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Save The Seeds: The Impact of the Disappearance of Traditional Seeds
on the Right to Adequate Food

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Abstract

The disappearance of traditional seeds is a direct consequence of the industrialization of agriculture, privatization of the common good, liberalization of the markets, and the rise of intellectual property rights. The extinction of traditional varieties considerably threatens biodiversity, farmers, and consumers, and leave multinationals with unfettered power to influence food production and food consumption habits. This jeopardizes the respect of essential elements of the right to adequate food. Through this paper, I assess the influence of the disappearance of traditional seeds on the right to adequate food. In addition, I explore the alternatives to save these seeds to protect society and nature, and ensure the realization of the right to adequate food for the present and future generations.

Keywords

Human Rights, Right to Adequate Food, Seeds, Industrialization of Agriculture, Multinationals, Privatization of Seeds, Intellectual Property Rights, Food Sovereignty, Genetic Diversity, Sustainability, Seed Banks, Botanical Gardens, Slow Food.

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Introduction

“Food is not just fuel. Food is about family, food is about community, food is about identity. And we nourish all those things when we eat well.”

Michael Pollan

Seeds are amongst one of the most beautiful and precious gifts that nature made to humanity and that human beings have sustained and improved, from generation to generation, for more than twelve thousand years.¹ Despite their measly appearance, these grains have persisted through the most tragic periods of wars and extreme climatic conditions. The mere fact of their existence today demonstrates their resilience over centuries and millennia. They have the extraordinary power to feed populations, as underlined by Pierre Rabhi: “multiplying one grain of wheat can provide food for the whole of mankind.”² Prior to industrialized farming, thousands of varieties of seeds were freely sown, conserved, and exchanged in all parts of the world. They seamlessly adapted to the environmental needs and cultural preferences. These activities led to the cultivation of a rich diversity of forms, colors, smells, tastes, nutritional values, and other traits. Nature and society have benefited from this diversity for centuries. However, in the last 100 years, agriculture changed with the onset of the industrial revolution, and seeds were at the heart of this profound transformation. From that moment on, the race for higher productivity at all costs was launched. Seeds passed from the hands of traditional farmers to government actors and onto corporations, where they were no longer perceived as common goods.

‘Traditional seeds,’ characterized as reproducible, diverse, and adaptable to various soils, climates, and farming practices, have been gradually replaced by ‘improved industrial varieties.’ These standardized seeds can adapt everywhere and produce high-yields with the input of fertilizers, pesticides, and large machines.³ The introduction of these high-yield seeds created a corner market and empowered agrochemical and seed companies. Over time, these powerful

¹ Pierre Rabhi and Juliette Duquesne, *Les Semences: Un Patrimoine Vital En Voie De Disparition* (Paris: Presses Du Châtelet, 2017), 11.

² Olivier Le Naire, *Pierre Rabhi Semeur d’Espoirs* (Actes Sud, 2013) 9. See also: Pierre Rabhi. “Un grain de blé pourrait nourrir toute l’humanité.” *La Guerre des Graines*. Youtube Video, 2:53. Posted 13th of April 2014. <https://www.youtube.com/watch?v=u9izPqeSks4>

³ La Via Campesina, *Our Seeds, Our Future*. (Jakarta, June 2013), 1. Accessed on June 10, 2019. <https://viacampesina.org/en/our-seeds-our-future/> See also: Elise Demeulenaere and C. Bonneuil, “Cultiver la biodiversité : semences et identité paysanne” in Bertrand Hervieu, et.al, *Les mondes agricoles en politique*. De la fin des paysans au retour de la question agricole. (Paris, Les Presses de Sciences, 2010) 79-81.

corporate conglomerates significantly influenced the way food is produced and consumed. Industrialized agriculture led to the rise of monocropping, biodiversity loss, and the disappearance of traditional seeds. In the last century, 75 percent of seeds were lost, and this number will only continue to grow if changes are not made within the food system.⁴ If the remaining traditional seeds together with the knowledge on how to cultivate them also vanish off the planet, future generations will be at the mercy of multinationals. By safeguarding these traditional varieties, further losses are prevented, farmers are empowered, and society gains access to a wider array of healthy, nutritious, and culturally appropriate food.

In order to examine the main question of this research: *how the loss of traditional seeds influence the right to adequate food* I will address two sub-questions. First and foremost, *what are traditional seeds from a theoretical perspective?* Secondly, I will examine *the factors that have led to the disappearance of traditional seeds*; furthermore, I will elaborate on *the consequences of such extinction on nature and society*. The larger significance of this study is to end on a positive note and seek for solutions to this problem. For this reason, the last section of this research will attempt to understand *how traditional seeds can be preserved and promoted to protect the right to adequate food*.

Accordingly, this work will be divided into four chapters. To ground the research, the first chapter will provide a foundational definition of seeds and their social, cultural, and environmental value. Thereafter, the second chapter will explore the disappearance of traditional seeds and the consequences such loss has on society and the natural world. The third chapter will analyze the effect of the disappearance of traditional seeds on the right to adequate food. Lastly, the final chapter will seek to examine alternatives to the loss of traditional seeds.

For the purposes of this study I will use a multidisciplinary approach with a strong emphasis on human rights disciplines. Whilst, the first three chapters will mainly be based on an inductive method with the aim to review the existing literature in the field, the last chapter will use deductive techniques and apply a qualitative research method by conducting semi-structured

⁴ Food and Agriculture Organization of the United Nations. *Building on Gender, Agrobiodiversity and Local Knowledge*. FAO. (Rome, Italy: 2004). Accessed June 3, 2019. <http://www.fao.org/3/y5609e/y5609e00.htm#Contents>.

interviews. Jean-luc Brault, the founder of the seed company *Graines del Pais*, Auriane Bertrand, the founder of the *Seed Tour project*, and Patricia Pierret, an organic food producer have all been interviewed to satisfy the objectives of this research. The interview with Patricia Pierret has allowed me to understand the difficulties faced by organic food producers regarding seeds. However, my work will only include the information released by Jean-Luc Brault and Auriane Bertrand as they provided useful insights about efficient initiatives to combat the disappearance of traditional seeds.

1

Chapter One: Seeds of Life

“Seeds is not just the source of life. It is the very foundation of our being.”

Vandana Shiva

To understand the ongoing debate surrounding the question of seeds and its implications for the right to adequate food, this first chapter aims to define what seeds are and what they represented to the people before they were privatized.

I. What are Seeds?

Before going into the subject of the disappearance of traditional seeds, it is important to take a step back and have a common comprehension of what exactly seeds are. The standard definition of seeds is as follows : *“fertilized ripened ovule of a flowering plant containing an embryo and capable normally of germination to produce a new plant.”*⁵ Put differently, seeds develop into plants that will later be harvested and will release new seeds to the earth, which in turn can produce new seed plants.⁶ It is necessary to stipulate the term ‘seed plant’ as not all plants grow from seeds. Ferns and mosses, for example, are plants that reproduce from spores which differ from seeds as they do not contain plant embryos.⁷ A spore consists of one cell and is microscopic, whilst a seed is constituted of a multicellular embryo and is easily identifiable.⁸

Seeds are part of an evolutionary life cycle. Meaning that sowing new seeds will never generate the exact same seeds from their next harvest.⁹ Their properties and color constantly

⁵ "Seed." Merriam-Webster. Accessed May 16, 2019. <http://www.merriam-webster.com/dictionary/seed>.

⁶ Frank Adams, et.al., "Diversité Des Plantes Utiles." SEED (Luxembourg, 2018) 6-7.

⁷ Lakna Panawala, "Difference Between Spores and Seeds," (May 2017) Accessed May 16, 2019, https://www.researchgate.net/publication/316953093_Difference_Between_Spores_and_Seeds.

⁸ Ibid.

⁹ Richard Thomas, *Global Biodiversity: Status of the Earth's living resources*. World Conservation Monitoring Center. (Netherlands: Springer,1992), xiii-xiv, http://93.174.95.29/_ads/AF37FD0F5943236F9D50051CF86C6DD4

change over time to adapt to their surroundings.¹⁰ Due to the variance of climate, soil, pests, disease, agricultural fields also vary from one season to another.¹¹ It is worth mentioning that the evolution of improved seeds is not processed alone. Human intervention is instrumental in the contribution of the amelioration of the quality of seeds by carefully “*selecting and replanting from those plants that fare best in their fields or to satisfy certain cultural interest.*”¹² They do so by crossing different varieties to obtain plants with specific characteristics and benefits, such as yield, resistance, beauty, and taste.¹³ All of this is done in harmony with nature; sowing seeds depends on the position of the sun and the moon, as well as the animals present, such as bees, which are essential for pollination.¹⁴ This process of selection and crossbreeding efforts have resulted in rich agricultural biodiversities.¹⁵

Ultimately, the plants that constitute our daily diet have all been developed from wild plants through the hard work of farmers and gardeners across the globe.¹⁶ The popular orange rooted cultivated carrot, for instance, was derived from the wild carrot which has ivory-colored roots.¹⁷

Whilst most plants play a vital role in making life on earth possible, this paper will place greater emphasis on the seeds of cultivated edible plants species, which include fruits, vegetables, and cereals. The focus on those type of plants is meaningful and necessary for two main reasons: first, they serve as the primary basis for human sustenance and have a special place in the struggle for food sovereignty, and secondly, the traditional diversity of those species has been considerably declining since the XXe century.¹⁸

¹⁰ La Via Campesina, *Our Seeds, Our Future*, 1-3

¹¹ Ibid.

¹² Devlin Kuyek, *Good Crop /Bad Crop, Seed Politics and the Future of Food in Canada*. (Toronto, Canada: Between the Lines, 2007), 9-10, <https://play.google.com/books/reader?id=kwHZBQAAQBAJ&pg=GBS.PT5>.

¹³ Ibid.

¹⁴ Deolinda Carrizo and Rodolfo Greco, "Peasants' View of the United Nations Decade of Family Farming - Via Campesina," La Via Campesina- International Peasant's Movement. May 24, 2019. Accessed May 24, 2019. https://viacampesina.org/en/peasants-view-of-the-united-nations-decade-of-family-farming/?fbclid=IwAR0U7qh1EHby_53YgRcEZcYY8l0Y_bLeN-G_JWtXB7hrHpQNdNRje2jhydk.

¹⁵ Kuyek, *Good crops/Bad Crops*, 9.

¹⁶ Frank Adams et al., "Diversité Des Plantes Utiles." SEED (Luxembourg, 2018) 6-7.

¹⁷ "The History of Carrots." History of Carrots - A Brief Summary and Timeline. Accessed May 20, 2019. <http://www.carrotmuseum.co.uk/history.html>.

¹⁸ Frank Adams, "Diversité Des Plantes Utiles - Initiatives Au Luxembourg." 6-7.

II. What Seeds Represent:

1. Social and Cultural Interests

When seeds were still the area of expertise of nature lovers, people had their specific identity as peasants, indigenous, or other people working in rural areas, which in turn gave them an essential role amongst a community.¹⁹ It helps in understanding that the utility of seeds was far beyond simply food production and consumption. Each seed also had its own story and identity in terms of origin and way of production. They shaped at each life cycle, the cultural heritage of a particular community that used specific skills, and tradition, to obtain high-quality, cultural, and environmental adapted seeds.²⁰ In other words, they represented the type of food people ate, how it was grown, and by whom they were grown.²¹

Seeds were also deeply rooted in social interests and interactions. During thousands of years, seeds have brought families, friends, neighbors, and even distant strangers together to exchange and save the different varieties.²² This network of exchange accorded a central role regarding social solidarity, trust and proximity.²³ It is important to underline that these tasks were not exclusive to men across the globe. A research conducted by the African Seed Trade Association (AFSA) and the GRAIN association showed that in Africa, each member of a peasant community had a specific role in the seed management.²⁴ In general, men dealt with transporting and exchanging seeds, and in times of shortage of a variety, they would cross the frontiers of the local community to find them.²⁵ Their role mostly consisted of land clearing, plowing the fields, mulching to improve the soils, weeding and harvesting crops.²⁶ It goes without

¹⁹ Sofia Monsalve Suarez, "The Right to Seeds and Biological Diversity. In the UN Declaration on the Other Rights of People Working in Rural Areas." Fian International. (March 2016). 2-4. Accessed May 31, 2019. https://www.fian.be/IMG/pdf/droits_semences_uk_web.pdf.

²⁰ La Via Campesina, *Our Seeds, Our Future*, 3-4. See also: Kuyek, *Good crops/Bad Crops*, 9-10.

²¹ Carrizo and Greco, "Peasants' View of the United Nations Decade of Family Farming - Via Campesina."

²² Laure Emperaire, Florence Pinton, and Gérard Second, "Gestion dynamique de la diversité variétale du manioc en Amazonie du Nord-Ouest," *Nat Sci Soc* 6. (1998): 27–28. doi:10.1016/S1240-1307(98)80006-X

²³ Beatriz Cid Aguayo and Alex Latta, "Agro-Ecology and Food Sovereignty Movements in Chile: Sociospatial Practices for Alternative Peasant Futures." *Annals of the Association of American Geographers*, 105:2, (2015) 402-403. <https://doi.org/10.1080/00045608.2014.985626>

²⁴ Patrick Mulvany and Peter Feldstein, *Les Vrais Producteurs De Semences*. (October 17, 2018) 28-30. <https://www.grain.org/fr/article/6045-les-vrais-producteurs-de-semences-les-petits-producteurs-sauvegardent-utilisent-partagent-et-ameliorent-la-diversite-semenciere-des-cultures-qui-nourrissent-l-afrique>.

²⁵ Mulvany and Feldstein, *Les Vrais Producteurs De Semences*, 28-29.

²⁶ Ibid.

saying that the different tasks undertaken by women and men sometimes overlapped. But African women, similarly to Indian women, were predominantly active in food production.²⁷ They were perceived as the custodians of biodiversity as they were the ones cross-breeding the different varieties.²⁸ They mainly selected and saved the seeds required (depending on the needs, yields, taste, resistance to disease, cooking facilities, and storage capacity), determined when to sow contingent on the weather conditions, and even worked the land.²⁹ Children, at least in Africa, were also involved in the land cultivation. For example, they were asked to shell peanuts, beans, maize, to either save the seeds or sew them.³⁰ They also helped their parents to work the land, sow the seeds, and chased the birds that were attempting to eat the seeds that were drying in the fields.³¹

2. Diversity

Seeds also represented a very wide diversity of species, knowledge, as well as a large variety of tastes. The safeguard, the use, and more particularly the flow of seeds have actively participated in the cultivation and preservation of large diversity of crops and varieties.³² According to La Via Campesina, the International Peasant Movement, seed exchange between the different national and even international communities, has led to approximately two million farmer's seed varieties out of 5000 species being identified.³³ This seed diversity has highly contributed to the overall biodiversity by influencing and diversifying the agricultural systems, and therefore, the ecosystems and landscapes.³⁴

At the heart of seed-saving practices, laid the intercultural exchange of ideas, skills, and knowledge.³⁵ Such customs were transmitted from generation to generation, and were extremely

²⁷ Vandana Shiva, "Women's Indigenous Knowledge and Biodiversity Conservation," *India International Centre Quarterly* 19, no. 1/2 (1992): 205-207. <http://www.jstor.org/stable/23002230>.

²⁸ Ibid.

²⁹ Mulvany and Feldstein, *Les Vrais Producteurs De Semences*. 28-30.

³⁰ Ibid.

³¹ Ibid.

³² Marc Pautasso, et. al. "Seed Exchange Networks for Agrobiodiversity Conservation," *Agronomy for Sustainable Development*. (2013) 33: 153-154. <https://doi.org/10.1007/s13593-012-0089-6>

³³ Lognon, *Seed Stories - Fighting Against The Privatisation of Life*. La Via Campesina, 2018. 5. Accessed May 24, 2019. <https://viacampesina.org/en/wp-content/uploads/sites/2/2019/01/BD-anglais-format-web-3-compressed.pdf>.

³⁴ Pautasso, "Seed Exchange Networks for Agrobiodiversity Conservation," 153-154.

³⁵ Aguayo and Latta, "Agro-Ecology and Food Sovereignty Movements in Chile: Sociospatial Practices for Alternative Peasant Futures," 403-404.

important to improve the resilience towards adverse trends or shocks - such as changing climatic conditions. It ensured farmers to have different alternatives and substitutions when facing challenges.³⁶ Seed-exchanging has also highly contributed to diversifying the varieties of seeds among and outside local communities. For instance in Jalisco State, a traditional village of Mexico, has managed to achieve a great diversity of maize due to the exchange of varieties with the neighboring communities.³⁷

This rich diversity was not only in terms of natural resources but also in terms of tastes. Seeds have been carefully selected, crossed, and planted mostly to satisfy the diverse palates of the people. In other words, they reproduced “*the tastes of the many mouths that enjoyed the results.*”³⁸ There is clear evidence that the diversity of seeds has always ensured people to find the gustative and nutritive value they were looking for. Finally, this diversity of food has also enabled each local community to develop their local culinary traditions and thus, strengthen their local pride.

3. Economic guarantee - Food Security

It is important to underline that before seeds became the objects of regulations and privatization, they did not only represent the knowledge of the past generations but also participated to the well-being of the present and future generations.³⁹ This was the case, as peasant farmers had access to a large portfolio of varieties, which allowed them to have substitutes in case of shortages, extreme weather events, pests, or other challenges.⁴⁰ Logically, it seems that managing and safeguarding the grains of the best-adapted plants was of prime importance for economic survivability on the short-term and long-term. Alike, people who nowadays assure they save enough money on their bank account to support themselves and their families, previously farmers made sure they had enough quality seeds in their stock for the next

³⁶ La Via Campesina, *Our Seeds, Our Future*, 2-3.

³⁷ Dominique Louette, André Charrier, and Julien Berthaud, “In situ conservation of Maize in Mexico: Genetic diversity and Maize seed management in a traditional community,” *Economic Botany*, (1997) 51: 20, 22-23
<https://doi.org/10.1007/BF02910401>

³⁸ Kuyek, *Good crops/Bad Crops*, 9-10.

³⁹ Carrizo and Greco, "Peasants' View of the United Nations Decade of Family Farming."

