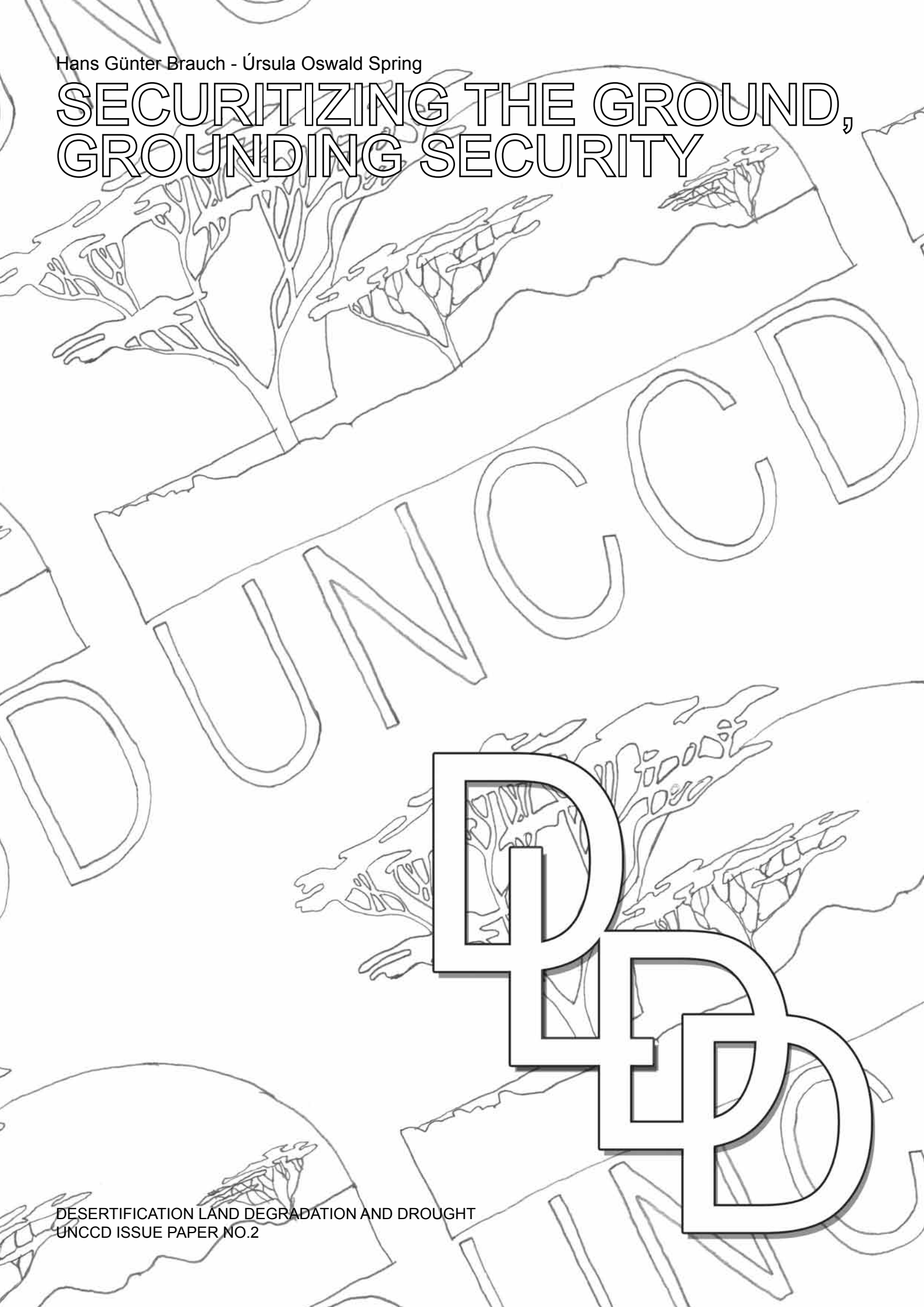


Hans Günter Brauch - Úrsula Oswald Spring

SECURITIZING THE GROUND, GROUNDING SECURITY



DESERTIFICATION LAND DEGRADATION AND DROUGHT
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Picture of a warrior in Xochicalco in Morelos, Mexico. This old
city in Mesoamerica's drylands collapsed about 1100 years ago
due to the loss of environmental and soil security (Photo taken
by Hans Guenter Brauch, 25 February 2009).

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The 10 Years UNCCD Strategy as an indispensable instrument for geopolitical stability

Foreword by the Executive Secretary of the UNCCD



Luc Gnacadja

In the not so long history of humankind, our ancestors too often fought for land and water. Those days have returned.

During the last decades, the international community has realized that the continuous and intensive degradation of the environment and related loss of ecosystem services can have major implications for public security at the national level, resulting in a threat to international stability. Global environmental changes have further upset fragile ecological balances imposing a necessary re-conceptualization of public security, including the awareness of increasing threats from and to the global environment.

In this framework, major environmental threats such as desertification, land degradation and drought (DLDD) under scenarios of climate change represent considerable disruptive factors with a direct negative impact on societies, their economies and public security at all levels. The severity of these phenomena and their complex interactions are challenging the viability and sustainability of the development of all affected countries and call for a responsive policy paradigm for environmental security. Within this response DLDD is clearly a growing global threat that requires global coordinated actions from the international community.

The present study “Securitizing the Ground – Grounding Security” brings the debate forward in proposing the paradigm of soil security in the context of the challenges ahead of us and highlights the unique contribution that the UNCCD can bring to the international community in that regard.

The UNCCD process indeed must exploit its comparative advantage as an integrative platform of intervention to address the challenges of environmental stress, poverty reduction and conflict prevention. The security-environment interlinkages can be better assessed under its 10-year strategic plan and framework, which were adopted at COP 8 in Madrid in 2007 to enhance the implementation of the Convention.

The Strategy provides a unique opportunity to address some of the key global challenges, to capitalize on UNCCD’s strengths, to seize opportunities provided by the new policy and financing environment, and to create a new, revitalized common ground for all UNCCD stakeholders. It highlights the importance of forging a coalition to combat DLDD in the present context of climate change. This will deliver benefits at all levels and contribute to reliable access to food and water, a sustainable livelihood and the protection of biodiversity.

I sincerely hope that the outcomes of this study, combined with the ongoing work undertaken by the different actors in the context of security and land degradation will help the emergence of a global political coalition that will go beyond traditional conceptions and address together security, sustainable environmental development and poverty alleviation interests in a consensual framework to efficiently contribute to world stability and prosperity.

Promoting peace through environmental stewardship

Preface by the Minister of the Environment and Rural and Marine Affairs



Elena Espinosa

I am pleased to introduce here the results of this study on desertification and security, for which Spain has lent a strong financial and scientific support, reflecting our belief in the importance of desertification not only as a global environmental issue, but also as a societal and security issue.

The II International Symposium on Desertification and Migration, convened by the Government of Spain, was held in Almería in October 2006 under the Presidency of H.M. the Queen of Spain. The Symposium established key elements to a new paradigm on security policy in the areas affected by the environmental crisis driven by desertification.

The need for this study stems from the relation between the people and land affected by desertification and the associated processes, such as drought, hunger, migration, as well as the conflicts that destabilize those areas. Desertification, land degradation and drought (DLDD) contribute to the environmental, food and human crisis in most dry regions of the world.

In the last decades, various reports by international bodies have shown that desertification progresses and degrades soil quality, that hunger affects a growing number of people, and that, in this context of declining food security, conflicts and wars increase.

There is a need to establish the causes, effects and impacts of DLDD, and to ascertain how degradation contribute to migrations and to the societal crises that lead to conflicts. By recognizing at an early stage the future changes associated to the climate change scenarios, and by contributing to a process of political cooperation, we will be able to forge tools to prevent the crisis. This early warning and its associated prevention mechanisms require a debate, and the United Nations Convention to Combat Desertification (UNCCD) can provide an independent multidisciplinary scientific framework for such a dialogue.

A first step in the way to ensuring security in the affected dry areas, that should be implemented by means of science and an accurate scientific and technical knowledge on DLDD, will lead to an adequate diagnostic of the situation, its causes and effects, and the relations between biophysical degradation and its socioeconomic consequences. Once the scientific diagnostic has been established, the second step is one of 'politicizing'. In other words, it is necessary to translate into the field of active policies the initiatives on environmental security or security prevention, understood not from a military perspective but in terms of sustainable development strategies. We are thus led to a new concept of security policy through its relations with climate, water, soil, health and survival, in order to stabilize the regions at risk.

The study proposes several measures to improve security, based on the knowledge of the interrelations between nature and human activities, the transition to new technologies based on traditional knowledge, and the increased effectiveness in the use of resources and energy through the combat against erosion, water management and the use of renewable energies.

To conclude, I would like to congratulate the UNCCD Secretariat, as the coordinator and leader of this study, for this outcome that provides actual elements for the outlining of active policies in this area.

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EXECUTIVE SUMMARY

The present severe economic and financial crisis has resulted in the collapse of banks, insurance and industrial companies, shrinking world trade that trigger protectionist trends leading to rising unemployment. Developing countries may again pay the highest burden due to lacking financial resources for job creation, credits and food imports. This is affecting rural communities and the urban poor, who are unable to obtain the resources for survival. Since 2007, the massive food price increases due to speculation and decline of food reserves have resulted in violent food riots in 2008 that caused at least 200 deaths. According to FAO another 40 million people have been pushed into hunger in 2008 and the number of undernourished people in the world reached 963 million. More than 24,000 people die of hunger-related causes daily and the financial and economic crisis could push even more people into hunger and poverty. Thus, food security has moved to the top of the international agenda.

As a result of population growth, demand for food will increase further, primarily in developing countries. In a business as usual scenario of climate change the food supply will decline especially in drylands as crop yields are expected to fall, but also due to drops in exports from major grain producing countries (USA, Canada, Australia). With the projected decline in fish stock due to overfishing and climate change impacts the demand for food grown on scarce fertile land will increase. Additional pressures include changes in the diet by growing meat consumption and the competition between the production of food and biomass for electricity generation and biofuels as substitutes for fossil energy sources.

This has already triggered famines and an increase in forced migration from drylands that experience a major population growth and decline in food supply. Repeated famines and a decline in food security have resulted in violent clashes and/or civil wars (e.g. in Darfur that is both in the Sahel Zone and in the Nile Basin). The realization of the food-related Millennium Development Goals is in jeopardy.

During the 20th century the process of desertification has progressed; the land and the quality of the soil have degraded. While GLASOD claimed that 15% of the land surface was degraded, the GLADA reports referred to 24%. In the 21st century, anthropogenic and climatic factors will further degrade the soil both due to poverty (overgrazing and overuse of the land), market-driven expansion of agricultural production and depletion of aquifers in drylands. As a result of climate change the number and intensity of droughts will increase and thus the vicious circle of drought, forced migration leading to political crises and conflicts may exacerbate threats for human, national and international security.

In the past century the world population tripled and water consumption increased six times. There is a high probability that climate change impacts, growing water stress, biodiversity loss and increasing desertification, land degradation and drought (DLDD) may all contribute to future food crises, unless extraordinary and innovative strategies, policies and measures are launched now for coping with these multiple security-relevant challenges that may negatively reinforce each other threatening the survival of billions of people, most particular in drylands.

On the background of these dramatic trends, soil security emerges as a constitutive paradigm of human, national and international security. It calls for a political process of securitization of DLDD issues and the development of effective international strategies, national policies and local measures based on a diagnosis of complex interactions between natural and societal causes. In this study:

- *securitizing the ground* implies creating a wider global political awareness of DLDD and their societal consequences, making combating DLDD a key international political commitment and upgrading DLDD to the security realm;
- *grounding security* includes reactive and proactive short-, medium- and long-term strategies for coping with soil insecurity by exposing its manifold societal, environmental and economic consequences.

Efforts towards a proactive security policy and related measures on DLDD are more effective for reducing the costs of potential political security threats that have been identified by institutions such as the UN, OSCE and NATO.

As DLDD may contribute to migration, societal crises, and conflicts, violent societal outcomes may be avoided by addressing their causes, effects and impacts. Recognizing future challenges under current climate change

scenarios and contributing to a process of political co-operation, anticipatory learning can forge tools of crisis prevention. This must be promoted through a conceptually-focused and policy-oriented intergovernmental debate of which the United Nations Convention to Combat Desertification (UNCCD) can be an important part, as its subsidiary bodies, the Committee on Science and Technology (CST) and the Committee for the Review of the Implementation of the Convention (CRIC) offer a suitable framework for independent scientific and expert assessment, dialogue and policy coordination.

Anticipatory learning requires a debate on longer-term challenges and a mutual understanding of relevant responses. The study advocates a multidisciplinary search for entry point strategies to cope both with the root causes of conflicts and their socio-economic implications. Partnership building measures must express political commitment to tackle the root causes of insecurity in the economic and ecological realm and should aim at:

- creating awareness on these challenges among decision makers and in the public;
- analysing and monitoring in detail the complex interrelationships among key problem areas;
- initiating regional impact studies and specific mitigation strategies against DLDD in support of existing regional programmes.

A political move by governments and international organizations to securitize DLDD should prioritize the upgrading UNCCD policy measures to enhance soil security with a rights-based approach in order to secure the livelihoods and survival of affected, often poor and marginalized people, primarily in developing countries whose source of livelihood is threatened by multiple crises and who often lack the financial and administrative capacities of a strong state.

The Parties to the Convention may consider, in an agreed timeframe, several proactive policies and regulatory measures such as:

- demand side management and efficiency improvements;
- providing more opportunities for environmental services and food with less resources;
- transition to alternative livelihoods and to a sustainable “green” economy;
- responding to environmentally-induced migration; and
- adopting mechanisms to prevent, avoid and settle environmentally-induced conflicts.

Globally agreed active co-operation policies on sustainable development in agriculture, rural development, industry, tourism, transport and urbanization must factor in soil and land scarcity to address the global and regional challenges. At a country level, long-term oriented and proactive local to national policies of sustainable development to combat DLDD require enhanced territorial governance to promote actions against soil erosion and desertification, to increase water management, to offer employment in rural areas and sustainable agricultural policies. Art. 10 of the UNCCD treaty provides a blueprint for policy-guidance through action programmes. The global partnership and framework envisaged by the 10-Years UNCCD Strategy may yet become an effective policy platform for human and societal security in the affected regions, contributing to conflict prevention and reducing the costs for coping with the consequences of missed opportunities for multilateral cooperative policies in the last decades.

Within its 10 years strategy, adopted in Madrid (2007), the UNCCD pursues five operational objectives which may be strengthened by the following policy recommendations on securitizing the ground and grounding security.

1. Networks of researchers on DLDD should be set up in Africa, Asia and Latin America, besides ARIDnet and Desertnet, on the links of soil security and societal outcomes.
2. In the framework of the Earth System Science Partnership a fifth science programme addressing specifically the research needs related to DLDD should be established.

3. An interdisciplinary scientific panel on DLDD should be set up by the UN General Assembly to assess research and to publish an assessment of DLDD knowledge.
4. These proposals should strengthen the CST to translate knowledge into policy advice for action as part of a proactive strategy of sustainable development.
5. Specific studies should be initiated and funded by UNCCD member countries on:
 - a. DLDD-induced forced migrations on desertification and migration.
 - b. A systematic and integral study on soil security and societal outcomes including forced migration, crises and conflicts by developing scenarios for coping with DLDD.
 - c. A study on the cost of inaction in combating DLDD with estimates on the socio-economic costs of increased forced migration flows and of emergency measures coping with natural hazards, food and water insecurity and potential conflicts.
6. Dissemination of information on soil security issues of DLDD by the UNCCD secretariat in cooperation with leading universities and research institutes.
7. Documentation of soil security hotspots by publishing research, best practices and experience as scientific papers and technological manuals that may support preventive actions
8. Establishment of an interagency land network that may lead to a new epistemic community on DLDD issues to foster international cooperation among UN and other agencies.
9. International workshops and symposia contributing to an exchange of practical experiences and knowledge on the best forms of territorial governance to promote soil security.
10. International initiatives for coping with desertification and migration may be advanced by pro-active strategies on desertification and its impact on migration. The EU and USA may fund technological proposals on the potential of renewable energies in drylands.
11. The countries affected by DLDD may enact legislation on soil security issues that support improved agricultural and land management practices.
12. Strengthening capacity on soil security issues and balancing capacity building based on traditional and innovative knowledge.
13. Training on best practices for conflict settlement at the sub regional and national levels and linked to the adjustment process of the UNCCD National Action Programmes.
14. International financial institutions, regional organizations and national donors may identify thresholds and benchmarks of soil security for allocating financial resources for land and water development projects for local areas.
15. Climate-related finance mechanisms may offer additional resources for affected rural areas for mitigation and adaptation to climate change, thus contributing to soil security.
16. Local area development programmes in regions affected by soil insecurity should promote sustainable livelihood and generate income (microcredit, insurance, land use micro investments) for vulnerable groups at risk of social destabilization due to DLDD.

