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SUB-COMMITTEE ON ENERGY AND ENVIRONMENTAL SECURITY

FOOD AND WATER SECURITY: IMPLICATIONS FOR EURO-ATLANTIC SECURITY

REPORT

PHILIPPE VITEL (FRANCE)
RAPPORTEUR

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I. INTRODUCTION

1. The Horn of Africa is experiencing its fifth drought in seven years. Somalia, in particular, is suffering from its worst food crisis in about 20 years, with several regions stricken with famine. More than 12 million people are in need of emergency assistance. The lowest rainfall level since 1950/51 is the main cause of this humanitarian crisis, but high food prices and price volatility, excessive livestock mortality, lack of adequate physical and market infrastructure and political instability exacerbate the situation significantly. The Somali extremist insurgent group al-Shabaab has reportedly at times prevented people from fleeing the worst-affected areas and even set up cantonment camps for them. While al-Shabaab is partially reversing its policy of denying aid groups access to areas under their control, Somalia still remains the most dangerous country in the world for aid workers. Indeed, the World Food Programme (WFP) pulled out from the south two years ago. This dire situation calls for intensified action from the international community to prevent even more deaths.

2. The crisis in the Horn of Africa is but a symptom of deeper underlying problems. Today, close to 130 countries are not self-sufficient in terms of food, but instead rely on international trade to make the food demanded by their people available.[1] Of these, 40 are among the world's least-developed countries, often with very limited means of importing the necessary food.[2] All of these developing countries have severe economic and social problems, and many are engulfed in civil conflict, such as Afghanistan, Somalia, Sudan and Yemen. In 29 countries the populations suffer from hunger:

- **Latin America**: Haiti and Columbia;
- **Africa**: Benin, the Central African Republic, Chad, Congo-Brazzaville, the Democratic Republic of Congo, Eritrea, Ethiopia, Guinea, Ivory Coast, Kenya, Liberia, Madagascar, Malawi, Mozambique, Niger, Sierra Leone, Somalia, Sudan, Uganda and Zimbabwe;
- **Asia**: Afghanistan, Iraq, Kyrgyzstan, Mongolia, North Korea, Pakistan and Yemen.

These are just some of the statistics that highlight the magnitude of global food insecurity.

3. Water is closely linked to food security and public health. Both water quantity and quality are major problems in many regions, especially in countries with low levels of food security. What often complicates sustainable water management is the fact that 263 river basins and 269 aquifers are shared by two or more states.[3] Indeed, 21 rivers and four aquifers cross the boundaries of more than five countries.[4] Currently, 2.4 billion people live in areas suffering from water scarcity, a number that is predicted to double by 2050, if no change in water management practices and productivity takes place.[5] Some 1.2 billion people also lack access to clean water, which leads to roughly five million deaths from preventable, water-related diseases every year.[6]

4. Even before the crisis in the Horn of Africa, food security had once again climbed to the top of the international political agenda - just as it did during the 2007/2008 food crisis, when much of the developing world was severely affected by high levels of food price volatility and drastic price increases in key food staples. As the price of basic food cereals rose rapidly in 2007 and 2008, with rice prices doubling in just a few months, for example, millions of people were thrown into extreme poverty, and food-related riots occurred in at least 30 countries.

5. By early 2011, the Food Price Index of the Food and Agricultural Organization (FAO) of the United Nations (UN) had surpassed the peak recorded in 2008.[7] By the summer, the index was down by about 1.5 %, but still remained about 70 % higher than a year earlier. On a positive note, food stocks are still sufficiently large, and the international community is better prepared to tackle the consequences of a new global crisis than just a few years ago, if the political will is present.

6. Arguably, food and water security[8] should be considered developmental or humanitarian issues. However, low food and water security can have a direct impact on political security as well. Food and water challenges could even come to define the landscape of security politics, as states and societal groups struggle to nourish themselves in the future. This makes the challenges of the

global food and water system an important topic for the NATO PA. Indeed, the NATO PA has followed this issue closely for a number of years, for example at the 2007 NATO Advanced Research Workshop in Budapest on Energy and Environmental Challenges to Security and during the 2009 visits to Rome, Milan and La Spezia as well as to Algiers. The Economic and Security Committee's Sub-Committee on Transatlantic Economic Relations has, for its part, analysed the 2007/2008 food crisis in its 2009 report.[9]

7. Most importantly, food and water insecurity can become interconnected with matters of international security in four main ways:

- *Humanitarian crises*: As this year's drought and crisis in the Horn of Africa shows, acute food insecurity and famine are a much-too-common concern for the international community, often requiring outside help and exacerbating politically unstable situations. In Somalia, pro-government forces have gone on the offensive against al-Shabaab, who, in turn, has responded with more suicide attacks. Over 400,000 refugees from Somalia have fled into Kenya already, and the crisis will undoubtedly also affect the political situation in Djibouti, Ethiopia, Kenya and Uganda.
- *Migratory pressures*: Poverty and limited prospects are still the most common reasons for migration, for example from Latin America, parts of Africa or South Asia. Nevertheless, in some regions, food and water stress will likely lead to an increasing number of people who cannot sustain their livelihood and, thus, turn to migration (internally or across national borders), potentially causing social tensions and unrest. This is already an important concern in the Mediterranean region. In fact, in 2007, there were 25 million 'environmental refugees', as one expert told members of the NATO PA at a workshop on "Energy and Environmental Challenges to Security" in Budapest in 2009.[10] This number might rise to 50 million by 2020.[11] Currently, over 800 million people live in Africa and more than 3.7 billion in Asia. In 2050, these numbers are set to rise to 1.8 billion and 5.2 billion respectively, highlighting the immense population pressures in those parts of the world, if living standards are not raised substantially.[12]
- *Intra-state tensions and conflict*: Deteriorating food and water security can lead to domestic unrest, thus destabilising countries. Often, such upheavals are directed against the ruling regimes, but they can also exacerbate existing tensions or lead to conflict between different groups within a state, as witnessed in Darfur. However, such tensions are not only limited to developing countries. In 2008, for example, Spain suffered its worst drought in 60 years, which led the government to divert water into Catalonia, but not into opposition-run Murcia and Valencia, thus drawing accusations of political favouritism.
- *Inter-state tensions and conflict*: While most tensions and conflicts over food and water arise within states, many experts expect them to occur more frequently between states in the future. The potential for increased tension or conflict is especially high where states share water resources, such as the Nile, Jordan, Euphrates and Tigris rivers.

8. This report was prepared for the Science and Technology Committee's Sub-Committee on Energy and Environmental Security (STCEES), to be presented at the 2011 NATO PA Annual Session in Bucharest, Romania. Given that food and water security is tightly connected with the environmental challenges of the future and considering the contributions that science and technology can make to solving food and water problems, this report is central to the interests of the STCEES.