⁴⁰ Olivier De Schutter, “The right of everyone to enjoy the benefits of scientific progress and the right to food : from conflict to complementarity,” *Human Rights Quarterly*, vol. 33 (2011) 305-306. Accessed on 12 June 2019.
<https://ssrn.com/abstract=2446915>

crop production. Having seeds at home did not necessarily mean making lucrative profits, but at least it gave farmers the possibility to put food on the table. This is particularly the case for cash-strapped farmers working in isolated and difficult environments.⁴¹ Planting, saving and exchanging seeds, therefore, were fundamental to protect minimum food security, well-being, and sustainability.⁴² To be clear, food security is a “*situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.*”⁴³ It is evident that seeds at that time, corresponded to all these criteria as they were free from restrictions, easy to access inside or outside a village, and highly diversified which enabled each community to adapt to their cultural and taste preferences.

⁴¹ De Schutter, “The right of everyone to enjoy the benefits of scientific progress and the right to food : from conflict to complementarity,” 304-308.

⁴² Marc Pautasso, “Seed Exchange Networks for Agrobiodiversity Conservation,” 153-154.

⁴³ Food and Agriculture Organization of the United Nations. *The State of Food Insecurity in the World 2001*. FAO (Rome, Italy: 2001). Accessed May 24, 2019. <http://www.fao.org/3/y1500e/y1500e00.htm>. See also: Raj Patel Guest Editor, “Food sovereignty,” *The Journal of Peasant Studies* 36, no.3 (2009), 664-665, DOI: 10.1080/03066150903143079

2

Chapter Two: Seeds: An Endangered Heritage

“Seed is the source of life and the first link in the food chain. Control over seed means control over our lives, our food, our freedom.”

Vandana Shiva

It is no longer a secret anymore that biodiversity is an endangered heritage. A new report from the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) supported by the United Nations Environment, United Nations Development Programme, United Nations Convention on Biological Diversity (CBD), UNESCO, and the Food and Agriculture Organization of the United Nations (FAO), has released the 2019 Global Assessment Report on Biodiversity and Ecosystem Services.⁴⁴ This unprecedented report puts the spotlight on how the economic development methods impact nature.⁴⁵ According to these 145 expert authors coming from 50 different countries, the decline of nature is alarming and threatens the well-being of humanity. One million animal and plant species face the risk of extinction.⁴⁶ This threatened biological-diversity concerns the diversity *“within species, between species, and of ecosystems.”*⁴⁷

A key element to the overall biodiversity is agrobiodiversity, which is defined by FAO as *“the variety and variability of animals, plants and micro-organisms on earth that are important to food and agriculture which result from the interaction between the environment, genetic resources and the management systems and practices used by people. It takes into account not only genetic, species and agro-system diversity and the different ways land and water resources are used for production, but also cultural diversity, which influences human interactions at all*

⁴⁴ Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). *UN Report: Nature's Dangerous Decline Unprecedented; Species Extinction Rates Accelerating - United Nations Sustainable Development*, United Nations, 2019. Accessed June 03, 2019.

<https://www.un.org/sustainabledevelopment/blog/2019/05/nature-decline-unprecedented-report/>.

⁴⁵ Ibid.

⁴⁶ Ibid.

⁴⁷ Ibid.

levels.”⁴⁸ Since the populations’ food directly rely on biodiversity, it is evidence that agrobiodiversity also declines at an alarming rate.

Seeds, which are central elements of agrobiodiversity, figure among the current loss of natural resources and biological diversity. This category of goods includes “*harvested species, varieties and breeds, and a wide range of unharvested species.*”⁴⁹ According to the FAO, since the 1900s, approximately 75 percent of plant genetic diversity has disappeared.⁵⁰ This means three out of four “*traditional, locally adapted crop varieties with historical origins and cultural significance as well as high genetic diversity*” are gone.⁵¹ The scale of loss is extremely extensive and worrying.

To gain a better understanding of why traditional seeds are endangered species, it is inevitable to put the disappearance of seeds in context and determine the causes of such damage as well as the consequences. The first section of this chapter will specifically focus on the industrialization of agriculture, the privatization and liberalization of the seed industry, and the regulations adopted in this context. The following section of this chapter will further elaborate on the consequences that such a profound transition has on biodiversity, farmers, and consumers.

1. The Causes

According to Pierre Rabhi and Juliette Duquesne, two scholars which fully investigated the subject, there are three principal movements that have jeopardized humanity’s vital heritage: the intensification of agriculture, privatization of seeds, and regulations.⁵² Each element will be closely analyzed to understand the overall damage that caused the disappearance of seeds.

⁴⁸ Food and Agriculture Organization of the United Nations. *Agricultural Biodiversity, Multifunctional Character of Agriculture and Land Conference*, Maastricht, Netherlands: FAO (1999) 6-7. Accessed June 03, 2019.

http://www.fao.org/mfcal/pdf/bp_1_agb.pdf

⁴⁹ FAO. *Building on Gender, Agrobiodiversity and Local Knowledge.*”

⁵⁰ Ibid.

⁵¹ Pautasso, “Seed Exchange Networks for Agrobiodiversity Conservation.” 153-154.

⁵² Pierre Rabhi and Juliette Duquesne, *Les Semences: Un Patrimoine Vital En Voie De Disparition* (Paris: Presses Du Châtelet, 2017), 23-24.

a) Intensification of Agriculture

After the Second World War, the agricultural sector went through profound structural transformations and conceptual changes. At that time, the belief was that intensifying agriculture was the most appropriate remedy to overcome mass starvation. For this reason, governments around the world started investing in research and development to put their vision into practice. Needless to say that this period strongly affected farming, particularly seeds, as they had the great potential to multiply food production significantly. From then on, seeds became the objects and subjects of plant breeding programs led by scientists in experimental stations.⁵³ Approved and encouraged by public agricultural research, the idea was to concentrate on selecting and crossbreeding a few varieties that were more interesting than others to use on a large scale.⁵⁴ To be more specific, plant breeders developed new plants called the pure lines *“based on simple criteria: strip down the plant populations that peasant farmers use, keeping only a few separate plants to then multiply individually.”*⁵⁵ Within a short period of time and after the introduction of these pure lines, plant breeders developed a new category of plants: the F1 Hybrids seeds, which are *“genetically identical, display higher crop yields than their parents seeds, and produce second-generation plants that do not resemble the first generation plants and whose yields are significantly reduced.”*⁵⁶ This invention was considered to be genius as they boosted crops yield capacity, and therefore, led to the progress of the agricultural sector.⁵⁷ Unfortunately, the advantages for farmers weren't so clear. Unlike their traditional varieties, F1 Hybrids seeds cannot be resown given that only the first utilization of these plants generate efficient productions.⁵⁸ An important element to keep in mind is that farmers started being dependent on the seeds developed by plant breeders. Moreover, crop diversity was sacrificed to leave more space for the high yielding varieties which at first consisted mostly of cereal crops.⁵⁹ From that

⁵³ Kuyek, *Good crops/Bad Crops*, 11-13.

⁵⁴ Ibid.

⁵⁵ Lognon, "Seed Stories - Fighting Against The Privatisation of Life," 7-8.

⁵⁶ Patricia Arenson, "'Enemies of Life in the Name of Life': Seed Patents, GM Crops, and the Global South," (2011).47-48. Accessed May 02, 2019. <https://digitalcommons.conncoll.edu/cgi/viewcontent.cgi?referer=https://scholar.google.fr/&httpsredir=1&article=1002&context=anthrohp>

⁵⁷ Thomas, *Global Biodiversity: Status of the Earth's living resources*, 428-429.

⁵⁸ Arenson, "'Enemies of Life in the Name of Life': Seed Patents, GM Crops, and the Global South," 47-48.

⁵⁹ Thomas, *Global Biodiversity: Status of the Earth's living resources*, 426.

moment on seeds became “*vehicles that could be used for deliberate social and political transformation.*”⁶⁰

The intensification of agriculture was further pursued globally with the arrival of the Green Revolution in the '70s.⁶¹ This third vague of revolution widely encouraged the United Nations Development Programme (UNDP), the Food and Agriculture Organization of the United Nations (FAO), and other institutes like the World Bank to implement a productivist model to overcome hunger and fight against the spread of communism, especially in the Third World.⁶² But this time, new agricultural techniques and technologies were adopted. The F1 Hybrid seeds were adapted to chemical fertilizers and pesticides to further stimulate yields productions.⁶³ These industrial commodities were not a choice but rather a requirement for the ones who sought a very good harvest.⁶⁴ In terms of outputs, the utilization of these inputs have considerably improved the food production in several countries.⁶⁵ According to FAO, the Asian-Pacific Region, the largest rice supplier in the world, has seen its production in rice considerably grow from 240 million tonnes in 1950 to 524 million tonnes in 1997.⁶⁶ This significant increase allowed this region to make rice more available and export higher quantities.⁶⁷ Another example is India, where the rice production after the introduction of the high yielding varieties between 1967-73, rose by 19.1 percent more than the previous period 1961-1965.⁶⁸

⁶⁰ Kuyek, *Good crops/Bad Crops*, 9.

⁶¹ The Green Revolution was an international political, economical, and technological movement highly sponsored by Institutes including the United Nations Development Programme (UNDP), the Food and Agriculture Organization of the United Nations (FAO) and the World Bank, to further heighten and systemize the use of improved varieties of seeds (high-yielding seeds) and agrochemical inputs. See: Andrew Pearse, "Seeds of Plenty, Seeds of Want: Social and Economic Implications of the Green Revolution." *Revisiting Sustainable Development* 139 (1980). 139-140. Accessed on June 05, 2019. <http://www.zbw.eu/econis-archiv/bitstream/handle/11159/2279/III-Revisiting%20Sustainable%20Development.pdf?sequence=1#page=157>. See also: Vandana Shiva. *The violence of the green revolution: Third world agriculture, ecology, and politics*. (University Press of Kentucky, 2016).19-20. Accessed on June 05, 2019. <http://www.jstor.org/stable/j.ctt19dzdcp>.

⁶² Ibid.

⁶³ La Via Campesina, *Our Seeds, Our Future*, 47.

⁶⁴ Kuyek, *Good crops/Bad Crops*, 10.

⁶⁵ Minas K. Papademetriou, Frank J. Dent, and Edward M. Herath, "Bridging the Rice Yield Gap in Asia and the Pacific," FAO (Thailand, Bangkok: October 2000). Accessed June 04, 2019. <http://www.fao.org/3/x6905e/x6905e04.htm>.

⁶⁶ Ibid.

⁶⁷ Ibid.

⁶⁸ D. N. Dhanagare, "Green Revolution and Social Inequalities in Rural India." *Economic and Political Weekly*. Vol. 22, No. 19/21, Annual Number (May, 1987). 137-138. Accessed on 05 June, 2019. <https://www.jstor.org/stable/4377016>

It goes without saying that the productivist model was not only developed for the benefit of all but also, and perhaps mostly, for the advantages of the producers of those industrial commodities.⁶⁹ To demonstrate this point in Canada, for instance, the number of farm machines increased from 162,000 to 1,398,000 between 1931 and 1961.⁷⁰ Still looking at the Canadian case, the use and expenses on fertilizers also rose from approximately \$10 million in 1931 to over \$77 million in 1961.⁷¹ This does not only concern Canada. In Argentina for example, the use of herbicide has grown from 1.3 million liters in 1991 to 59.2 million in only 7 years.⁷² These figures clearly show that the producers of industrial commodities managed to create a continuing dependence, which subsequently, generated them considerable amounts of money out of the food production. However, the story does not end there. During this transformation period, corporations saw the excellent opportunity to create dependence, not only for the high-yielding seeds developed by them but all the seeds. Whilst this section focused on determining how agricultural intensification has managed to shift seeds from the hands of farmers to the hands of the states, the following section will rather analyze how corporations have succeeded to privatize humanity's vital heritage.

b) Privatization and liberalization of the seed market

Agro-industrialization goes hand in hand with agro-liberalization and privatization.⁷³ Both movements have been encouraging one another; the industrialization of the agricultural sector has opened the doors for private investment, which in turn, has further encouraged the industrialization of the sector.⁷⁴

⁶⁹ Philip H. Howard, "Visualizing consolidation in the global seed industry: 1996–2008." *Sustainability* 1.4 (2009): 1270. Accessed on 05 June, 2019. doi:10.3390/su1041266

⁷⁰ Kuyek, *Good crops/Bad Crops*, 25-26.

⁷¹ Statistics Canada, Agriculture Division, "M-525 Expenses for fertilizer", Canada, 1926-1976. Accessed on 06 June, 2019. www.statcan.ca/english/freepub/11-516-XIE/sectionm/sectionm.htm#M525

⁷² Pengue Walter, "The Impact of Soybean Expansion in Argentina," *GRAIN*. (September 24, 2001). Accessed July 01, 2019. <https://www.grain.org/article/entries/292-the-impact-of-soybean-expansion-in-argentina>.

⁷³ Miet Maertens and Johan F.M. Swinnen, "Transformations in Agricultural Markets: FDI and Vertical Coordination," *Leuven Interdisciplinary Research Group on International Agreements and Development*. Working Paper No 10. (2006). 3-4. Accessed on 06 June 2019. https://www.researchgate.net/profile/Miet_Maertens/publication/266499259_Transformations_in_agricultural_markets_FDI_and_vertical_coordination/links/546498a00cf2837efdb3eea2.pdf

⁷⁴ *Ibid*, 3-4.

Before going into detail on the privatization of seeds, it is essential to shed light on the initial plant breeding programs intentions. Doing so will enable us to have a common understanding of how and what has led companies to take control over seeds.

At the time they were still public and led by state organizations, the research was based on national interests and needs, and the tasks of breeding were distributed among governments, farmers, scientists, and private entities.⁷⁵ Despite the fact that new plants were created outside the fields ‘to ameliorate the standards of living of the people’, the developed seeds were distributed to farmers to test and benefit from these varieties.⁷⁶ This was particularly the case with wheat and other cereals such as barley in Canada and the United States in the 1990’s.⁷⁷ Once the varieties developed were considered to be satisfying, public breeders started selling these species at fair prices and farmers could do whatever they wanted with them.⁷⁸ Although farmers gradually lost the exclusivity of plant breeding with public breeding systems, seeds were still perceived as the common good. Farmers had control over their own collection of seeds, and were free to plant, save, or even exchange them.

In the meanwhile, influential interest groups were laying the groundwork for the future profits the agricultural sector could generate.⁷⁹ These public programs have progressively opened the door to the intensification of agriculture and to the birth of agro-industries.⁸⁰ Put differently, it is actually through this “*large-scale farming of a few varieties that the big, grain-trading companies emerged and soon came to dominate the North American and, later, the international food trade.*”⁸¹ Thanks in large part to the *Green Revolution*, corporations managed to weaken the role of the state in this sector, and further pave the way towards the global process of liberalization and privatization of agri-food.⁸² Such profound transformation allowed

⁷⁵ Colin G.Thirtle, Chittur S. Srinivasan, and Paul W. Heisey, *Public sector plant breeding in a privatizing world*. No. 1474-2016-120901.(2001) 3-4. Accessed on June 05, 2019. <https://ageconsearch.umn.edu/record/33775/>

⁷⁶ Gordon Conway and Gary Toenniessen, "Feeding the world in the twenty-first century," *Nature* 402. (December, 1999) 55-58. Accessed on 04 June, 2019. <https://www.nature.com/articles/35011545.pdf>

⁷⁷ Thirtle, Srinivasan, and Heisey, *Public sector plant breeding in a privatizing world*, 9.

⁷⁸ Kuyek, *Good crops/Bad Crops*,38-39.

⁷⁹ Zewdie Bishaw and Anthony JG van Gastel, "ICARDA's seed-delivery approach in less favorable areas through village-based seed enterprises: conceptual and organizational issues," *Journal of New Seeds* 9.1 (2008): 70. Accessed on 03 June, 2019. <https://doi.org/10.1080/15228860701879331>

⁸⁰ Kuyek, *Good crops/Bad Crops*, 26-27.

⁸¹ *Ibid*,11-12.

⁸² Robert Tripp and Derek Byerlee, "Public Plant Breeding In An Era Of Privatization," Overseas Development Institute. Natural Resource Perspectives. (June 2000) 1-2. Accessed June 05, 2019. <https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/2845.pdf>.

corporations to progressively take over the control of seeds and gain power within the entire food chain.⁸³ It comes as no surprise that these companies were actually the producers of chemical fertilizers and pesticides.⁸⁴ They knew well enough that a lot of money could be made out of seeds.

The 1980s was a turning point in the process of liberalization and privatization of the agri-food sector, especially for seeds.⁸⁵ Competition on the market of pesticides was intense and larger corporations, such as Monsanto, the American pesticide and pharmaceuticals company, apprehended to see their prices and market share severely fall.⁸⁶ To tackle this problem, they shifted their attention towards plant breeding, and more particularly genetically modified plants, as it cost only U.S. 1\$ million to introduce new plants against a minimum of U.S. \$40 million for new pesticides.⁸⁷ By the 1990s, money was flowing for these agrochemical corporations.⁸⁸ Their money and existing relationship with farmers enabled them to take over the public plant breeding programs and enter the seed industry.⁸⁹ This revealed to be a strategic solution as the agro-businesses could develop genetically modified plants that were completely dependent on their brand name pesticides.⁹⁰ This is precisely what Monsanto did with its glyphosate which allowed it to become one of the biggest agrochemical and seed producers in the world.⁹¹

This empowerment resulted in the consolidation and monopolization of agricultural and food commodities.⁹² It became increasingly important for companies to merge with each other in order to limit generic competition.⁹³ According to FIAN, the International Food-first Information

⁸³ Bishaw and JG van Gastel, "ICARDA's seed-delivery approach in less favorable areas through village-based seed enterprises: conceptual and organizational issues," 70-71.

⁸⁴ Howard, "Visualizing consolidation in the global seed industry: 1996–2008," 1279-1280.

⁸⁵ Maertens and Swinnen, "Transformations in Agricultural Markets: FDI and Vertical Coordination," 3-4.

⁸⁶ Victor Pelaez and Gabriel Mizukawa, "Diversification strategies in the pesticide industry: from seeds to biopesticides," *Ciência Rural* 47.2 (2017).1-2. Accessed on 07, 2019. https://www.researchgate.net/publication/313310374_Diversification_strategies_in_the_pesticide_industry_from_seeds_to_biopesticides

⁸⁷ Kuyek, *Good crops/Bad Crops*, 12-13. Genetically modified plants can be defined as "organisms that have been modified by the application of recombinant DNA technology or genetic engineering." See: FAO, "Genetically modified crops," (2012), 312. Accessed on 07, 2019. <http://www.fao.org/3/i2490e/i2490e04d.pdf>

⁸⁸ Ibid, 11-12.

