



Food security and global security

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INTRODUCTION

FOOD SECURITY AND GLOBAL SECURITY

Santos Castro Fernández

■ INTRODUCTION

The Spanish Institute for Strategic Studies (IEEE), as part of its Strategic dossier, decided to conduct a preliminary analysis of what is undoubtedly one of the critical problems facing humanity. The institute wanted to examine food security within the framework of global security. This is due to both the importance of the debate surrounding food security and the role of food security in global security as the ultimate goal of the international community.

In his 2003 speech to the UN General Assembly, UN Secretary General, Kofi A. Annan, floated the idea of setting up a «High-level Panel on Threats, Challenges and Change» that would work on consensual analysis, ideas and project implementation with the goal of creating a «collective security system in the twenty-first century».

The report published by the group of experts adopts a «broad definition» of collective security, identifying six groups of threats, amongst which poverty and environmental degradation are prominent.

This is just one example of a shared conviction, in this case held by the world's top international organisation, that the twenty-first century faces severe security threats, amongst which hunger remains prevalent despite decades of efforts to tackle the problem, with the UN International Covenant on Economic, Social and Cultural Rights, requiring member states to respect and protect their citizens' right to food, still not being fulfilled despite its adoption in 1976.

The failure to meet this global commitment to eradicate hunger is not because of the enormity of the task, insufficient resources, inadequate scientific knowledge or technical materials. The great paradox is that we continue to live with a problem that is solvable, but one that we do not fix despite it representing one of the most pressing threats to collective security and global security.

As we see in this work, collective security, the security that we demand as human beings, cannot become a practical reality unless we achieve food security.

Collective security will always remain threatened whilst more than one billion people worldwide go hungry. It is no exaggeration to say that hunger is by far the most widespread pandemic that the world faces and one of the chief threats to humanity. However, this pandemic can be solved, as has been explicitly acknowledged for the last fifty years.

The studies making up this collective work take numerous approaches and offer discussions, assessments, proposals and multiple viewpoints on food security, or, to invert the expression, food «insecurity», and, to quote Jean

Ziegler, UN Special Rapporteur on the Right to Food from 2001 to 2008, the geopolitics of hunger.

The studies detail the extent of the pandemic. However, as a preliminary idea of the extent of the problem, our calculations show 17 million people worldwide die as a result of hunger and malnutrition every year, equivalent to 40,000 people each day or one person every two seconds.

As we will see, no committed and determined action to combat, significantly reduce and eradicate this pandemic has yet been forthcoming. Meanwhile, we have seen the international community, particularly developed countries, respond firmly and successfully to much less lethal, albeit contagious, pandemics such as bird flu, swine flu and more recently H1N1.

However, although hunger is not contagious, it is, in the words of the aforementioned Jean Ziegler, a «weapon of mass destruction» that could go off at any moment.

In a globalised and fully interdependent world a new aspect to hunger has emerged; whilst it has always been a terrible affliction for its victims, hunger now also poses an enormous threat to mankind. We can therefore say that without food security there cannot and will not be global peace and security.

The words of the former President of Brazil, Lula da Silva are fitting to end this brief introduction to the problem: «Hunger is in truth the worst of all weapons of mass destruction, reaping millions of victims each year. Combating hunger and poverty and promoting development are the only sustainable paths to global peace... There can be no peace without development, and no peace or development without social justice.»

These words are echoed in a statement from another world leader, who differed starkly with the Brazilian President on many other issues, President George W. Bush, who said: «This growing gap between rich and poor, between opportunity and misery, is as much a challenge to our compassion as it is a source of instability.»

Let us now briefly examine what commitments the international community has at least adopted and what action it has actually taken over the last few decades.

The United Nations agency specialising in this field, the Food and Agriculture Organization (FAO), held a very important summit at its Rome headquarters in the Autumn of 1996, from 13th to 17th November, attended by 186 countries and focusing exclusively on food security.

The «Rome Declaration» approved at the summit on the 13th November reaffirms, in its first paragraph, «the right of everyone to have access to safe and nutritious food consistent with the right to adequate food and the fundamental right of everyone to be free from hunger».

It also established that the world leaders, including 100 heads of state or government, would immediately aim to «reduce the number of undernourished people to half their present level no later than 2015».

Finally, the signatory countries stated that «poverty is a major cause of food insecurity and sustainable progress in poverty reduction is critical to improve access to food. Conflict, terrorism, corruption and environmental degradation also contribute significantly to food insecurity. Increased food production, including staple food, must be undertaken. This should happen within the framework of sustainable management of natural resources, elimination of unsustainable patterns of consumption and production, particularly in industrialized countries...».

A similar objective, and one more widely known amongst the general public, was decreed a few years later, as a core aspect of the First Millennium Goal.

In 2002, six years after the big Rome summit, the FAO assessed how much progress had been made towards achieving the objectives laid out. It found that, whilst some advances had been made, at the rate of progress seen up to 2002, the summit's targets would not be met in 2015 but instead in 2150, halfway through the twenty-second century.

That was the situation and future outlook as it stood in 2002. Over the last decade the global situation has only deteriorated at an alarming pace.

Some moderate progress was made up to 2007, but the setbacks caused by the 2008 global food crisis were of such magnitude that by October 2009, the number of people going hungry exceeded 1 billion, nearly 20% of the global population at the time.

Since then, there has been a slight reduction in this figure, but the root causes behind the crisis not only remain in place but in fact have worsened. These include the extreme volatility of food prices on international markets, the unpredictability of oil prices, the increased demand for meat products in emerging markets, the growing use of agricultural land for purposes other than food production and speculation or lack of regulatory mechanisms on global food markets.

In summary, prices will rise further and remain volatile over the next few years unless the structural causes of imbalances in the global agricultural system are

tackled. As the former Director-General of the FAO, Jacques Diouf, said last year of volatile agricultural prices, we only react to economic factors and fail to address structural problems, and thus merely perform crisis management.

According to many analysts, the food crisis, which has its own dynamics but has erupted alongside global economic and financial turmoil, is also a civic and moral crisis the root causes of which are not being addressed, with profoundly destabilising results. As has been the case at other key moments in the history of mankind, rather than there being a crisis in the system, we have a system in crisis that is wreaking social havoc and ultimately manifests itself in poverty and hunger.

One of the most damaging effects of the food crisis has been the doubling and sometimes even tripling of staple food prices on international markets. In Spain, just 17% of an individual's average salary is spent on food, whilst in developing countries this percentage often stands at over 70%. As has been said before, the multiplication of staple food prices hurts people in developed countries, but it kills in poor countries.

We close this brief overview of the last few decades with a statement that should serve to orientate readers as they go through the subsequent studies: the Millennium Goals to combat hunger are far from being achieved. In fact the number of people in the world going hungry, now standing at one billion, makes it impossible for the first goal to be met.

We have already described certain aspects of the problem and outlined some recent developments. We will now briefly examine the nature of and certain causal elements behind the problem, before finally concluding this introduction with a few proposals that would drive positive progress in the immediate future towards achieving the Millennium Goals.

Let us state «prima facie» that the problem of hunger is not a technical problem. It is not the result of a skills or scientific knowledge gap. The paradox of this great global pandemic is that hunger is not caused simply by a shortage of food, which is an assumption that many make without considering the numerous other facets of the problem.

As all the FAO's reports have clearly asserted, at present the planet that we inhabit has comfortably enough resources to feed the global population, even with constant population growth.

The food required does exist and is available on the international markets, but the distance between markets and the mouths of the hungry and malnourished is gaping and often insurmountable. Clearly the problem is not about producing food in sufficient quantities to feed the global population, but access to it. The

food exists but does not get to those who need it. In short, this is not a problem of technical capacity but of political will.

The understanding of the political nature of the problem is not as novel as it might appear. It was articulated nearly 50 years ago by President John F. Kennedy in a speech at the World Food Congress in the same year that he was assassinated, 1963.

He spoke bluntly: «We have the capacity to eliminate hunger from the face of the earth in our lifetime. We need only the will.»

Indeed, Mankind's resources and capabilities since then have not diminished but have, in fact, increased considerably. We now find ourselves in the current predicament because, just as in 1963, there is no political will amongst world leaders to bring an end to world hunger.

Based on the premise that food insecurity is political in nature, and having observed that little progress has been made in combating hunger over the last few decades, we will now examine some of the causal elements that will bring us closer to the core of the problem.

Firstly, if the cause of persisting hunger in the world is not a food production shortage but rather restrictions on food access, this access can be improved by enhancing local production, with family farming and women playing key roles.

Bear in mind that hunger and poverty go hand in hand. They are two sides of the same coin. All too frequently they are also related with armed conflict. Food access problems are caused by a scarcity of locally produced food and the lack of economic resources to buy products from areas that have surplus food.

The traditional means of combating hunger, via more or less ambitious food distribution and humanitarian aid programmes, have either brought food to the hungry or provided funds for them to buy food on international markets. The scope of these measures is highly restricted because they are planned and implemented as short-term emergency responses.

The only permanent, sustainable and efficient solution is to boost «in situ» production, as the majority of the world's hungry population, 70% of the total, live in rural areas. These agricultural communities need improvements to and support for their own agricultural and livestock production.

But unfortunately things have often moved in a different direction. In fact very little or no technical assistance has been provided to small-scale farmers, nor

has there been international research into improving the output of traditional agricultural systems, including genetic improvements of marginalised crops and local varieties that are adapted to these systems.

The FAO, in its November 2009 report entitled «The pathways to success», pointed out that the most efficient and cost-effective means of combating poverty and hunger in rural regions is to provide support to small-scale farmers, as nearly 85% of farms worldwide are under two hectares in size, whilst small-scale farmers and their families represent some 2 billion people.

Having established the strategy of increasing «in situ» production, the second thing to do is promote traditional farming as a means of guaranteeing the required «food sovereignty»: food sovereignty is at the heart of food security.

Otherwise, if traditional agricultural systems continue to be dismantled, dependence on international agricultural markets and prices will increase. The task therefore is to support traditional farming and thereby drive a considerable increase in output, whilst progressively adapting to the changing needs of the habitat and local society.

There can be no doubt that, amid the uncertainties and vulnerabilities triggered by climate change, the most efficient and intelligent manner of boosting and guaranteeing food security is to increase the diversity of the crop species used.

To mention just two successful examples of such policies, India and Vietnam have protected their traditional means of agriculture from international markets and have managed to substantially reduce agricultural poverty.

Thirdly, the importance of local marginalised crops must be emphasised in tackling the global food crisis and making significant headway in combating hunger.

According to the FAO's estimates, just 12 plant species and 5 animal species provide more than 70% of mankind's calorific food intake. And just 4 species of those plants (rice, corn, wheat and potatoes) and 3 animal species (cattle, pigs and chickens) provide more than half of that food.

This overwhelming dependence on just a few species in no way enables food security. As a result, the traditional crops that had provided staple foods to historic civilisations for thousands of years have now been marginalised, often for both economic and cultural reasons. But for poor people who inhabit rural areas, such marginalised foods remain the basis of their diet. We must not forget that these crops, often called «poor man's crops», have adapted over centuries to the agro-ecological conditions found in each populated region of the planet and form part of their local crops.

Such crops are not subject to the same price fluctuations and speculation as commercial crops, and there is real potential to drive up the productivity and quality of these crops with just a few technical and scientific improvements.

Fourthly, our proposals cannot be implemented unless agricultural investment is boosted and held at appropriate levels. According to figures from the World Bank, growth in the agricultural sector could reduce poverty twice as effectively as equal growth in the rest of the economic sectors. Not forgetting that agriculture remains the chief productive sector in the world's poorest countries and employs 65% of their labour force.

According to the FAO's forecasts, budgets allocated to agriculture in low income countries and countries with food deficits, now standing at around 5%, need to be increased to a minimum of 10%, whilst private domestic and foreign investment, now standing at around 140 billion dollars annually, needs to rise to 200 billion dollars.

Firm investment in agriculture in the wake of World War II helped an impoverished Europe to achieve full food sovereignty in just two decades. This model can and must be reproduced in those poor countries that need help to achieve secure and independent food production.

However, fifthly, one threat needs to be neutralised by curtailing the effects of international markets. Appropriate regulation is required in food markets to combat the mounting speculative attacks that agricultural prices have come under, particularly in the wake of the 2008 global food crisis.

A number of studies blame speculation for up to 50% of the price increase that has hit cereals and other staple foods on the international market since the food crisis. Speculation fuelled by the deregulation of agricultural future markets, amid economic and financial turmoil, allowed risk arbitrage instruments to be transformed into speculative financial products that provided attractive substitutes to other lower-yield investments.

Additionally, in order to reduce price volatility and combat speculation on the agricultural futures markets, the introduction of new transparency measures and regulations would allow governments to exercise control over staple food prices. Additionally, the stockpiling of food and agricultural produce could be ramped up, allowing this food to be released into the market when prices shoot up disproportionately.

We must acknowledge a very important truth.

This truth is at the heart of everything we have been discussing: agriculture, by its multifunctional nature, cannot be considered and treated as a mere

economic exercise; as just another industry amongst the myriad of sectors in a complex economy.

Agriculture, as well as producing food, supplying animal feed, providing fibres, biofuels, medicinal and ornamental plants, also has other essential functions of a social and environmental nature that guarantee stability. There is even a cultural side to agriculture, as well as other aspects that cannot easily be included in standard accounting practices and which are usually deemed mere «externalities» to the system.

The multifunctional nature of agriculture is one of the reasons why the «price» and «value» of agricultural products do not necessarily match up. This makes it difficult to assess the cost/benefit relationship of agricultural practices and the relative efficiency of different types of agriculture.

And we must make one final recommendation. It is an appeal for balance, for common sense and for a broad and comprehensive approach to the problem; there is no single solution or universal fix. On the contrary, intelligent solutions are required to different problems, each unique to their time and place in the world.

The circumstances and history of each country, with their own evolution, cultural singularities, social and community systems, soil and climatic conditions, demographics or modes of economic development, are all unique and different, and thus responses to their food and agricultural problems must also be distinct. Sometimes different kinds of agricultural systems are at work in the same country, each requiring a distinct approach.

The diversity of situations seen in so many countries, with vastly differing conditions, renders any attempt to impose a single mode of agriculture both unrealistic and irresponsible. Too often inflexible thinking has led to situations of ecological unsustainability and social degradation. The diversity of agricultural systems must be protected and increased as a means of generating positive value and to provide an important buffer at times of change.

A multitude of issues are raised when discussing the options and approaches to combating hunger and achieving food security as a means of supporting global security. Therefore, this first Strategy Notes report on the subject, covers just a few of the issues raised in the wider debate. Many other highly important factors will have to be left for discussion at another opportunity.

By way of a final conclusion, we would like to recap.

Eliminating hunger from the face of the Earth is a difficult task, but one that is within the reach of this generation if firm political will is in place.

The goal cannot be achieved if we employ mere temporary or partial solutions in a discontinuous and fragmentary manner. The structural causes of imbalances in the global food system must be addressed.

These imbalances have become accentuated over the last five years. The factors behind the 2008 global food crisis have not been eliminated and in fact have even worsened.

The current increase in global food prices is not a temporary or passing phenomenon. We cannot simply wait for things to return to a situation of normality by themselves, because in our fully interdependent world, based on a single and fundamentally unsustainable lifestyle and with all the problems caused by climate change yet to be tackled, there is no standard pattern for things to return to.

And because there is no standard to go back to, we must envision a new model. Unfortunately no consensus has yet been reached over what this new model will look like.

Such a consensus might well be reached at just such a difficult time as we are now experiencing. This is because crises stimulate new approaches and innovative responses to problems. They help us to share ideas and experience, and provide impetus to corrective measures.

The 2008 global food crisis did not simply trigger a one-off famine or make the Millennium Goals harder to achieve. It caused a sudden deterioration of a chronic problem that has remained unresolved for decades; a problem that condemns more than a billion people to hunger.

Hunger is a structural problem and therefore requires structural changes, all of which also need to be implemented at the international level and include governance of the food system.

Food security for everyone is possible as long as food is given the status of a global public good and food security is established as a central goal for both global governance and national development.

The world's hunger problem is not that too little food is produced, but that millions of people have no access to food.

If a solution to the problem is not found, the world's largest non-contagious pandemic will continue to grow. As a result, if we fail to achieve food security, world security and world peace will remain under threat.

Our globalised world requires an international treaty on food security, which must be negotiated within the framework of the United Nations via the recently overhauled Committee on World Food Security.

Spain should play a crucial role in this process, as a country that integrates a diversity of cultures and continents.

In order to promote consideration and in-depth analysis of these issues, we modestly submit this initial Strategy Notes report on «Food Security and Global Security».

This report is comprised of seven chapters that aim to cover the main facets of food security.

The first chapter, written by Dr. Susana Beltran and Dr. Julia Gifra, takes as a basis that food and water are, above all, human rights. States therefore are legally required to provide everybody, regardless of their nationality, with food that is sufficient, available and appropriate for their needs and circumstances, as well as access to clean drinking water. Hunger remains the main challenge that the international community faces and political commitments must be firmer and more coherent. The authors outline two strategic approaches for effective protection of the human right to food and water. One of these is to include human rights as an aspect of public policy-making and the other is to re-establish the status of water and food as a public good.

The second and third chapters are dedicated to two factors that play key roles in the fight against hunger: climate change and the role of women in food security. Agriculture is the most vulnerable sector when it comes to the direct and indirect effects of climate change, which has direct repercussions for the economies of countries and increases the risk of hunger and malnutrition. Agricultural and livestock production systems will need a radical overhaul in order to adapt to climate change and help offset the effects of climate change without compromising food security and nutrition, as well as to achieve sustainable development. This transformation will need funding. A financial gap currently exists that could be closed if the agricultural sector were deemed eligible for funds to combat climate change as well as development funds.

As for the role of women in the food sector, M^a del Mar Hidalgo discusses the difficulties that women encounter in terms of accessing certain resources, such as land and inputs, as well as funding systems and markets. If women had the same access as men do to such resources, their harvests could be improved by 20%-30%. Empowering rural women is therefore an essential part of combating hunger and poverty.

In the fourth chapter, Jose Esquinas warns of the effects of agricultural biodiversity (ABD) loss, which is occurring at break-neck speed. This loss poses socio-economic, ethical, political and strategic problems, endangering food security and national sovereignty, and threatening global peace and security. Negotiations for the International Treaty on Genetic Resources for Food and Agriculture (ITPGRFA), and its subsequent ratification by most countries, represented a significant step in the right direction, but, says the author, there is still a long road ahead. The recommendations given in the chapter include: placing agricultural biodiversity alongside hunger at the heart of the political agenda, increasing collaboration between international bodies and developing common programmes and strategies on agricultural biodiversity, accelerating the domestic implementation of the provisions of international agreements and instruments on agricultural biodiversity, and improving support for small-scale food producers in recognition of their work to develop and safeguard current and future biodiversity. With regard to Spain, Jose Esquinas' main recommendation is to develop a national strategy for the conservation and exploitation of agricultural biodiversity.

The fifth chapter takes a more in-depth look at the structural causes of the market volatility and global food crisis that occurred in 2008. According to Jose M^a Sumpsi, humanity faces a challenge of long-term food supply, not just in terms of food production but also its distribution. This problem can only be resolved using innovation and technology, increasing agricultural investment, designing and implementing appropriate agricultural policies and establishing a new system of global governance for agriculture and food. The author also proposes increasing food supplies by boosting production and agricultural productivity in order to reduce the volatility of agricultural markets.

The sixth chapter, written by Pablo Yuste, takes a two-pronged approach to the hunger-conflict pairing. On the one hand, armed conflict generates food insecurity by affecting food availability, access and use. Sometimes hunger is not only an indirect result of conflict but is itself used as a weapon of war. On the other hand, hunger may also be viewed as a cause of conflicts, a perspective that has been far less studied. The author concludes that a shift is needed in how we study the causes of conflicts that lead to hunger. Hunger should not only be viewed as one humanitarian aspect of armed conflict, but also as a cause of conflict. Therefore, security can successfully be improved by alleviating hunger.

The final chapter looks at the growth of biofuels and their impact on food security. The chapter, written by Jose M^a Medina, shows how such fuels are not only an alternative fuel that could comfortably replace fossil fuels, but also a significant factor behind the increase in food prices over the last five or six years, thus contributing towards the food crisis. Furthermore, biofuel

production does not usually general benefits for smallholder farmers. There must therefore be a re-evaluation of whether policies aimed at incentivising the use of such fuels are appropriate, or whether they might lead to situations of food insecurity.

Finally, this Strategy Dossier report aims to reaffirm that food security is a vital aspect of global security. The fight against hunger and poverty must be won if global peace and global security is to be achieved.

CHAPTER ONE

THE HUMAN RIGHT TO FOOD AND WATER

Julia Gifra and Susana Beltrán

ABSTRACT:

Eradicating hunger is still the biggest challenge of the international community. Hunger is a violation of the right to food, also in relation to the right to water. Any strategy or policy of eradicating hunger and fulfill the right to food and water should respect the fundamental normative content and addressing certain recommendations that emerge from the supervisory bodies of the UN. Food and water are primarily human rights.

KEY WORDS:

Hunger, right to food, right to water.

■ INTRODUCTION

Food and water are essential goods, a necessity for people's lives. There are not like any another commodity, although they are traded, subject to speculation and can be a source of income⁽¹⁾.

The right to food is widely recognised in different international treaties and a correct understanding of this and the main violation thereof - hunger - means taking into account its interdependence with the human right to water, since water shortage is one of the main causes for food shortages and malnutrition. The importance of the latter, despite there being questions surrounding the legal frameworks and obligations of countries, is not doubted as a guarantee for human life and, of course, a country's survival. Access to water is necessarily a part of the measures to fight hunger, so much so that one cannot guarantee the human right to food without also ensuring the human right to water.

Nonetheless, the regulatory progress consolidating not only the recognition of both rights but also their correct interpretation show a major contrast to actual practice. Scientific knowledge and economic resources currently available also contrast with reality since they would fully tackle the collective challenges surrounding both the food and water access issue.

Nevertheless, eradicating hunger continues to be the greatest challenge for the international community, much more important, although not stated, than overcoming the economic crisis, the financial crisis or the fight against terrorism. It is true that current challenges are linked to one another in a globalised and interdependent society, but figures on global hunger are more than clear. According to the most recent estimates released by the FAO, there were 852 million people suffering from hunger in 2008, two billion suffering malnutrition and around 6 million children who die every year through malnutrition and related diseases that could be avoided⁽²⁾. Most of these people live in Asia but it is sub-Saharan Africa that has the highest concentration between the number of victims and population; of these, most live in rural areas. The number of people suffering food insecurity currently sits at 1 billion.

Hunger is therefore one of the cruellest faces of poverty and, as stated by the former United Nations Special Rapporteur on the right to food, it is «asilent

⁽¹⁾ The terms global public goods are used to refer to food and water. See for example Ausin, T., «El derecho a comer: los alimentos como bien público global», *ARBOR Ciencia, Pensamiento y Cultura*, CLXXXVI, 745, September-October, 2010, pp. 1-12.

⁽²⁾ See, *The State of Food Insecurity in the World 2009: Economic Crises: Impacts and Lessons Learned*, FAO, Rome, 2009. There are no statistics for the last three years 2009, 2010 or 2011 since the FAO is reviewing its methodology for measuring hunger and undernourishment on request from the Committee on World Food Security (CFS).

tragedy [that] occurs daily in a world overflowing with riches»⁽³⁾. Its causes are not to be found in the lack of production capacity or in the higher global population. In fact, the FAO and subsequent United Nations Special Rapporteurs on the right to food have stated that agricultural production capacity is globally sufficient to meet current and future demand, and that the causes behind hunger are not due to the higher population⁽⁴⁾ but mainly to the chronic, long-term lack of access victims have to adequate food. Access that in recent years has been made especially difficult in the context of the food crisis due to volatile global food prices and speculation⁽⁵⁾. In this sense, hunger is not due to a lack of resources but to unfair distribution and the lack of real political will to tackle it.

The right to food and the fight against hunger are two sides of the same coin⁽⁶⁾ and currently comprise a legal obligation, legally binding for all countries that have signed the International Covenant on Economic, Social and Cultural Rights (hereinafter, ICESCR), including Spain and a further 159 countries to date⁽⁷⁾. In addition, many writers maintain that the right to food is not only a contractual obligation but also a general international right since there is an extended practice and an *opinio iuris* of countries that allows for its customary nature to be argued. In this sense, for example, the 1974 Declaration on the Eradication of Hunger and Malnutrition is a case in point of this conviction of countries. It stated, in the 1970s, that:

«Every man, woman and child has the inalienable right to be free from hunger and malnutrition in order to develop fully and maintain their physical and mental faculties. Society today already possesses sufficient resources, organizational ability and technology and hence the competence to achieve this objective. Accordingly, the eradication of hunger is a common objective of all the countries of the international community, especially of the developed countries and others in a position to help.»

A political dimension should also be added to this legal perspective, clearly including ethical and moral senses. Eradicating hunger is therefore also a

⁽³⁾ Report by the Special Rapporteur on the right to food, Mr. Jean Ziegler, E/CN.4/2001/53, p. 3.

⁽⁴⁾ Report by the Special Rapporteur on the right to food, Mr. Jean Ziegler, E/CN.4/2001/53, p. 3.

⁽⁵⁾ The FAO recognises this itself in its report on the state of food insecurity in the world from 2011, completely dedicated to food prices and their effects on world food security. See, *The State of Food Insecurity in the World 2011: How does international price volatility affect domestic economies and food security?*, FAO, Rome, 2011, pp.1-62. The briefing note by the Special Rapporteur on the right to food can also be consulted: «*Food Commodities Speculation and Food Price Crises*», 2010; as well as some doctrinal opinions, MARTÍN LÓPEZ, M.A. «El sometimiento de la especulación al derecho a la alimentación», *Revista Electrónica de Estudios Internacionales*, n° 22, 2011, pp. 1-23.

⁽⁶⁾ AÑON ROIG, M.J., «El derecho a no padecer hambre y el derecho a la alimentación adecuada, dos caras de una misma moneda», *Cursos de derechos humanos de Donostia-San Sebastian*, Vol. 3, 2002, pp. 285-318.

⁽⁷⁾ Ratification list as of 25th January 2012. This can be consulted on the website of the United Nations High Commissioner for Human Rights, Treaties Section.

political commitment and has been shown as such at different Global Summits on Food organised by the FAO. Here, countries have reaffirmed time and again their commitment to the right to food which has finally become a global objective.

In this way, the legal and political dimensions are both necessary and complementary when analysing an issue that still has a difficult outlook. Forecasts on the progress and achievements⁽⁸⁾ in reducing hunger show very unequal results since, whilst in general terms global hunger is said to have decreased since 1990, there are entire regions still suffering serious situations. In this sense, whilst progress in countries such as China is clear with up to 50% fewer people suffering starvation, in other countries not only has hunger not decreased but indeed the situation has got worse, mainly due to ongoing armed conflicts⁽⁹⁾. For example, according to the IFPRI⁽¹⁰⁾, countries such as Burundi, Chad or the D.R. of the Congo are in an alarming food emergency situation. In turn, United Nations annual assessment reports on the Millennium Development Goals state that in 2011 the share of people around the world suffering from hunger stood still at 16%; this despite lower poverty levels around the globe. This means that the general reduction in the number of poor people has not brought along with it a subsequent proportional decline in the number of starving people.

In this context, the outlook for eradicating hunger is negative and there is wide scepticism on achieving it. In fact, the recent food crisis has led to a superhuman effort in reduction and, as could only be the case, this has had a clear impact on moving forward with this target.

If we add the general international economic crisis to this context, the outlook is undoubtedly pessimistic. Indeed, the diagnosis in the second partial assessment in 2010 was as follows: «in around two-thirds of the time planned to achieve the Millennium Development Goals, a third of the goals have been achieved. It seems unlikely that in a third of the time, the outstanding two-thirds of the goals are achieved»⁽¹¹⁾. In turn, the UN annual assessment report for 2011 also recognises with regard to hunger that «it will be difficult to achieve the goal to reduce the amount of people suffering from hunger in many developing regions», and especially signals and points out sub-Saharan Africa.

⁽⁸⁾ Official MDG website, their progress and outlook at: <http://mdgs.un.org/unsd/mdg/Home.aspx>.

⁽⁹⁾ The report *Crop Prospects and Food Situation* published by the FAO in February 2009 identifies a total of 32 countries in a food crisis situation requiring external aid and the reason for the insecurity and hunger in 17 of these 32 countries is armed conflict.

⁽¹⁰⁾ International Food Policy Research Institute, *The Challenge of Hunger: Taming Price Spikes and Excessive Food Price Volatility* Global Hunger Index, Dublin, 2011, pp. 1-60.

⁽¹¹⁾ *Millennium Development Goals. 2010 Report, Conclusions*, UN.

In short, hunger continues to be one of the international community's most important challenges and is a violation of the right to food, also in relation to the right to water which will be looked at below.

This chapter firstly aims to define the right to food from a legal standpoint and its link to the human right to water, looking at the main international instruments with special focus on the International Covenant on Economic, Social and Cultural Rights. Secondly, some of the problem areas linked to eradicating hunger and protecting the right to food are looked at, placing special emphasis on Spain and its challenges and specificities. Finally, the article ends with a synopsis and outlook where key ideas and strategies for the future are laid out.

■ **NORMATIVE CONTENT OF THE RIGHT TO FOOD AND WATER**

■ **The Human Right to Food**

The right to food⁽¹²⁾ is set out in several international treaties and instruments, specifically in the area of human rights but also in international humanitarian law⁽¹³⁾.

At times, this recognition is made implicitly or indirectly as an integral part and prior condition to other human rights, such as the right to life or the right to an adequate standard of living⁽¹⁴⁾. In others, it is explicitly stated as in the Covenant on Economic, Social and Cultural Rights. Article 11 states:

⁽¹²⁾ For an analysis from different perspectives on the right to food, see AA.VV., *Seguridad Alimentaria y Políticas de Lucha contra el Hambre*, Chair of Studies on Hunger and Poverty, Servicio Publicaciones de la Universidad de Córdoba and Oficina de Cooperación Internacional al Desarrollo, Córdoba, 2006, pp. 1-332; and also AA.VV., *Derecho a la alimentación y Soberanía Alimentaria*, Chair of Studies on Hunger and Poverty, Servicio Publicaciones de la Universidad de Córdoba and Oficina de Cooperación Internacional al Desarrollo, Córdoba, 2008, pp. 1-450.

⁽¹³⁾ International Humanitarian Law (IHL) establishes a ban on making civilians suffer starvation as a war tactic in both international and domestic conflicts, as well as a ban on attacking, destroying or put out of action necessary goods for the survival of the civil population including crops, food and reserves of drinking water. See Additional Protocol I relating to the Protection of Victims of International Armed Conflicts, article 54 and Additional Protocol II relating to the Protection of Victims of Non-international Armed Conflicts, article 14. The protection of certain groups is also set out such as prisoners of war who have the right to daily food and water rations or pregnant women and children with their specific food needs, see III Geneva Convention relating to the Treatment of Prisoners of War, Art. 20, 23, 46, 89 and 127.

⁽¹⁴⁾ In this way, for example, according to article 25 of the Universal Declaration of Human Rights (1948), «everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food...». Or, according to article 27 of the Convention of the Rights of the Child, all children shall have the right «to a standard of living adequate for the child's physical, mental, spiritual, moral and social development».

1. The States Parties to the present Covenant recognize the right of everyone to an adequate standard of living for himself and his family, including adequate food, clothing and housing, and to the continuous improvement of living conditions. The States Parties will take appropriate steps to ensure the realization of this right, recognizing to this effect the essential importance of international co-operation based on free consent.

2. The States Parties to the present Covenant, recognizing the fundamental right of everyone to be free from hunger, shall take, individually and through international co-operation, the measures, including specific programmes, which are needed:

- a) To improve methods of production, conservation and distribution of food by making full use of technical and scientific knowledge, by disseminating knowledge of the principles of nutrition and by developing or reforming agrarian systems in such a way as to achieve the most efficient development and utilization of natural resources;*
- b) Taking into account the problems of both food-importing and food-exporting countries, to ensure an equitable distribution of world food supplies in relation to need.*

General Comment 12 on the right to food of 1999⁽¹⁵⁾ states that:

«it 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.»

The content on the right to food comprises several elements. Firstly, accessibility understood from a dual perspective: economic and physical. By *economic accessibility* it is understood that «personal or household financial costs associated with the acquisition of food for an adequate diet should be at a level such that the attainment and satisfaction of other basic needs are not threatened or compromised»⁽¹⁶⁾, in other words, that food prices should be reasonable and affordable and not place the enjoyment of other basic rights in jeopardy. By *physical accessibility* it is understood that «adequate food must be accessible to everyone, including physically vulnerable individuals, such as infants and young children, elderly people, the physically disabled, the terminally ill and persons with persistent medical problems, including the mentally ill»⁽¹⁷⁾.

Accessibility undoubtedly includes the existence of a second element, the prior availability of food, understood as «the possibilities either for feeding oneself directly from productive land or other natural resources, or for well functioning

⁽¹⁵⁾ General Comment No. 12 on the right to adequate food (Art. 11), Committee on Economic, Social and Cultural Rights, E/C.12/1999/5, 12th May 1999.

⁽¹⁶⁾ General Comment No. 12 on the right to adequate food (Art. 11), Committee on Economic, Social and Cultural Rights, E/C.12/1999/5, 12th May 1999.

⁽¹⁷⁾ *Ibid*, para.

distribution, processing and market systems that can move food from the site of production to where it is needed in accordance with demand»⁽¹⁸⁾.

A third element to the right to food is acceptability. This element comprises three aspects. Firstly, it means an individual should have the sufficient quality and quality of foods as per their circumstances and food needs, thus taking into account the age of the individuals throughout their life, their health, gender, occupation, etc. Secondly, acceptability comprises quality which alludes to the innocuousness of the foodstuffs, i.e. it should not be harmful but safe for human consumption. Lastly, acceptability comprises the cultural dimension to food since it should be appropriate for a specific culture. This means that it «implies the need also 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»⁽¹⁹⁾, values from a religious or cultural viewpoint.

■ The Human Right to Water

In turn, as has been stated, the correct interpretation of the right to food also requires its interdependence with other rights to be considered, specifically the human right to water⁽²⁰⁾. This right is not expressly regulated in international treaties although it is implicitly recognised.

The United Nations High Commissioner has rightly stated⁽²¹⁾ that the right to water prioritises water use for agriculture where necessary to prevent hunger, in line with General Comment 15 from the Committee on Economic, Social and Cultural Rights which states that, with regard to other uses, necessary water resources should be prioritised in order to avoid starvation.

Said Comment on the human right to water sets out that it is «The human right to water entitles everyone to sufficient, safe, acceptable, physically accessible and affordable water for personal and domestic uses»⁽²²⁾. This interpretation from 2002 is extremely important since the Committee believes that this right, despite not being explicitly recognised in the Covenant, is part of articles 11 and 12, i.e. of the right of everyone to enjoy an appropriate standard of living and right to health. In this sense, the Committee introduces the right to water in a wide-

⁽¹⁸⁾ *Ibid*, para.

⁽¹⁹⁾ General Comment No. 12 on the right to adequate food (Art. 11), Committee on Economic, Social and Cultural Rights, E/C.12/1999/5, 12th May 1999, para. 11.

⁽²⁰⁾ The right to water and the right to food are closely linked like all fundamental human rights, only that here the interdependence is evident and necessary. Any policy aimed at strengthening the right to food must conserve water and vice versa.

⁽²¹⁾ Fact Sheet No. 35, *The Right to Water*, Office of the United Nations High Commissioner, 2011, p. 13.

⁽²²⁾ *Substantive issues that arise in applying the International Covenant on Economic, Social and Cultural Rights- General Comment No. 15 (2002) «The Right to Water»*, E/C.12/2002/11, 20th January 2003.

reaching international treaty by both potential State Parties, which may be all, and by the content, and does so by interpreting the scope of articles 11 and 12.

The right to water is understood as drinking water and, in addition, the Committee states that it is necessary for the realisation of other rights such as that to food since water is required to produce food. Nonetheless, as stated, although access to water for personal and domestic uses is prioritised, the necessary water resources must also be prioritised so as to avoid starvation and disease. For this reason it is essential to guarantee sustainable access to water resources for agricultural purposes in order to exercise the right to adequate food, ensuring that all farmers, especially the poorest, may enjoy fair access to water and its management systems (points 6 and 7).

Beyond this conventional protection and interpretation on the right to water through the ICESCR, the inclusion of its analysis has been key in the area of protection mechanisms of the United Nations Human Rights Council. This, according to A. Salado, has meant this right «has started its course for regulatory recognition as a universal individual right»⁽²³⁾. There can be no doubt about this since the United Nations General Assembly finally recognised on 28th July 2010 «the right to safe and clean drinking water and sanitation as a human right that is essential for the full enjoyment of life and all human rights»⁽²⁴⁾. Furthermore, in our opinion, said recognition transforms an emerging human right into a consolidated right⁽²⁵⁾.

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The use of essential to describe all rights could also place it in a special category of regulations in international law known as *ius cogens* or peremptory norm where access to water would comprise a pre-requisite for any policy whose purpose was to eradicate hunger. The issue of prioritisation of water uses could be controversial from this stance of regulatory hierarchy: many farm and manufacturing businesses depend largely on water - who should have priority access? Furthermore, human consumption would have to be guaranteed a priori to protect life, following the thesis set out in General Comment 15 or in the Report from the United Nations High Commissioner in 2011, amongst others, where the right to water is understood as having to prioritise personal and domestic use as well as any action aimed at avoiding starvation. From this standpoint, water would first have to be allocated to agricultural uses ensuring nutrition for individuals⁽²⁶⁾.

⁽²³⁾ SALADO, A. «Derechos económicos, sociales y culturales. Derecho a un nivel de vida adecuado», *Los derechos humanos aquí y ahora, 60 años después de la Declaración Universal de los Derechos Humanos*, Ministry of Foreign Affairs and Cooperation, Madrid, 2008, p. 67.

⁽²⁴⁾ *The Human Right to Water and Sanitation*, A/RES/64/292, 3rd August 2010.

⁽²⁵⁾ For more details see the group work: Guarantee access to water for all and the Right to Water, *6th World Water Forum*, Marseilles, 12th-17th March de 2012, available at <http://www.worldwaterforum6.org/en/>.

⁽²⁶⁾ *The right to water...op. cit.* p. 13.

Another aspect to bear in mind in water prioritisation and uses is equity. The 2007 High Commissioner's Report states that access to water must be fair, i.e. in the same conditions and without any discrimination, having to prioritise the most disadvantaged groups⁽²⁷⁾ in line with the interpretation set out in General Comment 15. In turn, the voluntary guidelines supporting the progressive realisation of the right to adequate food approved by the FAO Council in 2004 elaborate on this in the same manner.

■ State Obligations

The legal nature of economic, social and cultural rights and their protection⁽²⁸⁾ has been questioned for decades on the basis of a relative and reprehensible distinction between civil and political rights and the doctrine of generations which has established their main differences⁽²⁹⁾. It is true that they exist and, from an historical and legal recognition standpoint, there are nuances, but it is no less true that all human rights are interdependent and indivisible and there is no hierarchy amongst them, as has been stated and consolidated in many resolutions and treaties adopted and ratified by countries from the international community⁽³⁰⁾.

In addition, the current debate on the enforceability of economic, social and cultural rights⁽³¹⁾ and the dichotomy between civil and political rights seems to have been overcome since the Protocol to the Covenant on Economic, Social and Cultural Rights of 2008 has been a major achievement for those who defend the legal value of these rights by allowing their enforceability via individual complaints.

• *Regarding the right to food*

in human rights theory, States are mainly those subject to obligations, as per international law with the ability to be bound via ratification of treaties. Their obligations linked to the right to food are respect, protection and compliance⁽³²⁾. The gradual and progressive nature is recognised as are certain

⁽²⁷⁾ *Report of the United Nations High Commissioner for Human Rights on the scope and content of the relevant human rights obligations related to equitable access to safe drinking water and sanitation under international human rights instruments*, A/HRC/6/3, 16th August 2007.

⁽²⁸⁾ CANÇADO TRINDADE, A.A., «La protección internacional de los derechos económicos, sociales y culturales», Serie: *Estudios de Derechos Humanos*, Vol. I, 1994, pp. 1-16.

⁽²⁹⁾ SAURA, J., «La exigibilidad jurídica de los derechos humanos: especial referencia a los derechos económicos, sociales y culturales (DESC)», *El tiempo de los derechos*, nº 2, 2011, pp. 1-16.

⁽³⁰⁾ Vienna Declaration and Programme of Action, A/CONF.157/23, 12th July 1993, The Millennium Declaration, A/RES/55/2, 13th September 2000; 2005 World Summit Outcome, A/RES/60/1, 24th October 2005.

⁽³¹⁾ See, ABRAMOVICH, V. & COURTIS, C., *Los derechos sociales como derechos exigibles*, Ed. Trotta, Madrid, 2002, pp. 1-254.

⁽³²⁾ On the content and international obligations of the human right to food, see Fact Sheet No. 34 *The Right to Adequate Food*, Office of the United Nations High Commissioner for Human Rights in collaboration with the FAO, June 2010, pp.1-59; MARTÍN LÓPEZ, M.A., «Reflexiones sobre

elements and dimensions of immediate effect. For the purposes of exposition and greater clarity, the general contents, progressive and immediate nature of the obligations arising from the right to food should be differentiated.

1. General obligations

The different United Nations treaty bodies have coherently interpreted that all human rights impose a series of general obligations regardless of their theoretical classification. Namely, these obligations are respect, protect and facilitation and are applied to different rights at different levels, seeking out a fair balance between more or less public intervention.

- a) *Respecting the right to food.* The obligation to respect means that States must not interfere in the enjoyment of the right to food or to limit it. In this way, they must not adopt any measure that comprises or results in impeding access to food, such as suspending programmes or legislation. The obligation to respect is practised in relation to the State's public institutions or bodies themselves.
- b) *Protecting the right to food.* The obligation to protect requires States to stop human rights abuses by third parties. This means that States must stop companies or individuals from depriving people of access to adequate food, ensuring, for example, that third parties do not contaminate water or land or that foodstuffs and their delivery to distribution sites comply with quality and guarantee requirements if they come from third party agents.
- c) *Facilitating the right to food.* The obligation to facilitate the right to food means that States must take steps to carry out and facilitate its enjoyment. This means that States must be proactive and adopt positive measures to facilitate the right to food and make it effective. Logic dictates that the right to food and the fight against hunger require specific public policies and State investments to guarantee people's access to necessary foodstuffs. The private sector also plays an essential role in this area which, as any other, has become part of market and business logic and, from a positive perspective, also replace in many instances or, better said, arrive where the authorities at times are unable to reach. Even though, as stated, it is the State's obligation to guarantee third parties do not impede access or make exercising this right difficult.

el contenido del derecho a la alimentación», in AA.VV., *Seguridad alimentaria y políticas de lucha contra el hambre: seminario internacional sobre seguridad alimentaria y lucha contra el hambre*, Chair of Studies on Hunger and Poverty, Servicio Publicaciones de la Universidad de Córdoba and Oficina de Cooperación Internacional al Desarrollo, Córdoba, 2006, pp. 131-138; VILLAN, C., «Obligaciones derivadas del derecho a la alimentación en el derecho internacional», in AA.VV., *Derecho a la alimentación y Soberanía Alimentaria*, Chair of Studies on Hunger and Poverty, Servicio Publicaciones de la Universidad de Córdoba and Oficina de Cooperación Internacional al Desarrollo, Córdoba, 2008, pp. 45-77, and by the same author, «Contenido y alcance del derecho a la alimentación en el derecho internacional» in *El derecho a la equidad: ética y mundialización*, Coord. by Terre des Hommes, 1997, pp. 197-228.

The measures to which these obligations refer have an immediate nature in some instances whilst, in others, they respect the principle of progressiveness.

2. Gradual and progressive obligations

In effect, the ICESCR sets out in article 2.1 the progressive realisation of the rights recognised so that States have a margin to act when making them effective to the maximum of their available resources. It expressly states in said article that

«Each State Party to the present Covenant undertakes to take steps, individually and through international assistance and co-operation, especially economic and technical, to the maximum of its available resources, with a view to achieving progressively the full realization of the rights recognized in the present Covenant by all appropriate means, including particularly the adoption of legislative measures».

Based on this provision, and in comparison with the Covenant on Civil and Political Rights which sets out immediate obligations of result, it is understood that the ICESCR fundamentally establishes performance obligations, i.e. the State parties to the treaty do not have to guarantee a specific result but must perform in a specific way until the progressive effective realisation of the rights is achieved.

In this sense, the principle of progressiveness is applied to the rights recognised in the ICESCR and based on this, the States shall carry out and assume their obligations gradually. In the face of doubts that an incorrect interpretation of this brings about, the Committee on Economic, Social and Cultural Rights rightly clarified, in its General Comment 3 of 1990 on the nature of the obligations of the State parties in the Covenant, that this should not lead to misunderstandings regarding the content and nature of the obligations⁽³³⁾.

⁽³³⁾ The comment states: «The concept of *progressive realization* constitutes a recognition of the fact that full realization of all economic, social and cultural rights will generally not be able to be achieved in a short period of time. In this sense the obligation differs significantly from that contained in article 2 of the International Covenant on Civil and Political Rights which embodies an immediate obligation to respect and ensure all of the relevant rights. Nevertheless, the fact that realization over time, or in other words progressively, is foreseen under the Covenant should not be misinterpreted as depriving the obligation of all meaningful content. It is on the one hand a necessary flexibility device, reflecting the realities of the real world and the difficulties involved for any country in ensuring full realization of economic, social and cultural rights. On the other hand, the phrase must be read in the light of the overall objective, indeed the *raison d'être*, of the Covenant which is to establish clear obligations for States parties in respect of the full realization of the rights in question. It thus imposes an obligation to move as expeditiously and effectively as possible towards that goal. Moreover, any deliberately retrogressive measures in that regard would require the most careful consideration and would need to be fully justified by reference to the totality of the rights provided for in the Covenant and in the context of the full use of the maximum available

It is recognised and permitted that States may have economic determinants, limited resources that may mean a delay in fully complying with the obligations relating to the right to food. However, this may not lead to excessive delay, nor mean that the States do not have to do anything until they have sufficient resources. On the contrary, the principle of progressiveness applied to the right to food means that States must demonstrate they are doing everything possible, available resources permitting, to achieve full realisation of this right to respect, protect and comply with it, especially guaranteeing an essential minimum level so that people do not suffer from starvation.

3. Immediate obligations

Gradual realisation should, therefore, be compatible with certain immediate obligations that the Committee has repeated and set out both in said General Comment 3 and Comment 12 on the right to food. In this way, the principle of progressiveness is limited by some obligations that do not allow the determinant «to the maximum of its available resources», namely:

- a) The obligation to «take steps» shortly after the entry into effect of the Covenant (article 2(1))⁽³⁴⁾. Thus, it is a question of ensuring that the time intended to guarantee the right to food is reasonable and that steps intended for the full realisation of the right are taken in the process. Some examples are analysing and assessing hunger in a country based on reliable data and statistics; passing laws or programmes.
- b) The obligation to guarantee the exercise of the protected rights «without discrimination»⁽³⁵⁾, this being understood as a distinction, exclusion or restriction made based on different reasons that may be racial, linguistic, age-related or any other type that may aim to make equal exercise of the right to food and access to it difficult.
- c) The «immediate» applicability of certain provisions by legal bodies and others in internal legal regulations (articles 3, 7(a) (i); 8, 10(3), 13 (2) (a), (3) and (4); and 15(3))⁽³⁶⁾.
- d) The general obligation to constantly seek the realisation of the rights established without delay⁽³⁷⁾, i.e. the States should not allow the guaranteed or existing level of the right to food to be subject to regressive measures, unless there are reasons to justify this in each specific context.
- e) «Minimum obligations» in relation to all rights established and, in the event of non-compliance, the obligation to prove that «the maximum of its available resources» (at domestic level as well as via international co-operation and assistance) was used or so attempted for the realisation of

resources», in General Comment 3 on the nature of States parties obligations (Article 11[2]) of the International Covenant on Economic, Social and Cultural Rights, 1990, para. 9.

⁽³⁴⁾ General Comment 3, *Op.Cit.* para. 2 and 3.

⁽³⁵⁾ *Ibid.*, para. 1.

⁽³⁶⁾ *Ibid.*, para. 5.

⁽³⁷⁾ General Comment 3, *Op.Cit.* para. 9.

the rights established (articles 11, 15, 22 and 23 of the Covenant)⁽³⁸⁾. This ensures that all rights have their protection with an essential, minimum level and there are no major inequalities in progressing in all of them. These basic minimum obligations mean in the area of the right to food guaranteeing at least what is basic and essential to protect the populace from starvation. Specifically, General Comment 12 explains in this sense that the Covenant is violated when a State fails to guarantee a minimum level that protects against hunger⁽³⁹⁾.

- f) The gradual nature of the social rights linked to the economic resources of the States means meeting these rights is vulnerable during global economic crises like the one we have been experiencing since 2008. In this context of economic cuts and recession, the obligation to protect the most vulnerable members and sectors of society exists through specific programmes (General Comment 3 of 1990)⁽⁴⁰⁾.

Both General Comment 3 and 12 distinguish, by setting out which actions or omissions constitute a violation of the rights recognised in the ICESCR, between a State's inability and a lack of will; in this way, States are called upon to show that they have used all available resources, including asking for international help.

- *Regarding the Human Right to Water*

As with the right to food, the same outline of obligations is followed in the area of the human right to water and the same logic and interpretation applies for the principle of progressiveness and progressive and immediate obligations. Bearing in mind the considerations set out in the paragraph above, there are some specificities which seem appropriate for the human right to water.

Specifically, and in the area of international obligations, the Committee on Economic, Social and Cultural Rights's statement for States to cooperate is natural, either by ceasing to use measures impeding another State to be able to guarantee the right to water or avoiding practices being performed in their territory that place others' access to water resources in danger. This is a very basic collaboration method based on the principle of not harming the natural resources of other countries through our own actions. As General Comment 15 sets out, this general environment principle links with the statements in the Convention on the Law of the Non-navigational Uses of International Watercourses of 1997. Although not having come into effect, it sets out fundamental obligations for the protection of shared water resources which must naturally be compatible with the right to water; for example, the obligation to not cause sensitive damage, to cooperate or to use shared water equitably

⁽³⁸⁾ *Ibid*, para. 9 and 13.

⁽³⁹⁾ General Comment 12, Op.Cit., para. 17.

⁽⁴⁰⁾ *Ibid*, para. 12.

and reasonably so that the populations depending on the watercourse in each State are taken into account.

In turn, General Comment 15 sets out that water «should never be used as an instrument of political and economic pressure». This ban has certain effects on the international stage. The draft articles on international responsibility establish that counter-measures are not allowed (which are defined as pressure steps aimed at the offender State assuming the commitments it has ceased fulfilling) affecting obligations established for the protection of fundamental human rights or other standards arising from mandatory regulations. Therefore, it is compatible with the establishment of responsibility so that a counter-measure comprising the diversion of a watercourse shared amongst several countries that led to a population on any of the river banks not having a water supply would be a measure in contravention of international law, both from the standpoint of the human right to water and that of international responsibility.

Finally, in relation to the right to food, General Comment 15 states in a separate section what it considers to be the minimum content for the right to water with which States must comply and, furthermore, do so immediately. Specifically, they must guarantee access to the minimum amount of water required for the population's personal and domestic use and to prevent disease; ensure that drinking water is received by all, especially the most vulnerable groups; that distribution is carried out equitably, meaning States must pass national plans guaranteeing it; supervise compliance with this right and approve preventive measures to control diseases via adequate sanitation systems. Specifically, Spain as a Party to the ICESCR must therefore comply with these obligations.

Having looked at the legal system of the human right to food and water, it is advisable to now look into some of the current challenges on a global level and in Spain regarding compliance and respect.

■ CHALLENGES SURROUNDING THE HUMAN RIGHT TO FOOD AND WATER

■ From the International Community Perspective

- *Eradicating Hunger*

As stated in the introduction, the most important challenge regarding food is reducing hunger around the world since not only are figures alarming (around 1 billion people) but they discouragingly show the paradox of how such a widely established and recognised right by States is so widely violated. This contrast between the legal framework and reality shows that the realisation of the right

to food and the right to water requires additional pushes and real efforts by all States. It is in this context where the international community needs to set down initiatives to eradicate hunger such as the Millennium Development Goals (MDG) and the reduction target for 2015.

Indeed, the *Declaration* and the *Action Plan* adopted at the World Summit in 2006 set out for the first time the political target of cutting malnutrition around the globe in half. The challenge was then included in the MDGs which, as we know, arise from the Millennium Declaration approved at the World Summit General Assembly in the year 2000. Said resolution, on the one hand, reaffirmed the values and principles contained in the Charter of the United Nations and, on the other, set out an arrangement of all the agreements established at the many global summits organised by the United Nations and specifically focused on social development.

Specifically, 8 goals were set, all linked and broken down into 18 targets and 48 technical indicators, attainable in the maximum term running to 2015: 1) eradicating extreme poverty and hunger; 2) achieve universal primary education; 3) promote gender equality and empower women; 4) reduce child mortality; 5) improve maternal health; 6) combat HIV/AIDS, malaria and other diseases; 7) ensure environmental sustainability; 8) develop a global partnership for development⁽⁴¹⁾. The eradication of poverty is specifically broken down into two targets, the second of which is particularly interesting as it states the eradication of hunger as a global political goal: halve the proportion of people who suffer from hunger.

The contents of this goal take 1990 as the reference year and 2015 as the time target. As the Declaration states, it comprises halving the percentage of those suffering from hunger. It should be highlighted that this quantitative target is less ambitious than that set out at the World Food Summit in Rome in 1996 since it aims to half the percentage of those suffering from hunger and not, as was the case in Rome, the total number of people. In figures, the Rome Summit commitment meant a reduction to 412 million people. However, in figures MDG 1 means a reduction to 585 million.