9. The report seeks to offer an analysis of the longer-term trends regarding food and water security and the shorter-term risks to global food security. Moreover, it presents a variety of ways forward. In this way, it will inform the NATO PA members on the implications of food and water insecurity for the Euro-Atlantic area and will allow them to feed these discussions back into their own national debates. The report has been updated throughout 2011 to reflect ongoing developments and input from Assembly members at the 2011 Spring Session in Varna, Bulgaria.

II. FOOD AND WATER SECURITY: FUNDAMENTAL ISSUES

10. Adequate availability of, and access to, food and water is probably humanity's most perennial problem, for the individual as well as for public policy. Today, the world is presented with a dual challenge. First, with an ever-surging global population, more and more people will have to be fed and given access to clean fresh water. Second, as far too many people already go to bed hungry, the percentage of undernourished must be brought down.

11. By 2050, the world's population will have grown to more than nine billion. At the current rate of growth, over 81 million additional people have to be fed and given access to water every year.[13] This means that, by mid-century, agricultural production has to be increased by between 70 and 100 % and the amount of water withdrawn for irrigated agriculture by 11 % to meet demand.[14] For most of the 20th Century, food production outpaced demand, leading to a steady decline in food prices. However, in the latter half of the 80s, this trend reversed, and prices began to climb again at the beginning of the 21st Century.[15] Even though the Malthusian spectre of population growth outpacing food production in the long run has been banished time and again, these numbers still present an enormous challenge, both for individual states and the international community.

12. The world must also deal with an enormous number of undernourished people. In 2010, FAO estimated that about 925 million people were undernourished.[16] This is lower than the peak of over one billion recorded in 2009 and, in fact, represented the first decrease in undernourished people since 1995. However, the World Bank currently puts the number at over 945 million again.[17] The UN nevertheless maintains that the world is on target to achieve its first Millennium Development Goal of halving the proportion of people whose income is less than US$ 1.25 a day between 1990 to 2015.[18] The eight Millennium Development Goals were signed in September 2000 by 193 states at the United Nations Millennium Summit and aim to galvanise people and governments in to meeting the needs of the world's poorest by 2015 (see Figure 1). However, achieving the Millennium Development Goals remains a profound challenge, as the economic crisis still lingers, with fears of renewed recession in many developed countries, and food prices remain at very high levels. For example, when the FAO briefed the STCEES in Rome in 2009, it highlighted the need for significantly higher levels of investment in the agriculture sector in order to merely return to the pre-crisis number of undernourished people.[19] Regrettably, the UN News Centre reported, even before the current crisis in the Horn of Africa, that the high food prices recorded in 2011 had already thrown 44 million people into extreme poverty again.[20]

Figure 1:

MILLENIUM DEVELOPMENT GOALS

1. Eradicate 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

13. This section provides an analysis of the longer-term trends that put pressure on global food and water security and the shorter-term risks, as seen in the 2007/2008 food crisis.

A. LONGER-TERM TRENDS IN GLOBAL FOOD AND WATER SECURITY

14. Most experts agree that worldwide food production and productivity is under severe strain. Indeed, some developing countries might see per capita production levels in 2030 that will resemble those of the 1960s/1970s.[21] The most pressing factors to address are evolving food and

energy demands, the effects of climate change, increasing stress on water resources, ongoing environmental degradation and resource scarcities.

1. Evolving Food Demands

15. Many emerging countries continue to experience strong economic growth and to lift millions of people out of poverty. China alone has lifted over 600 million people out of extreme poverty since it began its economic reforms in 1978. However, as people emerge from poverty, their means to buy food increases, and food demand expands accordingly.

16. Furthermore, when people become more affluent, especially at the lower income levels, this is accompanied by a substantial shift in diet. While poorer people consume a mostly grain-based diet, more affluent people make the transition to a more meat and dairy-based diet. Producing livestock, however, is extremely feed and water-intensive, increasing demand for grain, like corn and soybeans. For example, it takes roughly 2.6 kg of corn and 39 litres of water to produce one kg of chicken and 7.1 kg of corn to produce one kg of beef.[22]

17. Today, the world is becoming ever-more urbanised. Slightly more than half of the world's population lives in urban rather than in rural areas.[23] At the current rate, over 128 million people are added to the world's urban population every year.[24] This means that potential croplands are diverted into urban development and more people come to rely on food purchases instead of farming the land. Incidentally, urbanisation often leads to degradation of water quality as well.

2. Evolving Energy Demands

18. A rather recent development, but one that has already had an impact, is the increasing demand for biofuels as an alternative energy source to stem the tide of climate change and manage import dependencies. When the STCEES was briefed by the FAO in Rome in 2009, it was told that the impact of biofuels on food prices has been difficult to gauge because estimates vary widely. For example, the US Council of Economic Advisors suggested that about 3 % of the price rises during the 2007/2008 food crisis can be attributed to the diversion of food crops into biofuels, but most other estimates are in the range of 35 to 40 %.[25] In a June 2011 meeting, the G20 agricultural ministers acknowledged the complexity of the issue, but promised to "continue to address the challenges and opportunities posed by biofuels, in view of the world's food security, energy and sustainable development needs."[26] They also supported the ongoing work of the Global Bioenergy Partnership, the result of a 2005 meeting by the G8 +5 (Brazil, China, India, Mexico and South Africa), which promotes bioenergy for sustainable development, taking account of climate change and food and energy security. At this point, it comprises 23 countries and 13 international organizations.

19. Today's biofuels are most often produced from corn or oilseed. Hence, the main problem lies in the fact that new linkages have been created between the agriculture and energy sectors. Increased biofuel production raises the demand for grains and, thus, price levels. It has been calculated that oil prices above US$ 58 per barrel already make some corn-based ethanol a competitive alternative to oil,[27] although other experts question whether ethanol can ever be truly competitive. Heightened demand for biofuel crops also means that agricultural products are diverted away from food to the energy market and that necessary cropland expansion is partially redirected towards biofuel production. Furthermore, increased biofuel production could lead to greater levels of grain stock depletion, as reserves are funnelled into biofuel production.

20. In many industrial powers, such as the United States and the European Union, biofuel production is highly regulated through legislation that creates markets and by stimulating the industry via subsidies and tariffs. Many experts argue that such biofuel support policies in the United States and the European Union created a demand shock, which was a major contributing factor to the international food price rises of 2007/08.[28] If this trend continues, food prices will likely

remain high because the link between energy and food security creates a price floor for many agricultural products - unless a way of de-coupling biofuel and food production can be found. Investing in second-generation biofuels, such as waste and algae, could be helpful, as they compete only minimally with food.

3. The Effects of Climate Change

21. Many experts expect that the negative effects of climate change will create the most dramatic pressures on global food and water security. Almost certainly, the least-developed and most food-insecure states will suffer the most.

22. The negative consequences of climate change are manifold:

- Rising sea levels multiplies flooding of coastal areas, thereby also leading to increased soil salinisation;
- The increase in the rate of extreme weather incidents, such as severe droughts, is threatening the stability of food supplies and prices;
- Rising temperatures lead to reductions in crop yields of up to 16 %;[29]
- Rainfall will increase in tropical zones and higher latitudes, but fall in dryer areas and the interiors of large continents;
- Water requirements for agriculture will rise; and
- Shifts in growing seasons and rainfall patterns necessitate profound adaptation.