I Introduction: Securitizing the Ground, Grounding Security

1. Challenges from the Ground for Human Survival

"The food crisis continues in countries that deal with erratic rainfall, like in Sub-Saharan Africa. In addition, many of these countries are food importers, so to see the extreme drought in Argentina, Australia, and now China, is indeed alarming"

Luc Gnacadja, Executive Secretary General of the UNCCD Secretariat, February 2009

The world may have reached a turning point where several simultaneous and interrelated crises require extraordinary policy measures to cope with these multiple challenges that may pose severe dangers to human, national and international security and to the human well-being and survival of billions of people. Some worrying crisis factors are as follows:

- *Economic crises:* The world faces the most severe financial and economic crisis since 1929 that has already resulted in a collapse of large private banks and insurance companies in industrialized and emerging countries and in the destruction of significant economic wealth, in a drastic drop of the gross domestic product, in increased unemployment and in a decline of remittances of migrants.
- *Population Growth:* The world population has tripled during the 20th century from 2 to 6 billion and it is projected to grow to 9 billion until 2050. Most of the growth will occur in developing countries, and a significant proportion will be in drylands.
- *Climate Change:* Due to global climate change, the global average temperature is projected to rise between 1.1 and 6.4°C by the year 2100, where an increase of 2°C is virtually certain, of 4°C may be probable and of 6°C is possible if business-as-usual scenarios prevail. The sea-level may rise between 18 cm and 2.4 metres. The precipitation patterns are projected to change significantly with most of the drylands and deserts becoming hotter and dryer. Climate related hazards, such as droughts, storms, floods will increase in number and intensity affecting more people and enlarging economic damages.
- *Water Security:* During the 20th century population tripled and water consumption increased six fold. Many countries are already experiencing water crises due to growing water scarcity resulting from declining precipitation and overexploitation of aquifers. In many parts of the world the water has been salinized and polluted creating major health security problems for the poor. By 2025, more than 2.8 billion people in 48 countries are projected to face water stress of which 40 are in West Asia, North Africa and Sub-Saharan Africa.
- *Food Crises:* In October 2008 the food crises was extremely alarming in D.R. Congo, Ethiopia, Eritrea, Haiti, Liberia, Niger and Sierra Leone and alarming for Angola, Bangladesh, Burkina Faso, Chad, Guinea, India, Laos, Madagascar, Malawi, Mali, Mozambique, Nepal, Pakistan, Sudan, Tanzania, Tajikistan and Zambia. From 1990 to 2008 the hunger increased in Botswana, Burundi, Comoros, D.R. Congo, Guinea-Bissau, Liberia, North Korea, Swaziland, Zambia and Zimbabwe. The food crises may become even more severe until 2050 and 2100 due to a growing demand and declining supply.

The interaction of these factors may result in extreme or fatal societal outcomes that will bring severe consequences for human, communal, national and international as well as for environmental, societal, economic, political and military security.

So far, there is no agreement with regard to the extension of drylands and the land affected by DLDD. According to GLADA (2008: 1) "land degradation is a global environment and development issue. Up-to-date, quantitative information is needed to support policy and action for food and water security, economic development, environmental integrity and resource conservation." Lands affected by DLDD cover between 33% and 41% of the Earth, 46% in Africa, which is the highest affected region; the

productivity loss per year is estimated at 0.5 to 1%, what indicates an accumulated loss of about 20% during the last 40 years (Sivakumar/ Ndiang'ui 2007). These areas are home to more than 1.5 to 2 billion people.

2. From the Holocene to Anthropocene

In earth and human history a gradual and fundamental change has occurred since the industrial revolution (1750) from the 'Holocene', the period of earth history since the end of a glacial period (10,000 year ago), to the 'Anthropocene'. Increasing human interventions, especially through the use of fossil energy sources have resulted in an anthropogenic period of global climate change (Annex 1). In response to the gradual understanding of the anthropogenic contribution to global environmental change (GEC) including climate change, sustainable development (Brundtland 1987) became the overriding policy goal of the Earth Summit in Rio de Janeiro (1992), of the Millennium Report (2000), at the World Summit on Sustainable Development (WSSD) in Johannesburg (2002), and of the UNCSD.

3. Definitions of Desertification, Land Degradation and Drought

According to the United Nations Convention to Combat Desertification (UNCCD) "desertification is caused by complex interactions among physical, biological, political, social, cultural and economic factors." Its objective (Art. 2) is twofold to "combat desertification" and "to mitigate the effects of drought", especially in Africa with "long-term integrated strategies" aiming at "improved productivity of land, and the rehabilitation, conservation and sustainable management of land and water resources, leading to improved living conditions, in particular at the community level." This treaty defined land as the terrestrial bioproductive system and thus land degradation (LD) as the loss of environmental services or the reduction of the biological and/or economic productivity.

UNCCD's 10-Year Strategy recognized the global magnitude of the challenge. Indeed desertification is not just a problem for developing countries or for particular groups of people. More than 110 countries are potentially at risk. UNEP estimates that desertification costs the world US\$ 42 billion a year. Africa alone loses some US\$ 9 billion a year (Lean 2008: 10). The continent with the highest proportion of severely or moderately desertified drylands is North America (74%), but also 13 European countries suffer from desertification.

The deterioration of 30% of the earth's land is due to overgrazing, overuse of land, poor irrigation methods, deforestation, climate variability and change. Other key factors of desertification are the human-induced increase in demand for food, water and soil due to population growth, modernization processes, and livelihood changes, resulting in economic inefficiencies and in an increase of waste. Loss of yield productivity, water and food scarcity, inadequate land management and poverty are key drivers of forced migration of people from drylands to humid regions where new desertification trends surge from an increased demand on the carrying capacity of the land.

By 2050, the competition for land use will rise dramatically due to the doubling of global food demand and a projected increase in biofuels as a result of the declining fossil fuel supply. This process further intensifies dual large scale land investments in the context of globali-zation that can be harmful to local communities whose customary rights are not sufficiently recognized. Thus a global environmental change (GEC) with a greater demand for and pressure on resources and a lower supply of soil, water, food and energy can undermine the "right to food" (Ziegler/de Kalbermatten 2008) and the "right to water" and create resource conflicts.

Land degradation (LD) due to soil, water and wind erosion, fertility and biodiversity loss is prevailing in drylands affecting primarily marginalized people. Combined with drought and desertification each year 12 million hectares are lost, where 20 million tons of grain could have been grown (GEF-IFAD 2002: 3). Desertification, land degradation and drought (DLDD) are human-induced and natural processes with negative effects on ecosystem functions such as storage and cycling of water and soil resources, generating energy and materials. DLDD occurs not only in drylands but has also adverse effects on other ecosystems. Dust storms cross seas and affect people in other regions.

Short-term crop yield increases may threaten the long-term conservation of agricultural land. This is a major cause of soil deterioration due to land-use change, resulting from feed-back mechanisms that emerge from different system types (ecological, economic, climatic, demographic). These factors create physical stressors on land: wind and water erosion, removal of nutrients, increase in acidity, salinization and alkalization, destruction of soil structure and loss of organic matter. DLDD has gradually evolved in three phases from a scientific problem to a policy question and, increasingly, a security danger and concern (Annex 1). Thus, DLDD is also a push factor for population movements to urban areas and industrialized countries, contributing to social breakdown, cultural alienation, feminization of poverty and conflicts.

4. Three Phases of the Evolution of DLDD

Three stages of Global Environmental Change (GEC) can be distinguished: a) of scientific agenda-setting and research (*scientizing*), b) of political action (*politicizing*), and c) upgrading to a security issue (*securitizing*).

4.1 Scientizing by Creating Scientific Awareness for Desertification

GEC has emerged as a new multidisciplinary scientific field since the 1970's that has focused on climate change, water, DLDD and biodiversity, as well as on the human factors, of population growth, urban and rural systems and economic processes. Since the 1990's, scientific networks on global change and policy-focused scientific epistemic communities (e.g. the IPCC) have evolved that assess scientific research, and explain them to the global policy community (scientific agenda setting).

In response to the severe Sahelian droughts of the 1970's several scientific and political efforts were launched with the establishment of a) the Inter-States Committee for the Fight against Drought in the Sahel (CILSS); b) the Club du Sahel within OECD to mobilize donations and to coordinate the assistance in countries confronted with droughts; c) the United Nations Sahelo-Sudanian Office (UNSO) to coordinate all UN activities. In 1977, the United Nations Conference on Desertification (UNCOD) in Nairobi proposed a Plan of Action to Combat Desertification (PACD).

In addition to the relevant work of the CGIAR network, specific scientific and policy-focused activities related to DLDD include:

- The *Global Assessment of Human Induced Soil Degradation* (GLASOD) (1990) by the *International Soil Reference and Information Centre* (ISRIC) is the first global assessment of soil degradation and the only uniform source of land degradation data (FAO 2000).
- *TerrAfrica*, a partnership that aims to address land degradation by scaling up harmonized support for effective and efficient country-driven (SLM) practices in Sub-Saharan African countries and NEPAD (GLADA Report No. 5).
- *DesertNet* is an interdisciplinary group of scientists to improve research on combating and preventing desertification in Europe and at a global scale and to support communication with policy makers and with other stakeholders.
- *ARIDnet* is a research coordination network with members from the Americas and Australia simultaneously addressing the meteorological, ecological (*biophysical* factors) and the human dimensions (*socio-economic* factors) of desertification.

Within the framework of the Earth System Science Partnership (ESSP) and its four research programmes issues related to the ground are researched, but DLDD lacks a specific programme compared with climate change (WCRP), biodiversity (DIVERSITAS) and water (Global Water Partnership or GWP). No similar assessment body compared to the Intergovernmental Panel on Climate Change (IPCC) has been set up so far (Vlek 2005: 25).

4.2 Politicizing Desertification, Land Degradation and Drought (DLDD)

Since the Earth Summit in Rio de Janeiro in 1992, three key conventions on climate change (UNFCCC), biodiversity (CBD) and desertification (UNCCD) have resulted in new forms of international governance

that have moved to the centre of political concerns in the framework of the conference of parties (COPs) of UNFCCC, CBD, UNCCD, and of the three-annual World Water Fora (politicization).

With the UNCCD a political process was created that has put DLDD on the international political agenda through its conferences of parties and its Committee for the Review of the Implementation of the Convention (CRIC) that monitors the state of DLDD at the intergovernmental level. Implementing a recommendation of the World Summit on Sustainable Development (WSSD) in 2003 the Global Environment Facility (GEF) adopted land degradation as a GEF Focal Area and launched an Operational Programme on Sustainable Land Management (SLM).

The 2007 debate of the Security Council of the United Nations on Climate Change explicitly recognized DLDD issues has climate related security risks. So far, in the UNCCD context an equivalent to the Stern Report (2006) is missing that estimates the potential costs of DLDD.

4.3. Securitizing Desertification

The Spanish government was instrumental in launching a process of securitization of desertification together with the UNCCD with four international symposia and workshops in Almeria (1994, 2006) and in Valencia (2003, 2007)¹. Due to its extensive experience with the subject, Spain contributed to making DLDD an issue of 'utmost importance' requiring 'extraordinary coping measures'. On 30 November 2007 the Foreign Ministers of the OSCE countries adopted the 'Madrid Declaration on Environment and Security'² that noted among the environmental risks, "those related to land degradation, soil contamination, desertification and water management." Within the UNCCD context, these links have been discussed during the CRIC 3 meeting in Bonn in May 2005.

5. Object of the Study

This study addresses the complex security-related interactions between the natural environment and humankind affecting the land (ground, soil) as the provider of ecosystem services and food for living organisms (plants, animals and human beings). Increased demand on the land due to population growth and climate change are intensifying the process of desertification, notably in the drylands. The land and the quality of the soil have degraded, and the impact of drought has increased. On this background this study will:

- discuss to what extent these interactions pose *objective security dangers* and *subjective security concerns* for human beings, the state and the international community;
- introduce '*soil security*' as a new sectoral concept by reviewing the various factors contributing to '*soil insecurity*';
- review the 'securitizing moves' by international organizations, nation states and civil society and analyse DLDD as an issue of utmost importance that requires extraordinary measures for coping with its consequences to avoid that they result in people's movements, crises and conflicts.

Desertification and land degradation are environmental challenges that affect the livelihood and survival of about one third of humankind. Drought has emerged as the most deadly natural hazard that has killed more than 900,000 people in thirty years and has affected millions more. Thus, there is a high certainty that coping with DLDD is becoming a key issue of survival and security in the 21st century necessitating a detailed conceptual security analysis.

¹ See: Puigdefábregas/Mendizabal 1995); II International Symposium: "Desertification and Migration", Almeria, Spain, 25-27 October 2006; at: <http://www.sidym2006.com/eng/eng_ponencias_conclusiones.asp>.and in (2006) on 'desertification and migration'. The first Valencia conference in 2003 focused on 'desertification in the Mediterranean as a security issue' (Kepner/Rubio/Mouat/Pedrazzini 2006). Under the joint auspices of the Spanish OSCE Chairmanship and of the NATO Science for Peace and Security Programme a second Valencia workshop in 2007 dealt with 'Water Scarcity, Land Degradation and Desertification in the Mediterranean Environment and Security Aspects' (Rubio/Safriel/Daussa/Blum/Pedrazzini 2009).

² Resolution on Environment and Security adopted by the Ministerial Council of the OSCE in Madrid on 30 November 2007 as "Madrid Declaration on Environment and Security", in: Organization for Security and Co-operation in Europe. MC.DOC/4/07; at: <http://www.osce.org/documents/mcs/2007/12/28657_en.pdf>.

II Security Aspects and Securitization of the Ground (Land, Soil)

1. Security Concepts and Approaches

Security refers to several dimensions, applies to states and individuals, issue areas, societal conventions, and its conceptual definition evolves with changing historical conditions and circumstances. Security is an aspiration of nation states and of political actors that require extraordinary measures. As a societal value to be achieved, security is linked to protection, certainty, reliability, trust and confidence, predictability in contrast with danger, risk, destruction, disorder and fear.

The League of Nations (1919) used the concept of 'collective security' in its Covenant, and it is central to the UN Charter (1945). The 'social security' concept gradually evolved since the 19th century for the security of the citizens covering the home, livelihood, and social insurance. The right to social security is stipulated in the Universal Declaration on Human Rights (Article 22), which was adopted in 1948. The 'national security' concept emerged during World War II in the United States.

Security depends on a normative core that cannot simply be taken for granted. Security has real world effects and guides action of policymakers, thereby impacting on political order. The 'security concept' has gradually widened and deepened since the 1980's.

Wolfers (1962: 150) pointed to two sides of the security concept: "Security, in an objective sense, measures the absence of threats to acquired values, in a subjective sense, the absence of fear that such values will be attacked." Security in an objective sense refers to clearly identified dangers related to sectors (social, energy, food, water, health, livelihood and now also soil), while security in a subjective sense refers to perceptions expressed in security concerns by government officials, media representatives, scientists or the people who securitize dangers through responses to security concerns. Security refers to existential threats for survival and requires extraordinary measures to face and cope with these concerns. Security concepts offer tools to analyse, interpret, and assess past actions and to request or legitimize present or future activities.

2. Review of the Debate on the Reconceptualization of Security

The reconceptualization of security has gradually emerged since the 1990's in response to: a) the end of the Cold War as a global bipolar order; b) the process of globalization; c) the recognition of GEC as security issues in the Anthropocene. The Copenhagen School (Buzan/Wæver/de Wilde 1998) of security studies widened the traditional narrow military and political focus to embrace economic, societal and environmental dimensions. They also deepened the reference to the nation state by adding international, regional, societal and individual actors (referent objects). But this school did not analyse the sectorialization of security and human and gender security concepts (table 1).

Table 1: Dimensions of security and levels of interaction

Security dimension ► Level of interaction ▼	Military	Political	Economic	Environmental ▼	Societal
Human ►			Securing soil, water, food, health, livelihood and energy for human beings combining all levels of analysis & interaction		
Village/Community/Society			▼▲		
National	Security dilemma of states		Social, energy, food, health, livelihood and <i>soil</i> threats may pose a survival dilemma in areas with high vulnerability		
International/Regional/Global	Security of the territory				

The environmental dimension of security (Brauch 2009) has gradually evolved since 1989 from a policy debate and a research agenda to a new international policy field involving major environment (UNEP), development (UNDP) and security organizations (OSCE, NATO) in Central Asia, the Caucasus, and South-eastern Europe (ENVSEC Initiative) and the Mediterranean.

A combination of Human, Gender and Environmental Security (HUGE) represents a widened security concept, which includes vulnerable groups, such as women, children, elders, indigenous and other minorities with a human-centred focus on environmental security challenges, peace building and gender equity (Oswald 2008). This embraces livelihood, food, health and other sectoral security issues, including the new soil security concept related to agricultural practices and sustainable drylands management.

3. Theory of Securitization

The emerging policy debate on the security implications of GEC has not been guided by considerations of a sustainability science for the Anthropocene. Wæver (1997) and the Copenhagen school (Buzan/Wæver/de Wilde 1998) developed the securitization theory³ that offers an approach for analysing the security aspects of DLDD.

Wæver (1997: 221) argued that by declaring a development a security problem, or as an existential threat to sovereignty, the state has been the major securitizing actor. Buzan, Wæver and de Wilde (1998: 23-26) introduced securitization as being “above politics” and as a “more extreme version of politicization.” They argue that any public issue could be located in a spectrum between *nonpoliticized* (no state action is needed), *politicized* (requiring government decision and resources), and *securitized* (existential threat that requires emergency measures). They state that the securitization of environmental issues could also be enacted by non-state actors.

