FOUR PHASES OF RESEARCH ON ENVIRONMENT AND SECURITY

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Summary

Research on linkages between the environment and security and on environmental security has gradually evolved since the end of the Cold War. Since the 1970s global environmental change has become a new research field in both the natural and social sciences. As a result of the global contextual change of 1989-1991 the concept of security itself has widened and deepened (see: Reconceptualizing Security). Three research phases are distinguished: a first conceptual phase in the 1970s and 1980s on the environmental impact of wars, and on policy proposals to include an environmental dimension into U.S. national security; a second empirical phase with two research projects in Canada and in Switzerland; and a third phase with manifold theoretical and empirical research but little integration. Several authors (Dalby, Brauch et al) have proposed a fourth phase “of synthesis and reconceptualization”.

This chapter offers an overview of major research contributions during these three phases with a special focus on the theory-guided empirical case studies of Homer-Dixon and Bächler and their major critiques, on several projects of the third phase by GECHS, two new Swiss projects (ECOMAN and ECONILE), on syndromes of global change, on causes and intensity of violent conflicts, on transboundary freshwater, and of the US
State Failure Task Force, as well as on classifications of the causes of war. This is followed by critiques of the environmental security and environmental conflict literature by Diehl and Gleditsch (2001), Peluso and Watts (2001), Conca and Dabelko (2002), as well as by Bannon and Collier (2003) and by a survey of international environmental security activities in the UN and EU. The piece concludes with conceptual proposals for a fourth phase of research on human and environmental security and peace (HESP) and a review of ongoing research.

1. Introduction

Research on linkages between the environment and security and on environmental security has gradually evolved since the end of the Cold War. Since the 1970s global environmental change has become a new research field in both the natural and social sciences. This research has been integrated in a model on global environmental change, extreme outcomes and on the political process in dealing with them (see The Model: Global Environmental Change, Political Process and Extreme Outcomes). As a result of the global contextual change of 1989-1991 the concept of security has widened and deepened (see Reconceptualising Security from National to Environmental and Human Security). Since 1990, the four key scientific concepts of security threats, challenges, vulnerabilities and risks have proliferated and have been used by different scientific communities with different meanings (see Security Threats, Challenges, Vulnerability and Risks).

Wolfers (1962) 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”. Three basic views on security have been distinguished by the English school (Wight 1991) that of: a) a Hobbesian pessimist (realism) where power is the key category; b) a Kantian optimist (idealism) where international law and human rights are crucial; and c) a Grotian pragmatist where cooperation is vital. Influenced by these world-views, security is a key concept of competing schools of a) war, military, strategic or security studies from a Hobbesian perspective and b) peace and conflict research that has focused on conflict prevention from a Grotian or Kantian view.

Since 1990, many authors (Buzan/Wæver/de Wilde, 1998) have observed a widening and a deepening of the security concept in post-modern OECD countries, while in USA since 2001 a military security concept has prevailed. Within the UN and NATO, different security concepts coexist, a Hobbesian state-centered political and military security concept and an extended Grotian concept that includes economic, societal and environmental security dimensions (Table 1). While many scholars in the Hobbesian tradition and security studies prefer a narrow concept of “national security”, specialists on environmental change and in peace research, as well as many international organizations, have continued to use concepts of “environmental security”. The concept has also been sectorialized as energy, food, health and livelihood security and used by international organizations.
Table 1 combines five dimensions of the widened security concept (military, political, economic, environmental and social), and five levels of interaction or referents of security policy (human, societal/community, national, regional and international as well as global. Not all governments have accepted this widening of the security concept. Since the 1990s, most OECD countries, the European Union and many UN organizations have accepted this widening and used concepts of extended or human security in their policy statements, but since 20 January 2001, in USA, a shrinking of the security concept has been observed, and in all parties to the conflict in the Middle East, as well as by many developing countries, a narrow security concept has prevailed. These different security agendas have complicated the transatlantic security cooperation and the Euro-Mediterranean security dialogue (Brauch/Marquina/Biad, 2000).

The “security dilemma” focuses to a threat-driven military security concept where one nation’s armament is perceived by its opponent as a threat and thus contributes to an arms race. The survival dilemma has been introduced by Brauch (2004) as a new concept where environmental security challenges expose the societal vulnerability for those with a high degree of societal vulnerability that may be the most seriously affected during the realization of natural (or man-made) environmental hazards. The survival dilemma implies for the most vulnerable (the poor, women with children, old persons, indigenous populations) either to stay and die, or to migrate as internally displaced persons and thus often to become victims of clashes with resident populations.

During the Cold War, environmental concerns were rarely perceived as security problems. ‘Environment’ and ‘ecology’ as key concepts in the natural and social sciences have been used in different traditions and schools, in conceptual frameworks and approaches. The Encyclopaedia Britannica defined environment as: “the complex of physical, chemical, and biotic factors that act upon an organism or an ecological community and ultimately determine its form and survival”. Ecology refers to: “study of the relationship between organisms and their environment”.