⁽⁴¹⁾ The importance thereof resides in that for the first time they represent an effort for universal political commitment as well as a rationalisation of the challenges and goals set out at the summits held over recent decades. Even so, there are many criticisms from them being simple instruments perpetuating the neoliberal system, with its international institutions, to them taking unrealisable figures as a premise, amongst others detailed by Professor Pérez de Armiño in an interesting article on the issue. See, PEREZ DE ARMIÑO, «Los Objetivos de Desarrollo del Milenio. Una visión crítica de sus implicaciones para la lucha contra el hambre y para el derecho a la alimentación» in AA.VV., *Derecho a la alimentación y Soberanía Alimentaria*, Chair of Studies on Hunger and Poverty, Servicio Publicaciones de la Universidad de Córdoba and Oficina de Cooperación Internacional al Desarrollo, Córdoba, pp. 163-199.

- *The special rapporteur agenda for the right to food*

With this being the main challenge and priority for States, the United Nations protection system has also pointed out other problem areas linked to eradicating hunger. Specifically, Human Rights Council special rapporteurs⁽⁴²⁾ - also known as special procedures and defined as a heterogeneous set of independent experts, rapporteurs, working groups or special representatives⁽⁴³⁾ - have carried out an essential task when examining and publically informing on other situations and challenges linked to the right to food and water.

The mandate on the right to food dates to the year 2000 in the framework of the former Human Rights Commission which named a first special rapporteur, initially for three years and subsequently renewed until present⁽⁴⁴⁾. The first special rapporteur reports covered, as is logical, introductory issues relating to the content of the right to food, its history and regulatory protection⁽⁴⁵⁾, as well as other issues such as the justiciability and enforceability of the right to food and its progressiveness, recognising at the time in 2002 its problems and deficiencies as, at the time, the Committee on Economic, Social and Cultural Rights had no chance of receiving or responding to individual complaints⁽⁴⁶⁾. A vacuum, however, that the rapporteur replaced via the creation of a complaints mechanism for the right to food where they could be sent and which still exists today⁽⁴⁷⁾.

After these three initial reports centring on the nature and concept of the right to food, Professor Ziegler looked more deeply into different pending topics and issues. Indeed, the rapporteur had identified in the second report some specific areas that affected and affect, either directly or with a clear impact

⁽⁴²⁾ There are many guarantee mechanisms in the universal human rights protection system that can be systematised according to whether they are conventional (set out in the main international conventions and overseen by treaty bodies) or non-conventional mechanisms in the sense that they are not set out in any treaty but arise from international practice carried out by bodies created by virtue of the Charter of the United Nations. These especially include those established at the heart of the Human Rights Council which replaced, in 2006, the former Commission.

⁽⁴³⁾ GIFRA, J., «La reforma de los procedimientos especiales del Consejo de Derechos Humanos: ¿una mejora de los mecanismos extra convencionales?», *Anuario de Derechos Humanos Nueva Época*, Vol. 10, 2009, pp. 223-261.

⁽⁴⁴⁾ The first rapporteur was Professor Jean Ziegler who held the post from 2000 to 2008. The updated Human Rights Council, via resolution 6/2 of 27th September 2007, updated the initial mandate and named a new rapporteur, Olivier de Schutter, who currently holds the post.

⁽⁴⁵⁾ Report by the Special Rapporteur on the right to food, Mr. Jean Ziegler, A/56/210, 23rd July 2001 and E/CN.4/2001/53, 7th February 2001.

⁽⁴⁶⁾ The creation of the Working Group for the production of an Optional Protocol to the ICESCR occurred in 2003.

⁽⁴⁷⁾ Report by the Special Rapporteur on the right to food, Mr. Jean Ziegler, E/CN.4/2002/58, 10th January 2002.

on the right to food⁽⁴⁸⁾ and which were covered more widely in subsequent reports. For example, access to land and credit. Based on the reality that hunger is mainly a problem in rural areas and that these are mostly home to populations with no access to land, whether through corruption or because there is no ordered census system for property ownership, farming permits or because there is a high concentration of farmland ownership not in the hands of those who work the land. The rapporteur put forward the need to tackle a fair transparent agrarian reform process that was redistributive and guaranteed land access as one of the main elements to eradicate hunger around the world. Several reports were dedicated to this, specifically that of 2002 which, in short, defined land access and agrarian reform as essential elements to the right to food and suggested paying more attention to the concept of food sovereignty and the demands of small-scale farmers without land, based on the reforms already promoted and carried out in several countries that had effectively led to improving the situation of many people⁽⁴⁹⁾.

Many other topics should be added to this issue, including gender and food or the role of multinational corporations⁽⁵⁰⁾, the relationship between the right to food and the right to water⁽⁵¹⁾, the fish trade and fishing industry⁽⁵²⁾, food security and sovereignty⁽⁵³⁾, States' extraterritorial responsibilities⁽⁵⁴⁾, the right of indigenous communities to food and the responsibility of international organisations regarding the right to food⁽⁵⁵⁾. With regard to the latter, the former rapporteur set out, at the time, an open complaint against the economic development models promoted by the World Bank, the International Monetary Fund and the World Trade Organisation as he saw them as placing the right to food of small-scale farmers at risk.

Another highlight on the long list of topics assessed by the former rapporteur is the impact of globalisation on the right to food⁽⁵⁶⁾, children's right to

⁽⁴⁸⁾ Report by the Special Rapporteur on the right to food, Mr. Jean Ziegler, E/CN.4/2001/53, 9th February 2001, para. 68.

⁽⁴⁹⁾ Report by the Special Rapporteur on the right to food, Mr. Jean Ziegler, A/57/356, 27th August 2002.

⁽⁵⁰⁾ Report by the Special Rapporteur on the right to food, Mr. Jean Ziegler, A/58/330, 28th August 2003.

⁽⁵¹⁾ Report by the Special Rapporteur on the right to food, Mr. Jean Ziegler, E/CN.4/2003/54, 10th January 2003.

⁽⁵²⁾ Report by the Special Rapporteur on the right to food, Mr. Jean Ziegler, A/59/385, 27th September 2004.

⁽⁵³⁾ Report by the Special Rapporteur on the right to food, Mr. Jean Ziegler, E/CN.4/2004/10, 9th February 2004.

⁽⁵⁴⁾ Report by the Special Rapporteur on the right to food, Mr. Jean Ziegler, E/CN.4/2005/47, 24th January 2005.

⁽⁵⁵⁾ Report by the Special Rapporteur on the right to food, Mr. Jean Ziegler, A/60/350, 12th September 2005.

⁽⁵⁶⁾ Report by the Special Rapporteur on the right to food, Mr. Jean Ziegler, E/CN.4/2006/44, 16th March 2006.

food⁽⁵⁷⁾, the impact of biofuels on the right to food⁽⁵⁸⁾, refugees and the right to food⁽⁵⁹⁾.

The new rapporteur appointed in 2008 has sustained some continuity with the work of his predecessor, even if the start of his mandate was marked by the food crisis; this led to the first report being concerned with the right to food, speculation and the global food price crisis⁽⁶⁰⁾. Nonetheless, this has not stopped him from looking further into some of the topics already pointed out by Professor Ziegler, such as the impact of international regulations on trade and the responsibility of the WTO regarding the right to food⁽⁶¹⁾. The current rapporteur has also looked into different issues such as the rights to land, to tenure and the concentration of ownership as a current challenge. In fact, since 2006 the trend has pointed to a phenomenon of large-scale purchasing or leasing of land which, as is logical, creates problems and abuses, especially for poor farmers in many countries affected by hunger⁽⁶²⁾.

⁽⁵⁷⁾ Report by the Special Rapporteur on the right to food, Mr. Jean Ziegler, A/HRC/4/30, 19th January 2007.

⁽⁵⁸⁾ Report by the Special Rapporteur on the right to food, Mr. Jean Ziegler, A/62/289, 22nd August 2007.

⁽⁵⁹⁾ Report by the Special Rapporteur on the right to food, Mr. Jean Ziegler, A/HRC/7/5, 10th January 2008.

⁽⁶⁰⁾ Report by the Special Rapporteur on the right to food, Mr. Olivier de Schutter, A/HRC/9/23, 8th September 2008.

⁽⁶¹⁾ In this regard, a whole report was dedicated to the link between agreements reached within the framework of this organisation, specifically the Agriculture Agreement and the obligation of WTO members to respect the human right to adequate food. It states that if world trade must contribute to the realisation of the right to food, it may not treat agricultural products as any other basic commodity but rather deal with its specificities and allow developing nations to protect their products and farmers from the competition of farmers in industrialised nations. See, Report by the Special Rapporteur on the right to food, Mr. Olivier de Schutter, A/HRC/10/5/Add.2, 4th February 2009.

⁽⁶²⁾ This is what some critics have called land grabbing. Calculations show that between 15 and 20 million hectares of agricultural land in developing nations have been subject to transactions or negotiations with foreign investors from 2006 to 2009. In this vein, the current rapporteur has presented a set of minimum principles and measures that should be taken into account so as to respect human rights in the buy-sell context and commercial transactions in agricultural land. These principles are aimed at both the recipient States and at investors and their main aim is «to ensure that negotiations leading to land acquisitions and leases comply with a number of procedural requirements, including the informed participation of local communities. They also seek to ensure adequate benefit-sharing, and a proviso that under no circumstances should such transactions be allowed to trump the human rights obligations of States». Some of these principles are the participation of local communities in negotiations, free, prior and informed consent of affected communities, the regulation and exceptions in forced evictions, that income from the investment agreement benefits the local population, that they contribute to job creation, amongst other recommendations presented clearly in the Appendix to said report. It should be stated that this topic continues to incite concern, especially over the pressure placed on vulnerable groups such as indigenous communities, small-scale farmers and special groups such as shepherds, small-scale cattle-raisers and fishermen/women. A new report dedicated to the topic of land access from 2010 is proof of this. See the Report by the Special Rapporteur on the right to food, Mr. Olivier de Schutter, A/HRC/13/33/Add.2, 28th December 2009 and Report A/65/281, 11th August 2010.

In turn, the current rapporteur has not only continued some topics already looked at by Professor Ziegler but has also looked at and incorporated new elements for study and analysis⁽⁶³⁾ such as seed policy and the need to improve agricultural biodiversity and promote innovation⁽⁶⁴⁾, or the role of commodities buyers, food production companies and retailers, i.e. agro-food and the right to food⁽⁶⁵⁾, as well as newer issues such as those in the last two reports. On the one hand, agroecology and its advantages as a farming system and highly sustainable and productive production⁽⁶⁶⁾. On the other, an analysis of how to improve the method by which farmers access markets and the development of small-scale local and regional markets⁽⁶⁷⁾.

Finally, and so as to properly understand the importance of all these reports and the problem areas highlighted, two considerations should be underlined. Firstly, all the reports here from the two special rapporteurs should be assessed and understood as a whole, not separately, since on the one hand, and as has been shown, a type of thematic continuity runs through them and, on the other, they all comprise a type of *corpus* built upon year after year in a coherent way so as to look at the progress and difficulties regarding the right to food.

Secondly, it should be stated that the United Nations special rapporteurs do not interpret the legal content of the standards set out in the Covenants, nor do they extend or narrow the obligations set out or the interpretation thereof. Nevertheless, the conceptual progress and provided practices in the area of the right to food are highly valuable for the realisation and attainment of this right, and also to provide answers to the main problems they have to face and which do not always find an appropriate answer in international regulations, e.g. the food crisis and price speculation and volatility, land grabbing, amongst other issues which, thanks to the work of the rapporteurs, are incorporated into States' agenda and human rights protection institutions.

⁽⁶³⁾ The work areas, all information, as well as the agenda and contributions from the rapporteur at international conferences and country missions can be consulted on the official website: <http://www.srfood.org>.

⁽⁶⁴⁾ Report by the Special Rapporteur on the right to food, Mr. Olivier de Schutter, A/64/170, 23rd July 2009.

⁽⁶⁵⁾ Report by the Special Rapporteur on the right to food, Mr. Olivier de Schutter, A/HRC/13/33, 22nd December 2009.

⁽⁶⁶⁾ On this topic, the rapporteur, on the one hand, justifies agroecology in conceptual and applicability terms with the right to food and, on the other, defines the public policies and priorities and changes to be taken into account for adoption as a new system, see Report by the Special Rapporteur on the right to food, Mr. Olivier de Schutter, A/HRC/16/49, 20th December 2010.

⁽⁶⁷⁾ Report by the Special Rapporteur on the right to food, Mr. Olivier de Schutter, A/66/262, 29th August 2011.

■ Specific Challenges for Spain

As is to be imagined, all these global issues and challenges do not apply equally to all countries as each has its particular features. In this vein, it is appropriate now to focus on the specificities in Spain.

In general, the amount of human rights treaties passed by Spain is in line and coherent with what is to be expected in a European geopolitical context, i.e. a member of the European Union and Council of Europe. Spain has therefore ratified the main regional agreements, the European Convention on Human Rights of 1950 and the Charter of Fundamental Rights of the European Union, appended to the Treaty of Lisbon, in force since 2009 as a legally binding text.

In addition, Spain is also part of most universal human rights treaties⁽⁶⁸⁾, e.g. the Covenant on Economic, Social and Cultural Rights since 1976 and, at present, holds the position of Member State of the United Nations Human Rights Council. It was also the first European country to ratify the Optional Protocol to the International Covenant on Economic, Social and Cultural Rights, which recognises the Committee's authority to receive individual notifications and complaints⁽⁶⁹⁾.

From a regulatory recognition standpoint, the Spanish Constitution does not set out explicitly protection for the right to food or the human right to water, but these do derive from the right to life and physical integrity recognised in article 15 which states: «*Every person has the right to life and physical and moral integrity...*». The fundamental rights set out in the Constitution should be interpreted in light of the Universal Declaration of Human Rights and of international treaties and agreements. Article 45.2 of the Constitution states that «public authorities shall ensure the rational use of all natural resources with the aim of protecting and improving quality-of-life and defending and restoring the environment, based on essential collective solidarity».

In turn, in Spain, some competences in the areas relating to economic, social and cultural rights are decentralised from the National Government to the 17 Autonomous Regions. As a Member State of the European Union, Spain also shares certain areas of responsibility. The Treaty of Lisbon offers, for the first time, a systematisation of the responsibilities of the European Union and the Member States, differentiating between exclusive, share and coordinated responsibilities, providing the principles of proportionality and subsidiarity with a clearer content whilst allowing, in relation to this, *ex ante* political oversight by national parliaments. It is in this way, for example, that some areas such as agriculture and fishing that have a close link to the right to food

⁽⁶⁸⁾ With some exceptions such as the International Covenant on the Protection of the Rights of All Migrant Workers and Members of Their Families.

⁽⁶⁹⁾ The Covenant was ready to sign in 2009 and is awaiting its entry into force when it attains the necessary number of ratifications.

are the shared responsibility of the European Union and Member States; the well-known common agricultural policy is run in this way. Further, there is an action programme in the area of water dating back to the 1970s and which has seen wider developments with the establishment of a sustainable water policy, specified in different legislative measures such as Directive 2000/60/CE of the European Parliament and the Council.

In this way, the areas related to the human right to food and water can be found in some decentralised areas, whether at regional or local level or shared with the European Union. This demonstrates the particular complexity of Spain where it is clear that exercising responsibilities in the area of economic, social and cultural rights, and closely linked issues, does not always fall to a single administration. Despite this, the State is obliged to respect, protect and realise human rights at local, regional and national level without discrimination, as well as at the international level. In this sense, the particularity lies in pointing out that Spain as a guarantor of the protection of the human right to food and water is a complex example and, despite this, must assume responsibility at the international level by virtue of the treaties it ratifies as well as its membership of international organisations such as the European Union. On the one hand, this responsibility is passed on to its decentralised regional and local authorities and, on the other, extends beyond its borders and means extraterritorial responsibilities may be demanded. In this light, the challenges and difficulties are clear.

In this context, it seems appropriate to focus on three issues and set out, firstly, the official version presented by Spain itself regarding compliance with the right to food and water before the bodies of international oversight, specifically, the United Nations Committee on Economic, Social and Cultural Rights. Secondly, some considerations should be stated regarding the decentralised institutions and, lastly, mention should be made of Spain's extraterritorial responsibilities.

- *The last periodic review before the committee on economic, social and cultural rights of 31st january 2011*

Within the framework of its international obligations and, specifically, the Covenant on Economic Social and Cultural Rights, Spain must present periodic monitoring reports to the Committee. Although this chapter does not aim to analyse the series of periodic reviews presented by Spain, it would seem appropriate to look at the contents of the last review⁽⁷⁰⁾ as a source of true official information on the current status of respect and compliance with the rights set out in the Covenant, specifically food and water.

⁽⁷⁰⁾ Fifth periodic report submitted by Spain in accordance with articles 16 and 17 of the International Covenant on Economic, Social and Cultural Rights, E/C.12/ESP/5, 31st January 2011.

The report was debated during the sessions held in Geneva between 30th April and 18th May 2012 and, despite the comments or conclusions still not being available when this article was written⁽⁷¹⁾, the official report can be consulted, as can the list of issues the Committee expects to be extended before the appearance of the Spanish delegation in the planned sessions⁽⁷²⁾, as well as the parallel reports presented by civil society institutions and the Ombudsman which were used to expand and correctly understand other dimensions and issues which are either omitted in official reports or are not dealt with thoroughly enough⁽⁷³⁾.

Spain adopts a position in relation to compliance with and respect for the right to food within the framework of development cooperation, i.e. a State that through its official development policy contributes to the progress of the right to food and the fight against global hunger. As a promoter State internationally of initiatives to promote the right to food, the efforts of the Spanish government in its strategy on the eradication of hunger should surely be highlighted, set out in its International Cooperation Plan 2009-2012⁽⁷⁴⁾. This recognises the importance of food and nutritional security and also underlines in the specific context of the global food crisis that Official Spanish Cooperation has increased its funding, providing 286 million euro for agriculture, nutrition and food security in other countries. It has also committed a further 200 million per year to fight hunger over the next 5 years⁽⁷⁵⁾.

In turn, with regard to the human right to water, Spain has been one of the promoter countries for recognition of the right to access to drinking water and sanitation at the United Nations General Assembly, as well as one of the promoters for establishing a thematic remit for this right, now adopted by the special rapporteur Catarina de Albuquerque. Further, the aforementioned III Spanish Cooperation Master Plan 2009-2012 includes the right to water and sanitation as one of its sector priorities.

It is officially recognised, however, that in a country such as Spain «water is a scarce resource, hit by serious water imbalances due to uneven distribution»

⁽⁷¹⁾ The final version of this chapter was finished on 15th June 2012.

⁽⁷²⁾ E/C.12/ESP/Q/5, 2nd September 2011.

⁽⁷³⁾ For example, *List of Issues in response to the Fifth Periodic Report of Spain Prepared for the Pre-Sessional Working Group of the Committee on Economic, Social and Cultural Rights*, The Center for Economic and Social Rights and Observatorio de los Derechos Económicos, Sociales y Culturales, 1st April 2011; *Contribution from Spain's Ombudsman's Office for the review of the Fifth Periodic Report of Spain before the Committee of Economic, Social and Cultural Rights*, 14th March 2012, pp. 1-16; ; *Joint Submission to the Committee on Economic, Social and Cultural Rights Review of Spain's 5th Periodic Report*, 48th Session of the CESCR, presented by 19 organisations, May 2012, pp.1-50.

⁽⁷⁴⁾ *Plan Director de la Cooperación Española 2009-2012*, Ministry of Foreign Affairs.

⁽⁷⁵⁾ *Fifth periodic report submitted by Spain in accordance with articles 16 and 17 of the International Covenant on Economic, Social and Cultural Rights*, E/C.12/ESP/5, 31st January 2011, para. 538 to 550.

and, therefore, appropriate water policy planning is a need and a political priority⁽⁷⁶⁾.

Despite Spain not positioning itself as part of the logic of a country whose population suffers general starvation or a lack of access to drinking water in its report to the Committee, this does not mean that there are not people who do go hungry or people who live in extreme poverty and social exclusion - phenomena which generally, without the need for explanation, could represent, at times, violations of the right to food or access to drinking water. Indeed, many sectors of civil society have stated just this.

As a brief review of the situation in Spain,⁽⁷⁷⁾ and taking into account the current economic crisis, estimates for 2010 show 11,675,000 people in danger of poverty, according to Eurostat, i.e. a quarter of the population (25%), an increase of over a million people in comparison to the previous year. In a European context, over 115 million people were at risk of poverty in 2010 in the European Union, 40 million in a serious situation of material deprivation, 1.8 million of whom are in Spain⁽⁷⁸⁾.

The figures for 2011 set out in the Caritas and Foessa Foundation Report *Exclusión y desarrollo social. Análisis y perspectivas* (Social Exclusion and Development: Analysis and Outlooks) also show increasing poverty in its most serious guises as a key feature. The percentage of households in Spain not receiving any income either from work or from unemployment benefits or Social Security now sits at 3.3% - in absolute terms, this represents 580,000 households. As the report states, this indicator is representative of the existence of extreme poverty which signifies serious privation of basic goods such as, logically, food and water⁽⁷⁹⁾.

⁽⁷⁶⁾ At present, resolving these possible imbalances and guaranteeing access to drinking water for the entire population is set out in the National Hydrology Plan, which includes harmonic and coordinated use of all water resources. In turn, law no. 11/2005 of 11th June has established a new legislative water policy, substituting the surplus basic income transfer system to deficit basins and partially modified by the previous law no. 10/2001 whereby the National Hydrology Plan was approved. The current law is based on Directive 2000/60/CE of the European Parliament and Council of 23rd October 2000 which establishes a community framework in the area of water policy. The political realisation of this legislative framework is found in the Water Management and Usage Activities Programme (AGUA) whose main aims are to 1) increase available water for the entire population via re-using treated water and desalinated sea water, 2) improve consumer efficiency, via the optimisation of irrigation and improved urban supply, and 3) improve available water quality through the treatment and restoration of watercourses and continental water bodies. See, the Fifth periodic report submitted by Spain in accordance with articles 16 and 17 of the International Covenant on Economic, Social and Cultural Rights, E/C.12/ESP/5, 31st January 2011, para. 538 to 550.

⁽⁷⁷⁾ Caritas and Fundación Foessa: *Informe anual sobre la Exclusión y desarrollo social. Análisis y perspectivas 2012*, Madrid, pp. 1-73.

⁽⁷⁸⁾ *Ibid*, p. 32.

⁽⁷⁹⁾ Caritas and Fundación Foessa: *Informe anual sobre la Exclusión y desarrollo social. Análisis y perspectivas 2012*, Madrid, pp. 10-14.

The fact that these figures are not shown in Spain's fifth periodic report does not mean there is no concern nor public policies on the issue, as certainly there are. The figures perhaps demonstrate that the policies are not adequately responding to the crisis situation or the pointed growth trend in the number of people in situations of extreme privation. In this sense, it should be highlighted that the Committee on Economic, Social and Cultural Rights already requested Spain provide, in its 2011 periodic review, «disaggregated and comparative data on the number of people living in poverty and on progress made in reducing the incidence of poverty» and recommended redoubling the «efforts to combat poverty and social exclusion and to develop a mechanism for measuring the poverty level»⁽⁸⁰⁾ since this is a clear obstacle for enjoying human rights and, at the same time, the absence of data (or scant amount) on this reality makes effective realisation difficult for many affected rights.

- *The role of decentralised institutions*

A second challenge or factor to focus on in Spain is the role of the Autonomous Regions since, as has been stated, some areas relating to economic, social and cultural rights are decentralised.

Both international treaties and the mechanisms set out by the United Nations focus on the State in this area, the main entity charged with their protection, without going into the political structure of each. The particularity with regard to other international safeguard systems lies in pointing out that the State, as a guarantor of the protection of human rights and specifically the human right to food and water, is not only considered an impermeable unit but also covers its decentralised regional or local institutions. The respect for the equality of States in international legal regulations and the subsequent logic thereto, the obligation of not interfering in the domestic issues of countries, is a customary standard. In turn, the Charter of the United Nations lays down the principle that the Organisation is not authorised to intervene in issues which are essentially the domestic jurisdiction of States. In this way, it is not customary that in the guarantee system for the right to water and food much stress is placed on the obligation of protection covering any political/administrative organisation that comes under the sphere reserved for the State.

Specifically, General Comment 15 sets out the obligation to coordinate between national ministries and regional and local authorities with the aim of harmonising policies on water; and in the case that said responsibility is assigned to decentralised institutions, the State shall be the maximum responsible body for compliance with the International Covenant on Economic, Social and Cultural Rights. This is compatible with instituting international responsibility where any act carried out by decentralised institutions and public bodies,

⁽⁸⁰⁾ *Concluding observations of the Committee on Economic, Social and Cultural Rights, regarding the report presented by Spain in 2004. E/C.12/1/Add.99, 7th June 2004, para. 37.*

amongst others, is attributed to the State in terms of responsibility. Nonetheless, said General Comment goes further in directly setting out that regional and local authorities are also involved. Why, then, is there an insistence on the obligation to protect being directed to all country institutions and levels? We see two possible relevant reasons. On the one hand, international regulations are gradually entering in the sphere reserved for the State, attempting to increase the protection level for human rights. On the other, we could perhaps interpret that the guarantees on the specific right to water must be higher since it is a universal good. This would justify an increase in the duty bearers internationally.

The first reason can also be seen in the Special Rapporteur's Report on the right to water in 2011, stating that responsibilities in the water sector are split between ministries, different administration levels, including municipalities and regions. It therefore requires optimum coordination to overcome fragmentation. Vertical collaboration: State-decentralised institutions or horizontal, amongst the latter, is a further confirmation of the State's obligation to comply with its international obligations - something difficult to achieve unless all of them work together. The rapporteur goes even further in the report, requesting local institutions play a role from the start of planning as they are going to be in charge of managing any plan. In a certain sense, a strict regulatory framework, whatever it may be, is surpassed to focus on the common good to protect⁽⁸¹⁾. Performance of the planning and management of the right to water is essential at all administration levels, seeking complementarity instead of confrontation. In other words, this is what the European Union Committee of the Regions has defined as multi-level governance⁽⁸²⁾. Indeed, this ever more intense concentration inside State borders can be seen in the European Union where, even based on non-interference in domestic issues, penetration occurs with the Treaty of the European Union alluding to regional and local autonomy⁽⁸³⁾ and a *de facto* demand for decentralised institutions to also comply with the obligations arising from international treaties.

The second reason is also pointed out in the High Commissioner's Report of 2007 which, despite taking up again the principle of the State's unity of action and from this all obligations deriving to comply with fair access to water and the right to food, clearly states that, in addition to States' obligations regarding human rights arising from the ratification of international treaties or from customary international law, other actors such as transnational corporations, private companies, international organisations and individuals also play a role regarding

⁽⁸¹⁾ Report by the Special Rapporteur on the human right to drinking water and sanitation, Ms, Catarina de Albuquerque, A/HRC/18/33, 4th July 2011, pp. 12-13.

⁽⁸²⁾ European Union Committee of the Regions, *White Book on Multi-level Governance*, CDR 89/2009, 17th and 18th June 2009, p. 5.

⁽⁸³⁾ BELTRÁN GARCÍA, S., «La inclusión de los principios de autonomía regional y local en el Tratado de Lisboa», in *La incidencia del Tratado de Lisboa en el ejercicio de las competencias autonómicas*, IEA, Barcelona, 2010, pp. 93-128.

the respect and promotion thereof. In short, protection is sought that brings together the maximum number of guarantees and duty holders to perform it.

- *Extraterritorial responsibilities and coherence with government policies regarding the right to food*

Following our assessment of the specific challenges in Spain, we now focus on a third aspect linked to the area of extraterritorial responsibilities arising from the ratification of international treaties, as well as the drafting and interpretation of constitutional provisions.

The drafting of the aforementioned article 15 and the legal comprehension of the right holder («all») involves a double focus. Within its borders, the State must guarantee the right to life and food of its own nationals, but also of any person, Spanish or not, who is in the national territory in application of the jurisdiction criteria, overcoming the strict link to nationality. In this way, the State is obliged to promote and eliminate obstacles to the respect, protection and guarantee of this right to any person in its territory and not necessarily a national. This interpretation of the protection offered by article 15 is justified in light of international treaties and the Universal Declaration of Human Rights of 1948 which transcends Spanish geographical territory and imposes certain obligations on the State beyond its borders.

The extraterritorial application of human rights covenants recognises, as a starting point, that the fundamental responsibility of a State is to guarantee the rights, first and foremost, within its national territory, applying a wide criteria which is that already mentioned for jurisdiction. Nevertheless, it is also understood that a State protects its citizens when they are abroad and suffer human rights violations, being able to exercise, where it deems appropriate, diplomatic protection. In turn, the State assumes responsibility where one of its institutions carries out any action contrary to the right protected and the latter is attributed to it. This extraterritorial nature to the Covenant on Economic, Social and Cultural Rights is also part of the authorised interpretation made by the Committee in General Comment 12:

«States parties should take steps to respect the enjoyment of the right to food in other countries, to protect that right, to facilitate access to food and to provide the necessary aid when required»⁽⁸⁴⁾.

The Committee thus introduces the area of extraterritorial responsibility comprising international cooperation and assistance between States, which should lead to the protection and enjoyment of the right to food. In this vein, the former special rapporteur, Jean Ziegler, dedicating a full report to this issue, also argues that «in the current climate of globalization and strong

⁽⁸⁴⁾ See, General Comment 12, *Op.Cit.*, para. 36.

international interdependence, the national Government is not always able to protect its citizens from the impacts of decisions taken in other countries. All countries should therefore ensure that their policies do not contribute to human rights violations in other countries»⁽⁸⁵⁾. This means, «in a globalized and interdependent world, decisions taken in one country can have very far-reaching effects on other countries»⁽⁸⁶⁾.

Taking this line of thought to the specific area of the right to food, he sustains that «there are many policies and actions of Governments that have negative impacts on the right to food for people living in other countries»⁽⁸⁷⁾. This means that «to fully comply with their obligations under the right to food, States must respect, protect and support the fulfilment of the right to food of people living in other territories» and they have the obligation to guarantee «that their policies and practices do not lead to violations of the right to food in other countries»⁽⁸⁸⁾.

In this way, the special rapporteur promotes a comprehensive view of the State's responsibility which may, with its acts and decisions, as well as its policies and strategies, have negative effects on the right to food. It therefore goes beyond the area of state institutions in other countries to which a specific act would be attributable or the protection of its citizens overseas, and includes a much wider outline of extraterritorial responsibility.

It is argued that this may involve a somewhat exaggerated vision of extraterritorial obligations since it is difficult to predict or avoid the consequences that a specific public policy could have on human rights in other countries. Indeed, the rapporteur's argument clearly highlights a delicate topic - international trade in agricultural produce. This illustrative example is given stating that «it is widely recognized that subsidies to farmers in developed countries can have negative impacts on farmers and the right to food in developing countries if food products are *dumped* on developing countries»⁽⁸⁹⁾, and here he alludes, without explicitly stating it, to the European Union Common Agriculture Policy and to all member States and, therefore, to Spain as well as the WTO.

It thus seems to include the lack of coherence in government policies in the area of extraterritorial responsibility in human rights treaties and, specifically, the right to food since, from this perspective, a government, such as in Spain, may protect and guarantee this right within its borders and even offer assistance for agricultural development outside them providing, as it does, large financial

⁽⁸⁵⁾ Report by the Special Rapporteur on the right to food, Mr. Jean Ziegler, E/CN.4/2005/47, 10th January 2005, para. 39.

⁽⁸⁶⁾ *Ibid*, para. 40.

⁽⁸⁷⁾ *Ibid*, para. 40.

⁽⁸⁸⁾ Report by the Special Rapporteur on the right to food, Mr. Jean Ziegler, E/CN.4/2005/47, 10th January 2005, para. 48.

⁽⁸⁹⁾ *Ibid*, para. 39.

sums to eradicate hunger and for food security in other countries. Nonetheless, at the same time it may be implementing trade policies which have negative effects for human rights and the right to food in other countries.

This is stated by the special rapporteur: «development policies and programmes are not always well coordinated with trade policies programmes agreed to within the framework of WTO, IMF and the World Bank, which means well-intentioned development policies are often undermined. For example, developed countries might offer development assistance for agricultural development, whilst at the same time, they subsidize their agriculture and sell products at below the cost of production, in ways that can limit the possibilities for agriculture development in developing countries. In the same way, developed countries sometimes provide food aid in ways that undermine local food security, through destroying local production in developing countries»⁽⁹⁰⁾.

The dilemmas and repercussions of development cooperation policies on other countries are not new. Neither is the problem area relating to the lack of coherence of public policies in general. It is true, however, that at a time of special momentum to eradicate global hunger, greater focus on this should be expected. It is not a question of being able to predict the effects of specific policies, or lesser issues, but rather of clear contradictions. Indeed, it is surprising to find Robert Zoellick, Chairman of the World Bank, follow the same critical vein surrounding the incoherence of States and the negative impacts of public policies on other countries. At a conference held at the George Washington University in 2011, he stated that «the language of development has been the language of old hierarchy. Old World. Old Order. And not without a whiff of hypocrisy. (...) When countries with large fiscal deficits preach fiscal discipline to poor countries – what are they really saying? «Do what I say, not what I do.» When countries pay homage to free trade but hold back developing countries with barriers, what are they really saying? «Do what I say, not what I do»⁽⁹¹⁾.

Perhaps, as the Chairman of the World Bank himself states, if the contradictions are so clear «the old ways can and must change». The change of the stated incoherence can be considered based on two proposals: the voluntary guidelines promoted by the FAO and the adoption of a focus on rights in public policies, as the last section of this article proposes.

Undoubtedly, a major step forward in developing policy coherence around the right to food was the adoption in 2004 of a voluntary guidelines instrument within the framework of the FAO⁽⁹²⁾.

⁽⁹⁰⁾ Report by the Special Rapporteur on the right to food, Mr. Jean Ziegler, E/CN.4/2005/47, 10th January 2005, para. 40.

⁽⁹¹⁾ ZOELLICK, R., *Beyond Aid*, George Washington University, 14th September 2011, p. 3.

⁽⁹²⁾ VIDAR, M. «The right to food guidelines» in AA.VV., *Derecho a la alimentación y Soberanía Alimentaria*, Chair of Studies on Hunger and Poverty, Servicio Publicaciones de la Universidad de Córdoba and Oficina de Cooperación Internacional al Desarrollo, Córdoba, 2008, pp. 77-91.

These guidelines aim to help States and other involved members to progressively attain the right to food nationally and they include all State obligation levels, as well as the aspects of the fight against hunger. As M. Vidar states, they go some way to providing clarity on the complexity⁽⁹³⁾ since they do not introduce new content but systematise all related issues which are structured in the document in three parts⁽⁹⁴⁾. Fundamentally, the FAO Voluntary Guidelines contain and systematise both the regulatory and political aspects of the right to food and their main potential lies in the introduction of practical measures that are understandable for actors who have to implement the right to food in line with the strategies defined at the World Food Summit and the regulatory provisions. Consequently, the idea is to provide greater clarity and coherence albeit without granting them a binding legal standing so that States and international organisations have the obligation to take them into account but without any penalty due to possible incoherence. This provides flexibility and encourages States to gradually introduce these guidelines in their legislation and provide coherence to their policies.

In short, throughout this work the main challenges surrounding the right to food and water have been set out, the eradication of hunger, both at a global level and at a specific level for Spain with its own circumstances and complexity. In effect, the figures on global hunger continue to be alarming despite global progress and commitments and, paradoxically, whilst advances have been made in legal and political recognition of the right to food and its close link to the right to water, the greatest global food crisis seen in the last few decades has occurred. This again confirms that the challenges remain valid and that political commitments should be firmer and more coherent.

■ STRATEGIC APPROACHES FOR EFFECTIVE PROTECTION OF THE HUMAN RIGHT TO FOOD AND WATER

It is in this context where some key future proposals are put forward and summarised.

■ A Human Rights Focus in Public Policies

Many institutions⁽⁹⁵⁾ call for and recommend the adoption of a human rights focus in public policies linked to the right to water and food so as to avoid some of the incoherences and contradictions set out in this article.

⁽⁹³⁾ *Ibid*, p. 79.

⁽⁹⁴⁾ The first introductory section includes the main international instruments on the protection of the right to food from the prism of human rights. The second section covers related and strictly linked issues such as the environment, aid, national strategies regarding the regulatory framework, policies and their adaptation taking into account the specificities of each State. The third section talks about the international dimension of the right to food, including actions and commitments adopted by the international community.

⁽⁹⁵⁾ See the following reports for examples: KIRKEMANN, J. & MARTIN, T.: *Applying a rights-based approach. An inspirational guide for civil society*, The Danish Institute for Human Rights,

This focus aims to outline the global framework where any public policy involving human rights is to be carried out⁽⁹⁶⁾. It aims for all policies and plans to take the duties and obligations set out in international law in the specific area involved as a starting point. The adoption of this approach introduces two highly useful aspects: firstly, it helps to define more clearly State obligations regarding the main human rights principles involved in a strategy or policy.

Secondly, this approach changes the logic that has guided the production of public policies for decades, understood as more or less discretionary services, that States carry out to meet the needs of their citizens. However, it introduces a fundamental change of outlook since public policies on the right to food (and the eradication of hunger) should not only be drafted from the confirmation of those in need being able to be helped or not in the context of a temporary political commitment, but rather from the perspective that these individuals have rights, today and beyond 2015. In some way, this human rights approach in public policies tempers the importance of political discourse since food and the eradication of hunger is not only a voluntary commitment but a full legal obligation⁽⁹⁷⁾. This means that, beyond 2015, States shall continue to put the same energy and commitment into reducing the number of people suffering

2007, pp. 1-47; *A Human Rights' Based Approach to Development, New perspectives by taking cultural rights into account?*, Synthesis Documents, Interdisciplinary Institute for Ethics and Human Rights, University of Fribourg, 23rd May 2011, pp. 1-7; *UNESCO Strategy on Human Rights*, adopted by the 32nd session of the General Conference of UNESCO, 16th October 2003, resolution 32 C/27; *Frequently Asked Questions on a Human Rights-based Approach to Development Cooperation*, Office of the United Nations High Commissioner for Human Rights, 2006, pp. 1- 50.

⁽⁹⁶⁾ MEDINA REY, J.M., «La lucha contra el hambre desde el enfoque de los derechos económicos, sociales y culturales», in AA.VV., *Seguridad alimentaria y políticas de lucha contra el hambre: seminario internacional sobre seguridad alimentaria y lucha contra el hambre*, Chair of Studies in Hunger and Poverty, Servicio Publicaciones de la Universidad de Córdoba and Oficina de Cooperación Internacional al Desarrollo, Córdoba, 2006, pp. 139-155.

⁽⁹⁷⁾ This does not intend, not by far, to deny the importance of the political efforts and encouragement, such as the Millennium Development Goals or the Voluntary Guidelines of the FAO. In fact, regarding the MDGs, some state that the political, technical and quantitative dimension is its main advantage, since a temporary global-scope hunger reduction goal has never been set, based on supervising indicators taking into account global figures. See, MEDINA REY, J.M., «La lucha contra el hambre desde el enfoque de los derechos económicos, sociales y culturales», in AA.VV., *Seguridad alimentaria y políticas de lucha contra el hambre: seminario internacional sobre seguridad alimentaria y lucha contra el hambre*, Chair of Studies on Hunger and Poverty, Servicio Publicaciones de la Universidad de Córdoba and Oficina de Cooperación Internacional al Desarrollo, Córdoba, 2006, pp. 139-155.

However, reiterating this recognition and without undermining the success it signifies, we should qualify that the attainment of this goal cannot be realised outside the definition of the rights already set out in the International Human Rights Covenants. It is true that human rights need precision and to be set as global targets, but this should not confuse or forget their nature. This means that, beyond 2015, States shall continue to put the same energy and commitment into reducing the number of people suffering from hunger amongst its citizens since, above all else, it is a legal obligation and hunger is the main violation and in compliance.

from hunger amongst their citizens since, above all else, it is a legal obligation and hunger is the main violation and in compliance.

■ An ius Cogens Approach (a value for the International Community as a Whole)

A second proposal linked to the above is to re-establish the status of water and food as a public good. As gathered from General Comment 15, the final recipient of the right to water transcends the individual and covers humanity; it states that water is a «public good fundamental for life» and that States should «facilitate realization of the right to water in other countries». In this way, the right to food and access to drinking water should be included in the category of mandatory regulations of international law and their respect enforced as a human right.

This position carries specific legal consequences, especially in the priorities for water access and food distribution:

- Water for human consumption is a top priority as is having enough water so that farming is able to fight hunger.
- With regard to the doubt over which products to grow, countries should choose those that ensure the population's basic needs.

■ Final Summary

In short and by way of conclusion, any strategy or policy to eradicate hunger and comply with the right to food and water should respect, on the one hand, its fundamental regulatory content and, on the other, respond to certain recommendations that arise from the United Nations supervisory bodies.

- Food and water are, above all else, human rights. States therefore are legally required to provide everybody, regardless of their nationality, with food that is sufficient, available and appropriate for their needs and circumstances, as well as access to clean drinking water. (*Universal Declaration of Human Rights, Art. 11 of the International Covenant on Economic, Social and Cultural Rights, article 11, General Comment 12 on the right to food, General Comment 15 on the right to water.*)
- In order to meet the requirements and needs of the right, any public policy or global strategy on food and water should not only aim to reduce the amount of people but also guarantee that people have food that is available (sufficient resources), accessible (financially and physically) and adequate (quantity and quality), and access to drinking water. In turn, the real needs of each individual should be taken into account, respecting their circumstances and cultural identity. (*General Comment 12 on the right to food.*)
- Public authorities have three fundamental obligations regarding the right to water and food, and these should be priorities for public policies: respect,

protect and realise. Progressiveness is admitted in full compliance with the right to food and water but public systems should take the necessary steps to ensure that the term in which they intend to guarantee is reasonable and they should guarantee without discrimination and show they are making the maximum use of their available resources. With immediate effect, public authorities should guarantee at least what is basic and essential to protect the people from starvation and guarantee access to drinking water. (*Art. 11 of the International Covenant on Economic, Social and Cultural Rights, General Comment 12 on the right to food, General Comment 15 on the right to water.*)

- An explanatory guide could be useful in Spain on the use of the Optional Protocol to the Covenant by individuals since with its coming into effect, the possibility of individual complaints is to be enacted. We believe efforts should be concentrated on this option, especially taking into account that Spain has already ratified the Protocol.
- In the order of priorities for water and agricultural uses, it should firstly be highlighted that the entire population must receive enough for domestic use. Even so, in coming years and faced with a possible drought, this could be violated. The Human Development Report of 2007 sustains that climate change will lead to greater inequality regarding access to water and drought will extend to areas that until present were watered by rain. Taking this possible scenario into account and due to the precautionary approach, States should guarantee in future policies that in their territory everyone, as a minimum, is able to access water for human consumption above other considerations and the competences of the State and its decentralised institutions.
- In addition, there are well-known differences between different territories in Spain today. The imperative nature of protecting the right to water requires equal fair treatment of the issue. Since the Autonomous Regions and local institutions have responsibilities in this area, work should be carried out with them in putting together future plans.
- There needs to be effective coordination across all administrative levels with responsibilities regarding the right to water, including Autonomous Regions and local authorities. In line with the widest interpretation of State set out in international treaties and United Nations protection mechanisms on the right to water, it is not possible for the State to comply with its international obligations if there is no effective coordination. It is not only a problem of applying and carrying out the regulations of international law in domestic State legislation but also it is necessary for actors involved to show that their implementation work responds to the commitments arising from the treaties and that efforts are not wasted on the way. If this last *efficiency unity* requisite is missing, the international obligations cannot be fulfilled completely.

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CHAPTER TWO

THE IMPACT OF CLIMATE CHANGE ON FOOD SECURITY

María del Mar Hidalgo García

ABSTRACT

Climate change affects directly and indirectly in many aspects of food security. Agricultural production systems and livestock should undergo a transformation, mainly in developing countries, to adapt to climate change, contribute to mitigation without compromising food security and nutritional status of their populations and achieve the sustainable development of farming.

For carrying out this transformation, funding is needed. The current one is insufficient. Apart from the contribution obtained by development aid programs, agricultural systems should be considered in the allocation of funds for the fight against climate change.

Key Words:

Climate change, food security, mitigation, adaptation.

■ INTRODUCTION

We are beginning to experience the consequences of the gradual warming of the planet, and this will intensify over the coming decades. The momentum behind climate change is unstoppable, even if greenhouse gasses are reduced substantially.

A 2007 IPCC report concluded that the temperature increase must not exceed 2°C globally since any larger increase would have catastrophic consequences for developing countries, where droughts, increased bad weather, rising sea levels and warming of the oceans could put millions of people at risk of food insecurity.

Climate change directly and indirectly impacts many aspects of food security, particularly in the agricultural and livestock sectors. Agriculture is the main source of income and employment for 70% of the world's poor in rural areas. However, the livestock sector also makes a significant contribution to climate change, accounting for 18% of greenhouse gasses, whilst also being a prime cause of soil and water pollution⁽¹⁾.

Agricultural and livestock production systems, particularly in developing countries, must be transformed to meet these requirements, otherwise there will be serious consequences for their people and development. The challenge at present is to undertake the reforms needed to adapt to climate change, whilst offsetting its effects and maintaining food and nutritional security and sustainable farming.

The fourth IPCC report found that one of the most serious consequences of climate change will be an increase in the number of people suffering from malnutrition, mainly due to adverse effects on global farming production, as millions of people depend on subsistence farming. Indeed, weather conditions have always been a challenge for farmers.

Agriculture is therefore the sector most vulnerable to climate change, directly impacting the economic activity of countries and increasing the risk of hunger and malnutrition. This leads to a vicious cycle, as the poorest suffer the worst consequences of the adverse weather caused by climate change, whilst having the least capacity to deal with them, due to poor nutrition, the number of people affected, drinking water shortages and poor sanitation; this in turn leads to the rapid spread of infectious diseases and failings in social protection systems.

⁽¹⁾ <http://datos.bancomundial.org/tema/agricultura-y-desarrollo-rural>. As of 25 February 2012.

However, agricultural development is also the most effective tool against hunger and poverty, as it is two to four times more effective than other sectors at increasing the income of the poorest⁽²⁾.

There is an urgent need to identify the direct impact that climate change will have on agricultural production in different regions, and to establish the reciprocal relationship through which agricultural activity contributes to increasing greenhouse gas emissions, as this will impact significantly on the design and funding of policies to combat climate change. This is the only way in which measures can be implemented to make agricultural systems more *resilient* to the climate, and to achieve efficient resource usage that does not undermine future food security.

Climate change has very specific local effects. Even so, regional impacts are expected to be most severe in developing areas⁽³⁾. For example, the productivity of rain-fed agriculture is expected to fall by up to 50% in some countries, potentially undermining their food security. The area of arid and semi-arid land is also expected to increase by between 5% and 8% by 2080.

The outlook in Asia is equally discouraging. Fresh water levels are expected to fall in major river basins, and we can also expect higher sea levels and increased flooding in river deltas.

■ DIRECT IMPACTS OF CLIMATE CHANGE ON AGRICULTURE AND LIVESTOCK ACTIVITIES

■ The Effect of Higher Temperatures

Agriculture is perhaps the most sensitive of all food security activities to climate changes.

Agricultural and livestock farming has adapted to the local climate throughout the world. This has influenced what is grown and how, the type of rural buildings and the lifestyles of farming communities. This is the result of experience, the way that people have adapted to their environment and the passing of agricultural knowledge from generation to generation.

Scientific studies have found that increasing temperatures will, obviously, have different effects on farming in different parts of the world. Productivity may increase in medium and high latitudes due to longer growing seasons.

⁽²⁾ Ibid.

⁽³⁾ http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_sp.pdf.

In Europe, crops traditional to the south, such as maize, sunflower and soy, could flourish at higher latitudes, leading to harvests increasing by around 30% by 2050, depending on the crop⁽⁴⁾. A 2°C temperature increase in medium latitudes could result in a 10% increase in wheat production, but would result in a corresponding loss in lower latitudes⁽⁵⁾.

However, in semi-arid and tropical regions, where farming conditions are extreme, a temperature increase could result in reduced harvests, increasing the stress of high temperatures, with increased water loss through evaporation, further increasing water stress for plants. Soil fertility could also be affected by increased air temperatures.

Furthermore, losses from evaporation and longer growing seasons could result in increased water demand in the Middle East, North Africa and South-East Asia⁽⁶⁾.

■ Changes in Rainfall Patterns

Water is essential for plant life. Any change to rainfall patterns would impact directly on agriculture, 80% of which is dependent on rainwater⁽⁷⁾.

It is very difficult to predict the effects of global warming on rainfall in a particular region as a result of the changes this will cause to atmospheric circulation patterns. Nevertheless, most of the forecasts produced conclude that there will be an increase in rainfall at high latitudes in winter, with lower rainfall in tropical and subtropical regions.

In certain places, such as India, it is more useful to establish the seasonal changes that might occur, rather than talking about annual precipitation. In this region, there is expected to be lower rainfall in the dry season, with higher rainfall throughout the rest of the year, including the monsoon season⁽⁸⁾.

It has been estimated that rainfall shortages in certain African countries dependent on cultivation of non-irrigated and semi-humid crops could reduce production by 50% by 2020⁽⁹⁾. This would expose 70% of the population dependent on such crops on the continent to serious food insecurity.

⁽⁴⁾ Olesen, J.E et. al. «Uncertainties in projected impacts of climate change on European agricultural and terrestrial ecosystems based on scenarios from regional climate models.» *Clim. Change* 81, 123-143 (2007).

⁽⁵⁾ Jemma Gornall et al. Implications of climate Change for agricultural productivity in the early twenty-first century. *Phil. Trans. R. Soc.* 365, 2973-2989. 2010.

⁽⁶⁾ Ibid.

⁽⁷⁾ Ibid.

⁽⁸⁾ Christensen, J.H et al. Climate change 2007: the physical science basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

⁽⁹⁾ Altieri M.A. and Nicholls C. «Cambio climático y agricultura campesina: impactos y respuestas adaptativas». University of California, Berkeley, USA.

Maize would be one of the crops most affected by increased temperatures and changing rainfall. Some studies have found that output might decrease by 10% by 2055, mainly in Africa and Latin America, affecting over 170 million small-scale farmers in those regions⁽¹⁰⁾.

■ Extreme Weather

Meteorological records shows that heat waves have been more frequent since the end of the last century, and this trend is expected to continue over coming decades⁽¹¹⁾. Together with lack of rainfall, this directly impacts the performance of some crops. The adaptation of crops to these occasional temperature increases varies depending on the geographic region. The impact in more temperate zones will be lower than in hotter zones, where agriculture is already at the limit of its ability to adapt, and where it might be faced by conditions that have never been experienced before⁽¹²⁾.

If there is a heat wave during a key period in the plant's development, such as when it is flowering, this could have a serious impact on the harvest.

■ Drought

Drought is a regional phenomenon, with different characteristics depending on the climatic region, frequency and duration. Although there is no general description of what constitutes a drought, they are a natural catastrophe that affects a large part of the population, with high economic, social and environmental costs⁽¹³⁾.

Lack of rainfall causes water stress in plants and, as with heat waves, the areas most affected will be those already suffering extreme water shortages.

Dryness of the soil stops root growth and decomposition of organic material, further decreasing soil fertility. However, droughts have further effects, as they increase soil erosion due to reduced plant cover; this is of particular concern on mountainsides.

One of the results of climate change will be an increase in the severity of droughts, both in terms of their frequency and duration, such as that affecting the Horn of Africa in late-2011, with famine affecting 13 million people⁽¹⁴⁾.

⁽¹⁰⁾ Jones, P. G. and Thornton P.K. «The potential impacts of climate change on maize production in Africa and Latin America in 2055». *Global Environmental Change* 13:51-59.

⁽¹¹⁾ According to a scientific study published in *Nature* magazine (issue 432), heat waves in Europe will increase by 50%.

⁽¹²⁾ For example, peanuts can grow in semi-arid regions at temperatures of up to 40°C. However, a slight increase of just 2°C, even if only for a short time, reduces the crop.

⁽¹³⁾ Drought monitoring and early warning: concepts, progress and future challenges. WMO, 2006.

⁽¹⁴⁾ Message from Ban Ki-Moon, 16 October 2011.

Forecasts suggest that by 2050, the proportion of the earth subject to constant drought will increase from 2% to 10%, with the area suffering from extreme droughts increasing from 1% to 30% by the end of the 21st century⁽¹⁵⁾.

■ **Torrential Rain, Flooding and Tropical Storms**

Experts believe that there will be an increase in the amount of water falling as torrential rain over coming years. Excess water can damage crops, ruining harvests. And flooding can devastate large expanses of cultivated land.

Tropical cyclones may become more intense over the coming decades, with stronger winds and higher rainfall⁽¹⁶⁾. However, there is no expert consensus on whether they will become more frequent.

Tropical cyclones usually occur in summer or the early autumn: from May to November in the northern hemisphere and from November to April in the southern hemisphere. These cyclones can have serious social and economic impact, particularly in developing areas. This is critical in the Indian Ocean region, where the majority of the population lives in river deltas, for example in Myanmar, Bangladesh and India. Increasing populations in these areas make them extremely vulnerable to the risk of flooding, which will be aggravated by the loss of harvests.

However, inland regions may benefit from these weather systems as they decay to heavy rain. This happened for example with cyclone Eline which devastated agriculture in Madagascar in 2000, but whose subsequent rains helped to offset drought in the south of Africa.

■ **INDIRECT IMPACT OF CLIMATE CHANGE ON AGRICULTURAL PRODUCTION AND LIVESTOCK**

■ **Increased Infestations and Diseases**

Higher temperatures resulting from climate change may spread insects and pathogens to a wider range of latitudes. It is very difficult to forecast the effect of this on future agriculture, as this depends not just on the presence of the pathogen, but also on the condition of the crops; these two factors cannot be considered separately as they influence one other.