With the securitization approach the emerging policy debate on climate change and DLDD as a new international, national, and human security concern can be analysed. The securitizing actor that declares a threat is not solely the nation state but may also be a transnational epistemic community (e.g. IPCC, IUUCD). The referent objects are not only the state and the international community but primarily individual human beings and humankind who are both causes and victims of climate change and DLDD. Both actors are not identical, what creates new equity problems.

From a state-centred national security perspective the securitizing actor and the referent object remains the nation state (policy-makers and political elite), while from a wider environmental and deeper people-centred security outlook the scientific community has become a new securitizing actor. The referent object is not only the state but are the vulnerable groups that are most exposed to these emerging DLDD security issues exacerbated by anthropogenic climate change.

4. Towards Securitizing DLDD: Causes and Societal Effects

The two parts of *Securitizing the Ground, Grounding Security* refer to two different problems and policy issues:

- *securitizing the ground* creates a wider global political awareness for DLDD and their societal consequences, making it a key international political issue by upgrading it to the security realm;
- *grounding security* includes reactive and proactive short-, medium- and long-term strategies for mitigation and adaptation to soil insecurity and its manifold societal, environmental and economic consequences.

Addressing both aspects of soil security with a political process of securitization of DLDD and the development of effective international strategies, national policies and local measures requires a diagnosis of the complex natural and societal interaction.

4.1. Two Sides of Securitizing the Ground: Territorial vs. Soil Security

Securitizing the ground refers to two different aspects: the land as territory, which is the key feature of sovereignty at the national level; and the land as soil that produces essential ecosystem services, including food for living organisms. The first refers to the classic security of the territory (territorial security) and the second to the new soil security concept that applies primarily to the economic, environmental and societal security dimensions.

³ For further analyses see: <<http://polforsk.dk/download/securitytheory2006/homepage>>.

Soil security can be analysed from state-centred perspectives of local, national, regional and international security and from the perspectives of human, gender and environmental security (HUGE). The loss of soil capacity to regulate and store water and the depletion of aquifers for drinking and irrigation puts in extreme cases the survival of affected people at risk. This confronts them with a survival dilemma to choose among several undesirable choices: a) to stay at home, b) to move to national urban centres (urbanization process) or c) to emigrate to neighbouring countries (forced migration). Soil security is achieved when efforts succeed to conserve soil fertility, contain land degradation and combat desertification and when the consequences of drought are reduced by improving livelihood and human wellbeing of the people.

Soil security is threatened by a) the spatial expansion of existing deserts, b) the severe degradation of soils and related fertility and biodiversity losses due to processes of geophysical, wind and water erosion and c) drought resulting in bad harvests and crop yield declines. In developing countries DLDD has triggered severe and extended periods of famine affecting several billion people during the 20th century and causing the death of millions of people (table 3, page 16 below). Soil insecurity challenges basic ecosystem services, especially water as well as food production and supply. Droughts often result in increasing food prices, the poor and marginalized people cannot afford. Food riots, most recently during 2008, occurred in countries lacking financial resources and the capacity to effectively distribute food aid to the poor.

Securitizing DLDD implies that national governments, international organizations (UN), programmes (UNDP, UNEP), multilateral environmental agreements (UNFCCC, UNCCD, CBD), networks (ARIDnet, Desertnet, TerrAfrica, Nepad, RIOD, etc.) and knowledge-based epistemic communities (IPCC) succeed to counter DLDD issues. By labelling environmental, societal, economic and food aid issues as security threats of utmost importance for the highest political level, extraordinary measures may be justified to cope with their natural and anthropogenic causes and to face their societal and political consequences. Hence the following questions become security relevant:

- a) How can the processes of soil erosion, land degradation, and desertification be successfully delayed, contained, countered or stopped?
- b) How can the societal consequences of hunger, distress migration and in some cases of conflicts be curbed, and the impact be reduced by rapid response, preventive action, early warning and peacebuilding?
- c) How can emergency measures be more effective permitting the humanitarian aid to reach the most affected people?

How can decentralized authorities and local populations, primarily women and youth, get involved to mitigate and adapt to DLDD?

The instruments and actors for dealing with DLDD are to reduce potentially violent societal consequences. An early recognition and perception of the urgency of the desertification challenge and its consequences (drought, famine) as security issues depends on the view of the observer. This poses different tasks for political and military security, such as conflict avoidance and prevention. But only development and environment programmes may enhance resilience to achieve environmental, human, soil, food, health and livelihood security.

The task is to focus on causes, drivers as well as on potentially violent outcomes. However, this requires a mainstreaming of activities of coping with environmental hazards and conflict prevention and avoidance. There is no simple strategy to counter DLDD and its fatal outcomes. Knowledge creation and anticipatory and reactive learning can become important tools and must focus on the interface between national policies and local implementation. This requires complex strategies in national and international action plans to be implemented by the state, societal and economic actors.

With regard to hard security, desertification poses no direct military threats. From a subjective perspective, soil insecurity leading to DLDD and famine contributes to environmental and human as well as food, health, household livelihood and gender insecurity. National (political, economic, military) security may be threatened by general strikes and hunger riots, and the value at risk may be regime stability and the survival of governments.

The severe droughts and famine in the Sahel during the 1970's and 1980's have repeatedly resulted in violent clashes between nomadic tribes and resident farmers that have resulted in transboundary environmentally-induced migration. In the early 21st century, DLDD and famine and the related distress migration have been perceived as human security threats by the Commission on Human Security (CHS), but they have not yet been politically addressed by the Human Security Network (HSN). However, drought and famine have been considered as challenges to food security by many governments of developing studies, and among others, by FAO, WFP, UNDP and IFAD and to health security by WHO.

Thus, desertification is increasingly being recognized as a critical environmental and human security challenge by academic experts and many UN international organizations, but not yet by all governments. The political agenda setting of DLDD as a security issue has just started. While the linkages between soil erosion, land degradation and desertification with food security have been addressed since the 1990's, the systematic securitization of desertification started with a NATO conference on 'desertification as a security issue in the Mediterranean' in December 2003 in Valencia (Kepner/Rubio/Mouat/Pedrazzini 2006). Meetings in Almería (1994, 2006) discussed the links between 'desertification and migration' as a national and regional security issue for the states of North and West Africa and Southern Europe.

During the *International Year of Deserts and Desertification* (2006) the security linkage was occasionally addressed, but contrary to the intensive securitization of climate change no similar policy debate has so far emerged on DLDD, although the defence research establishment has started investigating DLDD related threats to geopolitical stability.

4.2. Grounding Security: Towards a Proactive Security Policy on DLDD

Grounding security refers to reactive and proactive short-, medium- and long-term strategies for coping with 'soil insecurity' and the manifold societal, environmental and economic security implications of DLDD. The Desertification Synthesis of the Millennium Ecosystem Assessment (MA 2005a) favours scenarios in a regionalized world that show clear preferences for proactive global and regional strategies for combating desertification with sustainable agricultural practices, poverty reduction and coping with climate change.

UNEP's fourth Global Environmental Outlook (UNEP 2007: 400-401) distinguished in its perspectives towards 2015 and beyond four scenarios with these priorities: a) Markets First, b) Policy First, c) Security First, and d) Sustainability First. While its Security First scenario increases income inequality, poverty, social vulnerability and reduces the coping capacity, what may result in higher human and environmental insecurity especially in the South, its Sustainability First scenario offers the best prospects for reducing global income gaps.

For the needed knowledge-based and scientifically-induced policy response for combating DLDD and its potential societal impacts on migration, crises and conflicts, a combination of two scenarios appear to be most promising: a) UNEP's *sustainability first* scenario and b) two proactive strategies of MA's *Desertification Synthesis* of a regionalized Adaptation Mosaic with a globalized TechnoGarden. These scenarios frame a policy response for achieving soil security.

Besides the top down scenarios of the MA and UNEP, the success of these strategies, policies and measures requires an active involvement of the people affected by DLDD at the local level. Women are educating children in resource management, taking care of vulnerable people, animals, plants and land and are responsible for soil management. Therefore, gender education and training need to be part of governmental and social programmes. To optimize the combat against desertification, land degradation and to mitigate the effect of drought and to guarantee the long-term conservation of fragile soils, an improved gender balance is needed at all decision-making levels and for the ground and water conflict settlements.

Poverty, diseases and the transformation from marginality into social violence and conflicts cross gender lines and are linked with poor economic achievements, low degrees of economic participation and limited opportunities, a lack of political empowerment and difficult health and survival conditions. There is an inherent link among poverty, disease and violence that reduces human, gender and environmental security. Finally, proactive and preventive measures are much cheaper than reactive ones. Once the combat against desertification, land degradation and drought mitigation have started and impacted on larger regions, enhanced territorial governance can improve the soil conditions and contain the process of deterioration.

III Diagnosis: Desertification, Land Degradation and Drought

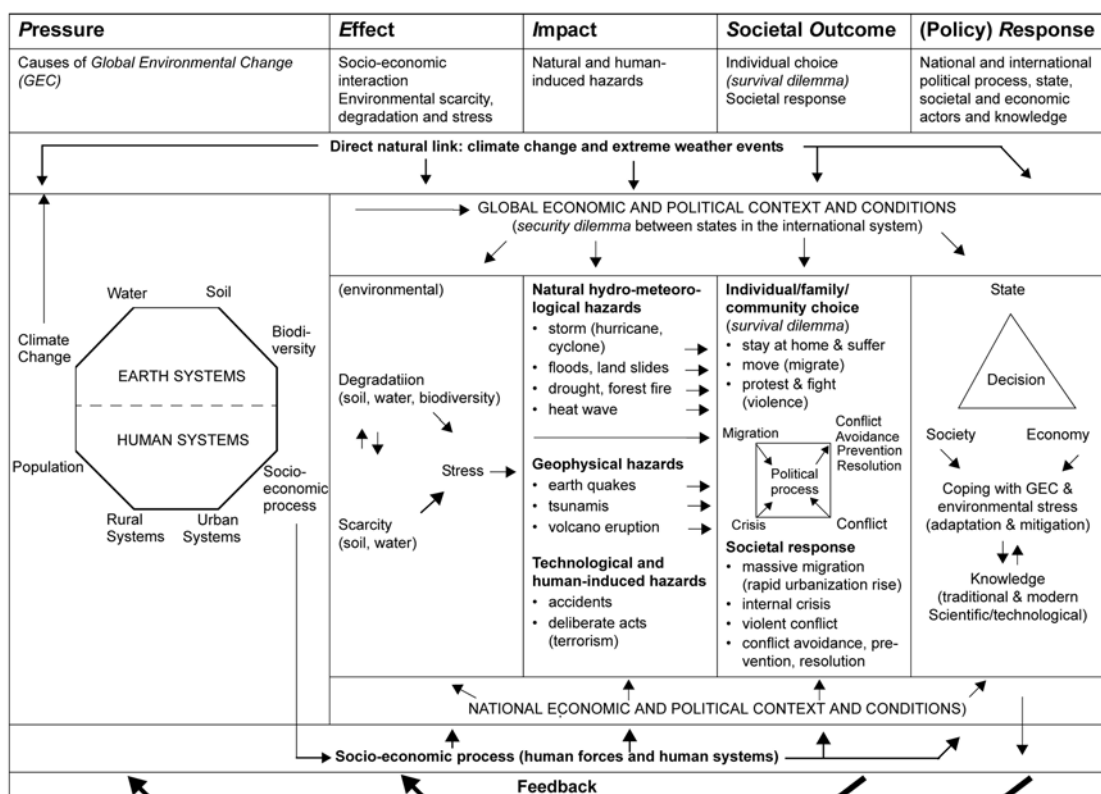
For the diagnosis of the securitization of the soil and the development of the soil security concept, a model will be used that divides the complex human and nature interactions into five consecutive phases where specific security problems may emerge. In this regard the dual focus of the study will be discussed addressing the political process of securitizing soil as an issue of utmost political importance requiring extraordinary responses. This points to a need for proactive comprehensive political strategies, binding policies and specific measures. A robust knowledge is required both for top-down strategies that award the needed financial resources, and also for bottom-up initiatives by the affected people to protect themselves against DLDD-induced hazards and to empower them for adapting to negative societal outcomes.

1. Models on Human-Nature Interactions for the Securitization of DLDD

Various models were developed to analyse the nature-human interactions. Instead of the simple stress-response model, the Pressure-State-Response model of OECD (2001) assumes that human-induced activities led to environmental changes to which the state and society respond with ecological and economic activities. The UN Commission for Sustainable Development used its Driving Force-State-Response model and the European Environment Agency distinguished among Driving Force - Pressure - State – Impact - Response. The framework of the Millennium Ecosystem Assessment (2003, 2005a) considers security as a key element of human well-being that is defined as the ability to live in an environmentally clean and safe shelter, and to reduce vulnerability to ecological shocks and stress. The PEISOR model (figure 1) gradually evolved as a scientific effort to securitize GEC issues reflecting the debates on environmental security. This model combines five stages:

- *P (pressure)* refers to eight drivers of global environmental change;
- *E* to the *effects* of the interactions on environmental scarcity, degradation, and stress;
- *I* to extreme *impacts* of human-induced and climate-related natural hazards;
- *SO* to *societal outcomes*: forced migration, slums, crises, conflicts or state failure;
- *R* to the *response* of all stakeholders.

Figure 1: PEISOR-Model



The PEISOR model refers under pressure to eight factors contributing to GEC. They often interact in a non-linear or chaotic way and impact on earth and human systems. The political and societal contexts may affect socio-economic processes contributing to anthropogenic environmental degradation or resource scarcity that may result in environmental stress.

Figure 2: Environmental Quartet: DLDD, Climate Change, Water Degradation and Biodiversity Loss. **Source:** Inspired by MA (2005: 17). The figure was developed by the authors and designed by Guillermo A. Peimbert, Mexico.

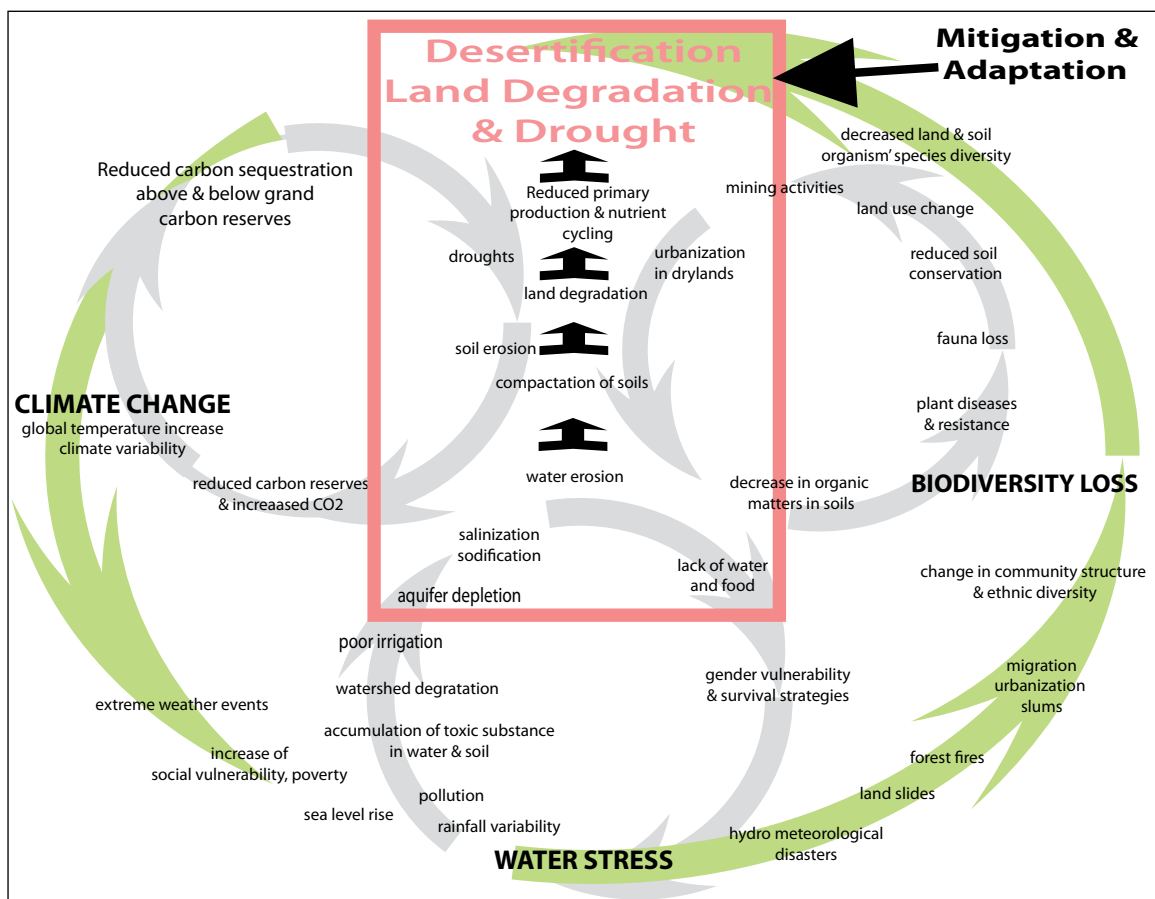


Figure 2 illustrates GEC and the complex interactions and feedbacks between the earth and human systems for understanding the impact of climate change, water stress and biodiversity loss on DLDD. The three small cycles with the factors determining climate change, water stress and biodiversity loss have each different effects on DLDD. The wider cycle representing GEC relates the often chaotic interrelations between the earth and human systems with unpredictable consequences on DLDD and their societal outcomes.