The environmental debate has gradually evolved since the 1950s, and since the 1970s global environmental change has focused on “human-induced perturbations in the
environment” that encompass “a full range of globally significant issues relating to both natural and human-induced changes in the Earth’s environment, as well as their socio-economic drivers”. According to Munn (2002) “changes greater than humankind has experienced in its history are in progress and are likely to accelerate”. Dealing with future environmental trajectories requires more than a prediction of a single future path. It requires “mapping a broad range of future environmental trajectories” that may confirm “that the changes of the twenty-first century could be far greater than experienced in the last several millennia”. Since the 1990s, besides the International Geosphere-Biosphere Program (IGBP), the International Human Dimensions Program (IHDP), the World Climate Research Program (WCRP), and DIVERSITAS were instrumental in rallying a global environmental change research community around coordinated scientific projects, and sensitizing policy-makers and the public.

The human dimension of global environmental change covers both the contribution and the adaptation of societies to these changes. These processes pose many questions for social, cultural, economic, ethical, and even spiritual issues. Wilson (1998) noted a growing consilience (the interlocking of causal explanations across disciplines) in which the “interfaces between disciplines become as important as the disciplines themselves” that would “touch the borders of the social sciences and humanities”. Global (environmental) change deals with changes in nature and society that have affected humankind as a whole and will increasingly affect human beings who are both a cause of this change and often also a victim. However, those who have caused it and those who are most vulnerable to and affected by it are often not identical. Global change affects and combines the ecosphere and the anthroposphere. The ecosphere comprises the atmosphere (climate system), the hydrosphere (water), the lithosphere (earth crust, fossil fuels), the pedosphere (soil) and the biosphere (life), while the anthroposphere deals with populations, social organizations, knowledge, culture, economy and transport systems (WBGU 1993).

More recently, Steffen et al (2004) have argued that a global perspective on the interactions between environmental change and human societies has evolved. This led to an awareness of two aspects of Earth System functioning: “that the Earth is a single system within which the biosphere is an active, essential component; that human activities are now so pervasive and profound in their consequences that they affect the Earth at a global scale in complex, interactive and apparently accelerating ways”. They have argued “that humans now have the capacity to alter the Earth System in ways that threaten the very processes and components…upon which the human species depends”. In the social sciences, the analysis of global environmental change and human-nature relationship is polarized between epistemological idealism and realism (Glaeser 2002: 11-24), or between social constructivism and neo-realism. The neo-idealist orientation has highlighted two aspects: a) the uncertainty of scientific knowledge and claims; and b) the attempt to explain the scientific and public recognition of environmental change influenced by political and historical forces. Two opposite standpoints exist on environmental issues:

- A pessimist or Neo-Malthusian view stimulated by Malthus’ Essay on Population (1798) that stressed the limited carrying-capacity of the Earth to feed the growing population;
• An optimist or Cornucopian view that believed an increase in knowledge, human progress and breakthroughs in science and technology could cope with these challenges (Table 2).

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<tr>
<th>Worldviews/Traditions on security (➔)</th>
<th>Standpoints on environmental issues (➔)</th>
<th>Hobbes, Morgenthau, Waltz (neo)realist pessimist</th>
<th>Grotius liberal pragmatist</th>
<th>Kant Neo-liberal institutionalist (optimist)</th>
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<td>Neo-Malthusian pessimist</td>
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<td>Power matters</td>
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<td>International law matters and prevails</td>
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<td>Resource scarcity</td>
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<td>Equity-oriented pragmatist</td>
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<td>V International organizations and regimes</td>
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<td>Cooperation will solve</td>
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<td>Cornucopian neo-liberal optimist</td>
<td>VII</td>
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<td>Technological ingenuity will solve</td>
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Table: 2. Worldviews and standpoints on security and environmental issues

These two positions have dominated the environmental debate since the Club of Rome’s Limits of Growth (Meadows 1972), and Lomborg’s (2001) Skeptical Environmentalist. Homer-Dixon (1999) distinguished among neo-Malthusians (biologists, ecologists); economic optimists (economic historians, neoclassic economists, agricultural economists) and distributionists (poverty, inequality, misdistribution of resources). Brauch (2002, 2003) opted for a third perspective of an equity-oriented pragmatist. Table 2 combines the three worldviews on security with three standpoints on the environment. This leads to nine combined ideal type positions on security and environmental issues. That of the United Nations system (position V) may be described as that of Grotian pragmatism in security terms and as an equity oriented pragmatic environmental perspective where “cooperation matters” and is needed to solve problems.

