shaping the Story of Food* (Friends of the Earth, 2015).

"bought" to restate industry talking points. Other egregious practices include infiltrating federal regulatory agencies via the "revolving door", with employees shifting between regulatory agencies and the pesticide industry. Pesticide manufacturers also cultivate strategic "public-private" partnerships that call into question their culpability or help bolster the companies' credibility. Companies also consistently donate to educational institutions that conduct research on pesticides, and such institutions are becoming dependent on industry owing to shrinking public funding.

88. Industry has also sought to dissuade Governments from restricting pesticide use to save pollinators. In Europe, a campaign was mounted preceding the decision by the European Union in 2013 to ban neonicotinoids. The chemical industry, allegedly with support from the Government of the United Kingdom, publicly contested findings of the European Food Safety Authority about the unacceptable risk of neonicotinoids to bees. Syngenta reportedly even threatened to sue individual European Union officials involved in publishing the Authority's report.[69] Bayer and Syngenta are still refusing to disclose their own studies that demonstrated the harmful effects of their pesticides on honeybees at high doses.[70]

89. Scientists who uncover health and environmental risks to the detriment of corporate interests may face grave threats to their reputations, and even to themselves. One of the most prominent examples are the actions of Novartis (later Syngenta), producer of atrazine, which engaged in a campaign to discredit scientists whose studies suggested adverse health and environmental impacts of this pesticide.[71] Despite their efforts, subsequent research by scientists largely validated the original findings.[72] In 2012, Syngenta settled a class action lawsuit brought by 20 water utility companies, paying $105 million to cover the costs of atrazine removal from affected water supplies.

V. Alternative to extensive use of pesticides: agroecology

90. Today, hazardous pesticides are in excessive use, inflicting damage on human health and ecosystems around the world, and their use is poised to increase in the coming years. Safer practices exist and can be developed further to minimize the impacts of such excessive, in some cases unnecessary, use of pesticides that violate a number of human rights. A rise in organic agricultural practices in many places illustrates that farming with less or without any pesticides is feasible. Studies have indicated that agroecology is capable of delivering sufficient yields to feed the entire world population and ensure that they are adequately nourished.[73]

91. The assertion promoted by the agrochemical industry that pesticides are necessary to achieve food security is not only inaccurate, but dangerously misleading. In principle, there is adequate food to feed the world; inequitable production and distribution systems present major blockages that prevent those in need from accessing it. Ironically, many of those who are food insecure are in fact subsistence farmers engaged in agricultural work, particularly in lower-income countries.

[69] Damian Carrington, "Insecticide firms in secret bid to stop ban that could save bees", *Guardian*, 27 April 2013.

[70] See https://www.euractiv.com/section/agriculture-food/news/pesticide-manufacturers-own-tests-reveal-serious-harm-to-honeybees/.

[71] Rachel Aviv, "A valuable reputation", *The New Yorker*, 10 February 2014.

[72] Thomas O. McGarity and Wendy Elizabeth Wagner, *Bending Science: How Special Interests Corrupt Public Health Research* (Harvard University Press, 2012).

[73] International Assessment of Agricultural Knowledge, Science and Technology for Development, *Agriculture at a Crossroads*.

92. Agroecology, considered by many as the foundation of sustainable agriculture, replaces chemicals with biology. It is the integrative study of the ecology of the entire food system, encompassing ecological, economic and social dimensions. [74] It promotes agricultural practices that are adapted to local environments and stimulate beneficial biological interactions between different plants and species to build long-term fertility and soil health.[75]

93. The amount of pesticides needed to protect crops depends on the robustness of the farming system. If crops are cultivated in unsuitable locations, they tend to be more susceptible to pests and diseases. Over the past decades, diversity in farming systems has been greatly reduced in terms of crops and varieties grown in natural habitats. The result is a loss of ecosystem services like natural pest control through predators and a loss of soil fertility. Rather than encouraging resistance, crop breeding in industrial agriculture has focused on high-yielding varieties that respond well to chemical inputs but that are more susceptible to pests and diseases. As most seed companies are now owned by agrochemical companies, there is limited interest in developing robust varieties. In order to succeed with pesticide reduction, it is essential to reintroduce diversity into agriculture and move away from monocultures of single varieties.[76]

94. In ecological farming, crops are protected from pest damage by enhancing biodiversity and encouraging the presence of natural enemies of pests. Examples include developing habitats around farms to support natural enemies and other beneficial wildlife or applying functional agrobiodiversity, using scientific strategies to increase natural enemy populations. Crop rotation and usage of cover crops also help protect the soil from various pathogens, suppress weeds and increase organic content, while more resistant crop varieties can help prevent plant disease.[77]

95. Agroecological farming can help secure livelihoods for smallholder farmers and those living in poverty, including women, because there is no heavy reliance on expensive external inputs. If properly managed, biodiversity and efficient use of resources can enable smallholder farms to be more productive per hectare than large industrial farms (A/HRC/16/49).