Climate change may cause -and is in fact already causing- changes to the geographic distribution of diseases, changing the dispersion of bacteria and

⁽¹⁵⁾ Report: «Migration and Climate Change». IOM Research Migration Series n° 31, 2008.

⁽¹⁶⁾ Fourth IPCC report. 2007.

fungi as wind patterns change, leading to the appearance of emerging and re-emerging illnesses, and an increase in the severity of pathogens⁽¹⁷⁾.

■ Water Supply

Irrigated crops account for 20% of cultivated land globally, but for 40% of the food produced⁽¹⁸⁾. In these cases, the water used is drawn from rivers; as a result availability depends on weather in remote areas. One example of this is agriculture along the length of the Nile, which depends on rainfall in its highest stretch in Ethiopia.

In other regions, river flows depend on ice melting. In medium and high latitudes, mild winters result in lower precipitation in the form of snow, resulting in reduced water flow in spring. Almost a sixth of the world's population lives around the Ganges and Indus river basins, using their waters for domestic and agricultural purposes. Both rivers depend on melting of glaciers in the mountains, and this in turn is being influenced by global warming. This phenomenon may result in seasonal flows in both rivers, decreasing in the dry season and increasing in the rainy season with greater risks of flooding. Combined with increasing populations in the area, this could result in water shortages in future.

In other situations, water shortages are not due to low rainfall, but to surface run off, evaporation and deep percolation⁽¹⁹⁾.

■ Rising Sea Levels

Rising sea levels are an inevitable consequence of climate change. There are two main reasons for this increase: thermal expansion of the oceans and an increase in the mass of water due to ice melting from warming. Although these effects should be taken into account at present, they are not expected to occur in the short term, given the rate of ice melting in the major ice shelves at present. The fourth IPCC report estimates that sea levels could rise by between 0.1 m and 0.5 m.

The most vulnerable regions to such changes are those in river deltas and island states in South-East Asia, which could suffer flooding of crops and salination of underground water sources.

⁽¹⁷⁾ Rosenzweig, C. and D. Hillel. «Climate change and the global harvest: potential impacts of the greenhouse effect on agriculture. Oxford University Press, New York.

⁽¹⁸⁾ Döll, P and Siebert, S. Global modeling of irrigation water requirements. *Water Resour. Res.* 38.

⁽¹⁹⁾ Altieri, M and Nicholls, C. «Cambio climático y agricultura campesina: impactos y respuestas adaptativas». University of California, Berkeley, USA.

■ Mass Migrations

Environmental degradation is one of the main causes of mass migrations at present, both intra and inter-state. This is increasing with climate change and has even led to coining of terms such as «environmental migrations» or «environmental refugees», and even original coinings such as «climigration»⁽²⁰⁾. This is a complex relationship and very hard to predict, in which migrations can be considered either a consequence of the ineffectiveness of policies to cope with climate change in the source countries, or as a means of adapting to climate change.

The most critical areas, and those requiring the greatest attention, are small island states, the Sahara, semi-arid areas in southern Africa, Latin America and the Caribbean and central and southern Asia.

The IPCC has estimated that by 2050 around 150 million people will have been forced to migrate from their homes as a result of the effects of climate change. Most of these will be in developing countries, and this mass migration may result in tension and conflict in the areas they move to⁽²¹⁾, whether in refugee camps or in urban areas. In refugee camps, mass concentrations often lead to extreme conditions, such as malnutrition, poor hygiene, disease and pollution. With migrations to urban areas, refugees often settle on the periphery, usually in areas lacking basic social services. This leads to heightened social inequalities, resulting in increased criminality and class conflict.

■ The Effects of Changes in Atmospheric Composition

A higher concentration of CO₂ in the atmosphere may have a direct effect on physical processes in plants, such as photosynthesis and transpiration. In general, studies show that increased CO₂ in the atmosphere increases photosynthesis by between 10% and 50%; this is beneficial⁽²²⁾. However, comparing the overall effect of CO₂ on fertility with the results of climate change, the experts consider that the former is much more critical for determining whether harvests increase or decrease. If CO₂ fertilisation remains high, climate change will benefit agriculture in Europe and the USA. However, in Africa and India, despite the increased fertilisation levels resulting from higher CO₂, climate change will result in harvests falling by 5% by 2050⁽²³⁾.

However, ozone hampers photosynthesis and accelerates leaf ageing, impacting on harvests. These effects are particularly visible in agricultural products, reducing their market value.

⁽²⁰⁾ <http://www.guardian.co.uk/global/2009/apr/17/alaska-migration-climate-change>.

⁽²¹⁾ Reuveny, R. «Climate change induced migration and violent conflict». *Political Geography*. 2007. Vol. 26, Issue 6. 656-673.

⁽²²⁾ Jemma Gornall et al. 2010 op.cit.

⁽²³⁾ Ibid.

■ ADAPTATION OF AGRICULTURAL SYSTEMS TO CLIMATE CHANGE

The fourth IPCC report states that the maximum increase in global temperatures must be limited to 2°C. This means that greenhouse gas emissions will have to be reduced. The temporary extension of the Kyoto Protocol until the end of 2013 and the commitment to establishing a new protocol in 2015 have set the pace of international progress towards a global agreement to reduce greenhouse gas emissions, contributing to offsetting the effects of climate change.

Meanwhile, many farmers are starting to feel the effects of climate change and the poorest countries are seeing their subsistence threatened.

Climate change is unstoppable, but the sooner this is accepted the sooner appropriate measures can be taken to adapt and to counter its negative effects and boost its positive effects, which we must also seek to do. Adapting is as, or almost as, important as offsetting these effects. Therefore, adapting farming to this new scenario must be a priority. Those who can adapt best and most quickly will be the most sustainable and the most competitive.

The IPCC defined adaptation in 2001 as «adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation».

Unlike mitigation, adaptation cannot be considered from a global perspective. Every region has its own peculiarities, with the adaptation measures required varying from place to place.

The challenge of adapting is much more difficult for developing countries because, in addition to being more exposed to the effects of climate change and being more vulnerable, they have weaker institutions and limited access to technology and markets⁽²⁴⁾.

The Cancun Adaptation Framework⁽²⁵⁾ establishes an inter-country adaptation framework for sharing information and capabilities, guaranteeing financial flows to more vulnerable countries, which are often those that contribute least to climate change.

According to the IPCC definition «the extent to which systems are susceptible to climate change is a function of the magnitude of climate change, the sensitivity of the system to changes in climate and the ability to adapt the

⁽²⁴⁾ Mitigation of climate change and adaptation of agriculture, forestry and fishing.

⁽²⁵⁾ In the United Nations Framework Convention on Climate Change. Decision 1/CP.16.

system to changes in climate». Adaptation capacity relates to the capacity to take on climate change to moderate its potential impact, benefit from new opportunities and handle its consequences

The experts argue that the farming sector should focus on the following areas:

- a Analysis of «hot spots».*
- b Improvement and integration of weather forecasting systems.*
- c Early warning systems for serious weather conditions.*
- d Appropriate handling of risks resulting from natural disasters and the preparation of contingency and social aid plans.*
- e Rural investment: harvest insurance, incentives and the adoption of best farming and land use practices.*
- f Improvement of water storage and conservation systems.*
- g Water reuse.*
- h Desalination.*
- i Increased efficiency of water use and irrigation.*
- j Changes to planting cycles for different crops.*
- k Improvements to land management to avoid soil erosion.*
- l Implementation of disease monitoring systems to warn of possible outbreaks.*

■ **Climate Change Adaptation Policies in the Agricultural Sector**

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Measures to ensure food security in the face of climate change must aim to achieve sustainable and robust agricultural development, taking into consideration the needs of the most vulnerable, such as women and children, whilst improving nutritional quality, as appropriate nutrition helps make the population more resistant to the consequences of climate change, such as disease outbreaks and poor hygiene.

Nutrition must not only be taken into account in agricultural production (where paradoxically, increased crop production does not always lead to better nutrition for the population), but also food storage and processing so as to avoid loss of nutrients⁽²⁶⁾.

As previously stated, the adaptation has to be very local and focused on the characteristics of the population and the geographic area, no matter how small. The main starting point is that there is no single solution, and neither technological development nor increased production will necessarily lead to increased food security in the face of climate change.

⁽²⁶⁾ Report «Climate change and nutrition security» by the SCN for the 16th Convention of Parties in Cancun, 2010.

Adaptation policies must consider technological progress, but must also pay attention to the traditional agricultural practices of small farmers and indigenous communities.

■ The Role of Traditional Agriculture

Traditional farmers have demonstrated sufficient capacity to adapt to extreme conditions by applying adaptation over many centuries, based on in-depth knowledge of local conditions and crop diversity⁽²⁷⁾. The practices used in this type of agriculture include polycultivation, exploitation of local genetic diversity (as local genetic variations offer the greatest resistance to extreme weather conditions), collection of wild plants and agroforestry.

■ Climate-Smart Agriculture

Investment in the agricultural sector must aim to contribute to food security, considering sustainable development, adaptation to climate change and its contribution to mitigation. These factors are included in what the FAO has called «Climate-smart agriculture».

The FAO defines this as being agriculture that sustainably increases productivity and resilience (adaptation) and productivity of agricultural production systems, whilst also reducing and removing emissions⁽²⁸⁾.

The smart-agriculture concept includes aspects related to improving production systems, policy coordination locally, nationally and internationally and finance for the transformation needed by agriculture.

• *Improvements in Production Systems*

The FAO has set out the key factors required for sustainable agricultural production. These include:

- Appropriate soil and nutrient management, based on practices that reduce needs for synthetic fertilisers.
- Improvements to the management of ecosystems and agricultural biodiversity.
- Use of genetic resources, both through preservation of natural genetic resources and the generation of new varieties that are more resistant to adverse climate conditions, pests and diseases, and adapting production cycles.
- Improved post-harvest preservation, both in storage and distribution.
- Implementation of agricultural conservation⁽²⁹⁾.

⁽²⁷⁾ Altieri. M. A and Nicholls C. Opus cit.

⁽²⁸⁾ Climate-smart agriculture. Policies, practices and financing for food security, adaptation and mitigation. FAO. 2010.

⁽²⁹⁾ According to the FAO, conservation agriculture helps with adaptation to climate change, reducing crop vulnerability. This consists of agricultural practices such as:

1. Minimum mechanical disturbance of the soil.

- Agroforestry⁽³⁰⁾.
- Developing urban and peripheral agriculture.
- *Local, National and International Policy Coordination*

The FAO has highlighted the need to establish consistency amongst policies to fight climate change and for agricultural development and food security. This requires:

- Fostering institutional and political support to channel investment, social security networks and access to insurance and land.
- Spreading information amongst agricultural communities on sustainable agricultural practices, together with information from early-warning systems for bad weather.
- *The Need for Finance*

the concept of «climate-smart agriculture» recognises that finance, investment and political commitment is needed to implement the changes to agriculture needed to adapt to climate change and ensure food security. This very necessary transformation of the agricultural sector also includes its capacity to make a significant contribution to mitigation.

There is a wide gap between the cost of adapting agricultural systems to climate change and the finance provided, mainly from development funds. Action is required to ensure that financing mechanisms and public and private funds for combating climate change consider the agricultural sector and food security.

■ THE ROLE OF THE AGRICULTURAL SECTOR IN MITIGATION

■ The Contribution of the Food Supply Chain to Climate Change

- *Greenhouse Gas Emissions*

Agricultural activity directly contributes 12% of greenhouse gas emissions⁽³¹⁾, mainly nitrous oxide⁽³²⁾. Agriculture also contributes a further 12% from changes in land use. We also need to include the contribution of the industrial sector directly related to agriculture (pesticides, fertilisers and

2. Conservation of an organic covering to cover and feed the soil.

3. Crop rotation, sequencing and association.

⁽³⁰⁾ Agroforestry consists of protecting crops by planting trees to provide appropriate cover to maintain soil humidity and to reduce temperatures, wind impact and direct sunlight.

⁽³¹⁾ Figures provided in the conference by Jean Francois Soussana, member of the FAO's experts group on «Greenhouse gas emissions in agriculture». Bilbao, 8 March 2012.

⁽³²⁾ Nitrous oxide is 296 times more harmful than CO₂.

machinery). This is of particular concern in Latin America, where agriculture generates 22.9 % of emissions, whilst deforestation and changes of land use account for 53%⁽³³⁾.

It is «very likely» that agriculture, together with the use of fossil fuels, has made the largest contribution to the increase of atmospheric CH₄ and that it is also responsible for increases in CO₂⁽³⁴⁾.

These high figures show that the agriculture sector has enormous potential to contribute to mitigating climate change, increasing carbon capture in the soil through better use of agricultural and pasture land and the recovery of degraded land.

The FAO⁽³⁵⁾ considers that the following practices could reduce greenhouse gas emissions:

- Reducing deforestation and degradation of forests.
- Fostering carbon retention.
- Improving control of forest fires.
- Stopping burning of farming waste.
- Adopting systems that do not use land clearance to reduce emissions from arable cultivation.
- More efficient energy use in agriculture and associated industries.
- More efficient management of nitrogen and manure fertilisers and cultivated land.
- More efficient irrigation of rice fields⁽³⁶⁾.

The livestock sector also makes a significant contribution to greenhouse gas emissions.

The FAO⁽³⁷⁾ forecasts that global meat production will more than double from 229 million tons in 1999/2001 to 465 million tons in 2050, and that milk production will increase from 580 to 1043 million tons in 2050.

Livestock is also one of the most damaging sectors for environmental impact, as it degrades land, drives climate change, increases air and water pollution, and reduces biodiversity. About 30% of the earth's land surface is used for livestock, the major land use on the planet. In total, 70% of agricultural land is used for livestock production.

⁽³³⁾ CAIT database, World Resources Institute, 2005. The predominant gasses are methane and nitrous oxide.

⁽³⁴⁾ http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_sp.pdf

⁽³⁵⁾ «Climate change and food security: a framework document. FAO. 2007.

⁽³⁶⁾ Wetlands, particularly rice fields, contribute significantly to methane emissions.

⁽³⁷⁾ «Livestock's long shadow». FAO 2009.

Around 20% of all pasture and grazing land in the world is totally or partially degraded as a result of livestock (over-pasturing, compacting, soil erosion, etc.). This is more serious in arid lands, where livestock is the only form of subsistence.

Livestock contributes 18% of greenhouse gas emissions. Livestock is responsible for a large share of human-induced climate change⁽³⁸⁾:

- 9% of CO₂ emissions are associated with expansion of pasture land and production of animal feed.
- 37% of methane emissions come from the enteric fermentation of ruminants. The global warming potential (GWP) of this is 23 times that of CO₂.
- 65% of nitrous oxide originates from manure, with a GWP 296 times that of CO₂.
- 64% of the ammonia that contributes to acid rain and the acidification of ecosystems.
- These levels are so high that they provide sufficient margin to offset global warming through reduced greenhouse gas emissions. The main measures suggested by experts to achieve this reduction are:
 - Increasing the productivity of livestock systems to avoid deforestation and degradation of pasture land.
 - Restoration of desert pasture land to increase carbon retention in the soil.
 - Methane and nitrous oxide emissions can be reduced by improving the nutrition of ruminants and handling of manure.
 - More effective management of livestock waste.

Another aspect to be included in the food sector's contribution to greenhouse gas emissions is that it accounts for 30% of global energy consumption and over 20% of total global greenhouse gas emissions⁽³⁹⁾.

The FAO is seeking «energy-smart food for people and the climate», this includes: access to energy for all, improved energy efficiency at all stages of the food supply chain and the replacement of fossil fuels by renewable energies in the food sector.

Measures to make energy usage in the food sector smarter include using more efficient engines, use of precision fertilisers, monitoring irrigation and selective water supply, introduction of agricultural practices without tilling and the use of agricultural varieties and animal breeds that are less dependent on consumption⁽⁴⁰⁾.

⁽³⁸⁾ Ibid

⁽³⁹⁾ According to the FAO report submitted at the World Climate Change Conference in Durban in late 2011. The food sector includes production of factors of production, production, processing, transport, marketing and consumption.

⁽⁴⁰⁾ According to the FAO report submitted at the World Climate Change Conference in Durban in late 2011.

- *Deforestation*

Although the FAO announced in late 2011 that the area of land deforested had been one third less than estimated in 1990-2005, deforestation continues to be a threat to the environment, for food security and the economic welfare of many communities. This is a rapid process that has accelerated over recent years due to the expansion of agriculture, infrastructure construction and demand for wood. The scale of global deforestation -mainly due to conversion of tropical forests into land for cultivation- was 14.5 million hectares on average between 1990 and 2005⁽⁴¹⁾.

The causes of deforestation vary in different regions. In Africa it is caused by small-scale agriculture and wood gathering. In Latin America it is caused by large-scale agriculture and extensive livestock farming. The causes in the Asia Pacific region are more varied, although agriculture plays a leading role⁽⁴²⁾. In conclusion, in two thirds of the countries where the agricultural sector has increased, this has been accompanied by a reduction in the area of forest⁽⁴³⁾.

Some governments and international organisations argue that the main cause of deforestation is subsistence rather than modern agriculture. Migratory «cut and burn» agriculture is the cause of degradation and soil erosion, in addition to loss of forest mass. The consequences of deforestation are most apparent in the Amazon region. Over the last ten years, Brazil has lost 2.6 million hectares of forest, mainly from the Amazon, whilst livestock production has increased by 9%⁽⁴⁴⁾.

Decreasing deforestation and fostering sustainable exploitation of carbon-capturing forests are two of the main approaches by international funds to the fight against climate change.

■ Mitigation Without Compromising Food Security

Agricultural activity plays two important roles in the fights against climate change: it is part of the problem, but also part of the solution. We can however go further, and state that mitigation could benefit food security⁽⁴⁵⁾.

Nevertheless, agriculture's potential contribution to mitigation should not be undervalued. A number of studies are currently underway to provide reliable tools for measuring this contribution.

⁽⁴¹⁾ According to the FAO, data obtained by satellite.

⁽⁴²⁾ FAO (2001).

⁽⁴³⁾ FAO report «State of the world's forests».

⁽⁴⁴⁾ iAmazon Alive! A decade of discoveries: 1999-2009.WWF, 2010.

⁽⁴⁵⁾ Report «Climate change and nutrition security» by the SCN for the 16th Convention of Parties in Cancun, 2010.

- *Carbon Retention in the Agricultural Sector*

Soil is the second most important reservoir of organic material. However, changes to rainfall patterns, increasing temperatures due to climate change and agricultural practices focusing on productivity have reduced the amount of organic material in the soil, resulting in its degradation.

Particular attention must be paid to increasing the volume of organic material in the soil, as retaining carbon in the soil could make a significant contribution to decreasing atmospheric CO₂ emissions. Experts estimate that land ecosystems have the capacity to absorb 13% of the CO₂ in the atmosphere⁽⁴⁶⁾.

In addition to helping to mitigate the effects of climate change, appropriate management of organic matter in the soil is also a form of adaptation to stop desertification and the negative effects of prolonged droughts, as organic material in the soil can absorb up to twenty times its own weight in water⁽⁴⁷⁾.

The FAO proposes the following ways of increasing organic matter⁽⁴⁸⁾:

- Fostering forestation and reforestation.
- Introducing agroforestry systems, combining crops, pasture land and trees sustainably.
- Recovery of pasture lands. Land in arid and tropical regions has been seriously degraded by poor use.
- In agricultural land, the solution consists of conservation agriculture; this includes leaving land fallow and covering the soil with vegetable matter, whether living plants or waste from these, and crop rotation.
- Change of use of degraded land for fuel biomass production and creation of productive forests.

- *Agriculture and Carbon Markets*

Although the agricultural and forestry sectors can make a significant contribution to decreasing the concentration of greenhouse gasses in the atmosphere, they have not been taken into account in carbon credit programmes. These programmes finance greenhouse gas emission reduction and carbon capture projects. This has mainly been due to the difficulty of quantifying the volume of carbon retained in the agroforestry sector.

⁽⁴⁶⁾ Report on the «Climate change: can soil make a difference?» conference held on 12 June 2008. http://ec.europa.eu/environment/soil/pdf/report_conference_es.pdf

⁽⁴⁷⁾ This case shows how adaptation and mitigation can go hand-in-hand in the search for finance.

⁽⁴⁸⁾ Climate change and food security: a framework document. FAO.

In late 2011, the FAO⁽⁴⁹⁾ presented its «Methodology for sustainable grassland management», which is being applied in China's Qinghai province⁽⁵⁰⁾. This methodology enables us to estimate the reduction of greenhouse gas emissions and the increase in carbon capture in the soil resulting from sustainable grassland management⁽⁵¹⁾. As a result, farmers in the area can sell carbon credits in markets that trade emission rights as a financing method to continue with their activities, whilst mitigating climate change. This is a pilot study, but it is opening the door by considering the significant role that could be played by the agricultural sector in mitigating climate change.

The methodology has been presented to the VCS (Verified Carbon Standard)⁽⁵²⁾ for approval.

- *The rise of biofuels*

The obligation to reduce the use of fossil fuels is encouraging the use of other energy sources, including biofuels. However, the purchase of extensive areas of land in developing countries to grow such crops conflicts with the fight against hunger and the need to ensure food security for the poorest communities.

■ FINANCING SUSTAINABLE AGRICULTURE

Finance is needed to adapt the agricultural sector in developing countries. However, very little work has been done to estimate how much is needed. The World Bank has produced an approximate estimate that the «investment required could be between 75 and 100 billion dollars per year in developing countries»⁽⁵³⁾. The World Bank increased its commitment to 9 billion at the end of 2012⁽⁵⁴⁾. However, there is obviously still a significant gap⁽⁵⁵⁾.

⁽⁴⁹⁾ The methodology was developed in collaboration with the Academy of Agricultural Sciences, the Chinese Academy of Sciences and the World Agroforestry Centre (ICRAF, for its French acronym).

⁽⁵⁰⁾ The methodology is based on the «Three Rivers Grassland Carbon Sequestration Project». This consists of improving the management of grasslands through practices such as rotation of grazing animals in summer and winter, limiting the time and number of animals in degraded grasslands, and restoration of degraded land through planting of perennial grasslands for long-term usage.

⁽⁵¹⁾ «Sustainable grassland Management Practices (SGM)».

⁽⁵²⁾ *Verified Carbon Standard (VSC)* is a not-for-profit body that certifies greenhouse gas emission reduction programmes worldwide so that they can issue carbon credits for trading in emissions markets.

⁽⁵³⁾ World development report. 2010. World Bank.

⁽⁵⁴⁾ <http://www.bancomundial.org/es/news/2012/07/30/food-price-volatility-growing-concern-world-bank-stands-ready-respond>

⁽⁵⁵⁾ The FAO's «Climate-smart agriculture» report is very clear on this, stating: that «available financing, current and projected, are substantially insufficient to meet climate change and food security challenges faced by the agriculture sector».

Mitigation strategies in the agricultural sector can also contribute to the development of sustainable practices that ensure adaptation to climate change, helping to achieve food security and sustainable development in developing countries. However, this synergy has not been recognised sufficiently. Food security must also have a place on the climate change agenda, as has often been proposed by a number of international institutions, including the FAO.

Despite the objective of the United Nations Framework Convention on Climate Change (UNFCCC) being to stabilise greenhouse gas emissions *to enable ecosystems to adapt naturally to climate change, ensure that food production is not threatened and to permit sustainable economic growth*, agriculture⁽⁵⁶⁾ and food security have never played a major part in international negotiations on climate change.

However, agriculture should play a greater role. The Convention states that the Party States should cooperate in this sector to establish adaptation and mitigation measures⁽⁵⁷⁾.

At the most recent Conference of Parties, held in Durban, there was a glimpse of a possibility that this situation might change and agricultural activity might have access to funds for fighting climate change. In order to intensify cooperation in certain sectors in relation to mitigation, the Conference agreed that its Subsidiary Body for Scientific and Technological Advice should examine issues related to agriculture so as to share opinions and for the Conference of Parties to make a decision in this regard at its 18th session⁽⁵⁸⁾.

Quantifying agriculture's contribution to climate change is a first step to accessing funds for adaptation and mitigation. The recently launched Green Fund for the climate may be a source of finance for the fight against climate change in developing countries⁽⁵⁹⁾ in order to foster sustainable agriculture.

⁽⁵⁶⁾ With the exception of agreements on deforestation, land use and changes of land use.

⁽⁵⁷⁾ Article 5 c) and e).

⁽⁵⁸⁾ <http://unfccc.int/resource/docs/2011/cop17/spa/09a01s.pdf>

⁽⁵⁹⁾ According to the FCCC/CP/2011/9/Add.1a report «*The Fund will contribute to the achievement of the ultimate objective of the United Nations Framework Convention on Climate Change. In the context of sustainable development, the Fund will promote the paradigm shift towards low-emission and climate-resilient development pathways by providing support to developing countries to limit or reduce their greenhouse gas emissions and to adapt to the impacts of climate change, taking into account the needs of those developing countries particularly vulnerable to the adverse effects of climate change.... The Fund will strive to maximize the impact of its funding for adaptation and mitigation, and seek a balance between the two, while promoting environmental, social, economic and development co-benefits and taking a gender-sensitive approach*».

■ CONCLUSIONS

feeding a population of 9 billion people by 2050 without increasing greenhouse gas emissions is one of the world's great challenges.

Climate change has, and will increasingly have in the near future, direct and indirect effects on food security in developing countries; and such countries are the most vulnerable to its consequences. This creates a vicious circle, as a malnourished population is less resistant to the effects of climate change, such as the spread of diseases.

To achieve food security at a time of climate change, the agricultural sector in developing countries needs to undergo a profound transformation. This process must consider the synergy between adaptation capacity and the mitigation opportunities offered by sustainable agriculture or «*climate-smart agriculture*», which take into account traditional practices, biodiversity and the fundamental role of rural women in developing countries.

This transformation of agricultural systems requires finance. This is not currently sufficient and there is a clear «financing gap». Apart from funds from development aid programmes, agriculture must also have access to funds for fighting climate change. However, the main problem is that there are no mechanisms to quantify the contribution of the agricultural sector as, to date, agriculture has not played a major part in international negotiations on the reduction of greenhouse gas emissions. This may change. One of the decisions at the Durban Conference was that the Subsidiary Body for Scientific and Technological Advice should examine issues related to agriculture.

Nevertheless, if such a contribution is established, both mitigation and adaptation strategies in developing countries must consider food security to avoid developing countries being monopolised by large areas taken over for biofuels or monocultivation as the agricultural sector enters carbon markets. Mitigation must not compromise food security.

CHAPTER THREE

THE ROLE OF WOMEN IN FOOD SECURITY

María del Mar Hidalgo García ⁽¹⁾

ABSTRACT

Rural women play an essential role in the four pillars related to food security: availability, accessibility, utilization and stability. However, there is a gender gap in access to resources such as: land, energy, technology, credit, pesticides and fertilizers. In addition, women have less access to training information, social protection and public services markets.

According to FAO, if women had the same opportunities of access to productive resources as men could increase yields by 20-30%. Therefore, a requirement on the fight against hunger and poverty is to promote the empowerment of rural women.

Key Words:

Food security, gender, rural women.

⁽¹⁾ The author wishes to thank Eve Crowlwy, Deputy Director of FAO's Gender, Equity and Rural Employment Division for her valuable contribution during the preparation of this document.

■ INTRODUCTION

In many developing countries, the agricultural sector represents over 30% of GDP and two thirds of the workforce. According to the World Bank, in such countries agricultural sector growth would be 3.2 times more effective in reducing poverty by 1 dollar/day than growth in any other sector. What is more, this sector can be far more resistant to economic and financial crises⁽²⁾.

Approximately 3.1 billion people, or 45% of the global population, live in rural areas. Of these, around 2.5 billion depend on agriculture as their principal means of subsistence⁽³⁾. A portion of this figure is made up of peasant women, specifically 500 million, who do not own any land and receive barely 5% of the agricultural resources.

The promoting of investment and the restructuring of the agricultural sector in developing countries represent the most effective way to increase productivity and stimulate their economic growth. Donor governments and agencies must take both aspects into account in order to decide upon their development policies. They should also take into account that closing the gender gap which exists in the rural sector would certainly be one of the most effective ways to achieve such an increase in productivity.

Women who live in rural areas represent 25% of the world's population and constitute an average of 43% of the workforce in developing countries. This percentage oscillates between 20% in South America and 50% in South-East Asia and sub-Saharan Africa⁽⁴⁾. And it is precisely in such rural areas where the differences and difficulties suffered by women and girls are most acute.

Yet similar inequalities also exist closer to home, in Europe. A few statistics will suffice to prove this point: more than 80% of women living in the countryside collaborate with or assist their husbands, 28.7% of agricultural workers are women and agricultural holdings run by women are 40% smaller than those run by men⁽⁵⁾.

The rural woman plays an essential role in the four pillars related to food security: availability, accessibility, utilisation and stability. However, women in rural areas of developing countries are at a disadvantage due to the fact that they do not have access to the same opportunities or resources as men owing to stereotype issues based on gender. There is a gender gap as regards access to certain resources such as: land, energy, technology, loans, pesticides

⁽²⁾ FAO Statistical Year Book. 2012.

⁽³⁾ Ibid.

⁽⁴⁾ Ibid.

⁽⁵⁾ Eurostat.

and fertilisers. Furthermore, women have more limited access to training, information, public services, social protection and markets.

Article 14 of the «The Convention on the Elimination of All Forms of Discrimination against Women» specifically highlights States' obligations to eliminate discrimination against women in rural areas. Yet, despite such commitments, governments are not responding with sufficient urgency in order to address the needs and priorities of rural women.

According to the FAO, if women had the same opportunities in terms of access to productive resources (seeds, fertilisers, tools, loans, etc.) as men, they could increase their yields by 20-30%. This would mean an increase in the production of agro-food of between 2.5 and 4%, thus reducing the number of people affected by malnutrition by around 12-17%.

Such telling statistics bring into stark relief the importance of the gender issue in achieving the objectives of all the Millennium Goals. Urgent measures must be taken in order to empower rural women in all aspects and from a holistic viewpoint, including the implementation of sustainable rural development policies on the part of governments.

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Achieving the Millennium Goals will depend on the progress made in terms of improving agricultural and rural development. The poorest populations are, precisely, small farmers primarily from sub-Saharan Africa and agricultural workers in South-East Asia. And all improvements in rural areas are dependent upon acknowledging the different roles played by men and women.

■ THE INTERNATIONAL LEGAL AND POLITICAL FRAMEWORK

In order to ensure that rural women achieve equal rights as well as greater participation and leadership in economic issues, a series of gender-related measures needs to be established within the rural ambit in legal, political and institutional terms.

In recent years, the situation of rural women and the role they play has been the focus of attention in treaties concerning human rights. Yet the «Convention on the Elimination of All Forms of Discrimination against Women»⁽⁶⁾ is the only international human rights treaty which dedicates an article to the situation of rural women. The article calls on all State Parties to adopt appropriate measures to eliminate discrimination against rural women in a number of areas. Article 14 of the Convention thus states:

⁽⁶⁾ The CEDAW came into force on 3 September 1981 following its ratification by 20 countries.

1. States Parties shall take into account the particular problems faced by rural women and the significant roles which rural women play in the economic survival of their families, including their work in the non-monetized sectors of the economy, and shall take all appropriate measures to ensure the application of the provisions of the present Convention to women in rural areas.

2. States Parties shall take all appropriate measures to eliminate discrimination against women in rural areas in order to ensure, on a basis of equality of men and women, that they participate in and benefit from rural development and, in particular, shall ensure to such women the right:

- a. To participate in the elaboration and implementation of development planning at all levels;*
- b. To have access to adequate health care facilities, including information, counselling and services in family planning;*
- c. To benefit directly from social security programmes;*
- d. To obtain all types of training and education, formal and non-formal, including that relating to functional literacy, as well as, inter alia, the benefit of all community and extension services, in order to increase their technical proficiency;*
- e. To organize self-help groups and co-operatives in order to obtain equal access to economic opportunities through employment or self employment;*
- f. To participate in all community activities;*
- g. To have access to agricultural credit and loans, marketing facilities, appropriate technology and equal treatment in land and agrarian reform as well as in land resettlement schemes;*
- h. To enjoy adequate living conditions, particularly in relation to housing, sanitation, electricity and water supply, transport and communications.*

In the Beijing Platform for Action⁽⁷⁾, whilst it does not include a specific section dedicated to rural women, it does stress the need to establish specific policies for improving their situation focused on facilitating access to resources, work and training, markets, commerce and technology.

The International Labour Organization (ILO) regards the gender issue as a universal matter which must be addressed in all international labour laws and conventions as well as in the recommendations and resolutions of the International Labour Conference⁽⁸⁾. According to the ILO, women encounter

⁽⁷⁾ The Platform for Action is an agenda aimed at creating the necessary conditions for empowering the role of women in society. It was approved at the Fourth World Conference on Women, held in Beijing between 4 and 15 September 1995.

⁽⁸⁾ In the specific case of rural workers, the ILO has a series of Conventions addressing their rights: Convention 141 of 1975 on rural workers' organizations, Convention 11 of 1921 on the rights of association in agriculture, Convention 99 of 1951 on ways to set minimum

difficulties in the four pillars which underpin the concept of «Decent Work»: social protection, rights in the workplace, creation of employment and social dialogue.

The ILO has various instruments at its disposal for promoting both equality between men and women and the fight against discrimination. These include the *Discrimination (Employment and Occupation) Convention* of 1958⁽⁹⁾. It also has the «Bureau for Gender Equality» to deal specifically with gender issues in the workplace. As regards actions for promoting non-discrimination in the rural ambit, the ILO has launched various programmes to highlight the importance of addressing gender issues within this sector. Firstly because discrimination against women constitutes a violation of human rights and, secondly, because otherwise it will never be possible to eradicate extreme poverty⁽¹⁰⁾.

In addition, the UN General Assembly has, on various occasions, acknowledged the pivotal role played by rural women in agricultural development, food security and the eradication of poverty. Amongst the resolutions approved by the UN General Assembly concerning the situation of rural women, it is worth highlighting A/RES/62/136 which calls on Member States to improve the situation of rural women by ensuring their political and socioeconomic empowerment and mainstreaming the gender perspective in the rural ambit into the planning, application, monitoring and assessment of development policies, as well as ensuring that rural women have access to social services. This resolution gave rise to the proclamation of 15th October as the annual «International Day of Rural Women»⁽¹¹⁾. Since its creation in 2010, the UN Women Entity has also focused on the promotion of rural women.

The UN Commission on the Status of Women⁽¹²⁾ has addressed the situation of rural women on several occasions. The most recent instance occurred during its 56th session held in late February 2012. The priority theme of the session was «The empowerment of rural women and their role in poverty and hunger eradication, development and current challenges».

wage (agriculture), Convention 110 of 1958 on plantations and Convention 169 of 1989 on indigenous and tribal peoples.

⁽⁹⁾ All the conventions and recommendations are included in the document entitled «Gender Equality and Decent Work. Key ILO conventions and recommendations for gender equality 2012». ILO.

⁽¹⁰⁾ Statements by Jane Hodges, Director of the ILO Bureau for Gender Equality, to mark International Women's Day which, in 2012, was dedicated to rural women under the slogan «Empower Rural Women. End Hunger and Poverty. Release the Power of Rural Women».

⁽¹¹⁾ Resolutions A/RES/ 54/135 of 7 February 2000 and A/RES/56/129 of 30 January 2002 are predecessors of A/RES/62/136.

⁽¹²⁾ Commission on the Status of Women (CSW) was created by way of a UN Social and Economic Council resolution on 21st June 1946 as a functional commission under its control. It is in charge of policy-making aimed exclusively at promoting gender equality and the advancement of women.

The UN Economic and Social Council, in its ministerial declaration of 2010, also called for the launch of a joint action to support the economic empowerment of rural women.

All major international development frameworks also take into account the issues of gender and the empowerment of women. What is more, the feminisation of hunger is also a point of debate, along with the vital role played by women from such regions in the subsistence of their families. For instance, at the plenary meeting of the UN General Assembly held in 2010 for the review of the Millennium Goals, the Member States emphasised the importance of the role played by rural women in eradicating hunger and poverty as well as the need to ensure that women have equal access to productive resources.

The UN Conference on Sustainable Development held in June 2012, known as Rio+20, also stressed the importance *of the empowerment of women in rural areas as key players for improving agrarian and rural development as well as food and nutritional security*⁽¹³⁾.

Moreover, the specific UN organisations for the fight against poverty and hunger, namely the FAO⁽¹⁴⁾, the IFAD⁽¹⁵⁾ and the WFP⁽¹⁶⁾, undertake initiatives which specifically highlight the important role of rural women in reducing hunger and poverty. Examples of such measures are the «Sourcebook on Gender in Agriculture»⁽¹⁷⁾ published by the World Bank, FAO and IFAD along with the FAO report on «The State of Food and Agriculture, 2010-2011,» focusing on the need to «close the gender gap for the benefit of development» and underlining that *«achieving gender equality and empowering women in agriculture is not only the right thing to do. It is also crucial for agricultural development and food security»*.

As regards Europe, gender equality is one of the main objectives of the «Europe 2020» strategy. In the specific case of rural women, a concerted effort has been made over recent years to get the member states to establish policies aimed at improving their situation and their access to technologies as well as increasing their representation within public, economic and social bodies from the agricultural sector⁽¹⁸⁾.

Overall, it is true to say that the international community is making a normative effort, including the publication of recommendations acknowledging the importance of rural women in the fight against hunger and the development of poorer countries. But there is still a long way to go. Some countries have seen

⁽¹³⁾ A/CONF.216/L1.

⁽¹⁴⁾ FAO: International Food and Agriculture Organisation of the United Nations.

⁽¹⁵⁾ IFAD: International Fund for Agricultural Development.

⁽¹⁶⁾ WFP: World Food Programme.

⁽¹⁷⁾ Published 2009.

⁽¹⁸⁾ European Parliament resolutions 2009/C66E/04 and 2010/2054(INI).

improvements, which has meant greater participation from rural women in terms of public life, access to productive resources, employment opportunities or access to health care systems. However, the opinion of such women, based primarily on their experience, is still not taken into consideration when establishing specific policies, assigning resources or introducing systems for sustainable development⁽¹⁹⁾.

■ THE ROLE OF WOMEN IN AGRICULTURE

The role of women in agriculture and their situation in rural areas depends on their geographic region, social class, age and ethnicity.

Women in rural areas play a crucial role for the subsistence of their communities, though this role is not always acknowledged. They take care of domestic chores, such as collecting water and firewood, they do agricultural and livestock tasks and also sell any surplus from their harvests at local markets. What is more, they look after the care and education of their families.

Women also play a key role in animal husbandry, fishing and forestry, although their work receives less acknowledgment and their activities in these sectors generally prove less profitable than for men.

The proportion of women working in the agricultural sector varies from 20% in South America to almost 50% in certain parts of Africa and Asia. In South-East Asia, the Middle East and North Africa, the percentage of women working in this sector is greater than that of men. Furthermore, due to the migration of men to urban areas, women are taking on greater responsibilities and tasks in rural areas⁽²⁰⁾.

As regards Europe, around 42% of the 26.7 million people who work in agriculture are women and at least one in five holdings is run by women⁽²¹⁾, though their total areas tend to be slightly less than those run by men. In Spain, this subsidiary nature of women in agricultural holdings is reflected in the Social Security affiliation figures, which reveal that 75% of married women do not pay into the system⁽²²⁾.

Most rural women are not gainfully employed and, even when they are, their salaries are far lower than those of men. Generally speaking, in developing countries those holdings run by women underperform in comparison to those

⁽¹⁹⁾ EGM/RW/2011/INF.1, Jun2 2011.

⁽²⁰⁾ Report entitled «The State of Food and Agriculture», 2010-2011. FAO.

⁽²¹⁾ 2010/2054 (INI).

⁽²²⁾ Data obtained from the document entitled «The Joint Ownership of Farms» issued by FEMUR and available at <http://www.femur.es/documentos-de-interes/la-cotitularidad-en-las-explotaciones-agrarias.html>



Figure 1. Report: The State of food and agriculture 2012-2011.

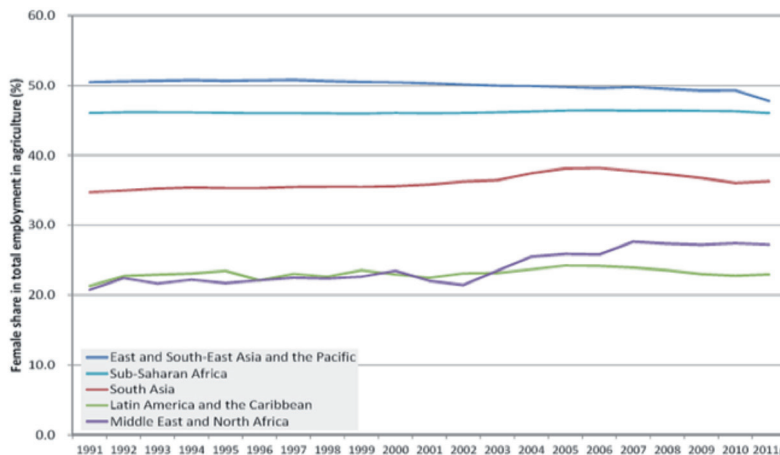


Figure 2. Source: Global Employment Trends 2011.

run by men due to the fact that women have more limited access to productive resources and have less opportunities.

However, it is when we talk about nutrition and food security that all their domestic labours come to light. Women cultivate, look after the livestock, select and prepare the food. What is more, any income they may obtain from selling surplus goods is invested back into the family in the form of food, education or health care.

Today, opportunities are being created for women to take the helm as regards changes within the agricultural sector, such as the production of new crops, new technologies and new markets. It is not a question of carrying out traditional agriculture but rather that women should have access to knowledge and technology which enables them to achieve greater performance in their tasks. It is essential to study those avenues which may allow the empowerment of rural women through their acquiring greater protagonism in social and economic relations.

■ **The Gender Gap as Regards Access to Productive Resources, Technology, Markets and Financing**

Major differences still exist between men and women in terms of access to resources, including the most basic ones such as land and water⁽²³⁾. And sometimes, even when such resources are available, they are of lesser quality, as in the case of land. Less than 20% of the world's agricultural landowners are women. This percentage drops to 5% in North Africa and Western Asia. In sub-Saharan Africa, they make up around 15%⁽²⁴⁾.

Access to productive land is essential because if women do not have secure land rights, they cannot enjoy access to credit and loans, rural organisations or certain services and agri-inputs. Yet ownership of land also means something else: it is an acknowledgment of a social position that enables them to ensure their status in the event of widowhood, separation, abandonment or divorce.

The lack of ownership rights or access to loans and credit suffered by rural women directly affects the well-being of their families. The number of malnourished children is 60% higher when there is no ownership of the land. And when there is no access to loans and credit, this figure rises to 85%⁽²⁵⁾.

In some countries, despite there being a legal framework which provides for gender equality as regards access to land titles, women fail to exercise their rights due to a lack of knowledge or awareness as to the importance of gender mainstreaming in land management.

In many cases, the Land Administration Institutions have long, complex and costly procedures. This creates a barrier, since women in developing countries have less geographical mobility, less resources, more limited access to information and, in general, enjoy a lesser status.

⁽²³⁾ According to data provided during Session 56 of the CSW, the women of sub-Saharan Africa jointly invest some 40 billion hours a year towards providing water for themselves and their families. Women in Guinea spend 5.7 hours a week searching for water, while men spend 2.3 hours; in Sierra Leone, the average is 7.3 hours for women and 4.5 for men and, in Malawi, the figure is 9.1 for women and 1.1 for men.

⁽²⁴⁾ CSW56. Facts and figures on rural women.

⁽²⁵⁾ OECD. «Gender inequality and the MDGs: What are the missing dimensions? 2010.

Various formulae exist for promoting the registration of land ownership on behalf of women. In India, for instance, property tax has been lowered from 8% to 6% when land is registered in a woman's name. And in Nepal, the government has reduced taxes by 40% for women who register land ownership⁽²⁶⁾.

In the case of Spain, Law 35/2011 on «Shared Ownership of Agricultural Enterprises» acknowledges that gender equality in rural areas is a slow process and that holdings owned by women tend to be economically smaller and less profitable.

This law is intended to regulate shared ownership of agricultural enterprises in order to promote and support real and effective equality for women in rural areas through the legal and economic acknowledgment of the part they play in agricultural activity.

And in the case of non-constitution of shared ownership, its objective *is to regulate the resultant economic rights in favour of the spouse or person with whom there is a similar relationship over the proprietor of the agricultural enterprise as compensation for their effective and regular agricultural activity in the enterprise.*

In general terms, the promoting of women's land rights should focus on the following lines of action⁽²⁷⁾:

- Raising awareness as to the importance of ownership rights through activities aimed at facilitating the necessary information.
- Claiming of rights. It is not only important to know your rights, but also to exercise them. In this section, it is important to highlight collective actions and the role of women's associations.
- Ensuring fulfilment of rights. Through adequate implementation of the legal framework and by expediting the administrative procedures.

■ Access to Financial Services and Markets

An additional problem which women must address is the difficulty of access to certain services such as financial aid and agricultural extension, technology, the acquisition of improved seeds or specific agri-inputs. Access to domestic and international markets is a key factor for many small farmers in order to generate income, increase the productivity of their holdings, generate economic growth in rural areas and combat hunger and poverty.

⁽²⁶⁾ More examples are available at: <http://www.landcoalition.org/sites/default/files/publication/1242/ILC%20CSW%20online%20discussion%20synthesis-ES.pdf>

⁽²⁷⁾ Conclusions extracted from an online enquiry made by «International Land Coalition» on the subject: How can women's land rights be assured?

Rural women's access to financial resources is a key factor for developing any agricultural development strategies. Traditionally, such resources, with the exception of certain microcredit programmes, have been focused on the male sector and the specific needs of rural women have been largely neglected. This is mainly due to the fact that the value of the land is the primary guarantee for obtaining a rural loan, whereby only approximately 10% of such loans are granted to women⁽²⁸⁾.

This lack of neutrality is due to various factors. In developing countries, women tend not to be the land owners. Furthermore, great emphasis is placed on the roles performed by men and women in the rural sector, in which men deal with the more large-scale agricultural investments and are regarded as being the main source of income and, therefore, better customers. Moreover, the lack of mobility of women due primarily to their responsibilities as regards domestic chores and caring for their families prevents them from gaining greater knowledge of the financial products available in their regions. In some cases, the cultural factor plays a major role due to the constraints on women's ability to talk to men, thus impeding their access to commercial agents.

We must also take into account that rural women in certain countries are less educated, thus impeding their understanding of clauses in financial product contracts, which can often be rather complex.

This gender gap is bridged when the husband acts as an intermediary, but when this option is not viable it becomes especially worrying.

The main financial services required for rural development include loans, savings products and insurance. Access to such resources means that farmers, and especially women, have protection against lost harvests due to weather conditions and against food price fluctuations, as well as providing them with a means to increase the scale of their operations and gain access to new markets and agricultural extension services. It also enables them to reduce the risk of lower-than-expected performance from certain crops adapted to climate change by way of improved seeds. Access to microloans may lead to investment in agricultural technology or electricity generation systems which increase the profitability of their holdings.

Earnings obtained by rural women have a positive knock-on effect for the well-being of their families and communities, though for cultural reasons or due to their own family environment they do not always manage the savings arising from agricultural activity. One way to avoid this problem has been to set up so-called «poor people's banks» such as Rotating credit and Savings Associations

⁽²⁸⁾ «Women 2000 and Beyond». October 2008.

(ROSCAs)⁽²⁹⁾. Such associations are most common in Asia and Africa and consist of groups, some exclusively comprised of women, who agree to pool their savings in order to create a fund to be used when the need arises.

Access to financial resources can also allow women to play a more active role in decision-taking within their family's economic activity concerning such matters as crop type, the use of new seeds, the introduction of irrigation agriculture, how to sell products, what type of livestock to buy, management of savings or the school attendance of their children, especially girls.

In order to resolve these issues, it is essential to get the financial sector involved so that reforms are carried out aimed at making changes to the regulation of their services, at an organisational level, the design of new products adapted to the specific needs of rural women and the introduction of new technologies⁽³⁰⁾.

The salaries of rural women are, on average, 25% lower than those of men⁽³¹⁾. The lack of information and the imposing of traditional social rules restrict rural women from having sufficient capacity to gain access to other sectors and achieve higher incomes.

With regard to access to markets, rural women in developing countries face the same difficulties as when attempting to access financial resources: lack of information, difficulties in the process of negotiating prices with buyers and lack of mobility.

In order to facilitate the opening of new local, domestic and international markets, the collaboration of international organisations and greater involvement from the private sector is crucial. By way of example, the yucca, which has traditionally been grown by women as a subsistence crop, can be used as a basic industrial product such as for producing baking flour or as an adhesive for the timber industry⁽³²⁾.

⁽²⁹⁾ KONGOLO M. «Women and Informal credit: lessons from Moterele, South Africa». *Journal of International Women's Studies*. Vol. 4. 2007.

⁽³⁰⁾ For more details on these proposals, see: Rural women's access to financial services. ESA Working paper n° 11-07. March 2011.

⁽³¹⁾ Data taken from «Empowering Rural Women. End Hunger and Poverty» issued by the International Labour Organization to mark International Women's Day.

⁽³²⁾ The project entitled «Sustainable use of the yucca as a basic industrial product» undertaken in Ghana has allowed women to have access to new markets for yucca products. World Bank 2008.

■ THE PRESENCE OF WOMEN IN ORGANISATIONS

The presence of women in agricultural organisations generally oscillates between 30% and 50%, although these percentages fall drastically when we talk about the presence of women in senior managerial positions⁽³³⁾. Their lack of power within associations means that proposals put forward by rural women in the creation of agricultural policies and programmes are seldom considered.

Women's associations play a crucial role in bridging the gender gap that exists within such an important factor as information. They constitute a stepping stone between individual women and international organisations in order to promote the launch of rural women empowerment and development programmes⁽³⁴⁾.

Proposals have been made to increase women's representation and promote their leadership in agricultural associations. The FIDA and the Women Organizing for Change in Agriculture and Natural Resource Management (WOCAN) have promoted experimental rural women leadership programmes in the Philippines and Nepal⁽³⁵⁾.

Rural women's associations can also play a major role in fostering the development of rural policies. Such is the case of the Soulaliyat women from the Kenitra province of Morocco, whose mobilisation campaign for collective land rights undertaken in 2010 culminated in a circular issued by the Ministry of the Interior urging provincial authorities to ensure that the principles of gender equality are upheld in the transfer of communal land. This led to the recognition of women's rights to inherit communal land and obtain money for the use of land belonging to them but which had been privatised, thus putting at risk their primary means of subsistence.

In Africa, special mention should be given to the RMW (Rural Women's Movement) encompassing 500 associations of indigenous women and whose actions are focused on land ownership rights.

In India, the SEWA Association brings together self-employed women working on small holdings or in small companies and who constitute a particularly vulnerable collective which includes women working in agriculture.

The European Union also stresses the importance of farmers' and women's organisations as a means of sharing new programmes aimed at diversifying

⁽³³⁾ Report E/CN.6/2012/4 of the UN Economic and Social Council cites the example of the Asian Farmers' Association where women are present in nine of its ten partner organisations but none include women amongst their senior managerial positions.

⁽³⁴⁾ The «International Directory of Women's Organisations» contains over 2000 women's associations from all ambits, including rural.

⁽³⁵⁾ Report E/CN.6/2012/4.

production and providing knowledge on and access to certain services and technologies⁽³⁶⁾.

Finally, we should mention the Dimitra project⁽³⁷⁾ launched by the European Commission in 1994 and which has been managed by the FAO since 1998. This project is a participatory information and communication project which contributes to improving the visibility of rural populations, African women in particular. The project is based on three pillars:

- partnership with local organisations
- active participation of civil society
- knowledge supporting the exchange of good practices, ideas and experiences.

■ WOMEN AND AGRICULTURAL BIODIVERSITY

Agriculture helps to maintain biodiversity, yet is also one of the primary activities which may lead to its loss. Many modern agricultural practices aimed at high crop yields are endangering the biodiversity in our crops, due mainly to single-crop systems which do not allow for rotation, the use of improved varieties or hybrids to the detriment of traditional ones and the overuse of pesticides, herbicides, fungicides and insecticides⁽³⁸⁾.

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To achieve food security, agricultural systems must undergo a transformation in order to meet such 21st-century challenges as climate change and rising population. Within this process, conservation of agricultural biodiversity has become a necessary tool in the processes of adaption to climate change.

Farmers, especially those involved in small-scale cultivation, possess the appropriate skills for both managing and preserving biodiversity. Amongst such farmers, rural women have traditionally been in charge of storing food and seeds, adapting crops to the external conditions and passing on their knowledge from one generation to the next.

The Convention on Biological Diversity recognises «the vital role that women play in the conservation and sustainable use of biological diversity» and affirms «the need for the full participation of women at all levels of policy-making and implementation for biological diversity conservation».

⁽³⁶⁾ 2010/2054 (INI).

⁽³⁷⁾ <http://www.fao.org/dimitra/dimitra-publications/en/>

⁽³⁸⁾ According to the FAO, around 75% of plant genetic diversity has been lost since the beginning of the century as farmers around the world have forsaken their own multiple local varieties in favour of high-yield, genetically uniform varieties.

Wherever there is subsistence agriculture, women collect and store seeds as if it were a ritual and their family's nutrition depended on it. Women have traditionally been in charge of choosing, improving and adapting the different varieties of crops.

This decision-making process in the proper choice and use of seeds is a complex one as it encompasses various factors such as resistance to plagues and disease, adaptation to climatic conditions, the nutritional quality of the resulting food as well as subsequent storage requirements⁽³⁹⁾.

Therefore, it would appear obvious that women have a role to play in the conservation of agricultural diversity and that this knowledge should be taken into consideration when making policies aimed at ensuring food security.