The claims on causal linkages between global environmental change, environmental stress and extreme outcomes have stimulated much research. According to Dalby (2002) and Brauch (2003) the research on environmental security evolved in three stages:

• Phase I: The research in the 1970s and 1980s resulting from the cooperation first between UNEP and SIPRI and later between UNEP and PRIO on the environmental impact of wars is closely linked to the pioneering work of Arthur H. Westing and with the conceptual contributions of Osborn, Brown, Galtung, the policy oriented proposals of Ullman, Mathews and Myers, often with a normative orientation (Brock; Gleick; Renner).
• **Phase II**: During the 1990s, two comprehensive empirical environmental conflict research projects were conducted by the *Toronto Group* (Homer-Dixon 1999, 2000; Homer-Dixon/Blitt 1999) and by the *Bern-Zürich Group* (Bächler/Spillmann 1996; Bächler 2003).

• **Phase III**: Since the mid 1990s, partly in reaction to and modification of the work of both research teams, comparative studies and conceptual deepening by different research teams, partly relying on modeling, on management efforts and focusing on the conflict potential of resource use, on state failures, and on syndromes of global change were launched.

According to Dalby (2002a: 96) “environmental security discussions can now move to a fourth stage of synthesis and reconceptualization”. Brauch (2003) suggested a fourth phase of research on Human and Environmental Security and Peace (HESP) that should combine structural factors from the natural (climate change, water, soil) and human dimensions (population growth, urbanization, pollution, agriculture/food) based on the expertise from the natural and social sciences with outcomes and conflict constellations. Former Soviet President Gorbachev “proposed ecological security as a top priority that *de facto* would serve as a forum for international confidence building”. The Brandt-Report (1980) noted that “few threats to peace and survival of the human community are greater than those posed by the prospects of cumulative and irreversible degradation of the biosphere on which human life depends”. The Brundtland Commission (1987) argued that the security concept “must be expanded to include the growing impacts of environmental stress – locally, nationally, regionally, and globally”. The Commission on Global Governance (1995) called for a broader concept of global security for states, people and the planet. It claimed a linkage between environmental deterioration, poverty and underdevelopment as causes of conflict. These reports put the linkage between environmental stress and conflicts and conflict resolution on the political agenda of international organizations.

Since the 1990s, the widening of the security concept has progressed and concepts of “environmental security” (UNEP, OSCE, OECD, UNU, EU), “food security” (WHO, World Bank), “energy security” (World Bank, IEA), and “livelihood security” (OECD) have been used. The Millennium Report of the UN Secretary General (Annan 2000) mentioned several international organizations that have addressed the linkages between environmental stress and conflicts. The World Summit on Sustainable Development in Johannesburg (2002) in its political declaration and plan of implementation referred to “food security” but “environmental” or “human security” were not included. Kofi Annan (2003) pointed to the potential threats posed by environmental problems and he suggested that the UN system should “build additional capacity to analyze and address potential threats of conflicts emanating from international natural resource disparities”.

In this regard, UNEP has been active in three areas: a) Disaster Management Branch (DEPI), b) UNEP’s Ozone Action Program (DTIE), and c) UNEP’s Post Conflict Assessment Unit. In January 2004 UNEP identified a “need for scientific assessments of the link between environment and conflict to promote conflict prevention and peace building”. UNEP’s Division of Early Warning and Assessment (DEWA) launched an “Environment and Conflict Prevention” initiative to stimulate “international efforts to promote conflict prevention, peace, and cooperation through activities, policies, and
actions related to environmental protection, restoration, and resources.

The Organization for Security and Cooperation in Europe (OSCE) has dealt with security risks from environmental stress. Among the non-traditional security risks confronting OSCE countries in Central, Eastern and South-Eastern Europe, in the Caucasus, in Central Asia and other parts of the former Soviet Union are trans-boundary pollution, shortage of drinking water, disposal of radioactive waste, reduction of human losses in man-made disasters and natural catastrophes, among them several hotspots in the Baltic Sea region, the Balkans, Central Asia, in the Black and Caspian Sea as well as in the Caucasus. The OSCE Economic Forum organized several meetings on environmental security issues.

In late 2002, OSCE, UNEP and UNDP launched a joint initiative to promote the use of environmental management as a strategy for reducing insecurity in South-Eastern Europe and in the Caucasus. The results were presented to the 5th ministerial conference in Kiev in May 2003 that adopted an environmental strategy for the countries of Eastern Europe, the Caucasus and Central Asia. After Kiev, the ENVSEC Initiative has focused on:

1. Vulnerability assessment and on monitoring environment and security linkages,
2. Policy development and implementation,
3. Institutional development, capacity building and advocacy.

In October 2004 a report on cooperation over environmental risks in the South Caucasus was released that focused on a) environmental degradation and access to natural resources in areas of conflict; b) cross-border water resources, natural hazards and industrial and military legacies and c) population growth and rapid development in major cities.