⁸⁹ Philip H. Howard, "Intellectual Property and Consolidation in the Seed Industry," *Crop Science*. 55:1-2. Madison: USA (2015). Accessed June 07, 2019. doi: 10.2135/cropsci2014.09.0669

⁹⁰ Kuyek, *Good crops/Bad Crops*, 12-13.

⁹¹ Dan Barber, "Save Our Food. Free the Seed." *The New York Times*. June 07, 2019. Accessed June 28, 2019. <https://www.nytimes.com/interactive/2019/06/07/opinion/sunday/dan-barber-seed-companies.html>.

⁹² Maertens and Swinnen, "Transformations in Agricultural Markets: FDI and Vertical Coordination." 4-5.

⁹³ Howard, "Visualizing consolidation in the global seed industry: 1996–2008," 1267.

and Action Network, nowadays ten corporations manage over two thirds of the global proprietary of seeds; ten corporations control nearly 90 percent of the commercialization of agrochemical products; ten corporations obtain three-quarters of the biotechnology industry revenue, and finally, six out of the ten leading seed corporations are also leaders in the pesticide and biotechnology industries.⁹⁴ With the recent merging announcement between Monsanto and Bayer, the largest pharmaceutical company, as well as the consolidation between their rivals: Dow Chemical, DuPont and Syngenta, leaves the control of two-thirds of the world's supply in seeds and pesticides, in the hands of only three companies.⁹⁵ These figures are alarming. It could not be clearer: the more time passes, the more control over seeds and global food order expands in the hands of a few players. These corporations set their prices for agricultural inputs, which may be unaffordable for many food producers.⁹⁶

It is now clearer how the control of seeds passed from farmers to states, and finally end up in the hands of corporations. However, an analysis of the regulations that have been put in place during this period of profound change is necessary to understand how transnational corporations have succeeded in imposing *“a model of agriculture where peasant farmers have no place and where a small number of global corporations control the entire food chain.”*⁹⁷

c) Regulations

Between the 1980s and 1990s, when agrochemical corporations started showing their interests in taking over the public plant breeding activities, there was no “ready-made market” for them to enter in as seeds were still perceived as a common good.⁹⁸ To achieve so, seeds had to become a merchandise and markets had to be established in order to transform *“the age-old act of saving and planting seed-the very basis of human civilization (...) in the complexity of patent rights, contracts.”*⁹⁹ For the first time in human history, seeds became subject to

⁹⁴ Suarez, "The Right to Seeds and Biological Diversity." 6-7.

⁹⁵ United Nations General Assembly, “Report of the Special Rapporteur on the right to food.” A/HRC/34/48. January 24, 2017. Note 86. Accessed on June 20, 2019. <https://hilalelver.org/resources/thematicreports/pesticides-and-food/> See also:Howard, "Visualizing consolidation in the global seed industry: 1996–2008," 1266.

⁹⁶ De Schutter, "Seed policies and the right to food: enhancing agrobiodiversity and encouraging innovation,"16.

⁹⁷ Kuyek, *Good crops/Bad Crops*,11-12.

⁹⁸ *Ibid*,14-15.

⁹⁹ *Ibid*.

regulations and laws.¹⁰⁰ Nevertheless, and fortunately, the process of commodification of seeds has been a hard and long-fought battle for companies. Seeds are overly complex to commodify as their nature is to reproduce themselves almost indefinitely.¹⁰¹ This being said, corporations had to find a way to claim ownership over a variety of plants as well as preventing farmers from using their 'owned varieties' without a financial contribution.¹⁰²

The development of hybrid plants, which produced high-yields only the first generation and drastically lowered yields in the subsequent generations, revealed to be a turning point for agro-industries.¹⁰³ Based on these hybrid plants, corporations were able to create plants that were sterile or unable to grow properly without the use of their chemicals.¹⁰⁴ The introduction of genetic engineering has also played an important role in commodifying seeds.¹⁰⁵ Nevertheless, those inventions revealed to be insufficiently solid to fight against the biggest rival: seed-saving. Corporations came to the realization that specific mechanisms and regulations were necessary in order to prevent farmers from saving and reproducing their own seeds.¹⁰⁶ From that moment on, companies started putting governments under pressure to strengthen their intellectual property rights (IPR) to further encourage innovation in agriculture and reward them for the investment made in that field.¹⁰⁷

(1) The Rise of Intellectual Property Rights (IPR)

The agricultural sector has been significantly influenced by two major international treaties: *Union Internationale pour la Protection des Obtentions Végétales* (UPOV) and the *Trade-Related Aspects of Intellectual Property Rights* (TRIPS). Both documents contain a set of

¹⁰⁰ Lara E. Ewens, "Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds," *Boston College International and Comparative Law Review* 23, no. 2 (Spring 2000): 287. Accessed June 13, 2019. <https://heinonline.org/HOL/P?h=hein.journals/bcic23&i=291>.

¹⁰¹ *Ibid*, 286.

¹⁰² Kuyek, Devlin. 13-14.

¹⁰³ Jack Ralph Kloppenburg, *First the seed: The political economy of plant biotechnology*, No. 303.483 (1988).11. Accessed June 13, 2019. http://93.174.95.29/_ads/F9C279737AB794E3738BC8EA9A54C003

¹⁰⁴ Kuyek, *Good crops/Bad Crops*, 39-40.

¹⁰⁵ E.Ewens, "Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds,"288.

¹⁰⁶ Vandana Shiva, "The seed and the earth," *Close to Home: Women Reconnect Ecology, Health and Development Worldwide*. Phila., PA: New Society Publishers (1994): 157. Accessed June 13, 2019. <http://el.doccentre.info/eldoc1/setdev/920101ddi3B.pdf>

¹⁰⁷ *Ibid*.

rules and minimum standards regarding IPR over plant varieties.¹⁰⁸ In short, UPOV requires its member states to grant minimum rights to *plant breeders*, whilst TRIPS imposes the World Trade Organization (WTO) members to provide protection over new plant varieties through *patent rights*. Overall, both of these agreements are recognized to have significantly strengthened the IPR of agri-businesses.¹⁰⁹

a) Union Internationale pour la Protection des Obtentions Végétales (UPOV)

The UPOV was initially adopted in 1961 in Paris, and then revised in 1972, 1978, and 1991, always under the same pretext: support an adequate plant variety protection that stimulates the development of new plant varieties for the benefit of all.¹¹⁰ Plant breeders ought to develop varieties that are new, distinct, uniform, and stable in order to receive the UPOV Convention's protection.¹¹¹ When a variety fulfills all these criteria, it can be included in the national catalog which discloses the list of the protected varieties that can be commercialized.¹¹² This represents a serious constraint to traditional varieties as they do not correspond to these norms. Because of their permanent evolution and instability, peasant farmer's varieties cannot benefit from the treaty.¹¹³ As of June 2019, a hundred and twenty countries, including large commercial powers became UPOV members.¹¹⁴ This high number can partly be explained by the pressure developing countries have received to become contracting parties of the UPOV, especially the

¹⁰⁸ Laurence R. Helfer, "Intellectual Property Rights in Plant Varieties - International Legal Regimes and Policy Options for National Governments." *FAO*. (Rome: 2004) Accessed June 13, 2019. <http://www.fao.org/3/y5714e/y5714e00.htm#Contents>.

¹⁰⁹ Olivier De Schutter. "Seed policies and the right to food: enhancing agrobiodiversity and encouraging innovation." *Background document to the report (A/64/170) presented by Prof. Olivier de Schutter, Special Rapporteur on the right to food, at the 64th session of the UN General Assembly (2009)*.3-8. Accessed June 20, 2019. http://www.srfood.org/images/stories/pdf/officialreports/20091021_report-ga64_seed-policies-and-the-right-to-food_en.pdf

¹¹⁰ "International Union for the Protection of New Varieties of Plants (UPOV)." *UPOV*. May 06, 2019. Accessed June 13, 2019. <https://www.upov.int/portal/index.html.en>.

¹¹¹ International Convention for the Protection of New Varieties of Plants art. 5(1), 2 Dec. 1961, 33 U.S.T. 2703, 815 U.N.T.S. 109 (*revised* 23 Oct.1978), [hereinafter UPOV Convention].

¹¹² Helfer, "Intellectual Property Rights in Plant Varieties - International Legal Regimes and Policy Options for National Governments."

¹¹³ De Schutter, "The right of everyone to enjoy the benefits of scientific progress and the right to food : from conflict to complementarity," 11-13.

¹¹⁴ "UPOV Lex." UPOV. November 30, 2018. Accessed June 13, 2019. <https://www.upov.int/upovlex/en/notifications.jsp>.

latest version, in order to be part of a trade or investment agreement.¹¹⁵ Moreover, each country joining the treaty after 1999, are in principle, compelled to apply the latest version of UPOV.¹¹⁶

Although each version of the UPOV made their own contribution to strengthen the plant breeders' rights, the 1991 UPOV Act is clearly the one that made a significant difference.¹¹⁷ First, the UPOV91 has extended the duration of the protection to a minimum of twenty years instead of fifteen years.¹¹⁸ Secondly, it widened the scope regarding breeder's rights from the "*production for the purposes of commercial marketing and the sale and marketing of propagation material of the variety*"¹¹⁹ to the "*production or reproduction; conditioning for the purpose of propagation; offering for sale; selling or other marketing; exporting; importing; stocking for any of the purposes mentioned above.*"¹²⁰ To be clear, all these actions are strictly forbidden without the approval of the plant breeder. The third difference concerns seed saving which are referred as "essentially derived varieties" in the UPOV91, whereby the authorization of the breeder is requested not only for the reproductive or vegetative propagating material, but also for the harvested material (seeds collected from the harvest) acquired by the illegal use of propagating material.¹²¹ In other words, the breeder has a narrower exemption to use its protected varieties as a way to create new varieties: the plant breeder that has developed a new variety "B" and attempts to commercialize it, ought to request it beforehand to the breeder from which that variety "B" is derived from.¹²² Finally, and most importantly, the UPOV91 Act forbids states to "*permit farmers to use for propagating purpose, on their own holdings, the product of the harvest they have obtained by planting, on their own holdings, the protected variety.*"¹²³ In other words, farmers are not allowed to save or exchange seeds from the protected variety's harvest.

¹¹⁵ "Bilateral Agreements Imposing TRIPS-Plus Intellectual Property Rights on Biodiversity in Developing Countries." GRAIN (Mar. 2008). Accessed June 13, 2019. http://www.grain.org/rights_files/TRIPS-plus-March-2008.pdf. See also: De Schutter. "The right of everyone to enjoy the benefits of scientific progress and the right to food : from conflict to complementarity," 316-317.

¹¹⁶ International Convention for the Protection of New Varieties of Plants art. 3(1).

¹¹⁷ Helfer. "Intellectual Property Rights in Plant Varieties - International Legal Regimes and Policy Options for National Governments."

¹¹⁸ International Convention for the Protection of New Varieties of Plants art. 19(2).

¹¹⁹ De Schutter, "The right of everyone to enjoy the benefits of scientific progress and the right to food : from conflict to complementarity," 12-13.

¹²⁰ International Convention for the Protection of New Varieties of Plants art. 14(1).

¹²¹ Ibid, art. 14(2).

¹²² De Schutter, "The right of everyone to enjoy the benefits of scientific progress and the right to food : from conflict to complementarity," 12-13.

¹²³ International Convention for the Protection of New Varieties of Plants art. 15(2).

It is now clearer how the UPOV Convention promotes homogeneity and stability of the varieties developed by corporations at the expense of the diversity of peasant farmer's varieties. It also clarifies how it made it increasingly difficult for peasant farmers to use, save, and exchange their traditional varieties.

b) Trade-Related Aspects of Intellectual Property Rights (TRIPS)

The adoption of the TRIPS agreement in 1994 by the WTO has added an alternative to the IPR of plant varieties. WTO requires its member states to adopt at a national level adequate protection of IPR in order to reduce obstacles to international trade.¹²⁴ Although TRIPS does not directly address plant breeders rights or plant variety protection, it indirectly does when addressing patents.¹²⁵ Put differently, the granting of patents has considerably strengthened the legal protection of plant varieties.¹²⁶ A patent protection gives the creator exclusive rights over its invention during a minimum twenty years and should be available for "*any inventions whether products or processes, in all fields of technology, provided that they are new, involve an inventive step and are capable of industrial application.*"¹²⁷ However, it is important to highlight that TRIPS does include a certain number of flexibilities to protect public interest. In this regard, members may exclude from patentability animals and plant life (other than microorganisms) as well as biological processes essential for the production of plants or animals (other than microbiological processes).¹²⁸ Nevertheless, signatories have to choose between three different alternatives to implement protection of plant varieties: "*either by patents or by an effective sui generis system or by any combination thereof.*"¹²⁹ The '*effective sui generis*' intends to be an alternative option to patents.¹³⁰ Although it does not stipulate it, the UPOV agreement can be a

¹²⁴ Agreement on Trade-Related Aspects of Intellectual Property Rights, 15 Apr. 1994, 1869 U.N.T.S. 299. (1994) [hereinafter TRIPS Agreement]

¹²⁵ "Multilateral Trade Negotiations on Agriculture." FAO (2000). Accessed June 14, 2019. <http://www.fao.org/3/x7355e/X7355e00.htm#TopOfPage>.

¹²⁶ Helfer, "Intellectual Property Rights in Plant Varieties - International Legal Regimes and Policy Options for National Governments."

¹²⁷ Agreement on Trade-Related Aspects of Intellectual Property Rights, 1994, art.27(1).

¹²⁸ Ibid, art.27 (3)(b).

¹²⁹ Ibid.

¹³⁰ FAO, "Multilateral Trade Negotiations on Agriculture."

sui generis plant variety protection.¹³¹ In other words, TRIPS gives member states the freedom to determine which IPR is best to apply depending on their specific circumstances.¹³²

Seeds, plant cells, and DNA sequences are all susceptible to be patented.¹³³ The main problem in this regard is that a single patented gene can impose a restriction on the entire seed.¹³⁴ Put simply, a plant that contains natural or that has been infected, or has simply developed the same patented characteristics through cross-pollination, is considered to be ownership of the one who filled to patent.¹³⁵ Plant patentability is however, harder to obtain than the plant breeder's rights as the inventor is requested to prove that its creation is "*non-obvious*" and "*useful*."¹³⁶ But if the inventor succeeds to do so, then its product or process is granted as the most far-reaching form of protection.¹³⁷ This explains why patents became over time, and especially with the rise of genetically modified crops, a key motivation for seed corporations.¹³⁸ It not only allows them to have a return on their investment and a considerable competitive advantage over their rivals but also to have complete control over farmers practices.¹³⁹ To be clear, farmers that cultivate patented seeds are generally requested to sign an agreement whereby they have no rights over the seeds of their plants: they cannot save, re-sow, nor exchange them.¹⁴⁰ This means that the more patents a company acquires, the more control it gains over plants, and thus, the more the peasant farmer is discouraged to save seeds as it could infringe IPR of a company.¹⁴¹

It is now evident that under the pretext of 'encouraging investment and innovation in agriculture for the benefit of the whole society' it was necessary to strengthen the IPR of private entities through patents and plant breeders rights. UPOV and TRIPS, thus, have been rewarding those investments by the commercialization of seeds.¹⁴² To further intensify agriculture, farmers had to have access to those so-called varieties of seeds. This is why governments have promoted this access through subsidized packages that included fertilizers and pesticides. This approach

¹³¹ Ibid.

¹³² Ibid.

¹³³ De Schutter, "The right of everyone to enjoy the benefits of scientific progress and the right to food," 11.

¹³⁴ Howard, "Intellectual Property and Consolidation in the Seed Industry," 2-3.

¹³⁵ Lognon, "Seed Stories - Fighting Against The Privatisation of Life," 15-16.

¹³⁶ Agreement on Trade-Related Aspects of Intellectual Property Rights, 1994, art.27(1).

¹³⁷ De Schutter, "The right of everyone to enjoy the benefits of scientific progress and the right to food," 11-12.

¹³⁸ Ibid.

¹³⁹ Lognon, "Seed Stories - Fighting Against The Privatisation of Life," 15-16.

¹⁴⁰ Kuyek, Devlin. 40-41.

¹⁴¹ Philip H. Howard. "Intellectual Property and Consolidation in the Seed Industry." *Crop Science*. 55:1-7. Madison: USA (2015). Accessed June 07, 2019. doi: 10.2135/cropsci2014.09.0669

¹⁴² De Schutter. "The right of everyone to enjoy the benefits of scientific progress and the right to food," 20-21.

has strongly empowered seeds corporations' control, which in turn has implications for biodiversity, farmers, and consumers.

2. Consequences

The commodification of seeds has been a long David and Goliath battle between governments, farmers, corporations, and civil society. On the one hand, some argue that this profound transition has enabled to increase employment, availability, and cheapness of food, thereby, limiting the damages of the spread of famine.¹⁴³ On the other hand, people denounce that this system has put agribusinesses interest ahead of the public interest and that this has disastrous effects on society.¹⁴⁴ Whilst both points of view have the merits to be considered, this section will mainly focus on the negative impacts the industrialization, privatization, and regulations on seed, has had on biodiversity, farmers, and consumers.

a) Biodiversity

It is generally acknowledged that the main cause of genetic erosion of local and traditional seeds is due to the widespread replacement and cultivation of fewer uniform and high-yielding varieties.¹⁴⁵ The mechanization of agriculture, the development of agrochemicals, and the use of genetic engineering have largely stimulated the massive production capability.¹⁴⁶ As a result of the growing acceptance of these new inputs, monoculture specialization have dramatically expanded throughout the world.¹⁴⁷ According to Miguel Altieri, a Professor of Agroecology at the University of California Berkeley, political and economic agendas have persistently prioritized monocultures under the pretext of being the most sustainable solution to

¹⁴³Rober Tripp. "Biodiversity and modern crop varieties: Sharpening the debate." *Agriculture and Human Values*, 13, (1996) 53. <https://doi.org/10.1007/BF01530523>

¹⁴⁴ Rabhi and Duquesne, *Les Semences: Un Patrimoine Vital En Voie De Disparition*.

¹⁴⁵ Thomas, *Global Biodiversity: Status of the Earth's living resources*. 429.