While natural hazards (drought) cannot be prevented, processes of land degradation and desertification can be mitigated by proactive human activities. Therefore, the impact of DLDD on societal disasters can be reduced by linking protection with empowerment of the people to become more adapted and resilient. Environmental stress increases the impact of hazards and contributes to internal displacement, urbanization, and transboundary forced migration. Whether these factors result in domestic crises, disasters, and violent conflicts, or whether they can be avoided, depends on many specific activities resulting from the interaction among the state, the society, and the business community and on knowledge-based response strategies at all levels.

In reference to the earth system, climate change and water have been widely securitized since the year 2000, e.g. by the Ministerial Declaration on Water Security (The Hague 2000) and by the discussion of climate change as a security issue by the UN Security Council in April 2007. Due to repeated initiatives, notably by the government of Spain, the process of securitization of DLDD issues is presently emerging. The economic, societal and environmental dimensions of security cover both the productive and consumptive patterns in rural and urban systems.

2. Environmental and Human Pressures (P)

Climate change produces at least four impacts: temperature and precipitation changes, rise in sea level and extreme weather events. The increase in greenhouse gases is influenced by the specific socio-economic development. Its impacts are influenced by the degree of social vulnerability. Climate change, land, water and biodiversity form an 'environmental quartet' with many complex interactions calling for synergies among the three related environmental regimes dealing with climate change (UNFCCC), biodiversity (CBD) and desertification (UNCCD) to which water is an integral part (figure 2).

The MA Desertification Synthesis Study (2005a) also referred to close linkages among desertification, global climate change and biodiversity loss, where desertification contributes to climate change and may become irreversible as a result of climate change. The study noted that

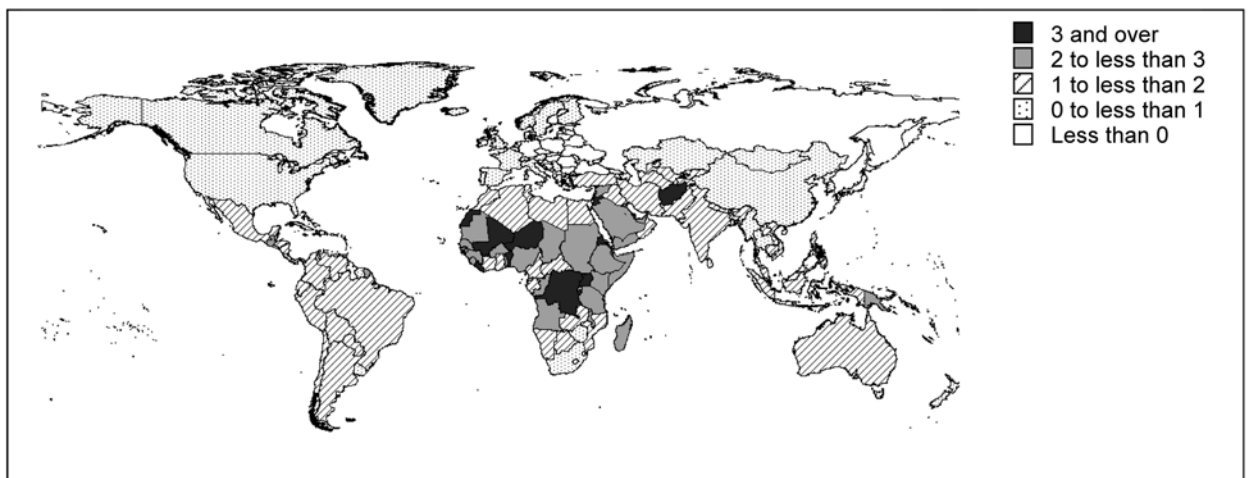
- Understanding the impacts of desertification on human well-being requires that we improve our knowledge of the interactions between socio-economic factors and ecosystem conditions. ...
- There are considerable scientific challenges in detecting thresholds beyond which drylands systems would reach a critical or effectively irreversible change.
- The impact of poverty reduction strategies on ecosystem services and desertification has not been fully explored by governments and the international community.
- The contribution of dryland urban areas to desertification may be significant but is not known.

The MA did not analyse the impact these complex processes may have on political and societal outcomes whether they triggered or intensified processes of migration, of domestic economic and political crises and conflicts.

2.1 Population Dynamic

According to the 2006 Revision of the World Population Prospects of the United Nation's Population Division (UN 2007) "the world population will likely increase by 2.5 billion over the next 43 years, passing from the current 6.7 billion to 9.2 billion in 2050." Most of this growth will occur in developing countries, "whose population is projected to rise from 5.4 billion in 2007 to 7.9 billion in 2050." But the population of the developed countries "is expected to remain largely unchanged at 1.2 billion," due to the projected net migration from developing to developed countries, "which is expected to average 2.3 million persons a year after 2010."

Figure 3: Average annual rate of populations change (2005-2010), medium variant (percentage). **Source:** UN Populations Division (2007: 7); at: <http://www.un.org/esa/population/publications/wpp2006/WPP2006_Highlights_rev.pdf>.



Between 2005 and 2010 the populations growth (figure 3) will be the highest for Mali and Niger, Congo and Afghanistan (above 3%) and between 2-3% for all countries in the Sahel zone and for most countries in West and East Africa and for Saudi Arabia, while in all Latin American and in the remaining African

countries (except in South Africa) it was between 1-2%. Figure 3 clearly illustrates that the population growth is the highest in drylands (figure 4, 5).

2.2 Climate Change as the Key Environmental Driver

During the Holocene the natural variability in climate was a major driver for continental and transcontinental migrations of peoples and for the collapse of civilizations (Annex II). During the Anthropocene due to the intensive use of cheap fossil energy an increase of the average global temperature by 0.6°C was measured for the 20th century (IPCC 2007). According to the Fourth Assessment Report of the IPCC (2007), the global average temperature may rise until 2100 between 1.1° and 6.4°C. The rapid partial loss of ice sheets on polar land may lead to a sea level rise between 18 cm and 2.4 metres. However, due to the limited understanding of the drivers of sea level rise, the IPCC (2007c: 79) did “not assess the likelihood, nor provide a best estimate or an upper bound for sea level rise.”

While the projected temperature increase will directly impact on the productivity of the soils and on crop yields with the projected sea-level rise an unknown part of the coastal land will disappear. This will have serious impacts for the highly populated coastal areas and for the productive agricultural lands in river deltas with increased pressure on soil security. At the same time the interaction between natural and socioeconomic processes threatens the marine life that forms the basis of the food chain, with depletion of fish stocks and triggering again a drastic increase in protein demand on land systems by 2040. These multiple global environmental changes are concomitant with a complex financial and economic global crisis with increasing inequity and inequality between South and North and within the countries

2.3 Projected Precipitation Changes due to Climate Change

Anthropogenic climate change will also directly impact on the precipitation level. The IPCC (2007a, 2007b) concluded that there will be significant precipitation declines in the American Midwest, in Mexico, Central America, Venezuela, Chile and Argentina, in the Mediterranean (Spain, Italy, the Balkans, Turkey, Maghreb and Masreq), in Central Asia, Southern Africa and in Australia while precipitation levels will increase in moist tropical and in higher latitudes in the Arctic Circle. According to the IPCC Report (2007c: 49), “there is also high confidence that many semi-arid areas ... will suffer a decrease in water resources due to climate change.” Further, “Drought-affected areas are projected to increase in extent, with the potential for adverse impacts on multiple sectors, e.g. agriculture, water supply, energy production and health” (IPCC 2007b: 49). Many drylands and deserts may get both hotter and dryer in the 21st century (Annex 3).

2.4. Projected Climate Change Impacts on Biodiversity

Climate change will also have multiple negative impacts on biodiversity that will have repercussions on DLDD. According to the IPCC, “approximately 20 to 30% of plant and animal species assessed so far are likely to be at increased risk of extinction if increases in global average temperature exceed 1.5 to 2.5°C. ... [and will lead to] major changes in ecosystem structure and function, species’ ecological interactions and shifts in species’ geographical ranges, with predominantly negative consequences for biodiversity and ecosystem goods and services, e.g. water and food supply” (IPCC 2007: 48).

2.5. Projected Climate Change Impacts on the Land, Ground and Soils

Scientific knowledge about GEC and DLDD is scattered in the literature of many disciplines and there is a need to establish a policy-relevant scientific assessment. On the impact of climate change on drylands, the IPCC (1996b: 161) stated with certainty that “most deserts are likely to become even more extreme if climate changes as projected by current scenarios; most desert regions are expected to become hotter and most will probably not become significantly wetter.” The IPCC also agreed that “opportunities to mitigate greenhouse gas emissions in desert regions are few.”

Climate change impacts differently in the five continents on land and soils. The IPCC (2007c: 50) stated that in Africa: “by 2020, in some countries, yields from rain-fed agriculture could be reduced by up to 50%. Agricultural production, including access to food, in many African countries is projected to be severely compromised. This would further adversely affect food security and exacerbate malnutrition. ... By 2080, an increase of 5 to 8% of arid and semi-arid land in Africa is projected under a range of climate scenarios.”

With regard to Asia: “by the 2050s, freshwater availability in Central, South, East and South-East Asia, particularly in large river basins, is projected to decrease. Climate change is projected to compound the pressures on natural

resources and the environment associated with rapid urbanization, industrialization and economic development.” For Australia and New Zealand: “by 2030, production from agriculture and forestry is projected to decline over much of southern and eastern Australia, and over parts of eastern New Zealand, due to increased drought and fire. ... In southern Europe, climate change is projected to worsen conditions (high temperatures and drought) in a region already vulnerable to climate variability, and to reduce water availability, hydropower potential, summer tourism and, in general, crop productivity”. In Latin America, the synthesis report (IPCC 2007c: 50) projected by mid-century widespread changes in vegetation cover, loss in crop and livestock productivity and a reduction of water availability for human consumption, agriculture and energy generation (IPCC (2007c: 50).

The projected temperature increase and the regional impacts on the probability of drought and flash floods will also directly affect the future food security, both globally and regionally. The projected yield decline in production regions of present cereal surpluses (USA, Canada, Australia) will have impacts on the food supply and prices. The Middle East, Latin America, South Asia and most of Africa will be very seriously affected.

2.6. Global and Regional Desertification, Land Degradation and Drought (DLDD)

Given the limitations of the existing data sets, the actual extent of desertified area may lie between 10 and 20% of drylands that are already degraded (medium certainty). Based on these estimates, the total area affected by desertification is between 6 and 12 million square kilometres. Based on the total number of people threatened by desertification this ranks among the greatest contemporary environmental problems. Figures 4 and 5 illustrate the degree and types of human-induced soil degradation.

Worldwide about one third of the land is threatened by processes of DLDD due to complex interactions of nature and human activities. Increase in soil temperature dries out the soil and favours wind erosion. Inadequate agricultural and irrigation practices create water losses and erosion, affects soil microbiology by swamping away micro-organisms what reduces the natural fertility of the soil, thus increasing soil vulnerability. The high salinity, alkalinity and sodicity of irrigation water simultaneously change the electrical conductivity and the residual alkalinity (calcite-residual alkalinity, residual sodium carbonates). As a result the soil exchange capacity with water can deteriorate and create even more fragile soils. Further, high evaporation draws the salt from the ground and irrigation with brackish ground water contributes to a salinization process on agricultural land. The interrelationship between land degradation and erosion and the development of salt-affected soils results in a partial or complete loss of the productive capacity of the soil.

One of the most widespread soil depletion occurs in tropical zones with low mineral content of soils. The combined effects of growing population densities, large-scale industrial development, deforestation due to slash-and-burn agriculture and extensive ranching have depleted soils. The increasing use of sewage waters for irrigation, chemical fertilizers and pest management increase the contamination of soils and water, which is aggravated by industrial, urban and human waste. Pollutants may incorporate in the soil, and thus drastically reduce soil fertility. The reduced time for recuperation of the savannah due to overgrazing and the utilization of wood for fuel strengthen DLDD trends. The thresholds of non-linear response occur beyond the carrying capacity of soils, affecting the yields in almost all grains (table 2), threatening the food security of the most vulnerable.

Table 2: Annual change in % in world grain yields by decade (3 years average). Source: Benton Jones (2003: 44).

Years	Total Grains	Rice	Wheat	Corn	Other Grains
1950-60	2.0	1.4	1.7	2.6	---
1960-70	2.5	2.1	2.9	2.4	2.3
1970-80	1.9	1.7	2.1	2.7	0.4
1980-90	2.2	2.4	2.9	1.3	1.7
1990-95	0.7	1.0	0.1	1.7	-0.8

Four UNCCD world monitoring cycles based on national reports document the specific features of and response to DLDD in the five Regional Implementation Annexes of the Convention. While progress in responses by states and societies has been noted, it is still too slow to reverse DLDD trends. Human activities had and will have a major influence on the natural and human interface and trigger environmental or climatic tipping points.

Figure 4: Global soil degradation (percentage of affected area). Source: WBGU (2006) based on GLASOD (1990).

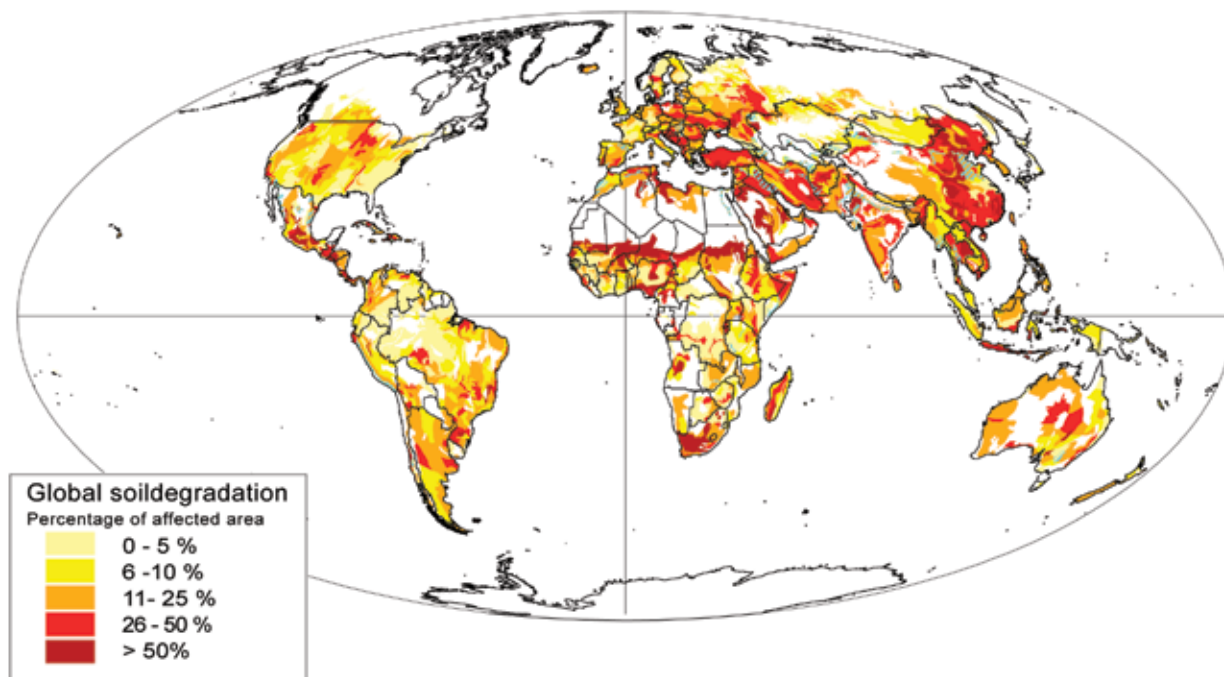
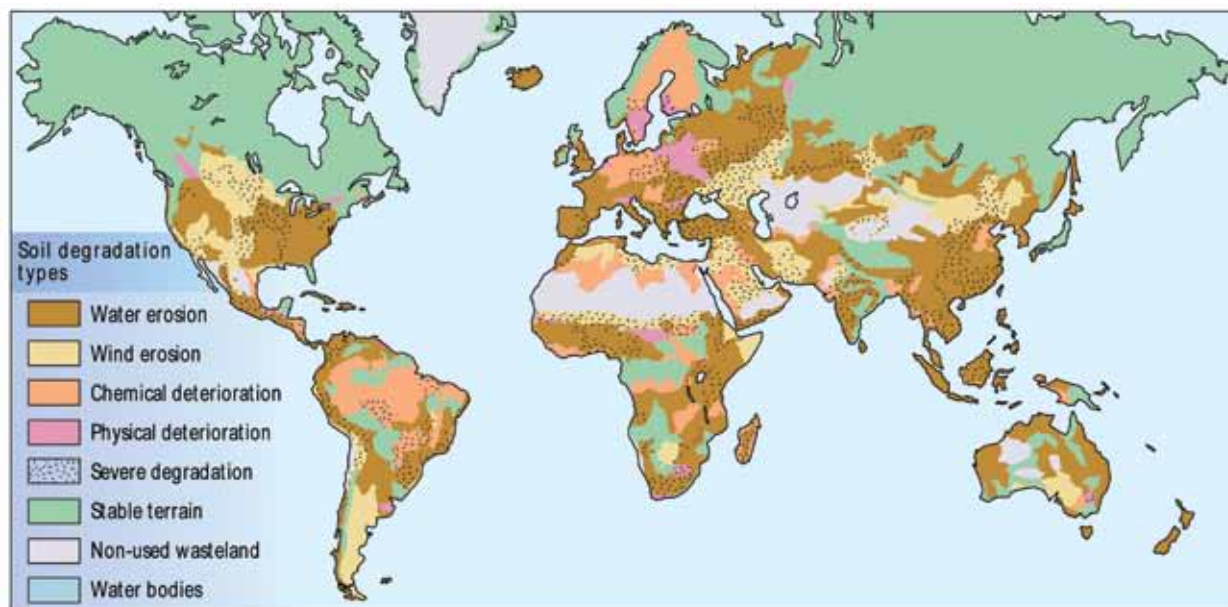


Figure 5: Types of human-induced soil degradation. Source: ISCRIC-UNEP 1996: 12; at: <[http:// www.fao.org/wfs/final/WFSmaps/Map12-e.pdf](http://www.fao.org/wfs/final/WFSmaps/Map12-e.pdf)>.