These are just some examples of the effects of climate change, but we need to enhance our understanding of these effects, especially of how they translate into challenges at the local level. What is clear, however, is the need for increased investment in agriculture, as will be discussed further below.

4. Water Stress

23. An absolutely crucial issue for global food security, as well as a profound problem in itself, is the increasing scarcity of water resources adequate for human consumption and agricultural production. Only about 0.44 % of global water reserves can serve human needs.[30] Indeed, humans are already tapping into more than half of all renewable and accessible fresh water resources and, in some regions, water use already exceeds the amount of water that is replenished every year.[31] With water use likely to increase by 40 % by 2020 and climate change stressing available resources even further,[32] severe shortages lie ahead in many regions, especially because water is expensive to transport, compared to its cost, and because it cannot be substituted by other resources.

24. In fact, many people already lack access to water suitable to their needs, be it for sanitation, drinking or agriculture. Through lack of proper infrastructure, a total of 3.4 billion people in developing countries are exposed to very high threat levels in this regard.[33] With the UN Millennium Development Goals, the international community set itself the target of halving the number of people without access to safe drinking water and basic sanitation. Many regions are, in fact, on target to meet this goal. However, in Central Asia, Oceania and Sub-Saharan Africa, the situation has either stagnated or, indeed, worsened.[34] For example, in Sub-Saharan Africa, 49 % of the total population had access to sustainable water in 1990. In 2004, the number was 56 % - still far from the 2015 target of 75 %.[35]

25. The UN warns that over 700 million people today live in states which are chronically short of water.[36] By the middle of the 21st Century, three quarters of the global population might face such shortages.[37] In the medium term, agriculture will suffer more than other sectors because it

accounts for 70 % of fresh water use.[38] Water stress is defined by the FAO as having less than 1,700 m³ of renewable freshwater per person per year.[39] For the sake of comparison, the total yearly renewable freshwater per capita in Canada is 87,255 m³. In the United States, it is 9,847 m³. Israel has a mere 252 m³, but this figure is even lower in many Arab countries. Indeed, 14 of the 20 most water insecure nations in the world are found in Northern Africa and the Middle East.[40]

26. In many countries, water shortages are due to poor water management. For example, Saudi Arabia is severely over-pumping its non-renewable fossil aquifers under the desert, allowing it to become the world's number six in wheat exports, even though it has no natural rivers or lakes.[41] The country is currently changing the agricultural subsidy policies which contribute to the accelerated depletion of this non-renewable water source for agriculture. At present levels of water usage, however, it has been argued that irrigated agriculture will come to a standstill within a decade, regardless of policies and subsidies, but simply as a result of running out of water.[42]

27. Water security not only concerns developing states. In many countries, including industrial states, water resources are stretched to their limits, and new sources are becoming evermore expensive to develop.[43] In fact, even large portions of the United States and Europe, excluding Scandinavia, face a growing threat to water security and quality as well.

28. In the 20th Century, the world's population tripled and water consumption increased six-fold.[44] This makes it clear that water quantity and water quality will be a defining issue for many countries in the future. It should also be kept in mind that, as developing countries raise their living standards and improve their economies, the patterns of water usage will also change, adding further pressure to local resources. Whereas water in developing countries, and not too long ago in industrial countries, is used mainly for agriculture and human consumption, further expansion of industry - for example high-technology, blue chip industries, the tourism sector and the demands of wealthy visitors - will lead to even greater demands.

5. Environmental Degradation

29. Progressive environmental degradation, due to climate change or unsustainable farming practices, is another issue of central concern for world food and water availability. One example is widespread soil erosion. Over-tilling, i.e. leaving too little crop residue on the field in preparation for the next harvest, leads to the degradation of the soil's ability to retain water and nutrients. In China, it has already led to severe dust storms, which *National Geographic* calls an "impending catastrophe".[45] Other forms of degradation include soil compaction, low quantities of organic matter, loss of structure, poor internal drainage, salinisation and soil acidity problems, which all lead to accelerated soil erosion. Some experts, in fact, judge that land degradation over the next 25 years could reduce global food productions by 12 %, compared to what it would be without such degradation, leading to the prices of some commodities increasing by almost a third.[46]

6. Resource scarcities

30. Mounting resource scarcity should not be overlooked either. For example, fertiliser, a key input into agricultural production, will become harder to produce in the future. Essential ingredients are increasingly depleted, among them phosphorus, which will peak by 2030 and run out within 100 years, and nitrates, which could run out in 60 years.[47] Indeed, the significance of fertiliser components was seen during the 2007/2008 food crisis, when prices roughly quadrupled for some key ingredients, as producers scrambled to secure larger amounts.[48]

31. Water-soluble potash, another major component of fertilisers, is only found in 10 regions of the world and is currently mined in only 12 countries, with 95 % of the market controlled by 10 corporations.[49] Its consequent strategic importance was recently demonstrated when the

Canadian government intervened in a planned takeover of a Canadian producer by an Australian mining group.

32. In light of the massive longer-term challenges examined in II. A, individual countries and the international community as a whole must come up with innovative, perhaps even radical solutions. However, an even more immediate step is to address shorter-term risk factors, which already led to the 2007/2008 food crisis, to avoid repetition of the subsequent human suffering in such food crises.

B. SHORT-TERM CATALYSTS OF THE 2007/2008 FOOD CRISIS

33. In 2007/2008, enormous price rises in food staples had dire consequences for the world's poor. These were, in part, caused by severe weather conditions, such as a protracted drought in Australia, too little rain in Eastern Europe and too much rain in France and Germany. Overall, food prices in 2008 were 40 % higher than in 2007 and 76 % higher than in 2006.[50] Rice prices, for example, roughly doubled in just a few months.

34. The effect was most dramatically felt in low-income countries, where individuals can spend as much as 80 % of their revenue on food.[51] It is extremely difficult to calculate the effects of such a food crisis, but the FAO estimates that some 115 million people were pushed into extreme poverty as a result of the crisis, amounting to the loss of roughly seven years of poverty reduction.[52]

35. While prices dropped rapidly after the crisis and remained lower throughout 2009 and the beginning of 2010, they have remained well above pre-2006 levels. By early 2011, prices rose sharply once again. Since January 2011, the FAO Food Price Index has remained above the peak recorded in 2008. The World Bank Food Price Watch rose by 15 % from October 2010 to January 2011, remaining slightly beneath its food crisis peak.[53] By the summer, the World Bank index had fallen slightly, but remained very high.[54]