■ CONCLUSIONS

The rural woman plays an essential role in the fight against hunger and poverty. Yet this role is far from being recognised. Lack of access to productive resources, markets and sources of financing means that the full potential of women for ensuring food security cannot be exploited. Moreover, there are other factors which affect women more directly, such as climate change, which makes them even more vulnerable.

Despite the fact that gender issues are being promoted by the different international organisations, rural women today do not yet hold senior decision-making positions when it comes to establishing policies related to the challenges facing the world food system. It is essential for commercial and agricultural policies to take into consideration the gender issue and non-discrimination.

Impetus can be found for achieving the empowerment of rural women if, when deciding upon the funding of sustainable development projects, those which address the gender issue are given greater consideration.

The sustainable management of water resources is an issue which is closely linked to the fight against hunger and poverty. In this point, as in all other points raised in this chapter, women also play a crucial role.

Rural women must be both heard and supported if we are to eradicate poverty and hunger as well as achieve sustainable peace and development⁽⁴⁰⁾.

⁽³⁹⁾ <http://www.fao.org/sd/nrm/Women%20-%20Users.pdf>

⁽⁴⁰⁾ Opening statement by Michelle Bachelet – 56th session of the Commission on the Status of Women.

CHAPTER FOUR

BIODIVERSITY AND SECURITY

José Esquinas Alcázar ⁽¹⁾

ABSTRACT:

Agricultural biodiversity, which is crucial to feed humanity, for the environment and sustainable development, is being lost at an alarming rate. Considering the enormous interdependence of countries and generations on this diversity, its loss raises socioeconomic, ethical, political and strategic questions that are capable of endangering Food Security, National Sovereignty and Global Security. The negotiation and ratification of a binding international treaty for countries and the development of technologies to conserve and use these resources more effectively are some reasons for hope, but it is necessary to act now before it is too late. This chapter also identifies the challenges that we face in this area and makes recommendations to the national and international level to overcome them successfully.

Key words:

Agricultural biodiversity, ABD, Plant Genetic Resources for Food and Agriculture, PGRFA, germplasm, World Security, Food Security, Biopiracy, International Cooperation, Bioespionage.

⁽¹⁾ The author wishes to thank José Luis Vivero, Esteban Esquinas, Santos Castro and María del Mar Hidalgo for their valuable comments and ideas during the preparation of this document, and Pepa Palma for her irreplaceable support in creating the tables and edition of the text.

■ INTRODUCTION

The non-specialised reader may ask what a chapter on Agricultural Biodiversity (ABD) does in a book about Global Security and Food Security. In this introduction we attempt to illustrate the strategic importance of conservation and access to ABD for Food Security and therefore for Global Security.

ABD and its genetic resources represent the basis for agricultural development and at the same time a genetic adaptation storehouse which acts as a buffer against environmental and climate change. The erosion of these resources poses a threat to world food security. The need to conserve and use plant genetic resources as a guarantee for an unpredictable future is well recognised. The prospect of decreasing plant genetic diversity, together with the increased demand for these resources, has become the focus of environmental and sustainable development debates worldwide.

From the utilitarian agricultural point of view, genetic resources can be considered limited and perishable natural resources. They provide the raw material (genes) which, when used and combined correctly, produce new and improved plant varieties, and are an irreplaceable source of traits such as resistance to disease, local adaptation and productivity. Genetic resources are now, and will continue to be in the future, of great value, whether used by scientists for conventional plant improvement or for modern genetic engineering. These genes are dispersed throughout local cultivars and wild plant populations that have been selected over thousands of years, respectively by farmers and nature, for their traits of adaptation, resistance and/or productivity.

In recent years the development of new technologies, the replacement of local varieties with imported ones, the colonisation of new lands, the changes in cultivation methods, etc. have caused a rapid and dramatic genetic erosion of plants. This affects both cultivated and wild species that offer direct, indirect or potential agricultural contributions. The erosion of these resources could lead to the extinction of valuable material that has not yet been cultivated. The path to a constant increase in production and quality of food necessarily passes through the protection and efficient use of plant genetic resources, which requires their conservation, evaluation, documentation and exchange.

In a certain way, the history of humanity is represented in the history of the exchange of genetic resources. The fight for access to useful plants for agriculture and food from other places has been one of the principal motivations of human exploration since the beginning of time, and has often given rise to encounters and alliances as well as conflicts and wars between different cultures.

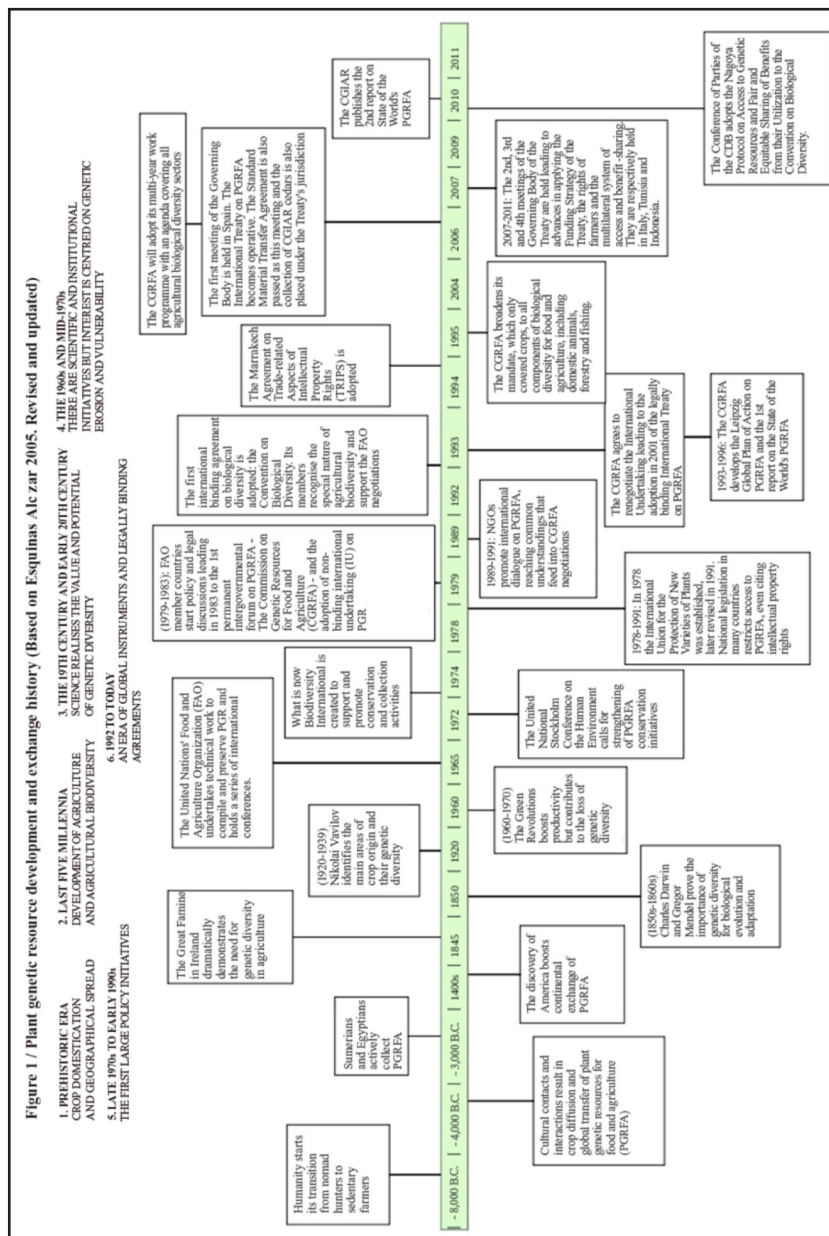


Figure 1⁽²⁾

⁽²⁾ ESQUINAS-ALCÁZAR, J. 2005. Protecting crop genetic diversity for food security: political, ethical and technical challenges. *Nature Rev. Genet.* 6:946-953.

This chapter will help us to illustrate the strategic importance given to ABD throughout history. Many examples demonstrate the recognition of the strategic value of genetic resources to reduce vulnerability and to increase the adaptive capacity of nations and people, and precisely how, because of its value, ABD has often been subject of embargoes, espionage, counterintelligence, biopiracy and bioterrorism.

The discovery of America itself was accidental as the real objective of Christopher Columbus's voyage was to find a shorter route to India in order to facilitate the trade and exchange of spices and Asian food species. The arrival in America, nevertheless, allowed introducing in the old world crops as valuable as beans, tomatoes, peppers, tobacco, maize, and potatoes. It is precisely the potato that gave us, centuries later, one of the most illustrative examples of the importance that access has, not just to the species but also to the genetic diversity of its traditional varieties, to prevent and fight against famine.

The notorious «famine» that ravaged Europe in the 1840-50s, causing the death of millions of people, was most devastating in Ireland where more than two million Irish died of starvation and many others were forced to emigrate to the USA. Most people are unaware that the cause of this famine was the lack of genetic diversity of the potatoes cultivated in Europe, originated from uniform material brought from Latin America in the 16th century. In the 19th century the potato had become the basis of the Irish diet and a violent and massive attack of blight (*Phytophora infestans*) devastated the European potato crop. To solve the problem it was necessary to locate blight resistance genes and to introduce them in the commercial varieties used in Europe. These genes were found in numerous traditional varieties of potato cultivated by Andean farmers in Peru, Bolivia and Ecuador. This example shows the danger of basing the national production of a crop on a small number of uniform and interrelated varieties. It also shows the need to have access to heterogeneous original material, often located beyond our borders, where to look for resistances and desired traits.

Another illustrative example of the strategic importance of biological diversity occurred in the late 19th and early 20th centuries with natural rubber derived from *Hevea brasiliensis*, a species with its centre of origin and diversity in the Amazon region. The rubber trade for vehicle tires and other industrial uses in the late 19th century made Manaus a very important trade centre and placed Brazil on the economic map of the world. In 1876 Henry Alexander Wickham had smuggled tens of thousands of seeds of different rubber trees from the Tapajos River area in the rainforests of Brazil and had given them to English scientists at the Kew Royal Botanical Gardens, from which 30 years later they were taken to the Imperial British colonies in Asia for commercial production. With the high production of rubber in South-East Asia, the extraction of Amazonian rubber began to decrease. At the height of the industrial revolution, this operation brought about the largest

economic and social catastrophe in the Amazon basin, ruining the economy of Brazil and other countries on the border of the Amazon and converted Great Britain, through its South-East Asian colonies, in the biggest rubber exporter on the eve of the First World War⁽³⁾. Many Brazilians consider this to be the first documented case of what is today known as biopiracy. Furthermore, some believe that the increased virulence of a disease that destroyed the rubber trees in the middle of the Amazon rainforest was provoked, and they link it to the beginning of commercial production of large rubber plantations in the aforementioned Asian colonies. It is not strange that in Brazil ABD is considered today one of the strategic resources of national interest and that the Ministry of Defence is part of the *Conselho Nacional de Gestão do Patrimônio Genético* (CGEN) (Genetic Heritage Management Council)⁽⁴⁾, the upper deliberative and policymaking body regarding access and conservation of Genetic Resources⁽⁵⁾.

The World War II was also witness of the strategic importance given by both sides to ABD and genetic resources of cultivated plants. Control of the world's most important collection, consisting of several hundreds of thousands varieties of major crops from all over the world and maintained in the Pavlovsk station⁽⁶⁾ (since 1992, the Vavilov Research Institute -VIR-) in Leningrad (now Saint Petersburg) was an important objective for both the Germans and the Allied forces.

The Germans established, within the SS, a commando unit for genetic resource collection ('*Sammelkommando*') led by lieutenant Heinz Brücher, a botanist and a geneticist, and capitan Konrad von Rauch. The function of the commando unit was the collection of PGR in territories occupied by German troops, and above all, the seizure of the collections in the Pavlovsk station in Leningrad. While they were never able to seize the hundreds of thousands of samples of the original collection during the siege of Leningrad, they took numerous duplicates of the collection that were conserved in the experimental agricultural stations of the occupied territories in Ukraine and Crimea. The several thousand collections seized of major crops were transported and cultivated with the help of prisoners of war in the experimental stations of the Plant Genetics

⁽³⁾ TADEO FERREIRA, LUCAS. El caucho en el Brasil. Photos: Sueli Correa Marques de Mello and Embrapa, Rondônia. Biotecnologia Ciência & Desenvolvimento. Sept.-Oct. 1999, Year 2. Number 10. p. 20 – 22.

JACKSON, Joe (2008). *The Thief at the End of the World: Rubber, Power, and the Seeds of Empire*. Viking. Penguin Group, 2008, p. 421.

⁽⁴⁾ Interim Measure n° 2.186-16 of 2001 governed by Decree n° 3.945 of 2001 (modified by Decree n° 4.946/03).

⁽⁵⁾ MINISTRY OF THE ENVIRONMENT, DEPARTMENT OF GENETIC HERITAGE. Regras para o Acesso Legal ao Patrimônio Genético e Conhecimento Tradicional Associado. Brasília DF, April/2005.

⁽⁶⁾ The Pavlovsk station in the USSR was founded in 1926 to conserve the most important collections of plant genetic resources in the world. The collections, over 300,000 samples, came from the numerous botanical expeditions by famous geneticist and scientist Nikolai Vavilov and his team during the 1920s and 1930s around the world, while developing his theory on the centres of origin of cultivated crops. Unable to fulfil his dream of ending world hunger, Vavilov was considered an enemy of the state in 1943 and died in a concentration camp.

Institute that the SS had in Lannach, Austria. In 1945, when the Russian front collapsed and the Soviet tanks were already in Warsaw and Budapest, Brücher was ordered by the SS to destroy all collections so they would not be captured by American and Soviet troops. However, Brücher refused to follow the order and hid some of the samples on farms in the villages near Lannach. At the fall of the Third Reich, and although many elite SS members were executed after their defeat, Brücher survived by agreeing to work for the American occupation forces. In 1947, Heinz Brücher himself recovered some of the collections sent to West Germany, most likely to genebanks in Braunschweig and Gatersleben. He also sent some samples to other countries such as the United States and the United Kingdom, as well as to private companies. In 1948 he went to Sweden and from there to Argentina, a refuge for many exiled Nazis. There he worked as a professor of botany and a plant breeder. Later, he visited several Latin American and African countries. There is documented evidence that at the end of the 1950s he sent collections of Latin American potatoes to the USSR. Heinz was accused of espionage and counterespionage in relation to genetic resources. In the end, he was killed in Mendoza, Argentina, in 1991 and to this day, the exact cause of his death has not been determined⁽⁷⁾.

Now we will see from the side of the Allied how it was possible and at what cost saving the original collections of the Pavlovsk station by first preventing them from falling into the hands of the invaders, and then protecting them from the besieged and starving population. When the Germans besieged Leningrad (now Saint Petersburg) in 1941, the Soviet authorities, aware of its enormous strategic importance, ordered the scientists in charge of the Vavilov collections to move them from the Pavlovsk station to other places out of reach of the invaders. A few days later, the Germans occupied the research centre and proceeded to cut off all exits from the city of Leningrad, a siege that lasted 872 days and that cost the lives of more than a million people. The Pavlovsk station fell into German hands during the siege of Leningrad, but before the troops arrived, the scientists, with the help of a military unit, were able to move on trains and in army trucks, the majority (over 100,000 seed samples weighing about 5 tons) of the collections of the station for safe storage in a building on Saint Isaac's Square. Another part

⁽⁷⁾ BRUMMITT, R.K. & POWELL, C.E., *Authors Plant Names*, Royal Botanical Gardens, 1992, p. 88.

DEICHMANN, Ute. Deichmann. Translated by T. Dunlap, *Biologists under Hitler*, 1996

GADE, D.W. Gade. Converging Ethnobiology and Ethnobiography: Cultivated Plants, Heinz Brücher, and Nazi Ideology, *Journal of Ethnobiology*, 2006, 261, p. 82-106

HAWKES, J.G. & HJERTING, J.P. *The Potatoes of Argentina, Brazil, Paraguay and Uruguay: a Biosystematic Study*. Oxford University Press, Oxford, 1969.

JSTOR PLANT SCIENCE. Collection: Plant Collectors: Brücher, Heinz 1915-1991 [online] [Accessed: 4 July 2012] Available at: <http://plants.jstor.org/person/bm000011112>

LANJOUW, J. & STAFLEU, F.A. *Index Herb. Coll. A-D*, 1954, p. 102

PEARCE, F. The great seed blitzkrieg. *New Scientist*, 2008, 2638, p. 39-41

THORNSTROM, CARL-GUSTAF & HOSSFELD, UWE. Instant appropriation - Heinz Brücher and the SS botanical collecting commando to Russia. *Plant Genetic Resources Newsletter*, FAO Bioversity, March 2002, Item 129, p. 54-57.

was transferred as hand luggage by employees evacuated. The winter of 1941 was especially cold and cruel. From then on, all food supplies to the city were cut. When the starving inhabitants of the city, who had heard that there were thousands of edible seed varieties, besieged the collections with the intention of obtaining food, a small group of scientists defended them from within. Twelve of them died of hunger before giving up or eating part of the agricultural biodiversity that was considered vital to the survival of humanity. Amongst them, Abraham Kameraz died surrounded by countless varieties of rice and Olga Voskrensenkaia succumbed in the basement in front of a large collection of potatoes. Similar fate befell A.G. Stuchkin, peanut specialist, and D.S. Ivanov, rice specialist; G.K. Kreier, laboratory chief, L.M. Rodine, curator of the collection of oats, and other workers such as M. Shcheglov, G. Kovalevsky, A. Malygina, A. Korzun, died of starvation surrounded by thousands of packets of grain, seeds and nutritious tubers⁽⁸⁾. Only many years after the World War was over were these men and women recognised as heroes⁽⁹⁾.

The islands are especially vulnerable to the lack of biological and agricultural diversity, and susceptible to pests and crop diseases. In Cuba there is a belief that the appearance, almost simultaneous, in the late 70s of a sugarcane rust, the tobacco blue mould, and eventually the swine fever attacks, which decimated the production of the two primary commercial crops and pork meat for the local population with devastating economic effects, was not coincidental, but part of a biological war orchestrated from outside aimed at destroying the most important part of Cuban monoculture-based agriculture, bringing the country to its knees. Whether coincidence or intentional, the agricultural disaster of 1979 taught the Cuban people an unforgettable lesson: that homogeneity increases vulnerability and that there is consequently a strategic need to diversify agricultural production, both in terms of number of species and the varieties or breeds within each species. In fact, the national production of the three affected species was based on a very reduced number of uniform varieties and breeds that were susceptible to the diseases mentioned⁽¹⁰⁾.

The political and strategic importance of ABD is also evident in the fact that food embargoes, still imposed today for political reasons on some countries, include the blockade of ABD or Plant Genetic Resources for Food and Agriculture (PGRFA) necessary for their agricultural development.

⁽⁸⁾ KRIVCHENKO, V.I. & ALEXANYAN, S.M. Vavilov Institute scientists heroically preserve world plant genetic resources collection during World War II siege of Leningrad. *Diversity*, 1991, 7(4):p.10-13.

LOSKUTOV, IGOR C. Vavilov and his institute. A history of the world collection of plant genetic resources in Russia. International Plant Genetic Resources Institute, Rome (Italy), 1999.

OSAZHDENOM, V. Leningrad. Lenizdat, 1969.

⁽⁹⁾ In more recent times, international recognition has continued both for them and their successors in office, as is the case of Dr. M. M. Girenko, who received the International Slow Food Award in 2000 for the Defence of Biodiversity

⁽¹⁰⁾ FOOD AND AGRICULTURE ORGANISATION OF THE UNITED NATIONS. State of the World Plant Genetic Resources for Food and Agriculture. 1998. [online] [Accessed: 4 July 2012] Available at: <http://www.fao.org/agriculture/crops/core-themes/theme/seeds-pgr/sow/en/>

The previous examples show how Food Security and finally Global Security are tied to the conservation and access to ABD. Also to ensure our National Sovereignty we must always maintain the capacity to produce our own food and this depends on the ABD, which is needed to confront changing socio-economic and environmental conditions. In this context we cannot ignore that our agriculture depends more than 80% on genetic resources from abroad and that the average dependence for NATO member countries is around 87% (see Figure 5 below).

It must be added that, due to the standardisation / homogenisation of agriculture, in the 20th century we have lost, on a global scale, more than 90% of the diversity of major crops that existed at the beginning of the century and that no country in the world is self-sufficient as regards the agricultural biodiversity needed to feed its population. Consequently, at present, international cooperation for the conservation and access to PGRFA is not an option but a necessity, with strong socio-economic, legal, political and ethical implications⁽¹¹⁾.

It is not strange then that in recent decades, this has been subject of debate at the UN, where international agreements and regulations have been negotiated and produced, amongst which it stands out for its binding nature the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) approved by the FAO in 2001 and ratified by the Spanish parliament in 2004.

In general, we can say that Diversity, be it biological, cultural, technological, based on knowledge, traditions, identities, etc. is necessary in order to broaden options and to maintain the capacity to adapt to unpredictable and changing environmental conditions and human needs. Maintaining diversity reduces vulnerability and provides a buffer and an outlet to absorb the changes and ensure that the errors we make are not irreversible. If some consider the 20th century as the century of uniformity and standardisation, the 21st century must be the century of diversity or simply it will not be.

■ AGRICULTURAL BIODIVERSITY AND ITS GENETIC RESOURCES AS THE BASIS OF WORLD FOOD SECURITY

■ ABD Development

The age of the Earth is estimated at about 5 billion years, and the appearance of the first signs of life on our planet goes back more than 3 billion years. The appearance of *Homo sapiens* is a relatively recent event, which took place less than a million years ago. Agriculture is a more modern phenomenon, barely 10,000 years old,

⁽¹¹⁾ ESQUINAS-ALCÁZAR, J. 2009. *Biodiversidad Agrícola, Biotecnología y Bioética en la lucha contra el hambre y la pobreza*. Revista Latinoamericana de Bioética 9(1): 102-113.

which arose when humans began to cultivate wild plants with a food value. This triggered an evolutionary process that has created countless varieties adapted to local conditions, which today constitute an incalculable reserve of genetic material.

Until they have reached this final stage, the evolutionary processes of the earth were controlled only by natural selection that designed the extant genetic variability produced by mutations, migration and recombination. The appearance of agriculture marked the domestication of the species of greatest interest to humanity. Natural selection now works alongside «artificial» selection. As a consequence, the evolution of these species was run by and for men.

Even though it is most likely that agriculture began independently in various parts of the world, the best known is the process that occurred in the Middle East and Central America. The first domesticated plants were cereals, legumes and other species used for their fruits or roots. These and other crops have been expanded and adapted to their present ecological limits, at first transported by migratory movements, and later through trade routes, often over great distances.

When the first crops were brought to new regions, they found major differences in climate, soil and other environmental factors. The natural geographic barriers often separated and isolated farming populations. The genetic variants that appeared in some populations were developed freely and independently; some of them grew like weeds amongst or around crops, which led to the creation of even more variable populations able to tolerate extreme conditions of cold, drought, pests and diseases. Thousands of years of selection by farmers and nature have produced local varieties and genotypes adapted to different locations and agricultural practices which were determined by climate and other environmental factors. Today, the spectrum of invaluable variation is enormous and this visible variation hides an even greater genetic diversity. To the inter-varietal variation it should be added a broad intra-varietal variation, which is the cause of the well-known morphologic heterogeneity of original breeds. This heterogeneity, which reflects local adaptation, also exists for other traits that are not readily observable, such as resistance to diseases, cold or heat, humidity or drought, oil and protein content, amino acid composition, etc.

■ The Increasing Loss of ABD And the Danger it Represents

Until somewhat recently, a steady increase in diversity was favoured. However, in the last several years, many factors have contributed to a drastic reversal of this trend. The industrial development and the subsequent migration of agricultural labour to industry, combined with the increasingly marked separation between production and consumption areas, tend to eliminate self-sufficient agricultural production units. This adds a new dimension to transportation and commercialisation of agricultural products, promoting the homogenisation and

standardisation of crop varieties. Moreover, the increasing mechanisation of agricultural activities and operations requires varieties with uniform traits for planting needs, harvest periods, etc. The mechanization of postharvest processes is based on machinery designed for standardised crops and fruit plants.

Based on market demand, plant breeders of commercial seed companies, as well as national and international institutes, have joined forces to provide new uniform varieties, which are generally more productive, to replace the wide selection of heterogeneous and original varieties best adapted to the needs of previous times. This phenomenon is occurring or has occurred in developing and developed countries both in the East and in the West.

Nevertheless, we should not forget that the heterogeneous varieties of the past are still raw material for plant breeders. These varieties are the foundation for the creation of new varieties through patient and careful selection of plants that carry the desired traits. Subsequently, through a long process of crosses and selecting amongst progenies, all of these traits are combined in a uniform commercial variety. This variety, especially in self-pollinating plants and those that are vegetatively propagated, is reproduced generation after generation and its evolution is practically negligible. It can be said that it remains fixed in a mould set by the plant breeder.

Plant breeding based on controlled crosses and not on the simple selection of genotypes in the field, began in the 18th and the 19th centuries in Europe. At the beginning of the 20th century, many of the cultivated areas of industrialised Europe and North America were planted with varieties that had been obtained or selected by professional plant breeders. However, until the 1940s, this process barely affected regions in warmer areas that contain the greatest genetic diversity. Around 1950, the intense and generalised agricultural development - mostly financed by international aid programmes - began to reduce the areas dedicated to primitive landraces, and the need to conserve the remaining genetic variability began to be recognised. This need became more evident in the 1960s, when millions of hectares in Asia and the Near East (where many centres of diversity of major crops are found) were planted with commercial varieties of semi-dwarf wheat, whilst new rice varieties were being introduced in the plains of southeastern Asia, and modern cultivation methods were expanding in South America and Africa.

Nobody can deny, however, that much of the current global population, growing and malnourished, depends on the introduction of improvements, high yielding varieties and also that this is a key element in the fight against hunger. In this context, the «green revolution» allowed an enormous increase in the productivity of the most important crops during the 1960s and 1970s (Figure 2 illustrates the increase in agricultural productivity and the loss of genetic diversity in recent decades).

This increase has made it possible to boost global food production, but at a very high cost, which may further increase in the future, since there is a greater dependence on energy and technology, and expensive inputs such as fertilisers, pesticides, irrigation, etc.

On the other hand, we cannot ignore that in the effort to increase production, we are removing Nature and the farmer the most important security mechanism provided to them through the ages: diversity.

Figure 2: Increase in agricultural productivity and loss of genetic diversity

TABLE: Average production (kg/ha) performance for the 6 main crops

	1961	1961-70	1971-80	1981-90	1991-00	2000-07
WHEAT	1.089	2.208	1.855	2.561	2.720	2.792
BARLEY	1.328	2.202	1.998	2.412	2.442	2.406
RICE	1.869	3.138	2.748	3.528	3.885	4.152
MAIZE	1.869	3.417	3.154	3.680	4.242	4.971
SOYA	1.129	1.748	1.600	1.896	2.171	2.278
POTATO	12.216	14.738	12.817	15.129	16.339	16.647

Source: FAO agricultural production statistics.

This table shows the dramatic increase in crop production over recent decades. This is mainly due to the use of a series of high-yield varieties (Fehr, 1984) that have taken the place of many traditional varieties. Nonetheless, a negative side to this substitution has been the loss of genetic diversity from the traditional varieties that have been replaced (Harlan, 1992; Frakel & Soule, 1981).

This loss of genetic diversity has been documented in many instances, according to the FAO publication “State of the World’s PGRFA” (FAO, 1998; FAO 2010) that is based on national and regional reports:

In the Netherlands, the three main varieties of the nine most important crops represented between 81% and 99% of their respective planted areas, indeed one farm represented 94% of planted barley. In 1982, the “IR36” rice variety was grown on 11 million hectares in Asia. In 1983, over 67% of wheat fields in Bangladesh were sown with the same “Sonalika” variety. US reports from between 1972 and 1991 showed that less than nine varieties represented between 50% and 75% of the total for the eight main crops. In Ireland in the 1990s, 90% of all wheat growing area was sown with just six varieties.

Around 96% of the 7,098 apple varieties in the US existing at the start of the 20th century has been lost. The same is true for cabbage (95%), maize (91%), peas (94%) and tomatoes (81%). In Mexico, only 20% of maize varieties existing in 1930 has been conserved. In the Republic of Korea, only 26% of the 14 varieties grown on family plots and documented in 1985 were still conserved in 1993. In China, almost 10,000 varieties of wheat were grown in 1949 but by the 1970s, this figure has dropped to 1,000.

The author of this article collected around 350 local varieties of melon across Spain in 1969 and 1972. Today there are no more than 10 on the market.

The primitive varieties are often capable of tolerating conditions that would severely damage many modern varieties, allowing for greater productive stability.

Their greatest value to humanity, currently and in the future, is found fundamentally in the genes they contain that not only are the source of traits such as resistance to diseases, nutritional qualities and adaptive capacity to adverse environmental conditions, but also the source of those currently unrecognised, which one day could have an incalculable value.

Until now primitive varieties and their related wild populations have been fruitful, sometimes the only source of genes for resistance to pests and diseases, adaptations to extreme conditions and other agricultural traits, such as the dwarf type in rice, wheat and other grains, which have contributed to the green revolution in many parts of the world.

With the replacement and consequent loss of a primitive variety, its genetic diversity is erased forever, endangering the possible development of future varieties adapted to the unpredictable needs of the future. To avoid these losses, the samples of replaced local varieties should be adequately conserved for future possibilities.

From a more theoretical point of view, the importance of maintaining genetic diversity is based on the relationships of the variation-selection equation. In fact, variation is the basis of all selection. Selecting is to choose an alternative, and this is only possible when there are various options. In other words, when there is diversity.

Likewise, all genetic selection requires the existence of genetic variation. The greater the genetic variation in a population, the greater the scope for selection, be it natural (driven by evolutionary action) or man-made (driven by agricultural breeding).

In 1970, *Helminthosporium maydes* destroyed more than 50% of the corn fields in the south of the United States, due to the fact that all came from hybrid seeds obtained through cytoplasmic male sterility from a sole variety that was susceptible to the disease. The problem was resolved with resistant local varieties found in Africa. Many similar cases, although with less devastating repercussions, have multiplied everywhere in the last few years, threatening the economic and social stability in some countries.

As a consequence of the *Helminthosporium* attack to maize in 1970, the National Academy of Sciences of the United States established a committee to study the genetic vulnerability of major crops. The committee found that

the genetic diversity of many of the important crops in the United States was dangerously narrow. For example, 96% of the peas planted in the country came from only two varieties. Also, 95% of the peanuts cultivated came from only nine varieties.

The phenomenon can be extrapolated to numerous crops and countries, and recent data show a clear tendency of worsening the situation. In order not to jeopardize the future it is essential to ensure that the processes being triggered are manageable and reversible. This implies adequately maintaining the genes of endangered species and those of replaced local varieties through representative samples.

■ Conservation of Agricultural Biodiversity and the Genetic Resources it Contains

Conserving Agricultural Biodiversity goes far beyond saving the species. The objective should be to conserve sufficient diversity within species to ensure their genetic potential can be used in the future. For example, it was only one population of *Oryza nivara* that provided resistance to the rice virus «Grassy Stunt», and not the species itself.

The conservation of genetic resources can be done both *ex situ* and *in situ*, and both systems should not be considered opposites but complementary:

Ex situ conservation involves collecting representative samples of the genetic variability of a population or a crop and its maintenance in genebanks or botanical gardens, as seeds, cuttings, *in vitro* tissues, entire plants, etc. The period of conservation depends on the species and the technique used. In many species, this period can be extended by reducing the metabolism of the parts conserved by controlling factors such as temperature and humidity. The conserved material should be multiplied periodically, in any case. The practice of fast and deep freezing (cryopreservation), for example using liquid nitrogen can, with the improvement of current techniques, prolong indefinitely the life of the stored germplasm.

Ex situ conservation is used mostly for cultivated plants that reproduce by seed. Its great advantage is the control of material in a small space and under intensive care. Another advantage is its easy accessibility for plant breeders. Its major drawback is that its evolution freezes with the germplasm, permanently detaining the processes of natural selection and adaptation to its habitat. Other drawbacks are the genetic drift due to the collection and reproduction of necessarily small samples, and the selection pressure since, in general, the material is reproduced in eco-geographic areas different from the collecting areas. Both phenomena bring about cumulative genetic erosion, which can on occasion overcome the genetic erosion that occurs in the field.

In situ conservation consists in the protection of the area and the habitat where the species grows, through laws and protectionist measures. It is the preferred method for wild plants. Its great advantage is that the dynamic evolution of the species is maintained, and its principal drawback comes from its cost and, at times, its possible social and political difficulties. This system can, however, be considered economical if the interest is to conserve all species in the area and not just one in particular.

The protection of plant genetic resources of the planet, either *ex situ* or *in situ*, is not exclusive to our century or our civilisation. The ancient Egyptians, more than 3000 years ago, when laying their pharaohs to rest, accompanied them with seeds which would allow them to cultivate the same crops in the afterlife as in the Nile valley. Thus, in 1922, when Carter discovered the undisturbed tomb of Tutankhamen, buried in the 16th century B.C., he found intact a wooden box with small sealed compartments containing barley seeds organised by variety. This box, which is conserved with its contents in the museum in Cairo, can be considered the first genebank in recorded history.

■ LOCAL VARIETIES AND LANDRACES ARE PART OF NATIONS' IDENTITY AND TRADITIONAL FARMERS ARE THEIR GUARDIANS

PGRFA, on a local and national level, besides providing varieties and genes best adapted through millennia to agro-ecological conditions and local preferences, constitute, along with language, the monuments and works of art, the authentic signs of cultural identity of every community and every nation.

We can rightly say that art and literature are to culture what own PGRFA local varieties of plants and traditional landraces of farm animals are to «agri-culture». PGRFA are authentic works of living art created and perfected by traditional farmers in every community through millennia of selection and adaptation to local preferences and conditions.

It is not strange, then, the worldwide spontaneous proliferation of NGO movements and local action networks committed to the defence of this traditional heritage.

Besides its value as part of the living culture of people and their adaptability to environmental conditions and local needs, these resources constitute a reservoir of unique genes and traits which each village can contribute to the achievement of the millennium goals and the development of all humanity, as illustrated in the examples above.

The genetic diversity that saved the potato in Europe in the 19th century and maize in the United States in the 20th century came from developing countries, and it was not there by accident. It was the product of selection made by thousands of generations of small traditional farmers. They are still today, in a world which often ignores them and sees them sometimes as a social burden relic of the past, the authentic guardians of the majority of agricultural biodiversity which we can still count on; those who continue to develop, conserve and make available to other farmers, professional plant breeders and even modern biotechnologists, the raw material required to confront changing environmental conditions and unpredictable human needs. Are these simple farmers who still have the keys to the future of food for humanity. The ITPGRFA recognises their importance and devotes Article 9 to the definition of their rights⁽¹²⁾.

■ INTERDEPENDENCE WITH REGARD TO ABD. DEPENDENCE OF MEMBERS OF NATO AND THE NEED FOR INTERNATIONAL COOPERATION

Genetic diversity is not distributed at random in the world, but it is located principally in tropical and subtropical areas, which in many cases coincide with developing countries. In the 1920-30s, Vavilov, pioneer in this matter, identified the geographical areas where the genetic richness of food plants is maximum: Central America and México, the Andes, the Mediterranean, Central Asia, Brazil and Paraguay, the Near East, Chile, China, Ethiopia, India and Indo-Malaysia. Consequent studies have not made significant modifications⁽¹³⁾. The examples in section 2 and the contents of Figures 3 and 4 illustrate an enormous interdependence amongst countries in regard to agricultural biodiversity necessary for research and agricultural development. In fact we can say that no country in the world today is self-sufficient and that average dependence amongst countries for the most important crops is around 70%⁽¹⁴⁾.

Figure 3: Average maximum and minimum dependency level (%) of countries in different regions on genetic resources for their most important crops.

Region	Minimum (%)	Maximum (%)
Africa	67.24	78.45
Asia and Pacific Region	40.84	53.30

⁽¹²⁾ FAO. International Treaty on Plant Genetic Resources for Food and Agriculture. 2009. [online] [Accessed: 12 July 2012]. Available at:

<http://www.planttreaty.org/es/content/textos-del-tratado-versiones-oficiales>

⁽¹³⁾ ZEVEN, A.C. & ZHUKOVSKY, P.M. Dictionary of Cultivated Plants and Their Centres of Diversity, PUDOC, Wageningen, 1975.

⁽¹⁴⁾ KLOPPENBURG, J. R. Seeds and Sovereignty. The Use and Control of Plant Genetic Resources, Duke University Press, Durham, London, 1988.

Region	Minimum (%)	Maximum (%)
Europe	76.78	87.86
Latin America	76.70	91.39
Middle East	48.43	56.83
North America	80.68	99.74
GLOBAL	65.46	77.28
Based on: Flores Palacios, X., 1998. COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE. Background Study Papers N° 7, REV 1. Contribution to the estimation of countries' interdependence in the area of plant genetic resources, by Ximena Flores Palacios. [online] [Accessed: 6 July 2012] Available at: ftp://ftp.fao.org/docrep/fao/meeting/015/j0747e.pdf .		

Paradoxically, many countries that are poor from an economic point of view are rich in genes and genetic diversity necessary for the survival of humanity. In fact, member countries of NATO are, with the exception of Turkey, highly dependent, for their agriculture and food, on genes and genetic resources from other countries (see Figure 4).

Figure 4: Estimated dependency range (%) of NATO member countries on genetic resources for their most important crops.

NATO member countries	Minimum (%)	Maximum (%)
Germany	83.36	98.46
Albania	92.07	99.32
Belgium / Luxembourg	82.26	97.73
Bulgaria	88.17	99.36
Canada	84.00	99.48
Croatia	87.02	98.99
Denmark	81.18	91.96
Slovakia	85.10	96.60
Slovenia	89.99	98.81
Estonia	86.66	95.13
Spain	71.41	84.84
United States	77.36	100
France	75.55	90.67
Greece	54.24	68.94

NATO member countries	Minimum (%)	Maximum (%)
Hungary	86.85	98.04
Iceland	83.82	99.21
Italy	70.82	81.21
Latvia	81.15	90.42
Lithuania	91.66	97.87
The Netherlands	87.94	98.49
Norway	90.67	98.94
Poland	90.06	99.32
Portugal	78.86	90.88
United Kingdom	89.23	99.10
Czech Republic	87.87	97.40
Romania	90.34	99.44
Turkey	32.21	43.16
AVERAGE	81.48	93.10

Based on Flores Palacios, X., 1998

COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE. Background Study Papers N° 7, REV 1. Contribution to the estimation of countries' interdependence in the area of plant genetic resources, by Ximena Flores Palacios. [online] [Accessed: 6 July 2012] Available at: <ftp://ftp.fao.org/docrep/fao/meeting/015/j0747e.pdf>

There is also a kind of generational interdependence. Agricultural biodiversity is a precious treasure inherited from preceding generations and we have the moral obligation to transmit it in its entirety to future generations so they can keep their options for the future. However the interests of future generations, which do not vote or consume, are not sufficiently considered by our political and economic systems.

Both the growing loss of ABD as its interdependence amongst countries and generations make international cooperation in this area not an option, but an imperative and urgent necessity.

■ INTERNATIONAL COOPERATION AND THE ROLE OF THE UNITED NATIONS

Genetic diversity of crops, which is crucial for feeding humanity, for the environment and for sustainable development, is being lost at an alarming

rate. Considering the enormous interdependence of countries and generations on this genetic diversity, this loss poses technical, socioeconomic, ethical and political questions of great importance.

Since the 1940s, some international organisations, particularly the United Nations Organization for Food and Agriculture (FAO), started to seriously worry about the loss of genetic resources in the world. First the technical activities and later the political negotiations culminated in the development and approval by consensus of all countries in a binding agreement: The International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA).

This process is explained in the following paragraphs.

■ **The 1960s and 1970s: International Discussions on Technical, Scientific and Economic Factors Preceding Negotiations**

In 1961, the FAO convened a technical meeting that led to the creation in 1965 of a Panel of Experts on Plant Exploration and Introduction. From then until 1974, this group met periodically to advise the FAO on the subject and make international guidelines for the collection, conservation and exchange of germplasm.

The first problems to appear were of a technical nature related to the detection of diversity and genetic erosion, identifying collection sites, sampling techniques, germplasm conservation methods and methods of evaluation and documentation. In 1967, 1973 and 1981, the FAO hosted international technical conferences that led to the publication of a series of volumes that compiled the technological advances to resolve these questions⁽¹⁵⁾.

Meanwhile, the first economic problems began. The need to organise and finance the new programmes for the conservation of these plant genetic resources led in 1968 to create the Genetic Resources and Crop Ecology Unit and to establish a fund to carry out these programmes. In 1972, the Consultative Group on International Agricultural Research (CGIAR), following the recommendations of the United Nations Conference on Environment (held in Stockholm) and of its own Technical Advisory Committee, decided to create the International Board for Plant Genetic Resources (IBPGR) with its own budget.

The IBPGR was born in 1974 headquartered at the FAO in Rome, and it promoted and carried out numerous activities related to the collection,

⁽¹⁵⁾ FRANKEL, O.H. & BENNET, E. Genetic Resources in Plants – Their Exploration and Conservation. IBP Handbook, n° 11, Blackwell Scientific Publication, Oxford, 1970.
FRANKEL, O.H. & HAWKES, J.G. Crops Genetic Resources for Today and Tomorrow, Cambridge University Press, Cambridge, 1975.
HOLDEN, J.H.W. & WILLIAMS, J.T. Crop Genetic Resources: Conservation and Evaluation. George Allen and Unwin, London, 1984.

conservation, evaluation, documentation and use of plant germplasm. In the 1980s, the IBPGR separated from the FAO and was renamed «International Plant Genetic Resources Institute» (IPGRI), and is currently called Bioversity International.

Parallel to the activities of the FAO and IBPGR activities and, in some cases due to their catalytic effect, numerous international, regional, national and private organisations created or strengthened programmes, starting from the 1970s, aimed at safeguarding and using plant genetic resources, especially *ex situ*.

■ **The 1980s: The First Debates and Political Negotiations that Resulted in the Adoption of the International Undertaking and THE Establishment of an Intergovernmental Commission at the FAO/UN**

In 1979 the first political debates began at the FAO Conference⁽¹⁶⁾. These discussions led in a few years to the adoption of the International Undertaking on PGRFA (hereinafter referred to as «the Undertaking») and later to the negotiation and approval of the Treaty. The questions raised by developing countries during the conference reflect the background of the difficult negotiations in later years and are the basis of the Treaty and the Multilateral System of Access and Benefit-Sharing.

The first question was the following:

Plant genetic resources are spread worldwide but the greatest diversity is in tropical and sub-tropical areas where there are the majority of developing countries. When the seeds are collected and deposited in genebanks, often in developed countries: who owns the stored seeds ? to the country where they were collected? to the country where they are stored? to humanity?

The next question was related to intellectual property rights:

If new varieties are the result of applying the technology to raw material or genetic resources, why recognising the rights of those who donated the technology (breeders' rights, patents), and not the rights of those who donated the germplasm?

The answers to these questions were not clear and convincing and on occasion they led to strong dialectical confrontations. To resolve these problems, Spain proposed the development of an international agreement and the establishment of a genebank under the jurisdiction of the FAO. The proposal received much

⁽¹⁶⁾ Highest decision-making body in the Organisation in which all member countries are represented.

support throughout the Conference, but it did not reach the point of becoming a draft resolution.

In autumn of 1981, in the months preceding the FAO conference, Mexico, first with the support of the Latin American and Caribbean Group, and later the Group of 77⁽¹⁷⁾, promoted a draft resolution that included the two essential elements of the Spanish proposal of 1979. During the FAO Conference in November 1981, this draft resolution elicited intense debates between countries. A debate that was scheduled for two or three hours lasted several days. In subsequent meetings, the technical feasibility of an FAO genebank was questioned. The controversy ended in the spring of 1983 when the Spanish government offered its own genebank to be placed under the jurisdiction of the FAO, showing that the problem was not about technical feasibility, but about political will. As a consequence, the FAO Agricultural Committee requested the Director General to draw up a document on the basis of the Spanish proposal, to be presented at the FAO conference that same year.

In November of 1983, the 22nd FAO General Conference was witness of long and difficult discussions in a tense atmosphere in which political tension was chewed. On the last day, after several votes, the Undertaking and the Intergovernmental Commission on Plant Genetic Resources for Food and Agriculture were born between screams, applause, tears and a standing ovation. Its mandate broadened since 1995, becoming the Commission on Genetic Resources for Food and Agriculture (in this text it will be referred to as «the Commission»), permanently responsible for monitoring adherence to the Undertaking. Nevertheless, eight countries expressed reservations⁽¹⁸⁾.

⁽¹⁷⁾ Informal group in the UN system made up of developing countries.

⁽¹⁸⁾ The delegations of Canada, France, Germany (Federal Republic of), Japan, New Zealand, Switzerland, the United Kingdom and the United States of America expressed their reservations about all or part of the text of the International Undertaking on Plant Genetic Resources (Resolution 8/83) adopted at the 22nd FAO Conference in Rome in November 1983. The same eight countries and the Netherlands also expressed their reservations about the text of the International Undertaking on Plant Genetic Resources (Resolution 9/83) adopted at the 22nd FAO Conference.

Figure 5: International Undertaking on Plant Genetic Resources for Food and Agriculture.

The International Understanding on Plant Genetic Resources for Food and Agriculture was the first international agreement on plant resources for food and agriculture. The FAO Conference passed it in 1983⁽¹⁾ as an instrument to promote international harmony in issues relating to access to plant genetic resources for food and agriculture.

According to the approved text, the Undertaking seeks ensure that plant genetic resources of economic and/or social interest, particularly for agriculture, will be explored, preserved, evaluated and made available for plant breeding and scientific purposes. The 11 articles of the International Understanding formally recognise plant genetic resources including improved and commercial varieties as world heritage and attempts to guarantee their free exchange without restrictions through a network of germplasm banks under the auspices and/or jurisdiction of the FAO.

The Undertaking was then the subject of a series of agreed interpretations, negotiated by countries at the Commission of Genetic Resources for Food and Agriculture and adopted in the form of FAO Conference resolutions, which became annexed to it. The aim was to achieve universal acceptance of this international agreement, promoting a balance between the products of biotechnology (commercial varieties and breeders' lines) on the one hand, and farmers' varieties and wild material on the other, and between the interests of developed and developing countries, by balancing the rights of breeders (formal innovators) and farmers (informal innovators).

Resolution 4/89 recognised that Plant Breeder's Rights, as provided for by the International Union for the Protection of New Varieties of Plants (UPOV), were not inconsistent with the Undertaking, and simultaneously recognised Farmers' Rights defined in Resolution 5/89⁽²⁾.

The sovereign rights of nations over their genetic resources were recognized in Resolution 3/91 (FAO, 1991), and it was agreed that Farmers' Rights would be implemented through an international fund for fair benefit-sharing.

(1): FAO.1983. *Report of the 22nd FAO Conference. Resolution 8/83.*

(2): FAO.1989. *Report of the 25th General FAO Conference, Resolutions 4/89 and 5/89.*

During the years following 1983, the Commission acted as an intergovernmental forum where countries continued to negotiate agreed interpretations of the Undertaking, which allowed the removal of reservations of the countries that remained outside of it. Thus, three resolutions were negotiated which became integrated annexes of the Undertaking. They introduced the concept of «national sovereignty», and parallel and simultaneously they recognized the rights of plant breeders and the rights of farmers (Figure 6).

During this process it was also agreed that farmers' rights would be developed by means of an international fund. Some countries felt that this fund should consist of a percentage of the benefits derived from the use of genetic resources, whilst the majority felt that it should be linked to the needs of the countries to ensure the conservation and sustainable use of those resources.

In order to quantify these needs, a process was launched leading to the Fourth International Technical Conference on Plant Genetic Resources, the first intergovernmental conference, held in Leipzig in 1996. At the conference, the Leipzig Declaration was adopted on the conservation and sustainable use of plant genetic resources for food and agriculture.

During this process, 155 countries prepared national reports which defined the situation of their genetic resources, their needs and priorities. Twelve regional meetings allowed the preparation of the corresponding regional reports, and the process culminated in Leipzig with the publication of the first State of the World's Plant Genetic Resources and the approval of the first Global Plan of Action for Plant Genetic Resources. This Plan eventually became the basis of Article 14 of the Treaty.

■ **From the 1990s to Present day: Searching a Binding Agreement for the Agricultural Sector and Food Security. From the Convention on Biological Diversity to an International Treaty specifically for Agricultural Biodiversity**

Between 1988 and 1992 the first binding international agreement on biodiversity in general was negotiated in the United Nations Environmental Programme (UNEP). The Convention on Biological Diversity (CBD) was presented for signature at the Earth Summit in Río de Janeiro in June 1992. This agreement, which also included agricultural biodiversity, did not take sufficient account of the specific needs of the agricultural sector, since the representatives of this sector were barely present during the negotiation process.

Only at the last moment, in May 1992 in Nairobi, during the last negotiation meeting, it was possible to bring together representatives from twenty countries, the only ones directly or indirectly linked to the agricultural sector. This group managed to write and introduce in the final act of Nairobi, by which the agreement was being approved, a resolution on agricultural biodiversity which highlighted the importance of the previous agreements reached in the FAO and requested the revision of the Undertaking in harmony with the CBD.

Shortly thereafter, in the context of the Uruguay Round, and also with minimal participation of the agricultural sector, trade agreements were developed and approved in Marrakech that led to the creation of the World Trade Organization, which also affect genetic resources for food and agriculture. These agreements include the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS).

The approval of both the CBD and TRIPS as binding agreements was a wake up call to the agricultural sector, which is caught between two binding agreements that did not sufficiently address their specific needs.

The Undertaking, with its purely voluntary character, lacked sufficient clout to defend agricultural interests. The growing pressure of other sectors, in particular the commercial and environmental sectors over the agricultural sector, made possible what seemed unimaginable a short time before: the unity of developed and developing countries, seed industries, and NGO's with a common political objective, transforming the Undertaking in a binding agreement allowing for an equal dialogue with the commercial and environmental sectors. All this was in order to contribute to global Food Security, legally guaranteeing the conservation and access on fair grounds for research and the genetic improvement of plant genetic resources important to agriculture. That is how, in a highly constructive atmosphere, the last phase of negotiations began on what is now the Treaty.

The Conference of the Parties of the CBD (Jakarta, 1995) provided significant support to further this cause with its decision II-15 «recognising the special nature of agricultural biodiversity, its distinct characteristics and problems, which require specific solutions»⁽¹⁹⁾. This decision ended with the reticence of certain countries to the negotiations, which (thanks to Resolution 7/93⁽²⁰⁾ of the FAO Conference⁽²¹⁾) were taking place at the heart of the Commission.

Indeed, as it would be shown later, the conservation and exchange of PGRFA requires agreements based on multilateralism, since it would be, both economically and politically, very costly to be limited to the bilateralism promoted by the CBD.

The formal negotiations lasted seven more years and were conducted through meetings of the FAO Commission and its subsidiary bodies.

As an example of the complexity of the negotiations and their political connotations, it can be cited what happened at the meeting of the Commission in April 2001, which discussed the crops to be included in the Treaty.

Finally, at the 31st FAO Conference on 3 November 2001, the negotiations concluded with the approval of the Treaty by consensus, in an atmosphere of general euphoria. The Treaty came into force in 2004, ninety days after forty governments had ratified it, and it became operational with the first meeting of its Governing Body in June 2006 in Madrid. The Treaty has been ratified or equivalent so far by the national parliaments of 127 countries.

⁽¹⁹⁾ CONVENTION ON BIOLOGICAL DIVERSITY. Report of the Second Meeting of the Parties to the Convention on Biological Diversity, UNEP/CBD/COP/2/19, 6-17 November 1995 - Jakarta, Indonesia. [online] [Accessed: 13 July 2012] Available at: <https://www.cbd.int/doc/?meeting=cop-02>

⁽²⁰⁾ Revision of the Treaty.

⁽²¹⁾ FAO.1993. Report of the 27th FAO Conference, Resolution 7/93.

Figure 6: A illustrative anecdote on the repercussions of international politics on Treaty negotiations.

An anecdote is better than a text book in explaining the strategic importance of genetic resources and the influence of international political events throughout the treaty negotiation.

One of the most complex and controversial topics in the formal negotiation process was the selection of the types or crops to be included in the Multilateral System of Access and Benefit-Sharing and which appear in Annex 1 of the Treaty. In order to provide a solid technical and scientific basis to negotiators having to decide on the crops to be included in the multilateral system, the following selection criteria were agreed: the crop's importance for global food security and the interdependence of countries with regard to the genetic resources of the crop in question. At the end of difficult negotiations, the countries had pre-selected 67 types.

When the negotiations on the 67 types were coming to a close in April 2001, a conflict surrounding the incursion of Chinese air space by a US plane marred the negotiations. The primary centre of soya diversity is located in China and the day after this event, Chinese delegates removed this crop from the Treaty since the US is one of the main producers and depends on China for the genetic resources of this crop. Brazil, the second most affected country, with the support of Bolivia withdrew the peanut, the maximum diversity of which is that country, so as to force China's hand since the product is very important there.

Nonetheless, China did not change its stance. The pressure from the most affected countries by China's decision meant that Latin American countries withdrew the tomato, which is also very important for the Chinese. In later months, the pressure on China intensified and the EU "troika" included this topic on its agenda during a visit to Beijing.

China, however, did not give way and, therefore, instead of 67 types, only 64 were included in the Multilateral System of the Treaty. Although the Multilateral System crops may be changed in the future, this would mean re-opening talks and have a high economic and political cost since any change, no matter how minimal, to the Treaty text requires a new parliamentary ratification process by all those countries on the Governing Body.

■ THE INTERNATIONAL TREATY ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE AS THE FIRST BINDING AGREEMENT ON AGRICULTURAL BIODIVERSITY

In November 2001 the FAO Conference adopted the International Treaty on Plant Genetic Resources for Food and Agriculture through Resolution 3/2001. This Treaty came into force on 29th June 2004 after being ratified by over 30 countries. Today, the parliaments of 127 countries and the European Union have ratified it, and its provisions are therefore legally binding for

those countries. Its Governing Body is made up of all the countries that have ratified it.