¹⁴⁶ Miguel A. Altieri, "The ecological role of biodiversity in agroecosystems," *Invertebrate Biodiversity as Bioindicators of Sustainable Landscapes*. Elsevier, (1999) 20-21. Accessed June 08, 2019. <https://www.assobio.it/web16/wp-content/uploads/2016/06/The-ecological-role-of-biodiversity-in-agroecosystems-1999.pdf>

¹⁴⁷ Miguel A. Altieri. "Green Deserts: Monocultures and Their Impacts on Biodiversity." In *Red Sugar, Green Deserts*, 67-68. FIAN International, 2009. Accessed June 08, 2019. https://www.fian.org/library/publication/red_sugar_green_deserts_report_on_monocultures_and_human_rights/

feed the growing population.¹⁴⁸ He illustrates this point by disclosing that out of 1.5 billion hectares of cultivated fields, 91 percent of these lands are devoted to the monoculture of rice, wheat, corn, soybeans, and a few others.¹⁴⁹ This undoubtedly explains why more than 75 percent of plant genetic diversity has disappeared in one century.¹⁵⁰ It also clarifies why only 12 plants feed 75 percent of the world's population.¹⁵¹ Genetic diversity is not only declining between crops but also within crops.¹⁵² To take an example of Sri Lanka, 2000 varieties of rice were cultivated in 1959, in 1992 barely were left, and five major varieties were the most cultivated.¹⁵³ These figures show the correlation between the imposed simplistic agricultural model and genetic erosion.¹⁵⁴ Monocultures are antithesis of biodiversity and their extensive cultivation represents a considerable threat to society and nature, as genetic uniformity is more vulnerable to disease and pests. The Irish potato famine that occurred in the late 1840's perfectly illustrates this last point. The potato blight, a fungus that has caused potatoes to turn black and rotten, destroyed most of the crops in 1846, 1848, and 1849.¹⁵⁵ Potatoes were the major crops grown and consumed in the country at the time, and the widespread virus led to the death of approximately 1 million people and the emigration of 1.5 million people outside the country.¹⁵⁶ This example clearly demonstrates the danger of relying only on monocultures to feed the world, especially in times of climate change as the weather will become increasingly unpredictable.

The impact on biodiversity not only concerns the considerable loss of genetic diversity among plants, but also the use of agrochemical products and other industrial activities that have caused the deforestation of millions of hectares, degraded soils, and put at risk several organisms of the countryside: plants, insects, wildlife, natural enemies of crop diseases, bees and other pollinators.¹⁵⁷ Each variety of organism plays an essential role in guaranteeing the well-functioning of the ecosystems. Nevertheless, pollinators are particularly important for plant

¹⁴⁸ Ibid.

¹⁴⁹ Ibid.

¹⁵⁰ FAO, "*Building on Gender, Agrobiodiversity and Local Knowledge.*"

¹⁵¹ Ibid.

¹⁵² De Schutter, "The right of everyone to enjoy the benefits of scientific progress and the right to food : from conflict to complementarity," 313-314.

¹⁵³ Thomas, *Global Biodiversity: Status of the Earth's living resources*, 427.

¹⁵⁴ Ibid, 411.

¹⁵⁵ Howard D. Leathers, and Phillips Foster. *The world food problem: tackling the causes of undernutrition in the Third World*. No. Ed. 3. (Lynne Rienner Publishers Inc, 2004), 10-11.

¹⁵⁶ Ibid.

¹⁵⁷ Altieri, "Green Deserts: Monocultures and Their Impacts on Biodiversity," 68-69.

reproduction, and thus, food for mankind. They highly contribute to agricultural yields by moving the pollen from one plant to another.¹⁵⁸ FAO reported that “75 percent of the world’s crops producing fruits and seeds for human consumption depends, at least in part, on pollinators for sustained production, yield, and quality.”¹⁵⁹ Alarming, these organisms are in a global state of decline which further threatens genetic diversity and thus, biodiversity.¹⁶⁰

Over time, genetically modified crops have become the quintessential model for further intensifying industrial agriculture.¹⁶¹ As reported by the International Service for the Acquisition of Agri-biotech Applications (ISAAA), the planting of biotech crops increased from 1.7 millions of hectares in 1996 to 189.8 hectares in 2017.¹⁶² These crops are concentrated in the large landscape of the United - States, Brazil, Argentina, Canada, and India, and mostly consist of monocultures of soybean, maize, cotton, and canola.¹⁶³ As stated previously, the large-scale of homogenized genetically modified crops require the intensive and continuous application of the same agrochemical inputs. The problem in this regard is that fertilizer nutrients tend to systematically end up in groundwater supplies.¹⁶⁴ They damage aquatic systems and wildlife by enriching the water with nutrients that overstimulate the production of algae, and prevent light from penetrating the surface.¹⁶⁵ Moreover, some fertilizers, such as the famous glyphosate, have been acknowledged as harmful for species that inhabit the soil such as “*spiders, carabid and coccinellid beetles, and others that feed off of detritus such as earthworms, and for aquatic organisms, including fish.*”¹⁶⁶ Pesticides are no better at protecting the planet's biodiversity. They not only endanger pollinators and wildlife in general but also put in jeopardy the natural enemies of crop plagues, which are essential insect predators and parasites that regulate pest

¹⁵⁸ Stéphane Kluser and Pascal Peduzzi, "Global pollinator decline: a literature review." (2007). 1-3. Accessed on 08 June, 2019.

https://www.researchgate.net/profile/Peter_Kevan/publication/254215024_The_global_decline_of_pollination_services/links/00463536a771c22321000000.pdf

¹⁵⁹ Food and Agriculture Organization of the United Nations. *Why Bees matter- The importance of bees and other pollinators for food and agriculture.* (FAO, 2018) 9-11. Accessed on 09, 2019.

<http://www.fao.org/3/19527EN/i9527en.PDF>

¹⁶⁰ Ibid.

¹⁶¹ Altieri, "Green Deserts: Monocultures and Their Impacts on Biodiversity," 67-68.

¹⁶² ISAAA. *Global Status of Commercialized Biotech/GM Crops.* ISAAA Brief No. 53. (Ithaca, NY:2017). Accessed June 10, 2019. <http://www.isaaa.org/resources/publications/pocketk/16/>.

¹⁶³ Ibid.

¹⁶⁴ James S.Shortle, David G. Abler, and Mark Ribaudo, "Agriculture and water quality: the issues," *Environmental policies for agricultural pollution control* (2001): 2-4. Accessed June 10, 2019.

https://www.researchgate.net/publication/286283639_Agriculture_and_water_quality_The_issues

¹⁶⁵ Ibid, 4-5.

¹⁶⁶ Altieri, "Green Deserts: Monocultures and Their Impacts on Biodiversity," 71-72.

insects.¹⁶⁷ Alarmingly the use of fertilizers and pesticides has dramatically increased over time. To illustrate this point, from 1960 to 2000, the utilization of fertilizers has risen by approximately 800 percent with corn, rice and wheat.¹⁶⁸ In the same years, the spreading of pesticides has also increased by 15 to 20 times.¹⁶⁹ Despite the application of these chemicals, pest continues to provoke considerable losses of crops: varying from 26 to 29 percent for wheat and soybean, and 31 to 40 percent of maize and rice.¹⁷⁰ This can be explained by the fact that the continuous same application of agrochemicals creates superweeds that are resistant to agrochemicals.¹⁷¹ Ultimately, such practices participate in the decline of nature and threaten the limited diversity of crops grown for human consumption.

Another great threat to genetic diversity is the high risk of contamination of genetically modified seeds.¹⁷² Indeed, the gene of these crops and the chemical products they require have the potential to be transferred to varieties that are sexually compatible wild relatives.¹⁷³ The main problem in this regard is that traditional farming, which is organic, relies heavily on the existing ecosystems to manage the fertility of their soil, prevent pest and diseases, and adapt to the climatic conditions. When unwanted gene flow from genetically modified crops occurs, it disrupts the whole system on which peasant farmers rely on, and foster pest resistance, superweeds, and put at risk wildlife in general.¹⁷⁴ As stated previously, biotech crops tend to put in danger wildlife, affect soil and aquatic ecosystems, create superweeds, increase pest and disease resistance.¹⁷⁵

¹⁶⁷ Shortle, Abler, and Ribaud, "Agriculture and water quality: the issues," 7. See also: Food and Agriculture Organization of the United Nations. "Dimensions of Need - Controlling Pests." FAO. Rome:1995. Accessed June 10, 2019. <http://www.fao.org/3/u8480e/U8480E0J.htm>.

¹⁶⁸ Urs Feller, Stansilav Kopriva, and Valya Vassileva, "Plant Nutrient Dynamics in Stressful Environments," (2018), 140. Accessed June 10, 2019. https://books.google.it/books?id=rjlvDwAAQBAJ&pg=PA140&dq=the+utilisation+of+fertilizers+and+pesticide+in+crease+over+time&hl=fr&sa=X&ved=0ahUKEwi_wqDiirLjAhVN_qQKHQW6AY8Q6AEIMjAB#v=onepage&q=the%20utilisation%20of%20fertilizers%20and%20pesticide%20increase%20over%20time&f=false

¹⁶⁹ Ibid.

¹⁷⁰ E.C.Oerke, "Crop Losses to Pests." *The Journal of Agricultural Science* 144, no. 1 (2006): 31–33. Accessed June 10, 2019. doi:10.1017/S0021859605005708.

¹⁷¹ Altieri, "Green Deserts: Monocultures and Their Impacts on Biodiversity," 70-71.

¹⁷² Ibid.

¹⁷³ Miguel A. Altieri, "The Myth of Coexistence: Why Transgenic Crops Are Not Compatible With Agroecologically Based Systems of Production," *Bulletin of Science, Technology & Society* 25, no. 4 (August 2005): 369–71. Accessed June 29, 2019. doi:10.1177/0270467605277291.

¹⁷⁴ Ibid.

¹⁷⁵ Ibid.

Therefore, such risk of contagion represents another considerable danger for the remaining local and traditional varieties. If these traditional varieties of seeds are contaminated by the modern ones, farmers will not only lose the benefit from freely enjoying them, but will also lose the remaining alternatives to the dominant seed system, and will have no other choice than being at the mercy of multinationals.

b) Farmers

It is evident that the structure of modern agriculture and the adopted policies have not only severely affected biodiversity but also farmers' lives, environment, and their ancestral practices.

One of the most visible and serious consequences on farmers is undoubtedly the introduction of commercial seeds (hybrids and GMOs) as they have gradually disconnected farmers from one of their most essential means of production.¹⁷⁶ Before the introduction of these varieties, seeds were the affair of farmers and not corporations. They were an integral part of their work as farmers were "*active plant breeders, conserving local landraces and selecting seeds for preferred and adaptive characteristics.*"¹⁷⁷ However, commercial seeds appeared to be extremely attractive as they could significantly boost their yields and produce uniform crops for the market.¹⁷⁸ Given that, encouraged by governments, farmers progressively abandoned traditional seeds to replace them with modern varieties, and therefore, delegated their previous task and knowledge regarding seed reproduction and selection to corporations. India for instance, was home to 100,000 different varieties of rice a few dozen years ago.¹⁷⁹ Today, these hybrids varieties cover "*more than 80 percent of India's rice acreage.*"¹⁸⁰

This period of profound transition has increasingly compelled farmers to be reliant not only on commercial seeds but also on agrochemicals, machinery, and fuel. To further encourage

¹⁷⁶ Kuyek, *Good crops/Bad Crops*, 17-18.

¹⁷⁷ Krystyna Swiderska, et al, "Adapting agriculture with traditional knowledge," *International Institute for Environment and Development (IIED) Briefing, London* (2011), 2. Accessed June 29, 2019. <https://pubs.iied.org/pdfs/17111IIED.pdf>

¹⁷⁸ Dan Barber. "Save Our Food. Free the Seed." *The New York Times*. June 07, 2019. Accessed June 28, 2019. <https://www.nytimes.com/interactive/2019/06/07/opinion/sunday/dan-barber-seed-companies.html>.

¹⁷⁹ Chitrangada Choudhury, "Why India's Farmers Want to Conserve Indigenous Heirloom Rice," *The Guardian*. September 24, 2017. Accessed June 30, 2019. <https://www.theguardian.com/environment/2017/sep/24/why-indias-farmers-want-to-convert-indigenous-heirloom-rice>.

¹⁸⁰ Ibid.

this dependency, and ensure the protection of intellectual property rights over the high yielding seeds developed, agribusinesses introduced contract agreements, whereby farmers are dictated what and how to produce, and to whom the crop should be sold.¹⁸¹ To illustrate this point, when purchasing Monsanto's Roundup Ready Seed, the grower ought to sign the Monsanto Technology Agreement (MTA) which imposes the respect of certain conditions and rules.¹⁸² Farmers can only spray Monsanto's herbicides and pesticides; they are generally forbidden to save the seeds of the Roundup Ready Seed to replant them for the next harvest and to sell or exchange them with anyone else; they ought to sell the crop to a specific purchaser; and finally, authorise Monsanto to make unexpected inspections in their fields.¹⁸³ As pointed out by Devlin Kuyek, "a farmer cannot actually purchase the seeds, only rent it for a season from its legal owners."¹⁸⁴ This clearly shows how high-yielding seeds have gradually imposed a totally different way of cultivating, which detaches farmers from their tradition and know-how handed down from generation to generation. The art of cultivating diversity is replaced by corporate farming with simplified and mechanized monocultures; in Argentina for instance, soybean production has grown from 38,000 hectares in 1970 to 10 million hectares in 2001.¹⁸⁵ It also shows how farmers started losing their previous freedoms and rights, such as the ancestral act of saving and exchanging seeds. The growing recognition of the intellectual property rights of plant breeders and inventors of biotechnologies (UPOV and TRIPS), transformed these ancestral actions as intellectual property infringements, which significantly compelled farmers to only use commercial seeds and respect the contract to avoid legal and financial risks.¹⁸⁶

Whilst the industrialization of agriculture has progressively transformed farms into factories, the privatization of seeds and the consolidation of large agri-businesses has increasingly dictated the prices to pay. For example in the U.S. farmers have spent 17 billions of dollars to purchase seeds, which according to the Ministry of Agriculture, is 56 percent more

¹⁸¹ Kuyek, *Good crops/Bad Crops*, 42-43.

¹⁸² Nicole C. Nachtigal, "A Modern David and Goliath Farmer v. Monsanto: Advising a Grower on the Monsanto Technology Agreement 2001," *Great Plains Natural Resources Journal* 6, no. 1 (Fall 2001): 52-53.

https://heinonline.org/HOL/Page?collection=journals&handle=hein.journals/gpnat6&id=57&men_tab=srchresults

¹⁸³ Ibid.

¹⁸⁴ Kuyek, *Good crops/Bad Crops*, 42-43.

¹⁸⁵ Walter Pengue, "The Impact of Soybean Expansion in Argentina." *GRAIN*. September 24, 2001. Accessed July 01, 2019. <https://www.grain.org/article/entries/292-the-impact-of-soybean-expansion-in-argentina>.

¹⁸⁶ Marcello Buiatti, et.al. *The Law of the Seed*. Report from Working Group on the Law of Seed. (February 2013). Accessed June 29, 2019. <http://www.navdanya.org/attachments/lawofseed.pdf>. See also: De Schutter, "Seed policies and the right to food: enhancing agrobiodiversity and encouraging innovation," 3-8.

than in 2006.¹⁸⁷ This figure is astonishing especially when considering that traditional seeds were totally free a few decades ago. It seems that farmers have seen their alternatives to this system decrease over time which has further pushed them in a dependency model. As stated by an American farmer, Todd Leake: “*we barely find any other alternative, we are compelled to buy their products and pay the price they ask.*”¹⁸⁸

Needless to say that only wealthy farmers can afford to pay such prices which encourages them to produce on a large-scale in order to get a return on their investment. Competition is fierce, and unsurprisingly, large farms in both the Global North and Global South are mostly favored.¹⁸⁹ Small farmers bear the brunt of this system: lower salaries, unemployment, extinction of farms, indebted, and appropriation of lands.¹⁹⁰ This explains why the number of farms has decreased over time throughout the world. Belgium for example has lost 63 percent of its farms in only 30 years.¹⁹¹ In the United States, there were 6 million farms in 1935, in 2012 there were only 2 million left.¹⁹² In the Argentine Pampas, more than 60,000 farms disappeared between 1992 and 1999.¹⁹³ Overall, small farmers are severely impacted by this system and figure amongst the poorest in the world. According to FAO, there are approximately 500 small farmers, men, and women, mostly located in developing countries that suffer from poverty and hunger.¹⁹⁴ The irony of the course is undoubtedly the fact that these small farmers produce most of the food in the developing world, and that they are actually the ones confronted with famine.¹⁹⁵

¹⁸⁷ P.J. Huffstutter, "MONOPOLE. Comment Les OGM Font Monter Les Prix," *Courrier International*. March 17, 2010. Accessed June 30, 2019. <https://www.courrierinternational.com/article/2010/03/18/comment-les-ogm-font-monter-les-prix>.

¹⁸⁸ Ibid.

¹⁸⁹ "Unite against the FFA for the Future of Agriculture" FIAN Belgium. March 27, 2017. Accessed June 30, 2019. <https://www.fian.be/Unite-against-the-FFA-for-the-future-of-agriculture?lang=nl>.

¹⁹⁰ Ibid.

¹⁹¹ Ibid.

¹⁹² Roberto A. Ferdman, "The Decline of the Small American Family Farm in One Chart." *The Washington Post*. September 16, 2014. Accessed June 29, 2019. https://www.washingtonpost.com/news/wonk/wp/2014/09/16/the-decline-of-the-small-american-family-farm-in-one-chart/?noredirect=on&utm_term=.fc0fd1c2afc2.

¹⁹³ Pengue, "The Impact of Soybean Expansion in Argentina."

¹⁹⁴ Dixon, J. A., David P. Gibbon, and Aidan Gulliver. *Farming systems and poverty: improving farmers' livelihoods in a changing world*, Food & Agriculture Organization (FAO:2001), 413. Accessed June 29, 2019. <http://agris.fao.org/openagris/search.do?recordID=SO2006100076>

¹⁹⁵ Ibid.

c) Consumers

Consumers are inevitably strongly affected by the extinction of biodiversity and the degradation of ecosystems. The type of food and the way food is produced went through profound changes these last decades and this has far-reaching implications for consumers.