The Organization for Economic Co-operation and Development (OECD) has also addressed the linkages between development, environment and conflicts in several policy statements, such as “Development Assistance, Peace and Development Co-operation of the 21st Century” (OECD/DAC 1997) and in a scoping paper on the economic dimension of environmental security that are reflected in the “Guidelines on Conflict, Peace and Development Co-operation” (OECD/DAC 2001).

The European Union has pursued two strategies for “environmental security”: a) integrating environmental goals into all sectoral policies (Cardiff process), including in development, foreign and security policies; and b) stressing conflict prevention and management in its activities in international organizations (UN, OSCE) and for specific regions. At the Barcelona European Council in March 2002, a sustainable development strategy was adopted that emphasized the integration of environmental concerns into sectoral policies. The European Council in Seville (June 2002) approved a conflict prevention program that aimed both at short-term prevention and at the root causes of conflict, in its development cooperation with poverty reduction, and in its strategy against terrorism. The European Council meeting in Thessaloniki in June 2003 approved a green EU strategy.
Below, the research will be reviewed for a) the first phase, focusing on impacts of wars and of the military on the environment (2); b) the second phase on the relationship between environmental stress and conflict (3); and c) the third phase with a pluralism of research goals, techniques and approaches (4).

2. First Research Phase: Impacts of Wars and of the Military on the Environment

During the 1970s and 1980s, Arthur Westing studied in detail the impacts of the U.S. military engagement in Vietnam on the environment, the legal efforts to constrain the military use of environmental modifying techniques in warfare and more recently to make the armed forces more conscious and responsible for the impact of military activity on the environment and to clean up the environmental damages after base closures and the withdrawal of foreign troops. UNEP has conducted independent assessments of the Gulf War and of the Balkan wars on the environment (Haavisto 2003). International lawyers have analyzed the legal constraints of environmental impacts of warfare in four different bodies of international law: a) in the humanitarian law of war; b) in arms control treaties; c) in environmental agreements and d) in human rights.

In the social sciences, the writings of Ullman, Mathews and Myers were of a political nature, putting the “environment” on the U.S. national security agenda and also creating awareness among international organizations. Many of these contributions had a strong normative basis, as Dabelko (1996: 2) correctly noted:

Environmental security has emerged as a transnational idea, the core of which holds that environmental degradation and depletion, largely human-induced, pose fundamental threats to the physical security of individuals, groups, societies, states, natural ecosystems and the international system. Security institutions in particular are currently failing to redress these threats. All institutions, according to the central tenets to the idea, must better address these threats. The alternative if these threats are not addressed will likely be economic, social, and ecosystem health and welfare decreases.

Rønnfeldt pointed to four major criticisms: a) for widening the security concept; b) for their lack of theoretical and empirical insights; c) for twisting their analysis to serve political agendas and d) for militarizing the environment. Gleditsch reminded the critics “that engaging in this conceptual debate does not in itself contribute alternative strategies for improving the field of empirical research”.

3. Second Research Phase: Environmental Scarcity and Conflict

The major body of empirical research on environmental security addressed the linkages between environmental scarcity, degradation, stress and outcomes. Two research teams, directed by Homer-Dixon and by Günther Bächler and Kurt Spillmann, offered different frameworks and results.

3.1. Thomas Homer-Dixon and the Toronto Group


The first project tested several hypotheses that resulted in modifications of assumed linkages between environmental stress and conflicts. Homer-Dixon (1994) concluded: “that environmental scarcity causes violent conflict. This conflict tends to be persistent, diffuse, and sub-national”. He predicted that “its frequency will probably jump sharply in the next decades as scarcities rapidly worsen in many parts of the world”, with cropland, water, forests, and fish being of immediate concern. He assumed that “global warming will probably not have a major effect for several decades, and then mainly by interacting with already existing scarcities”. Besides environmental degradation and the depletion of environmental resources he also pointed to population growth and unequal resource distribution as sources of environmental security.

These results were critiqued by Levy who claimed that environmental problems hardly constitute security risks for the US, who argued “that ozone depletion and climate change are the only significant environmental problems that currently pose a direct physical harm to US interests”. Homer Dixon (1995) replied that climate change “could endanger core American values” and thus could become “direct threats to U.S. security interests”, but not in the near term. Homer-Dixon focused primarily on links between the environment and violent conflicts in developing countries.