■ Objectives of the Treaty

Article 1 establishes that the objectives of the Treaty are the conservation and sustainable use of Plant Genetic Resources for Food and Agriculture (PGRFA) and the fair and equitable sharing of the benefits arising from their use, in accordance with the Convention on Biological Diversity (CBD) for sustainable agriculture and food security.

■ Essential and Innovative Elements of the Treaty: Multilateral System of Access and Benefit-Sharing, Farmers' Rights, Global Plan of Action and other elements of the Treaty

Through the Treaty, countries agree to promote the development of integrated national approaches for prospecting, characterizing, evaluating, conserving and documenting their PGRFA, including the development of national studies and inventories. They also commit to develop and maintain regulatory and legal measures that promote the sustainable use of these resources, including: *in situ* conservation, supporting research, promoting initiatives for plant genetic improvement, broadening the genetic bases of crops and promoting greater use of crops, varieties and underutilized species adapted to local conditions. These activities will be supported, as appropriate, by the international cooperation under the Treaty.

The heart of the Treaty is its innovative Multilateral System of Access and Benefit-Sharing, which ensures the continued availability of genetic resources for research and plant improvement, guaranteeing at the same time an equitable distribution of benefits, including the gains from commercialisation. This system includes 64 genera that constitute approximately 80% of human food obtained from plants.

The recipients of material from the System shall not claim any intellectual property rights or other rights that limit access to plant genetic resources for food and agriculture, or their genetic parts or components, in the form received. «The benefits arising from the use, including commercial, of plant genetic resources for food and agriculture in the Multilateral System shall be shared fairly and equitably through the following mechanisms: the exchange of information, access to and transfer of technology, capacity building and the sharing of the benefits arising from commercialisation, taking into account the priority activity areas in the rolling Global Plan of Action, under the guidance of the Governing Body»⁽²²⁾.

⁽²²⁾ FAO. International Treaty on Plant Genetic Resources for Food and Agriculture. 2009. [online] [Accessed: 12 July 2012] Available at: <http://www.planttreaty.org/es/content/textos-del-tratado-versiones-oficiales>

Even though the material included in the Multilateral System shall not be subject to any type of intellectual property, new products or varieties that incorporate material from the Multilateral System can be. Nevertheless, if the type of intellectual property applied to these derived materials is such that it limits their use for research or posterior improvement, 1.1% of the sales of the commercialised product must be entered in the fund established for «benefit-sharing».

This fund, administered by the FAO, will be used to support projects and activities related to the conservation and sustainable use of plant genetic resources according to the priorities and criteria established by the Governing Body of the Treaty.

But there is also a second alternative in which the contribution to the Benefit-Sharing Fund is only 0.5% of commercialised product sales by companies, which being interested in the material of the Multilateral System for certain species, commit to pay this percentage in all their commercial varieties of these species, regardless of whether or not they use material from the Multilateral System. This alternative is more transparent, easily verifiable and thus reduce transaction costs. All of this is regulated by the Standard Material Transfer Agreement, which was negotiated and approved by the member countries of the Treaty through its Governing Body in 2006, and its terms will be revised periodically by the Governing Body.

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The Treaty establishes a funding strategy to mobilise funds for activities, projects and programmes that enhance its implementation, particularly in developing countries and in line with the priorities identified in the Global Plan of Action. The monetary benefits obtained under the Multilateral System, as well as from the Global Crop Diversity Trust, are part of the funding strategy. The Governing Body of the International Treaty will periodically establish an objective for the funding strategy.

Another innovative feature are the measures for Farmers' Rights. It recognizes the enormous contribution that local and indigenous communities and farmers of regions worldwide have made and will continue to make for the conservation and development of plant genetic resources. The Treaty affirms that it is the responsibility of national governments to ensure their farmers' rights, including the protection of traditional knowledge, the right to participate equally in the sharing of benefits, and to intervene in the decision making process regarding national policies.

The International Treaty includes several supporting components, based on the elements previously prepared by the Commission on Plant Genetic Resources for Food and Agriculture, in particular the Global Plan of Action, the Global

Information System, international networks, and terms and conditions for the conservation and access to the *ex situ* collections maintained by the International Agricultural Research Centres (IARC).

■ Implementation: Process and achievements of the Treaty

The Treaty became operational with the first meeting of its Governing Body⁽²³⁾ in June 2006 in Madrid. This meeting approved the Rules of the Governing Body, the Financial Regulations of the Treaty⁽²⁴⁾ and the Funding Strategy of the Treaty. The Governing Body also approved an Standard Material Transfer Agreement (MTA) that determines the amount, form and method of monetary payments related to the commercialisation through the Multilateral System of Access and Benefit-Sharing of the Treaty. The Agreement on relations between the Governing Body of the Treaty and the Global Crop Diversity Trust was also signed during the meeting, an essential element of the Treaty's funding strategy. It was also approved the agreement between the Governing Body and the CGIAR Centres on the *ex situ* collections they hold.

In successive meetings of the Governing Body, held in Rome (2007), Tunisia (2009) and Bali, Indonesia (2011), progress was made on issues such as the implementation of the funding strategy, cooperation with the FAO Commission, cooperation with the CGIAR and the sustainable use of genetic resources, the development of Farmers' Rights and the Multilateral System of Access and Benefit-Sharing of the Treaty.

Over the years, there has been significant progress in the implementation of some of its provisions:

To date, the Treaty has been ratified or equivalent by 127 countries and the European Union. The countries have committed to contribute \$116 million dollars to support activities for the implementation of the Treaty's funding strategy over the next five years, of which \$14 million were obtained during the first year. In addition, one of the essential elements of the Treaty's funding strategy, the Global Crop Diversity Trust⁽²⁵⁾ for activities related to *ex situ* conservation, had received \$136 million dollars as of March 2010, and another \$32 million are firmly committed, including contributions from both public and private sources.

Regarding non-financial resources, 444,824 samples were transferred to potential users in just one year through the Treaty's Multilateral System and

⁽²³⁾ FAO.2006. Report of the 1st Meeting of the Governing Body of the International Treaty on Plant Genetic Resources for Food and Agriculture, Resolution 2/2006.

⁽²⁴⁾ Some provisions relating to contributions from the countries were put on hold, to be addressed in subsequent meetings.

⁽²⁵⁾ <http://www.croptrust.org/>

the corresponding Standard Material Transfer Agreement, which represents over 8,500 accessions per week.

■ FUTURE CHALLENGES AND PROSPECTS

The International Treaty is a starting point to address the new scientific, economic, legal and ethical challenges that the 21st century presents for food and agriculture. Remaining challenges include the full implementation of the Treaty both domestically and internationally, the solution to problems that were left out of the Treaty and, finally, those due to new challenges that have emerged after the negotiations as a result of climate change forecasts and new threats to food security and environmental sustainability.

It also discusses the difficulties encountered by our economic system to incorporate externalities, giving ABD the immense value it deserves, and also the issues related to increasing privatisation of these resources through intellectual property rights and other restrictive laws.

■ **Technical and Scientific Aspects: Conservation and use of Agricultural Biodiversity to Promote Food Security, Achieve Environmental Sustainability and Face Climate Change**

- *Food Security*

The main challenge for increasing food security is not the global production of food but rather its access. In addition, it is not simply a matter of giving more calories to more people. It is important to highlight that most of the poor in the world (70%) live in rural areas in developing countries. Solutions are needed to improve the stability of local production, to provide more options to small farmers and rural communities, and to improve the quality and quantity of available food.

Nutrition security should be considered a vital component of food security; and in this context, the diversification of diets plays an important role. To achieve this it is necessary to emphasise the use of diversity both in major crops and in neglected and underused crops. Researchers and plant breeders have neglected these crops, although they often contain great diversity and require little investment to obtain good progress.

To ensure that the benefits derived from plant genetic resources reach all those in need, research must be carried out by the public sector in those areas in which the private sector does not conduct research. Most commercial varieties are not adapted to the needs of the poorest farmers, especially in many

developing countries, which have little or no access to irrigation, fertilisers or pesticides.

It is necessary to develop public programmes to support and improve traditional crops and varieties capable of withstanding adverse conditions such as drought, high salinity, low soil fertility and resistance to local pests and diseases. Such programmes could be developed for traditional varieties and existing local crops containing these traits of interest and, where possible, through participatory research. This would reduce dependence on the volatility and unpredictability of prices in international markets, reducing the risk of food crises like that of 2008, which was due to the dramatic increase of international prices of agricultural products.

The emphasis of research should be placed at the local level, supporting genetic improvement of a broad range of crops and varieties adapted to local conditions and needs rather than seeking universal uniform genotypes. It is therefore desirable to follow a systematic and participatory process of cooperation between researchers, farmers and consumers.

- *Environmental sustainability*

Reducing the negative impact that agriculture has on the environment (water, energy, pesticides, herbicides...) must become a top priority. This requires an increase in the use of diversity in production systems by developing a broad range of varieties and crops to maximise the efficiency of the agricultural system.

A good example would be the use of strategies diversity-rich to reduce damage by pests and diseases. It is necessary to boost research to make these strategies more efficient and productive through the appropriate use of new and traditional technologies.

- *Climate change*

All scenarios presented by the Intergovernmental Panel on Climate Change (IPCC) predict significant consequences on the geographical distribution of crops, their varieties and the wild species related to them. In this context, some studies have used current climate data and models to predict the impact of climate change in certain areas and crops⁽²⁶⁾.

⁽²⁶⁾ JARVIS A., LANE A. & HUMANS RJ. The effect of climate change on crop wild relatives. *Agriculture, Ecosystems and Environment*, 2008, 126 (1), p.13-23.

FISCHER, G.; SHAH, M; van VELTHUIZEN, H. Impacts of Climate Change on Agro-ecology. En FISCHER, G.; SHAH, M; van VELTHUIZEN, H. *Climate Change and Agricultural Vulnerability*. International Institute for Applied Systems Analysis IIASA Publications Department, Vienna Austria, 2002, [online] [Accessed: 16 July 2012] Available at:

In any case, there is no doubt that the best way to reduce our vulnerability to climate change is to increase the diversity of species and crop varieties cultivated in order to provide the system with the necessary capacity to adapt to coming unpredictable changes. In this context, the so-called underutilized species and farmer's traditional varieties have great importance.

The development of varieties adapted to changing climatic conditions is also important. Although many crops have the genetic diversity to address many environmental conditions, it is necessary to take into account that:

- a) *The magnitude of change will require great capacity for adaptation.*
- b) *The potential of underutilized crops and other promising species increases.*
- c) *The need to broaden the genetic base used in improvement programmes using new sources of diversity.*
- d) *There is a growing need to increase the adaptability and homeostasis of cultivated varieties, which has not always been sufficiently taken into account for improvement.*
- e) *Production in different and unstable environmental conditions would require new improvement approaches.*

■ Socio-Economic Aspects

The cost of the conservation of genetic diversity is high but the cost of inaction is far greater. The financial resources for the conservation and use of agricultural genetic resources are well below adequate. This problem is particularly acute in the case of *in situ* conservation of traditional varieties and, increasingly, of wild relatives of cultivated plants, very important today for the application of new technologies, and which are mainly located in developing countries. The shortage of economic resources in these countries is not only an obstacle to the protection of this diversity, but also a major cause of genetic erosion.

From a macroeconomic perspective, PGRFA have been used as an unlimited source of continued benefits. They are actually a limited and vulnerable resource to be used by future generations. The total value of these resources for the future is still not reflected in market prices. A sustainable economic solution to the problem is the internalisation of the costs of resource conservation in the production costs of the product. For example, when buying an apple it is necessary not only to pay the production costs but also the costs of maintaining the genetic resources that enable future generations to continue eating apples. The International Treaty provisions on benefits, including the monetary sharing of benefits arising from commercialisation⁽²⁷⁾, represent a first step in that direction.

Taking all of the above into account, we can conclude that there exists an urgent need for economics research to provide a better description and quantification of the actual value of genetic resources. While we have a conceptual framework in terms of use value, future value, and option value, an adequate quantification mechanism is missing for channelling investment decisions and research planning.

■ Legal and Institutional Aspects

The entry into force of the Treaty is a milestone, as it provides a universally accepted legal framework for plant genetic resources. However, mechanisms should be developed to carry it out, and the Funding Strategy of the Treaty must become fully operational.

After ratification by the countries, the provisions of the Treaty must be applied at the national level, which requires the development of measures at this level. In some cases, legislation will be necessary to avoid genetic erosion, promote conservation, characterisation and documentation of local genetic resources, implement farmers' rights, facilitate access to genetic resources for research and improvement, and promote equitable benefit-sharing.

The Multilateral System of Access and Benefit-Sharing established by the Treaty to facilitate the exchange of crops became operational in January 2007 and its first Funding Strategy projects were approved in 2009. Once the benefits are fully realized, future negotiations could reach consensus on other controversial and difficult issues, such as the broadening of its scope by increasing the number of crops that are exchanged through the Multilateral System.

Access to genetic resources and to biotechnology are limited by the increasing number of national laws that restrict access and use of genetic resources in some countries and by the proliferation of Intellectual Property Rights and the expansion of their scope.

In this context, the adoption of the Treaty is an important step to facilitate such access. However, the Treaty, which was developed by representatives of the agricultural sector, cannot be seen in isolation from other international agreements on biodiversity and related technologies, such as the Convention on Biological Diversity (CBD) and the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) of the World Trade Organisation (WTO), developed by the environmental and trade sectors, respectively.

Sometimes the priorities of these three sectors do not match and difficulties in compatibility can arise in the way these agreements are implemented at a national level. To avoid this and to ensure complementarity, cooperation and

inter-sectorial coordination become necessary in the interpretation of its provisions and in the development of possible national regulations for its implementation.

FIGURE 7. Balance the value of PGRFA and biological technologies that use them (Source: Esquinas-Alcázar, 2005, revised and updated)

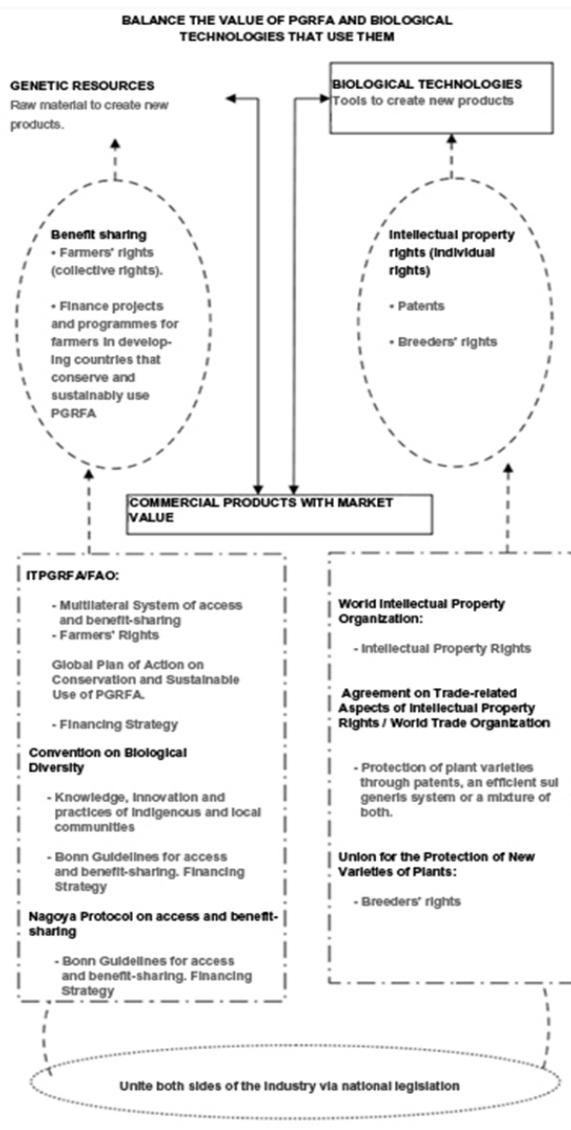
PGRFA provide the basic components allowing classic plant breeders and biotechnologists to develop new commercial varieties and other biological products. Despite their undeniable importance, neither genetic resources nor the biological technologies applied to them, have in themselves a relevant commercial value. Nonetheless, there is often a clear market value for commercial products derived from their use.

Since the 1960s, several international bodies and agreements (e.g. the Union for the Protection of New Varieties of Plants, the World Intellectual Property Organization and the Agreement on Trade-related Aspects of Intellectual Property Rights) have dealt with this topic.

In this sense, measures have been established that award individual rights to biological technology professionals (intellectual property rights such as rights and patents of plant breeders) that allow them to earn financial benefit for commercial products that could be the result of using those technologies.

From the 1990s, other international agreements, especially the International Treaty on Plant Genetic Resources for Food and Agriculture have recognised collective rights (the rights of the farmer and benefit-sharing) for those supplying the genetic resources.

This could contribute to a more harmonious and balanced incentive system that promotes the development and use of new biotechnology, but that also ensures the continuous conservation, development and availability of genetic resources to which these technologies are applied (see figure). It is now the job of national governments to put these measures into practice. For this, each country shall draft the appropriate national legislation that takes into account both sides of the system shown in the figure, in this way promoting harmony and synergy in putting different binding international agreements into practice.



Furthermore, the interests of the agricultural sector should be well represented in these three fora. The effectiveness of the Treaty to halt or reverse the current

trend towards restricting access to these resources will depend on how the provisions of the Treaty are interpreted and implemented by countries and by the international community.

■ International Cooperation

PGRFA should be considered in the context of the agroecosystem where they develop and are used, whether from the point of view of ecological balances, or in relation to the traditional knowledge associated with them, or to achieve food security. The guarantee of a diversified, sustainable and nutritionally diverse food production requires the conservation and sustainable use of all genetic resources, including those of animals, forests, fish and microorganisms of interest to food and agriculture. The FAO's intergovernmental commission, which since its establishment in 1983 was concerned only with plant genetic resources, expanded its field of competence in 1995 to also cover other sectors of agrobiodiversity.

In 2007 the member countries of the FAO negotiated and adopted, through the commission, a Multi-Year Programme of Work (MYPOW), including a timetable for the development and periodic publication of reports on the global state of the different components of agricultural biodiversity for food and agriculture⁽²⁸⁾, identifying the needs, shortages, emergencies, and priorities of each sector (crop plant genetic resources, livestock, forests, aquaculture, and microorganisms). This Work Programme would culminate in 2017 with the first publication of the State of the World's Biodiversity for Food and Agriculture. This document, with emphasis on agroecosystems, would also have specific modules for each sector.

The priorities and timetable set for the MYPOW⁽²⁹⁾ will allow better coordination of activities amongst all countries and provide guidance and an incentive to coordinate cooperation between them and international organisations working in this field and which include, at a global level, the FAO and its Commission, the Agrobiodiversity Programme of the CBD, Bioversity and the international centres of the Consultative Group on International Agricultural Research (CGIAR).

⁽²⁸⁾ The first publication on the State of the World and the first Global Plan of Action for Animal Genetic Resources for Food and Agriculture was adopted by over 100 countries in 2007, at the International Technical Conference on Animal Genetic Resources in Interlake (Switzerland). The FAO Commission is responsible for monitoring and evaluating the implementation of the Global Plan of Action and the development of the funding strategy for its implementation.

⁽²⁹⁾ FAO. 2009. Report of the 3rd Meeting of the Governing Body of the International Treaty on Plant Genetic Resources on Food and Agriculture.

■ CONCLUSIONS AND RECOMMENDATIONS

Agricultural biodiversity constitutes Humanity's common pantry. In an increasingly globalised and interdependent world, both the increasing loss of biodiversity and the difficulties of its access are a threat to Peace and Global Security.

There is no doubt that the negotiation of the ITPGRFA and its subsequent ratification by the majority of countries has been an important step forward in the right direction, but much remains to be done both internationally and domestically. The following recommendations, based on the findings of important meetings and recent publications, can help us walk the remaining road.

■ Conclusions and Recommendations at an International Level

The designation by the United Nations of 2010 as the International Year of Biodiversity, and subsequently this decade as the Decade of Biodiversity, reflects the importance attached to safeguard biodiversity for achieving the Millennium Development Goals and the essential contribution of biodiversity to development and human well-being. It is imperative that this recognition is accompanied by a strong commitment to the biodiversity that feeds the world: agricultural biodiversity.

In September 2010, the world's leading experts in the field of Agricultural Biodiversity met in Cordoba with senior representatives of national and international organisations related to the theme⁽³⁰⁾ to celebrate the International Year of Biodiversity, and developed the Cordoba International Declaration on Agricultural Biodiversity in the Fight against Hunger and Climate Change. This Declaration was distributed at the request of the Spanish government, as an official document A/65/485 in the 65th Session of the United Nations General Assembly in New York.

The following considerations and recommendations are based on this Declaration, which thinks that urgent actions are necessary to meet the challenges of food security and climate change and to stop the unacceptable and continuing loss of biodiversity. To this end the following actions are proposed:

⁽³⁰⁾ The Declaration was the result of an international seminar organised by the Chair of Hunger and Poverty Studies (CEHAP) of the University of Cordoba and jointly organised by the Spanish government (Ministry of Environment and Rural and Marine Affairs and the Ministry of Science and Innovation), international organisations (FAO, International Treaty on Plant Genetic Resources for Food and Agriculture, Biodiversity Convention, Biodiversity International), local entities (Delegation of Cordoba, University of Cordoba, Cordoba City Council), and the Chair of Studies on Hunger and Poverty as host. It included the participation of developed and developing countries and members of civil society, farmers' organisations, industry and consumers, at international and national levels. The seminar was opened by the Secretary of State for International Development Cooperation and closed by the Minister of the Environment and Rural and Marine Affairs.

1. Place agricultural biodiversity next to hunger in the centre of the international political agenda.

Agricultural biodiversity must become a top priority in order to meet the challenges of food security and climate change. Its importance and value must be recognised by governments and politicians at all levels. Decisions are needed that:

- Contribute to halting the loss of diversity of cultivated plants, domestic farm animals and other diversity that is essential for food security.
- Ensure the provision of agro-environmental services that contribute to health, nutrition, human livelihood and well-being.
- Include agricultural biodiversity as a key component in the accounts of the «wealth of nations».
- Increase the share of international development aid that goes to agricultural biodiversity.

2. Strengthen collaboration between relevant international organisations and develop common international programmes and strategies on agricultural biodiversity.

To develop the full potential of agricultural biodiversity, multilateral and multi-sectorial actions must be carried out and ties must be strengthened, especially between the environmental and agricultural sectors. This would ensure consistency and synergy in the implementation of the various agreements and instruments. We call for:

- The development of a common roadmap for the United Nations with verifiable goals and milestones, including the establishment and strengthening of ties between relevant multilateral financial mechanisms.
- The development and strengthening of multilateral solutions on access and benefit-sharing through collaboration between the Convention on Biological Diversity, the International Treaty on Plant Genetic Resources for Food and Agriculture and the Commission on Genetic Resources for Food and Agriculture.
- The adoption under the Convention on Climate Change of a work programme on agriculture that recognises the importance of agricultural biodiversity and the development of synergies between the Convention mechanisms and fora on agricultural biodiversity.

3. Accelerate the national implementation of the provisions of existing international agreements and instruments related to agricultural biodiversity.

This requires countries to:

- Develop laws and regulations, or review existing ones if applicable, to implement international commitments.

- Develop and implement strategies and programmes that translate international instruments into national realities. This will require international assistance.
 - Integrate agricultural biodiversity into national and local development plans and strategies for the reduction of poverty.
 - Establish greater cooperation between sectors and institutions involved, especially amongst environmental and agricultural sectors and between the private sector and civil society.
 - Give high priority to research and training in agricultural biodiversity.
4. *Improve support to small-scale food producers, in recognition of their work in developing and safeguarding current and future agricultural biodiversity.*

Many of the provisions of international agreements, such as those related to on-farm management of agricultural biodiversity and its conservation *in situ*, can only be developed locally. It is urgent to find mechanisms to give high priority to supporting the local agro-ecological approaches that recognise farmers' rights and the fundamental role of women. The visions exposed by the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD) can be used and reflected in local actions. We urge to the following:

- Improve the livelihoods and welfare of small-scale food producers to enable them to continue their development work and safeguard agricultural biodiversity.
- Strengthen food systems rich in biodiversity with a local focus and promote the local knowledge and techniques related to them.
- Improve participation in decision-making, ensure access to necessary local resources and respect the rights of farmers.

■ Conclusions and Recommendations at the National Level

- *The role and potential of Spain in the world as regards ABD*

For cultural and geographical reasons, Spain has served as a bridge throughout its history for the exchange of genetic resources from different cultures and continents. The southeastern strip of the Peninsula is part of one of the centres of diversity identified by Russian scientist Vavilov in the last century. From the first centuries of the modern era, Spain has been the bridge between Africa and Europe and a crossroad for agricultural and cultural techniques and genetic resources from the Arab world to Europe.

Thus, some crops from Asia such as citrus fruits, rice and aubergine were incorporated into Spain's agriculture. Subsequently, beginning in the 16th century, Spain was the bridge between the New and the Old World. Key crops

in the Old World such as wheat, barley and faba beans reached Latin America through Spain, and major crops unknown in Europe, Africa and Asia, such as maize, potatoes, beans, tomatoes and squash reached Europe via Spain from Latin America.

Perhaps for these reasons Spain has also played a leading role, recognised and appreciated by all countries during the negotiations of FAO for the conservation, sustainable use, access to research and benefit-sharing derived from these resources. In 1979 at the FAO Conference, our country presented the first proposal for an international agreement on genetic resources and an international genebank.

Spain also had the honour in 1983 of unlocking the political impasse in the negotiations of that agreement thanks to its generous offer to put its national genebank under the auspices of the FAO for the conservation of *ex situ* collections of plant genetic resources from all over the world. Spain was again the country that, in 1987, presented the first proposal for the development of Farmers' Rights.

The Spanish parliament was among the first to ratify the Treaty in 2004 and the first meeting of its Governing Body took place in Madrid (June 2006), in which the Treaty became operational. Throughout the negotiation process, first the International Undertaking and then the brand new binding International Treaty, Spain has been the Chair of the negotiating committee twice, and the Secretary of the negotiating committee was a Spaniard, appointed by the Director-General of FAO, since its creation in 1983 up to 2007.

Consistent with this, Spain should maintain its international leadership on this important issue, meeting existing expectations, both in the development of international policies and international cooperation and technical assistance to developing countries. This does not necessarily imply any additional expense, but a redefinition of priorities in the context of the fight against hunger and the Millennium Goals 1 and 7. In addition to the UN, other additional multilateral policy frameworks could be the Alliance of Civilizations and the Quintet Against Hunger (or Alliance against Hunger), both Spanish initiatives.

- *The ABD situation in Spain:*

Spain is the richest country in Europe when it comes to agrobiodiversity, with a huge variety of species as well as within species. This does not mean, however, that it depends on more than 80% of genes from other countries for our most important crops, as has been shown in previous sections.

The National Inventory of Plant Genetic Resources for Food and Agriculture has about 32,000 local Spanish varieties of cultivated species and the Official

Catalogue of Spanish livestock breeds in 2008 had a total of 153 breeds catalogued. Nevertheless, the loss in recent decades of the enormous genetic heritage representing agricultural diversity has been, and continues to be, substantial, difficult to quantify and often irreparable. In recent decades, rural depopulation and rapid modernisation of agricultural, forestry and fishery production systems have led to the disappearance of countless varieties of crops, livestock breeds, microbial strains, forest species populations and fishery resources. With them, many genetic resources with enormous potential value have also been lost for use in Spain and outside of Spain today and in the future.

The destruction of Spanish agricultural biodiversity constitutes the loss of a very important part of our national heritage. Also, the traditional knowledge associated with the use of agricultural biodiversity is being lost, and consequently an entire culture, because genetic resources are an essential component of local identity in the areas where they were developed and adapted and they are crucial as a cultural element throughout the entire territory.

The first national genebank was established in the 1970s and the first legal and institutional measures that were taken in Spain to stop the erosion of genetic resources for food and agriculture are more than 30 years old. Since then, thanks to different initiatives such as the national sectorial programmes of conservation and use of genetic resources, many diverse materials have been gathered for conservation in long-term maintenance collections, and they have been made available to users. An interesting point is that the majority⁽³¹⁾ of the material conserved in Spanish genebanks is of national origin, contrary to what happens in other industrialised countries. Much progress has also been made in the knowledge of our genetic resources, the awareness of its value has been promoted among farmers and consumers, and many materials have been used in genetic improvement programmes for the benefit of agriculture.

- *Recommendations for the improvement of national coordination: the development of a national ABD strategy.*

It is necessary to develop and better coordinate a national, regional and local ABD policy, dispersed up to now, through the creation of an interministerial Committee, as have other European countries, and promoting laws, regulations and initiatives in this area. The objectives should include: the implementation of the International Treaty, plans of action and international programmes ratified or signed by Spain on this subject; the conservation of our PGRFA, *ex situ* and *in situ*, in genebanks and protected areas; the application of farmers' rights referred to in Article 9 of the ITPGRFA; the promotion of agricultural research and the broadening of the genetic base of our crops; the promotion of public awareness and education of the Spaniards in this matter.

⁽³¹⁾ It is estimated around 65%.

Our Autonomous Communities should play a crucial role in safeguarding their traditional landraces and varieties. In fact, some autonomous communities are taking regional initiatives aimed at the sustainable conservation and use of their own ABD. The case of Andalusia is noteworthy, which has just published a White Paper⁽³²⁾ on PGRFA of interest in Andalusia, as a first step for the development of the future strategy for the conservation and sustainable use of plant genetic resources with risk of genetic erosion and of interest to agriculture and food in Andalusia. This White Paper includes recommendations at a regional level, such as developing an inventory of plant genetic resources of Andalusian origin, constituting a Panel of PGRFA Experts in Andalusia, addressing the regulatory development of the provisions of the International Treaty on Plant Genetic Resources and Law 30/2006 on seeds, contributing to the preparation of reports on the national and international situation of the PGRFA, providing regular information on the status of these resources at the regional level and valuing the potential of Andalusian indigenous plant resources.

In recent years we are witnessing the birth of public and private initiatives specifically concerned with genetic resources. An example of this is the presentation in 2006 of the Spanish Strategy for the Conservation and Sustainable Use of Forest Genetic Resources⁽³³⁾, the development of which is presently being attempted by means of several national plans. In 2009, the Ministry of Science and Innovation decided to launch the OPIS 2020 Strategy, establishing the ten issues in which the country should show levels of excellence by the year 2020. One of these issues is that of genetic resources, including in this case, plant, animal and microbial resources. Should also be mentioned the various associations that are emerging in civil society to conserve and promote the use of these resources and the associated traditional knowledges.

The coordination of all the parties involved in the conservation and use of genetic resources in Spain must be reinforced. There are areas in which there has been little or no progress and that require taking action at the national level, common to all subsectors of agricultural biodiversity, such as the issues related to access to genetic resources or to intellectual property rights, biosafety and recognition of farmers' rights in relation to genetic diversity for food and agriculture.

Furthermore, each of the subsectors (cultivated crops, farm animals, forest species, fish species, microorganisms) require new and effective measures to secure and improve their infrastructure for conservation and use, streamline

⁽³²⁾ Libro blanco de los recursos fitogenéticos con riesgo de erosión genética de interés para la agricultura y la alimentación en Andalucía /Sevilla: Ministry of Agriculture and Fishery, Publishing and Dissemination Service: Directorate-General of Agricultural and Livestock Production, 2012. [online] [Accessed: 16 July 2012]. Available at: http://www.juntadeandalucia.es/export/drupaljda/1337159508LIBRO_BLANCO_sin_portada.pdf

⁽³³⁾ MINISTRY OF THE ENVIRONMENT. *Estrategia de Conservación y uso sostenible de los recursos genéticos forestales*. DGB, Madrid, 2006. [online] [Accessed: 16 July 2012] Available at: http://www.inia.es/gcontrec/pub/ecrgf_11mayo_imprensa_1151661517156.pdf

management and transfer systems, and strengthen national and international cooperation. Also, in recent years new challenges have emerged such as, amongst others, the role that genetic resources must play for agriculture to adapt to climate change, the recognition and use of ecosystem services provided by agricultural biodiversity and the mechanisms to compensate those who preserve and develop it, as well as the growing demand from consumers for diverse, safe, highly nutritious products from an accredited source.

It is therefore necessary to frame all measures and actions currently being taken in a common Strategy that serves the national interests of conservation and sustainable use of our agricultural biodiversity, and that establishes measures for the problems that persist and for the new challenges that are already emerging. This strategy must have mechanisms for a joint and coordinated action of all stakeholders (various public administrations, farmers, universities, research centres, NGOs, private companies, etc.), and establish priorities, distribute responsibilities and allocate the necessary resources. All of this should contribute to the corresponding policies and regulations in force, complementing the existing national strategies and programmes, and incorporating the provisions arising from international commitments assumed by Spain and the future trends in the Common Agricultural Policy.

In a Declaration⁽³⁴⁾ developed by the Ministry of Environmental, Rural and Marine Affairs and the Ministry of Science and Innovation, with contributions by experts from international institutions, there are recommendations to effectively combat the loss of agricultural biodiversity in Spain and for its sustainable use in benefit of the agricultural sector and society in general, especially in view of sustainable food production and climate change expected in the future. In particular, the development and implementation of a National Strategy is proposed, developed with the participation of all stakeholders in the conservation and use of agricultural biodiversity, combining efforts in this area, creating synergies, establishing common principles and objectives, and setting the basis of national and international cooperation on this topic.

- *Specific recommendations on the purpose and objectives, process for their development and possible content of a spanish strategy for the conservation and use of agricultural biodiversity of national interest.*

1. Goal and Objectives.

A National Strategy for the Conservation and Use of Agricultural Biodiversity should pursue the following objectives:

⁽³⁴⁾ This Declaration is the result of the International Seminar on the role of Agricultural Biodiversity in the fight against Hunger and Climate Change, convened by the Chair of Studies on Hunger and Poverty (CEHAP) of the UCO and held in Cordoba from 13-15 September 2010, organised as a contribution to the International Year of Biodiversity and as a complement to the International Declaration that was drafted. The seminar was opened by the Secretary of State for International Development Cooperation and closed by the Minister of the Environment and Rural and Marine Affairs.

- Achieve long-term conservation of genetic resources for food and agriculture and their broad use for the benefit of agriculture and society.
- Balance the sustainable use of agricultural biodiversity through the protection and restoration of natural ecosystems and endangered species.
- Compliance and development of international conventions and treaties ratified by Spain and other international commitments in this area.
- Strengthen national and international cooperation and joint action for the management of genetic resources for food and agriculture.

The National Strategy should guide and frame all actions and programmes for the conservation and use of agricultural biodiversity. It should set the principles and objectives that should govern the subsequent proceedings and establish the creation of new mechanisms and tools when necessary. Also, the implementation of the objectives of the international agreements and initiatives in this area should be considered, such as the Convention on Biological Diversity, Convention on Climate Change, International Treaty on Plant Genetic Resources for Food and Agriculture, and the Multi-Year Programme of Work of the Commission on Genetic Resources for Food and Agriculture of the FAO, amongst others. In this context, it will be necessary to consider the regulatory development and the implementation mechanisms of the measures included in these instruments, such as the systems and protocols to access genetic resources and benefit-sharing derived from their use, and the application of farmers' rights.

The Strategy should also incorporate appropriate mechanisms to acknowledge the work of farmers, cattle-raisers and fishermen as primary custodians of agricultural biodiversity and their major contribution in the past, present and future to the conservation, development and availability of a variety of genetic resources. In this context, the primary role of women should be highlighted.

This Strategy should be integrated into the new orientations derived from the debate on «the Common Agricultural Policy beyond 2013». It should especially contribute to the essential role that agriculture must play in the sustainable use of resources, the conservation of natural habitats, biodiversity and the fight against climate change and its ability to supply healthy, safe and quality food, in line with the document «Europe 2020: a strategy for smart, sustainable and inclusive growth.»

2. *Process.*

For the National Strategy to be truly effective it must be developed by means of a process of dialogue between all stakeholders involved in the conservation and use of cultivated biodiversity in its various subsectors (crops, animals, fish, microorganisms, forest species, etc.). Coordinating the development of the Strategy corresponds primarily to the Ministry of the Environment and Rural

and Marine Affairs that has the competence in this area, but it is also essential to rely on the active participation of the following, among others:

- Relevant agencies of the Central Government: Ministry of Science and Innovation, Ministry of Industry, Tourism and Trade, Ministry of Foreign Affairs and Cooperation, Ministry of Development, as well as relevant Autonomous Agencies (National Institute for Agricultural and Food Technology Research, Spanish National Research Council, Spanish Agency for International Development Cooperation).
- Autonomous Regions.
- Other National administrations involved (councils, regional administrations, etc.).
- Associations and organisations of producers (farmers, ranchers, fishermen, etc.).
- Private companies from different sectors (genetic improvement, seed production, food industry) and their associations.
- Foundations (such as Biodiversity Foundation) and specialised NGOs (such as the Seed Network).
- Public research centres.
- Universities.

3. *Content.*

With regard to content, the following elements must be considered:

- Extensive diagnosis of the present situation, with special emphasis on the major shortcomings and needs of the current system of conservation and use of agricultural biodiversity and on the opportunities and threats that arise for the future, such as climate change.
- General Measures:
 - Infrastructures.
 - Management systems.
 - Funding.
- Sectorial approaches:
 - Cultivated crops and other plant species of interest to food and agriculture.
 - Livestock.
 - Fishery resources.
 - Forest species.
 - Microorganisms of relevance to food and agriculture.
 - Other important components of biodiversity for food and agriculture.
- Cross-cutting themes:
 - Access and exchange of genetic resources and aspects related to intellectual property.
 - Relationships between agricultural biodiversity and climate change.
 - Relationships between agricultural biodiversity and wild biodiversity, including the ecosystem perspective.

- Relationships between agricultural biodiversity and the sustainable development of rural areas.
- Relationships between agricultural biodiversity and edapho-climatic biodiversity.
- Analysis of the contribution of agricultural biodiversity as a key component of the «wealth of the nation».
- Research, Development and Innovation. To this end, the Ministry of Science and Innovation, and where appropriate, the relevant institutions of the Autonomous Communities, should include agrobiodiversity as a priority line of research.
- Creation of new markets and product diversification.
- International Cooperation
- Training, congresses and seminars.
- Communication and dissemination, especially those directed to consumers.

For the implementation of the Strategy it is necessary to take into account the following:

- Mechanisms for management decision-making regarding the Strategy (National Commission, or similar).
- Mechanisms for inter-territorial cooperation with representation of the Autonomous Communities.
- Mechanisms for the best use of existing funding and additional funding mechanisms.
- Mechanisms of coordination and administrative management of the Strategy.
- Mechanisms for implementation of the Strategy in the short to medium term (plans of action).
- A network of infrastructures supported by the Strategy.

■ FINAL CONSIDERATIONS

Although regulatory issues remain crucial, legal provisions alone are not enough because they must be understood, accepted and implemented by both citizens and their governments. For this to occur, it is essential the awareness of the general public. In fact, it is very important that stakeholders and citizens improve their knowledge of the provisions of the International Treaty. Training in this area, as well as public awareness of the importance of genetic diversity and the dangers of its loss, are important challenges.

It must be remembered that genetic erosion is only a consequence of human exploitation of the planet's natural resources. The fundamental problem is the lack of respect for nature, and any lasting solution must involve the establishment of a new relationship with our planet and the understanding of its limitations and fragility. If humanity is to have a future, it is imperative that children learn this in school and that adults include it in their daily lives.

CHAPTER FIVE

THE VOLATILITY OF THE AGRICULTURAL MARKETS AND THE WORLD FOOD CRISIS

José María Sumpsi

ABSTRACT

The paper analyzes the main causes of strong and sudden increase in agricultural prices and food prices in the first half of 2008 that caused food crisis, which was complex, multifactorial and not cyclical. After that, significant price reductions on 2009 and part of 2010 have taken place and again price increased strongly from August 2010 until July 2011. This situation supports the view of a strong agricultural price volatility, which is one of the problems concern to the international community, as evidenced by the fact that the G-20 considered the issue of agricultural market volatility and its impact on the global food crisis as one of the key themes in 2011 under the French Presidency. Structural causes of the high volatility and particularly strong and price spikes, particularly the supply-demand imbalance and climate change, mean that humanity faces a challenge of long-term food supply, which can only be solved through innovation and technology adoption, increased agricultural investment, design and implementation of appropriate agricultural policies and a new global governance for food and agriculture.

Key Words:

Food security, food crisis, price volatility, agricultural investment, agricultural policy.

■ THE GLOBAL FOOD CRISIS OF 2007-2008

The global food crisis began in late 2007 as a result of soaring food prices. The spectacular rise in food prices posed a serious problem for consumers, particularly for the more vulnerable households in developing countries whose food expenditure represents between 60 and 80% of total household expenses⁽¹⁾. But the increase in agricultural prices also represents a great opportunity for agricultural producers, although it is usually only the producers in the most developed countries and commercial farmers in developing countries who are capable of taking advantage of high agricultural prices, as in fact occurred in 2007-2008⁽²⁾. Although from July 2008 world food prices began to fall, they never returned to their previous levels, and in many countries -particularly the poorer ones- food prices did not decline with the same intensity as international prices⁽³⁾. The rise in food prices was compounded by the financial and economic crisis which began at about the same time, and took a turn for the worse in the summer of 2008. The economic downturn led to a reduction in the employment and income of the most vulnerable populations in developing nations and caused serious problems of economic access to food in poorer households, and thus serious problems of food security. The conjunction of these two crises caused an acute increase in the number of people suffering from hunger all over the world, which went from 850 million in 2007 to 1.02 billion by the end of 2009. The return to the path of economic growth in emerging countries and the continuation through 2009 and a large part of 2010 of prices below 2008 levels explains the decline in the number of people suffering from hunger to 925 million in 2010⁽⁴⁾. However, the food crisis not only affected the number of people in the world who suffer from hunger, but also increased the cost of importing food for low-income countries and net food importers, which led to major imbalances in their balance of payments, a rise in public debt in order to finance their food imports and an increase in public expenditure on subsidies for staple foods in order to quiet social unrest.

■ The Nature and Causes of the Global Food Crisis

The 2007-2008 global food crisis marked a new stage in world food insecurity and was quite different to previous crises⁽⁵⁾. The current world food crisis can be defined by three main characteristics: it is global, multifactorial and long-lasting. As we will see later, the complex nature of the current food crisis was at the root of the considerable difficulty that governments and international

⁽¹⁾ FAO. The state of food insecurity in the world (2008a).

⁽²⁾ FAO. The state of food commodity markets (2009a).

⁽³⁾ Ibidem.

⁽⁴⁾ FAO. The state of food insecurity in the world (2010).

⁽⁵⁾ It is necessary to go back to 1972, with the USA's soy and maize embargo of the USSR, which had lost a large part of its harvest, to find a price rise of the same magnitude, and in that case it was more a specific market crisis due to geopolitical reasons that disappeared in the following campaign when the agricultural production in the USSR returned to its normal levels.

institutions experienced in tackling the crisis and alleviating the negative impacts on world food security. Some of the factors involved in the crisis can be addressed by governments, whilst others are more volatile and beyond their control, being market-driven akin to oil prices.

- *Global crisis*

The current crisis is global in the sense that what occurs in some countries (economic development, increase in per capita income, the urbanisation process, increase in the demand for agricultural produce, changes in diet, and the various economic, commercial, agricultural, environmental and energy policies adopted) affects many others due to the phenomenon of globalisation and the interdependence of the global economy in recent years.

Nonetheless, the globalisation of the global economy does not mean only spatial interdependence, but also sectorial interdependence. In fact, the food crisis is a clear example of sectorial interdependence with the energy and financial sectors. The food crisis that began in 2007 and worsened in 2008 cannot be understood without considering the effects of the energy crisis and the financial crisis on the international agricultural and food markets.

The relationship between the energy crisis and the food crisis occurs in two ways. The first is cost inflation. In fact, the prices of some of the primary means of production used in agriculture, such as fertilisers, plastics, herbicides, insecticides, diesel oil, transport depend largely on oil prices. In this way, a rise in oil prices ultimately leads to an increase in the cost of food due to higher agricultural costs caused by the substantial rise in the price of oil.

The second is the production of biofuels⁽⁶⁾, since as the price of oil increases, the production of biofuels from agricultural products becomes economically viable⁽⁷⁾ or else the subsidies designed to make it so are significantly reduced. This leads to an increase in the amount of agricultural commodities that are dedicated to non-food uses, thereby reducing the food supply and forcing a rise in food prices⁽⁸⁾.

The relationship between the economic and financial crisis and the food crisis is also clear. In this sense, the macroeconomic imbalances in the United States, with a strong balance of payments deficit and the policy of extremely low interest rates followed by the Fed, caused the value of the dollar to fall steeply, which affected international agricultural trade flows and contributed to a rise in agricultural

⁽⁶⁾ See the article *Food for Fuel* (DASCHLE, FORD RUNGE and SENAUER, 2007).

⁽⁷⁾ For the relationship between the prices of agricultural commodities and oil prices and the threshold which makes the production of biofuels profitable -in particular maize for the production of ethanol in the USA- see the work of *Tyner et al, 2008* and the study by the International Monetary Fund in 2008.

⁽⁸⁾ See the article by Medina in that same issue which explores in-depth the relationship between food security and energy security.

commodities prices. Furthermore, the housing and financial crisis of 2007 meant that a large amount of money that had previously been deposited in real estate and financial assets was displaced to other markets, in an attempt to flee the dismal profitability forecasts and the uncertainties of financial assets. Thus large volumes of funds ceased to be invested in financial products and were diverted to the futures markets and agricultural commodities exchanges, where prices were already undergoing a clearly upward trend. This in turn led to a considerable increase in the international prices of the main agricultural products, and particularly cereals.

There has been considerable debate as to the role played by speculation by institutional investors and by investment and pension funds⁽⁹⁾ (not traditional commodities traders in the futures markets and grain exchanges) in the steep rise in the international prices of cereals and oilcrops. The main problem from an analytical point of view is to determine the causal link. The question is the following: is it the high price of agricultural commodities that causes funds which were previously invested in other assets to move towards the futures and options markets for agricultural commodities, or is it the diversion of funds from financial assets to the trade in agricultural commodities futures and options that provokes the rise in the prices of the agricultural commodities? A recent research project⁽¹⁰⁾ determined -albeit inconclusively- that it was the first. However more information and research is required into this subject before any conclusions can be drawn as to the responsibility of the speculation in the agricultural commodities markets and exchanges for the steep rise in international agricultural prices. In any case, what is certainly a proven fact is that in the period between 2006-2008 there was a notable increase in non-traditional traders in the agricultural commodities markets, such as investment and pension funds, who took long-term positions in the futures and options markets for cereals and oilcrops. Specifically between 2006 and 2008, non-traditional traders doubled their participation in the futures and options market for maize, wheat and soy, and in the first nine months of 2007 alone, the trading volume of futures and options increased by 30% (FAO, 2008 b)⁽¹¹⁾.

- *Multifactorial crisis*

One of the features that best defines and helps to understand the complexity of the current world food crisis is its multifactorial character; that is to say, there is no one single factor which explains the crisis, but rather it is a crisis caused by multiple factors which at times interact. In the previous point we have already mentioned some of the factors involved in the interrelation between markets, such as the increase in the price of oil, the intensification of the policy for the promotion of biofuels, the devaluation of the dollar and speculative financial

⁽⁹⁾ For a thorough analysis of the relationship between financial investments and agricultural prices see the article by DOMANSKI and HEATH, 2007.

⁽¹⁰⁾ Irwin, García and Good, 2007.

⁽¹¹⁾ For an in depth analysis of the relationship between the evolution of the grain futures markets and international food prices see the FAO publication entitled «Food outlook. Global market analysis» corresponding to November 2008 and December 2009.

movements. These factors could be defined as exogenous to the agricultural and food sector, and their characteristics are more closely associated with other crises such as the energy crisis, the economic crisis and the financial crisis.

In addition to these factors, there are others which could be considered to be endogenous to the agricultural and food sector, and which in some cases have a more structural nature. These include poor harvests due to natural disasters and adverse climate conditions, the increase in the demand for food in developing countries, and particularly in what are known as the emerging countries (China, India, Indonesia, Korea, Thailand, Brazil, Mexico), and the result of both phenomena combined -a reduction in supply and an increase in demand- which is the constant reduction of the level of stocks in the last ten years.

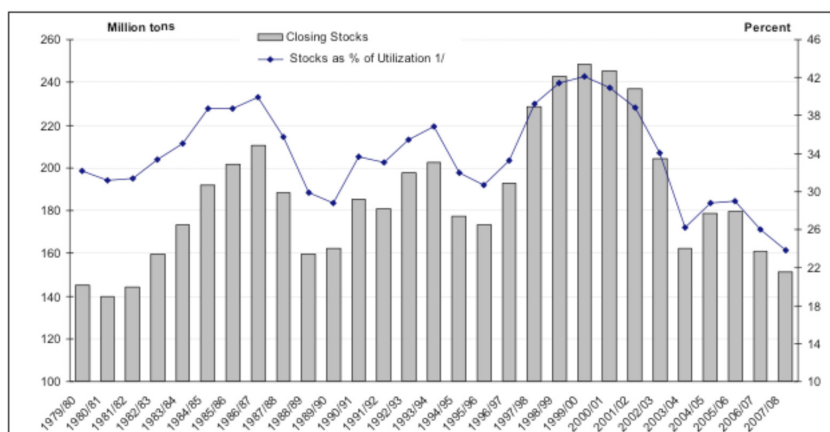
One of the elements that has triggered the rise in agricultural prices has been the decline in cereal production in exporting countries due to adverse climate conditions, which began in 2006 and continued in 2007, and involved a drop in production of 4% and 7% respectively (FAO, 2008). Poor harvests were observed in 2007 due to drought in countries such as Australia, Ukraine and Argentina, but these were offset by increases in production in the United States and the European Union; whereas in 2008, in response to high prices, cereal production increased by 11% in developed countries and by only 1% in developing countries, confirming fears that only farmers in developed countries and a small minority of farmers in developing countries would be capable of reacting to high agricultural prices by increasing their supply. The cause of this situation is that poor farmers in developing countries have no access to land and water, nor can they increase their use of certified seeds or fertilisers to boost production owing to their lack of financial resources, to structural deficiencies in the markets for seeds, fertilisers and other production resources, and -in some cases- even to the lack of availability of these same production resources.

The most important variable, however, was not so much the evolution of agricultural supply as that of agricultural demand, as a result of the sustained and cumulative increase in the last ten years in the demand for agricultural commodities in developing nations, and primarily in emerging countries. This increase has occurred as a consequence of the substantial and sustained rates of growth in these countries, the increase in per capita income and the elevated elasticity of the demand with regard to per capita income. But there has not only been a rise in the volume of food demanded; there has also been a change in dietary habits and thus the composition of food demand, with an increased proportion of meat, milk and eggs, which in turn has boosted the demand for the cereals, fodder and oilcrops that form the basis of cattle feed.

The result of the evolution of the supply and demand of agricultural commodities is that the gap that existed in the 1980s and 90s -the surplus of supply over demand- gradually narrowed until it practically disappeared in 2007, a year in which stocks

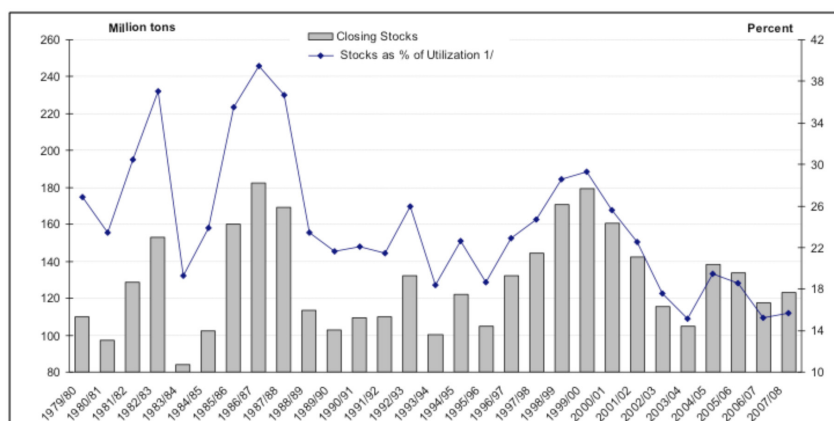
fell to their lowest levels in the last 25 years (graphs 1 and 2). In the opinion of many experts, this constitutes the primary cause for the sharp increase in agricultural prices in 2007 and the first half of 2008. In fact the level of stocks plays a key role in balancing the markets and in mitigating the oscillations in international agricultural prices. If the level of stocks is low in relation to total use, the markets have great difficulty in absorbing a sudden shock in supply or demand, and therefore any drop in supply due to natural disasters and/or adverse climate conditions, or increases in demand, will provoke a sharp increase in agricultural prices, as was the case in 2007 and 2008. In fact, as can be seen in the following graph, the stock-to-use ratio for the main cereals fell to its lowest values in the last 25 years.

Figure 1 – Stocks to utilization ratio for wheat (1979/80-2007/08)



Source: FAO 2008 b

Figure 2. Stocks to utilization ratio for maize (1979/80-2007/08)



Source: 2008 b

Apart from a greater recurrence of natural disasters and adverse climate conditions, droughts, frosts, floods, hurricanes and other phenomena, which many experts link to climate change, certain modifications have been introduced in the agricultural policies of developed countries and some developing countries after the Uruguay Round Agreement; this has led to a sharp reduction in the levels of stocks in the main exporting countries. The volume of cereal reserves maintained by public institutions has been drastically reduced as a consequence of the elimination of intervention purchases by these same institutions, the high cost of storing agricultural produce, the development of other less costly risk management instruments than the policy of regulatory stock, the increase in the number of countries with an export capacity, and the advances in information and transport technology. When there are several poor harvests in a row in the main exporting countries-as a consequence of climate phenomena, a reduction in the planting area for a particular crop, or other reasons- in a situation of low stock levels, the international markets hold back and become highly volatile so that any sudden shock in supply or demand is rapidly and strongly transferred to the prices of agricultural commodities. According to many experts this is one of the main causes for the soaring agricultural prices in 2007 and early 2008.