Although the consequences of this system on biodiversity and farmers have recently received a lot of attention from the international community, sufficient research on consumers is still worryingly missing. Nonetheless, a new study conducted by several scientists such as Colin K.Khoury, a researcher at the International Center for Tropical Agriculture, has analyzed the global trends of crop plants produced and consumed worldwide over the past 50 years.¹⁹⁶ These scientists have raised awareness on the fact that “*national food supplies globally have become increasingly similar in composition, based upon a suite of truly global crop plants. The growth in reliance worldwide on these crops heightens interdependence among countries in their food supplies, plant genetic resources, and nutritional priorities.*”¹⁹⁷ In other words, global diets are becoming more and more standardized throughout the world.¹⁹⁸ Indeed, it appears that the dwindling diversity of our plates simply reflects the loss of diverse food cultivated. For consumers, this means that nutritional diversity has progressively been replaced by a limited number of major crop plants such as wheat, rice, maize, and potato.¹⁹⁹

Yet, at the same time grocery stores have never provided as varied food as nowadays.²⁰⁰ Nonetheless, the varieties proposed are not genetically diverse but rather different products that come from the four corners of the globe. Tomatoes can be taken as examples to illustrate this point, although there are hundreds of varietal diversity with different colors and sizes, supermarkets generally only propose a few of them, which all look alike, and rarely change their offerings.²⁰¹ Similarly to tomatoes, bananas are widely consumed in the world. Despite rich

¹⁹⁶ Colin K.Khoury, et.al. "Increasing homogeneity in global food supplies and the implications for food security." *Proceedings of the National Academy of Sciences* 111.11 (2014): 4001-4006. Accessed June 29, 2019.

<https://www.pnas.org/content/111/11/4001.short>

¹⁹⁷ Ibid.

¹⁹⁸ Ibid.

¹⁹⁹ Ibid.

²⁰⁰ Bryan Walsh, "Study Shows Global Diet Is Becoming More and More Similar," *Time*. March 04, 2014. Accessed July 01, 2019. <https://time.com/12366/global-diet-becomes-homogenized/>.

²⁰¹ "Tomates." Association Kokopelli. Accessed July 01, 2019. <https://kokopelli-semences.fr/fr/c/semences/potageres/legumes-fruits/tomates?page=25>.

genetic diversity, only a handful of varieties are actually cultivated.²⁰² However, indeed, grocery stores will display other fruits and vegetables, which compensates the lack of genetic diversity amongst the products proposed. Therefore, it is extremely difficult for consumers to find local and genetically diverse products, as their food has been replaced by global genetic uniformity, which is generally coming from modern varieties, the high-yield hybrids. Consequently, farmers have increasingly been deprived from growing their traditional seeds, it seems that consumers face the same issue, they are deprived of their traditional and diverse food.

The standardization of global diets is not only a problem in terms of access and consumption of genetic diversity but also in terms of taste. In India for instance, the modern hybrid ‘sarkari dhaan’ which means ‘government rice’ has been introduced to replace the traditional ‘desi’ varieties.²⁰³ However, most farmers have abandoned them not only because they were not adequately adapted to their soils and climatic conditions, but also because they did not correspond to their taste preferences. As claimed by the Indian farmer Gomati Raut “*with sarkaari rice, even if you have three vegetables accompanying it, it does not taste that good (...) our desi rice you can eat it by itself.*”²⁰⁴ In addition to this point, the Professor Haim Rabinowitch, the inventor of the ‘eternal tomato’, a modern variety that only rots after three weeks, which has completely revolutionized the market, affirms openly that his invention is tasteless.²⁰⁵ He recognizes that this point is one of the principal drawbacks of his development and that he proposed to multinationals to develop flavorful varieties, but unsurprisingly, agribusinesses did not show any interest.²⁰⁶ What is worrying about this revelation, is that more than 80 percent of the tomatoes sold to consumers through large retailers come from modern hybrid varieties.²⁰⁷ For consumers, this creates an additional issue as they have gradually lost access to their traditional and diverse food, and the replaced varieties are tasteless. Moreover, to this date, there is still no system of label, such as organic labels, that enables consumers to identify if the food has been grown from traditional seed crops or modern varieties. Only

²⁰² Nadia Ordonez et.al., "Worse comes to worst: bananas and Panama disease—when plant and pathogen clones meet." *PLoS pathogens* 11, no. 11 (2015). <https://doi.org/10.1371/journal.ppat.1005197>

²⁰³ Choudhury, "Why India's Farmers Want to Conserve Indigenous Heirloom Rice."

²⁰⁴ Ibid.

²⁰⁵ Mathilde Gérard. "Cash Investigation : Le Goût Amer Des Graines De Tomate." *Le Monde.fr*. June 18, 2019. Accessed July 02, 2019. https://www.lemonde.fr/culture/article/2019/06/18/cash-investigation-le-gout-amer-des-graines-de-tomate_5477654_3246.html.

²⁰⁶ Elise Lucet. "Cash Investigation: Multinationales Hold-up sur nos fruits et légumes." *Rutube Video*, 59:05. Posted 18th of June 2019. <https://rutube.ru/video/ceba97e5d74152949fc86556085b3f5b/>

²⁰⁷ Ibid.

consumers that know the producers that still cultivate these varieties will be more advantaged. Unfortunately, it goes without saying that this is far from being the majority of the populations.

It is now clear that the disappearance of traditional seeds further threatens consumers, as the alternatives to this food supply is becoming increasingly low. The homogenization of global diets, the loss of traditional tastes, and the lack of alternatives have far-reaching implications for consumers, but unfortunately, there are not the only consequences. To avoid overlapping, these points will be developed in the following chapter: *The Disappearance of Traditional Seeds and The Right to Adequate Food*.

3

Chapter Three: The Disappearance of Traditional Seeds and the Right to Adequate Food

“Freedom from want of food, therefore, must mean making available for every citizen in every country sufficient of the right kind of food for health. If we are planning food for the people, no lower standard can be accepted.”

Sir John Boyd Orr

After analyzing the impact of the modern agricultural system and the disappearance of traditional seeds on biodiversity, farmers, and consumers, it is evident that the situation jeopardizes nature and society. Soils, forests, freshwater, oceans, and biodiversity are being degraded at an unprecedented rate; farmers are increasingly being separated from their means of production and affected by poverty and hunger; consumers no longer have access to a portfolio of culturally appropriate and nutritious food necessary for their health. Following these observations, in my point of view, it is clear that the current utilization and perception of seeds is at the heart of all these problems. The commercial seeds mostly benefit large agri-corporations which treat us as consumers rather than citizens. This is why this work argues that the disappearance of traditional seeds is a considerable threat to citizens’ freedoms and human rights, such as the right to adequate food.

I. Disappearance of Traditional Seeds and Human Rights

Seeds are crucial components of agricultural biodiversity, which in turn are instrumental in the production of food.²⁰⁸ If seeds are the primary basis for food, and the right to food is a

²⁰⁸Agricultural biodiversity is defined by FAO as the “variety and variability of animals, plants, and micro-organisms on earth that are important to food and agriculture which result from the interaction between the

human right, then seeds are indivisibly linked with other rights. General Comment 12 of the International Covenant on Economic, Social, and Cultural Rights states “*the human right to adequate food is of crucial importance for the enjoyment of all rights.*”²⁰⁹ The former South African President Nelson Mandela highly supported the idea of the interdependence between civil and economic rights by claiming, “*we do not want freedom without bread, nor do we want bread without freedom.*”²¹⁰ The right to adequate food cannot be fully realized if the right to self-determination, the right to an adequate standard of living, the right to physical and mental health, and others rights are not respected. I argue that the disappearance of traditional seeds undermines the enjoyment of these human rights, as the access to means of production and the options for culturally appropriate food are considerably reduced. Whilst all these human rights are of prime importance, the focus will be put on the right to adequate food as seeds directly influence the quality and the integrity of humans’ diets.²¹¹ In this section, the privatization of seeds will be systematically referred to the disappearance of traditional seeds, as the more traditional varieties vanish off the face of the earth, the more commercial varieties will be used as a substitute.

A. Right to Food as a Human Right

The right to Food was officially stipulated under Article 25 of the United Nations Declaration of Human Rights (UNDHR) as an important aspect of the right to an adequate standard of living but was not yet clearly recognized as a human right.²¹² In 1976, although Article 11 of the International Covenant on Economic, Social, and Cultural Rights (ICESCR) further affirms food as part of the right to a suitable standard of living, is also recognized for the

environment, genetic resources, and the management systems and practices used by people.” FAO. *Agricultural Biodiversity, Multifunctional Character of Agriculture and Land Conference*, 5-6.

²⁰⁹ U.N. Econ. & Soc. Council [ECOSOC], Comm. on Econ., Soc. & Cultural Rights. Substantive Issues Arising in the Implementation of the International Covenant on Economic, Social and Cultural Rights: General Comment 12, F/C.12/1999/5 (May 12, 1999). Note 21. <https://europa.eu/capacity4dev/hunger-foodsecurity-nutrition/document/general-comment-no-12-right-adequate-food>

²¹⁰ Marc J. Cohen and Mary Ashby Brown, “Access to Justice and the Right to Adequate Food: Implementing Millennium Development Goal One,” *Sustainable Dev. L. & Pol’y* 6 (2005). 54-55. Accessed June 18, 2019.

https://heinonline.org/HOL/Page?collection=journals&handle=hein.journals/sdlp6&id=10&men_tab=srchresults

²¹¹ Hubbard and Zystro, “State of organic seed,” 5.

²¹² Universal Declaration of Human Rights, G.A. Res. 217 (III) art.25 (1), U.N. Doc. A/RES/217 (III) Dec.10, 1948). <https://www.un.org/en/universal-declaration-human-rights/index.html>

first time “*the right of everyone to be free from hunger.*”²¹³ Following the adoption of this Covenant, states did little to protect the right to food, believing an increase in agricultural production, due to private investments, would address global hunger.²¹⁴ The international community recognized over time that higher agricultural productivity did not eradicate famine in the world, as the problem was a lack of access to food rather insufficient food.²¹⁵ Unsurprisingly, this growing awareness coincided with the recent adoption of the UPOV91 and TRIPS agreements, which significantly strengthened the intellectual property rights of agri-corporations. It seems that the more companies obtained rights in the field of food production, the more the right to adequate food had to be reinforced. To illustrate this point, the member states of the ICESCR requested at the 1996 World Food Summit that the rights relating to food should be addressed in a more aggressive way.²¹⁶ Finally in 1999, the United Nations Economic and Social Council adopted Comment 12 which clearly states that the right to adequate food is realized when: “*every man, woman, and child, alone or in community with others, has physical and economic access at all times to adequate food or means for its procurement.*”²¹⁷ To better understand this definition, Comment 12 puts emphasis on the fact that the right to adequate food should be understood as: “*the availability of food in a quantity and quality sufficient to satisfy the dietary needs of individuals, free from adverse substances, and acceptable within a given culture (...) and the accessibility of such food in ways that are sustainable and that do not interfere with the enjoyment of other human rights.*”²¹⁸ Access to adequate food or means for its procurement were finally clearly recognized as a human right.

Given this understanding, an analysis of the wording of certain provisions of the Comment 12 is necessary to conceive how the disappearance of seeds can restrict the realization of the right to adequate food. The emphasis will be put on the adequacy term of the right to food,

²¹³ International Covenant on Economic, Social and Cultural Rights, 1966, particularly part VI, Article 11.
<https://www.ohchr.org/Documents/ProfessionalInterest/cescr.pdf>

²¹⁴ K. Heather Devine, “Vermont Food Access and the Right to Food: Using the Human Right to Food to Address Hunger in Vermont,” 41 Vt. L. Rev. 177 (2016). 178-179. Accessed March 19, 2019.
<http://lawreview.vermontlaw.edu/wp-content/uploads/2016/12/08-Devine.pdf>

²¹⁵ U.N. Econ. & Soc. Council, Substantive Issues Arising in the Implementation of the International Covenant on Economic, Social and Cultural Rights: General Comment 12, Note 5.

²¹⁶ Ibid, Note 2.

²¹⁷ Ibid, Note 6.

²¹⁸ Ibid, Note 8.

which includes dietary needs, free from adverse substances, and culturally acceptable, as well as the accessibility of the right to food.²¹⁹

B. The disappearance of Seeds: A Threat to the Right to Adequate Food?

The first fundamental element of the right to adequate food implies that the availability and accessibility of food should satisfy the *dietary needs* of the people. This notion refers to the diversity of diets that “*contain a mix of nutrients for physical and mental growth, development and maintenance, and physical activity that are in compliance with human physiological needs at all stages throughout the life cycle and according to gender and occupation.*”²²⁰ It seems necessary to remind at this point that out of 80,000 edible plants available for food production, only 150 are actually cultivated, and 12 of them feed 75 percent of the planet.²²¹ These figures demonstrate that food could be more diverse, but that the produced varieties are being considerably diminished, which implies that the consumption of food is also following the same path. The disappearance of traditional seeds is a considerable threat in this regard, as it leaves more space for monocultures which further homogenizes diets. Moreover, adequate dietary does not only imply sufficient quantitative food but more importantly qualitative food (i.e. nutritious food). As stated by Olivier De Schutter, former United Nations Special Rapporteur on the Right to Food, the focus should be on health and well-being rather than simply on higher levels of available calories.²²² Indeed, it is shown that the currently available food is increasingly poor nutrient food: lack in essential vitamins and micronutrients.²²³ To illustrate this last point, recent research showed that between 1960 and 2017, seventy fruits and vegetables lost 16 percent of

²¹⁹ Olivier De Schutter. "UN Special Rapporteur on the right to food." *Report on agroecology and the right to food* (2014). 3-12. Accessed on June 21, 2019.

https://foodsecurecanada.org/sites/foodsecurecanada.org/files/20120321_SRRTF_Aide-m%C3%A9moire_Canada.pdf

²²⁰ U.N. Econ. & Soc. Council, General Comment 12, Note 9.

²²¹ FAO, “*Building on Gender, Agrobiodiversity and Local Knowledge.*” See also: Silvia Ceriana, et.al. *Seeds According to Slow Food.* (Slow Food: Italy, 2014). October 2014. Accessed June 20, 2019.

<https://n4v5s9s7.stackpathcdn.com/sloueuropa/wp-content/uploads/ING-libretto-semi-b.pdf>

²²² Olivier De Schutter, “The Right to Adequate Nutrition.” *Development.* (2014). 57 (2), 152-153. Accessed June 20, 2019. doi:10.1057/dev.2014.64

²²³ Seth Cook, "We Need to Safeguard Biodiversity and Promote Diverse Diets," International Institute for Environment and Development (IIED). July 27, 2018. Accessed June 20, 2019. <https://www.iied.org/we-need-safeguard-biodiversity-promote-diverse-diets>.

calcium, 27 percent of vitamin C, and practically 50 percent of iron.²²⁴ This being said, the 5 fruits and vegetables a day campaign should be revised upwards to adjust to this disastrous situation. This further questions the likeness of meeting the diverse quantitative and qualitative dietary needs over time.

The second essential element of the right to adequate food concerns the *free from adverse substances* requirement. This insinuates that protective measures ought to prevent “contamination of foodstuffs through adulteration and/or through bad environmental hygiene or inappropriate handling at different stages throughout the food chain (...).”²²⁵ Although Comment 12 does not cite pesticide amongst its statement, the Voluntary Guidelines for the implementation of the right to food does mention it through its Guideline 9.3: “states are encouraged to adopt scientifically based food safety standards, including standards for additives, contaminants, residues of veterinary drugs and pesticides (...).”²²⁶ Pesticides have received considerable attention these last few years as its utilization has been in a state of growth in the production of food. An increasing number of studies attempt to analyze the harmful side-effects of such utilization on society and nature, but the implications are still not fully understood. Nevertheless, there is a growing recognition that pesticides can have disastrous consequences on human rights, in particular, the right to adequate food and the right to health.²²⁷ As reported by Hilal Elver, the UN’s Special Rapporteur on the right to food, the number of victims of pesticide poisonings is a serious concern, especially in the developing countries.²²⁸ To name a few, in India in 2013, 23 children died after consuming a meal that was full of “hazardous pesticide monocrotophos”; in China in 2014, 39 children died because of the consumption of food contaminated by dangerous pesticides; and in Bangladesh in 2015, 11 children lost their lives after eating fruits laced with pesticides.²²⁹ It is no surprise that pesticide residues are found everywhere, in the air, in the water, in the soil which affect the roots of plants

²²⁴ The investigation of Elise Lucet was based on Donald Davis research on the changes of the nutritional values of crops. See: Elise Lucet. “Cash Investigation: Multinationales Hold-up sur nos fruits et légumes.” Rutube Video, 59:05. Posted 18th of June 2019. <https://rutube.ru/video/ceba97e5d74152949fc86556085b3f5b>. See also: Claiborne Ray, “A Decline in the Nutritional Value of Crops.” The New York Times. September 12, 2015. Accessed July 12, 2019. <https://www.nytimes.com/2015/09/15/science/a-decline-in-the-nutritional-value-of-crops.html>.

²²⁵ U.N. Econ. & Soc. Council, General Comment 12, Note 10.

²²⁶ Food and Agriculture Organization of the United Nations. *Voluntary guidelines to support the progressive realization of the right to adequate food in the context of national food security*. FAO. (Rome: 2005). Guidelines 9.3. Accessed June 20, 2019. <http://www.fao.org/docrep/meeting/009/y9825e/y9825e00.HTM>.

²²⁷ Hilal Elver, “Report of the Special Rapporteur on the right to food,” Note 5.

²²⁸ Ibid, Note 10.