The second project analyzed the links between environment, population, and security (EPS) based on case studies on Chiapas, Gaza, South Africa, Pakistan and Rwanda (Homer-Dixon/Blitt, 1998) that focus on social consequences of renewable resource scarcity. They argued that under certain circumstances scarcity of these resources may cause violent conflict. They focused on six types of environmental change: water and land degradation, deforestation, decline in fisheries, and to a lesser extent global warming and ozone depletion that can produce scarcities of vital renewable resources. They distinguished among “supply-induced” scarcity that is often called environmental change, “demand-induced” scarcity that is linked to population growth and per-capita consumption; and “structural” scarcity arising from unequal social resource distribution. Two patterns of interaction are discussed: resource capture by powerful groups, and ecological marginalization resulting in a lack of access for the poor that are often forced to migrate to ecological fragile and vulnerable regions. Environmental scarcity will not necessarily result in social disruption and violent conflict. But different adaptation failures (market failure, social friction, lack of capital) may produce five types of social effects: “constrained agricultural productivity, constrained economic productivity, migration, social segmentation, and disruption of legitimate institutions”. They consider environmental scarcity as a cause that interacts with various contextual factors ranging “from the nature of relations among ethnic groups to the state’s degree of autonomy from outside pressure groups”. A combination of the first three social effects can increase segmentation that arises:

when groups respond to scarcity by hardening the already existing religious, class, ethnic, or linguistic divisions that separate them...All these developments can seriously disrupt legitimate institutions at every level of society...Environmental scarcity increases state vulnerability by threatening the delicate give-and-take relationship between state and society...The five key social effects of environmental scarcity...can, either singly or in combination, produce or exacerbate conflict among groups. They do so by simultaneously...
increasing the grievances of the affected populations and changing the structure of political opportunities so that it is more rational to act violently upon these grievances (Homer-Dixon/Blitt 1998: 9-10).

The case studies of the EPS project addressed three key questions: a) “Does environmental scarcity contribute to violence in developing countries? b) If it does, how does it contribute? c) What are the critical methodological issues affecting this type of research? They looked at cases “that appeared to exhibit a causal relationship between scarcity and violence”. The case study research “has definitely shown that severe environmental scarcities often contribute to major civil violence”, and that the result of the complex interaction of scarcity factors and societal groups “is often chronic and diffuse subnational violence that is increasingly difficult to control” (Homer-Dixon/Blitt 1998: 15).

Homer-Dixon and Blitt (1998: 223-228) summarized the results by pointing out that “under certain circumstances” scarcities can produce civil violence and instability by “generating intermediate social effects, such as poverty and migrations, that analysts often interpret as conflict’s immediate causes”. Scarcity is often caused by “degradation and depletion of renewable resources, the increased demand for these resources, and/or their unequal distribution” that “interact and reinforce one another”. It often encourages powerful groups to capture these resources and forces marginal groups to migrate to ecologically sensitive areas. This reinforces scarcity and may lead to social instability, constrained economic productivity, population movements, social segmentation, and weakening of institutions and states that may in turn “cause ethnic conflicts, insurgencies, and coups d’etat”. Such conflicts can also produce indirect effects on the international community.

In the third project, in cases on water in China, cropland in India, and forests in Indonesia, the Toronto group “sought to determine if scarcities of cropland, forests, water, and other renewable resources are decreasing the capabilities of governments in the developing world and, if so, whether this raises the probability of widespread civil violence such as riots, ethnic clashes, insurgency, and revolution”. They tried to find out whether their findings “supported their original hypotheses, whether the hypotheses could be changed to have greater explanatory power, and whether there were cross-case generalizations about the effects of environmental scarcity on state capacity and civil violence”.

The project started from the premise that environmental scarcity is the result of: a) reduced resource supply, b) increased resource demand, and c) skewed resource distribution. It defined “state capacity [as] a function of variables such as the state's fiscal resources, political autonomy, legitimacy, internal coherence, and responsiveness”. They identified “links between rising environmental scarcity and declining state capacity” and found four effects: First, environmental scarcities increase the demands on the state by marginal groups that need government support by moving to the cities. Second, scarcities can threaten the incomes of elites, aggravate competition among them and generate opportunities for powerful coalitions to capture windfall wealth by obtaining monopolistic access to resources through bribery, kickbacks, and corruption. Third, such a behavior often provokes weaker groups to struggle for resource control and this may result in a loss of trust in the state, reducing its legitimacy.
Fourth, if resource scarcity affects the economy’s general productivity, tax revenues may decline, hurting elites and reducing the state’s capacity to meet the increased demands.

This third project concluded that environmental scarcity “can constrain a state’s fiscal resources”, and “it can reduce state autonomy”. Furthermore, “rivalry among political elites reduces coherence, and…weakens civil society”. These four changes constrain “state responsiveness by reducing its ability to supply social ingenuity in the form of efficient markets, clear property rights, and an effective judicial and police system”. Thus, “environmental scarcity can also boost financial and political demands on the state and increase grievances of marginal groups”. The widening gap between rising demands and state performance, “erodes state legitimacy, further aggravates conflicts among elites, and sharpens disputes between the elites and the masses. As the state weakens, the social balance of power can shift in favor of groups challenging state authority”.

In all three projects, Homer-Dixon (1999) pursued the linkages between environment, scarcity, and violence looking to five future types of likely violent conflicts that third world countries will be less able to prevent: 1) disputes from local environmental degradation; 2) ethnic clashes arising from population migration and deepened social cleavages; 3) civil strife (insurgency, banditry, coups d’état); 4) interstate war (on water), and 5) North-South conflicts over global environmental problems (global warming, ozone depletion, biodiversity). Homer-Dixon (1999: 6) considers the first and last type unlikely and of the remaining three interstate scarcity wars as the least likely.