148 | However, the major world economic recession of 2008 and 2009 and the drop in the income of poorer families has led to a decline in the demand for food and a contraction of global trade which, together with the increase in world agricultural production in 2008 (record harvests) and in 2009 (albeit to a lesser degree), has meant lower agricultural prices globally and in developed nations. Thus, at the present time, high agricultural and food prices in many developing countries coexist with low prices in developed countries, as in the case of the countries of the European Union, where farmers are mobilising in order to maintain farm subsidies.

The last factor that explains the recent steep price rises in the period from March to July 2008, when the international agricultural markets reached record historical highs, involve the defensive public policies followed by some countries since early 2008 in order to defend their domestic consumers. In fact, when the panic took hold of consumers (it is worth recalling how American consumers stockpiled rice around this time, leading to several supermarket chains placing limits on the amount of rice a person could buy) or governments, who began to prohibit, limit or tax agricultural exports, prices shot up and went out of control. For example, in March 2008 and after the limitation on rice exports introduced by several of the main exporting countries, the global price for rice increased by 75% in just one week (FAO, 2008b). Nevertheless, these factors have a temporary effect and when the gravity of the situation subsides, these measures are gradually relaxed.

- *Structural crisis*

One of the most inflamed debates on the nature of the global food crisis concerns the issue of whether it is interim and transitory or permanent or, at least, long-lasting. Most experts and analysts have reached the conclusion that this is not a transitory or short-term crisis like the one in 1972-73, when agricultural grain prices rose exorbitantly due to the shortfall in the harvest in the USSR and other countries and the embargo on maize and soy exports implemented by the main exporter, the United States. Most studies predict that we have entered a phase of high agricultural prices which will last a minimum of five to seven years. There are two main arguments supporting the hypothesis that this is a long-term crisis. This is an issue of considerable importance, as the combination of measures to be adopted in order to tackle this crisis will be different depending on whether this is an interim and temporary situation or whether it is more structural.

The first of the variables to defend the thesis that we are in the presence of a long-term crisis is the low stock levels, the lowest in 25 years. In fact, to recover an acceptable volume of stocks and attain an adequate stock-to-use ratio is not something that can be achieved in one agricultural campaign, but requires various campaigns and sustained growth in agricultural production, which is no easy task. The second variable to explain the persistence of the global food crisis is the demand for food, since the increase in demand can be expected to continue in the medium and long term, and with a high rate of growth, as a consequence of population growth and the increase in per capita income in developing countries.

However, international cereal and oilcrop prices began to fall in July 2008. The drop in world prices for primary agricultural commodities was due to the exacerbation of the international economic and financial crisis which negatively affected the economic growth rates in a number of countries, even in certain developed countries with negative rates, with the resulting impact on the decline in food demand, a sharp fall in the price of oil, and the drain of capital from the futures and options markets. This new situation reignited the debate on whether the global food crisis was interim or structural, with some experts even considering that the crisis had already been overcome and that a new period of low agricultural prices was about to begin.

However, most experts and international organisations, led by the FAO, considered that it was too early to speak of the end of the global food crisis. In the first place, because although it is true that prices had been falling since August 2008, the levels were still higher than the average prices for the period 2005-2007. Secondly, because although international prices had dropped noticeably, the mechanisms whereby international prices are transmitted to

national and local prices are not immediate or effective, causing food prices to continue to remain very high in many developing countries. Thirdly, because stocks were very low, so that any shock in supply, or a reduction in planting as a result of the fall in agricultural prices, particularly in developed countries, could trigger another rise in prices in 2009. Finally, developing countries and particularly emerging countries returned to a path of healthy economic growth rates in 2010, so that the demand for food once again began to increase strongly in those countries. It was thus that in August 2010, as a result of the poor wheat harvest in the Russian Federation and the Ukraine caused by drought and fire, the ban on wheat exports by these major exporting countries and the low maize harvest in the United States at the end of 2010 set off a new food crisis as a consequence of soaring prices from August 2010 to August 2011, when they began to decline slightly until December 2011, although they still remained high. In January and February 2012 international agricultural prices have once again recovered their upward trend. This evolution of international agricultural prices, and particularly cereal grains and oilcrops, confirms the thesis of the experts and organisations such as the FAO, who in 2008 predicted that this was a structural crisis and not an interim and transitory situation⁽¹²⁾.

■ Lessons from the Global Food Crisis

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The present crisis leaves us with a series of lessons that we will attempt to summarise below. The first and most important is that there is an absence of global governance or adequate mechanisms for tackling a global food crisis of the kind we have undergone and are currently experiencing. The global economy and the markets have become globalised, but no global monitoring and coordination mechanisms have been created, nor have the necessary international regulations been established to prevent or at least to tackle this type of crisis when it occurs. The powerlessness of the United Nations and other international organisations such as the World Trade Organization to establish some rules of the game or international regulation in the matter of international agricultural trade, or to obtain international agreements on biofuel policies, the possible creation of global grain reserves, and -in a general manner- public policies, reveals the need to rethink the institutional architecture and the global governance of agriculture and food.

In fact one of the proposals that was presented at the Conference of Rome and which was then discussed at the meeting of the G-8 in July and again at the High-Level Conference in January 2009 held in Madrid, is the creation of a Global Alliance on agriculture and food which, in addition to governments and international agencies, will involve the participation of civil society and the private sector. Agriculture is a private economic activity, and thus to tackle the world food security crisis decisively requires not only the commitment of the

⁽¹²⁾ For the evolution of international agricultural prices, see the FAO publication entitled *“Food outlook. Global market analysis”* of August 2012.

public sector, but also the participation of the private sector and civil society. This Global Alliance would play a key role in the international coordination of public policies which affect food security (agricultural policies, trade policies, biofuel policies and others), as well as promoting a medium and long-term increase in public and private investment, official development aid, and the agriculture and food security of developing countries. It would serve as a forum for discussing the approval of international regulations on sensitive issues which affect world food security, such as international grain reserves, for example.

A second lesson is the lack of financial instruments for immediate response when beset by the most pressing and immediate effects of a food security crisis such as the one experienced. Indeed the United Nations has various financial mechanisms to respond rapidly in the case of natural or humanitarian disasters, but there is no type of mechanism or instrument when the cause that provokes the food crisis is a market shock, as in the case of the 2007-2008 food crisis. There is currently a discussion under way on the possibility of creating a fund with these characteristics, or of extending one of the already existing funds, and various financial options are being debated in order to enable the mobilisation of resources in the short and medium-term for the purpose of stimulating an increase in food production.

This crisis has also highlighted the multiplicity of causes and its complex nature which have made it so difficult to tackle. There is a lack consensus on the primary causes of the crisis, the remedies to be applied, and the public policies to be followed. Issues so seemingly far removed from agriculture and food as the housing crisis, the energy crisis, financial speculation or climate change affect world food security, and it is therefore necessary to set up multidisciplinary groups of high-level experts and networks of research institutions to improve our knowledge of this type of crises, both with regard to their causes, and the remedies and policies to be enacted to avert or resolve future crises of this kind.

In every crisis there are always opportunities, and the international community reacted positively in this crisis, albeit not as quickly as might have been hoped. Today, governments and society in general are much more aware of the problem of hunger, and this will ultimately bear fruit. Today there is no world summit at which the hunger and food crisis is not a topic for discussion. This implies a social awareness which will certainly lead to policy changes and additional financial resources in order to combat hunger. Another positive element that became clear from the FAO conference in June 2008 is that agriculture and food security have returned to the international agenda after many years in the wilderness. Finally, it is worth pointing out the fact that the international agencies that make up the United Nations and the Bretton Woods system have succeeded in working together in a coordinated manner. This has been another

important result of this crisis and an opportunity which has been maximised under the leadership of the Secretary General of the United Nations.

The final conclusion is the need to abstain from implementing only short-term measures as a means of fighting against the crisis. In fact, given that the crisis is not transitory but long-term, the only approach is to use a combination of short, medium and long-term measures, and to integrate these measures into national strategies and policies on food security.

■ THE VOLATILITY OF THE AGRICULTURAL COMMODITIES MARKETS

■ The Increase in the Volatility of the Agricultural Markets and its Effects

The volatility of the agricultural markets is nothing new for agricultural economists, but is a characteristic that is inherent in the agricultural sector which has to do with the elasticities of agricultural supply and demand, the lag between the decision to plant and the time the crops are harvested, the variability in harvests as a consequence of the variation in the climate conditions in each campaign, and other factors. Developed countries implemented agricultural policies such as market intervention (and even price guarantees in certain cases), direct aid to production, protection at the borders and export subsidies and/or food aid, which succeeded in reducing the volatility of agricultural prices -at the expense, of course, of exporting the volatility to the rest of the world.

However, since 2007 the volatility of the agricultural markets has increased significantly⁽¹³⁾, with episodes of sharp rises in the period from November 2007-June 2008 and August 2010-June 2011 and major falls in the period from July 2008-July 2010. The negative effects of high volatility are multiple and vary depending on the actors involved in the food chain. In the short term it offers an opportunity for producers to improve their profits, an opportunity which experience shows is only exploited by farmers in developed countries and by commercial producers in developing countries, but which also creates uncertainty in the medium term leading to sub-optimal decisions with regard to agricultural investment. For consumers in low-income countries and net food importers it represents problems for economic access to food, and thus greater food insecurity. For the governments of poor countries it creates serious macroeconomic imbalances due to the increase in the cost of food imports, lower income due to the reduction of tariffs, and higher expenditure due to subsidies for agricultural production means and/or foodstuffs. And for international bodies, particularly those responsible for food aid, it represents enormous problems, as against a backdrop of serious food insecurity, they

⁽¹³⁾ For a more detailed analysis on the causes of the rise in agricultural prices see *Leipziger, 2008, Mitchell, 2008 and OECD 2008*.

must reduce the number of people they can help as a consequence of the sharp rise in agricultural prices, unless donors provide additional contributions to offset the rise in food prices, which does not always occur⁽¹⁴⁾.

■ International Action to Reduce the Volatility of Agricultural Markets

In view of the above, it is not surprising as a result that the G-20 summit held in Seoul in November 2010 approved a multi-year plan for development including a chapter on agriculture and food, which discusses the issue of the volatility of agricultural markets. It is less surprising that France, a country with a long farming tradition, and which held the presidency of the G-20 in 2011, chose the issue of volatility as the central theme of the G-20 that year. At the request of the G-20, the international bodies, particularly the World Bank, the OECD and the FAO, drew up an analysis of the problem of the volatility of agricultural prices and presented a series of proposals to reduce this volatility⁽¹⁵⁾. These proposals were subsequently debated by the meeting of the agriculture ministers of the G-20 in June 2011, and finally approved at the G-20 summit of November 2011. The measures approved at that summit focused on improving information and intelligence systems for agricultural markets⁽¹⁶⁾, improving information, and establishing regulation for the futures markets, introducing a system of notification, justification and monitoring before the WTO for restrictions on agricultural exports, a commitment to advances in the Doha Round under way with regard to the deregulation of the international agricultural commodities trade, exemptions from measures restricting exports in the case of purchases by international bodies for food aid, support for instruments of market risk management, including agricultural insurance, and stimulating increases in agricultural productivity. In contrast, they were unable to approve any commitment to eliminate obligatory mandates for the use of biofuels and/or the subsidies for its production from cereals and oilcrops or its consumption; nor did they consider the establishment of an international stock management system, either physical or virtual -not even for emergencies- due to the problems of management, the high cost, and doubts as to its effectiveness. However they did approve an upgrade in real-time information on existing stocks in the world, as part of the commitment to improve the information and intelligence on the agricultural markets.

⁽¹⁴⁾ In the 2008 food crisis the World Food Programme (WFP) had to appeal to the international community to increase its resources by 1.5 billion dollars, of which they achieved only 60%, in order to offset the rise in the price of the food needed for its programmes. The restrictions on rice exports which caused the price of rice to soar in March 2008 were also applied to the purchases of the WFP, which aroused serious criticism from the international community and became one of the primary demands of the High-Level Group set up by the SG of the UN in April 2008 in order to coordinate the actions of all the agencies in the United Nations system.

⁽¹⁵⁾ For more details on the proposals of the international agencies to the G-20, see the publication *Price Volatility in Food and Agricultural Markets: Policy responses March 2011*

⁽¹⁶⁾ Specifically, it approved the creation of the AMIS (Agricultural Market Information Systems) as an inter-institutional system formed by the various international agencies that work in this field, whose secretariat is at the FAO.

The question that arises is: which of these measures is the most decisive and can contribute most to reducing the volatility of the agricultural markets, and therefore to reducing the negative effects of this volatility, particularly on vulnerable consumers in developing countries, or -in other words- on the food crisis suffered by the world since 2008 and which has led to a situation where the number of people living under minimum levels of nourishment has gone from 850 million to almost 1 billion? But before we can answer this question we need to ask what are the primary causes underlying the increased volatility of the agricultural markets. This we will do in the following section.

■ Causes of the Increased Volatility in the Agricultural Markets

One of the great debates amongst agricultural economists in recent years has been whether the deregulation of the agricultural commodities markets approved at the Uruguay Round would increase or decrease their volatility⁽¹⁷⁾. However in spite of numerous studies, a clear conclusion has yet to be reached on this issue. What is clear, however, is that prior to deregulation there was less volatility in agricultural commodities markets in developed countries, thanks to the protectionist policies enacted since the 1960s⁽¹⁸⁾, although the same cannot be said of developing countries, or of the volatility in international agricultural markets. In contrast, critics of deregulation consider that it has led to an increase in volatility in the agricultural commodities markets, although many of these critics come from the developed world, which has powerful and protectionist agricultural policies. In a global economy (and whether we like it or not, globalisation is here to stay), it is evident that the lack of deregulation existing in the international agricultural commodities trade is one of the causes of the volatility on international markets. For this reason it is understandable that the undertaking of the G-20 summit to reduce volatility included a commitment to conclude the Doha Round in order to reinvigorate the deregulation of the international agricultural commodities trade.

Beyond this academic debate, however, it is worth posing the same question in view of the situation during the crisis of 2007-2008, when the price of staple foods rose between 50 and 100% in a few short months. There is a divergence with regard to the relative importance of each factor in explaining these steep price rises, but there is total consensus as to the underlying factors, and even as to the distinction between the primary and secondary causes. The crucial and originating factor explaining the increase in the volatility on agricultural markets is that since the year 2000, and as a consequence of the rapid growth of emerging countries such as Brazil, China and India (demand), and a decline in agricultural investment in developing countries (supply), the demand for food

⁽¹⁷⁾ For an analysis of the effects of the deregulation of international agricultural trade on the volatility of agricultural prices, see the work of *Trostle 2008*.

⁽¹⁸⁾ For an analysis of the volatility of prices in the agricultural markets in developed countries and in particular in the EU, see the article by *Cramon-Taubadel, 2009*.

has grown faster than its supply, to the point where the minimum historic levels of global grain stocks were reached in 2007. This is true for cereals for human consumption, but even more so for cereals for animal fodder. The increase in per capita income in emerging nations has not only boosted demand for food, but has also led to changes in diet, with an increase in the consumption of animal products, leading in turn to greater demand for fodder cereals, oilcrops and protein crops. The gap between supply and demand is so narrow and the levels of stocks are so low that there is not much room for manoeuvre. This means any climate event that reduces the harvest in a major producing country -as occurred in Australia (wheat) and Argentina (soy and wheat) in 2008 or Russia (wheat) and the USA (maize) in 2010- can trigger steep and very rapid price increases (soaring prices). The increase in the recurrence of extreme climate events due to climate change, and the shocks in supply they produce have played a part in exacerbating the volatility of agricultural prices.

Financial speculation in the futures markets and the increase in the demand for grain to produce biofuels, due to their profitability in a climate of high oil prices or due to legal mandates in response to environmental concerns, have also affected the rise in prices, but should be considered as secondary causes or factors accompanying the original factor mentioned above. Finally, once the crisis, caused by reduced harvests in various major producing and exporting countries, as a result of drought, or other climate phenomena, is under way, the ensuing panic leads governments to adopt certain measures such as restrictions or even bans on exports, which ultimately aggravates the crisis. This also highlights the lack of mechanisms for the coordination and convergence of policies and systems of global governance -a subject discussed below- in order to prevent and avert this second crisis wave caused by these defensive and hastily enacted policies. We have already mentioned the case of rice (a staple foodstuff for 2 billion people) which in April 2008 saw its international prices shoot up by 70% in one week due to the prohibition on rice exports adopted by three of the world's five main rice-exporting countries. Other countries decided on hasty purchases in the grip of panic when faced with the prospect of a rice shortage, which were later seen to be unnecessary when the markets settled down after a few months, and contributed to aggravating the food crisis of 2008.

Therefore the main measure, although not the only one, for reducing the volatility of the agricultural commodities markets is to increase the supply of food, and in order to do so it is necessary to boost agricultural production and productivity. In this aspect the experience of the crisis of 2008 is far from encouraging, as although the supply of agricultural produce reacted to trading signals, it did so very unevenly. Thus, although developed countries increased their production of cereals by 10% in response to the high cereal prices, in developing countries the increase was only 1% due to the inability of poor and

smallholder farmers in these countries to increase their agricultural production due to lack of land and water, lack of financing for purchasing certified seeds and pesticides, fertilisers, fuel and fodder, lack of training, lack of transparency in the markets for agricultural inputs and other factors. And in view of the fact that the imbalance between supply and demand is the primary cause of the increasing volatility of the agricultural markets and of world food insecurity, and that for the future the great potential for the increase in world agricultural production lies not in developed countries but in developing countries, there are reasonable doubts as to the future of the volatility on agricultural markets and global food security, which will be analysed throughout the rest of this article.

■ THE CHALLENGE OF FEEDING THE GLOBAL POPULATION IN 2050

Mankind has always lived under the threat of the Malthusian prophecy, which predicted that the population would grow exponentially while food production would grow linearly, and the time would come when there would be insufficient natural resources on the planet to feed mankind. Today, this prophecy has not come about fundamentally for two reasons. The first is that the demographic policies of the most populated countries of the world, and particularly in the aspect of birth control, have succeeded in slowing the demographic explosion of the first half of the 20th century. The second is that the technological revolution in agriculture has enabled crop and livestock yields to increase more than linearly in the second half of the century. Examples of that revolution include the member countries of the European Economic Community, which in the 1960s had a deficit in almost all agricultural produce, and in only 20 years following a highly protectionist agricultural policy which made it profitable for the wholesale application of new agricultural technologies, went to a situation of surpluses in all basic products such as cereals, milk, meat, oils, wine and other products, which had to be given outlet through extremely expensive export subsidies. But there are also examples of productive successes in developing countries, and it is perhaps the case of India that best illustrates the success of the green revolution which has enabled crop yields to be multiplied three- or fourfold and the milk and meat production yield to be increased. This has been a decisive factor in the country's development and the elimination of famine in a country with 1 billion inhabitants.

Although the demographic explosion has slowed thanks to the intervention of birth control policies in the most populated countries in the world, in 2050 global population will reach a figure of 9.2 billion inhabitants, an increase of 35% over the current population. Most of this increase in population will occur in developing countries. The urban population will represent 70% of

the total, compared to 49% today, and the per capita income will rise sharply in developing countries. In order to satisfy the increased demand for food in an ever-growing, more urban and more prosperous population, it is estimated that global food production will need to increase between now and 2050 by 70%, and to double in developing countries. This is the great challenge facing mankind for the future⁽¹⁹⁾.

■ The Challenges Facing World Agriculture

The pressure of the demand for food from an expanding world population will be aggravated in the coming decades by the impact of climate change on agricultural productivity -particularly in the countries in sub-Saharan Africa-, the degradation of natural resources, soil, water, forests and fisheries, and the increase in the use of agricultural commodities for the production of biofuels. According to the conclusions of a meeting of international experts held at the FAO headquarters in October 2009⁽²⁰⁾, 90% (80% in developing countries) of the increase in food production will come from an increase in crop yields, and only 10% (20% in developing countries) will come from an increase in land under cultivation, given that there has been a considerable expansion of agricultural boundaries in recent decades, and land is now limited; futher, this also poses vast challenges and produces serious environmental problems⁽²¹⁾. The uneven evolution of global population and the total area of arable land means that the arable land per inhabitant will decrease from 4.3 ha in 1960 to 2.6 ha in 2010 and 1.5 ha in 2050. Therefore, and given that there are clear limits to the expansion of the agricultural boundary and the increase in the area under cultivation, in order to feed the global population, each hectare will have to produce more food than it does today, against a backdrop of scarce resources, particularly water and land, and climate change, which represents a major challenge for agriculture. The bad news is that the average growth rates of world agricultural productivity have gone from 3% in the 1960s to only 1.4% in the first decade of the 21st century, and it is estimated it will fall below 1% in the 2050s. Furthermore, and after the lessons learnt from the technological revolution of the second half of the 20th century, and particularly from the green revolution and its negative impacts on the environment and on natural resources, the rise in agricultural productivity must be achieved by means of agricultural systems and practices which ensure that the increase

⁽¹⁹⁾ [How to feed the world in 2050](#). International conference organised by the FAO in Rome. October 2009, where a group of international experts analysed and debated for three days the primary challenges facing agriculture in its quest to feed mankind in 2050.

⁽²⁰⁾ [Ibidem](#)

⁽²¹⁾ In a recent study on the possible extension of crop lands in the world, three scenarios were considered based on the information from two international databases (GAEZ and SAGE); these scenarios were much more expansive than the one considered by the experts gathered at the FAO in the international conference mentioned above in October 2009. However these scenarios only take into account soil data and the suitability of lands for cultivation, without considering economic and social criteria (Roudart and Even, 2010).

in food production is compatible with the conservation of natural resources, the mitigation of climate change and with economic and environmental sustainability. And the only way of ensuring that these objectives are compatible is by adopting existing agricultural technologies that are economically and environmentally sustainable, and of course by generating and adopting profitable new agricultural technologies adapted to climate change.

■ Technologies

The first conclusion is that the use of agricultural technologies that safeguard the environment, natural resources and climate change, and are well-adapted to the particular ecological, economic and social conditions prevailing in developing countries, will be a key factor in increasing agricultural productivity in a sustainable way and in feeding mankind in 2050. This is because the great potential for increasing food production does not lie in developed countries, which are now almost near their biological limits, but in developing and emerging countries, where the margin for increasing agricultural productivity is still very significant, as the initial levels are very low. In Africa, for example, the irrigated area is no more than 5% and the average fertiliser dose used is 7 kg per hectare⁽²²⁾. The good news is that there are already some well-proven agricultural policies which enable agricultural productivity to be increased without damaging the environment and natural resources, and which may contribute to mitigating climate change. These technologies are grouped into what the FAO designates the ecosystem approach to sustainable productive intensification, constituting the basis of the second green revolution, which must be adopted in developing countries, and particularly in Africa. Some of these technologies and practices include conservation agriculture, precision agriculture and particularly the efficient use and application of fertilisers, integrated plague management, sustainable management of natural resources, water, land, forests and fisheries, and the conservation and sustainable use of genetic resources.

But feeding the world population in 2050 is not simply a technological challenge, amongst other reasons because -as we have just seen- there are already new technologies that have been successfully tried and tested and allow productivity to be increased in a sustainable way, without degrading the environment and natural resources, and that even have a positive effect on mitigating climate change. Nonetheless, all this is of no use at all if these proven and available technologies are not adopted in developing countries and by poor smallholder farmers who produce more than half the food in the world⁽²³⁾. In order for these proven and available technologies, and others that may be generated in the future, to be adopted by poor farmers in developing

⁽²²⁾ See the work *The special challenge for sub-Saharan Africa*, presented at the International Conference *How to feed the world in 2050* FAO, 2009.

⁽²³⁾ Sustainable intensification (FAO, 2011).

countries, it is necessary to have adequate policies and strong institutions, both at the global and national level, in addition to a significant increase in public and private investment in agriculture and food security.

■ Policies

The World Summit on Food Security in 2009 established a twin-track model which consists of combining emergency measures such as food aid and social protection networks for the most vulnerable populations, with medium and long-term measures designed to improve rural production infrastructures (electrification, storage, irrigation, roads, transformation and processing of agricultural products), research and development (R&D), agricultural extension, access to markets for means of production and agricultural products, the establishment and reinforcement of agricultural credits and risk management systems, the creation of food reserve systems, at least to tackle emergency situations, dismantling agricultural subsidies for developed countries which distort the international agricultural commodities trade and supporting farmers in developing countries with public aid for private investment, and providing public assets such as plant health and animals.

In the first quarter of 2008 and to tackle the crisis situation caused by the sharp increases in food prices, many governments adopted protectionist policies in an attempt to contain social unrest. However many of these policies had negative effects which made the crisis worse, for example, the reduction of import tariffs and the subsidy on staple foods which exacerbated public deficits and foreign debt, the fixing of maximum prices for agricultural products and sometimes for seeds and fertilisers -which caused even greater scarcity as operators stockpiled agricultural production and production means whilst awaiting the relaxation of these exceptional measures-, or the emergence of a black market. Most governments in developing countries affected by the crisis, and international bodies, focused on emergency measures to achieve a short-term increase in production through the subsidised or even free distribution of seeds, fertilisers and other means of production. The lessons learnt from the crisis of 2008, however, demonstrate that although it is necessary to implement emergency and food aid measures, paramount importance should be given to applying the most suitable policies, and not merely prioritising short-term but also long-term measures in order to establish the foundations for sustainable agricultural development.

One of the main problems of agricultural policies in developing countries is that they are aimed at commercial farmers, and fail to take account of poor smallholders and subsistence farmers. Three billion people live in a rural environment, and 2.5 billion are engaged in farming on 400-500 million farm holdings of 2 hectares or less. Approximately 75% of the world's poor and

hungry live and work on these smallholdings. Various studies, and specifically the 2008 report on world development by the World Bank⁽²⁴⁾, have demonstrated that agricultural development is more effective for alleviating poverty and hunger than other types of development. The experience of many countries has also shown that a farmer in the developing world with 2 ha or less can be viable when the policies and incentives are correct, and that when this occurs, small-scale farmers in developing countries respond to price signals⁽²⁵⁾.

Smallholder peasant and family-run farms have long experienced major difficulties which new technologies can contribute to resolving. In many countries the quality of the soil and water is deteriorating, and there is a decline in the growth rate of agricultural productivity and even in the yields of certain crops. The services of some other ecosystems are also deteriorating, for example forest and grassland systems. Smallholder farmers and peasants have been ignored by their governments, and by scientists, donors, the private sector and practically everyone, but they are still today responsible for most of the world's food production, and they can do more to feed themselves and feed others with a little help. The FAO is promoting the ecosystem approach for the sustainable intensification of agricultural production as the best means to overcome food insecurity, poverty and the degradation of natural resources in a context of climate change. This method is based on technologies, policies, knowledge, information, and development of capabilities, so that the developing countries can increase the agricultural productivity and profitability of smallholder farmers in a sustainable way.

■ Institutions

With regard to international institutions, the food crisis triggered at the start of 2008 by the sharp increase in food prices revealed that one of the causes of that crisis was the lack of an international institutional architecture and a system of global governance for agriculture and food which would guarantee the regulation, convergence and coordination of national policies which adversely affected global food security, a subject which will be discussed in another section of this article.

With regard to national institutions, it is essential to reorganise and reinforce the ministries of agriculture and the public institutions responsible for animal and plant health and food safety, as these are public resources which must be financed by the public sector at least through mixed -not purely private- formulae, as this was already attempted in the 1990s with the result of a sub-optimum contribution of public assets. It is also crucial to rebuild and strengthen the institutions for agricultural research and experimentation, since many of the new technologies cannot simply be transferred from one country to another but must be previously adapted to local conditions, and this is the

⁽²⁴⁾ World Development Report 2008. World Bank.

⁽²⁵⁾ The example of the green revolution in India.

role of the agricultural experimentation centres. The agricultural extension services, using methodologies such as the Farmer Field Schools, are also an essential instrument in ensuring the adoption of technologies by smallholder farmers in developing countries.

■ Investments

According to estimates by the FAO, the gross annual agricultural investment needed to achieve an increase in agricultural production in order to feed the world population in 2050 must go from 142 billion to 209 billion USD (2009 dollars) -an increase of 50%⁽²⁶⁾. Increasing investment in agriculture and food by 50% requires raising both private investment and public expenditure in developing countries, as well as agriculture and food aid from developed countries. Numerous developing countries devote less than 10% of their public expenditure to agriculture, even though in these countries this is in many cases a key sector for the balance of trade, contribution to GDP, and even more so to employment. On the other hand, the proportion of development aid for developing countries that is dedicated to agriculture has fallen from 17% in the 1980s to 3% in the period 2005-2008⁽²⁷⁾. Furthermore, the total amount of development aid has been falling since 2008 as a consequence of the economic and financial crisis besetting developed countries, which further aggravates the situation.

The same study by the FAO calculates that the investments necessary in developing countries to support this expansion of agricultural production accounts for a net annual average of 83 billion USD (2009 dollars)⁽²⁸⁾. This total includes investments in primary agricultural activity and post-harvest services such as storage and processing, but does not include public assets such as roads, large-scale irrigation projects, electrification and others that are also necessary. Another challenge is to increase capital stocks in lagging areas with a view to both reducing hunger and improving agricultural productivity. One study examining the long-term results of investment in agriculture since the 1970s highlighted the fact that, in general, the countries that had made the greatest steps in reducing hunger also presented the highest rates of net investment per farm worker. During the whole of the 1990s, the added value per worker in the group of countries with less than 2.5% of undernourished population was approximately 20 times higher than in the group in which over 35% of their population was undernourished.

⁽²⁶⁾ See the work *Investment*, presented at the International Conference *How to feed the world in 2050*, FAO 2009.

⁽²⁷⁾ Ibidem.

⁽²⁸⁾ The predicted 83 billion net USD in net annual investment in agriculture until 2050 comprises around 20 billion USD destined to crop production and 13 billion for livestock production, whereas the other 50 billion USD would be destined to support services for secondary activities such as cold and dry storage, facilities for rural markets and wholesalers, and the first stage of processing.

In particular, investments in research and development into agriculture have been demonstrated to produce very high yield rates and have a potentially important role to play. Currently a large body of public research is carried out by international centres within the Consultative Group on International Agricultural Research (CGIAR). Although there is general acknowledgement of the usefulness and the advantages of this system of international research bodies and affiliated organisations -which has made an enormous contribution to the worldwide stock of agricultural technology and knowledge- it continues to be a matter of debate as to how to finance these bodies, as often governments do not consider that it is in their interests to provide substantial donations to a body whose benefits are distributed far beyond its components or borders. For this reason it is understandable that the reform and financing of the CGIAR appeared on the G-20's agenda as a central element for increasing agricultural productivity and reducing the volatility of the agricultural markets.

Agriculture is not a public activity; it is a private activity, even though it may generate public externalities which benefit the whole of society and which should be remunerated (payments for environmental services, conservation of natural resources -particularly soil and water-, carbon sequestration, and others), and for this reason a large part of the investment in agriculture should be private. However, in order to increase private investment in agriculture it is necessary to have a favourable legal and economic climate. With regard to the first, it is essential to address the security of property rights, -including intellectual property- and the regulation of foreign investments -including the purchase of land-, and the repatriation of profits. With regard to the economic climate, the essential variable is agricultural commodities prices. The situation of high prices for agricultural commodities that we saw in 2007 and 2008, and have again been experiencing since August 2010, has a serious negative impact on global food security and on food for poorer consumers, as well as on the public finances of low income countries and net food importers; however it definitely represents an opportunity for increasing agricultural investment and productivity, and farmers' incomes.

Nevertheless, the poor in developing countries have a limited capacity to resolve their investment deficit. The proportion of public spending corresponding to agriculture has dropped to approximately 7% in developing countries and to an even lower level in Africa, whereas the percentage of Official Development Aid that is dedicated to the sector has gone from 17% in the 1980s to 3.8% today⁽²⁹⁾. The proportion of loans from the World Bank and regional development banks that are granted to agriculture in developing countries is also very low, and is less than 10% in sub-Saharan Africa. Although private investment funds dedicated to African agriculture represent an interesting new development in recent years, the actual volume of these investments is still very low.

⁽²⁹⁾ Data from OECD reports on the ODA (Official Development Assistance).

■ THE NEED FOR GLOBAL GOVERNANCE OF AGRICULTURE AND FOOD

■ Advances Achieved after the Global Food Crisis of 2007-2008

International agencies reacted rapidly to the world food crisis of 2007-2008. Thus in December 2007 the FAO launched its ISFP programme (Initiative on Soaring Food Prices), which was embodied in an ambitious action programme in 2008⁽³⁰⁾. But it soon became clear that the lack of coordination between the main international agencies was one of the primary hindrances to providing an effective response to a food crisis that was worldwide, complex and of vast proportions. It was thus that at the end of April the Secretary-General of the United Nations convened a meeting of the heads of all the agencies in the United Nations and the Bretton Woods system (World Bank, International Monetary Fund and World Trade Organization), in which it was decided to create a High-Level Group (HLG) for the global food crisis, chaired by the Secretary General of the United Nations, with the Director General of the FAO as its Vice President and all the directors and chairmen of each of the agencies mentioned as members. The ultimate aim of the HLG was to guarantee the coordination between all the agencies, to draw up a Global Action Plan (GAP) and to ensure the application and effectiveness of this GAP in the countries most seriously affected by the crisis, which were basically low-income countries and net food importers.

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In June 2008, at the peak of the explosion in food prices, a high-level international conference was held at the headquarters of the FAO in Rome. This conference produced significant achievements, such as the acknowledgement of the strategic importance of agriculture and food, the need to increase public and private investment in agriculture, and to earmark development aid for agriculture and food, lead to the reinstatement of agriculture and food on the international agenda. Various heads of state, ministers and presidents of the World Bank and regional development banks announced additional financial resources to combat the global food crisis to the tune of 22 billion dollars. However the weak point of the conference was its final declaration, as it was impossible for the 183 countries present to reach an agreement on such sensitive but important issues for alleviating the crisis as the moratorium on subsidies to stimulate the production and use of biofuels, or the elimination of export restrictions. The wide-ranging interests of the different FAO member countries, the difficulty of reaching agreements due to the rule of unanimity for the taking of decisions in the organisations of the United Nations, and the prevalence of national interests over and above global interests, prevented

⁽³⁰⁾ Soaring Food Prices (FAO, 2008).

agreements being achieved on the most sensitive issues, and highlighted the need for a new global system of governance for agriculture and food⁽³¹⁾.

The exacerbation of the financial crisis and the economic recession in the middle of 2008 diverted the attention of the international community towards this new crisis, although the food crisis continued largely unabated, in spite of the reduction in international prices observed from August 2008. The financial crisis adversely affected the mobilisation of financial resources announced at the High-Level Conference held in Rome in June 2008, and in January 2009 only 20% of the total resources stated at the Conference had been reached. The only initiative worth highlighting was that of the European Commission, which dedicated 1 billion euro to the EU Food Facility approved in late 2008 to finance rapid response actions aimed at increasing agricultural production in fifty countries, mostly in Africa.

The G8 Summit was held in L'Aquila in July 2009, and was enlarged with the presence of emerging countries, some aid-receiving countries and international agencies. At this summit one of the most important international agreements in the matter of food security was achieved with the creation of a fund of 20 billion dollars for three years. The L'Aquila Food Security Initiative recognises that the means of ending poverty and hunger in the world is not through food aid, but by developing agriculture in developing countries. The L'Aquila declaration enshrines five fundamental principles, in line with the Declarations of Paris and Accra on the effectiveness of development aid, which are the following: 1) support for national plans led by developing countries; 2) support for national plans which contemplate broad measures in the short and long-term to increase agricultural production and economic access to food; 3) improved coordination between donors, beneficiary governments, interest groups and international agencies on both the global, regional and national scale; 4) importance of the role of international technical and financial agencies; and 5) ongoing and sustainable financial support for national food security plans with monitoring and accountability. These five principles became the World Summit on Food Security of November 2009 organised by the FAO, on the Rome principles.

Part of the conclusions of the international conference on world food security organised by the Spanish Prime Minister and the Secretary General of the United Nations and held in Madrid on 26 and 27 January 2009 included the initiation of discussions and work to reform the Committee on World Food Security as a central element of the Global Alliance for agriculture and food proposed at the international conference in Rome in June 2008. The Committee on World Food Security was set up at the World Summit on Food Security in 1996, and was based in the FAO, but it had long since ceased to perform any

⁽³¹⁾ The international High-Level Conference held in Rome in June 2008 marked the first time the need for a Global Alliance for Agriculture and Food was raised, although it was not specified what this Alliance would consist of.

relevant function. The reforms which were discussed and approved by all the actors and interest groups involved made it more inclusive -so that not only participating governments took part, but also the private sector, organisations in civil society, private foundations, agencies of the United Nations and the World Bank-, reinforcing its attributions -particularly in the coordination and convergence of policies-, increasing its resources and endowing it with a high-level panel of experts. The 2009 Summit approved the reform of the Committee on World Food Security, which thus became a central element in the new system of world governance for agriculture and food. The first plenary session in October 2010 approved the committee's working plan for 2010-2011, as well as the high-level panel of experts for the analysis of policies which affect food security and the recommendations for measures to be adopted for the coordination and convergence of policies. The execution of the work plan was analysed in the plenary session of November 2011.

The riots and social protests provoked by the food crisis were enough to convince world leaders and the United Nations that it was impossible to ensure a safe and peaceful world in which almost 1 billion people suffered from hunger, and this has largely contributed to the reinstatement of the issue of agriculture and food on the international agenda after many years of oblivion. Thus the last G-20 summit held in Seoul in November 2010 approved a multi-year work plan to promote global development, consisting of seven chapters, one of which is agriculture and food security. The issues addressed in this chapter include the need to invest in research and development, reforming and increasing the financing of the CGIAR, monitoring compliance with the initiative of the amplified L'Aquila G-8 summit (AFSI), studying measures to attenuate the strong volatility of agricultural prices, and a code of conduct for foreign investment in land. The French presidency of the G-20 in 2011 chose as its central theme the volatility of agricultural prices, and in the summit of the G-20 in November 2011, as indicated above, important agreements were achieved on the adoption of measures to reduce the volatility of agricultural prices. It is also worth highlighting the considerable advances of the G-20 in reinforcing the international system of R&D and establishing a code of conduct for foreign investment. These issues will be discussed below.

■ Strengthening the International R&D System

The role of technological innovation will be fundamental, and in addition to already existing technologies, innovation in technology is potentially important for increasing agricultural productivity, but this must be achieved using clean low-carbon technologies to mitigate and adapt to climate change. In this regard, it is worth pointing out the importance of biotechnology and genetic engineering. Given the complex challenges facing agriculture in its quest to increase world food production -against a background of degradation

and scarcity of natural resources and climate change- turning our backs on biotechnology and genetic engineering is something that mankind can probably not afford to do. It will be vital to establish all the necessary precautions and to enact legislation on biosecurity to minimise the risks of genetically modified organisms, but biotechnology has so much potential that it will be very difficult to do without it if we wish to feed the population in 2050, and even more so against a backdrop of climate change. A large part of the adaptation of agriculture to climate change will come through biotechnology. But in order for that potential to be developed, it is essential to increase public and private resources dedicated to agricultural research, to reform and reinforce the Consultative Group on International Agricultural Research, and to reconstitute the national systems of agricultural research.

It will undoubtedly be necessary to design and implement new and imaginative formulae for promoting R&D in agriculture and food in developing countries. An important challenge is to close the gap between research and development with regard to the main cereals and the staple foods which are most important for smallholder farmers in regions with a high prevalence of hunger, for example secondary cereals such as sorghum and millet. Most of the investment in the private sector was made by private companies in high-income countries. In contrast, the role of the private sector in most developing countries is very limited, due to lack of opportunities for financing and incentives for private research, in addition to the uncertainty of the returns. This is particularly true in the case of biotechnology and genetic engineering, where a small number of multinationals conduct research in order to launch new varieties of commercial crops such as soy, maize, rapeseed and cotton, which allow these companies to recover the necessary investment to launch new transgenic varieties onto the market. The application of biotechnology to crops which are less commercial but which are of great interest for food security in some regions would require public-private agreements in order to exploit the greater scientific and research potential of the major multinationals, but with public-sector or international cooperation funds cofinancing part of the research and development, so that the new varieties can be sold to poor farmers in developing countries at low prices, following a similar pattern to the approach taken by the pharmaceutical industry, international organisations and public health funds to promote the sale of generic medicines at low prices.

Code of Conduct for foreign Investment in Agriculture

Given the limitations of alternative sources of financing for investment, direct foreign investment in agriculture could make an important contribution to reducing the investment deficit in agriculture in developing countries. But this investment has increasingly been directed to the purchase of land, for purposes ranging from the production of biofuels, to the diversification of

investors' portfolios or food security. Although this type of investment may provide benefits for development in terms of transfer of technology, creation of employment and promoting infrastructure and gains from exports, the associated increases in food production are often destined to be exported to the country of the investing company or sovereign wealth fund, which raises a range of political, economic, and even ethical issues, particularly when investments are made in a country which is beset by food insecurity, and a sovereign wealth fund or public company from another country buys hundreds of thousands or even millions of hectares. The fundamental question is whether the outlook for food security and the reduction of poverty in developing countries is better with these investments or without them, and how to enhance their benefits and avert their negative consequences. For this reason a code of good practices has been drawn up for foreign investment in agriculture and food by various international agencies such as the World Bank and the FAO, which is currently being analysed by the G-20.

■ CONCLUSIONS

After all we have seen so far, we can now attempt to respond to the question: is it possible to reduce the volatility of agricultural prices and avoid food crises such as the one we have been experiencing since 2007? The answer is complex because it depends on many factors, including the evolution of nutritional patterns for the global population between now and 2050. If in 2050 the 9 billion inhabitants on the planet were to eat like we do today in developed countries, the answer is that there would not be enough food in the world, and the food crisis -and even the Malthusian prophecy- would become a reality. However, this is unlikely to happen, amongst other reasons because from the standpoint of nutrition and public health, it is unadvisable to eat the way a large part of the population in the developed countries does, where obesity is one of the most serious public health problems. Thus we find ourselves facing a problem not only of production but also of distribution, not -in this case- of wealth, but of foodstuffs, as whilst one part of the world's population has too little to eat and is undernourished, the other part eats too much and suffers from obesity.

If we start from the basis of adequate nutritional levels and a sufficient and healthy diet, we can conclude that the wholesale adoption of already available sustainable technologies -plus the generation and adaptation of new technologies- will in the coming decades allow greater flexibility between supply and demand in the agricultural markets. This would lead to a situation of lower volatility and lower prices than at present, thereby improving world food security, and particularly if advances are made in the deregulation of the international agricultural trade, which is certain to come about sooner or later.

But in order for the sustainable increase in agricultural productivity -the key factor- to become a reality in the context of a scarcity of natural resources and climate change, it is not enough only to reinforce the international and national system of R&D to generate the required technological innovation; it is also necessary to move towards reinforcing national agricultural institutions, designing and applying adequate agricultural and food policies, and increasing public and private investment. To do all this, it is essential to achieve a new global governability for agriculture and food. All this is a commitment to be undertaken by everyone: by the governments of the poorer nations, who are primarily responsible for developing their agriculture and eradicating hunger in their countries; by the governments of rich countries who must supply more development aid for the agriculture of these countries, and eliminate policies which adversely affect the agricultural sector of developing countries; and by international organisations, civil society and the private sector.

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CHAPTER SIX

HUNGER AND CONFLICT

Pablo Yuste Echarren⁽¹⁾

SUMMARY

Conflicts⁽²⁾ do not necessarily have to be violent, or negative: they are often normal elements within social relations and they help to maintain, develop or change entities which are at the very heart of our society⁽³⁾. Yet we shall be specifically focusing on armed conflicts, i.e. those in which the community is unable to manage and confront their conflicting interests in a creative manner, whereby the situation degenerates into a cycle of physical violence⁽⁴⁾. The dynamics of conflict may therefore mean that a disagreement between various parties turns into a war, which may be a low-intensity war, as the majority tend to be, but which may take on greater dimensions and become a high-intensity conflict whenever it involves more than 1000 victims per year.

On a different note, hunger is the most extreme and radical manifestation of poverty. Reducing by half the number of hungry people in the world has been earmarked as a priority within the

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⁽²⁾ Civil and internal armed conflicts have been on the rise since the late 80's and constitute an overwhelming majority of conflicts in the post-Cold War era: only 3 of the 61 major armed conflicts between 1989 and 1998 were inter-State conflicts. The end of the bipolar confrontation has reduced the risk of a world war, but it has also given rise to a more insecure world, given the proliferation of local conflicts, especially in poor countries.

⁽³⁾ COSER, L. A., «Conflict», in W. OUTHWAITE and T. BOTTOMORE (ed.), *The Blackwell Dictionary of Twentieth-Century Social Thought*, Blackwell, Oxford, 1993, pp. 103-5.

⁽⁴⁾ PÉREZ DE ARMIÑO, Karlos, *Diccionario de Acción Humanitaria y Cooperación al Desarrollo*, Hegoa, Universidad del País Vasco, 2000.

UN's Millennium Goals (MDGs). Widespread hunger is marginalised from government agendas when compared to the media attention that famines tend to receive. Yet the overall impact, both economically and in terms of lives, is far greater in the case of widespread hunger than that of famines.

Studies and research centred on the links between war and hunger have been conducted on the premise that hunger is a consequence of conflict. Through this paper, we aim to provide a more in-depth analysis in order to identify hunger as also being both a cause and instrument of conflict.

Key words:

Conflict, food security, hunger, malnutrition, humanitarian aid.

■ INTRODUCTION

War and hunger have ridden side-by-side since the times of the Old Testament in a coupling which ultimately culminates in the Fourth Rider: Death. Although the connections between war and hunger have been studied in depth, little work has been done linking food crises to conflict. Yet experience shows that both are likewise closely related in a cycle whereby the effects and consequences of one compound and augment the effects of the other.

We can establish differing types of civil conflicts by taking into account their causes, objectives, dynamics, combatants, consequences and the instruments employed. Yet we must establish that certain conflicts are the end product of various realities in one. Conflicts may thus be the result of support provided by regional groups or powers to rebel groups (Mozambique), counterinsurgency wars (Afghanistan), civil wars (Eritrea), wars of liberation (Ethiopia), wars against marginalisation or to prevent genocide (Uganda) and wars of rebellion against a central power in decline (Liberia, Somalia, etc.) and exploited by so-called *Warlords*.

Internal armed conflicts⁽⁵⁾ also present differences in terms of their outcomes, which tend to be the following: a) All-out victory on the part of the rebel movement or movements and the introduction of a new regime (Zaire/Congo, Uganda, Ruanda, Ethiopia, Albania). b) The *de facto* creation of a new State (Eritrea, Somaliland, Bosnia). c) Negotiated peace with a power-sharing option (Mozambique, Liberia, Nicaragua, El Salvador, Camboya, Georgia, Sierra Leone). d) A stalemate (Sudan, Angola, Algeria, Afghanistan, Sri Lanka, Burundi). e) Perpetuation of the collapse of the State (Somalia)⁽⁶⁾.

On a different note, food security has become one of the most fertile fields of study as regards development and humanitarian action⁽⁷⁾. Yet this concept

⁽⁵⁾ For more information on the new typology of conflicts, see, among others: GALTUNG, JOHAN, «Los fundamentos de los estudios sobre la paz», in RUBIO, A. (ed.), *Presupuestos teóricos y éticos sobre la Paz*, Universidad de Granada; GALTUNG, JOHAN, «Paz», in RUBIO, A. (ed.), *Presupuestos teóricos y éticos sobre la Paz*, Universidad de Granada, 1993; KALDOR, MARY, *New and old wars. Organized violence in a global era*, Tusquets, Barcelona, 2001; MARTÍNEZ GUZMÁN, Vicent, *Filosofía para hacer las paces*, Icaria, Barcelona, 2005; MUÑOZ, FRANCISCO A, *La paz imperfecta*, Universidad de Granada, Granada, 2001; NÚÑEZ VILLAVÉRDE, Jesús and REY MARCOS, FRANCISCO, *Iraq en su laberinto: apuntes para una salida*, CIP/IECAH, Madrid, 2003.

⁽⁶⁾ *Op Cit* PÉREZ ARMIÑO, Karlos.

⁽⁷⁾ Food Security as a scientific discipline first appeared in the 70's thanks to the world oil crisis, which gave rise to a worldwide crisis in cereal and foodstuffs. Since then, different explanatory paradigms have occurred concerning the origin and causes of hunger. Recently, the political causal explanation has gained strength, relating to long-term policies, the willingness of leaders, the need for concertation agreements that create social capital within States and the realisation of the right to food. According to this paradigm, the victims of hunger in many cases are not characterised so much by resource poverty as by lack of political power in order to claim their rights and put political pressure on the State which is supposed to represent them.

is often treated vacuously, linking it to the causes of hunger and famines and aimed at their eradication. Moreover, food security is now an ever-present aspect of development projects, especially those related to rural and agricultural development. Through this article, we aim to provide an in-depth analysis of the existing interaction between hunger and conflict as well as shedding light on how the right to food tackles this issue.

Technically, when referring to situations where part of the population suffers from hunger, we tend not to employ the term hunger but rather food insecurity. A population has food security when «all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life»⁽⁸⁾. Food security has four dimensions⁽⁹⁾:

- a. The physical availability of food, which depends on local production, reserves and markets;
- b. Physical and economic access to food;
- c. Utilization of food. In reference to how food is turned into nutrients, divided among the members of a family, handled, cooked...; and
- d. Stability of food availability. Variations in the availability of food throughout the year may lead to food problems.

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We are also obliged to analyse food security in terms of its temporality:

- a. Chronic food insecurity – hunger - or moderate malnutrition suffered endemically by the most vulnerable sectors;
- b. Temporary food insecurity, associated with exceptional causes and which may lead to famines if adequate measures are not taken; and
- c. Seasonal food insecurity, conditioned by diverse factors such as shortage of food reserves, increased food prices, etc.

For our initial approach, and although they will be clearly defined over the following pages, it is essential to outline two concepts which are often identified in a similar way. On the one hand, *hunger* is a generic term which describes a situation of an *under* consumption of food or malnutrition, usually chronic, and, on the other, *famine*, which often encompasses a more specific reality.

■ INTERRELATIONSHIP BETWEEN HUNGER AND CONFLICT

Famine can be viewed as a disaster which is secondary to other disastrous events such as droughts and war, which in turn lead to other types of disasters: mass displacement and refugees. For instance, when there are large-scale migratory movements due to a famine, over-population occurs in small areas giving rise to safety and humanitarian problems.

⁽⁸⁾ 1996 World Food Summit.

⁽⁹⁾ Food Security Information for Action. Practical Guides. FAO.

The stability of social, political and economic conditions are the determining factors in food insecurity and define the capacity to address the situation when the population is vulnerable, such as during a drought. Immediate risk factors such as wars or droughts are closely associated with those fundamental factors; more vulnerable populations are less able to overcome setbacks and more susceptible to famine. Political stability alone often leads to armed conflict and civil unrest, which can be a direct cause of famine.

In such contexts, food insecurity is graded according to its intensity and classified in five levels⁽¹⁰⁾:

1	General food security	Crude mortality rate: 0.5/10,000/day Acute malnutrition: <3% Stunting: <20% Access/availability: 2100 kcal person/day
2	Chronic food insecurity	Crude mortality rate: 0.5/10,000/day; Under-Five Mortality Rate or U5MR <1/10,000/day Acute malnutrition: >3% but <10% Stunting: >20% Access/availability: 2100 kcal person/day unreliable and barely adequate food
3	Acute crisis in food and means of subsistence	Crude mortality rate: 0.5-1/10,000/day; U5MR 1-2/10,000/day Acute malnutrition: 10-15% Access/availability: 2100 kcal person/day through sale of assets
4	Humanitarian emergency	Crude mortality rate: 0.5-1/10,000/day; U5MR >2/10,000/day Acute malnutrition: >15% Access/availability: less than 2100 kcal person/day
5	Famine/catastrophe	Crude mortality rate: >2/10,000/day; Acute malnutrition: 30% Access/availability: extreme lack of access, far less than 2100 kcal person/day

Food insecurity may arise for different reasons and in any one of its intensities. The most common causes are:

- War, armed conflict or social upheaval,
- Crop failures due to climatic or environmental causes such as drought, floods, wind, insect plagues (mainly locusts),
- The interruption or destruction of the food distribution chain and/or market system affecting a large part of the population. The cause may lie in political, environmental or economic crises.

⁽¹⁰⁾ Summary of the table from the Integrated Food Security Phase Classification FAO June 2006. Table created by the authors.

Amongst the cited causes, the most common are drought and conflict. In the case of conflict, the resulting instability interrupts the delicate productive cycle of agriculture, destabilises the markets and transport networks which deliver the food to its final destination and increases the costs of food production. Conflict impedes normal food production as it displaces populations and halts the arrival of supplies, as well as dismantling markets. Conflict affects all elements of food security as it affects the availability of food, its access and exploitation. On occasions, hunger is not only an indirect result of conflict but a weapon of war in itself.

At times, hunger is imposed upon a population under the control of the opposing side seeking to weaken the enemy and the loss of popular support. History shows us how, despite being a common strategy, it is not any more effective. The combatants, who are usually armed young men, are the last ones to go hungry. The most vulnerable population is the most affected: women and children. An extreme example of this phenomenon can even be found in Europe when, during the great Russian sieges (Leningrad, Kiev, etc.), it was revealed that the population had «stopped eating» in order to feed the soldiers.