36. It is not only the absolute level of prices that affect households. Often, price volatility has a much larger effect, rather than high, but stable, prices: Over time, families can often adapt to high food prices by making trade-offs, but it is much harder to react to price shocks in the short term. Indeed, the societal costs of price volatility are high: The level of hunger and disease rises; private investment is reduced; government spending increases, as social protection measures come into effect; adverse macroeconomic dynamics come into play due to inflation; and sometimes political instability ensues. It is widely acknowledged that over the past five years, price volatility has been higher than in the two decades before, albeit lower than in the 1970s. This is why the G20 agricultural ministers, in their summer 2011 meeting, presented an Action Plan on Food Price Volatility and Agriculture to improve agricultural production and productivity, to increase market information and transparency, to strengthen international policy co-ordination, to improve and develop risk management tools and to improve the functioning of agricultural commodities' derivatives markets (see also below). The High-Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security (CFS HLPE), a UN intergovernmental organisation that has dealt with food security since 1974, also released a report in July 2011 on the topic, making a number of recommendations on trade rules, food stocks, financial regulation, demand for food products, agricultural investment, incorporation of externalities in production, the promotion of food security strategies as well as the role of the CFS. Stressing the importance of actions taken at all levels, the report points out, however, that there is "no 'one policy response fits all' approach."[55]

37. Even before the crisis in the Horn of Africa, Paul Larsen, Director of Multilateral Relations at the WFP, had called the global food situation "extremely precarious."[56] Indeed, the WFP was already on 'red alert'. Still, David Nabarro, co-ordinator of Secretary-General Ban Ki-moon's High-Level Task Force on Global Food Security, does not yet believe that the world is seeing a

renewed global food crisis, as "not all regions are reporting higher food prices and crop harvest and food availability are ample in several poorer countries with grain prices, especially for rice, remaining relatively stable."[57]

38. To avoid or, at least, be prepared for the next global crisis, it would be instructive to look at the shorter-term factors underlying the most recent one. Many factors contributed to the food crisis, not least severe weather in parts of the world. However, this report analyses high energy prices, low food stocks, the role of financial speculation and the short-sighted government responses.

1. High Energy Prices

39. Most analysts agree that high energy prices, specifically oil prices, had a precipitating impact in 2007/2008. In early January 2007, world petroleum prices were at about US$ 55 per barrel. A year and a half later, they were almost at US$ 140. The level of oil prices is, in fact, the least controversial and perhaps most substantial cause of the crisis.

40. Oil is linked to agricultural prices in a variety of ways, both on the demand and supply sides. It has already been argued that high oil prices make biofuels more competitive, thus increasing agricultural demand and pushing prices up. However, petroleum prices are linked to the costs of production and modern agriculture, especially in the industrial world, which are very energy- and chemical-dependent. For example, the nitrates used in fertilisers are primarily derived from natural gas, of which the price is closely tied to the value of oil, and pesticides are, in many cases, derived directly from petroleum. It has been estimated that US production costs were 30 to 40 % higher than they would have been if oil-related costs had not soared in the preceding years.[58] Furthermore, shipping and freight costs went up as well because of the energy prices. The bulky nature of grains meant that food transportation costs rose substantially.[59] Due to the situation in the Middle East and North Africa, oil prices shot up to over US$ 100 per barrel in the first half of 2011, worrying food price experts. However, oil prices have come down again since the summer to around US$ 80 per barrel. The current negative outlook in the world economy and fear of further economic and financial turmoil makes it unlikely that oil prices will be a main ingredient in further food price increases this year.

2. Low Food Stocks

41. The fact that stocks of several grain types were at low levels is argued to have caused the last food crisis or, at least, have worsened it when it set in. As supplies of food stocks fell, the argument goes, prices rose accordingly.

42. Based on FAO numbers, it has been calculated that wheat and coarse grain stocks, such as corn, declined by well over 30 % in 2007,[60] and that grain stocks in 2007/2008 were at a 30-year low.[61] Poor harvests, caused by bad weather and drought were the main culprits of low stock levels.[62] This included a protracted drought in Australia, a major player on the rice market and a provider of counter-seasonal wheat supplies to the northern hemisphere.

43. Others cast doubt on declining stocks as a main contributor to the crisis. Low stocks could be explained by normal market behaviour and may have played only an indirect role, or added little, to the crisis, mostly after the initial price rises.[63]

44. Today, as already pointed out, stocks are at a normal level again, lessening the probability of a major global crisis.[64]

3. The Role of Financial Speculation

45. Many analysts argue that financial speculation played a role in the volatility and price rises in 2007/2008. As the value of stock and housing markets declined, they believe, investors turned to commodities that provided higher levels of interest, such as gas and oil, but also agricultural products. Thus, speculation on the agricultural commodity market might have contributed to volatility and price rises. Dr. von Braun told the STC at the 2011 Spring Session that he had no doubt that speculation had played a role in the food crisis, but told the committee that today's economic models could not yet quantify the impact. Other analysts dispute that financial speculation was a significant driver. The European Commission, for example, states that "[t]here is little evidence that the price formation process on commodity markets has changed in recent years with the growing importance of derivatives markets."[65]

46. Regarding the high food prices of 2011, however, David Nabarro asserted that they are influenced by financial speculation, even though it again cannot be determined to what degree.[66] The G20 agricultural ministers, in their June 2011 Action Plan on Food Price Volatility and Agriculture, recognised "that appropriately regulated and transparent agriculture financial markets are indeed key for well-functioning physical markets. These markets facilitate price discovery and allow for market participants to hedge their exposure to price risks."[67] They thus launched the Agricultural Market Information System (AMIS), which aims to increase transparency, restore market confidence, reduce uncertainty and help developing countries by providing better food market information. Furthermore, they "strongly encourage G20 Finance Ministers and Central Bank Governors to take the appropriate decisions for a better regulation and supervision of agricultural financial markets", which the latter had already stressed in a spring meeting. The 2011 French Presidency of the G20 wants to extend financial regulation to markets for agricultural derivatives, but opinions among the G20 states differ on how to appropriately regulate and supervise these markets.

4. Short-Sighted Government Responses

47. As the food crisis took off, several countries introduced short-sighted solutions, thus deepening the crisis substantially. Crucially, at least 30 countries with very high price levels introduced export restrictions on key agricultural commodities, in order to shield domestic food security in the short run. Of course, states have the sovereign right to secure enough food for their population in time of crisis. The G20 agricultural ministers thus explicitly recognised "that the first responsibility of each member state is to ensure the food security of its own population."[68] Nevertheless, export restrictions can create market failures in international agricultural trade, as the volume traded falls, which has the biggest impact on those states that are dependent on food imports. It has to be noted that there are wide differences between states on the question of trade liberalisation in international agricultural trade that will be difficult to overcome and is, in fact, a stumbling block to successfully bring the Doha Development Round to an end.

48. In many cases, states also engaged in protective-buying behaviour. While legitimate, of course, some states over-reacted and thus aggravated the situation. For example, the Philippines bought more rice in the first four months of 2008 than in the whole of 2007.[69]

49. Furthermore, a number of countries also introduced price controls, which can negatively affect adjustment to global conditions. As prices stay artificially low, farmers have little incentive to increase their production.