He discussed the scarcity’s causal role between: Environmental Scarcity → Social Effects → Violent Conflict. While he admits that scarcity as such is neither a necessary nor a sufficient cause of conflict (7) he claims “that environmental scarcity is an important cause of these conflicts” (8). Among the major determinants of supply-induced environmental scarcity that contribute to the depletion and degradation of renewable resources, Homer-Dixon (1999: 50) referred to a) ideational factors (social relations, preferences and beliefs), b) physical availability of natural resources and c) ecosystem sensitivity that impact on population and resource consumption (energy → global warming; cropland scarcity → deforestation; fresh water). On the background of continued population growth, the decrease in quality of renewable resources can either result in a) resource capture (via unequal resource access) or b) unequal resource access (74).

Among the socio-economic factors Homer-Dixon (1999: 160) reviews in detail the contradictory literature on the links between urban growth and violence in periods of economic stress. After a decade of research, Homer-Dixon (1999) concluded: ”that scarcity of renewable resources…can contribute to civil violence, including insurgencies and ethnic clashes” and he predicted that in the future “such violence will probably increase as scarcities of cropland, freshwater, and forests worsen in many parts of the developing world”, where the role of scarcity will be “often obscure and indirect”, interacting with political, economic and many other factors. He further predicted that continued population growth and rising resource demand and persistent inequalities will affect environmentally sensitive regions. Whether this will result in
technological innovations and societal adaptations will partly depend on capital availability and investments in the science sector and on the readiness of the North to share and transfer critical technologies and resources. In his book *The Ingenuity Gap* Homer-Dixon (2000) drew political conclusions on how to solve these future problems.

### 3.2. Günther Bächler and the Swiss ENCOP Group

During the 1990s, the *Environment and Conflicts Project* (ENCOP), co-directed by Günther Bächler and Kurt R. Spillmann (Bern and Zürich group), started from the premise that environmental transformation does not directly result in conflicts but that it impacts on existing socio-economic conflict potentials that violently escalate. According to its working definition:

environmental conflicts manifest themselves as political, social, economic, ethnic, religious or territorial conflicts over resources or national interests, or any other type of conflict. They are traditional conflicts induced by environmental degradation. Environmental conflicts are characterized by the principal importance of degradation in one or more of the following fields: a) overuse of renewable resources; b) overstrain of the environment’s sink capacity (pollution); c) improvement of the space of living (Bächler 1998: 24).

According to ENCOP’s analytical framework (Bächler 1993) the analysis of environmental conflict followed four steps: 1) to describe the environmental situation on the background of human activities; 2) to deduce the social and economic effects of environmental transformation and degradation; 3) to analyze the political implications of these socio-economic effects and conflicts arising from them; and 4) to evaluate approaches to peaceful management and resolution on different levels of analysis. ENCOP concluded that besides resource degradation other contextual factors were decisive for conflicts. In a case study on Rwanda, Bächler (1998, 1999) stressed “that violence was to occur in more remote areas, mountain locations, and grasslands—places where environmental stress coincides with political tensions and unjust access to resources” (Dalby 2002).

The results of the ENCOP project were published in three volumes. The first volume—on environmental degradation as a cause of war—examined the environment as a topic of conflict research, environmental degradation through over-development (*wealth-driven*) and underdevelopment (*poverty-driven*) focusing on actors, on key environmental factors of soil, rivers, mining. It offered a synthesis on environmental degradation as a cause of war and how environmental conflicts can be solved peacefully. The second volume contains eight case studies by members of the ENCOP research team on Bangladesh, Sudan and Darfur, Nigeria, Central Asia, the Jordan Basin, Rwanda and on mining in the South Pacific. The third volume includes thirteen studies by external experts.

In his synthesis, Bächler (1998: 24-44) examined “the critical role of transformation regarding causation on environmental conflicts in certain areas of developing countries”. To do so one has “to build on prepared empirical ground to highlight the different patterns of causation, to select types of environmental conflicts in terms of different pathways leading to violence, as well as to stress the socio-political characteristics of environmental conflicts” (24). Bächler (1998: 24) concluded
that neither apocalyptic scenarios of environmental catastrophes nor alarmist prognoses of world environmental wars are tenable. Environmentally-caused conflicts escalate across the violence threshold only under certain conditions. Human-induced environmental change can be either a contributing or a necessary factor for both the emergence and/or the intensification of violent conflicts. On one hand, violent conflicts triggered by environmental disruption are due in part to socio-economic and political developments. On the other, social and political maldevelopment, due in part to degradation of natural resources, has become an international peace and security challenge. Development and security dilemmas are connected to a syndrome of problems which produces environmental conflicts of varying intensity and nature.