The capacity of hunger to generate conflict is a subject that has been studied to a far lesser degree. Although scientific approaches to the issue have recently been instigated within *Peace Studies*, strictly direct relationships have not been considered, though this may be about to change. Agricultural productive capacity has become a strategic element not only as a means of subsistence for people, but also for its strategic value in the struggle for raw materials and as a source of speculation in an international panorama in which it seems that food is becoming scarce and crops have become an element of energy policy.

Excessive population growth in certain regions has led to governments and multinationals purchasing large areas of land beyond their borders. China, for instance, which has a huge and growing population, also has large desert areas. It has therefore started to buy up large areas of land in Africa, a form of agrarian colonialism, which has a significant destabilising potential.

In a similar vein, European regulations making it mandatory to use 10% of biofuels in transport as from 2015⁽¹¹⁾, along with the attractive business opportunities arising from intensive food production in the light of future climate change, water shortages and the increase in current population levels, specifically in countries such as China and India, are encouraging large countries like China to buy up huge areas of land in Africa. In recent years, and by way of illustration, the Ethiopian government has offered three million hectares of its most fertile land to developed countries and some of the wealthiest individuals in the world so that they can export food to their own

⁽¹¹⁾ Source: European Commission, 2012.

populations. The paradoxical statistic here is that 13 million people in Ethiopia are suffering a food crisis⁽¹²⁾.

Furthermore, drought is generally the main cause of reduced agricultural production. However, the traditional idea of there being a direct cause-effect relationship between drought and famine has been overturned by studies over the last twenty years which have revealed other, more complex relationships between them⁽¹³⁾. In recent years, wars have been the primary cause of famines; we only need to look at Africa for confirmation of this. As a natural phenomenon, drought has been ever-present throughout history and occurs to a greater or lesser frequency in many regions.

In those contexts in which the vulnerability of the population is very high, this type of natural catastrophe can give rise to a crisis which, if it cannot be tackled through family coping strategies, government policies or international aid, may trigger a disaster, including famine. Droughts have diverse consequences, which both spread and worsen as the situation goes on, and they affect⁽¹⁴⁾:

- a. Livelihoods, especially those of farmers and shepherds, who lose part of their food production and income, being forced to gradually sell off their productive resources in order to survive, thereby jeopardising their future subsistence;
- b. Food security, more the result of diminishing economic resources than of diminishing supplies;
- c. Health, since the scarcity of drinking water forces people to drink contaminated water, which in turn leads to diarrhoeal illnesses;
- d. The work overload of women, who must travel even further in order to bring water back to their homes; and
- e. The macroeconomic situation of the country, which deteriorates on several fronts due to the fall in agricultural production.

■ HUNGER AND FOOD SECURITY

In terms of food security, hunger is defined as the «*inability of people to cover their food needs*»⁽¹⁵⁾. Minimal nutritional needs are currently measured in caloric terms at 2100 Kcal a day, though this not an average and certainly does

⁽¹²⁾ However, Ethiopia is not the only country offering up its most fertile and plentiful fields to these new kinds of colonisers, displacing millions of farming families who suddenly find their property being invaded by tractors and farm machinery. To date, 20 African nations have sold 50 million hectares of their land.

⁽¹³⁾ *Op Cit.* PÉREZ DE ARMIÑO, Karlos,

⁽¹⁴⁾ CLAY, E., «Aid and Drought: Responding to the Human and Economic Consequences of Natural Disasters», in O'Neill, H. and J. Toye (coords.), *A World without Famine? New Approaches to Aid and Development*, Mcmillan Press and St. Martin's Press, London-New York, 1998, pp. 199-220.

⁽¹⁵⁾ This definition is provided by the World Food Programme (WFP).

not mean that all the members of a family have the same caloric requirements⁽¹⁶⁾. The inability to meet food needs results in malnutrition. Malnutrition can refer to either a lack of food (undernourishment) or an excess. Undernourishment manifests itself to a greater or lesser degree according to its severity and nature:

■ **Protein-calorie Undernourishment Occurs from an Insufficient Intake of Proteins and Calories and can lead to two Different Pathologies:**

- Kwashiorkor and marasmus. Kwashiorkor is usually linked to protein deficiency. The name of this illness is clearly related to its origin. The name Kwashiorkor comes from Ga, a language spoken in South-Eastern Ghana, and translates as «deposed/displaced child» in reference to a baby who has been weaned from the breast when a younger sibling comes along. It should be taken into account that meat consumption amongst populations living in poverty is minimal or even non-existent.
- In Afghanistan for instance, people eat an average of one meal a year containing meat. The symptoms of kwashiorkor include oedema and distended abdomen. It is also associated with ulcerations and skin problems. The most poignant sign of this illness is without doubt the swollen belly that we see all too often in famine situations.
- In contrast, marasmus does not only imply protein deficiency, but rather it is caused by a complete lack of food. This in turn causes the body to consume its own tissues to ensure its survival. The symptoms include an absence of fat tissue, even in areas such as the buttocks where fat tends to build up, depigmentation and hair loss. A combined pathology also exists, known as marasmic kwashiorkor.

■ **Micronutrient Undernourishment**

Micronutrient undernourishment refers to the lack of vitamins and minerals. A deficiency of such micronutrients not only causes short-term health problems. It also leads to long-term learning disabilities and retardation along with lower resistance to disease. The consequences for the future development of societies are difficult to gauge. The most common deficiencies among developing countries are in vitamin A, iron and iodine⁽¹⁷⁾:

- Vitamin A: According to the FAO, every year between 250,000 and 500,000 children are left blind for life due to a lack of vitamin A (xerophthalmia). Two thirds of these children are exposed to a greater risk of dying than the rest of the population.
- Iron: a lack of iron primarily results in anaemia. It also causes physical fatigue, complications during childbirth, retardation and lower resistance to disease. The loss of blood associated with anaemia causes 20% of deaths during childbirth. Anaemia also increases infant mortality after delivery.

⁽¹⁶⁾ Source: World Food Programme (2005).

⁽¹⁷⁾ Source: International Food and Agriculture Organisation of the United Nations (FAO)

- Iodine: according to the FAO, more than 200 million people suffer from mental retardation or goiter caused by a lack of iodine. Iodine deficiency is the primary cause of preventable mental retardation in the world.

As you will certainly have realised by now, women and children are the ones who suffer most from the effects of undernourishment. This is mainly because, in communities affected by hunger, women and children, along with the elderly, are always the first to go hungry. To date, few studies have been conducted as regards the impact on the elderly population, although in such scenarios merely reaching old age is an accomplishment in itself and something which only a very small minority ever achieves.

Other vulnerabilities, as in the case of people suffering from a physical disability, are exacerbated during food shortages. In our brief journey through hunger-related pathologies, a further relationship arises on which, due to its difficulty, few studies have been carried out. Namely, the fact that a loss of mental capacity due to undernourishment throughout childhood can lead to fewer opportunities upon reaching adulthood, which can in turn lead to the person being more prone towards violent behaviour. One thing that is certain and which does not require any extensive studies is that the lack of mental resources can result in far fewer job opportunities, thereby leading to a greater number of young people to swell the ranks of the combatants.

■ Obesity

There is a third type of malnutrition, increasingly linked to poverty as a new, yet equally worrying phenomenon. It involves an over consumption of calories, with or without a sufficient intake of micronutrients.

When we compare a map of areas affected by traditional undernourishment to a map showing areas of child obesity, we find that they coincide. As a growing phenomenon, those within the poor population who can afford the required daily calorie intake turn to cheap food that has a high number of calories and very low nutritional value. This type of malnutrition leads to obesity, diabetes and high blood pressure as well as potentially serious micronutrient and protein deficiencies.

In order to classify the severity of malnutrition, an age, weight and size comparison is made between the target population and the members of that population who have never gone hungry.

All those weighing 80% less than the average weight for their age and height are deemed to be affected by undernourishment. Moderate undernourishment applies to those within the 70-79% bracket and severe undernourishment to

those below 70%⁽¹⁸⁾. Another measurement of undernourishment is the Middle-Upper Arm Circumference, or MUAC. A value below 12.5 indicates Moderate Acute Malnutrition (MAM) and below 11 implies Severe Acute Malnutrition (SAM). The sum of both is called General Acute Malnutrition (GAM).

One crucial factor must be taken into account as regards the humanitarian impact of any event, including food shortages: vulnerability. It is difficult for a European reader to understand the extent to which conflict situations and their populations are fragile. The fragility of such populations is caused by various issues:

- The poorer a population, the greater the percentage of its income spent on food, leaving less money available for other types of expenditure such as health, investment in productive elements, or education. In developing countries, the most vulnerable live on less than one dollar a day and spend 80% of their resources on food. The slightest price rise has a huge impact on their chances of surviving a crisis.
- Hunger does not affect all people equally. Take the population of the Sahel, for instance. It constantly faces undernourishment beyond emergency levels. When the situation gets worse, people do not have sufficient reserves in their body to go for long periods without eating and still maintain their productive capacity.
- Besides bodily reserves, those of families are also extremely low. When a shortage arises, people are forced to take uneconomical decisions simply to survive. They sell their herd of animals, for example, which would enable them to farm the following year, or eat the seeds which they keep for planting from one harvest to the next. This means that their survival today puts their short-term future into jeopardy.

All of which creates situations of extreme vulnerability, whereby the impacts of having no access occur more quickly and far more dramatically than we could ever imagine from our viewpoint in an overfed world.

■ HUNGER AND CONFLICT

We must analyse the relationship between hunger and conflict bidirectionally. In one direction, food insecurity and malnutrition seem to have contributed towards the increased rate of crises and the increased vulnerability of those countries facing them. Today, most armed conflicts and natural disasters are centred on regions which are highly dependant on agriculture and countries with a high percentage of homes suffering from food insecurity, classified by

⁽¹⁸⁾ See the report published by Save the Children, *Acute Malnutrition Summary Sheet*, at <http://www.savethechildren.org/atf/cf/%7B9def2ebe-10ae-432c-9bd0-df91d2eba74a%7D/Acute-Malnutrition-Summary-Sheet.pdf>

the FAO as «*Low-Income Food-Deficit Countries*» (LIFDCs)⁽¹⁹⁾. In the other direction, as well as being the result of a conflict, food insecurity can in fact be both its cause and origin. Very few conflicts occur in situations where there is food security.

■ Conflict as a Cause of Food Insecurity

«Conflict causes food insecurity by reducing the production of food, access to food, well-being and human capacity through the destruction of the environment, health and health care services, education and social infrastructure»⁽²⁰⁾. The first way in which conflict affects the food security of populations is to reduce production. According to FAO data, between 1970 and 1997, agricultural losses caused by conflict in developing countries amounted to 121 billion dollars. In sub-Saharan Africa, losses in the 80s and 90s represented over 50% of the aid received and greatly exceeded foreign investment. According to 2003 World Bank data, inter-state wars lead to an annual fall of 2.2% in Gross Domestic Product (GDP)⁽²¹⁾.

Another major effect is the breakdown of normal trade. Conflict tends, on the one hand, to increase the military spending of the affected countries at the expense of other investments, such as infrastructures which could provide a cheap means of bringing food to people suffering from insecurity. And on the other, military operations compete to a large degree for the same logistical elements as the procurement market, thus raising food transport costs and impeding access, especially that of the poorest people. Conflict also brings about a reduction in health spending in favour of military spending.

It should be pointed out that conflict as a cause of hunger has been extensively studied and therefore we do not intend to dedicate a large part of this article to its analysis. Generally speaking, the elements described by Frederick C. CUNY in his book *Famine, Conflict and Response* (1991) are still relevant. Conflict leads to hunger by way of the following causes:

- It interrupts the agricultural cycle
- It drives farmers from their land
- It interrupts trade mechanisms
- It destroys food stores
- It provokes food shortages which pushes up prices

⁽¹⁹⁾ International Food and Agriculture Organisation of the United Nations (FAO), *Reducing Poverty and Hunger*, Document Repository, 2002, at: <http://www.fao.org/DOCREP/003/Y6265S/y6265s03.htm>

⁽²⁰⁾ SEN, Amartya, «*Conflict, Food Insecurity and Globalization*» in Ellen MESSER and Marc. J. COHEN, *Conflict, Food Insecurity and Globalization*, Food Policy Research Institute report (IFPRI), May 2006.

⁽²¹⁾ Source: World Bank.

■ Hunger as a cause of conflicts.

Hunger as a cause of conflicts has been the subject of far fewer studies. As we shall see, until recently hunger was not regarded as a key element of armed violence. It was regarded as just another element which required many other destabilising elements. Only recently has this relationship come to light and the effects of the global food crisis have begun to alter the paradigm. Food, a secondary conflict-triggering factor in early warning indicators of conflict, is now becoming a primary factor. Time will tell whether, as predicted by certain studies, it becomes a crucial factor in the long term as food insecurity increases around the world.

A report issued by the *International Food Policy Research Institute* (IFPRI)⁽²²⁾ in May 2006 entitled *Conflict, Food Insecurity and Globalization* includes the following emphatic statement: «most wars of the late 20th century and early 21st century are “food wars”, meaning that food is used as a weapon, food systems are destroyed in the course of conflict, and food insecurity persists as a legacy of conflict»⁽²³⁾. The study analyses various conflicts based on their levels of food insecurity, defining food insecurity as a lack of food, a lack of access to food or undernourishment.

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In a study conducted by the same institute in 2003, the results could not be more unequivocal. Overlaying a map of food insecurity on a map of conflicts revealed that of the 44 countries that had high or average food insecurity (between 5% and 20% of the population), 24 had active conflicts, 18 were in post-conflict situations and 2 were receiving refugees from external conflicts⁽²⁴⁾. This result seems to prove beyond any doubt that conflict and the subsequent situations caused thereby generate rates of food insecurity that exceed 20% of the population. Furthermore, a large percentage of that population meets the criteria to qualify for humanitarian aid. In other words, their acute food insecurity culminates in the loss of human lives which, as we have already seen, mainly involves women and children.

The report thus proves something that, by common sense, we have been aware of since biblical times: hunger and war ride side-by-side. However, the study debunks one of the great dogmas of the advocates of globalisation. One of the ideas upheld as being positive effects of globalisation was that the opening up of markets could prevent insecurity in contexts of conflict by allowing markets to remain supplied.

⁽²²⁾ The *International Food Policy Research Institute* (IFPRI) is probably the Research Centre which has carried out most research into the relationships between hunger and conflict.

⁽²³⁾ *Op Cit.* Ellen MESSER and Marc J. COHEN.

⁽²⁴⁾ See Map 2 of Discussion Paper 206 *Conflict, Food Insecurity, and Globalization* May 2006 International Food Policy Research Institute.

Despite the fact that in many such contexts it was shown that the affected economies' access to international markets was high, this did not prevent the consequences for the food insecurity of the populations. Globalisation also failed to create a more stable world as its advocates had been suggesting⁽²⁵⁾. Globalisation has not brought peace to the world, quite the opposite. It has in fact brought new tensions, as we shall see. This study confirms what we have been seeing for the last 20 years.

Although globalisation has led to a reduction in inter-State conflicts, intra-State conflicts have increased very significantly. One thing that does seem apparent is that the effects of globalisation are clearly beneficial to the arms trade, yet the food markets do not appear to benefit from the same level of access⁽²⁶⁾. A clear example is the recent famine in Somalia, where the markets could not be supplied with food, but the militias' access to weapons allowed them to build the most sophisticated arsenal that money can buy.

Although IFPRI studies have established a clear link between post-conflict situations and food insecurity, with more than 20% of the population having no access to adequate food, not all of the population affected by high food insecurity lives in countries in conflict. Some countries have a large number of people suffering from food insecurity but who live in non-conflict situations, as is the case of India.

Literature from *Peace Studies* tends to evaluate two sources of conflict: the *greed* of certain sectors of the population for resources controlled by another sector, and historic *grievances*. Both concepts are linked to rivalry between groups over certain resources, including access to harvests that can provide economic rewards. Along with the cause of conflict, we also find certain catalysts of conflict, such as:

- Political catalysts: Political catalysts are related to the struggle for resources and are only triggered when the country in question lacks sufficient social dialogue to solve its problems without resorting to armed conflict in the face of unjust political measures and little or no rule of law. Examples of this are the land evictions by the Zimbabwe Government or the refusal to grant access to land in Chiapas.

⁽²⁵⁾ By way of example, see GLEDITSCH, PETTER, Nills, WALLENSTEEN, Mikael, «Armed Conflict 1946–2001: A New Dataset», in *Journal of Peace Research*, N° 39, 2002, pp. 615–637; MARSHALL, M. and GURR, T., *A Global Survey of Armed Conflicts, Self-Determination Movements, and Democracy*, Peace and Conflict, Center for International Development and Conflict Management, University of Maryland, 2005; MARTÍNEZ GUZMÁN, Vicent «Teorías de la guerra en el contexto político de comienzos del siglo XXI», in MURILLO, I. (ed.), *Filosofía práctica y persona*, Centro Internacional Bancaja para la paz y El Desarrollo, Castellón, 2004.

⁽²⁶⁾ Much related literature exists on this subject. However, if you would like more information on this issue, see: NAIM, Moisés, *Ilícito*, Ed. Debate, Barcelona, 2005; BECK, Ulrich, ¿Qué es la globalización? Falacias del globalismo, respuestas a la globalización, Paidós, 2007, Barcelona.

- Natural catalysts: droughts, floods, etc., such as the 1973-74 drought in Ethiopia, the recent drought in West Africa or the current drought in East Africa, where 11 million people are at risk. While no direct connection has been established, the Tuareg conflict in northern Mali grew out of changes in traditional transhumance routes due to climate change. The same seems to be true of the conflicts in northern Kenya and Somalia.
- Economic catalysts: such as spikes in food prices or falls in international prices of monocultures (coffee, cocoa, rice, etc.) making it impossible for populations to subsist. An example of the first catalyst can be found in last year's Arab Spring, which coincided with a rise in the cost of wheat. As an example of the second, we can look at the case of Rwanda and the fall in coffee prices. Indeed, according to the FAO, one of the main accelerators of conflict is the price fluctuations in raw materials that come from monoculture. Monoculture makes a country highly dependant on price variations and the importing of basic foods. A change in international prices generates conditions among vulnerable populations that are below subsistence levels.

As we can see, food as a cause of conflict, whether through «greed» or «historic grievances», requires catalysts according to the classical viewpoint of Peace Studies. That is why most Conflict Early Warning Systems do not view food insecurity as a central triggering element but rather as simply another catalyst.

As an example of this classical viewpoint, the *European Commission Check-list for Root Causes of Conflict* establishes eight groups of indicators: legitimacy of the State, rule of law, respect for fundamental rights, civil society and media, relations between communities and dispute-solving mechanisms, sound economic management, social and regional inequalities and geopolitical situation. The document only refers to food in regards to the pressure put on resources by flows of refugees. It also refers indirectly to food in regards to the existence of inequalities.

Early Warning Indicators for Preventive Policy created by the SIPRI set out a series of similar parameters which are used to assess how prone a society is to conflict. The indicators are divided into nine groups (justice and human rights, socio-cultural factors, internal security setting, geopolitical setting, military and security, environment and resource management, governance and political stability, socio-economic factors, regional and country specific variables). Only in regard to resource management does the SIPRI mention water management and, indirectly, food.

However, this classical viewpoint could be wrong, and we have very recent examples which give a primordial role to food crises as triggers of conflicts (needless to say, with additional catalytic agents).

One interesting study by the New England Complex Systems Institute sheds new light on the connection between hunger and conflict⁽²⁷⁾. The study shows

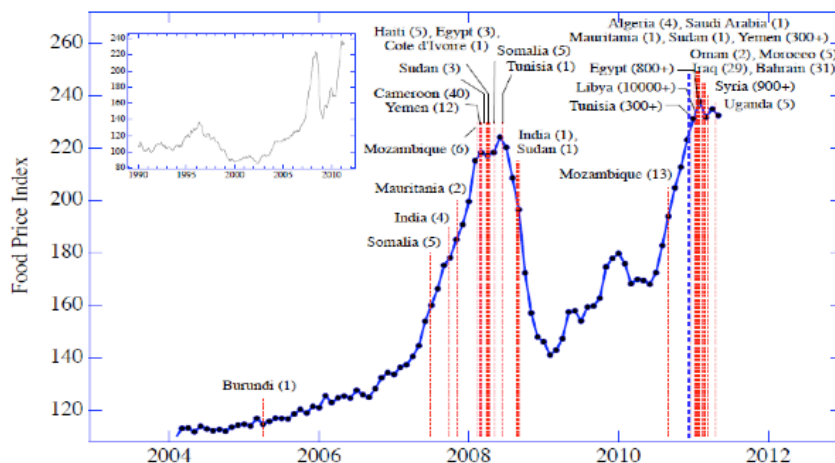
⁽²⁷⁾ LAGI, Marco, BERTRAND, Z. and BAR-YAM, Yaneer, *The Food Crises and Political Instability in North Africa and the Middle East*, England Complex Systems Institute, London, 2011.

how international food prices precipitate conditions of political instability to the point of being a conflict-triggering element.

The authors' predictions even go so far as to set a price level beyond which global instability may become widespread. Such instability seems unavoidable unless corrective actions are taken, as it is predicted that these levels will be reached in just a few years, regardless of the occasional price spikes which we will suffer for differing reasons. The theory upheld by the article for establishing a relationship between prices and instability is that people rely on a political system, whatever type it may be, to offer them a series of assurances. Any failure in this respect causes people to react and to look for some form of political change.

The authors of this study (Chart 1), by way of an in-depth econometric study, clearly establish the implications of the global food crisis and the rise in prices. They even go so far as to predict the price level beyond which new conflicts will arise, as well as when the world will reach the determined price level. They thus establish that if we take into account the values at constant prices (without taking inflation into account), the world will face a new critical period in August 2013. However, when we carry out the same analysis at current prices, we reach the danger zone as early as August of this year.

Chart 1. The FAO Food Price Index from 2004 to May 2011⁽²⁸⁾



⁽²⁸⁾ Chart taken from a study by the New England Complex Systems Institute which correlates conflicts with the FAO Food Price Index from 2004 to May 2011. The vertical red lines correspond to the commencement of conflicts, the brackets contain the number of victims of armed violence). As we can see, there is a clear correlation between social instability and global food prices.

But, what exactly has changed? Is it the world that has changed, or our perceptions of conflict-triggering causes? The fact is that a number of factors have made populations vulnerable, more than ever before. Those sectors of society that spend 70-80% on food will be unable to cope with the new situation arising from a huge variation in global price dynamics.

The study by the New England Complex Systems Institute determines that global prices affect dissimilar economies equally. An upward trend in global prices affects such dissimilar economies as those of India, Somalia, Yemen or Sudan. This impact, caused by the effects of globalisation, has been compounded by differing factors of our current reality, which are in turn negative consequences of this phenomenon. In other words, due to a number of circumstances which we shall try to summarise below, it does not seem like the situation is going to improve:

- *Higher energy costs*

Numerous FAO studies link the price of energy, particularly the price of gas and oil, to increases in the price of food. After water, oil is the main input in extensive farming. Agricultural fertilisers come from natural gas and pesticides come from oil. And this is before we take into consideration the energy cost of pumping water, of using agricultural machinery, of food-related transport, processing, packaging, etc., as well as a myriad of steps which all depend on oil to carry food from the farm to our table. Unless a new global energy model comes along, oil is set to become an increasingly scarce commodity.

- *Biofuels*

Rising oil prices mean that biodiesel is becoming a more attractive alternative. Today, 25% of corn production in the US, the world's largest producer, is allocated to biodiesel. And 15% of global production is used for this purpose. This shift in the use of corn, from food to raw material for biofuels, is one of the contributory factors to the sharp rise in food prices that occurred in 2008. According to an article in The Guardian, which cited a secret World Bank report⁽²⁹⁾, biofuels have forced global food prices up by 75%. The impact of such fuels on food prices meant that many countries, including the UK, were forced to reduce their goals regarding their integration and use. In light of their effect on the global stability of food prices, it seems the decision was more than justified. In 2009, ethanol production in the US required enough grain to feed 350 million people for one year⁽³⁰⁾. One of the few pieces of good news arising

⁽²⁹⁾ Aditya CHAKRABORTHY, *Biofuel caused food crisis. Internal Secret report: World Bank study delivers blow to plant energy drive*, guardian.co.uk, Thursday 3 July 2008.

⁽³⁰⁾ BROWN, Lester, «The Great Food Crisis of 2011. It's real, and it's not going away anytime soon», in *Foreign Policy*, January 2010.

from the recession is that it has curbed the surge in demand for biofuels, giving food markets some breathing space⁽³¹⁾.

- *Export restrictions*

Rising demand has led to many countries imposing export restrictions in order to keep their own markets supplied. Once again, in a situation that augured an even greater price rise in 2011, Russia lifted the export restrictions which it had imposed thanks to an unexpectedly good harvest in the Black Sea region at the end of last year. Nigeria has recently imposed export restrictions on rice. It is not the first time that such a measure has been introduced in Nigeria which, as an oil producer, has relatively low-cost output. Yet such restrictions are especially harmful to neighbouring countries who are suffering a major food crisis.

- *Food price speculation*

Deregulation of the food market began in the mid-90's. However, interest in commodity futures began to rise as the economic crisis took hold towards the end of 2008. In 2011, a European Parliament resolution regarded financial speculation as being responsible for 50% of the rise in food prices⁽³²⁾ and stated that intervention was required in order to avoid negative effects on global food security. Speculation is not restricted to spurious interests. In 2011, the Mexican government, aware that its population is highly dependent on corn to make tortillas, one of its staple foods, guaranteed its purchase prices by buying futures on the Chicago Commodities Exchange. The Mexican government was aware of the need to maintain a certain price level in order to avoid social unrest, such as occurred in Ciernes in 2007 in the so-called «tortilla crisis» (caused precisely by the surge in demand for corn from US ethanol producers).

- *Land accumulation by multinationals and States*

Amid the current global situation, and based on strategic analysis, many international actors, States and companies have begun to assert themselves in what is expected to be a fight for a future resource that is set to become increasingly scarce: food. Countries like China, India and Saudi Arabia have already begun to assert themselves by leasing huge tracts of land in Africa. Saudi Arabia has found itself pushed into this situation due to the depletion of its aquifer and a significant drop in its wheat production. China has been forced to do so because of its growing population and rampant desertification. India finds itself obliged to do so due to the tremendous growth of its population and 18% inflation rate of food prices in 2011, which is still increasing.

⁽³¹⁾ Source: reports issued by the International Grain Council, 2012.

⁽³²⁾ Draft resolution RC-B7-0114/2011.

- *Demographic growth*

Demographic growth has been one of the few breathing spaces given to the global food market in recent times. Compared to the 2% global growth rate of the 70s, the last decade ended with a 1.2% world population growth rate. This, combined with the alleviation that the crisis has provided as regards the pressure of biofuels on the food market, has delayed the even harsher expectations from materialising this year. Nevertheless, the population continues to grow and this does not only affect the demand side. The supply side is also affected by the use of agricultural land for other purposes, the diversion of available water to cities and the urbanisation of the populace.

- *Climate change*

The IFPRI again alerts us to the consequences of climate change for the food market. According to a 2009 study⁽³³⁾, climate change will have the following consequences by 2050:

- A reduction in global food production (especially in South-East Asia, whereby rice is likely to be one of the most affected commodities).
- A fall in the production of irrigation commodities
- A widespread rise in the price of corn, soya, rice and wheat. As a result of these rises, the price of meat will also go up.
- There will also be a significant fall in worldwide caloric availability to 2000 levels, along with a 20% increase in infant malnutrition when compared to the same scenario if climate change can be avoided.

This whole scenario will be decided by various factors, such as the rise in plagues due to temperature rises, reduced water availability, soil erosion caused by the destruction of arable land, the often combined effect of severe droughts and extreme weather phenomena such as hurricanes, floods, etc.

- *Changes in eating habits*

According to studies carried out by Cornell University⁽³⁴⁾, the cost of producing one kilo of beef entails an investment of 13 kilos of grain and 30 kilos of hay, which in turn require a total water usage of 35,400 litres. The grain which the US allocates to feeding livestock over the course of one year would be enough to feed 800 million people over the same time period. Reference has often been made to the introduction of meat into the eating habits of a growing middle class in China. However, figures reveal that, to date, China has a relatively high

⁽³³⁾ In this respect, see: NELSON, Mark, ROSEGRANT, Jawoo Koo, ROBERTSON, Richard, SULTER, Timothy and AA.VV, *Climate Change Impact on Agriculture and Costs of Adaptation*, International Food Policy Research Institute Washington, D.C. October 2009.

⁽³⁴⁾ PIMENTEL, David and PIMENTEL, Marcia *Sustainability of meat-based and plant-based diets and the environment*. Department of Ecology and Evolutionary Biology, Cornell University, Ithaca, NY, 2009.

level of self-sufficiency in food. Yet we cannot rule out the possibility that, as other economies continue to grow and add to the overall number of consumers, future prices will be adversely affected.

- *Loss of agricultural skills due to major population displacements*

According to figures released by UNHCR, the number of displaced people worldwide has reached record levels since the 90s, there being over 50 million such people. Displaced people often have age-old agricultural skills that allow them to subsist in their homelands. Such ancestral knowledge may disappear within a single generation of displacement. Displaced people, with no land and without the necessary skills to survive even if they did have land, often end up feeding the combatants of the conflict. This situation occurs in numerous contexts, the most paradigmatic of which is possibly that of Afghanistan where those returning after years as refugees in Iran and Pakistan often end up swelling the ranks of the Taliban.

■ ACTION MECHANISMS IN FOOD AID MATTERS

It is possible that, throughout this article, we have been able to at least raise the question of food aid becoming a way to prevent conflict. If we take into account that dramatic price rises can be a destabilising factor and root cause of crises, it seems logical to think that food-related interventions can act to «cool down» specific regions. What is more, and this will have to be the fruit of a more in-depth study, it might seem that preventive actions can end up being cheaper than after-the-fact actions deriving from conflict. In the *Oceans Beyond Piracy* report issued by the *One Earth Future Foundation*, the 2011 cost of Somali piracy reached 6.6 billion dollars in terms of rescues, insurance, increased fuel consumption by ships, military operations, etc. The entire 2011 United Nations Humanitarian Appeal came to 7.4 billion dollars for a total of 50 million beneficiaries.

Therefore, we shall now move on to an analysis of the different action mechanisms in food aid matters. In other words, what the International Community can do when the dreaded humanitarian consequences of hunger are upon us. In this article, we intend only to analyse the humanitarian aspects of the solution, given that price stability, support for agricultural production, etc., lie more within the realm of development aid. Humanitarian aid deals with the symptoms rather than the illness and its function is not to deal with the structural issues which tend to be behind nutritional crises, but rather to avoid the loss of human lives and the extreme suffering caused by crises.

We have to bear in mind that humanitarian aid often acts in the same way as chemotherapy in a cancer patient. Food aid is the last resort for saving lives yet, just like cancer medication, it has a toxic nature since injecting food into an economy often produces distortions that alter market dynamics. The few

farmers who have managed to save their crops see how, suddenly, what they sell at the market is now being given away by International Agencies and NGOs. This ultimately leads to new famines in precisely that sector of the population which would not have been affected by food crises if we had not intervened.

In order to avoid such fallout, humanitarian aid has generated a whole range of intervention instruments based on different parameters, such as local production capacity (i.e. if the crisis is one of economic access to food or market shortages), the final beneficiaries (children, pregnant women, AIDS patients, etc.) and the phases of the crisis. We ask the expert reader to be patient as regards the generalisation that we are performing here. The reality is obviously more complex and each organisation has its own ideas concerning the stages of intervention in a crisis and the methods to be used. If at any time we make an inadequate generalisation, please understand that it is out of a need to bring such a highly technical subject matter to the attention of non-specialists.

The outset of crises: Hoarding. Regardless of the root causes of a food crisis (an economic crisis, drought, floods, plagues, conflict, etc.), the usual effect on individual behaviour in the face of an impending bad harvest or food shortage is that of hoarding food in order to better cope with the harder times to come. Consumer hoarding practices logically lead suppliers to stockpile food in the face of impending price rises at peak moments of a crisis. This dynamic gives rise to general economic behaviour which leads to increased unemployment, even higher price rises and the sale of productive assets. Once the initial stage of a crisis has peaked, it is not uncommon to see families being forced to sell productive assets in order to buy food. Thus, many families sell their draft animals to buy food, thereby jeopardising next year's harvest.

During this stage, humanitarian aid actions endeavour to focus on the protection of resources and assets. Actions aimed at avoiding the sale of productive assets strive to prevent families from falling even further into the depths of hunger and poverty by selling that which enables them to generate revenue. Actions which are sought to be carried out during this stage mainly involve the creation of wealth and are equivalent to our economic stimulation policies. We humanitarians endeavour to inject money into the economy through *cash-for-work* programmes, cash transfers to the most vulnerable groups or other revenue-generating actions.

At the same time, projects for the protection of livestock and any other productive assets are undertaken aimed at protecting productive resources which allow people to emerge from the crisis once its cause has disappeared. The use of food distribution in this phase can do more harm than good, since it can put an end to what little local production the farmers have managed to save, thereby giving rise to a new aid-dependant population.

Emigration. Once the initial stage is over, and once food hoarding has led to a substantial price rise (by way of illustration, the price of millet in Mali this year is double that of last year), the populace starts to migrate in search of alternative income and areas where food is cheaper. Bartering commences, as does the migration of the workforce to areas of greater opportunity. Normally, these will be large cities or areas offering alternative job opportunities that often lead to their falling into the hands of human traffickers for all manner of activities including the mobilisation of combatants and child soldiers, sexual slavery, organ trafficking, etc. At the same time, the sale of livestock also commences, allowing families to buy other items that are necessary for their survival as well as for diversifying their diet. A common symptom of this stage is the fall of livestock prices. As they can neither feed nor provide water for their livestock, herdsmen undersell their animals, as do many others. This in turn jeopardises their ability to survive, as they do not even make adequate profit.

During this stage, humanitarian workers launch food aid activities for the more vulnerable collectives by distributing rations at schools, high-energy biscuits for children, nutritional support for breastfeeding mothers, the sick, the disabled, etc. Such activities have a specific target population, focusing on the most vulnerable. At the same time, cash-for-work activities are continued, as is monetisation through local traders (products are sold to local retailers at subsidised prices on the understanding that they re-sell them within specific price limits) and support for livestock.

Undercapitalisation and death. The critical phase. In this phase, the need to sell all types of assets becomes a matter of survival. The decisions taken in this phase are ultimately uneconomical, since they arise from a need to survive. Having used up all their reserves, families are not only forced to sell productive assets (implements, work animals, etc.), they are forced to do so at any price, which leads to a fall in price of such assets, especially of livestock, since families are unable to feed them.

By underselling their livestock and being frequently forced to abandon their dependant family members including sons and daughters, families lose their productive resources, thus condemning themselves to future poverty in order to survive the cycle of hunger which they are suffering. This survival strategy is usually accompanied by a resorting to food which does not have suitable nutritional value or is even harmful to health. This in turn leads to an even worse phase, namely severe undernourishment and death from illness or hunger.

Mortality rates rise, especially amongst the most vulnerable: breastfeeding women, children under five, the disabled, the elderly, the sick, etc. Two of the symptoms that accompany this acute phase is the death of livestock and the rise in prices, which not only affect the region in question, but also neighbouring

regions (a current example can be found along the Nigeria-Niger boundary, where prices have risen alongside the hunger in Niger).

We also find a sharp fall in population levels, due to an increase in both mortality and migration. In response to the mortalities, food actions are also launched to help the more vulnerable groups. Throughout this phase, and when humanitarian personnel detect a rise in mortality, mass distribution of food commences and which accompanies all other actions during the entire critical phase. A critical phase which continues until the root cause or causes have disappeared. New rains, the signing of a peace agreement, the end of flooding or frosts or the end of a plague pave the way to the next, early recovery phase.

It goes without saying that the critical phase always occurs through the failure of actions carried out in previous phases. A failure which not only means the loss of human lives. It is also a failure in economic terms since, at this point, all actions are significantly more expensive and their results are less important. By way of example, the intensive feeding of a child under five years of age (which often entails their hospitalisation and monitoring by expert personnel) is five times more expensive than the preventive distribution of food of high nutritional value among the same collective. What is more, brain damage suffered by a child who has needed intensive feeding tends to be irreparable and will predetermine their future.

Early recovery. Early recovery must pave the way for the complete recuperation of the livelihoods of the affected populace, increased income and the replenishment of reserves and livestock. In this phase, humanitarian action is focused on helping the transition towards development. Here is where our development aid colleagues must take the helm in order to address the structural deficiencies that led to the food crisis. Now is the time to treat the illness, not the symptoms, by way of long-term political solutions.

■ CONCLUSIONS

Conflict today involves an increasing number of non-State actors. Rather than a bilateral or multilateral conflict in which States are the major actors, it is an insurgent struggle in which non-State actors take advantage of the people's dissatisfaction in order to support political, economic or commercial causes. Within the framework of insurgent conflict, the key lies in the population's perception of the role of the Government or State which it supports and, in that context of satisfaction or dissatisfaction, the fact of being able to feed oneself takes on political dimensions which become relevant in both the domestic and international ambit.

As has already become apparent, hunger is not only a consequence of conflict but also leads to a more direct relationship by its being both a cause and instrument of conflict. Hunger cannot only be perceived as a technical, social or humanitarian matter, but instead should be analysed as a real problem with deep political roots and an anomaly of the economic systems of production, distribution and access to food.

Within the context of globalisation, agricultural productive capacity has become a strategic element in the struggle for raw materials and as a source of speculation in an international panorama in which food is becoming scarce and crops have become an element of energy policy. Along these lines, large multinationals and some State actors are taking advantage of the power afforded them by their position on the international stage in order to adopt measures aimed at increasing their profits. This posture implies a vindication of realistic and conservative theories and, moreover, reveals the lack of sensitivity towards situations affecting the stability of the majority of the world's population.

Within the context of economic globalisation, livelihood systems are being adversely affected, giving rise to a loss of income for farmers and shepherds in contexts of high food insecurity. The direct effects on this population are: the sale of their productive resources; a worsening of the state of health of the populations; scarcity of water giving rise to diarrhoeal illnesses; work overload of the most vulnerable populations; and long-lasting crisis in the local economic systems.

Therefore, the poorer a population, the less resources it can invest in other activities such as health, education and improvement of productive systems, thus increasing vulnerability. Food insecurity and malnutrition contribute directly to the increase in crises. Current conflicts, along with natural disasters, are centred on regions which are dependant on agriculture and where the percentage of homes with high rates of food insecurity is amongst the highest in the world.

To the present day, hunger has been identified as a consequence of conflicts as it impacts on the productive cycle, directly affects farming populations, interrupts trade mechanisms and generates food shortages. Yet food also triggers conflicts, especially in situations where food insecurity persists over time and becomes the cause of the following conflict.

Accordingly, we are starting to take early warning mechanisms into account in conflict prevention interventions related to situations of food insecurity. However, actions are not being implemented in all variants associated with hunger and the outbreak of conflicts. For instance, there continues to be a lack of policies aimed at mitigating the rise in food prices that hastens conditions of instability, not only economic but also political, thus becoming a conflict-triggering element;

measures are not adopted in order to reduce energy price increases; lax regulation is allowed in the area of biofuel production; the protectionism of major States such as the US, Canada, Japan, etc., as well as regional organisations such as the European Union, promotes export restrictions which exacerbate, among other things, food insecurity; speculation on food prices continues; large multinationals and powerful States are accumulating huge tracts of land in countries where there is food insecurity; policies are not being drawn up to reduce demographic growth; so far, agreements reached on climate change issues have failed to deliver the expected result; changes to eating habits are being encouraged; and there is no exchange of balanced agricultural knowledge, with standardised models being imposed to the detriment of local production.

In conclusion, food crises are the result of an accumulation of failures which ultimately affect the lives of many people. They imply a policy failure on the part of the affected States which, for differing reasons (institutional weakness, lack of resources, etc.) find themselves condemned to crisis. It also implies failure of the actions of these governments in association with donor governments in development aid actions. And, finally, it implies the failure or inability of humanitarian actors to tackle the crisis before it reaches its most critical phases.

However, the sheer size and complexity of the challenge makes it unfair to paint a picture of guilty and innocent parties. Yet it should be added that food crises seem to have taken a new turn: they are becoming a conflict-triggering factor. In line with this scenario, we should ultimately explore the potential of food aid as a preventive and stabilising factor in various ways:

- It helps to prevent mass population movements, especially if intervention occurs in the initial phases of a crisis.
- It prevents the creation of new combatants.
- It reduces social conflict and disaffection amongst the population. One line of research which this article may open up is the link between this year's food crisis in the Sahel and a clear upturn in Al Qaeda activity within the region.
- It avoids the undercapitalisation of large sections of society, who are left with no alternative for their survival other than illegal activities.

In summary, a shift is needed as regards how we study the causes of conflicts that lead to hunger. Hunger should not only be viewed as one humanitarian aspect of armed conflict, but also as one of the causes behind the increase in conflicts. Alleviating hunger leads to improved security. This requires political action and multi-sectoral interventions, sustained over time, together with political, economic and social participation, underpinned by solid institutional frameworks with their respective budgetary support.

CHAPTER SEVEN

BIOFUELS AND FOOD SECURITY

José María Medina Rey

ABSTRACT

The increase in the price of oil has had an important impact in the rise of food prices in several ways; one of them has been the rise of biofuels whose production has experienced exponential growth in the last decade. In this article we describe what are biofuels, what factors have driven their boom, how positive are their balance in economic, energy and environmental terms, and, especially, what is their impact on food security and what role have played in the food crisis.

Key words:

Biofuels, food security, food crisis

■ EVOLUTION OF THE ENERGY MIX: FROM THE BIOMASS TO THE BIOMASS

Until the 19th century, biomass was the main fuel used by humans. Straw, wood, dried animal dung and other waste were, for centuries, almost the only source of energy for cooking, heating and light. In other words, the biomass catered for people's energy demands. Even today, a large part of the world's population, especially those living in poverty in rural areas, continue to use this type of energy. In many places, cooking with wood or cow dung is the norm, with the additional work involved in collecting the fuel and its impact on health, especially for women and children. According to data from the United States Environmental Protection Agency, approximately half the world's population depends on burning solid fuel, such as wood, charcoal, remains from harvesting, discarded textiles, dung, etc. for cooking and heating. In general, countries with a lower GDP per capita are the ones that use more biomass as an energy source, which still accounts for about 13% of all energy used throughout the world⁽¹⁾.

All through the 18th and 19th centuries, with the Industrial Revolution, fossil fuels became more widely used, first coal and later gas and oil, which quickly took over from biomass as the main energy sources. During the last century and a half, fossil fuels in their solid (coal), liquid (petroleum) or gas (natural gas) forms have heavily dominated the world energy scenario, despite the arrival of other kinds of energy production, such as nuclear, which was developed during the 20th century and has always caused strong social controversy.

A key moment in redefining the energy mix was the oil crisis in the 1970s, the first serious crisis for the fuel, whose consumption had risen so sharply since the Second World War that the main developed economies had become highly dependent on its supply. A string of several causes, some economic (devaluation of the dollar, abandoning the gold standard) and others political (the support of some western countries for Israel during the Yom-Kippur war) led to the decision by the Organization of Arab Petrol Exporting Countries to raise the price of crude oil in 1973, knowing that there was little alternative to the demand for oil as it was the main source of energy for the industrialised world. The price of a barrel of oil rose fourfold in a very short time.

The beginning of the 1980s saw a second oil crisis; the price of a barrel of crude, which had fluctuated between 10 and 15 dollars during the 70s, now rose again to 35 dollars in 1982. This constituted a wake-up call to the developed economies, who were still heavily reliant on oil, to look for alternative energy sources to reduce their dependence.

⁽¹⁾ Details on this can be seen in ANDRÉ, FRANCISCO. *Los biocombustibles. Estado de la cuestión*, Madrid: ICEI, 2009, pag. 8-9.

Thus, from the 1970s, research was stepped up into other energy sources than fossil fuels, which at the time cornered almost 85% of global energy production. For example, electricity produced from wind power started in 1980 and has mostly been developed in the 21st century. In 2009, it accounted for 2% of all electricity produced in the world and 13.8% of that in Spain. Although solar energy is based on scientific discoveries made in the first half of the 19th century (the photovoltaic effect), it has only become widespread in the last 40 years as solar panels increase in efficiency to make use of the sun's energy striking the Earth, which is ten thousand times higher than the current energy consumption for the planet. In addition, nuclear programmes were developed in several countries from the 1960s and 70s to produce electricity from a technology that was originally used to make the atomic bomb.

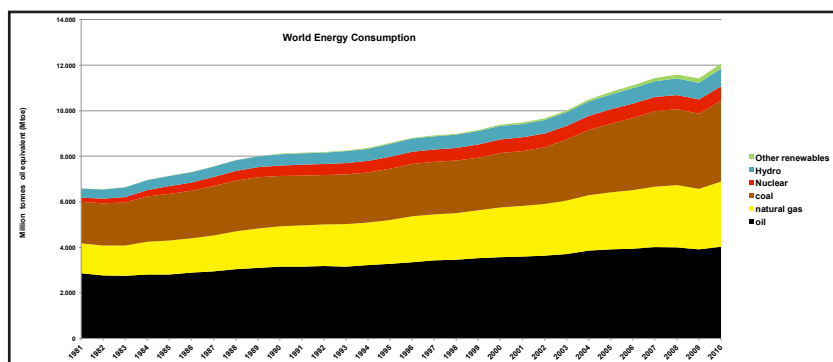


Figure 1: Source: Own elaboration from the BP Statistical Review of World Energy 2011 data. It includes data from sources of energy negotiated commercially; does not include therefore the traditional use of biomass estimated that it can represented around 13% of world energy consumption.

From the 1970s, the idea of producing fuel using the biomass as raw material was taken up again and added to the alternatives to fossil fuels. The transport and automobile sector is the most heavily reliant on oil; therefore, it is not surprising that something that was already present when the internal combustion engine was invented, was re-visited. Bueno-Oliveros explained that, by 1912, Rudolph Diesel, who invented the engine bearing his name, thought that the use of vegetable oils, which was insignificant at the time, would eventually become as important as those derived from petroleum.⁽²⁾

In fact, in 1975, a short while after the first oil crisis, the Pro-Alcohol programme was started with backing from the Brazilian government to gradually replace automobile fuels derived from oil with bioethanol produced from sugar cane. By developing this programme, Brazil has become one of the foremost producers of biomass fuels, with bioethanol used for half the country's fuel needs for transport.

⁽²⁾ BUENO-OLIVEROS, José Antonio. *Las alternativas al petróleo*, Madrid: Fundación Alternativas, 2007, p.19.

Thus, after more than a hundred years of fossil fuels reigning almost supreme as the fuel of choice for the transport sector, attention is once again focused on the biomass. This has been helped or boosted by a set of circumstances:

- The fact that a large part of the global crude oil supply comes from politically unstable countries has been a point of concern since the first oil crisis. Tensions among western countries and radical factions in the Islamic world, whose most obvious manifestation was in the attack on the World Trade Centre in September 2001, have aggravated the situation and acted as a stimulus in finding alternative sources to reduce dependency on oil supplied by these countries.
- Moreover, rising crude oil prices coupled with signs showing that reserves may be almost exhausted in the second half of this century are another push in the direction of diversifying the energy mix.
- Faced with this situation, nuclear energy, which was the option favoured by some countries, such as France, has been losing ground and gaining opponents not only because of the large amount of dangerous nuclear waste generated, but also because of nuclear accidents. The one that occurred in Chernobyl (Ukraine) in 1986, considered the most serious one ever, caused huge alarm to the point where the relative weight of nuclear energy in the global energy mix, which had grown from 0 to 10% in just 40 years, has hardly risen any further from that time. The accident at the Fukushima nuclear plant in Japan in March 2011, due to the earthquake and subsequent tsunami in the country, has served to revive the debate on the safety of nuclear power.
- As has already been pointed out, the transport sector is undoubtedly the one that is most dependent on oil⁽³⁾ and where it is more difficult, expensive and slower to use other types of energy (solar, wind, electricity). However, the introduction of liquid fuels from the biomass is a well-known technology which does not in principle require any significant adaptation of engines and appears to be profitable in the face of the high oil prices currently charged.

All these circumstances have contributed to biofuels or agrofuels expanding greatly, as will be discussed later. An example of this is the fact that bioethanol production in the United States rose from 175 million gallons in 1980 to 1.77 billion in 2001 and to 13.23 billion gallons in 2011, according to statistics published by the Renewable Fuels Association. In spite of this, their relative weight in the energy mix scarcely reaches 0.5%.

■ THE IMPACT OF PETROLEUM PRICES ON FOOD SECURITY

The agro-industrial production model which has been strongly promoted during the last 30 years has had the effect, amongst others, of closely linking petroleum prices to food prices by at least two main methods:

- First, because the agro-foodstuffs system that has appeared has pushed countries into specialist production, so that each country specialises in

⁽³⁾ It is estimated that about 90% of passenger and goods transport depends on oil.

large-scale cultivation of food for which it has a comparative advantage. Amongst other things, this means that a not insignificant part of foodstuffs travels between countries before being consumed: kiwis from New Zealand, tomatoes from Morocco, bananas from Ecuador, fish from the coast of Mozambique, coffee from Central America, cocoa from the Ivory Coast, asparagus and artichokes from Peru and many other products from overseas that are found in the daily shopping basket. If we measure the frequency of these journeys by taking into account that 7 billion people have to be fed every day, and that in many cases the journey involves thousands of kilometres, it can be seen that this agro-foodstuffs system, which seemed to be very efficient economically (every country cultivates what it is best at producing), includes transport costs that will be unsustainable sooner or later. As transport is the sector most reliant on petroleum, it is understandable that an increase in the price of crude oil affects transport prices, and these will then affect food prices.

- In addition, this type of industrial agriculture uses oil as the main energy source⁽⁴⁾ and requires extensive use of fertilisers and pesticides which very often are based on petroleum or natural gas. It is not easy to specify a measurement for the relative weight of agricultural production costs relating to petroleum. However, based on an analysis of the causes operating in the 2007-2008 food crisis, the IFPRI (International Food Policies Research Institute) established that, for the United States, 30 to 40% of the increase in the price of the main crops that occurred between 2002 and 2007 was due to higher costs of oil⁽⁵⁾.

This relationship between petroleum and agriculture means that the evolution of crude oil prices must have a direct impact on food prices and, therefore, on food security, especially for the most vulnerable people, who spend a high percentage of their income (between 60 and 80%) on food. Chart 2, comparing the evolution of petroleum prices over the last 15 years and the price index for food by the FAO⁽⁶⁾ (annual average), shows the strong parallel of both lines, especially in the last five years when the 2007-2008 food crisis occurred and a new spike after the second half of 2010. These two recent episodes of food crises happened at the time of high price increases for oil and prove the link between the two.

⁽⁴⁾ According to data from the International Energy Agency, oil accounts for approximately 60% of energy used in agriculture in developed countries, and up to 80% in less developed countries.

⁽⁵⁾ HEADLEY, Derek & FAN, Shenggen. *Reflections on The Global Food Crisis. Research monograph 165*, Washington: International Food Policy Research Institute, 2010, p. 27.

⁽⁶⁾ The food price index is calculated on the basis of the average of price indices for the main basic food groups (cereals, meat, dairy products, sugar, oils and fats), weighted by the average export quotas for each group in 2002-2004. The main index shows 55 prices which specialists in basic products from the FAO deem representative of international prices for foodstuffs.

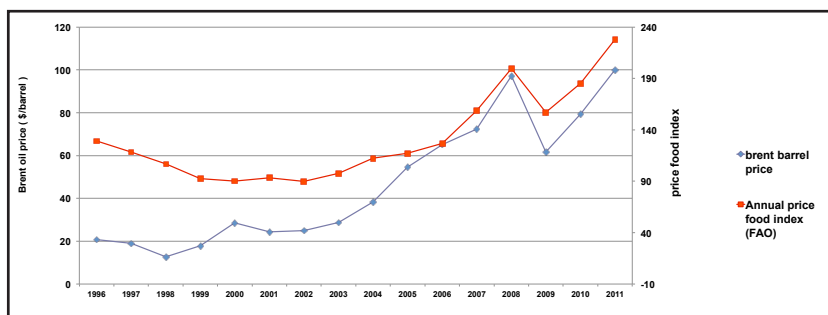


Figure 2: Source: Own elaboration: Data on oil prices are taken from the BP Statistical Review of World Energy 2011, expected for the 2011 corresponding to the IEA report. The food price index data correspond to those published by the FAO

In addition to these two links between the price rise in oil and that of food -transport costs and agricultural costs relating to petroleum-, a third intermediate link has been consolidated recently, which spurred by more expensive crude oil, is in turn having an impact on higher food prices: the increase in production of liquid fuels from the biomass.

■ THE RISE OF BIOFUELS

■ Explanation of Concepts and Terminology

Recently, articles and news on biofuels have frequently appeared in the press, to the point where the term is relatively well-known by the public at large. However, their knowledge on the matter is superficial and probably confused, and so it is best to start by clarifying some of the terms and aspects used with biofuels.

In Spain, people usually believe that the prefix «bio» relates to some positive feature of the word it belongs to, especially to it being environmentally friendly, or that it is a natural or organic product. When talking about biofuels, many people may think that these are fuels that respect the environment, provide a positive balance for the emission of greenhouse gases, or have been produced organically, etc. However, the meaning of the prefix «bio» in this case refers to the raw material for making the fuel, which is to say that the fuel is produced from biological material, from biomass, with this being understood as organic material produced by recent biological processes and apt for use as an energy source⁽⁷⁾. Therefore, fossil fuels are excluded as, although they may be produced from organic material, they have required long processing over several million

⁽⁷⁾ In Directive 2009/28/EC, the European Union defines the biomass as the biodegradable fraction of biological products, waste and residues from farming (including substances of vegetable and animal origin), from forestry and allied industries, including fishing and aquaculture, also the biodegradable fraction of industrial and urban waste.

years. Fossil fuels are seen as non-renewable because they are being consumed much faster than the processes needed to make them and will run out sooner or later. However, fuels from the biomass are deemed to be renewable because the original biological material is produced rapidly, in under a year in many cases.