50. Today, officials of the World Bank, the US Department of the Treasury and other institutions, for example, judge that a decision taken by Russia last year to suspend its wheat exports for the rest of the year is a major contributing factor to the current high price levels.[70]

51. The food crisis of 2007/2008 was surprising in its suddenness and complex in its causes and effects. Thus, it is debatable whether the next food crisis can be predicted. Nevertheless, it is clear that both the longer, as well as the shorter-term factors underlying food and water security must be even more closely examined and monitored in the future.

III. FOOD: RISKS AND PROPOSITIONS

52. Food has often been used as an instrument in civil conflict, for example in Columbia, Guatemala or Haiti, and hunger is often a consequence of such conflicts. If one looks at the globe from this perspective, the risk of conflict is thus especially high in several regions. Sub-Saharan Africa is the region where hunger is most widespread, especially in Central Africa: Angola, the Central African Republic, the Democratic Republic of Congo, Eritrea, Ethiopia, Chad and Zambia all have under-nourishment rates of more than 35 %.[71] South and Southeast Asia, from Afghanistan to Laos, also suffer from such high rates. But, even Latin America is affected. For example, more than a quarter of the Bolivian population is undernourished.

53. To increase world food and water security, many complex problems have to be tackled. Regrettably, previous efforts to do so could not prevent the 2007/2008 food crisis and have not led to substantial reductions in the rates of poverty or to increasing agricultural productivity growth. It thus appears increasingly necessary to improve the global food system. National-level solutions are equally important, however. States should consider the real value of water in food production, improve domestic food markets, increase the availability of and access to food, reduce poverty and inequality, ensure adequate social protection mechanisms to shield those most at risk and improve governance across the board. Such national strategies must be country-driven and -owned, but the international community, mainly through aid and assistance programmes, has a role to play here as well. The following section will deal mainly with proposed solutions at the international level.

A. FOREIGN LAND ACQUISITIONS

54. Some countries which are particularly at risk in terms of food and water are investing in agricultural land in other states whose agricultural potential is not fully exploited. Such land acquisitions are not only tied to food production; often, investors acquire land for the production of biofuel as well. In the media, such investments in foreign land have often been dubbed “land grabs.” Statistics for foreign land acquisition are often uncertain. Still, a World Bank report finds that “approximately 56 million hectares worth of large-scale farmland deals were announced even before the end of 2009,” compared to an average expansion of cropland per year of less than four million hectares before 2008.[72] While this represents less than three % of total cultivated land in the world today, these foreign land acquisitions will soon take on significance if they proceed at the current pace.

55. Proponents argue that such land deals are benign and mutually beneficial. Countries with large cultivable, but unused, tracts of land can mobilise expertise from abroad and alleviate structural problems, such as underdeveloped infrastructure. Indeed, such investment in lands can result in conservation projects, forests plantations or other types of terrestrial carbon sinks that could qualify for the Clean Development Mechanism in the Kyoto Protocol for the investing country, contributing to meeting their emission targets.

56. Critics, however, argue that the sudden influx of capital in under-producing agricultural regions could endanger the host country’s environment and resources, peasants’ livelihoods and rights as well as national development and sovereignty. The anger often expressed at such ‘land grabs’ by local inhabitants can be considerable. Indeed, in 2009, the government of Madagascar was overthrown in a coup at least in part because the president had signed a land deal with a Korean conglomerate that would have granted it a 99-year lease of nearly 50 % of the country’s

arable land, exporting all of the produce to South Korea.[73] Critics of such large-scale land acquisitions point out that other kinds of investment into local agriculture could be a more viable way forward, pointing, in particular, to micro-loans or shifting foreign aid towards building up agriculture in the long run.

57. Many developing states do not have sufficient mechanisms in place to protect local rights and interests, as well as livelihood and welfare. Many organisations argue that guidelines, or formal rules for such land investment, should be established. The World Bank has already suggested five guiding values: the recognition of rights, the 'voluntariness' of transfers, transparency, technical and economic viability as well as environmental and social sustainability.[74] Global guidelines for responsible agricultural investment, facilitated by the FAO, the International Fund for Agricultural Development, the UN Conference on Trade and Development and the World Bank, have also been developed. These organisations hope that their set of seven principles (see Figure 2) can garner "support from all major countries from which investment initiatives are emanating and towards which such investments are directed."[75] Still others point out that the provision of legal and other expertise, training at national and local levels, the public disclosure of contracts and greater sharing of lessons could also contribute to making land deals more equitable.[76] The contributions of non-governmental organisations regarding land acquisitions should not be forgotten as well, for example Survival International with their campaigns for the rights of indigenous and uncontacted people.

Figure 2:

Principles for Responsible Agricultural Investment that Respects Rights, Livelihoods and Resources

Principle 1:	Existing rights to land and associated natural resources are recognized and respected.
Principle 2:	Investments do not jeopardize food security but rather strengthen it.
Principle 3:	Processes relating to investment in agriculture are transparent, monitored, and ensure accountability by all stakeholders, within a proper business, legal, and regulatory environment.
Principle 4:	All those materially affected are consulted, and agreements from consultations are recorded and enforced
Principle 5:	Investors ensure that projects respect the rule of law, reflect industry best practice, are viable economically, and result in durable shared value.
Principle 6:	Investments generate desirable social and distributional impacts and do not increase vulnerability
Principle 7:	Environmental impacts of a project are quantified and measures taken to encourage sustainable resource use, while minimizing the risk/magnitude of negative impacts and mitigating them.

(*FAO, International Fund for Agricultural Development, UN Conference on Trade and Development and the World Bank*)

B. SCIENTIFIC AND TECHNICAL SOLUTIONS TO FOOD AND WATER INSECURITY

58. Almost all policy recommendations emphasise the importance of science and technology in increasing global as well as local food and water security. The contribution of science and technology has been very substantial in increasing the quality and quantity of both food and water in the last century. Research and development in agricultural and hydrological science and technology can be a most effective tool for reducing poverty and inducing growth. Efforts to extend and improve current best practices should, thus, be redoubled.

59. Unfortunately, spending on agricultural science and technology has been stagnant for about 15 years and the gap between rich and poor nations is still vast.[77] Many observers, therefore, believe that nothing short of another Green Revolution is needed to increase world food and water security, referring to the vast array of agricultural research and development efforts as well as

technological transfers that occurred after the Second World War. Often, proponents point to biotechnological possibilities, such as genetically modified food, but others think that conventional or even alternative ecological approaches are equally, if not more, important.

60. Many different visions of how the world should enter a new agricultural era exist. The Alliance for a Green Revolution in Africa, supported by the Rockefeller Foundation and the Bill and Melinda Gates Foundation with a budget of about US$ 400 million, aims "at implementing practical solutions to significantly boost smallholder farm productivity and incomes while safeguarding the environment and promoting equity."[78] For example, it breeds biofortified crops that are high in micronutrients, which could lead to a nutritional transformation in the developing world. Indeed, more than the sheer number of calories, the amount of nutrients in food consumed by the poor is extremely important, and more and more research is devoted to this topic. For now, the non-governmental organisation focuses on conventional breeding techniques, but it does not preclude genetic engineering, if and when it becomes more viable.