²²⁹ Ibid.

and therefore, the food too.²³⁰ Even though certain groups are more vulnerable to the exposure of pesticides: agricultural workers, communities living beside cultivated lands, indigenous people, pregnant women, and children, ultimately, it is a matter that affects everyone, as each citizen is a consumer.²³¹ The disappearance of traditional seeds seems to be a significant threat in this regard, as it reduces the chances of people to feed themselves with varieties that do not require the input of agrochemical products to be productive.²³²

The following indispensable element to consider, in order to fully respect the right to adequate food, is the “*cultural or consumer acceptability*” which implies “*to take into account, as far as possible, perceived non-nutrient based values attached to food and food consumption and informed consumer concerns regarding the nature of accessible food supplies.*”²³³ This point complements the two previous ones by justifying that food is not only about dietary and nutritional requirements but also, and mostly, about the cultural significance of food and eating habits.²³⁴ It is increasingly recognized that peoples’ food choices and preferences are not a hazard, but rather, the fruit of social connotations, cultural traditions, or even religious beliefs.²³⁵ To take a concrete example, in Hawaii, the taro plant is considered to be the core of the local culture, the dietary staple of native Hawaiians, and the incarnation of ancestors.²³⁶ Hawaiians have been cultivating this plant with farming traditions for more than thousands of years, and obtained approximately 300 different varieties that were selected according to the local conditions, needs, and tastes.²³⁷ Hawaiian children were even taught how to grow taro as part of their cultural education.²³⁸ Recently, researchers developed and introduced the genetically

²³⁰ Julie Ruiz, “Ces fruits et légumes les plus contaminés par les pesticides.” *Le Figaro*. Accessed June 21, 2019. <http://www.lefigaro.fr/conso/2018/02/20/20010-20180220ARTFIG00085-ces-fruits-et-legumes-les-plus-contamines-par-les-pesticides.php>

²³¹ United Nations General Assembly, “Report of the Special Rapporteur on the right to food,” Note 14-31.

²³² *Ibid.*, 10.

²³³ U.N. Econ. & Soc. Council, Substantive Issues Arising in the Implementation of the International Covenant on Economic, Social and Cultural Rights: General Comment 12, Note 10.

²³⁴ Anne Murcott, “The Cultural Significance of Food and Eating,” *Proceedings of the Nutrition Society* 41, no. 2 (1982): 203–10. Accessed on June 21, 2019. doi:10.1079/PNS19820031.

²³⁵ *Ibid.*

²³⁶ “Taro Culture and Genetic Engineering.” Hawai’i SEED. Accessed June 22, 2019.

<http://www.hawaiiseed.org/local-issues/taro/>. See also: Alexandra Coe, “Culture and religion,” *Socio-economic considerations in biotechnology regulation*. Natural Resource Management and Policy, vol 37. (Springer, New York, 2014). 247-258. https://doi.org/10.1007/978-1-4614-9440-9_17

²³⁷ *Ibid.*

²³⁸ Coe, “Culture and religion,” 250-251.

modified taro to overcome the high susceptibility of the plant to various pathogens.²³⁹ This could appear on the surface to be a good step to improve food productivity and therefore, the right to food. Instead, it created a big wave of protests and anger among the island. Locals claimed that this situation was highly affecting the taro market and the livelihood of farmers.²⁴⁰ But most importantly, they argued that taro is a sacred plant; when it is affected by a disease it is actually communicating something.²⁴¹ This example demonstrates how important the cultural values attached to food production and consumption are in parts of the world. It also shows that practices in a specific context can be incomprehensible from the outside. Some people do not want to see locally appropriate food be substituted by foreign food although it may be from the same variety. Therefore, the privatization of seeds is a considerable threat in this regard, as locals may see their traditional varieties progressively replaced by modern varieties. The more traditional seeds disappear, the less people will have chances to continue cultivating and finding food that is culturally appropriate. That being said, there is a noticeable risk to further treat food as a commodity rather than anything else.

Ultimately, let us not forget that the right to adequate food *“is realized when every man, woman, and children (...) has (...) access at all times to adequate food or means for its procurement”* and *“in no case may a people be deprived of its own means of subsistence.”*²⁴² The ‘means for its procurement’ or ‘means of subsistence’ are particularly relevant in the context of privatization of seeds as the right to adequate food does not only entail the access to adequate food but also the access to resources for food.²⁴³ As highlighted by Comment 12, *“feeding oneself directly from productive land or other natural resources (...)”* is one of the core contents of the right to adequate food, as the aim is to feed oneself rather than being fed.²⁴⁴ In other words, there is a lower need for State to act as a food provider if people are able to access food-producing resources. The loss of traditional seeds is also a significant threat to the sustainability

²³⁹ Ibid, 252.

²⁴⁰ "Taro Culture and Genetic Engineering." Hawai'i SEED.

²⁴¹ Coe, "Culture and religion," 254-255.

²⁴² U.N. Econ. & Soc. Council, Substantive Issues Arising in the Implementation of the International Covenant on Economic, Social and Cultural Rights: General Comment 12, Note 6. See also: International Covenant on Economic, Social and Cultural Rights, 1966, particularly part VI, Article 1.
<https://www.ohchr.org/Documents/ProfessionalInterest/cescr.pdf>

²⁴³ Ibid, Note 26.

²⁴⁴ Ibid, Note 12. See also: Hans Morten Haugen, "Food Sovereignty: an Appropriate Approach to Ensure the Right to Food?" 78 Nordic Journal of International Law (2009) 263-265. Accessed June 16, 2019.
<https://heinonline.org/HOL/Page?handle=hein.journals/nordic78&collection=journals&id=273&startid=&end=302>

dimension of the right to adequate food, as less diverse, free from substance, and culturally appropriate food may be available and accessible for the upcoming generations.²⁴⁵

To conclude this section, it is clear now that the right to adequate food goes far beyond the right not to starve.²⁴⁶ Whilst the international community has progressively been recognizing this human right, it has also been encouraging the industrialization of agriculture, the privatization of seeds, and strengthening intellectual property rights of plant varieties. It seems to Olivier de Schutter that the commercialization of seeds complicates the full realization of the right to adequate food of all people at all times, as people are increasingly being separated from their means of production.²⁴⁷ Moreover, since the disappearance of traditional seeds is a reality, how will society cope with respecting the key dimensions of the right to adequate food in both the present and the future?

²⁴⁵ U.N. Econ. & Soc. Council [ECOSOC], Comm. on Econ., Soc. & Cultural Rights. Substantive Issues Arising in the Implementation of the International Covenant on Economic, Social and Cultural Rights: General Comment 12, F/C.12/1999/5 (May 12, 1999). Note 7.

²⁴⁶ De Schutter, "The Right to Adequate Nutrition," 147-154.

²⁴⁷ De Schutter, "Seed policies and the right to food: enhancing agrobiodiversity and encouraging innovation," 4.

4

Chapter Four: Save the Seeds- Alternatives to the Disappearance of Traditional Seeds

“The most systematic and comprehensive organic and living alternative to existing hegemonies comes not from the ivory towers or the factories but from the fields.”

Rajeev Patel

It is now evident that traditional seeds are vital for both society and nature. They participate in the cultivation and preservation of biodiversity, which is necessary for the well-being of the ecosystems and human populations. They also enable farmers or any other person that wants to produce their own food to have access to means of production. Consumers benefit from their existence as traditional varieties are more nutritious and tasteful than the modern ones. The disappearance of seeds is a reality, and it does not only put in jeopardy nature and human rights but also, and most importantly, threatens global food security. Several initiatives have been put in place to fight against the total loss of crop genetic resources. In the first section of this chapter, I will analyze and criticize one of the most important international ex-situ conservation initiative seed banks, or genes banks, which is considered to be “*a place where seeds, cuttings or important genetic material from crops, both domesticated and wild, are stored, catalogued and preserved for future research.*”²⁴⁸ In the second section, based on the European Union’s legislation and interviews conducted, I will propose two other alternatives to complement the work done by gene banks: sowing, distributing, and consuming traditional varieties in order to save them.

²⁴⁸ Natasha Geiling, "From Lack Of Diversity To Lack Of Funding, Seed Banks Face a World Of Challenges," Smithsonian. June 17, 2016. Accessed June 26, 2019. <https://www.smithsonianmag.com/science-nature/lack-diversity-lack-funding-seed-banks-face-world-challenges-180959409/>.

I. Seed Conservation in Ex-Situ Gene Banks

Genetic erosion is not a new phenomenon. Indeed, it was already observed in the early 1940s, but regrettably, it took plant scientists more than 20 years to realize how serious the situation had become.²⁴⁹ Extremely concerned by this rapid loss of the genetic diversity of crops, the Consultative Group on International Agricultural Research (CGIAR) established in 1974 an international scientific-organization called the International Board for Plant Genetic Resources (IBPGR).²⁵⁰ The IBPGR aims at raising awareness about the necessity of conserving plant genetic resources for the present and future generations, as doing nothing could seriously jeopardize the future of sustainable crop production.²⁵¹ To achieve this, the IBPGR funded resource and development programs which, for example, training scientists and technicians worldwide to collect seeds and manage seed databases.²⁵² More importantly, the IBPGR has created a global network of seed banks, which enables the storage of a maximum amount of seed varieties that are in danger of becoming extinct, or that represent major social and economic importance.²⁵³ After being collected, these seeds are dried and frozen to enable long-term storage.²⁵⁴ These gene banks are one of the primary methods of ex situ conservation which is defined by Article 2 of the Convention on Biological Diversity (CBD), as “*the conservation of components of biological diversity outside their natural habitats.*”²⁵⁵ Although the CBD affirms that: “*the fundamental requirement for the conservation of biological diversity is the in-situ conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings*” it also declares that “*ex-situ measures,*

²⁴⁹ *International Board for Plant Genetic Resources*. CGIAR (Rome: 1988) 1-15. Accessed June 24, 2019. <https://cgspace.cgiar.org/bitstream/handle/10947/605/cg8805j.pdf?sequence=1>.

²⁵⁰ CTA. "IBPGR: International Board for Plant Genetic Resources." CGSpace. January 01, 1992. Accessed June 24, 2019. <https://cgspace.cgiar.org/handle/10568/45742>.

²⁵¹ *International Board for Plant Genetic Resources*, 1-15. See also: CTA. "IBPGR: International Board for Plant Genetic Resources."

²⁵² Ibid.

²⁵³ Miguel A. Altieri, and Laura Merrick, "In situ conservation of crop genetic resources through maintenance of traditional farming systems." *Economic Botany* 41.1 (1987): 7-8. <https://doi.org/10.1007/BF02859354> See also: *International Board for Plant Genetic Resources*.

²⁵⁴ Cameron Tyler, "International Conservation of Plant Genetic Resources." *ILSA J. Int'l L.* 11 (1987): 79-80. Accessed June 14, 2019.

https://heinonline.org/HOL/Page?handle=hein.journals/ilsa11&div=6&g_sent=1&casa_token=&collection=journals&t=1561396213

²⁵⁵ *Convention on Biological Diversity* ('CBD Treaty'), UN Doc DPI/130/7 (opened for signature 5 June 1992, adopted 29 December 1992). Preamble. <https://www.cbd.int/doc/legal/cbd-en.pdf>

preferably in the country of origin, also have an important role to play."²⁵⁶ To date, more than 1700 genebanks have been created and have gathered 7.4 million seed samples coming from 120 different countries.²⁵⁷ These figures clearly demonstrate the influence IBPGR has had over the years, which in turn, also shows how serious the threat is.

To name a few important seed banks, there is the International Maize and Wheat Improvement Centre (CIMMYT) in Mexico, the International Rice Research Institute (IRRI) in the Philippines, the International Potato Centre (IPC) in Peru and Ecuador, the International Centre for Agricultural Research in Dry Areas (ICARDA) in Syria, and finally, but most importantly, the Svalbard Global Seed Vault in Norway (Svalbard or Vault).²⁵⁸ The Vault also called "Noah's Ark of seeds" will be regularly referred to as it is considered to be one of the most important seed banks in the world. Contrary to the other seed banks, Svalbard is an international bank that stores varieties from all over the world.²⁵⁹ It currently holds more than 5000 plant species and has a capacity to safeguard 2.5 billion of seeds.²⁶⁰ Most importantly, it has been constructed to be disaster-proof: "*130 meters up the mountain in case of sea-level rise, earthquake resistant and with natural insulation of permafrost to ensure the contents were kept frozen for decades to come.*"²⁶¹ The expectations behind Svalbard are huge. As promised by the Crop Trust, the International organization behind the foundation of the Vault "*seeds at Svalbard would endure forever, a lifetime in an uncertain future.*"²⁶²

At first sight, gene banks, particularly Svalbard, seem to have developed a solid and effective way to collaborate and preserve seed diversity at a national and international level.

²⁵⁶ Ibid.

²⁵⁷ Food Authority Organization of the United Nations (FAO). *Genebank Standards for Plant Genetic Resources for Food and Agriculture*. Rev. ed. Rome: 2014. Accessed June 25, 2019. <http://www.fao.org/3/i3704e/i3704e.pdf>. See also: Tyler, "International Conservation of Plant Genetic Resources," 41.

²⁵⁸ Sommer Jenkins, "Genetic engineering and seed banks: impacts on global crop diversity." *Macquarie J. Int'l & Comp. Envtl. L.* 9 (2013): 67-77. Accessed June 05, 2019. https://heinonline.org/HOL/Page?handle=hein.journals/macqjice9&div=8&g_sent=1&casa_token=&collection=journals&t=1561454658

²⁵⁹ Simran Sethi, "Why Seed Banks Aren't the Only Answer to Food Security," *The Guardian*. November 26, 2015. Accessed June 25, 2019. <https://www.theguardian.com/sustainable-business/2015/nov/26/why-seed-banks-arent-the-only-answer-to-food-security>.

²⁶⁰ "The Seeds." Svalbard Global Seed Vault. June 14, 2019. Accessed June 25, 2019. <https://www.seedvault.no/about/the-seeds/>. See also: Ciara Ryan, "Seed Banks and Their Sprouting Need for Stricter Contracts," *California Western International Law Journal* 47, no. 1 (Fall 2016): 83-84. Accessed June 24, 2019. <https://scholarlycommons.law.cwsl.edu/cwilj/vol47/iss1/4/>.

²⁶¹ Suzanne Goldenberg, "The Doomsday Vault: The Seeds That Could save a Post-apocalyptic World," *The Guardian*. May 20, 2015. Accessed July 03, 2019. <https://www.theguardian.com/science/2015/may/20/the-doomsday-vault-seeds-save-post-apocalyptic-world>.

²⁶² Ibid.

Although this system has successfully stored the seeds of many important crops, it also generates several drawbacks that ought to be taken into account as they call into question the validity of the seed conservation in ex-situ gene banks.²⁶³

A. Problems associated with Seed Banks and Ex-situ Conservation

To begin with, one of the main acknowledged problems concerns the ex-situ conservation method itself. Advocates for biodiversity conservation, such as Pierre Rabhi, claim that seeds should not be stocked in refrigeration chambers but rather in-situ, which means in their ecosystems.²⁶⁴ They argue that as crops may be removed from their cultural and ecological context when placed in gene banks.²⁶⁵ Moreover, long-term storage does not allow the plants to adapt to the landscapes, new diseases, and pests, and environmental conditions.²⁶⁶ The real problem here is that the collected plants are generally only resistant to the diseases and pests that were existent before the storage process.²⁶⁷ In addition to this point, not all the seeds resist to the method of conservation as certain varieties die after a few weeks or months of storage.²⁶⁸ This is at least the case for many species from extremely high altitudes or from the tropics, such as exotic fruits and tropical plantations.²⁶⁹ These remarks seriously question the function of seed banks as first, they cannot stock all types of varieties, secondly, the ones that survive the storage process have no guarantee to be productive once released in nature, and finally, they may jeopardize the culturally appropriate requirement for the respect of the right to adequate food.

The next area of concern relates to the inadequate sampling of the reaped varieties as well as the insufficient representation of the existing genetic diversity.²⁷⁰ Indeed, a recent study conducted by the Crop Trust Organization and the Center for Tropical Agriculture (CIAT) showed that more than 70 percent of essential crop wild relative species, which are distant cousins of the most important crops such as potatoes or maize, is insufficiently represented in the

²⁶³ A. Altieri and Merrick, "In situ conservation of crop genetic resources through maintenance of traditional farming systems," 86-87.

²⁶⁴ Rabhi and Duquesne, *Les Semences: Un Patrimoine Vital En Voie De Disparition*, 46-47.

²⁶⁵ Ibid, 87-88.

²⁶⁶ Rabhi and Duquesne, *Les Semences: Un Patrimoine Vital En Voie De Disparition*, 46-47.

²⁶⁷ Tyler. "International Conservation of Plant Genetic Resources," 51-52.

²⁶⁸ Ibid.

²⁶⁹ Ibid.

²⁷⁰ A. Altieri and Merrick, "In situ conservation of crop genetic resources through maintenance of traditional farming systems," 86-87.

world's seed banks.²⁷¹ This high figure reflects that storage centers lack crucial pieces of biodiversity.²⁷² Although the most essential global and regional varieties have been saved and stored, the local minor ones have been generally neglected.²⁷³ It goes without saying that identifying local minor varieties is extremely challenging as some are situated in isolated areas and little is known about them. Nonetheless, gene banks cannot claim to tackle the loss of biodiversity, if they do not put sufficient emphasis on assembling traditional varieties of seeds, which are of prime importance for nature and society.

The following consideration touches upon the issue of internal and external threats. Although the number of gene banks has been increasing these last decades, it seems important to highlight that many of them lack proper funding and equipment to ensure the effectiveness of the projects.²⁷⁴ Those seed banks have perhaps successfully managed to acquire and stock a certain number of varieties, but the maintenance of the collection is not promised over time as it may be affected by a lack of proper funding or mismanagement. Moreover, sometimes a simple power outage, as occurred recently in Venezuela, can seriously jeopardize the functioning of the refrigeration chambers, and thus, destroy the seeds collected.²⁷⁵ Although the Vault may be a disaster-proof gene bank, it has also been vulnerable to such type of glitches. On the 16th of December 2015, Svalbard revealed that 2 degrees above the required -18C occurred because of a rusted electrical connection.²⁷⁶ That specific equipment could not be delivered until after Christmas, hopefully, the closest local supermarket's freezer had the same piece of equipment which enabled the Vault to function properly again.²⁷⁷ Whilst Svalbard is supposed to be protected from natural disasters or conflicts, most of the gene banks are not. For instance, in

²⁷¹ Crop Trust. "Crop Wild Relative's Gap Analysis." News release, March 21, 2016. Crop Trust. Accessed June 26, 2019. <https://www.croptrust.org/press-release/crop-wild-relatives-gap-analysis/>.

²⁷² Natasha Geiling, "From Lack Of Diversity To Lack Of Funding, Seed Banks Face a World Of Challenges." *Smithsonian*. June 17, 2016. Accessed June 26, 2019. <https://www.smithsonianmag.com/science-nature/lack-diversity-lack-funding-seed-banks-face-world-challenges-180959409/>.