2.7. Complex and Chaotic Interactions of the Natural and Human Interface

Societal factors intensify these negative natural outcomes. Rapid population growth and rising food demand fosters an overexploitation of the soil due to an inadequate rotation of crops. In contrast, a mixed agriculture relying on water harvesting practices, using efficient irrigation techniques, soil management, poly-cultivation and natural and biofertilizers could enrich the soils and reduce these deterioration processes. The negative interrelationship between natural and societal factors may produce irreversible effects on soil that may reinforce each other in a chaotic and unpredictable way. Land and soil deterioration can become irreversible as a result of these processes of salinization, sodification, compactation, surface sealing and erosion.

Scientists have argued that climate related tipping points could have dramatic natural and societal effects when even a small change caused by human activity may cross a threshold. Lenton et al. (2008: 1186) argue

that different tipping points could occur in the global climate system and pointed to the melting of the Arctic sea-ice, rapid changes in the Greenland and in the West Antarctic ice sheet, a shutoff of the Gulf Stream (Atlantic Thermohaline Circulation), changes in the El Niño-Southern Oscillation (ENSO), in the Indian summer monsoon, in the Sahara/Sahel and West African monsoon, a drying of the Amazon basin and changes in boreal forests.

In the North Atlantic, an abrupt climate change due to a shutoff of the Gulf Stream could trigger serious consequences for U.S. national security. These climatic tipping points may trigger additional changes for the hydrological cycle. For the ground this implies an increased demand on land-based food production through population displacement and production shifts, a probable further decline in the global fish catch and in land based food supply due to soil insecurity and related soil fertility and biodiversity losses.

3. Environmental Effect (E): Environmental Scarcity, Degradation and Stress

The possible linkages between environmental scarcity, degradation and stress and conflicts are complex. They were analysed during the 1990's by two research groups (Toronto and Swiss groups). During this phase of the environmental security debate the concepts of environmental scarcity, degradation and stress were applied to DLDD related issues. The approaches of both groups influenced the policy debate on the environmental dimension of US national security during the Clinton administration (Matthew/McDonald 2009).

After a decade of research a consensus emerged that “environmental stress is rarely considered to be the sole factor in precipitating conflict” both within and between nations. A major effect of several types of environmental stress is economic decline that will affect the poor more than the rich groups and countries. Environmental stress coupled with rapid population growth contributes to soil insecurity, internal displacement, socially precarious slum formation and often larger-scale migration sometimes in life threatening conditions. A second pathway from environmental stress to conflict is through forced migration caused by floods, droughts, locusts or famine linked to deteriorated land. Additional DLDD-related push factors are water and air pollution and deforestation due to lacking fuel wood. Urban and rural violence or direct internal conflict have occurred due to environmental stress, e.g. in the Sudano Sahelian region where many nomads clashed with peasants.

The human-induced environmental stress has a direct impact on the components of the earth and human systems and reinforces the anthropogenic drivers of GEC. With the progressing ‘securitization’ of climate change and related water and soil issues, a new policy-focused scientific discourse is emerging emerged that addresses the security implications of climate change and DLDD from the vantage point of international, national and human security. This debate will be taken up below in section 5.

4. Impact (I) of Environmental Stress and of Climate Change on Hazards

The pressure exerted by global climate change and the local, national and regional environmental stress have resulted in an increase in the number and intensity of hydro-meteorological hazards, such as drought, heat waves and forest fires as well as storms, flash floods, landslides. While drought, forest fires and heat waves have contributed to wind erosion, intensive storms (e.g. hurricanes or cyclones) and flash floods have intensified water erosion that directly impact on DLDD.

On a global level, the impact of extreme weather events differs according to the social, economic and political system that influences the vulnerability of the affected people. The largest number of hydro-meteorological hazards as well as the highest number of killed and affected people has been documented in Asia, Africa and in Latin America while the highest economic damages have been recorded in OECD countries (CRED; IFRC-RCS; MunichRe). While in industrial countries a significant part of the damage is insured, in developing countries poor people cannot afford insurance and lose all their belongings and are often forced to leave their homes. This ambiguity becomes obvious for India that experienced the highest number of deaths and affected people from drought (table 3), but was not even listed among the ten countries that experienced the highest economic damages.

Based on EM DAT data, table 3 summarizes the statistical evidence on the ten most severe droughts since 1900 that occurred in India (1900, 1942, 1965 causing 4,250,000 deaths), China (1920, 1928

Box 1: Impact of DLDD on Spain.

For centuries Spain has been repeatedly and severely affected by local and regional droughts (Domínguez et al. 2008). Between 1900 and 2008, among the most deadly natural disasters in Spain were six floods and three extreme temperature events in August 2003 (15,090 deaths), January 1971 (400 deaths), 9 January 1985 (40 deaths). Among the 10 major events was one drought of September 1990 that affected 6 million people. Among the ten most economically damaging events were two droughts in Spain that amounted to 4.5 billion US\$ in September 1990 and 3.2 billion US\$ in April 1999.

Since the mid-1990's Spain has also experienced a significant increase of immigration from regions and countries in the Maghreb and from West Africa that have experienced DLDD. This dual experience of DLDD and of emigration from degraded, desertified and drought-stricken areas to urban centres within Spain since the 1950's and to other countries but since the 1990's also increasingly from elsewhere to Spain, was a background for the country's sustained interest in the security dimension of the UNCCD process.

Table 3: The most severe droughts (1900-2008). **Source:** EM-DAT: The OFDA/CRED International Disaster Database, Université Catholique de Louvain - Brussels – Belgium; at: <[http:// www.em-dat.net](http://www.em-dat.net)> (created on 5 January 2009, Data version: v12.07).

By the number of people killed on the country base			By the number of people affected on the country base			By the economic damage on the country base		
Country	Date	Killed	Country	Date	Affected (million)	Country	Date	Damage in US\$ (1000)
China P.R.	1928	3,000,000	India	1982	300	China P.R.	Jan 1984	13,755,200
Bangladesh	1943	1,900,000	India	2002	300	Australia	1991	6,000,000
India	1942	1,500,000	India	1972	200	Spain	Sep. 1990	4,500,000
India	1965	1,500,000	India	1965	100	Iran	Apr.1999	3,300,000
India	1900	1,250,000	India	Jun 82	100	US	July 2002	3,300,000
Sov. Union	1921	1,200,000	China P.R.	Jun 94	82	Spain	Apr. 1999	3,200,000
China P.R.	1920	500,000	China P.R.	April 2002	60	Canada	Jan 1977	3,000,000
Ethiopia	May 83	300,000	India	April 2000	50	China P.R.	May 2006	2,910,000
Sudan	April 83	150,000	China P.R.	June 1988	49	Zimbabwe	Oct. 1982	2,500,000
Ethiopia	Dec 73	100,000	China P.R.	January 2003	48	Brazil	1978	2,300,000

with 3.5 million victims), Ethiopia (1973, 1983 with 400,000 deaths), Bangladesh (1943 with 1.9 million victims), the Soviet Union (1921 with 1.2 million victims) and in the Sudan (1943 with 1.5 million victims). Among the 10 cases with the highest number of persons that were affected on a country basis six occurred in India (1,050 million people) and four in China (239 million persons). Of these ten cases four occurred between 2000 and 2003 in China (2002, 2003) and India (2000, 2002). Of the 10 droughts that caused the highest economic damage since 1900, two occurred in China and Spain, and one in Australia, Iran, the US, in Canada, Zimbabwe and Brazil.

During the three decades between 1974 and 2003, about 44% of the reported deaths (2,066,273) and 36% of the affected people (5,076,494,541) from natural disasters were the victims of drought (Guha-Sapir/Hargitt/Hoyois 2004). Thus, drought has become the most deadly and least noted hazard killing some 909,160

people and affecting 1,827,538,000 persons in thirty years, where nearly all 'silent' casualties occurred in developing countries.

The projected changes in the average temperature, in precipitation levels, in the sea-level rise and in these two extreme hydro-meteorological hazards have a direct impact on the crop yield and thus on the food security during the 21st century and may lead to an increase of climate related food crises and conflicts. Thus, drought, heat waves and forest fires directly contribute to soil insecurity, not only in drylands.

5. Societal Outcomes (SO): Famine, Societal Crises and Conflicts

DLDD triggers different societal outcomes, depending on the level of economic development and the degree of environmental and social vulnerability. Severe land degradation and desertification undermines the rural livelihood of often marginalized and poor people in drylands. The resulting decline in water and food has caused hunger and famine primarily in developing countries. These interrelated natural developments and their severe societal outcomes increase soil insecurity and confront the victims with a 'survival dilemma' to leave their rural livelihood, to move to urban slums or overseas.

Precipitation alteration, failed agricultural policy, but also conflicts and wars contribute to hunger and famines as the most extreme outcomes of DLDD. Famines have been documented for the past 4,500 years where climatic factors (droughts and floods) resulted in crop failures that triggered the deaths of many people. During the 19th century, hunger and famine were major triggers for emigration, e.g. from Ireland in 1845-1848 ('Great Famine').

The most severe famines due to droughts in modern history occurred in 1769/1770 in Bengal (10 million deaths), in 1876-1879 in Northern China (19 million deaths), in 1943 in India and Bengal (3 million deaths) and since the late 1970's primarily in Africa (Sahel, Ethiopia, Somalia, Mozambique). In many cases crop failures and famines contributed to social unrest, mass protests, hunger riots and in some cases they even created a revolutionary situation prior to the major revolutions in 1789 in France, in 1848 in several European countries and in 1910 in Mexico (Arredondo Moreno/Huber-Sannwald 2010). Since World War II the most severe food crises occurred in the USSR, Ethiopia, China, India, Biafra, the Sahel region, in Cambodia (Khmer Rouge), Uganda, Somalia, Sudan/Darfur, in the Northeast of Brazil, in the Congo Wars (1998-2009), in Myanmar, North Korea, Afghanistan, Bangladesh, East Africa and Tajikistan (box 2); most of them occurred in the drylands of Africa, Asia and Latin America.

According to the Global Hunger Index of October 2008 the situation was extremely alarming in Zaire (Congo), Ethiopia, Eritrea, Niger, Sierra Leone, Liberia and in Haiti. The situation was alarming for Guinea, Mali, Burkina Faso, Chad, Sudan, Tanzania, Mozambique, Zambia, Malawi, Angola, Madagascar, Pakistan, India, Tajikistan, Nepal, Bangladesh and Laos (figure 6). The GHI combined three indicators: a) proportion of people who are undernourished; b) prevalence of underweight in children under the age of five; and c) under-five mortality rate. Between 1990 and 2008, the global hunger score decreased by 20%, and most highly in Kuwait, Peru, Syria, Turkey, Mexico, Egypt, Vietnam, Thailand, Brazil and Iran. But during the same period the hunger increased in the D.R. of Congo, in North Korea, Swaziland, Guinea-Bissau, Zimbabwe, Burundi, Liberia, Comoros, Botswana and Zambia (figure 7).

In a few cases, periods of drought and famines have resulted in public protests, food riots, small scale clashes between nomads and resident farmers, or between ethnic and religious groups. Since the 1970's, cases of a link between drought and food riots were reported for North Africa (Morocco, Tunisia, Egypt). But the countries concerned referred to food price increases due to the IMF requests to cut food subsidies as a trigger.

During 2007 and 2008, besides natural and political causes, several economic factors have contributed to increasing food scarcity, to food price increases that triggered food unrest causing over 200 deaths. Adding to the DLDD impact, declining global grain reserves and food supply (partly due to a shift from food production to biofuels) as well as increasing demand due to changing diets (China, India) have contributed to massive price increases. The World Food Programme warns of the looming threat of recurrent price hikes in the aftermath of the global economic and banking crises. UN Secretary General Ban Ki-moon warned during 2008 of the "the larger political and security implications of the food crisis" while the IMF director Strauss-Kahn argued that such questions "sometimes end in war".

Box 2: Fault lines of Environmental Induced Conflicts in Central Asia

In Central Asia the collapse of the Soviet Union, the war in Afghanistan and the domestic conflict in Tajikistan created an unstable environment in the newly independent states. Economic, political, ethnic, religious and natural resource scarcity combined with foreign interests (Russia, China, Turkey, Iran and the USA) and regime collapse created weakened states who were unable to integrate alienated minorities. This geopolitical situation was further aggravated by resource conflicts.

The upstream countries of the Syr Darya and Amu Darya (Kyrgyzstan, Tajikistan) generate hydro power, while the downstream countries (Uzbekistan, Turkmenistan, Kazakhstan), rich in fossil fuels, rely on this water for irrigation of extensive cotton and grain production. Downstream agriculture needs water during the summer, the hydro power of upstream countries during the winter. Since independence, the water allocation has been contested, but not the timing of its delivery. In 1998, Kazakhstan, Kyrgyzstan and Uzbekistan signed an agreement on water and energy lacking provisions on enforcement, service and the food security upstream.

With regard to future agriculture, Turkmenistan wants to add to its 1.735 million ha an additional 450,000 ha; Tajikistan to its 469,000 ha another 500,000 ha; Uzbekistan to its 2.321 million ha another 634,400 ha, and Afghanistan plans to extend its 460,000 ha (1965) to a total of 1.6 million ha. These plans require more water that has not yet been negotiated, creating enormous resource pressures, particularly the diversion of water to Afghanistan, where estimates vary from 10 to 20 km³.

To mitigate the water demand crop patterns have changed in the region: from 40% cotton and 7% wheat in 1990, by 2000 cotton was reduced to 35% and wheat increased to 30% (reducing water demand). Tajikistan decreased livestock and increased rice and wheat production (higher water consumption). Water is suboptimally used due to leaching and a deteriorating irrigation infrastructure. Further, the privatization of land, e.g. in Kyrgyzstan from 450 to 40,000 private farms between 1990 and 1996, increased water consumption due to the change from livestock to food crops and the on-farm infrastructure was not equipped to control small plots, creating internal conflicts.

At the regional level Kyrgyzstan would like to charge downstream countries for “water as a national commodity”, but the downstream countries argue that water was given by God. The metering stations are mostly internally controlled and there are doubts about the real data, e.g. in Turkmenistan, while Uzbekistan is using more water than the agreed limits. During droughts Tajikistan overuses water creating higher scarcity downstream. Although Tajikistan is one of the water richest countries/capita, due to lack of capital and proper resource management, its population has no regular access to safe drinking water.

Finally, the intensive use of chemical fertilizers and pesticides polluted soils and water. The poor water management created land degradation due to water erosion. Given the fragile food and economic security in the region, after the fall of the Taliban the drug crime increased. Poverty and social inequality in Central Asia require food aid, food-for-work programmes, a sustainable resource and preventive conflict management. These complex problems require agreed data, regional agreements, sustainable water and soil management including all stakeholders. Only a transparent natural resource governance and management with the harmonization and coordination of sustainable policies can prevent conflicts in these resource depleted regions where soils and water are getting polluted and scarce.

The linkage between the four earth system factors and severe societal outcomes has been addressed for possible security impacts of climate change, in a report (WBGU 2008: 1) on Security Risk Climate Change. A principal cause of land and soil degradation in drylands has been the increased use of marginal land for agricultural production that was either poverty-driven in many developing countries or market-driven in several industrial countries (Mendizabal/Puigdefabrics 2003).

The Sahel zone and most recently Darfur (box 3) has also been a major environmental hotspot due to a climate-induced decline in food production and an increase in environmentally-induced migration. Between 1980 and 2006, land and soil and often also water-related conflicts prevailed in Central America,

Figure 6: 2008 Global Hunger Index. Source: IFPRI (2008). at: <<http://www.ifpri.org/media/20081014ghi.asp>>.