Measuring success

96. Despite their widespread use, chemical pesticides have not achieved reduction in crop losses in the last 40 years.[78] This has been attributed to their indiscriminate and non-selective use, killing not only pests but also their natural enemies and insect pollinators. Efficacy of chemical pesticides is also greatly reduced owing to pesticide resistance over time.

97. Such resistance is particularly likely and rapid in monoculture of genetically engineered crops. As a result, genetically engineered crops may create a cycle of entrapment for farmers, with herbicide-tolerant crops eventually requiring more herbicides to fight pest resistance. Farmers using genetically engineered seed are obliged to buy the

[74] International Foundation for Organic Agriculture, Organics International, Biovision and Millennium Institute, "Agroecology", briefing note, 11 July 2015.

[75] International Panel of Experts on Sustainable Food Systems, *From Uniformity to Diversity*; Meriel Watts and Stephanie Williamson, *Replacing Chemicals with Biology: Phasing Out Highly Hazardous Pesticides with Agroecology* (Pesticide Action Network Asia and the Pacific, 2015).

[76] HELVETAS Swiss Intercooperation, response to the questionnaire on pesticides and the right to food.

[77] Allsopp, *Plan Bee*, pp. 39-51.

[78] E.C. Oerke, "Crop losses due to pests", *Journal of Agricultural Science*, vol. 144, No. 1 (February 2006).

pesticides that go along with it, benefiting the pesticide industry without considering the economic burden on famers or the cost to the environment.[79] Farmers' right to assess technologies such as genetically engineered crops and weigh these in the light of other possible alternatives has also been ignored under the assumptions of conventional economics.[80] Indeed some argue that the development of alternatives has been undermined by the emphasis on investment in genetically engineered technologies.[81]

98. Replacing highly hazardous pesticides with less hazardous pesticides is necessary and overdue but not a sustainable solution, as many pesticides initially considered relatively "benign" are later found to pose very serious health and environmental risks.

99. Measuring the success of agroecology in comparison with industrial agricultural systems requires further research. Studies using short time frames and focusing on individual crop yields underestimate the potential long-term productivity of agroecological systems. Comparative studies are increasingly showing that diversified systems are advantageous and even more profitable when looking at total outputs, rather than specific crop yields. Aiming to build balanced and sustainable agroecosystems, agroecology is more likely to produce constant yields in the longer term owing to their greater ability to withstand climate variations and naturally resist pests.[82]

100. Success must be calculated in terms other than economic profitability, and take into consideration the costs of pesticides on human health, the economy and the environment. Agroecology prevents direct exposure to toxic pesticides and helps improve air, soil, surface water and groundwater quality.[83] Less energy intensive, agroecology can also help mitigate the effects of climate change by reducing emissions of greenhouse gasses and by providing carbon sinks.

VI. Conclusions and recommendations

A. Conclusions

101. **While the present report has illustrated that there is no shortage of international and national legislation, as well as non-binding guidelines, such instruments are failing to protect humans and the environment from hazardous pesticides. These instruments suffer from implementation, enforcement and coverage gaps, and generally fail to effectively apply the precautionary principle or meaningfully alter many business practices. Existing instruments are particularly ineffective in addressing the cross-border nature of the global pesticide market, as proven by the widespread and often legally permitted practices of exporting banned highly hazardous pesticides to third countries. These gaps and inadequacies should be confronted on the basis of human rights mechanisms.**

102. **International human rights law sets forth comprehensive State obligations to respect, protect and fulfil human rights. In particular, the rights to adequate food and**

[79] International Panel of Experts on Sustainable Food Systems, *From Uniformity to Diversity*, p. 16.
[80] Daniela Soleri and others, "Testing economic assumptions underlying research on transgenic food crops for third world farmers: evidence from Cuba, Guatemala and Mexico", *Ecological Economics*, vol. 67, No. 4 (1 November 2008), pp. 667-682.
[81] Oye Ka and others, "Biotechnology: regulating gene drives", *Science*, vol. 345, No. 6197 (8 August 2014).
[82] International Panel of Experts on Sustainable Food Systems, *From Uniformity to Diversity*, pp. 31-37.
[83] International Foundation for Organic Agriculture, "Agroecology".

to health provide clear protections for all people against excessive or inappropriate use of pesticides. Taking a human rights approach to pesticides guarantees the principles of universality and non-discrimination, under which human rights are guaranteed for all persons, including vulnerable groups, who disproportionately feel the burden of hazardous pesticides.