²⁷³ Jenkins, "Genetic engineering and seed banks: impacts on global crop diversity," 72-73. https://heinonline.org/HOL/Page?handle=hein.journals/macqjice9&div=8&g_sent=1&casa_token=&collection=journals&t=1561454658

²⁷⁴ Geiling, "From Lack Of Diversity To Lack Of Funding, Seed Banks Face a World Of Challenges."

²⁷⁵ *Ibid.*

²⁷⁶ Goldenberg, "The Doomsday Vault: The Seeds That Could save a Post-apocalyptic World."

²⁷⁷ *Ibid.*

2002 the war in Afghanistan completely demolished the collection of seeds in Kabul.²⁷⁸ These type of potential threat create further uncertainty for plant genetic resources stored ex-situ. Therefore, it becomes clear that gene banks cannot guarantee absolute security to save biodiversity and global food security.

Lastly, but most importantly, there is a general concern about who has access to the seeds and who funds the seed banks. Whilst, the Vault has received widespread attention and considerable amounts of money, they actually do not give farmers direct access to seeds.²⁷⁹ Instead, farmers have to ask samples to the national gene bank that has donated the seeds in question.²⁸⁰ In other terms, it is extremely difficult to obtain the seeds placed in Svalbard. Although the privatization of seeds has already been a considerable threat in terms of access to essential natural resources, it seems that the most well-funded and equipped seed bank does not ease this access. As stated by Phil Pardey, an agricultural economist at the University of Minnesota: *“all they are doing is parking those seeds. At the end of the day, it is just one repository.”*²⁸¹ This criticism cannot be applied to all gene banks, as some, including the Ethiopian Institute of Biodiversity, work in direct collaboration with the local farmers.²⁸² As stated by Melaku Worede, the founder of the Institute: *“From a global perspective, the single focus of gene banks seems to be on collecting and preserving whatever samples they can find, and they call that conservation (...) we (...) believe in conservation through use, in keeping diversity alive as you use it.”*²⁸³ It is unfortunate, that these types of projects which truly attempt to preserve biodiversity and facilitate the access to seeds receive tremendously less attention from the international community. Moreover, when looking at the funds of the Crop Trust organization, which directly contributes to the Vault, it is surprising to see the largest agribusinesses like Bayer-Monsanto, DuPont-Pioneer, and Syngenta figure amongst the most

²⁷⁸ Ryan, "Seed Banks and Their Sprouting Need for Stricter Contracts." See also: Courtney Fullilove, "The Syrian Seed Bank That Keeps Going despite the War – Aeon Ideas." Aeon. December 22, 2016. Accessed June 26, 2019. <https://aeon.co/ideas/the-syrian-seed-bank-that-keeps-going-despite-the-war>.

²⁷⁹ Jenkins, Sommer. "Genetic engineering and seed banks: impacts on global crop diversity." *Macquarie J. Int'l & Comp. Envtl. L.* 9 (2013): 73-74.

²⁸⁰ Ibid.

²⁸¹ Goldenberg, "The Doomsday Vault: The Seeds That Could save a Post-apocalyptic World."

²⁸² Eric J. Wallace, "This seed bank preserves biodiversity by opening its doors to farmers." GRAIN. October 23, 2018. Accessed June 26, 2019. <https://www.grain.org/fr/article/entries/6047-cette-banque-de-semences-preserve-la-biodiversite-en-ouvrant-ses-portes-aux-agriculteurs>.

²⁸³ Ibid.

generous donors.²⁸⁴ This aspect further questions the purpose of seed banks, and the real intentions behind these donations. How can they support the combat against the disappearance of seeds whilst their activities highly contribute to the loss of biodiversity? Are gene banks a way for corporations to further control seeds and patent varieties collected from farmers? Ultimately, who benefits the most from the ex-situ conservation of seeds, populations or corporations?

Whilst these questions remain answered, what can certainly be inferred is that all hopes cannot be pinned on seed conservation in ex-situ gene banks. Although they have the potential to veritably prevent the definitive loss of the most important crop species, they also depend on numerous internal and external factors that can destroy all the varieties collected. As argued by in-situ conservation defenders “*diversity cannot be boxed up and saved in a single container no matter how secure it may be.*”²⁸⁵ Given these considerations, it seems that the issue of genetic erosion has simply been addressed by a high focus on conservation rather than on access. Emile Frison, a previous advisor of the Crop Trust organization, further affirms this position by claiming that “*the goal really was to maintain the material, watching it carefully to make sure it was identical over the years. It was almost like a religion.*”²⁸⁶ Moreover, a huge amount of traditional seeds are still not well enough represented in these seed banks. This being said, a new study conducted by Karl Zimmerer, a geography professor, and his colleagues from the Geographic Synthesis for Social-Ecological Sustainability, around 75 percent of global seed diversity is still held and widely used by small farmers.²⁸⁷ Ultimately, this shows that genetic seed diversity is still mainly conserved in-situ and that there is a tremendous willingness to keep these varieties in the hands of the people.²⁸⁸ For this reason, the conservation of seeds in gene banks should be associated with the cultivation of traditional seeds in-situ to have a larger impact. This system has the potential to allow producers and consumers to be at the heart of the action against the extinction of biodiversity.

²⁸⁴“Our Donors.” Crop Trust. Accessed June 26, 2019. <https://www.croptrust.org/about-us/donors/>.

²⁸⁵ Goldenberg, “The Domsday Vault: The Seeds That Could save a Post-apocalyptic World.” The Guardian.

²⁸⁶ Ibid.

²⁸⁷ Penn State, “World crop diversity survives in small farms from peri-urban to remote rural locations,” ScienceDaily. Accessed July 02, 2019. www.sciencedaily.com/releases/2015/02/150213164846.htm

²⁸⁸ Goldenberg, “The Domsday Vault: The Seeds That Could save a Post-apocalyptic World.”

II. Reintegrating Traditional Seeds in Our Daily Life

Waiting passively and relying on the conservation of plant genetic material in gene banks should not be considered as the only solution to combat the progressive loss of biodiversity. Time is precious, immediate and practical actions ought to be taken to save the varieties that still exist. Doing so is not an act of charity but rather a duty, a duty towards society and nature for the present and future generations. In seeking for efficient alternatives to the disappearance of traditional seeds, I have had the chance to interview two experts in the field; Jean-Luc Brault, a highly publicized French plant breeder, and Auriane Bertrand, the founder of the Seed Tour project who traveled around the world to interview plant breeders from diverse backgrounds.²⁸⁹ It was particularly interesting to hear about their experiences and opinions on how seeds can be concretely saved. Both interviewees emphasized the importance of sowing, distributing, and consuming traditional seeds to keep them safe. Given these considerations, the question of legality needs to be addressed to clarify what can be done to save these varieties. As legislations vary from one country to another and that all national legislation cannot be analyzed, this section will mainly focus on the European Union.

A. European Union Legislation Regarding Seeds

There is some positive news concerning the European Union (EU) and traditional seeds. After years of extensive negotiations, seemingly the longest of the EU's history, the Regulation (EU) No 2018/848 of the European Parliament and the Council of 30 May 2018 on organic production and labelling of organic products and repealing Council Regulation (EC) No 834/2007 was adopted in May 2018.²⁹⁰ In European law, according to article 288 of the Treaty on the Functioning of the European Union, regulations are legally binding on all member states

²⁸⁹ Interview with Jean-Luc Brault, Founder of Graines del País. Neufchâteau, Belgium. June 2019. And, Interview with Auriane Bertrand, Founder of Seed Tour. Neufchâteau, Belgium. June 2019.

²⁹⁰ Regulation (EU) No 2018/848 of the European Parliament and the Council of 30 May 2018 on organic production and labelling of organic products and repealing Council Regulation (EC) No 834/2007 (O) L 150/1 14/06/2018. p)1 See also: Blanche Magarinos Rey, "Le Nouveau Règlement Européen Sur La Production Biologique." Artemisia Lawyers - Cabinet D'avocats Au Service Des Droits De L'Homme Et De L'Environnement. Accessed July 02, 2019. <https://www.artemisia-lawyers.com/français/publications-et-interventions/nouveau-règlement-ab/>.

and are directly applicable.²⁹¹ This regulation contains a specific provision on seeds and biodiversity which raises several interesting and promising points. Before going into details about the regulation, it seems important to have a common understanding on the meaning of organic production, which is defined by the EU as “*an overall system of farm management and food production that combines best environmental and climate action practices, a high level of biodiversity, the preservation of natural resources, the application of high animal welfare standards and production standards in line with the demands of a growing number of consumers for products produced using natural substances and processes.*”²⁹² Organic production is becoming indispensable as it provides goods that respect the environment, ecosystems, and animal welfare, and that respond to the increasing demand of consumers for natural and safe products.²⁹³ It seems important here to clarify that the seeds used in organic productions does not necessarily mean traditional seeds. Unfortunately, most of the large organic productions are grown out of modern hybrid seeds.²⁹⁴ Indeed, the Commission’s Regulation (EC) n°889/2008 authorized the use of non organic seeds in the case where no organic seeds were available for plant varieties.²⁹⁵ However, these varieties of seeds are developed to be agrochemical tolerant which is useless for organic productions.²⁹⁶ This element seriously undermines consumers trust in organic products.²⁹⁷ Finally, in all cases, sustainable farming is gaining more and more popularity in the world, and the genetic diversity present in traditional seeds is therefore, also increasingly recognized as essential.²⁹⁸ Hence, a new regulation was necessary to address all these concerns regarding on organic production and labelling of organic products.

²⁹¹ European Union, *Consolidated version of the Treaty on the Functioning of the European Union*, 13 December 2007, 2008/C 115/01. Accessed July 02, 2019. <https://www.refworld.org/docid/4b17a07e2.html>

²⁹² Regulation (EU) No 889/2009 on organic production and labelling of organic products, (1).

²⁹³ Ibid.

²⁹⁴ Brault, Interview. See also: Frédéric Prat, "Semences Bio : Comment Renforcer Leur Disponibilité ?" InfOGM. August 19, 2014. Accessed July 04, 2019. <https://www.infogm.org/5679-Semences-biologiques-comment-renforcer-leur-disponibilite>. See also: Kristina Hubbard and Jared Zystro, "State of organic seed," *Port Townsend, WA: Organic Seed* (2016). 5. <http://stateoforganicseed.org/wp-content/uploads/2017/01/SOS-2016-report-FINAL-DIGITAL.pdf>

²⁹⁵ Regulation (EU) No 889/2009 on organic production and labelling of organic products, 29.

²⁹⁶ Prat, "Semences Bio : Comment Renforcer Leur Disponibilité ?"

²⁹⁷ Ibid. And see also: Sangam Dwivedi, Irwin Goldman, and Rodomiro Ortiz, "Pursuing the potential of heirloom cultivars to improve adaptation, nutritional and culinary features in a changing climate," (2019). Accessed on 08 June, 2019. <https://www.preprints.org/manuscript/201906.0022/v1>

²⁹⁸ Dwivedi, Goldman, and Ortiz, "Pursuing the potential of heirloom cultivars to improve adaptation, nutritional and culinary features in a changing climate," 18.

The key element of regulation No 2018/848 is article 5 which gives the possibility for farmers to: *“use plant reproductive material obtained from their own farm in order to foster genetic resources adapted to the special conditions of organic production.”*²⁹⁹ Given this declaration, it seems important to recall that this change is remarkable, as previously, farmers who had the intention to commercialize their seeds, could only sell or exchange the plant genetic resources that were included in the Common Seed Catalog.³⁰⁰ As stated previously, the catalog requires the respect of three criteria: distinctness, uniformity, and stability, however, due to their instability and heterogeneity, traditional seeds did not comply with them, and thus could not be sold or exchanged.³⁰¹ With this new regulation on organic products, farmers are authorized to produce, use, and commercialize their own seeds or productions grown out of these seeds even if they do not conform with the catalog requirements.³⁰² Article 13 declares: *“these plant reproductive material of organic heterogeneous material may be marketed without complying with the requirements for registration and the certification categories of pre-basic, basic and certified material, or the requirements for other categories.”*³⁰³ Farmers are simply requested to notify the utilization of their seeds beforehand in order to enter the market.³⁰⁴

The motivations behind this regulation concern the: *“(…)encouragement of the preservation of rare and/or native breeds in danger of extinction, contribution to the development of the offer of plant genetic material adapted to the specific needs and objectives of organic agriculture, contribution to a high level of biodiversity, notably by using diverse plant genetic material (...) suitable for organic production, foster the development of organic plant breeding activities in order to contribute to favourable economic perspectives of the organic production sector.”*³⁰⁵

It is clear that the EU acknowledges that the use of traditional seeds has the potential to be more appropriate for organic productions than the modern ones. First, because traditional seeds are reproducible which allows the farmers to collect their seeds and adapt them to their

²⁹⁹ Regulation (EU) No 2018/848 on organic production and labeling of organic products, Art.5 (i).

³⁰⁰ "Commercialisation Des Semences Et Plants." Réseau Semences Paysannes. Accessed July 03, 2019.

<https://www.semencespaysannes.org/semons-nos-droits/commercialisation-des-semences-et-plants.html>.

³⁰¹ "Plant Variety Catalogues, Databases & Information Systems." European Commission. October 17, 2018.

Accessed July 03, 2019.

https://ec.europa.eu/food/plant/plant_propagation_material/plant_variety_catalogues_databases_en.

³⁰² Rey, "Le Nouveau Règlement Européen Sur La Production Biologique."

³⁰³ Regulation (EU) No 2018/848 on organic production and labeling of organic products, Art.13 (1).

³⁰⁴ Ibid, Art.13 (2).

³⁰⁵ Ibid, Art.4

needs as well as the soil, environment and climatic conditions. With such fundamental characteristic, traditional seeds also have the potential to “*reduce the spread of diseases, improve resilience and increase biodiversity.*”³⁰⁶ Moreover, it allows farmers to reconnect to their plants and soils, and regain the knowledge of plant breeding lost during decades.³⁰⁷ Finally, consumers will benefit from this new regulation as they will have more access to organic products grown out of traditional seeds which are more tasteful and richer in nutrients.

To conclude, although this regulation is considered as a “*temporary experiment carried out for a term of seven years*” it has the potential to change the mentality and raise awareness about the importance of regaining seed autonomy.³⁰⁸ The use of traditional seeds should be allowed to all producers, organic or not, nonetheless, this new regulation is a considerable step forward to combat the disappearance of traditional seeds, and more generally, the loss of biodiversity. Finally, this regulation also has the potential power to convince producers to make the transition to organic production, and thus, produce in a way that is healthier for both consumers and nature. Traditional seeds can therefore, in the EU, be sowed and distributed on a large-scale or small-scale, for commercial or non commercial purposes.

1. Sowing and Distributing Traditional Seeds

Traditional seeds are not only destined to either vanish off the planet or simply be locked in cold storages of gene banks. Quite on the contrary, there are growing possibilities to save these varieties and reintroduce them in people’s daily life. But in order to achieve so, traditional crops ought to be sowed by as many people as possible.³⁰⁹ In any case, there is less choice as climate is becoming more erratic, and society needs a portfolio of diverse crops that are

³⁰⁶ Ibid, note 36.

³⁰⁷ Véronique Chable and Jean-François Berthelot, "La sélection participative en France: présentation des expériences en cours pour les agricultures biologiques et paysannes," *Le courrier de l'environnement de l'INRA* 30 (2006): 129-138.
https://www.researchgate.net/profile/Veronique_Chable/publication/228859679_La_selection_participative_en_France_Presentation_des_experiences_en_cours_pour_les_agricultures_biologiques_et_paysannes/links/00b7d535f5979a5778000000.pdf

³⁰⁸ Regulation (EU) No 2018/848 on organic production and labeling of organic products, note 39.

³⁰⁹ Brault, Interview. & Bertrand, Interview. See also: Dwivedi, Goldman, and Ortiz, "Pursuing the potential of heirloom cultivars to improve adaptation, nutritional and culinary features in a changing climate," 18.

adaptable to the evolving environments.³¹⁰ Rather than shrinking the world's crop genetic diversity, efforts should concentrate on enhancing them in order to ensure the present and the future's food security.³¹¹ This being said, FAO raises awareness about the fact that global hunger is on the rise, the number of undernourished people passed from 804 million in 2016 to approximately 821 million of people.³¹² As pointed out by La Via Campesina, small-scale farmers using traditional farming practices produce more food than industrial farming on the same surface of land.³¹³ If the know-how of traditional farming practices disappear as older farmers pass-away, the future generations will be at the mercy of multinationals.³¹⁴ All the more reason to multiply traditional seeds to make them more accessible and available for use. By doing so, populations are given alternatives to the ones proposed by multinationals, which enables them to truly take back control over food production and consumption.³¹⁵ Sowing and distributing traditional seeds therefore, is about sowing life and diversity necessary for the preservation of nature and the well-being of people.

Sowing seeds is the first required step to be able to reproduce, conserve, select, exchange, distribute, and consume seeds.³¹⁶ This collective effort is mushrooming everywhere, they are "*being reclaimed and brought back as a central part of life in communities.*"³¹⁷ To illustrate these important points, a few interesting initiatives are worth being mentioned.

a) *Le Potager Extraordinaire*

The 'Potager Extraordinaire' was established in the French region of Pays de la Loire in the 1990's to limit the loss of biodiversity. The aim of this garden is to sow a great amount of traditional varieties in order to safeguard these threatened species.³¹⁸ It currently has sowed 1500

³¹⁰ Dwivedi, Goldman, and Ortiz, "Pursuing the potential of heirloom cultivars to improve adaptation, nutritional and culinary features in a changing climate," 18.

³¹¹ Ibid.

³¹² FAO, IFAD, UNICEF, WFP and WHO. "The State of Food Security and Nutrition in the World 2018 Building climate resilience for food security and nutrition." (Rome: 2018). <http://www.fao.org/3/I9553EN/i9553en.pdf>

³¹³ La Via Campesina, *Our Seeds, Our Future*, 2-3.

³¹⁴ Ibid, 3-4.

³¹⁵ Bertrand, Interview.

³¹⁶ La Via Campesina, *Our Seeds, Our Future*, 3-4.

³¹⁷ Ibid, 2-3.