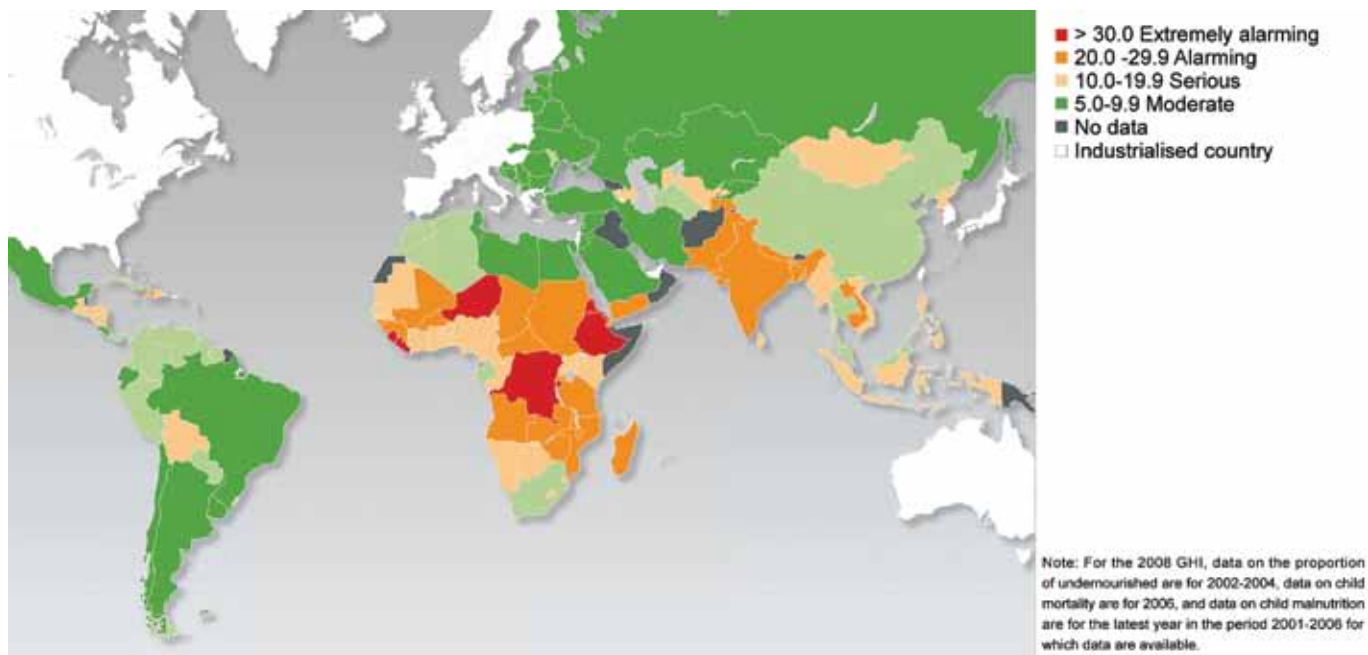


Figure 7: Country progress in reducing the Global Hunger Index between 1990 and 2008. Source: IFPRI (2008)



Box 3: Darfur: DLDD triggering a Civil War.

The Darfur conflict is normally interpreted as a humanitarian crisis and not as a conflict connected to economic interests and DLDD. Extended severe droughts in north and east Africa, during four decades with the most dramatic in 1980, have created a cycle of environmental collapse, conflicts and displacement. In the Northern part of Darfur the nomads from the Zaghawa tribe were forced to migrate southward in search for water and food for their animals, affecting the resident agricultural tribes of the Fur and Masalit. The climate in the Darfur region ranges from arid (West Sudan) to semi-arid, tropical and semi-humid, but most of the population is located around the water sources.



Source: Milany; at: < <http://www.american.edu/TED/ice/darfur.htm>>

Triggering factors were the population increase (that rose 6 times from 1956 to 2002) and the expansion of agriculture and livestock. Deforestation with slash-and-burn clearance became a serious problem as the demand for firewood and charcoal increased in the more rainy regions. The expansion of agriculture on qoz soils increased by 150% and on the clay and wadi soils by 300%.

The preventive animal health services reduced the loss of livestock due to diseases and the rising demand for mutton and beef in the Gulf countries encouraged an increase of livestock what induced farmers to shift their production to cattle. Further, land that was cleared for new settlements put additional stress on the environment and the reduction in bush cover promoted erosion and soil fertility decline, soil depletion and salinization, above all in the top soil layer of the qoz sands, reinforcing the desertification process.

resolved through 11 animal routes, agreed with local leaders in 1950, but the drought and the changing property right conditions increased the pressure on land and water. While animal production is privately owned, the grassland is communal and did not get any improvement, thus productivity of natural pasture has decreased including also the deterioration of trees often used for feeding animals. The pressure on the land and water was not settled by mediation but modern arms were used against the fences of the farmers. “The weakening and politicization of the traditional local administrative system has undermined its effectiveness in minimizing conflicts between the pastoralists and agriculture” (Abduljabbar Abdalla Fadul 2006: 43). In 2003, the conflict erupted when the Sudanese Liberation Army and the Justice and Equality Movement started an armed conflict, which escalated into a civil war with 2.5 million Darfurian being internally and externally displaced, and a dead toll of more than 225,000 people.

Traditionally the competition between resident farmers and nomads was

Ban Ki-moon argued that: “the Darfur conflict began as an ecological crisis, arising at least in part from climate change.” A UNEP study pointed to its environmental dimension:

- The desert in northern Sudan has advanced southwards by 60 miles over the past 40 years
- Rainfall has dropped by 16%-30%
- Climate models for the region suggest a rise of 0.5°C to 1.5°C between 2030 and 2060
- Yields in the local staple, sorghum, could drop by 70%.

in the Andean region, in the Amazon, in Uruguay and Argentina and in the Caribbean in the Americas. Conflicts were registered in the Sahel zone, in eastern and southern Africa, in the Middle East, Central, South, Southeast and East Asia. These regions overlap with the countries that have been prone to the effects of drought, hunger and famine. The regions and many countries that have been most effected by desertification, drought, hunger, and conflicts are also the regions that have experienced net emigration rates. During the past five decades in Southern Europe, Spain, Portugal, Italy and Greece have turned from countries of emigration to countries of immigration primarily from North and West Africa, Latin America (box 4) and Asia

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The Sahel zone and most recently Darfur (box 3) has also been a major environmental hotspot due to a climate-induced decline in food production and an increase in environmentally-induced migration. Between 1980 and 2006, land and soil and often also water-related conflicts prevailed in Central America, in the Andean region, in the Amazon, in Uruguay and Argentina and in the Caribbean in the Americas. Conflicts were registered in the Sahel zone, in eastern and southern Africa, in the Middle East, Central, South, Southeast and East Asia. These regions overlap with the countries that have been prone to the effects of drought, hunger and famine. The regions and many countries that have been most effected by desertification, drought, hunger, and conflicts are also the regions that have experienced net emigration rates. During the past five decades in Southern Europe, Spain, Portugal, Italy and Greece have turned from countries of emigration to countries of immigration primarily from North and West Africa, Latin America (box 4) and Asia.

To summarize, there is a consensus that DLDD contributes to forced migration, especially among vulnerable social groups, and that disasters cause migration, while migration itself may intensify DLDD. There is also agreement that environmental factors are not the sole reasons influencing the decision of people to leave. Demographic, socio-economic, and ethnic push factors as well as pull factors (family networks) have contributed that young people are leaving rural areas.

The link between gradual soil degradation and migration is stressed in the UN Desertification Convention (UNCCD) (Prologue, Art. 17, Sec. 1; UNCCD 1994). Environmentally-induced migration may be triggered by environmental degradation and extreme weather events. Whether this leads to environmental conflicts depends on many intervening factors, such as individual attributes, specific vulnerability, functioning institutions and government structures, and other causes of conflicts.

In the Sahel, for centuries, the nomads have moved with their herds to the lands of resident farmers with higher precipitation, what has often resulted in violent clashes between migrant herders and farmers (see box 3). Many of these small-scale local and national land and water conflicts are not listed in the war data bases as they do not meet their war criteria. Only the Non-state Conflict Project of the Uppsala Conflict Data Program (UCDP) has included minor non-state clashes but in all these conflict datasets, environmental factors, such as DLDD are not listed as causes of conflicts.

Until today there is no comprehensive and systematic scientific assessment of the social science research on the potential societal outcomes of climate change and DLDD. Therefore, systematic theory-guided and comparative empirical research is needed that develops a common methodology to collect data on environmental and pastoral conflicts, and to analyse the possible linkages between DLDD and environmentally-induced people's movements, such as rapid and chaotic urbanization and international migration. It is still too early to draw systematic generalizations from the many case studies that have so far been ignored by many security, conflict and peace specialists.

The reviewed societal outcomes of GEC and DLDD issues resulting in environmentally- and hazard-induced distress migration and in the worst case also in national and regional crises and conflicts in the affected regions may further intensify existing environmental stress that in turn may further increase

Box 4: DLDD Impacts on Mexico

Mexico is severely affected by DLDD, high rates of land flight, urbanization, emigration and transmigration. The causes of DLDD in Mexico are: loss of soil fertility (18%), water erosion (12%); wind erosion (11%); and salinization (8%). In 2008, 120 million hectares were affected by desertification; about two thirds of the country. Of this 93% are a result of inadequate land management, often linked to poverty, due to the lack of productivity of the soil that creates malnutrition, unemployment and misery, and forced each year 400,000 people to abandon their rural communities.

The urbanization process in the central high plateau of Mexico City (capital and 27 municipalities in the State of Mexico) increased the population density during the last century from 32.2 to 2,451 persons/km² as a result of the failed agricultural policy, the exhaustion of the land, inadequate irrigation techniques and low agricultural prices. Deprived rural areas contributed about 38% to this growth.

This rapid rural-urban and later international migration has multiple causes: a) the transfer of the rural capital accumulation to the industrial zones and from the agricultural to the service sector; b) severe drought periods; and c) the human-induced desertification process due to livestock overgrazing that generate a depletion of aquifers, salinization of water and soils, and DLDD. This was further aggravated by the green revolution due to improved seeds, irrigation, the use of heavy machines and chemical inputs. The North American Free Trade Agreement accelerated the annual importation of 16 million tons of basic grains (2008), the emigration of 1,780,000 peasants (1994-2003) due to the loss of rural jobs, the decline of wages in real terms by 23% and the diminution of corn prices by 64%, while simultaneously the price for the basic food basket increased by 256% (1988-2004). Together with the low economic growth of less than 1%, three thirds of the rural population is living now below the poverty line. Through survival strategies women are maintaining often their extended family and pay also for the illegal emigration of their husbands. In 2007 about 12.4 million illegal immigrants were living in the USA, of which up to 50% were Mexicans.

Box 5: Definitions and discussions on environmentally-induced forced migration.

The International Association for the Study of Forced Migration (IASFM) listed three types of displacement: a) conflict-induced, b) development-induced, and c) disaster-induced. Forced migrants are distinguished as: i) refugees, ii) asylum seekers, iii) internally displaced persons, iv) development displacees; v) environmental and disaster displacees, vi) smuggled people, and vii) trafficked people.

The International Organization of Migration (IOM) distinguished among four scenarios on the propensity to migrate due to: a) less advanced stages of gradual environmental change (temporary work migration, support of family with remittances); b) advanced stages of gradual environmental change (permanent often irregular migration, e.g. due to sea-level rise); c) extreme weather events (temporary or permanent movement); d) large-scale development and land conservation (temporary or permanent resettlement).

Migrants may also cause environmental impacts on the areas of destination as a result of deforestation, unsustainable resource management, overexploitation, rapid urbanization, strain of infrastructure, and also in the areas of origin by reducing resources for combating the causes. The IOM listed two scenarios on the interaction between migration, environmental change, human security and conflict. Scenario 1 focuses on human security challenges of environmental change and migration due to diseases, destruction of infrastructure, income decline where the poor are the most vulnerable; and scenario 2 deals with the conflict potential of environment change and migration (environmental conflicts as a cause for displacement, resource competition, beyond coping capacities, impact on social cohesion in urban centres). IOM suggested four principles for an effective environmental migration management: 1) proactive policy and early action; 2) comprehensive and coherent policies; 3) bilateral- and regional cooperation; and 4) multi-stakeholder partnership.

A UNHCR report (1993) listed environmental degradation as one of four root causes of refugee flows besides political instability, economic tension and ethnic conflict. In the framework of the Environmental Security Initiative, OSCE, UNEP, UNDP and NATO are collaborating on projects on environmental migration.

There are major problems with the term environmental 'refugee' because neither in international legal conventions nor in national immigration, asylum or internal security laws accepts 'environmentally-induced causes' for granting a refugee status.

existing political, economic, ethnic and religious conflicts. Environmental stress, droughts, heat waves and forest fires and their societal outcomes also negatively affect the earth system by contributing to a degradation of water and soil as well as the reduction of carbon storage.

All these causal factors and feedbacks directly contribute to soil, water, food, health and livelihood as well as human, gender and environmental insecurity. These manifold security challenges require effective policy responses and long-term proactive strategies, policies and measures for dealing both with the causes and impacts of DLDD.

6. Policy Response (R): Quartet of Knowledge and Three Key Actors

The last aspect in the PEISOR model refers to the policy response where the promotion of best natural resource governance and appropriate technologies can replicate and expand sustainable land management practices. This requires a political strategy to manage the complexity of nature-human interactions where the emerging global, regional and local risks are linked to multiple and often simultaneous crises. Such a response can be facilitated by UNCCD's policy advocacy and necessitates the involvement of the state, the society (social movements, NGOs), the business and academic community. Evidence-based assessments are key factors for affected countries adopting proactive response strategies, policies and measures that include best practices and traditional and modern scientific knowledge.

Focusing on soil security may enhance problem awareness on environmental risks for the population and ecosystems. Thus, good governance, scientific recognition and public awareness call for processes of anticipatory learning and proactive policies to mitigate the probable societal impacts of the complex nature-human interactions in order to prevent that the projected trends become a future reality. Climate change, water, DLDD and biodiversity loss pose multiple threats to international, national and human security that may overstretch both the classic security policy and the capacities of the global governance system. The development and transmission of traditional, scientific and technological knowledge through policy-relevant research, rapid translation into education and training of experts and of the population at large become crucial. Thus, science and knowledge-based policy strategies are an utmost priority for coping with DLDD.

UNCCD's 10-Year strategy that was adopted in COP-8 in Madrid (2007) adheres to the vision: "to forge a global partnership to reverse and prevent desertification/land degradation and to mitigate the effects of drought in affected areas in order to support poverty reduction and environmental sustainability." The UNCCD pursues this mission: "to prevent, control and reverse desertification/land degradation and mitigate the effects of drought through scientific and technological excellence, raising public awareness, standard setting, advocacy and resource mobilization, thereby contributing to poverty reduction" (ICCD/COP(8)/16/Add.1: 17). According to this strategy three of UNCCD's five operational objectives are knowledge-based and refer to science, technology and knowledge; advocacy, awareness raising and education; and capacity-building. UNCCD's third operational objective is "to become a global authority on scientific and technical knowledge pertaining to desertification/land degradation and mitigation of the effects of drought."

Based on this strategic guidance affected countries may address soil security in their programming (adjustment of national action programmes) and monitoring (national reports) tasks. This requires a combination of top-down strategies, policies and measures that must be closely linked with bottom-up local initiatives involving and empowering the people that are affected most by DLDD.

The state remains the key actor due to its financial and administrative resources to plan, initiate, monitor and implement knowledge-based strategies facing DLDD and its societal outcomes. In this regard, the specific system of rule and the governance structures matter. However, many weak states in the countries most affected by DLDD often lack the financial and administrative resources to control their territory and thus to implement DLDD strategies.

For both top-down and bottom-up strategies an active involvement of societal groups and business organizations matters. DLDD must be combated at the local level with the full and active participation of the affected people to enhance their resilience for adapting to periods of drought and mitigating soil degradation. Women play a critical role in the mitigation and adaptation to DLDD, taking advantage of their abilities in resource management and conflict prevention. Water and energy policies should be gender sensitive and trained women can be excellent agents of change, when 'soil security' is declining. UN resolution 1325 recognized the impact of war on women and their role in conflict resolution. For the realization of the Madrid strategy for coping with DLDD (Gnacadjia 2009), the involvement and active participation of the most affected economic sectors (agriculture, services and industry) and of the local business community is evidently crucial. This requires an ethical commitment for long-term sustainable management of land, water and biological resources in the interest of all stakeholders and resisting short-term profits.

IV Conclusions: From Knowledge to Action

This diagnosis of the complex interactions between developments in the earth and human system contributing to DLDD and its potentially violent societal outcomes has pointed to various factors contributing to soil insecurity. The soil security concept highlights the multiple causes, effects, impacts and societal outcomes of soil insecurity and to contribute to proactive policies for grounding security. Through a process of securitization these emerging security challenges of the 21st century linked to the DLDD may be politically upgraded as policy issues of utmost importance that require extraordinary proactive policy measures with the goal to counter the possible worst case developments in the highly vulnerable regional hotspots. The Stern-Report on the economics of climate change has conveyed the clear message that the cost of inaction or of a late policy response to these interdependent environmental and human challenges will be much higher than acting early by launching proactive strategies and policies and measures as has also been convincingly argued by the Millennium Ecosystem Assessment (2005) and by UNEP's GEO 4 report (2007).