61. Others have, however, called for a 'blue revolution', which would centre on water as the key resource. Instead of thinking of land as either irrigated or rain-fed, one should emphasise the use of supplemental irrigation, i.e. "small amounts of additional irrigation at certain points in the growing cycle - which results in a significant increase in yield."[79] Another option would be to make the next agricultural revolution 'triply green'. Such a revolution would be green in the sense of increasing food production, being environmentally sound and based on the under-used resource of 'green water', i.e. the water which is lost to evaporation in the irrigation process.[80]

62. Increasing conventional best practices could lead to a significant increase in food production and productivity, however. Simple things such as "land modifications, plot landscape positioning, alternative crops or varieties, in-soil vegetative material and well-placed biodiversity can all play a role in countering unfavourable climatic events."[81] Undoubtedly, increasing rural infrastructure and, thus, access to markets is crucial as well.

63. Albeit a politically sensitive and controversial topic, genetically modified organisms (GMOs) have been hailed in some quarters as the solution to world hunger. While North America has become a major producer of GMO crops, Europe is generally strongly opposed to the technology. In fact, in July 2011, the European Parliament adopted a resolution allowing member states to impose bans on GMO crops on environmental grounds.[82]

64. Producing GMOs involves splicing DNA and inserting coded genetic structures to alter certain features into living organisms. More ambitious projects have included placing fish DNA in strawberries to protect them from the frost. However, the most common types of commercial GMOs are crops that can sustain a level of herbicide on fields that would normally kill the crop as well. In terms of food sustainability and future yields, GMO crops have the advantage of being 'custom built', allowing them to be planted in places that would otherwise not be fertile. Proponents of GMO techniques argue that farmers who use the technology find that it is a cost-effective way to manage the relation between crop yield and labour input. Increased tolerance against drought and salt as well as improved use of nitrogen are areas of focus, as this would offer higher yields and less need for irrigation in the future. Perhaps, GMO crops could even reduce greenhouse gas emission.

65. Critics of GMO crops argue that they do not, in fact, increase yields compared to non-GMO high yielding seeds that are properly fertilised. For example, a team at the University of Kansas demonstrated that, "even under optimal conditions," GMO-soya yields were 10 % lower than conventional crops.[83] Another important vulnerability resides in the lack of genetic diversity. In a field of GMO soya, every bean is essentially a clone of the next. This makes GMO fields particularly vulnerable to diseases. In contrast, in biologically diverse fields, some strands will naturally be resistant to some pests or diseases, leading to fewer crop failures and potential adaptation for the next growing season. In general, biodiversity is already diminishing in a rapid

manner. In this context, it is to be welcomed that the Norwegian state is financing the Svaldbard Global Seed Vault, a secure seed bank located on the island of Spitsbergen, which the STC plans to visit in 2012. The aim is to store, in an underground cavern, duplicates of seeds from seed collections around the globe, mainly from developing countries. In case of natural disasters, climate change, war or simply a lack of resources, the seed collections that have been preserved may be re-established using seeds from Svalbard. Activists and critical farmers also worry that the agricultural biotech industry, largely epitomized by Monsanto or Syngenta, is encouraging reliance on their own products, which could lead to monopolies and higher costs for farmers. Other possible risks of GMO techniques relate to increasing allergic reactions by humans, gene transfers from GMO foods to cells of the human body or bacteria in the gastrointestinal tract as well as outcrossing, i.e. the mixing of crops derived from conventional seeds with those grown using GM crops.

66. Others believe that a fundamental revolution, based on new or revolutionised technology - whether conventional or GMO-based - is not the way forward. One observer notes that another agricultural revolution that focuses too much on science and technology "would further destroy Africa's soil and water in the long run and exacerbate the problems: food insecurity, bare land, soil erosion, increased drought and then flooding when the rains finally do come; increased pests and invasive plants; and the collapse of the river systems and groundwater stores."[84] Advocates of an alternative way forward thus advance an approach that "looks to work with nature, refining more traditional techniques to enable farmers of small scale holdings around the world to sustainably produce quality food without depending upon unnatural inputs, many derived from oil or gas, or transgenics."[85] For example, while some argue that increasing the size of farms in the developing world is important to increase productivity, others point out that about three-quarters of agricultural production in Africa comes from small farms, arguing that large gains in productivity can be made with comparatively little investment. Furthermore, the contributions that organic farming techniques can make to solving some of the world's food problems should not be underestimated. This market is growing strongly worldwide. From 1999 to 2009, the land dedicated to organic farming more than tripled, and in 2009 the market grew by almost eight %.[86] In a recent report by Olivier de Schutter, the UN Special Rapporteur on the Right to Food, he argues that organic farming - or 'agroecology' in the report's language - "not only shows strong conceptual connections with the right to food, but has proven results for fast progress in the concretization of this human right for many vulnerable groups in various countries and environments. Moreover, agroecology delivers advantages that are complementary to better known conventional approaches such as breeding high-yielding varieties. And it strongly contributes to the broader economic development."[87] The aforementioned report of the High-Level Panel of Experts on Food Security and Nutrition also stresses that organic farming "offers an important and complementary base of experience and perspectives for such a transition that is particularly suited for producers with limited access to chemical inputs."[88] Proponents of such an approach also point out that local crop varieties are better adapted to local conditions.

67. To solve some of the world's water scarcity problems, water desalination has been put forward, at least in some regions. As of 2008, there were over 13,000 desalination plants in the world, producing over 12 billion gallons of water a day.[89] Indeed, desalination is an important source of fresh water for many water-stressed countries. In regions that are both low-lying and near the ocean or salt-water seas, desalination is an especially useful method, since the costs associated with transporting water by pipes and pumping it above sea-level are considerably reduced.

68. Problems exist with water desalination, however. First, desalination is unlikely to be a viable option for low-income countries, given the immense initial investments required to build desalination plants. Second, given that it is very energy intensive, unless it is achieved using renewable and low- or non-carbon sources of energy, increasing its output could be self-defeating. It would contribute to the problem it is trying to solve, as climate change has been linked to altered

rainfall patterns and desertification. Third, water requirements for agriculture are far too great to make desalination useful in this respect.

C. SOCIAL SAFETY NETS

69. In short-term situations and protracted food crises, social protection measures are critical for shielding the weakest members of a society from the effects of food price volatility and rises.[90] Such measures come in a variety of forms and can take place either at the national level or in co-operation with international organizations. A distinction can be made between a) food-based safety nets, which involve giving out food directly, b) cash-based safety nets, where cash is transferred to risk groups that can be used to buy the necessary food, c) targeted agricultural input distribution, which aim to boost food production by small farmers for their own consumption and local markets, and d) health and nutrition efforts, which target vulnerable groups, such as women and children.[91]

70. Of course, the main aim of such safety nets is to mitigate the immediate effects of food insecurity. Nevertheless, such social protection mechanisms can also help to build up productive capacities by strengthening human capital and assets. For example, public food-for-work and cash-for-work programmes can be directed towards increasing agricultural production or building farm-to-market roads and other key infrastructure.