³¹⁸ "Découvrir les jardins remarquables du Potager Extraordinaire." Le Potager Extraordinaire. Accessed July 05, 2019. <https://potagerextraordinaire.com/>. See also: Auriane Bertrand, "Semons," Seed Tour. August 2018. Accessed July 05, 2019. <https://seedtour.org/semons/>.

different plants, and has 3000 varieties conserved in a ‘grainothèque’ which is basically a library for seeds.³¹⁹ The Potager Extraordinaire is open to the public, and attempts to sensitize its visitors about the richness and importance of plant genetic resources. It does so by organizing tasting sessions and by distributing its seeds to the public.³²⁰ It moreover, exchanges varieties with 60 other gardens.³²¹ The example of the Potager Extraordinaire illustrates that farmers are not the only ones that can contribute in ensuring the viability of traditional seeds. Botanical gardens also can play an important role in sowing these varieties in order to multiply and distribute them.

b) *Graines del Pais*

Jean-Luc Brault, the French plant breeder interviewed for this thesis, has also acted to develop alternatives to the disappearance of traditional seeds. He did so by creating a small seed company called Graines del Pais in 2005, in the south of France, in Bellegarde-du-Razès.³²² The purpose of Graines del Pais, is to create a collaborative system whereby farmers reproduce traditional seeds, and distribute them through the company.³²³ This allows seed producers to increase their capacity to sell their varieties, and permits other producers to find seeds they do not cultivate yet.³²⁴ Moreover, it enables any person wishing to cultivate their own food to find traditional varieties on the online platform of the company.³²⁵ Overall, Graines del Pais not only aims at encouraging the reproduction and distribution of traditional seeds, but also sharing skills and knowledge necessary to maintain biodiversity over time.³²⁶ This example demonstrates that companies promoting alternatives to the actual seed system, play an important role in supporting producers of traditional crops, and the diffusion of these species on a larger-scale.

³¹⁹ Ibid.

³²⁰ Ibid.

³²¹ Ibid.

³²² Brault, Interview.

³²³ "Qui Sommes-nous? Graines Del Pais." Graines Del País. Accessed July 09, 2019.

https://www.grainesdelpais.com/qui_sommes_nous_11.php.

³²⁴ Brault, Interview.

³²⁵ Ibid.

³²⁶ Ibid.

c) *Slow Food Ark of Taste*

Slow Food is a well-known international grassroots organization founded in the 1980's by Carlo Petrini and a group of activists to prevent the extinction of food heritage.³²⁷ Slow Food's main operative tool is the Slow Food Foundation for Biodiversity whose primary goal is to preserve the diversity of local crops and traditional crop management.³²⁸ Amidst its numerous initiatives to achieve so, the foundation has created the Ark of Taste and the Presidia projects which aim at protecting local, cultural, and traditional food by ensuring their long-term viability.³²⁹ Whilst the Ark of Taste identifies and catalogs plant and animal species as well as processed products such as cheeses and breads, Presidia creates a connection between these products and producers.³³⁰ Presidia highly contributes to the persistence of traditional seeds as it engages with the producers of endangered varieties to support the sustainability of their work by attributing them a 'Slow Food Presidia label', or attempts to find producers willing to sow and multiply traditional seeds to safeguard their existence.³³¹ This project has already succeeded in involving 13,000 producers for more than 500 products.³³² By doing so, Slow Food not only protects traditional seeds from disappearing but also preserves the know-how passed down through generations. This concrete illustration shows that developing partnerships between the products and the producers can significantly contribute to the conservation of biodiversity.

Ultimately, it becomes clear that the extinction of traditional seeds can be fought through different ways. Botanical gardens, seed companies, farmers, or even non-profit organizations can all participate at their level to the reappropriation of seeds by reintroducing these varieties in the daily lives of people. Nonetheless, identifying, sowing, and distributing the diversity of plant genetic resources is not enough to tackle the overall problem. It certainly makes traditional

³²⁷ "Slow Food." Slow Food International. Accessed July 06, 2019. <https://www.slowfood.com/about-us/>.

³²⁸ Cristiana Peano, Paola Migliorini, and Francesco Sottile, "A methodology for the sustainability assessment of agri-food systems: an application to the Slow Food Presidia project." *Ecology and Society*. 2014. 19(4): 24. 1-2. Accessed July 07, 2019. <http://dx.doi.org/10.5751/ES-06972-190424>

³²⁹ Serena Milano, Raffaella Ponzio, and Piero Sardo, *The Ark of Taste*. Slow Food, 2018. Accessed July 6, 2019. 3-4. https://a2e5c2y9.stackpathcdn.com/wp-content/uploads/2015/04/ING_libretto_arca.pdf.

³³⁰ Ibid.

³³¹ Peano, Migliorini, and Sottile, "A methodology for the sustainability assessment of agri-food systems: an application to the Slow Food Presidia project," 4-5.

³³² "Slow Food Presidia - What We Do." Slow Food Foundation. Accessed July 06, 2019. <https://www.fondazioneSlowFood.com/en/what-we-do/slow-food-presidia/>.

means of production more accessible and available to producers, but does not necessarily consumers. As well-said by Simran Sethi, a food writer, “farmers (...) can’t be expected to grow crops or raise livestock for which there is no market.”³³³ Consumers therefore, ought to be integrated in the combat against the loss of traditional seeds, as this global issue is not only affecting their daily diets but also threatening their right to adequate food.

2. Consuming Food Cultivated from Traditional Seeds

It is generally acknowledged that consumers have been far too long excluded in the pursuit of saving traditional seeds.³³⁴ Indeed, seed banks such as the Svalbard Global Seed Vault which has mainly been initiated by governments, companies, and foundations, as well as the recent adoption of the United Nations Declaration on the Rights of Peasants and Other People Working in Rural Areas, which has been largely driven by the peasant movement La Via Campesina, demonstrate that the focus has been put on producers and governments rather than on consumers.³³⁵ Although the success of these initiatives can positively affect food production and thus, food consumption, producers still strongly rely on consumers. This entails that food producers can only successfully reappropriate traditional seeds in their daily life, if consumers are demanding and consuming these varieties.³³⁶ Consumers therefore, have a tremendous capacity to influence the way food is cultivated, produced, and distributed, by shaping supply and creating a market primarily based on their needs and preferences.³³⁷ For this very reason, consumers should be considered as key actors in the battle for the reintegration of traditional seeds in the food system.

³³³ Simran Sethi, "Why Seed Banks Aren't the Only Answer to Food Security," *The Guardian*. (November 2015). Accessed June 25, 2019. <https://www.theguardian.com/sustainable-business/2015/nov/26/why-seed-banks-arent-the-only-answer-to-food-security>.

³³⁴ Sarada Krishnan, et al. *Resetting the table for people and plants: Botanic gardens and research organizations collaborate to address food and agricultural plant blindness*. Plants, People, Planet (2019). 2-4.

<https://doi.org/10.1002/ppp3.34> See also: Sethi, "Why Seed Banks Aren't the Only Answer to Food Security."

³³⁵ La Via Campesina, "United Nations: Third Committee Approves the UN Declaration on the Rights of Peasants and Other People Working in Rural Areas - Via Campesina." (November, 2018). Accessed July 07, 2019. <https://viacampesina.org/en/united-nations-third-committee-approves-the-un-declaration-on-the-rights-of-peasants-and-other-people-working-in-rural-areas/>.

³³⁶ Krishnan, *Resetting the table for people and plants: Botanic gardens and research organizations collaborate to address food and agricultural plant blindness*, 2-4. See also: Sethi, "Why Seed Banks Aren't the Only Answer to Food Security."

³³⁷ "Slow Food." Slow Food International. Accessed July 06, 2019. <https://www.slowfood.com/about-us/>.

Despite their power, consumers are as vulnerable to the current food system as producers. It seems consumers are as disconnected to the production of food as farmers are from traditional modes of production. Colin Khoury emphasises raising this global issue as he argues that the system decreases consumers' possibilities to have a direct contact with agriculture, which alarmingly prevents people from understanding, appreciating, and respecting the flora that feeds them on a daily basis.³³⁸ Although this may appear trivial, it impedes consumers from comprehending where food comes from and how it is produced. If consumers do not understand what they consume, or used to consume for centuries, they cannot acknowledge what has been lost or what to reclaim.³³⁹ Indeed, it is a vicious circle which is not inconsequential. Being disconnected from food production can affect the significance of food, the culturally appropriateness of food, and healthy nutritional and traditional habits, which are key elements of consumers' right to adequate food.³⁴⁰ This being said, FAO recently underlined the urgent need to *"manage food demand and change people's unhealthy and inadequate dietary preferences according to their socio-economic and cultural, as well as traditional, contexts and habits."*³⁴¹ Interestingly, Juan Carlos Garcia y Cebolla, one of FAO's managers, also mentioned that consumers have to be *"better aware of what having the right to adequate food means and what they can do to contribute to its realization."* Because of the disconnection between consumers and agriculture, multinationals gain unfettered power to influence consumers' food habits. As an antidote, consumers should be educated about traditional means of cultivation. In turn, consumers can secure the full realization of their right to food by creating a demand for more culturally appropriate and adequate food.

It is now evident that consumers need to be made aware of the benefits of food grown from traditional seeds, in order to be able to create a demand for these products to support producers, and guarantee the realization of the right to adequate food. On a similar note, Patrick Mac Leod, a researcher in sensory neurophysiology and the founder of the French Taste Institute, argues that consumers need to rediscover their five senses to be able to make purposeful choices

³³⁸ Krishnan, *Resetting the table for people and plants: Botanic gardens and research organizations collaborate to address food and agricultural plant blindness*, 2-4.

³³⁹ Sethi. "Why Seed Banks Aren't the Only Answer to Food Security."

³⁴⁰ Food and Agriculture Organization of the United Nations, "Engaging with Consumer Organizations for the Realization of the Right to Adequate Food," (FAO June 10, 2019). Accessed July 07, 2019. <http://www.fao.org/right-to-food/news/detail-events/en/c/1197769/>.

³⁴¹ Ibid.

in their food consumption.³⁴² He claims that standardized food is solely focusing on appearance and neglecting all the other senses, especially smell and taste.³⁴³ The hybrid varieties of tomatoes for instance, have been developed to create perfectly red, round, and resistant tomatoes.³⁴⁴ The diversity forms and colors used to be the norm, but unfortunately, the standardization of this fruit has increasingly compelled consumers to perceive it this way: perfect but tasteless.³⁴⁵ If consumers start realizing and accepting that the beauty of products does not equate to quality, perhaps they will begin to shift their attention on the true taste of food rather than simply being satisfied with their appearance. For that to happen, consumers need to be aware that there are less nutrients and flavors in products cultivated from modern varieties of seeds than in the ones grown from traditional seeds.³⁴⁶ They also need to rediscover the real flavor of food and be informed about the fact that there is a huge portfolio of food diversity outside grocery stores. Doing so may create a desire for food cultivated from traditional seeds.³⁴⁷ The Slow Food organization is doing considerable work in that regard as it organizes large food events such as tasting sessions, seminars, and workshops to experience the value and sensation of taste.³⁴⁸ By doing so, Slow Food brings together consumers and producers, and thus, reconnects consumers to food production and agriculture. This point has also been highly emphasized by Auriane Bertrand, which organizes collaborative learning opportunities between consumers and food producers in the île-de-France region.³⁴⁹ Colin Khoury also argues that by creating partnerships between botanical gardens and academic institutions, people will be able to reassociate to the plants that fed them everyday.³⁵⁰

³⁴² Patrick Mac Leod, "La Gourmandise. Délices D'un Pêché." Interview by Catherine N' Diaye. *Autrement, Coll. Mutations/Mangeurs* (1993) 1-2. Accessed July 07, 2019. http://www.cndp.fr/crdp-reims/polegout/formation/stage_reims_2005/macleod.pdf See also: Eric Collier, "La Reine Déchue Des Potagers," *Le Monde*. August 03, 2012. Accessed July 07, 2019. https://www.lemonde.fr/m-styles/article/2012/08/03/la-reine-dechue-des-potagers_1741422_4497319.html.

³⁴³ Collier, "La Reine Déchue Des Potagers."

³⁴⁴ Ibid.

³⁴⁵ Ibid.

³⁴⁶ Lucet, "Cash Investigation: Multinationales Hold-up sur nos fruits et légumes."

³⁴⁷ Dwivedi, Goldman, and Ortiz, "Pursuing the potential of heirloom cultivars to improve adaptation, nutritional and culinary features in a changing climate," 16.

³⁴⁸ Ariane Lotti, "The commoditization of products and taste: Slow Food and the conservation of agrobiodiversity," *Agriculture and Human Values* 27.1(2010): 72-73. Accessed July 07, 2019. <https://doi.org/10.1007/s10460-009-9213-x>

³⁴⁹ Bertrand, Interview.

³⁵⁰ Krishnan, *Resetting the table for people and plants: Botanic gardens and research organizations collaborate to address food and agricultural plant blindness*, 2-4.

Overall, there are multiple ways to inform and sensitize consumers about the benefits of food cultivated from traditional seeds that can empower them to make more informed decisions about their food consumption. Although it is important not to fall in idealistic expectations that all consumers' food habits will be revolutionized, it is also essential to recall that even a niche of people can create small changes and make a difference over time. The Slow Food movement proves this point as in less than three decades of existence the organization has developed its presence in 160 countries and has attracted 1 000 000 supporters, 100 000 members, and identified 4930 products in the Ark of Taste catalog.³⁵¹ Whilst this represents only a small portion of the population, it also demonstrates that people are increasingly caring about what they eat, how the food is produced, and the decisions that affect the current food system.³⁵² Finally, if consumers have managed to create a demand for organic products, why could they not complement this demand by requesting food that is cultivated out of traditional seeds?

Ultimately, whilst producers have an essential role in cultivating food from traditional seeds, consumers, have an indispensable role to play in reintegrating these varieties in the daily food production and consumption. Consuming these varieties highly strengthens the necessary steps to prevent traditional seeds from further vanishing off the planet. Informing consumers about the relevance of traditional seeds is necessary for the preservation of biodiversity and the work of food producers, as well as, for safeguarding access to tasteful, diverse, culturally appropriate, and adequate food for the present and future generations.

³⁵¹ "Slow Food." Slow Food International. Accessed July 06, 2019. <https://www.slowfood.com/about-us/>.

³⁵² Food and Agriculture Organization of the United Nations. *Consumers Concerns and External Drivers in Food Markets*. Rome, Italy: FAO (2015). Accessed on July 06, 2019. <http://www.fao.org/3/a-i4939e.pdf>

Conclusion

“A significant part of the pleasure of eating is in one’s accurate consciousness of the lives and the world from which food comes.”

Wendell Berry

This research began with the aim to further understand the disappearance of traditional seeds; the causes, the effects, and alternatives to this phenomenon. Through analysis and synthesis, answers have emerged.

The act of selecting, exchanging, conserving, and sowing traditional seeds reflects much more than simply growing edible plants. Seeds, like vessels, have carried the vision, knowledge, and farming practices of hundreds of communities worldwide for centuries. Throughout the millennia, seeds have adapted to environmental, social, and cultural interests and preferences of people. This common effort resulted in an extraordinary diversity of appearance, colors, smells, tastes, and nutritional food that continues to sustain the environment and society. For many, the local and cultural pride is rooted in these tiny seeds. Unfortunately, the symbolized act of producing and consuming food profoundly changed along with the commodification of seeds.

The intensification of agriculture and the privatization of seeds were turning points in the history of agriculture. Increasingly perceived as promising solutions to address hunger and empower food producers; traditional, diverse, and free seeds became widely replaced by monetized high-yielding varieties. Although these improved varieties were developed from traditional seeds, corporations claimed intellectual property rights. Patents and contract agreements emerged, and farmers were hindered from using, saving, and exchanging traditional varieties. More importantly, farmers’ dependency on industrial inputs rose as alternatives to sustainable traditional seeds reduced. Traditional and genetically diverse seeds gradually vanished off the planet and further trapped food producers in the seed provision system. The widespread use of improved varieties of seeds and agrochemicals continues to threaten ecosystems, damage the soil, the air, and the water. Biodiversity and farmers are not the only ones affected by the situation, consumers are impacted as well. The food supplied to consumers

is now mostly cultivated from improved varieties, which homogenized global diets and reduced the access to local, diverse, flavorful, and nutritious food.

Overall, these consequences hindered the realization of the right to adequate food. The right to adequate food is fully respected when all people have access to food that satisfies the dietary needs of individuals, is free from adverse substances, and is culturally appropriate. The industrialization of agriculture and the privatization of seeds has led to the widespread cultivation of monocultures. In turn, these monocultures limit the right to adequate food by reducing the range of food available and decreasing access to essential nutrients previously found in traditional varieties. Unfortunately, these two elements are not the only threats in regards to the right to adequate food. The increased utilization of agrochemicals in food production limits access to food that is free from adverse substances. If traditional seeds completely disappear from the planet, people will have no other alternative than producing seeds that require agrochemicals to grow. Ultimately, the right to adequate food is not only about the respect of dietary and nutritional requirements, but also, the cultural values attached to food production and consumption. The more traditional seeds disappear, the lower the likelihood that people will continue to cultivate and find culturally appropriate food.

With the rise of industrialized food and the loss of traditional seeds, society must explore ways to secure the key dimensions of the right to adequate food. In this regard, saving traditional seeds from further disappearing is a responsibility to ensure the well-being of the present and future generations. Numerous initiatives have been implemented to attain this global objective. Regrettably, tremendous attention has been put on collecting and conserving seeds in national and international gene banks, rather than on making these varieties more accessible to the public. Although this initiative has the potential to achieve positive results, all hopes cannot be pinned on the vulnerable conservation of biodiversity in gene banks. Instead, the attention ought to be shifted towards the reintegration of these varieties in people's daily lives. Doing so will enable society to take back control over food production and consumption. Botanical gardens, seed companies, farmers, and even non-profit organizations, all play an important role in reproducing and distributing the remaining traditional seeds. However, since producers strongly rely on consumers, consuming these varieties is also of prime importance. For consumers to create this demand, they ought to be informed and sensibilized about the relevance of food grown from traditional seeds. This can empower consumers to make more informed choices to

preserve biodiversity, contribute to the work of food producers, and safeguard the access to healthy, tasteful, diverse, and culturally significant food.

Ultimately, seeds are at the center of all life. They shape the present and future of the right to adequate food, and the health of humanity as a whole. By sowing sustainable seeds, producers and consumers will reap a harvest of hope for an endangered heritage.

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