1. Scientization, Politicization and Securitization of DLDD

To overcome the vicious circle of desertification, land degradation, droughts, hunger, famines, forced migration and conflicts, the implementation of the UNCCD and of its 10-Year Strategy on DLDD may be assisted by three major activities of scientization, politicization and securitization.

1.1. Scientization of DLDD

UNCCD's 10-Year Strategy (2008-2018) emphasizes its global authority on scientific and technical knowledge on the fight against desertification, land degradation and to mitigate the effect of drought. Its Committee on Science and Technology (CST) is tasked to assess peer-reviewed high quality scientific knowledge and to widely disseminate traditional and modern knowledge based on scientific research and adapted technologies to combat DLDD. Further, the UNCCD secretariat, CST and the Committee for the Review of the Implementation (CRIC) are cooperating closely with leading universities and research institutes in developing common methodologies and monitoring relevant research activities on DLDD issues. In this regard, the following initiatives may be considered under the UNCCD 10-Year Strategy:

- *A Global Network of Researchers* (emerging for instance from ARIDnet, DesertNet and other networks) developing common frameworks, concepts and methodologies, collecting data and best practices on the linkages between soil security and societal outcomes with a focus on the regions most affected by DLDD, migrations and low intensity conflicts, especially in Africa, the Middle East, Central, South and East Asia and Latin America.
- *International Workshops, Symposia and Systematic Exchange of Experiences and Knowledge* related to appropriate research and monitoring approaches, results and the best forms of territorial governance to promote social cohesiveness and income generation through combating DLDD, in connection with soil, water and food security and sustainable agriculture, renewable energy and energy efficiency.
- *Publishing proceedings, best practices and experience*, scientific papers and technological manuals that link the scientific knowledge with dissemination to target audiences.
- *Strengthening the capacity* to include soil security in environmental impact assessment studies and environmental auditing to provide evidence-based findings for decision-makers in affected countries and regions.

A major task of the UNCCD comprehensive communication strategy is to disseminate these research results, to enhance the sense of political urgency in its capacity building and to create public awareness for the needed extraordinary policy measures.

1.2. Politicization of DLDD

Based on globally accepted scientific data on DLDD there is a need to translate into sound policies the required actions to tackle the challenges ahead. Global environmental change poses major environmental challenges for the people affected by DLDD. Besides water, food and health security, the new soil security concept becomes an additional focus for environmental security initiatives that are being pursued by regional security institutions (OSCE, NATO), in cooperation with the global UN programmes for development (UNDP) and environment (UNEP) in the context of the ENVSEC Initiative for Central Asia, the Caucasus and South Eastern Europe. An initiative is being considered for the Mediterranean involving OSCE countries and their partners in West Asia and North Africa.

So far these environmental security initiatives have focused on the Northern Hemisphere (Europe, Central Asia, Mediterranean) while the countries of Africa, Asia and Latin America that will be affected most by the effects of climate change, DLDD, water stress and biodiversity loss have reservations about securitizing global and regional environmental issues due to concerns that these securitization moves may lead to infringements of their national sovereignty.

The goal of this new security discourse has not been to militarize the environment but to demilitarize security by upgrading mutual environmental and human issues to policy issues of utmost importance that require extraordinary non-military sustainable development strategies that address the new DLDD-related security challenges for two billion people living in drylands, and in addition for those suffering from land degradation and drought. The environmental security issues posed by soil insecurity may be considered by other regional organizations that experienced environmentally-induced famines, forced migration, crisis and conflicts.

The DLDD-related security challenges and related preventive measures may be put on the agenda of the Arab League, the African Union and the Organization of American States and of sub-regional organizations, as for example ECOWAS in West Africa, SADC in Southern Africa, of the EAC in East Africa or the South Asian Association for Regional Cooperation (SAARC) whose member countries are experiencing DLDD and severely suffer from water, soil and food insecurity.

The goal of securitizing the ground and developing the soil security as a strategic guidance for efforts to counter DLDD and to implement the UNCCD 10-Year Strategy is not to legitimize new military missions or interventions but to sensitize policy-makers about the need to include DLDD in regional strategies, policies and measures for conflict avoidance and prevention as well as for post-conflict rehabilitation and peacebuilding. Many military hotspots and war-stricken countries have suffered from DLDD (box 3 on Darfur). Achieving peace in these regions requires to mainstream water, soil, food and health security challenges into sustainable development strategies for post-conflict rehabilitation and peacebuilding

1.3. Securitization of DLDD

The new soil security concept is closely related to climate, water, food, health and livelihood security. Global environmental change and DLDD can trigger a vicious circle of environmental degradation, poverty, migration and conflicts over land, water and other resources that may threaten the political stability of regions. Due to climate change many drylands will become hotter and drier and will be even more affected by desertification and salinization of agricultural land resulting in declining productivity of crops and livestock. Natural disasters, environmental degradation and competition for resources exacerbate conflict, especially in situations of poverty and population growth, with humanitarian, health, political and security consequences, including greater migration.

Africa is highly vulnerable to climate change related to multiple stresses and low adaptive capacity. In North Africa and the Sahel, increasing drought, water scarcity and land overuse will degrade soils and could lead to a loss of 75% of arable, rain-fed land. In the context of the Regional Implementation Annex for the Northern Mediterranean, parties can cooperate on the securitization of desertification, land degradation, drought and related migration processes. Building on past initiatives taken under Spain's leadership, such as the adoption of the Madrid Declaration of the OSCE on 30 November 2007, they could foster research to disaggregate the push factors of forced migrations and develop benchmarks for best practices in addressing DLDD induced migratory flows focusing more on the root causes of these trends instead of primarily securing borders to fight illegal immigration.

2. Extraordinary Policy Measures for Enhancing Soil Security

Under present scenarios of global environmental change and the threat of irreversible land degradation, international organizations and governments need to stress the urgency of DLDD by securitizing the ground. This implies upgrading policy measures to enhance soil security as an issue of utmost importance to prevent further weakening in the livelihood of millions of affected and often poor people, primarily in developing countries that lack the means and the financial and administrative capacities of a well-equipped state. In this regard specific proposals are suggested related to the demand side management and efficiency improvements; supplying more environmental services and food with fewer resources; developing alternative livelihoods in drylands; responding to and coping with environmentally-induced migration and avoiding environmentally-induced conflicts.

Finally, adverse climate conditions could provoke severe droughts and crop failures. Thus, a responsible governmental action is to move closer to food sovereignty while also asking for timely food aid. Its transparent distribution could avoid famine and social unrest.

2.1. Demand Side Management and Efficiency Improvements

Combating desertification, land degradation, mitigating the effect of drought and enhancing soil security is a complex process that involves many different activities from river basin management to reforestation. Thus, recovering and protecting the mountain ecosystem is crucial for erosion control, water harvesting, and flood protection, but also for maintaining soils and biodiversity in upstream regions. This helps avoiding disasters, landslides and the destruction of urban infrastructure in lower-lying densely populated areas. In the river plains and valleys, where agriculture, life-stock and urbanization are pressuring on soils, a sustainable and participative land planning is required to optimally use existing resources and to avoid further deterioration.

Remote sensing and geographic information systems (GIS) have revolutionized data collection on DLDD issues, but they cannot substitute field studies on specific human, societal, cultural and historic conditions. The lack of reliable information on desertification contributes to increased land degradation and thus also the cost of DLDD. Therefore, monitoring desertification indicators is a long-term activity that offers the needed information on land and water degradation trends. It should not be limited only to technical items but include the complex interrelationships between human activities and nature.

Upgrading the political will through soil security awareness in affected countries may give drylands the highest priority in governmental support for sustainable land management, because the loss of natural vegetation and/or inappropriate irrigation and cultivation methods can bring limited biological, soil, and water resources to a state of extreme scarcity.

2.2. Supplying More Environmental Services and Food with Less Resources

On the supply side a major goal is to produce more environmental services and food with fewer resources by an efficiency enhancement that must be implemented at the local level through optimized territorial governance. In semi-dry and sub-humid areas, groundwater substitutes the lacking rain during plant growth. Harvesting flood water is a key aquifer management technique for recharging groundwater. Adequate land and basin managements enhance or restore soil fertility. Adequate soil drainage and water-saving irrigation techniques may reduce salinity and water-logging problems and maintain crop yield.

To produce enough food for the rapidly growing population with scarce and polluted resources requires manifold efficiency enhancement activities in agriculture. By using more cereals in the human diet, instead of feeding animals and producing biofuels, the reduction of animal proteins cannot only save water and reduce the negative impacts on climate change, but it can also feed more people with less resources. Rangeland rehabilitation, grazing management, farming system development, and on-farm water husbandry practices, the use of bio-fertilizers and micro-organisms or composting organic waste may improve soil quality.

The plastic greenhouse technology offers the conservation of residual humidity, the use of dew for irrigation and the reduction of plagues, while organic fertilizer could enhance crop yields. Such models often rely on the social organization of cooperatives at the local level, thus enhancing the quality of life and creating jobs for locals and migrants.

Combating desertification is a local and a regional effort that combines traditional and modern knowledge. Most of the densely populated desertified drylands are based on an agricultural and livestock economy, where improvement in the tenure regime must clarify land and water rights. The control of wind and water erosion and of moving sand dunes involves a mixture of trees, shrubs and grasses, together with improved irrigation and soil management techniques. To improve the quality and quantity of water, energy efficiency and renewables from solar, wind and waste play a crucial role. The tropical deserts have the highest solar radiation and could generate in both centralized and decentralized systems energy for desalinization of brackish groundwater or sea water.

2.3. Transition to Alternative Livelihoods and to a Sustainable Economy

Decentralized governance involving women, peasants and indigenous grassroots movements play an important role in the poor rural areas of developing countries. Their expertise may strengthen the strategies for controlling desertification. New technologies that are integrated into traditional management techniques require a prior assessment of natural and social impacts for the involved population. The consolidation of the traditional leadership in the village by old men and women and the integration of young people with technical training and of migrants returning from industrialized countries can support the combat against desertification.

Local stakeholders such as clergymen, spiritual leaders, doctors and lawyers may play a crucial role in efforts to fight against desertification, land degradation and to mitigate the effect of drought. Schools and teachers are natural sources of new knowledge that educate generations of young people. As desertification processes evolve relatively slowly, these trained young people are the future actors to fight from the grassroots against desertification. They may also be trained in energy efficiency and renewables for exploiting their comparative advantages of sun and wind energy. Generating a sustainable energy and transport systems could promote drylands ecotourism and other forms of private sector investments with low environmental impact and thus alleviate pressure on the land. Off-farm jobs should create and generate the financial resources to recover degraded land and to maintain fragile dryland soils. Besides the integration of such concrete proposals for coping with DLDD in the National Action Programmes, additional measures are needed to respond to societal outcomes, such as environmentally-induced migration and crises and conflicts.

2.4. Responding to and Coping with Environmentally-Induced Migration

The most cost-effective and humane possible policy responses to environmental migration are to intervene at the earliest possible stage. Sustainable development assistance must engage the most vulnerable to strengthen the adaptation capacity of communities affected by DLDD, the more so in the context of climate change. Community stabilization through participatory governance should involve diasporas and returning migrants to optimize their financial resources. Urban authorities should be prepared to limit negative impacts on the environment due to the influx of population. The expected additional flow of environmental migrants requires capacity building to reduce the push factors of population movements and to cope with irregular migration, including human trafficking.

2.5. Avoiding Environmentally-Induced Conflicts

As DLDD may cause societal crises and low level forms of conflicts, addressing such causes may avoid the potentially violent societal outcomes. A first step is public awareness to contribute to a process of political learning and co-operation. Anticipatory learning is a tool for crisis prevention and for peace building involving academics and government officials. Joint North-South anticipatory learning calls for a debate on longer-term challenges and a multidisciplinary search for complex strategies to cope with the root causes and their socio-economic implications. Anticipatory learning must be addressed at three levels: across the boundaries of scientific disciplines, across the North-South divide and between scientists and action-oriented decision-makers and other crucial stakeholders.

In this regard, partnership-building measures in the economic and ecological realm may have positive impacts on the societal and cultural level by fostering a common response of decision makers and the public. An example to mitigate impacts of DLDD could be a survival pact linking the virtual water through food imports with the virtual sun or renewable energy exports. Such a partnership building project implies a new international division of labour that links two commodities that are crucial for life

(cereals) and work (energy). Active and efficient implementation of climate policies and of measures to cope with DLDD could become the best security platform to prevent environmental conflicts from occurring and to contribute to a sustainable peace that combines nonviolent conflict resolution, more equitable economic relations and sustainable development policies in North and South. We thus see the need to analyse the complex interrelationship between the factors of the earth and human systems and initiate regional climate impact studies and specific mitigation strategies against DLDD.

Thus, long-term oriented and proactive policies of sustainable land management that prioritize combating DLDD require functional cooperation to enhance the fight against soil erosion and desertification, to increase water management and pollution control techniques, to offer employment in rural areas and in intermediary urban networks. Sustainable agricultural policies backed by decentralized governance of natural resources may become the most cost effective policy of conflict prevention and peace-building. Promoting soil security through the empowerment of grassroots stakeholders will enhance both human and societal security in the affected regions. It will expand the outreach of adaptation measures to climate change and may also increase soil security and reduce the costs of coping with the consequences of the missed opportunities that exist for multilateral cooperative policies in the early 21st century.

V. Policy Recommendations: Implementing Knowledge to Action

Within its adopted policy framework the UNCCD is to pursue four strategic and five operational objectives for which specific recommendations are offered below with regard to the dual focus of this study on securitizing the ground and grounding security.

1. Knowledge Creation and Management

To enhance UNCCD's operational objective of knowledge-based initiatives these proposals should contribute to achieving soil security through research capabilities on the DLDD issues.

1. Existing continental and regional networks on desertification should be complemented with networks of researchers in Africa, Asia and Latin America. These regional networks should develop standardized research methods to guide data collection and fact finding also on the links between soil security and environmental and societal outcomes with a focus on those regions most affected by DLDD, migrations and low intensity conflicts.
2. In the framework of the Earth System Science Partnership the four existing science programmes, the World Climate Research Programme, the International Geophysical and Biological Programme, the International Human Dimension Programme and Diversitas, should be complemented by a fifth cross-cutting science programme addressing policy-relevant research needs related to DLDD with the goal to overcome the lack of agreed methodologies, concepts and comparable data, and thus to initiate, coordinate and plan international multidisciplinary research activities.
3. Based on the model of the IPCC an interdisciplinary scientific panel should be set up, possibly in the context of livelihood and food security, to periodically assess the results of peer-reviewed research and to publish an authoritative assessment of the best available scientific knowledge on desertification, land degradation and droughts.
4. These three proposals should facilitate the creation, assessment and transfer of knowledge to enhance the political urgency and strengthen the CST to translate the scientific knowledge into scientific-technological advice. As part of a proactive strategy of sustainable development contributing to a sustainable peace, clear priorities for action shall be identified to legitimate the extraordinary measures needed for coping with soil security in the context of DLDD.
5. To create scientific and public awareness for the security aspects of DLDD, specific initiatives should be launched and funded by UNCCD member parties:
 - a. Case studies on DLDD-induced forced migrations may be launched in the context of UNCCD's Regional Implementation Annex for the Northern Mediterranean building on past initiatives by Spain, such as the adoption of the Madrid Declaration of the OSCE on 30 November 2007. Such a study may point to knowledge gaps on environmentally-induced forced migration and develop benchmarks for best practices in addressing DLDD induced migratory flows in both source and target countries.
 - b. A systematic assessment of soil security reviewing the globally available peer reviewed scientific knowledge on desertification, land degradation, drought and other hazards (heat waves, forest fires, dust storms) as well as the possible societal outcomes of forced migration, crises and conflicts should develop scenarios for adapting and mitigating DLDD outcomes. This requires obviously the participation of scientists from the most affected countries.
 - c. A study on the cost of inaction in combating DLDD should also include estimates on the socio-economic costs of increased forced migration flows and of emergency measures coping with natural hazards, food and water insecurity and potential conflicts.

- d. In this regard, specific recommendations of the second Almeria Symposium on desertification and migration (2006) are validated by this study and are recalled below for easy reference⁴.

These studies may become the basis for policy initiatives to securitize DLDD in appropriate international organizations (UN, OSCE, OAS, AU, Arab League, NATO, EU) that may be launched by UNCCD member parties during their presidencies of these organizations. Spain may use its leadership on DLDD and soil security during its EU Presidency (2010).

2. Awareness Raising

A second task of the UNCCD 10-Year Strategy is to create public awareness for DLDD through:

6. Dissemination of information on soil security issues based on the scientization of DLDD. The UNCCD secretariat should cooperate closely with leading universities and research institutes globally, including the UNU system, in translating knowledge to relevant actions on DLDD related security issues by informing parties through the CRIC and CST.

Documenting soil security hotspots by publishing peer reviewed research, best practices and experience as scientific papers and technological manuals that may identify thresholds of extreme land degradation and support preventive actions.