Bächler (1998: 40-44) provided a typology of 40 environmental conflicts with different conflict intensity he categorized as: 1) intrastate a) ethnopolitical, b) center-periphery, and c) regionalist migration/displacement conflicts; 2) intrastate conflicts with a transboundary dimension, caused by a) migration, b) demographic pressure, and c) water/river basin conflicts; and 3) international global environmental conflicts.

3.3. Assessments of the Second Phase of Research

The GECHS (1999) Science Plan noted “an increasing acceptance that environmental degradation is at least a contributor to conflict and insecurity”. For GECHS the debate has also shown: “how various factors or relations of inequality and impoverishment structure threats…Environmental change…is related to insecurity through conditions of inequality, institutional weakening, and impoverishment. The second phase of environment and security work has reinforced the deficiencies in the research program that were identified in the first phase.” The GECHS Science Plan suggests “building upon the early empirical work…and to provide additional empirical studies on environmental change and its relationship to a broader conception of security”.

Why the critical socio-economic constellation escalated into violent conflict and when and why they could be avoided by bilateral and multilateral cooperation of states, experts and representatives of civil society could not be explained by these studies. Inductive case-study projects have laid the foundations for a third phase of empirical and theoretical environmental security studies that focus both at the complex environmental inputs and at the societal outputs in terms of peaceful disputes and violent conflicts. A consensus emerged that “environmental stress is rarely considered to be the sole factor in precipitating conflict” both within and between nations. Schwartz (2002, 137) stated:

In many cases environmental stress is a relatively distant factor, acting in combination with other economic and social factors such as poverty and weak governments. In other cases, conflict breaks out when rival nations, or rival groups within a nation, battle for diminishing supplies of environmental resources. Although environmental stress is usually only one cause of conflict among many, the evidence suggests that it can play an important role, and that violence may be avoided by addressing environmental problems.

Schwartz (139) considers population growth as closely linked with environmental stress. Among the wide-ranging environmental factors he includes ozone depletion and global warming and among the localized ones those that affect small areas at different
times (desertification, water pollution). He points to “five pathways to indirect internal conflict that involve environmental stress: economic decline, migrations, social fragmentation, erosion of civil society and curtailment of the state”. A major effect of environmental stress is economic decline that effects the poor more than the rich. A second pathway is migration that is sometimes caused by floods, droughts or locusts, by a lack of arable land that again is often the result of environmental stress, but also by water and air pollution, and a shortage of fuel wood. The complex interaction of environmental stress and its social, economic and political ramifications has often resulted in increasing urban violence.

Global warming may affect freshwater availability and food productivity, that will have severe impacts on poorer nations, and may have possible longer-term security implications. Direct international conflicts may result from the increasing competition over access to water while others counted only few minor skirmishes over international waters due to increasing international cooperation. Direct internal conflict, especially in developing countries, has also occurred as a result of environmental stress (e.g. in Sahel due to drought) that caused many nomads to clash with agriculturalists in neighboring and less affected zones. Schwartz (2002: 148) argues that causal linkages between environmental stress and conflict could be shown in individual case studies, but that future research is needed “to estimate the causal effects of environmental stress.”

Hauge and Ellingsen (1998) who integrated environmental degradation (soil erosion, deforestation) into a model of civil war concluded: “that environmental degradation does stimulate the incidence of conflict, but less so then political, economic, and cultural factors, or previous conflict history”. In a study on deserts and conflict Saltnes (1998) “found that there was indeed a bivariate relationship between the spread of deserts and internal armed conflicts in the period 1980-1990”. In conclusion, Gleditsch (2002: 56) suggested that resource and environmental aspects of conflict “should be examined within the context of a broader view of armed conflict” with a special focus at politics, economics, cultural factors and the conflict history.

4. Third Research Phase on the Environment, Conflict and Conflict Resolution

The following survey relies on information available in December 2004 on ongoing or recently completed research projects. The inductive case studies of the Toronto and Swiss groups were complemented with deductive approaches. Both focus on the complex interaction among environmental inputs, environmental-societal linkages and extreme outcomes. One difference between the second and third phase was leaving dependent-variable, violent conflict or cooperation open. Below several research projects are reviewed, some also address cooperatively managed scarcity problems.

- The Global Environmental Change and Human Security (GECHS) project was launched as a framework for research cooperation and coordination.
- ECOMAN, ECONILE and “Environmental Change and Conflict Transformation” in Zürich and Bern continue the case study approach and focus on peaceful and cooperative management of renewable resource use in the Horn of Africa, the Nile region and other areas. This is part of a Swiss project on “Research Partnerships for Mitigating Syndromes of Global Change”.

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• Several research teams have analyzed causes and intensity of violent conflicts, but only few have focused on environment and conflict linkages.