103. **Implementing the right to adequate food and health requires proactive measures to eliminate harmful pesticides. Corporations have the responsibility to ensure that the chemicals they produce and sell do not pose threats to these rights. There continues to be a general lack of awareness of the dangers posed by certain pesticides, a condition exacerbated by industry efforts to downplay the harm being done as well as complacent Governments that often make misleading assertions that existing legislation and regulatory frameworks provide sufficient protection.**

104. **While efforts to ban and appropriately regulate the use of pesticides are a necessary step in the right direction, the most effective, long-term method to reduce exposure to these toxic chemicals is to move away from industrial agriculture.**

105. **In the words of the Director-General of FAO, we have reached a turning point in agriculture. Today's dominant agricultural model is highly problematic, not only because of damage inflicted by pesticides, but also their effects on climate change, loss of biodiversity and inability to ensure food sovereignty. These issues are intimately interlinked and must be addressed together to ensure that the right to food is achieved to its full potential. Efforts to tackle hazardous pesticides will only be successful if they address the ecological, economic and social factors that are embedded in agricultural policies, as articulated in the Sustainable Development Goals. Political will is needed to re-evaluate and challenge the vested interests, incentives and power relations that keep industrial agrochemical-dependent farming in place.**[84] **Agricultural policies, trade systems and corporate influence over public policy must all be challenged if we are to move away from pesticide-reliant industrial food systems.**

B. Recommendations

106. **The international community must work on a comprehensive, binding treaty to regulate hazardous pesticides throughout their life cycle, taking into account human rights principles. Such an instrument should:**

(a) **Aim to remove existing double standards among countries that are particularly detrimental to countries with weaker regulatory systems;**

(b) **Generate policies to reduce pesticide use worldwide and develop a framework for the banning and phasing-out of highly hazardous pesticides;**

(c) **Promote agroecology;**

(d) **Place strict liability on pesticide producers.**

107. **States should:**

(a) **Develop comprehensive national action plans that include incentives to support alternatives to hazardous pesticides, as well as initiate binding and measurable reduction targets with time limits;**

[84] International Panel of Experts on Sustainable Food Systems, *From Uniformity to Diversity*, p. 6.

(b) **Establish systems to enable various national agencies responsible for agriculture, public health and the environment to cooperate efficiently to address the adverse impact of pesticides and to mitigate risks related to their misuse and overuse;**

(c) **Establish impartial and independent risk-assessment and registration processes for pesticides, with full disclosure requirements from the producer. Such processes must be based on the precautionary principle, taking into account the hazardous effects of pesticide products on human health and the environment;**

(d) **Consider non-chemical alternatives first, and only allow chemicals to be registered where need can be demonstrated;**

(e) **Enact safety measures to ensure adequate protections for pregnant women, children and other groups who are particularly susceptible to pesticide exposure;**

(f) **Fund comprehensive scientific studies on the potential health effects of pesticides, including exposure to a mixture of chemicals as well as multiple exposures over time;**

(g) **Guarantee rigorous and regular analysis of food and beverages to determine levels of hazardous residues, including in infant formula and follow-on foods, and make such information accessible to the public;**

(h) **Closely monitor agricultural pesticide use and storage to minimize risks and ensure that only those with the requisite training are permitted to apply such products, and that they do so according to instructions and using appropriate protective equipment;**

(i) **Create buffer zones around plantations and farms until pesticides are phased out, to reduce pesticide exposure risk;**

(j) **Organize training programmes for farmers to raise awareness of the harmful effects of hazardous pesticides and of alternative methods;**

(k) **Take necessary measures to safeguard the public's right to information, including enforcing requirements to indicate the type of pesticides used and level of residues on the labels of food and drink products;**

(l) **Regulate corporations to respect human rights and avoid environmental damage during the entire life cycle of pesticides;**

(m) **Impose penalties on companies that fabricate evidence and disseminate misinformation on the health and environmental risks of their products;**

(n) **Monitor corporations to ensure that labelling, safety precautions and training standards are respected;**

(o) **Encourage farmers to adopt agroecological practices to enhance biodiversity and naturally suppress pests, and to adopt measures such as crop rotation, soil fertility management and crop selection appropriate for local conditions;**

(p) **Provide incentives for organically produced food through subsidies and financial and technical assistance, as well as by using public procurement;**

(q) **Encourage the pesticide industry to develop alternative pest management approaches;**

(r) **Eliminate pesticide subsidies and instead initiate pesticide taxes, import tariffs and pesticide-use fees.**

108. **Civil society should inform the general public about adverse impact of pesticides on human health and environmental damage, as well as organizing training programmes on agroecology.**