3. Policy Advocacy

The UNCCD Strategy links research and awareness raising to policy advocacy that may be fostered through:

7. Establishment of an interagency land network that may lead to a new epistemic community on DLDD issues to foster international cooperation and bring together science and policy making on soil security issues in the context of implementing the UNCCD strategy. Under the leadership of UNCCD, several UN agencies, among them the UN Food and Agricultural Organization (FAO), the United Nations Educational, Science and Cultural Organization (UNESCO), the World Health Organization (WHO), the World Meteorological Organization (WMO), the UN Development Programme (UNDP), the UN Environment Programme (UNEP), the United Nations University (UNU), the United Nations Sudano-Sahelian Office (UNSO), OSCE, NATO, IUCN and the Consultative Group on International Agricultural Research (CGIAR), may be involved in prioritising support for soil security in the context of sustainability strategies for drylands and countries suffering from DLDD, taking the experience of the UN/ISDR into account.
8. International workshops and symposia may be held in the near future contributing to a systematic interchange of practical experiences and knowledge that should relate to the best forms of territorial governance to promote soil security through social cohesiveness, income generation and combating DLDD, in connection with water management, food supply and sustainable agriculture, renewable energy and energy efficiency.

⁴ See the recommendations of the II International Symposium: "Desertification and Migration", Almeria, Spain, 25-27 October 2006; at: <http://www.sidym2006.com/eng/eng_ponencias_conclusiones.asp>. 1) Multidisciplinary studies should include an analysis of socio-environmental conditions of migration, including its causes and consequences with a conceptual framework and improved statistics. International organizations (UNCCD), the affected countries and civil society should promote scientific and technological developments that will enhance economic activities in arid areas. 2) A research, training and coordination centre on desertification and migration in Spain may be considered and become a partner of the UNCCD Secretariat and of the UNU system. The UNESCO initiative on the Decade of Education for Sustainable Development (2005-2014) may offer a political framework to reduce desertification and migration. 3) The Plataforma Solar de Almeria as a leading centre for the development of solar energy in Europe may become a focal point for training experts from DLDD affected regions that may be co-financed by the EU and international financial institutions. 4) A trilateral initiative of Spain, México and Germany to cooperate in research on climatic change, desertification, migration and renewable energies potential in drylands may be pursued in the OECD framework.

9. International initiatives to fight against desertification and migration may be advanced by pro-active strategies for adjustment and mitigation that combine desertification challenges and its impact on migration. More resources should be invested in emigration areas as a preventive measure and be used to fight DLDD. The EU countries and their private sector may fund proposals to overcome DLDD by stressing the potential of rural production, renewable energies or eco tourism. Hyper-arid, arid, semi-arid and dry sub-humid areas have huge technical potentials for developing sustainable energy resources.
10. On the national level, the countries affected by DLDD may enact legislation on soil security issues that support improved agricultural and land management practices.

4. Capacity Building

Implementing knowledge on DLDD into proactive policies for grounding security requires:

11. Strengthening capacity for embedding the assessment of levels of soil security into the environmental impact and risks assessment, land use planning and environmental auditing. This implies balancing capacity building based on traditional and innovative knowledge.
12. Training on best practices for conflict settlement mechanisms should be provided at the sub regional and national levels and linked whenever relevant to the adjustment process of the UNCCD National Action Programmes.

5. Channelling Resources

13. The above proposals for achieving soil security in the 21st century necessitate additional financial resources to counter extreme societal outcomes of DLDD for human, national and international security in the environmental, societal and economic security realms.
14. International financial institutions (IFI), such as the World Bank and the regional development banks, and the International Fund for Agricultural Development (IFAD), facilities, such as the Global Environmental Facility (GEF), in cooperation with regional organizations (e.g. DG Development and Environment of the EU) and national donors (ministries of development cooperation and environment) may review their policies related to land and soil and identify thresholds and benchmarks of soil security for allocating financial resources land and water development projects for local areas in regions that may otherwise be affected by soil insecurity.
15. Climate related finance mechanisms may also offer additional needed resources for affected rural areas for ecosystem services, for the mitigation and adaptation to climate change. The post-2012 climate regime to be adopted in December 2009 in Copenhagen at COP 15 of the UNFCCC may contribute to achieving soil security.
16. Local area development programmes in regions affected by soil insecurity should promote sustainable livelihood and off farm income generation including micro credit, insurance and land use micro investments for vulnerable groups at risks of social destabilisation due to DLDD.

These 16 recommendations are intended to ground security by proactive policies to cope with the scientific, political and security challenges posed by the interrelated effects of climate change, water stress, biodiversity loss as well as desertification, land degradation and drought. 2007 has been a turning point for a successful securitization of global climate change due to the release of the fourth IPCC assessment report. It is worth noting that the discussion of climate change as a security issue in the UN Security Council in April 2007, the awarding of the Nobel Peace prize to the IPCC and the adoption of the EU's policy paper on climate change and international security (March 2008) and its incorporation into the EU's European Security Strategy (December 2008), has gradually pointed to the securitization of DLDD thanks to the sustained political leadership of affected countries such as Spain.

Soil insecurity severely challenges the security and survival of billions of people during the 21st century. The securitization of the ground by making DLDD a policy issue of utmost importance that requires extraordinary

measures still requires a major increase in public awareness and policy advocacy. The successful securitization of global climate change has been facilitated by an institutionalized epistemic community supported by the World Climate Research Programme that was set up in 1987, by the IPCC that was established by the UN General Assembly in 1988 and that relies on the World Meteorological Organization. No similar knowledge-based and well-funded scientific infrastructure exists yet for DLDD. Thus, the study submits that intensified scientization, politicization and securitization of DLDD security concerns must be fostered in the context of the 10 years UNCCD Strategy. Grounding security by acting now may be both the most promising and cost-effective security policy for achieving the mutual goals of sustainable development and sustainable peace.

Annex 1: Historical Context of DLDD and its Impacts

During the past millennia there have been various cases of massive people's movements that were partly triggered by environmental factors and extreme weather events (e.g. of drought that resulted in dropping precipitation, bad harvests, decline in food availability and famine forcing people to leave their homes and leading to massive peoples' movements).

The role of climate for the fall of civilizations has been disputed between the climate determinists that treat "climate as a prime mover, repeatedly playing a salient role in shaping our historical experience", and the climate sceptics that "locate it more towards the periphery of causation as a factor liable to come critically into play as and when a political regime is delicately poised for other reasons" (Brown 2001). The essence of the first paradigm is that the geographical-physical conditions, which are determined mainly by the climate and climate changes, decide the character of the people, as well as their history. Since the 1930's the anthropogenic model placed all blame on human mal-practice.

Since the Sahelian droughts (1968-1984) a neo-deterministic paradigm "emphasizes the dynamic interaction between the natural environment as decided by the geographical position, climate, water, soil, vegetation, etc. and the human society supported by that environment. This interaction oscillates within the endurance capacity of both systems dictated by their sustainability, as well as by the flexibility of the natural system and the agility of the human mind" (Issar/Zohar 2009).

For the Holocene, Bluemel (2009) distinguished between 'climatic optima' as "periods with mostly favourable conditions for human societies; while 'climatic pessima' are cooler periods with unfavourable and often precarious living conditions." During the warm period (10,000 -5,000 years before present: BP) the Saharian desert had nearly disappeared and changed into a grassland and bush savannahs where pastoral nomadic life emerged. This change "of the Saharian ecosystem is an impressive ... example for the ecological consequences of climatic variations" (Bluemel 2009). During the following cooler period with the diminished precipitation the 'green Sahara' ended and the desert expanded again.

Many neo-determinists have argued that during the Holocene era both climate pessima (cold periods) and changes in the precipitation patterns and long periods of drought were major triggers for several phases of massive people's movements:

- The warm phase (3,300 BP) in central Eurasia triggered a movement of various people, including the so-called Sea Peoples originating in the Balkan Peninsula and from the Aegean Sea and from different Mediterranean lands and islands. They moved into the Fertile Crescent after the disintegration of the Mycenaean civilization, the destruction of the Hittite empire, and the Canaanite cities along the Levantine coast.
- The period of massive people's movements may be divided into two phases: the first (300 -500 AD) mobilized Germanic, Turkish and other peoples and put Germanic peoples in control of the societies of the former Western Roman Empire while the second phase (500-900 AD), saw Slavic, Turkish and other peoples on the move, re-settling Eastern Europe and making it predominately Slavic (Avars, Huns, Arabs, Vikings, Varangians). There were several phases of mass migrations from the steppes of Central Asia during the 9th century to Hungary (Huns), Turkey (Turk peoples) and to Northern Europe (Finland), and by the Mongols to Russia up to Eastern Prussia, to the Middle East, India and Japan.
- The Turco-Mongol invasions occurred during the 13th century, resulting in a Mongol Empire covering much of Asia by 1300 due to a series of conquests in Central and Western Asia, reaching Eastern Europe by the 1240's. Ethnic groups from the central Asian steppes ruled into the 15th century in Persia (Timurid dynasty) and in Russia (Tatar, Mongol raids), and into the 19th century in India (Mughal Empires).

Major environmental changes due to natural climate variability and longer periods of drought and famine resulted in the sudden collapse of several high civilizations (Diamond 2005):

- By 5,500 BP, the Late Uruk society flourished in southern Mesopotamia. The expansion of this society suddenly collapsed at about 5200-5000 BP due to a severe drought.
- A complex interrelation between cultural and environmental factors influenced the collapse of the Mycenaean kingdom, the Hittite Empire in Anatolia and Syria and the Egyptian Empire (3206-3150 BP) due to periods of drought (Weiss 1982).
- Between 810 and 910 AD, several mega-droughts occurred in the Yucatán Peninsula and in the Petén Basin (Mexico, Guatemala, Belize) that resulted in a fertility decline of the soils. Intensive agriculture using irrigation, population growth and a rising food demand resulted in land degradation and drought and triggered the fall of the Mayan empire.
- In China, isotopic studies linked the social unrest and decline of Chinese dynasties to changes in precipitation patterns. The decline of the Tang regime (850-940 AD); a strong decline of the monsoon during the Yuan period (1340-1360); and in the late Ming period from 1580 to 1640 were all related to severe droughts. When the monsoon declined, the Tang, Yuan and Ming dynasties collapsed.

During the Holocene these selected historical cases of massive peoples' movements and collapse of civilizations indicate a causal link between periods of severe soil insecurity due to DLDD and major often violent societal outcomes that are increasingly being perceived or projected as possible societal outcomes due to anthropogenic climate change and DLDD.

Today, various analyses and studies referring to DLDD argue, in the words of an EU paper (2008) that "desertification could trigger a vicious circle of degradation, migration and conflicts over territory and borders that threatens the political stability of countries and regions."

Annex 2: Definitions of Desertification, Land Degradation and Drought

In response to the Sahel drought, the *UN Conference on Desertification* (UNCOD) in 1977 proposed 28 recommendations to combat desertification offering the first official definition:

Desertification is the diminution or destruction of the biological potential of land, and can lead ultimately to desert-like conditions. It is an aspect of the widespread deterioration of ecosystems, and has diminished or destroyed the biological potential, i.e. plant and animal production, for multiple use purposes at a time when increased productivity is needed to support growing populations in quest of development (UNCED, Part I, 1996).

In 1990, UNEP claimed: “Desertification is land degradation in arid, semi-arid and dry sub-humid areas resulting from opposite human impact” (UNEP 1991). During the Earth Summit (1992) this definition was amended as “resulting from various factors, including climatic variations and human activities” (UNEP 1991). Both definitions see land degradation as a continuous phenomenon that leads to the reduction of potential resources. Mechanisms and consequences were omitted, the responsibility of humankind was diluted, and the combat against desertification should be launched at the regional and local level and not in global terms. Several degrees of severity are noted and the problem of irreversibility is defined as occurring in one generation and its spatial application is limited to dry ecosystems.

Based on a mandate of UNCED (1992) the *United Nations Convention to Combat Desertification* (UNCCD) was adopted on 17 June 1994, and it entered into force on 26 December 1996. At the second Conference of Parties (COP II) in Senegal (1998) a UNCCD permanent secretariat was set up that opened in Bonn (Germany) in January 1999.

According to the UNCCD treaty (1994), which elaborates on previous definitions, “desertification is caused by complex interactions among physical, biological, political, social, cultural and economic factors.” According to Art. 1 (b) “*combating desertification*” aims at:

“(i) prevention and/or reduction of land degradation; (ii) rehabilitation of partly degraded land; and (iii) reclamation of desertified land.” *Drought* is used for “the naturally occurring phenomenon that exists when precipitation has been significantly below normal recorded levels, causing serious hydrological imbalances that adversely affect land resource production systems.” The task of “mitigation the effects of drought” (Art. 1, d) implies improved drought prediction “to reduce the vulnerability of society and natural systems to drought.”

UNCCD defined in 2007 four strategic objectives that will guide the actions of all stakeholders and partners:

1. to improve living conditions of affected populations
2. to improve the condition of affected ecosystems
3. to generate global benefits through effective implementation of the UNCCD and
4. to mobilize resources to support the implementation of the convention through building effective partnerships between national and international actors (UNCCD 1994: 36).

The 10-Year Strategy recognized the global magnitude of the challenge. Indeed desertification is not just a problem for developing countries or for particular groups of people. UNCCD noted that desertification and land degradation affect men and women differently according to their roles in productive activities. Men and women are all equal, but culture and social representation starts do distinguish and to discriminate,

especially women. The decline of soil fertility reduces the crop yields and their income. When the socio-economic situation worsens, men often emigrate seasonally or permanently transferring the workload and the survival strategies to women, who face adverse conditions with a decline in crop productivity. The *Millennium Ecosystem Assessment* (MA) stated:

The definition of biological productivity and economic benefit depends on users' priorities - transforming woodland to cropland may decrease biological productivity, degrade the economic benefit of firewood production but increase the economic benefit of food production. With respect to the mechanisms of land degradation - changes in the properties of the land (soil, water, vegetation) do not correspond linearly to changes in productivity. Loss of productivity can also be attributed to non human-induced factors such as rainfall variability and human factors such as low labour input. Thus, a range of interacting variables that affect productivity should be addressed in order to assess objectively and unambiguously land degradation (Safriel/Adeel 2006: 626-627).

Changes in the Anthropocene are related to fossil energy use, increase in CO₂ and other greenhouse gases, but also due to population growth, increase in food demand, intensification of agricultural production, regressive globalization with a greater regional and social inequality. Under these shifting conditions, DLDD has been linked with poverty, adaptation to climate change, the loss of biodiversity and natural disasters.

In scientific terms, the *Global Assessment of Human Induced Soil Degradation* (GLASOD 1990) and the *World Soil Information* (ISRIC) are global sources on land degradation data (FAO 2000). Regional studies were conducted on human-induced soil degradation in Latin America; South and South East Asia, in Russia and in Central and Eastern Europe. A consensus emerged that DLLD is both a human-induced and a natural process with negative affects on land affecting the function of an ecosystem for storing, recycling water, generating energy and nutrients.

Annex3: Recent IPCC Assessment of Relevance for DLDD

In the first four assessment reports of 1990, 1995/1996, 2001 and 2007, Working Group II of the IPCC has assessed the complex impacts of climate change on the land, ground and soils. Climate change will impact differently on the five continents. These different territorial impacts may trigger different societal and political responses by the most affected populations. The IPCC Synthesis Report of AR4 (2007c: 50) summarized the projected climate change impacts for *Africa* until 2100, of which these are relevant for DLDD:

- By 2020, in some countries, yields from rain-fed agriculture could be reduced by up to 50%. Agricultural production, including access to food, in many African countries is projected to be severely compromised. This would further adversely affect food security and exacerbate malnutrition. ...
- By 2080, an increase of 5 to 8% of arid and semi-arid land in Africa is projected under a range of climate scenarios (*high confidence*).

The IPCC Synthesis Report (IPCC (2007c: 50) summarized the projected climate change impacts for DLDD in *Asia* until 2100:

- By the 2050s, freshwater availability in Central, South, East and South-East Asia, particularly in large river basins, is projected to decrease. ...
- Climate change is projected to compound the pressures on natural resources and the environment associated with rapid urbanisation, industrialisation and economic development. ...

The IPCC Synthesis Report (IPCC (2007c: 50) summarized the projected climate change impacts for *Australia* and *New Zealand* until 2100: ...

- By 2030, production from agriculture and forestry is projected to decline over much of southern and eastern Australia, and over parts of eastern New Zealand, due to increased drought and fire. ...

The IPCC Synthesis Report (IPCC (2007c: 50) summarized the projected climate change impacts for DLDD in *Europe* until 2100:

- In southern Europe, climate change is projected to worsen conditions (high temperatures and drought) in a region already vulnerable to climate variability, and to reduce water availability, hydropower potential, summer tourism and, in general, crop productivity.

For *Latin America*, the synthesis report (IPCC (2007c: 50) summarized the projected climate change impacts for DLDD until 2100:

- By mid-century, increases in temperature and associated decreases in soil water are projected to lead to gradual replacement of tropical forest by savannah in eastern Amazonia. Semiarid vegetation will tend to be replaced by arid-land vegetation. ...
- Productivity of some important crops is projected to decrease and livestock productivity to decline, with adverse consequences for food security. In temperate zones, soybean yields are projected to increase. Overall, the number of people at risk of hunger is projected to increase.
- Changes in precipitation patterns and the disappearance of glaciers are projected to significantly affect water availability for human consumption, agriculture and energy generation.

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