The fact that the prefix «bio» may cause confusion has led to some sectors, especially amongst civil society, preferring to use the term «agrofuel», as these days they mostly originate from agricultural products⁽⁸⁾.

It is very likely that, when talking of biofuels, they are thinking of a single type. Nonetheless, a wide range of fuels is found depending on the materials used to make them, whilst also taking into account the type of fuel produced and the manufacturing procedures. The scenario that appears on studying these variables is quite complex and may even include several generations of biofuels. Without wishing to make an exhaustive study on the subject, we do want to present at least some basic ideas which help to understand the situation.

- *Classification according to the fuel produced*

The types of fuel produced can first be separated into solid, liquid and gaseous biofuels.

Solid biomass has been used as fuel since ancient times. As mentioned earlier, burning wood or residues provided mankind with energy for cooking, warmth and a little light. Nowadays, although this traditional use of the biomass continues to be very important in many places, other more complex uses have been developed. Thus, for example, there are plants producing electricity from burning biomass; or the high calorific value of olive pits, left over from making olive oil, is used to feed domestic heating boilers.

Biofuel can also be produced in a gaseous state, or biogas, which is basically a combination of gases (mainly methane and carbon dioxide) following digestion of the organic matter by microbes under anaerobic conditions i.e. without oxygen. This process requires several stages, each one of which is catalysed by different bacteria that act at various temperatures. In sealed tanks known as biodigesters, the bacteria gradually decompose the carbonated chains of organic residues placed inside until methane is obtained (at about 50% to 70%), together with carbon dioxide (at about 30% to 50%) and small proportions of other gases. The digestive process can be used with several types of organic matter: remains from the food industry, sludges from industrial purifiers,

⁽⁸⁾ In the strict sense of the word, *agrofuels* can only be applied to fuels that have been produced from cultivated plants; this would not include some biofuels not produced from cultivated plants. In this article, based on the argument explained and first highlighting that it is imprecise, we prefer to use the term *agrofuels*, as it covers a large majority of those currently produced and because they are the ones with the greatest impact on food security.

residue from various crops (cereals, vegetables, fruit, tubers, legumes, etc.), waste from food and used oils, manure, algae, etc.

The fuel crisis during the Second World War gave a boost to research on biogas. However, because biogas production required temperatures higher than 30°C, in addition to other fuels being easier and more convenient, the technology was mostly shelved some years later. Despite this, in China, India and South Africa, the lack of economic resources led to the spread and development of these methods, so that it is estimated that there are over 30 million biodigesters at present in those countries, both on a small and large scale.

Biogas production has advanced greatly and, these days, installations are found ranging from small domestic scales to industrial applications. With domestic installations, the fuel supplied is used for cooking and light, in addition to making organic fertiliser. With large plants, the biogas is usually used to feed co-generation motors to produce electricity, and to produce heat for heating systems and industrial processes, although it can also be used as an alternative to natural gas.

However, it is the liquid biofuels that have been most widely developed and increased, especially those for transport and automobiles, which are also called transport biofuels. As they are mainly produced from raw materials from the agricultural sector, they are also known as agrofuels. Directive 2003/30/EC, from the European Parliament and Council, on encouraging the use of biofuels and other renewable fuels for transport, recognises ten types of biofuels, but production has mainly focused on two liquid agrofuels: bioethanol and biodiesel.

Bioethanol is ethyl alcohol from renewable organic matter which can be hydrated (up to 5% water) or dehydrated (with less than 1.2% water, also called absolute bioethanol)⁽⁹⁾.

The Directive defines biodiesel as a set of methyl esters produced from animal or mineral oil and which have similar properties to those of diesel when used as fuel for diesel engines.

Bioethanol and biodiesel require different production methods: while bioethanol is produced by fermentation, biodiesel uses a process known as transesterification. However, what interests us most in assessing the impact on food security are not the production methods of these fuels, but the raw materials used to make them.

⁽⁹⁾ This differentiation is relevant because the use of hydrated bioethanol in transport requires specially adapted motors; this is what happens in Brazil, where vehicles with multi-purpose engines that can run on petrol mixed with this type of ethanol are widely sold and account for up to 85% of automobile sales. With absolute bioethanol, the mix can work in normal combustion engines.

- *Classification according to the raw material used*

Bioethanol can be manufactured either from crops storing their reserves as sugars (such as sugar cane or beet), or from crops storing their reserves as starch (such as cereals or potatoes)⁽¹⁰⁾. Of these many raw materials, sugar cane and maize have most commonly been used. Most bioethanol is manufactured by two countries, the United States and Brazil, which account for approximately 85% of global production. Brazil uses sugar cane, and the United States mainly depends on maize.

Biodiesel is produced from oily plants, such as oil palm, rapeseed, soya, sunflowers, jatropa, etc. The European Union is at the forefront of production and use of biodiesel; just three of the member states, (Germany, France and Italy) manufacture almost half of the world's biodiesel between them. Europe started biodiesel production using mostly rapeseed, with a yield of approximately one thousand litres of biodiesel per cultivated hectare. However, the growth in consumption of this type of agrofuel in Europe is leading other countries in tropical zones to produce oil palms, which have a yield four times higher than rapeseed. Another of the alternatives receiving a great deal of attention is jatropa, whose oil is not edible, but used to make soaps and candles; although the biodiesel yield is less than half that of oil palms, it has a range of benefits, such as the fact that it will grow in arid soil and could be an excellent agent in reforesting such areas; or the fact that it is sown to last for 40 to 50 years, during which time it requires no fertilisation or insecticides, as it is highly resistant to parasites. It may even help to recover lands for farming.

The type of raw material used was the main criterion in differentiating between two generations of agrofuels (there is talk of a third generation of biofuel based on algae). The first generation of agrofuels is described as those mainly produced from conventional crops which can often be used as food; crops with a sugar or starch content for bioethanol, and oily seeds for biodiesel. These types of agrofuel are the ones most highly developed and most often produced. However, a second generation of agrofuels has also been identified which are obtained from ligno-cellulosic biomass, both from herbaceous (straw) and woody (chippings) plants, as well as from organic material from waste. There is a range of agrofuels belonging to this second generation⁽¹¹⁾ which are still in

⁽¹⁰⁾ For a detailed explanation of the various usable raw materials and the processes required, see the article by Jesús Fernández «Los biocarburantes en un contexto de producción sostenible» included in the book «Biofuels - part of the problem or part of the solution?», published by the «Right to Food. Urgent» campaign in 2007 and available on the website www.derechoalimentacion.org in the section on campaign materials.

⁽¹¹⁾ As Jesús Fernández states in the above article, this group includes bioethanol manufactured by fermenting the hydrolysed ligno-cellulosic biomass and biofuels obtained by thermochemical means, such as oil from pyrolysis, biohydrocarbons obtained by pyrolysis and then transforming the biomass (KDV process), petrol and diesels from the Fischer Tropsch synthesis method and alcohols obtained via thermochemistry, among others.

the process of research and development⁽¹²⁾. Likewise, there is a wide variety of non-edible herbaceous and woody species that can be used as crops for energy in biofuels, as the cellulosic biomass is the most abundant biological matter on earth, and so it should be viable to easily select those most suited to the climate and crops of the regions available for cultivating them, whilst not interfering with land used for food crops.

■ Principal Reasons Explaining the Growth in Agrofuels

The recent growth in agrofuels and their improved positioning amongst sources of energy as an alternative to fossil fuel originates from a set of beneficial characteristics that have helped to awaken interest in their production and use.

The first feature is that they are renewable, unlike fossil fuels (petroleum, coal and gas). As Francisco André pointed out in the article mentioned above, this means that use of the energy and activities depending on it can be organised in a sustainable manner, so that current needs are met whilst at the same time preserving natural assets for future generations. This is not possible with fossil fuels, which are non-renewable, as use of any amount of them means their complete destruction. Agrofuels are produced from crops that normally provide at least one harvest per year and which, if properly managed, should not damage the resources on which they are based. In a scenario where fossil fuel is running out, the fact that energy sources can be renewed makes agrofuels, amongst others, particularly attractive.

This gives rise to a second important feature, which is the fact that agrofuels enable energy sources to be diversified in a sector that is heavily reliant on oil, namely transport and automobiles. As with other uses of energy, especially in the production of electricity, several different alternative sources have been developed (hydro-electric, wind, solar, nuclear, wave power, etc); in the transport sector, alternative developments are at a very early stage. For example, electric vehicles have still not been developed or expanded much and must evolve a great deal more before they become an alternative to petroleum. However, agrofuel can be used on the same type of vehicles that already use oil-based fuel. In fact, mixes of petrol and bioethanol or diesel and biodiesel in varying proportions is becoming widespread and increasing, without the need to make substantial alterations to the automobile industry, or to fuel distribution and sales networks. Therefore, agrofuels constitute an alternative that, at present, do not compete with petroleum, but work with it, in the sense that they do not involve any significant change to the status quo and can also help to prolong the oil reserves.

⁽¹²⁾ According to forecasts from the International Energy Agency in the *World Energy Outlook 2010*, second generation biofuels will not be on the markets in significant quantities before 2020.

A third factor that has boosted the production and use of agrofuel is its theoretically neutral character regarding greenhouse gases and, therefore, for climate change. As stated by Vivero and Porras⁽¹³⁾, this has been one of the main arguments put forward by defendants of agrofuel, as it emits less carbon dioxide into the atmosphere than fossil fuel, because agrofuel only releases the amount that had previously been held by photosynthesis in the plants used in manufacture; thus, the balance is neutral. This led to them being referred to as green fuel or eco-fuel. However, as will be seen later, this statement requires clarification on a large number of points.

Francisco André highlights two other possible benefits from agrofuel. On the one hand, he points out that a general use of agrofuel could result in higher incomes for farmers, due to more demand for agricultural products and provide an additional outlet for these, especially for countries with surplus production. This may strengthen the sector, whose profitability has sometimes been in question, and could help maintain rural populations which have very often been on the verge of disappearance.

On the other hand, he also points out that a desirable feature of biofuel is a stable, assured supply which, following the oil crisis in the 70s and 80s, is very important for the industrialised economies that are heavily dependent on oil. The transition to agrofuel allows a reduction, or at least a significant diversification, in reliance on outside suppliers since it is more viable for a larger number of countries.

■ Current Situation and Trends

As mentioned earlier, in spite of the rise that biofuel has enjoyed recently, so far it represents a very small percentage of total energy sources, scarcely 0.5%. Its relative weight is rather higher if only the transport sector is taken into account where, according to data from the International Energy Agency, it currently has about a 3% share and the forecast is that it could reach 7% in 2030⁽¹⁴⁾. This should not hide from view the progress made over the last decade and which is expected to continue in the future. As shown in chart 3, although the almost 2 million barrels produced per day are very few when compared to the 82 million barrels of oil, the fact is that biofuels have increased sixfold in the last ten years, mainly in the United States and Brazil.

⁽¹³⁾ VIVERO, José Luis and PORRAS, Carmen. *Los biocombustibles en el marco de la crisis alimentaria, energética y ambiental. Reflexiones y propuestas para España. Documento de trabajo 34/2008*, Madrid: Observatorio de Política Exterior Española, Fundación Alternativas, 2008, p. 45.

⁽¹⁴⁾ IEA. *World Energy Outlook 2006 and 2010*. Paris: OECD.

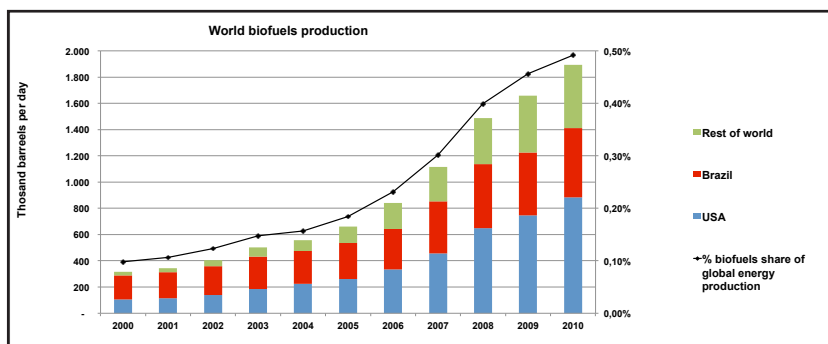


Figure 3: Source: Own elaboration from the BP Statistical Review of World Energy 2011 data.

The evolution of the trend toward the expansion of biofuel will depend on the arguments put forward by a series of forces that will propel it forwards, in some cases, or hold it back, in others. In this respect, public policies supporting and incentivising its production and use, especially in the United States and Europe, as well as the business interests of large companies investing in biofuel as a highly profitable sector and exerting a significant influence on important global decisions, are working in favour of the rise of biofuel. Nevertheless, growing criticism points towards the harmful effects of producing biofuel and questioning some of the benefits attributed to it, may cause its progress to slow down.

Until now, as stated by Wise and Murphy⁽¹⁵⁾, some of the countries involved, especially the richest ones, have refused to review their national policies that encourage foodstuffs to be used to produce biofuel, in addition to the spread of crops specifically for the purpose. In this respect, the researchers say that the G-20 Ministries of Agriculture have ignored the recommendation given in an expert report they had asked for themselves, simply stating that a more in-depth analysis was required.

■ CONSIDERATIONS ON ECONOMIC, ENERGY AND ENVIRONMENTAL RETURNS FROM BIOFUEL

Justification for producing and using biofuel is usually based on mainly of three types of argument that are inter-related. Firstly, because in a scenario of high oil prices, the use of biofuel brings financial returns and may be an opportunity to revitalise the economy of rural areas. Secondly, because as oil will get progressively scarcer in the fairly near future, biofuels can be an alternative source of energy, especially for the transport sector. And thirdly, because even if they are not economically competitive and profitable compared

⁽¹⁵⁾ WISE, Timothy y MURPHY, Sophia. *Resolving the food crisis: assessing global policy reform since 2007*, Medford: Institute for Agriculture and Trade Policies y Global Development and Environment Institute, 2012, p. 29.

to fossil fuels, or whether they are able to effectively replace these, in the short term, biofuels can help to reduce greenhouse gas emissions and combat climate change. Each of these three arguments deserves to be considered further⁽¹⁶⁾.

■ Profitability of Biofuels

From an economic point of view, the viability and profit thresholds of biofuel depend, in the first place, on the price of oil, and become profitable when production costs are lower than those of equivalent fossil fuel. However, it must also be remembered that production costs vary widely, depending on the crop and where it is grown. As Ángeles Sánchez states⁽¹⁷⁾, there is no agreement on the margins from which the production of biofuel would no longer be profitable, but some studies carried out in the last few years estimate that bioethanol from sugar cane produced in Brazil will continue to be cost-effective whilst a barrel of oil remains above 35 dollars. However, with bioethanol produced from maize in the United States, the figure may be as high as 50 dollars a barrel. For its part, the European Commission says that, with existing technology, the biodiesel produced in Europe will make a profit whilst oil is higher than 60 euro per barrel; however, bioethanol from Europe is less profitable and requires the oil price to be over 90 dollars per barrel.

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Therefore, with current technology, the costs for producing crops and converting them into bioethanol or biodiesel are, in many places, too high to compete commercially with fossil fuel without active help from the government to promote their development and subsidise their use⁽¹⁸⁾. Brazilian bioethanol from sugar cane is the only biofuel that regularly keeps its price lower than that of the equivalent fossil fuel.

It is important to remember that the price of the raw materials accounts for a high percentage of total production costs of biofuels and weighs heavily on their economic viability. As Pfaumann points out⁽¹⁹⁾, the crops on which production is based account for 50% to 80% of the total price of the biofuel and, therefore, are the key factor in competitiveness. However, as with the price of oil, the price of these raw materials is not fixed but varies with demand, even more so if it is incentivised through government policies, including subsidies. Thus, the aforementioned FAO report exemplifies the situation by looking at the profitability of bioethanol produced from maize in the United States. Based

⁽¹⁶⁾ Detailed data and in-depth explanations on these three aspects can be found in the FAO report titled *The State of Food and Agriculture 2008*.

⁽¹⁷⁾ SÁNCHEZ DIEZ, Ángeles. *El nuevo escenario de la diversificación energética y los biocombustibles en la agenda birregional de América del Sur y la Unión Europea*, Sao Paulo: Universidad de Sao Paulo, Cuadernos PROLAM, 2010, Vol.1, p.30.

⁽¹⁸⁾ DOORNBOSCH, Richard and STEENBLIK, Ronald. *Biofuels, is the cure worse than the disease?* Paris: OECD, 2007.

⁽¹⁹⁾ PFAUMANN, Peter. *Biofuels, the magic formula for rural economies of LAC?* Inter-American Development Bank, 2006, p. 9.

on studies carried out by Tyner and Taheripour, it explains that, with oil prices at about 60 dollars a barrel, bioethanol is cost-effective whilst maize is less than 75 dollars per ton; after that, subsidies are needed to maintain bioethanol production. With the help of public money given to produce it, bioethanol is «profitable» even if maize costs about 150 dollars per ton.

Price rises in food crops over the last few years, including those used to make biofuels, have evidently made production more expensive. Also the growth in demand for biofuel, which has risen sixfold in just ten years, is one of the contributory factors to the volatility in food prices.

However, there are other factors influencing the price of biofuels. As already mentioned, the lowest total costs are those for Brazilian bioethanol made from sugar cane, not only because the raw material is very cheap, but also because energy needed to produce bioethanol is obtained from burning the bagasse, the main by-product from processing sugar cane. However, biofuel in the United States and Europe is normally made with energy that has to be purchased; on the other hand, the by-products from manufacturing bioethanol and biodiesel are sold, mostly for animal feed, and the sales price can be deducted from production costs. Brazilian biodiesel made from soya and ethanol made from maize in the United States have the lowest secondary net manufacturing costs, although they are higher than the market price for fossil fuel, in both cases. Manufacturing costs in Europe for biodiesel are usually more than twice those of fossil diesel. Despite this, the combination of incentives and compulsory mixing help to stimulate its production and use.

The search for higher cost-effectiveness in biofuel may lead to -and, in fact, is leading to- finding production systems which, regardless of other aspects, try to reduce costs, including labour. This means that large areas of a single crop are grown and highly mechanised. Thus, for example, the labour force in the Brazilian sugar industry fell from 670,000 workers in 1992 to 450,000 in 2003, mainly due to the trend in mechanising harvesting. The search for higher profit can affect the environment in undesirable ways, as will be seen later.

According to the FAO, the future development of an international, economically efficient biofuel sector will depend on creating the appropriate national policies that do not distort the market, as well as commercial standards that promote an efficient geographic model for biofuel production.

■ The Capacity for Agrofuel to Become an Alternative to Fossil Fuel

Linking the evolution of world oil consumption and that of global biofuel production can help us to establish a preliminary reference framework on the real possibility that the latter may be a true alternative to petrol and diesel derived from oil. At

present, the consumption of petroleum is 46 times greater than the production of biofuel. Furthermore, as shown in chart 4, despite the sharp growth curve in biofuel production over the last ten years, oil consumption has continued to increase, with a 14% rise worldwide from 2000 to 2010. Therefore, the contribution of biofuels has not provided an alternative to oil, but has been accumulative; it is likely that, without biofuel, oil consumption would perhaps have been greater, and even that prices would also have been higher. However, what can be seen quite clearly in any case is that, taken as a whole, it seems biofuel does not at present have the real potential to substitute petroleum-based fuel.

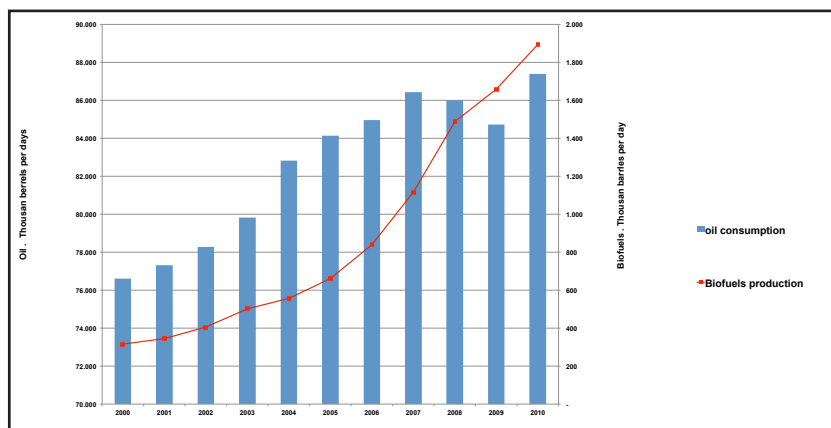


Figure 4: Source: Own elaboration from the BP Statistical Review of World Energy 2011 data.

In fact, forecasts from the International Energy Agency state that, between 2011 and 2035, there will be continued growth in world oil consumption, rising from 87 to 89 million barrels per day during the period, despite biofuel production increasing to 4 million barrels a day, with a large part of the increase due to transport requirements in emerging markets⁽²⁰⁾.

In order to be able to assess more precisely the potential for biofuel to become a viable alternative to oil, a closer look must be taken of the effort made over the years of high growth in production, as well as the real possibilities for its continued increase. Vivero and Porras⁽²¹⁾ explain that, in 2007, biofuels constituted 1.7% of global fuel demand for vehicles, and that 1% of the world's arable land was used to cultivate them. Based on these data, and assuming a scenario in which the demand for transport fuel will not increase substantially -which is not the case-, it can be said that about 60% of arable land worldwide would have to be used in order to be able to completely replace petrol and

⁽²⁰⁾ The International Energy Agency. *World Energy Outlook 2011. Executive Summary*, Paris: OECD, 2011, p.5-6.

⁽²¹⁾ VIVERO, José Luis and PORRAS, Carmen. Cited study.

diesel from oil with biofuel. As fuel demand is rising, this percentage would, in fact, be higher.

However, the real situation is very different, depending on which countries are observed, the type of biofuel produced, and what procedures and raw materials are used. These differences are shown in Pfaumann's⁽²²⁾ analysis on the United States and Brazil, the two largest bioethanol producers. In 2005, Brazil used 2.75 million hectares to produce 16.5 billion litres of bioethanol, half the arable land given over to sugar cane, which accounted for 0.5% of the total cultivated farmland in Brazil. This amount replaced almost half the petrol used. Nevertheless, for the same amount of bioethanol but produced from maize, the United States needed almost 6 million hectares or 15% of arable land given over to maize, accounting for 3.5% of the total cultivated farmland. In spite of this heavier use of resources, the bioethanol produced only replaced a scant 2.5% of total petrol consumption. Estimates on the total potential for ethanol production from maize in the United States conclude that it will not be possible to increase maize-based ethanol beyond substituting 15% of petrol consumption. Just by manufacturing second-generation cellulose ethanol more petrol could be replaced, perhaps up to 50%, by using raw materials produced in the United States.

Only a small number of countries have the potential to reduce dependence on oil imports significantly. The amount of fossil fuel that can be replaced by locally produced biofuel will be very small in most countries. A useful example is biodiesel manufacture in Germany, the world's largest producer. Even if the country were to give 100% of its arable land over to cultivating rape and sunflowers to make biodiesel, it would hardly meet 20% of the internal demand for the fuel⁽²³⁾.

According to estimates shared by several analysts, in order to reach a mix of 10% bioethanol in petrol, the United States would have to use half their maize and 15% of arable land to make bioethanol⁽²⁴⁾. In order for the European Union to replace 10% of petrol and diesel from fossil sources with biofuel from their own raw materials, it would have to make available three-quarters of its arable land for the purpose⁽²⁵⁾. Industrialised countries, which are the largest consumers of fuel, could not substitute significant amounts of fossil fuel with what they can cultivate; if they wish to reach the set goals, they would have to import part of the biofuel or the raw materials needed to make it. However, Brazil could manage to replace 100% of petrol with bioethanol by using just 1% to 1.5% of its arable land.

⁽²²⁾ PFAUMANN, Peter. Cited study.

⁽²³⁾ This calculation is based on data supplied by Doornbosch and Steenblik in the OECD report mentioned above.

⁽²⁴⁾ In an article published in the Foreign Policy journal in January 2011, titled *The great food crisis of 2011*, Lester Brown stated that, in 2009, the United States earmarked 119 billion tons of cereals, i.e. almost 29% of total production, to manufacture bioethanol. In 2010, the United States used 35% of total maize production to make bioethanol.

⁽²⁵⁾ HOLTZ-GIMÉNEZ, Eric. Article published in *Le Monde Diplomatique*, June 2007.

In addition to the physical limitations in producing biofuels, when assessing the contribution of each one to the energy supply and, therefore, its ability to replace fossil fuel, the energy content of the biofuel, as well as that required to make it, must be taken into account. This includes energy used in cultivating, harvesting and transporting the plants comprising the raw material for manufacturing the biofuel, in addition to that needed to process the biomass to obtain it, and for distribution. The expression «fossil energy balance» is used to describe the proportion of energy content in biofuel and the energy from fossil fuel used throughout its production cycle. Thus, when saying that a specific biofuel has a fossil energy balance of 1, it means that the energy from fossil fuel used to produce one litre of biofuel is equal to the energy it contains, and therefore the biofuel provides no net gain or loss of energy. A fossil energy balance of 2 means that a litre of biofuel contains twice the amount of energy as required to make it.

The estimated fossil energy balance for biodiesel lies between 1 and 4 for that made from rape and soya. The estimated balances for palm oil are higher at around 9. With bioethanol, the estimated balances range between less than 2 for maize, and 2 to 8 for sugar cane. As stated previously, the good fossil energy balance for bioethanol made from sugar cane does not only depend on the productivity of the raw material, but also on the fact that waste from sugar cane biomass (bagasse) is used as an energy source.

The estimated fossil energy balances for biofuels made from cellulose raw materials have an even wider range, showing the stage of development at which the technology stands, as well as the large variety of raw materials and production systems in place. However, it is interesting to note that, in some cases, the balances can be higher than 10.

To conclude, the capacity to substitute petrol and diesel for biofuels would be greater if the most suitable crops for each zone were selected, to give good yields (litres of biofuel per hectare) and a good energy balance. Even so, it is not feasible to think that, with current technology, a high percentage of substitution can be obtained. According to estimates from the International Energy Agency, biofuels can be expected to meet 13% of fuel demand for transport in 2050⁽²⁶⁾.

■ Possible Environmental Benefits of Biofuels

In spite of the fact that there are still difficulties in establishing firm, widespread and binding commitments, these days almost no one disputes the need to take measures to reduce greenhouse gas (GHG) emissions that are causing climate

⁽²⁶⁾ INTERNATIONAL ENERGY AGENCY. *Energy Technologies Perspectives*, Paris: OECD Publications, 2006, Chapter 5, Road Transport Technologies and Fuels.

change. One of the methods that many countries are using is to support the production and use of biofuels to replace fossil fuel, at least in part.

Since biofuels are made from the biomass, in theory they should be carbon neutral, as they only release into the atmosphere the CO₂ that was captured by the plant through photosynthesis during growth. However, as already described for the energy balance, in order to assess the emissions balance⁽²⁷⁾ of GHGs of a biofuel, both the emissions caused by combustion and those arising throughout the production and consumption cycle also have to be taken into account: sowing and harvesting the crop; transforming the raw material into biofuel; transporting the raw material and the final product, storage, distribution and retail sales of the biofuel, etc. Thus, for example, the use of fertilisers containing nitrogen in intensive farming produces nitrous oxide, which is a greenhouse gas with a global warming capacity about 300 times that of carbon dioxide. The use of machinery in farming arable land also means that there is a quota of emissions, partly from manufacturing the machines and partly from using them. In addition, using fertilisers and pesticides whose production relies on oil also involves a quota of GHG emissions.

To a large extent, GHG emissions vary according to the type of crop used, cultivation methods, the location, the technology and procedures converting the raw material into biofuel, and its use. The wide range of biofuels, raw materials and production and conversion technology, means that there is a similar number of results for the emissions balances.

The FAO⁽²⁸⁾ states that most studies have highlighted the fact that production of biofuels from the raw materials currently used has achieved a reduction in emissions of approximately 20% to 60% in comparison to fossil fuels, provided the most efficient systems are used. On the other hand, although second generation biofuels are still commercially negligible, they can reduce emissions by about 70% to 90% in comparison to fossil fuel.

In both cases, these calculations published by the FAO do not take into account -and they warn of this- the carbon emissions that may have arisen due to a change in land use. However, for the results from these balances to be true, it is very important to remember the data from emissions from a change in land use, which takes place in the early stages of the biofuel production cycle and may require many years before it is compensated by the biofuel produced from it. For example, the carbon stored in forests or pastures is released from the soil during a changeover to crop use; whilst maize destined for bioethanol production can generate a saving in GHGs of 1.8 tons of CO₂ per hectare per

⁽²⁷⁾ The balance of greenhouse gas emissions is the result from a comparison among all greenhouse gas emissions arising from all stages of manufacture and use of a biofuel and all greenhouse gases emitted in production and use of an equivalent amount of energy from the corresponding fossil fuel.

⁽²⁸⁾ FAO. *The State of Food and Agriculture 2008*. Rome, 2008.

year, converting pasture to these crops can emit 300 tons per hectare. Likewise, conversion of forest land can emit between 600 and 1,000 tons of CO₂ per hectare, which means that 150 to 300 years of bioethanol production from maize would be required for the balance of CO₂ emissions to read positive. The same FAO report states that over 400 years would be needed to compensate for GHG emissions caused by changing the tropical rainforests and peatlands in Indonesia and Malaysia over to cultivating oil palms to produce biodiesel; from the environmental point of view, this operation is scarcely profitable.

If the assessment for the emissions balance includes all the variables mentioned, biofuels may have a worse environmental impact than that of fossil fuel. Therefore as mentioned previously, an assessment of the GHG emissions balance and of the environmental impact would be required for each biofuel, depending on the location and conditions under which it is produced and the type of land on which the raw material is cultivated, the raw materials used, the conversions procedures and techniques, transport requirements, later use, etc. There are many factors to bear in mind before it can be generally said that biofuels help to combat climate change or, on the contrary, they take part in exacerbating the situation.

François Houtart⁽²⁹⁾, one of the founders of the World Social Forum, when systematising the ideas and experiences gathered over countless journeys and contacts with specific situations in which biofuels were being produced, states that, although it is evident to everyone that the fossil fuel cycle is reaching its end, that its effects on the environment are harmful and that alternatives must be sought, the use of biofuels as a substitute and a mean in fighting to help the climate has clear limitations defined by the negative effects, both from an environmental and social point of view. Second or third generation solutions can certainly increase the role of biofuels in solving energy and climate problems, but he believes that we should remain cautious on future prospects. He explains that even the most radical movements, such as the Landless Movement in Brazil, have not taken a stance that completely excludes the use of biofuels, although they do lay down conditions. The conditions for ecological and social groups to accept biofuel production can be summarised in five points:

1. Respecting biodiversity, which means rejecting the idea of single-crop farming to give priority to varied plantations that do not endanger existing flora and fauna⁽³⁰⁾.
2. Restricting the agricultural frontier to prevent encroachment into forests, especially virgin forest. This means using the land already available and

⁽²⁹⁾ HOUTART, François. *Agroenergía: ¿solución para el clima?*, Panama: Ruth Casa Editorial, 2011, p. 158.

⁽³⁰⁾ In an interview given by Houtart to a Mexican newspaper, he explained: «I have walked for kilometres and kilometres in the Chocó, in Colombia, in the regions where palma africana is cultivated, and there is not one bird or a butterfly, nor fish in the rivers, owing to the use of chemical products».

- legal protection of the carbon sinks and areas of biodiversity or where indigenous peoples are living.
3. Respecting the ground and water tables, which excludes mass use of fertilisers and chemical pesticides to give priority to organic farming.
 4. Promoting peasant farming, allowing them to improve their methods of work, access to credit and sale of products.
 5. Combating the monopoly held by international companies.

According to Houtart, if these conditions are respected, the production of biofuels will automatically first be directed toward the needs of local populations. Therefore, the main questioning is not aimed at biofuels in themselves, but at the agro-industrial model that produces them. Thus, declarations by La Vía Campesina, an international movement of rural farmworkers, state:

«...leaving aside the madness of producing food to feed cars while many human beings are dying of hunger, industrial production of biofuels will increase global warming instead of reducing it. Biofuel production will revive the colonial plantation systems, re-install slave labour and significantly increase the use of agrochemicals, as well as contributing to deforestation and the destruction of biodiversity. Yet again, the greatest impact will fall on developing countries, since industrialised countries cannot be self-sufficient in biofuel and must import large amounts from countries in the southern hemisphere»⁽³¹⁾.

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■ THE IMPACT OF BIOFUELS ON FOOD SECURITY

■ Have Biofuels Played a Part in the Food Crisis?

If the lack of cost-effectiveness of biofuels or their extremely limited ability to replace petrol and diesel from fossil sources is a cause of concern, and if in many cases they cannot even make a positive contribution towards reducing greenhouse gases, their impact on the food security of millions of people is of much greater concern. The serious outbreaks in food crises that have occurred since 2007 have awakened concerns over the role played by biofuel production in the crisis. This is a complex assessment that cannot be made in isolation; the increase in biofuels is operating as a cause of the food crisis in conjunction with a complex string of other causes. Analyses made on the 2007-2008 food crisis clearly identified it as having several causes, with factors affecting both the supply and demand for food, sometimes situational and in other cases, structural⁽³²⁾.

⁽³¹⁾ VIA CAMPESINA. *Los pequeños productores y la agricultura sostenible están enfriando el planeta*. Discussion document on global warming, 2007.

⁽³²⁾ A synopsis of these causes can be found in the first chapter of the book *Especulación financiera y crisis alimentaria*, published in 2011 by the campaign for the «Right to Food. Urgent», which can be downloaded from the website www.derechoalimentacion.org.

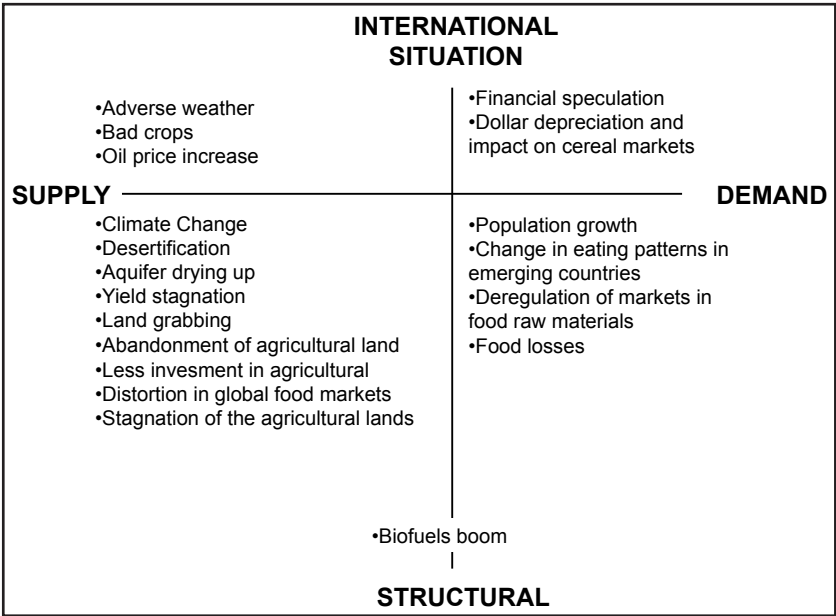


Figure 5: Source: *Especulación financiera y crisis alimentaria*. Campaña «Derecho a la alimentación. Urgente», 2011, p. 20.

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Many of the causes act in synergy. Population growth involves, amongst other things, a growing demand for energy, especially oil, which, together with other factors, is pushing up the price of crude. Higher oil prices lead to some farming produce being more expensive -some of these costs are directly or indirectly related to oil- and promotes cultivation of biofuels, with the increased demand for these also contributing to price rises in raw materials for food used to make them. When the raw materials for food become more expensive, it attracts speculative capital investment which floods the markets for agricultural products and gives impetus to volatile prices, which is the prime condition for making profits. When prices of raw materials for food become volatile, a very few entities -large investors, large cereal companies, multinationals in the agroindustry- reap huge profits, whilst hundreds of millions of vulnerable people cannot buy the basic foodstuffs needed to survive. A good example is the fact that some of these large companies tripled or quadrupled their profits between 2006 and 2008, with the food crisis in full swing⁽³³⁾.

Owing to these inter-related causes, it is difficult to measure how far biofuels have been responsible for generating the food crisis. In fact, there are several points of view, from those who say it plays very little part, to those who attribute most of the responsibility to biofuel. On this subject, in 2008, there

⁽³³⁾ ALIANZA BIODIVERSIDAD. *Crisis climática: falsos remedios y soluciones verdaderas*. 2010, p.27.

were leaks⁽³⁴⁾ of an alleged- it was even said to be secret- internal report from the World Bank, written by Don Mitchell, an economist at the World Bank, who laid 75% of the responsibility for the food crisis at the door of biofuel production, in contradiction of the United States government, which only attributed to it a 3% responsibility for the rise in food prices. This would most certainly be the reason why the report never saw the light of day⁽³⁵⁾.

■ How does the Production of Biofuel Affect the Pillars of Food Security?

A population has food security when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their needs and food preferences for an active and healthy life. Therefore, the four basic pillars of food security are: the availability of food; a stable supply; access to food by the population; and the biological use of food. There follows an analysis of the current and potential impacts of biofuels within this description of food security.

• *Impact on food availability*

The global availability of food is being directly and indirectly affected by the increase in biofuels. It is directly affected because the majority of current biofuel production comes from raw materials often used for food. Between 2005 and 2010, global cereal production increased by 8%; the use of cereals for food for humans rose by 7%, and by 2% for animal food. In the same period, the other uses it was put to, including biofuels, increased by almost 45%, so that almost all the higher cereal production over the time was absorbed by uses other than for food for humans⁽³⁶⁾. These days, the biofuel industry uses almost 40% of the maize grown in the United States, and two-thirds of vegetable oils produced in the European Union⁽³⁷⁾. Until now, biofuels have accounted for a small percentage of global agricultural production, but the trend has been, and continues to be, upward. Whilst biofuels demanded 2% of the world's cereals in 2004 and almost no vegetable oils, in 2010 they required 6.5% of cereals and 8% of vegetable oil⁽³⁸⁾.

There is a real danger in the rising use of food products for biofuels, despite their having only a limited capacity to replace oil; if the entire global production

⁽³⁴⁾ CHAKRABORTY, Aditya. *Secret report: biofuel causes food crisis*. Article published in The Guardian, 03/07/2008.

⁽³⁵⁾ It would seem that there was no clear denial from the World Bank regarding this alleged secret report. On the web page «The World Bank Live», where online dialogues take place with some of their managers on subjects in the news, when asked a specific question on this report, it was said that it was a preliminary draft, but did not go further into the accuracy or otherwise of the data or why it had not been published. <http://live.worldbank.org/foodcrisis>

⁽³⁶⁾ BOIX, Vicent. *Otra crisis alimentaria y al «Dios mercado» no hay quien le tosa*. Article from the «Crisis agroalimentaria» series, 2011.

⁽³⁷⁾ FOOD SECURITY COMMITTEE. *Price volatility and Food security*. Report from the High-Level Panel of Experts (HLPE) Rome, 2011, p.32.

⁽³⁸⁾ SEARCHINGER, Tim. Article published in the Washington Post, 11/02/2011.

of wheat, rice, maize, sorghum, sugar cane, yucca and beet were converted into ethanol, it would only correspond to 57% of total oil consumption⁽³⁹⁾.

FAO forecasts point to basic agricultural products continuing to be the main raw material for bioethanol and biodiesel for the next decade, and that the technical and financial obstacles limiting production and sale of biofuels derived from other raw materials will continue to make them prohibitive. Moreover, although not in the case of biofuels that do not use raw materials for food, there is an indirect impact through competition for resources for production, such as land and water. When the demand for biofuels increases the prices of products used as raw materials to make them, the prices for all agricultural products depending on the same resource base tend to rise. For this reason, manufacturing biofuels from non-food crops does not necessarily remove competition between food and fuel; if the same land and other resources are needed for crops both for food and raw materials to generate biofuels, their prices will follow the same path, even when the cultivated raw materials cannot be used for food.

Some of the crops currently used as raw material to produce biofuels require prime arable land and large inputs of fertilisers, pesticides and water to become economically viable. Policies for encouraging biofuels may lead to the decision to put aside larger areas of land to produce them, to the detriment of other crops. A good example of how these mechanisms operate can be seen in making bioethanol from maize in the United States. It is estimated that, in 2007, the land used to grow maize for bioethanol increased by 23%, at the same time as land used for soya decreased by 16%, contributing to a 75% rise in the price of soya in just one year.⁽⁴⁰⁾

The link between the growth in biofuels and land-grabbing is equally well-known; from a comparison of land transactions where it is known for which product or commodity it is to be used, at least 58% has been destined for biofuels⁽⁴¹⁾. Regarding the use of water, the FAO estimates that, at present, more than 2% of irrigation water goes to crops used for biofuels, in addition to the fact that the process for transforming the raw materials into biofuel requires large amounts of water, mainly to wash plants and seeds.

- *Impact on a stable food supply*

At first sight, it is not easy to assess the extent to which biofuel production may have a negative impact on the stability of the food supply. However, it must be remembered that a farmer or agroindustrial company will choose to produce raw materials for biofuel instead of food if they obtain a higher net income than

⁽³⁹⁾ FAO. *The State of Food and Agriculture*, 2008

⁽⁴⁰⁾ HEADEY, Derek & FAN, Shenggen. *Reflections on The Global Food Crisis. Research monograph 165*, Washington: International Food Policy Research Institute, 2010, p. 29.

⁽⁴¹⁾ ANSEEUW, Ward et al. *The right to land and land grab fever. Executive summary*. International Land Coalition, 2012.

for crops or alternative uses. This can mean that, at a given moment, because of expected profit, as well as encouragement from incentives, although the stability of food supply may be in danger, production in a certain place is geared toward producing biofuels.

- *Impact on access to food*

The increase in the price of food recorded since 2007 has not been an isolated, short-term incident. After 15 years in which the food price index made by the FAO has remained fairly steady, stable and low, from 2007 prices became volatile, leading to the index almost doubling over past years. On seeing the food crisis of 2008, some analysts have stated that the era of cheap food has ended and that prices will never return to earlier levels. These price rises have a very negative impact on both rural and urban populations who are net buyers of food and have low incomes; they spend over half their incomes on food. Price rises in basic foodstuffs mean that such people cannot buy sufficient food.

The growing dynamic of biofuel production that has happened at the same time as the food crisis was emerging and manifesting itself, has also played a part in restricting access to food. In fact, the earliest appearance of the food crisis is a clear example of this; the first alarm raised for what was to become the global food crisis of 2008 sounded in 2007, with the «tortilla crisis» in Mexico. Rising maize prices made tortilla, the basic product in diets in Mexico and Central America, much more expensive and put feeding the population in serious danger, especially more marginalised people whose diet is based on tortilla. That led the population to take to the streets in protest. The origin of the situation dated back several years, when Mexico signed the North American Free Trade Agreement (NAFTA) in 1993, which came into force on 1 January 1994, having a major impact on the peasant population of Mexico. Until then, the Mexican government used customs duties and subsidies to small maize farmers to protect them from United States maize, as this was much cheaper than Mexican, since farmers in the United States were generally much bigger and had a great deal of support from the government in the form of subsidies, more access to credit and technical assistance, better technology and better land for maize cultivation. After the NAFTA agreement came in force, the Mexican government had to gradually remove duties on maize from the United States and, suddenly, Mexican farmers had to compete with imported maize at artificially low prices. In the first ten years that the NAFTA was in force, maize prices in Mexico fell by 70%, leading to over a million and half Mexican agricultural workers losing their jobs,⁽⁴²⁾ Food dependency in Mexico increased so that, within 10 years, it was importing 95% of its soya, 58.5% of its rice, 49% of its wheat, 25% of its maize and 40% of its meat⁽⁴³⁾. Despite the fact that Mexico is considered the birthplace of maize, it

⁽⁴²⁾ According to an evaluation ordered by the Mexican government, between 1992 and 2002, the number of farming families fell from 2.3 million to 575,000.

⁽⁴³⁾ <http://www.ciepac.org/neoliberal/esp/tlcan.html>.

imports millions of tons per year from the United States, its main trading partner. The problem started with the increase in bioethanol production in the United States, which caused a greater internal demand for maize used for the purpose and a rise in its price. Higher maize prices also affected Mexican imports of maize from the United States, with the subsequent rise in the tortilla price.

It has been said that more biofuel could be an opportunity to revitalise many rural areas and benefit farm workers. However, it must not be forgotten that most farms producing the required raw materials adopt agroindustrial systems that do not usually help to improve the conditions of small farmers, but very often displace them and dispossess them of their land. In fact, the question of which agricultural model is applied is a key aspect in food security or insecurity. Abandoning small- and medium-scale farms in developing countries is one of the main reasons why the rise in food prices has affected the food security of so many millions. Reduced public investment in agriculture in developing countries has been unstoppable over the last 30 years. The 2008 World Bank Development Report states that public investment in agriculture in countries whose economy is based on the sector did not reach 4% of total expenditure. The immediate consequence of such abandonment is the dramatic increase of developing countries dependence on the international food markets and, therefore, their vulnerability to fluctuations in international prices. In the last 30 years, the 49 poorest countries in the world changed from being exporters to net importers of food⁽⁴⁴⁾.

So far, the rapid growth in biofuels has had a negative impact on food security, having contributed towards raising food prices. This trend seems set to continue, as the increasing use of cereals, sugar, oily seeds and vegetable oils to meet the needs of the constantly growing biofuel industry is one of the main determining factors in the outlook for agriculture in the next few years⁽⁴⁵⁾.

According to the FAO, the rise in world food prices does not necessarily affect food security in the home; the effects depend on the extent to which international prices are reflected in internal markets. Government policies aimed at preventing large crises in national prices tend to reduce the transfer of world market prices to home markets⁽⁴⁶⁾. However, it is just those countries which are most vulnerable that have less capacity to adopt such policies.

■ POLICIES PROMOTING BIOFUELS

As recognised by the FAO, with current technology, the costs for producing crops and converting them into bioethanol or biodiesel are, in many places,

⁽⁴⁴⁾ Campaign on the «Right to food. Urgent» and the Instituto de Estudios del Hambre. *Hacia una nueva gobernanza de la seguridad alimentaria*. Madrid, 2010, p. 20.

⁽⁴⁵⁾ OECD and FAO. *Agricultural Outlook 2008-2017*. Paris, 2008.

⁽⁴⁶⁾ FAO. *The State of Food and Agriculture 2008*. Rome, 2008, p. 87.

too high to compete commercially with fossil fuel without active help from the government to promote their development and subsidise their use. This has led to various incentive and promotion policies for biofuels in several countries, especially the United States and European Union. There are differing incentive modalities, which are not mutually exclusive:

- Direct financial support to produce the raw materials for biofuels: An example is the United States, where farmers growing maize for bioethanol receive large subsidies that, in many cases, make them decide to abandon food crops and concentrate on crops for biofuels, which are more profitable. A similar situation occurs in the European Union, where a certain amount is given per hectare to subsidise crops for biofuels.
- Direct financial support to transform the raw materials into biofuels: In the United States, bioethanol manufacturers receive a subsidy of fifty cents for each gallon of bioethanol produced. According to the International Energy Agency, subsidies for biofuel production in the United States and European Union reached 8 billion dollars in 2009.
- Indirect financial support through tax exemptions for producers, distributors and consumers of biofuels: In the European Union, although biodiesel production is significantly more expensive than fossil diesel oil, tax relief together with other incentives help to promote its production and use.
- Removing subsidies from fossil fuels: According to the International Energy Agency, subsidies for fossil fuel consumption were more than 400 billion dollars in 2012⁽⁴⁷⁾. Thus, for example, in view of the demand in Europe for biofuel, the Indonesian government reduced and later removed subsidies for fossil fuels in 2005, and allowed the biofuel industry to become economically viable. The industry enjoys a strong competitive advantage, thanks to large amounts of palm oil being produced, which would lead Indonesia to become the second largest producer of biodiesel in the world.
- Support through regulations making it compulsory to mix in a specific percentage of biofuels: At least 17 countries have introduced a legal requirement to mix bioethanol with petrol in proportions varying between 10% and 15% (except Brazil, which has a much higher percentage in the mix), also to mix between 2% and 5% biodiesel.
- Protectionist measures, with restrictions or customs duty on imported biofuels to boost internal production: The United States levied duty on imports of Brazilian bioethanol, which is much cheaper to produce than the bioethanol from maize made in the United States, to promote local production.
- Investment in public research or aid to private research on biofuels.
- These policies promoting biofuels, which are expensive, are justified by their contribution to combating climate change and their capacity to reduce energy dependency, arguments which, as we have seen in previous sections, are questionable in many cases. However, these public measures lead to

⁽⁴⁷⁾ The International Energy Agency. *World Energy Outlook 2011. Executive Summary*, Paris: OECD, 2011, p.3.

over-rapid growth in biofuel production without taking any negative consequences into consideration.

The International Energy Agency forecasts that, owing to the policies in place, the land used for biofuel production may undergo a three- or four-fold increase in the next few decades, and that this will be faster in Europe and North America. Poorly directed incentives can give rise to unforeseen and unwanted consequences. According to the High-Level Panel of Experts on the United Nations Food Security Committee, there is no question today that biofuel production was one of the main factors influencing the increase in food prices during the 2008 food crisis; because of this, policies supporting biofuels, especially subsidies setting compulsory mixing percentages, must be abandoned immediately, without ruling out that more robust measures might be needed in the future to prevent biofuel production from having a negative impact on stability in world food markets⁽⁴⁸⁾.

■ REGULATIONS IN EUROPE AND SPAIN

Directive 2003/30/EC of the European Parliament and of the Council presented the use of biofuels as a tool to reduce dependence on imported energy and influence the market for transport fuel, with the consequent repercussions on the security of the medium and long-term energy supply, by which they proposed to promote research and technological development on the sustainability of biofuels. It stated that their increased use should go hand in hand with a detailed analysis of the environmental, economic and social impact, in order to decide if it is advisable to raise the ratio in relation to conventional fuels. The directive set a benchmark for biofuels of 2% of all petrol and diesel sold in its markets for transport for the end of 2005, and 5.75% for the end of 2010.

Directive 2009/28/EC sets a quota of 10% of energy from renewable sources in fuel consumption for transport in all member states of the European Union for 2020, a target it hopes to meet through biofuels. It states that biofuels used to meet the targets set by the Directive and those benefiting from national subsidies are obliged to fulfil sustainability criteria. In short, it stipulates that a consequence must not be to encourage the destruction of land with a rich biodiversity and the impacts arising from a change in land use due to biofuel production must also be taken into account, especially for forests, pastures, marshlands, peat bogs, etc.

These sustainability criteria detailed in the Directive relate both to the effects of assessing fulfilment of the targets set by the Directive and assessing compliance with obligations to use renewable energy and to decide if there

⁽⁴⁸⁾ FOOD SECURITY COMMITTEE. *Price volatility and Food security. Report from the High-Level Panel of Experts (HLPE) Rome, 2011, p.40.*

should be financial help for biofuel consumption. In doing so, the reduction in greenhouse gas emissions due to the use of biofuels should be a minimum of 35%; and, from 2017, this figure rises to at least 50%.

In relation to third countries and member states providing a significant source of biofuels or raw materials for biofuels consumed in the European Union, every two years, the European Commission will inform the European Parliament and Council, firstly on measures taken nationally to meet the sustainability criteria given and to protect the land, water and air; and secondly on the consequences for social sustainability in the Community and third countries of the increase in demand for biofuel and the Community policy on biofuels, in addition to the availability of foodstuffs at an affordable price, in particular for people living in developing countries. The first report will be presented in 2012 and the Commission will propose any corrective measures required, especially if there is proof showing that biofuel production is having a considerable influence on food prices.

In Spain, Royal Decree 1700/2003 provides for specifications on the use of biofuels and transfers Directive 2003/30/EC to Spanish law. Royal Decree 1597/2011 of 4th November (State Gazette BOE 17465 dated 05/11/2011) from the Ministry of Industry, Tourism and Trade, was also approved and which regulates sustainability criteria for biofuels⁽⁴⁹⁾. In this Royal Decree, social sustainability criteria and concerns on the negative impact on the right to food for the most vulnerable people are absent, in spite of the fact that organisations from civil society provided pointers and information on the subjects during the preliminary report stage at the Environmental Advisory Council.

■ CONCLUSIONS AND RECOMMENDATIONS.

- With the technology currently available, biofuels are not an alternative to largely replace fossil fuels. At present, they are generally more expensive and insufficient to meet the global demand for fuel for transport.
- Not all biofuels bring benefits to the environment in terms of reducing greenhouse gas emissions, and therefore, an assessment must be made for each case, each type of crop, each type of biofuel, each production method and the conditions of the location.
- There is fairly wide consensus on the opinion that biofuels have had a significant impact on the increase of food prices in the last five or six years, thus contributing towards the food crisis.
- The industrial agriculture system that mainly supports biofuel production does not normally benefit small farmers and, therefore, does not provide

⁽⁴⁹⁾ This regulation involves the transfer of articles 17, 18, 19 and 20 and appendix V from Directive 2009/28/EC.

solutions to food insecurity affecting rural populations (3 out every 4 of those starving in the world live in rural areas).

- Therefore, policies promoting biofuels must be revised. In particular, the European Union must review the compulsory quota for mixing biofuel with fossil fuels, in addition to subsidies for producing them.
- Spain, which has no advantages over tropical countries in the production of first generation biofuels, should concentrate its efforts on research and development of the second and third generations of biofuels, which will have more beneficial effects on the environment, whilst at the same time eliminating the negative impact on food security.
- Furthermore, in view of the first reports presented by the European Commission in 2012 on the social and environmental impact of their biofuel policies, Spain must focus on the sustainability criteria contained in Royal Decree 1597/2011, especially those for social criteria, placing special importance on the impact on food security in developing countries.

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