71. If social protection programmes were made more efficient, they could make more indirect and possibly counterproductive protective measures such as export restrictions or 'panic buying' unnecessary to protect populations from the effects of food crises. Unfortunately, many such programmes in developing countries are very inefficient, however. In India, for example, the Public Food Distribution System suffers from high levels of corruption. Bringing foreign distributors into these programmes could help reduce corruption and lower prices. In addition, social protection programmes must also be carefully balanced, so that they are not counter-productive by, for example, crashing local markets.

D. AGRICULTURAL INVESTMENT

72. A main underlying cause of food insecurity in many developing countries is the lack of investment in the agricultural sector. Over the past decades, there has been a decline in spending on the agricultural sector, as resources have been shifted to education and health. In 1980, developing countries spent 11.3 % of total government spending on agriculture.[92] In 2002, this number had fallen to 6.7 %.[93] Research has, in fact, shown that expenditure on agricultural research, education and rural infrastructure are the three most effective ways to promote agricultural growth and poverty reduction.[94] In developing countries, agricultural research, in fact, has the biggest impact on these two areas.[95]

73. Not only has spending by developing countries in the agricultural sector declined sharply, but so too has the share of development aid earmarked for this sector. In the 1980s, such aid made up well over 15 % of official development assistance.[96] In the new millennium, however, it fell well below 5 %.[97] Fortunately, from 2006 to 2007, committed aid for agriculture went from 2.1 to 3.5 %.[98] In light of the critical need to shift more resources to this sector, a slight fall to 3.3 % in the latest data is not encouraging, however.

74. All of this shows that agricultural investment must grow. Governments in developing countries, foreign aid donors as well as domestic and foreign investors must reallocate resources accordingly. The FAO highlights, for example, that investment in water management, rural roads, marketing and storage facilities, research, an extension of best practices and international research centres specialized in agriculture would be particularly valuable.[99] The World Bank and leading international donors have already followed this advice, but it must be ensured that

investment in agriculture must rise far more rapidly. In Africa especially, this development strategy would guarantee great returns.

IV. WATER: BETWEEN RISK AND OPTIMISM

75. As already pointed out, the potential for tension, or even conflict, between countries exists wherever states share water resources. If states act only according to their short-term self-interest in the exploitation of water resources, the consequences for all the states sharing those resources could be substantial. International co-operation in many regions of the world is, thus, crucial to avoid future conflicts over water.

76. Several regions of the world suffer from physical water scarcity, i.e. more than 75 % of the river flows in those areas are withdrawn for agriculture, industry and domestic purposes. The potential for tension, or even conflict, is therefore higher in those regions. The worst-hit in this regard are the Southwest of the United States, much of Mexico, North Africa and the Middle East, parts of Southern Africa, Central Asia and Eastern Australia. Many regions, including parts of South America, are approaching physical water scarcity as well. Still other regions, in particular Sub-Saharan Africa, suffer from economic water scarcity, i.e. enough water would be potentially available if better managed, but access is limited by human, institutional and financial factors. While rich nations can more easily deal with such scarcities, albeit at great cost, less developed countries will struggle, especially as the effects of climate change increase.

77. Issues of physical and economic scarcity are amplified by the fact that most water resources that can be used for human needs are shared between states. Naturally, the best solution would be for interested parties to co-operate on policy-making and the management of these shared resources, which would include confidence-building measures, efficient enforcement of agreements and the highest possible levels of transparency. Such an approach would build on existing conventions, treaties and norms, but would go much further.

78. However, not everywhere is international co-operation without friction. Tension over shared water resources exist on every continent, from South America, where Argentina and Uruguay have taken their issue to the International Court of Justice in the Hague, to China, where water-sharing is creating problems within the country as well as with many of its neighbours. The Jordan River, for example, is a key hot spot. Here, over 42,000 km² of water are shared by Israel, Jordan, Lebanon, the Palestinian Territories and Syria. Indeed, water is a central concern in the relationship between Israelis and Palestinians. The Palestinian authorities maintain that Israel is not equitably sharing the water from the Jordan River Basin and the aquifer underneath the West Bank. They calculate that only 10 % of the water goes to Palestinians, whereas an arrangement of equal per capita shares should grant them about 45 %.[100] Israel, however, underlines that it is complying with all water agreements and even exceeds them in some respects.[101] The centrality of this issue - an equitable and reasonable allocation of water resources is one of the four cornerstones in a final peace agreement - was also highlighted to the Assembly when the GSM (Mediterranean and Middle East Special Group) visited the region in 2010. The relationship between Iraq, Syria and Turkey over water, has also been fierce at times. Turkey controls 40 % of the Tigris and the country's construction and use of hydroelectric dams has caused tension with downriver neighbouring states. However, with Turkey's current policy of 'zero problems' with its neighbours, relations have improved over the last years, even leading to joint dam-building projects along the border, which should be mutually beneficial. Potential for future tensions certainly remain in place and should be carefully monitored. A third example can be found in the Nile River region, where some countries want to strip Egypt of its pre-eminent status. This could prompt the country to opt out of regional co-operation under the Nile Basin Initiative, which reduces prospects for regional co-operation and could, in fact, exacerbate existing tensions.

79. A country that faces many water challenges, now and in the future, is China. For one, disputes with its neighbours over shared water resources abound, for example with Bangladesh, India and Nepal over the water that flows from the Himalayas, which serves the food and energy needs of over three billion people,[102] and with Cambodia, Laos, Myanmar, Thailand and Vietnam over the use of water from the Mekong River. However, China also has pressing concerns inside the country. For decades, rapid economic growth has not taken into account the environmental impact of its growth strategy. Today, 43 % of the water in the seven most crucial river basins is not suitable for drinking, for example.[103] Economists have estimated that China needs to spend 2 % of GDP on clean-up efforts to merely stabilize pollution and more than 3 % to reverse its effects. However, China has recognized these problems and is beginning to address them. While China-India relations are tense over border issues recent meetings between the two countries have eased some of the tensions. In the newest five-year plan, China has increased the resources pledged to environmental clean-up efforts, and now accepts lower growth rates in exchange for a reduced negative impact on the environment.[104]

80. This section has highlighted some of the potential tensions and conflicts over water in the world, but it must be remembered that water disputes have not turned into inter-state wars, although local conflict has broken out in places, most notably Darfur, where nomadic farming groups compete for ever-scarcer water resources. In general, water disputes are dealt with diplomatically and by negotiation. In fact, over 300 agreements have been put into effect between water-sharing countries.[105] This gives rise to cautious optimism. Sometimes, this can even foster new avenues of co-operation. With the so-called Helsinki Rules of 1966 and the 2004 so-called Berlin Rules, the international community has a number of tools in its hands to handle disputes. Nevertheless, there is ample room to develop further rules and norms on water co-operation between states.

81. This section has shown that many practical steps can be taken by the international community in order to reduce concerns about food and water security at the global level. However, as many suggested policy courses remain relatively controversial, with their worth still unproven, further in-depth studies must be prioritized. Food and water security is too serious an issue to be under-funded and not given sufficient consideration.

V. CONCLUSION: CHANGING THE INTERNATIONAL COMMUNITY'S APPROACH TO FOOD AND WATER

82. It is apparent at the end of this analysis that a solution to food and water supply issues is a political requirement. There are many grounds for concern, as there are for optimism. Consequently policies should be implemented which ensure food and water security for the peoples of the earth.

83. Having regard to their great strategic importance, agriculture and water management cannot be left to market forces alone. All the NATO countries are wedded to freedom of trade and industry, and this principle cannot be challenged; but it is not a hard and fast rule either. Food security and access to water are so important politically that no State can ignore them. Most of the developed countries subsidise large areas of their agriculture, and the crisis now developing in several African countries is due to a lack of public investment in support of agriculture. So States still retain a key role.

84. As the 2007/2008 food crisis has shown, not only does the world need to tackle the consequences of accommodating an increasing number of people and bringing down the number of undernourished people, it must also work hard to prevent food crises that throw millions of people into poverty and destroy years of development work. The current humanitarian crisis in the Horn of Africa, especially in famine-ridden regions of Somalia, is a poignant example. While natural causes are the main drivers, in particular prolonged drought, high global food prices

exacerbate the crisis. Nevertheless, there are no immediate and severe threats of a repeated truly global food crisis such as the world witnessed a few years ago. Still, risks might exist in the medium- and long-term, i.e. in a decade or two.

85. Global problems of food and water security might strike some observers as merely a developmental, humanitarian or trade issue. However, it must be remembered that crucial links to international security exist. The Euro-Atlantic community has had to react to humanitarian crises, migratory pressures as well as intra- and inter-state tensions and conflicts as a result of low food and water security in the past - and will, with all likelihood, need to do so in the future.

86. It is, thus, of utmost relevance that the Science and Technology Committee, and the NATO PA in general, monitors and reacts, in appropriate ways, to the long- and short-term problems of the global food and water system.

87. Global food security is under stress. In many developing countries especially, it is an acute problem. Water scarcity is also a very real concern for many countries, but here greater optimism reigns, as states normally deal with inter-state water issues in a diplomatic and peaceful manner, though there can be occasional tensions. The report has, in the main, looked at international solutions that can aid the necessary national efforts to increase food and water security. It is increasingly clear that what is needed in international efforts to strengthen global food and water security is a redirection of aid budgets, increased investment in agriculture and more research and development in the food and water science and technology, the development of new water sources as well as international co-operation on regional water management.

88. Not all solutions are ripe for implementation. Further research as well as scientific and/or technological developments are still necessary. Other approaches, most prominently GMO crops, are considered controversial by many. Still, a degree of consensus is emerging on the way forward in international food and water security. Your Rapporteur believes that two stand out:

- *Redirecting aid and assistance towards longer-term food and water security*: A shift towards increased aid and assistance that prioritizes longer-term development is needed to improve food and water security in developing countries and to lift many people out of poverty. This will reinforce food and water security as well as economic development. However, such a shift should not negatively impact emergency aid. The current crisis in the Horn of Africa underlines that such aid remains crucial.
- *Increased resource allocation to agricultural research and development*: Investment in this field, at the international level as well as in developing countries, must be increased if it is to drive innovation and thus create the foundations for a more food- and water-secure world.

The Euro-Atlantic community, as the leading player in international development and governance efforts, should therefore vigorously reinforce these trends.

89. In conclusion, the international community took some important steps to achieve greater long-term food and water security in the aftermath of the 2007/2008 food crisis, but commitments have been wavering subsequently.

90. In L'Aquila, Italy, in 2009, the G8 and other international leaders pledged US$ 20 billion for an Agriculture and Food Security Initiative. This evolved into the Global Agricultural and Food Security Programme (GAFSP) in 2010. However, implementation of the programme is already lagging behind. The GAFSP has only received pledges from six countries and the Bill and Melinda Gates Foundation for a total of US$ 925 million, and, of US$ 475 million pledged by the US Government, only US$ 160 million have been released by the US Congress so far.[106]

91. It is imperative that the international community meets its commitments. It is, therefore, encouraging that the Obama administration has raised development and foreign assistance to being in US national security and economic policies and that the French President has devoted

France's presidency of the G20 to the stabilization of global food prices.[107] In particular, it is the hope of your Rapporteur that the G20 Leaders' Summit in November will come forward with a strong plan on food price volatility and agriculture. The world's hungry deserve no less, and international security could be enhanced in the process.

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[2] See Ng and Aksoy, "Who Are the Net Food Importing Countries?", pp. 35ff.

[3] Heather Cooley, Juliet Christian-Smith, Peter H. Gleick, Lucy Allen and Michael Cohen, *Understanding and Reducing the Risks of Climate Change for Transboundary Water* (2009), available from http://www.pacinst.org/reports/transboundary_waters/transboundary_water_and_climate_report.pdf, pp. 3-4.

[4] Cooley, Christian-Smith, Gleick, Allen and Cohen, *Understanding and Reducing the Risks of Climate Change for Transboundary Water*, p. 5.

[5] Veolia Water, "Finding the Blue Path for A Sustainable Economy," *Veolia White Paper* (2011), available from http://www.veoliawaterna.com/north-america-water/ressources/documents/1/19979,IFPRI-White-Paper.pdf, p. 2.

[6] Pacific Institute, *Global Water Crisis* (2011), available from http://www.pacinst.org/topics/water_and_sustainability/global_water_crisis/.

[7] FAO, *FAO Food Price Index* (February 2011), available from http://www.fao.org/worldfoodsituation/wfs-home/foodpricesindex/en/.

[8] Food security is defined as "a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life." (See FAO, *Trade Reforms and Food Security* (2003), available from ftp://ftp.fao.org/docrep/fao/005/y4671e/y4671e00.pdf, p. 28.) Water security means that "that every person has access to enough safe water at affordable cost to lead a clean, healthy and productive life, while ensuring that the natural environment is protected and enhanced." (Global Water Partnership, *Towards Water Security: A Framework for Action* (2000), available from http://www.gwpsudamerica.org/docs/publicacoes/doc_78_en.pdf.)

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[13] Calculated based upon the World Bank's *World Development Indicators*, available from http://data.worldbank.org/indicator?display=graph.

[14] UN Department of Economic and Social Affairs, *World Economic and Social Survey 2011: The Great Green Technological Transformation (2011)*, E/2011/50/Rev. 1, ST/ESA/333, p. VIII and High Level Panel of Experts on Food Security and Nutrition, *Price Volatility and Food Security* (July 2011), p. 10.

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