• The Transboundary Freshwater Dispute Database at the Oregon State University and the Global Assessment of Environment and Security (GLASS) project at Kassel University.

As some projects are not completed, a comprehensive evaluation of the results is not yet possible.

4.1. Global Environmental Change and Human Security (GECHS)

The Global Environmental Change and Human Security (GECHS) Project is a core project of the International Human Dimensions Program on Global Environmental Change (IHDP) that was initially launched in 1990 by the International Social Science Council (ISSC) of UNESCO. The IHDP is a partner with the International Geosphere-Biosphere Program (IGBP), the World Climate Research Program (WCRP) and of the Program on biodiversity science: DIVERSITAS. These programs focus on climatic, biogeochemical, socio-economic and biodiversity processes related to global environmental change.

The IHDP is an international, non-governmental, interdisciplinary science program dedicated to promoting and coordinating research aimed at describing, analyzing and understanding the human dimensions of global environmental change. It focuses on research, capacity building and networking. IHDP has four international projects, one of which is GECHS. The IHDP provides synthesis reports and policy-oriented summaries to contribute a scientific basis for decision-making and supports research capacity-building. Its science projects are to: (i) identify and generate new IHDP research activities in priority areas, (ii) promote international collaboration, and (iii) link policymakers and researchers. The IHDP is actively involved in the work of SysTem for Analysis, Research and Training (START), a joint program whose mission is: a) to develop a system of regional research centers and networks; b) to conduct research on regional aspects of global change; c) to assess the impact of the regional findings, and to provide regionally important information to policy makers and governments; d) to enhance scientific capacity, and e) to augment scientific capabilities and infrastructure in developing countries.

GECHS focuses on the human dimensions of environmental change and the reconceptualization of security. Its objectives are threefold: 1) to promote research activities in the area of global environmental change and human security; 2) to promote dialogue and encourage collaboration among scholars from around the world; and 3) to facilitate improved communication and cooperation between the policy community, other groups, including NGOs, and the research community.

According to the GECHS definition: “Human security is achieved when and where
individuals and communities: a) have the options necessary to end, mitigate, or adapt to threats to their human, environmental, and social rights; b) actively participate in attaining these options; and c) have the capacity and freedom to exercise these options.”

Its primary purpose is to promote research on topics related to environmental change and security on: a) conceptual and theoretical issues in environment and human security; b) environmental change, resource use, and human security; c) population, environment, and human security; d) modeling regions of environmental stress and human vulnerability; and e) institutions and policy development in environmental security. GECHS augments international research on environment and security issues, through facilitating the networking of researchers, circulating information, and linking with other organizations active in this area. These activities are supported by the International Network on Environment and Security (INES).

The GECHS Science Report outlined an integrated research program based on: i) comparative analysis, ii) action oriented research, iii) policy oriented research, iv) participatory research, v) emphasis on data and scale issues, and vi) threshold analysis.

GECHS will pursue five key research foci. Focus 1 includes: “conceptual and theoretical issues in environment and human security, why some regions and societies are more vulnerable than others, the relationship between environment and conflict, how environmental change threatens human security”. Focus 2 addresses: “environmental change, resource use, and human security, water and human security, food security, energy security, atmospheric change and human security, land use change and human security (linkage project with LUCC), environment and conflict/cooperation”. The third research focus is on: “population, environment, and human security; environment, migration, and human security, urbanization and human security, population, impoverishment, and human security, health, the environment, and human security, environmental change and indigenous people, women, environment, and human security”. The fourth research focus will deal with: “modeling regions of environmental stress and human vulnerability, developing indicators of environmental change and human vulnerability, critical zones”. Finally, the fifth research priority will address: “Institutions and policy development in environmental security; the framework of global governance; environment, conflict, and democracy; environmental change, adaptation, and human security; private vs. public investment and human security, technological innovation and transfer”. The first activity will deal with “data and methodological issues in environment and human security” and the second with “communications, education, and training for GECHS”.

In their index of human insecurity, Lonergan, Gustavson and Carter (2000) argued that human security is achieved “when and where individuals and communities: a) have the options necessary to end, mitigate, or adapt to threats to their human, environmental, and social rights; b) have the capacity and freedom to exercise these options; and c) actively participate in attaining these options“. They saw a threefold relationship between environmental degradation and human security:

1. There exists a cumulative causality between environment and security (e.g., environmental degradation may result in population movement that in turn poses a threat to the environment).
2. The responses to insecurities posed by environmental degradation may contribute to other insecurities (e.g., population movement could threaten other aspects of human security not linked to the environment).

3. Human security embodies the notion that problems must always be addressed from a broader perspective that encompasses both poverty and issues of equity as often these issues lead to insecurity and conflict.

In their “Index of Human Insecurity” (IHI) they selected indicators based on these criteria:

- The indicator measures either key structural or functional relationships of the system with reference to environmental, economic, societal, or institutional components;
- Existence of a theoretical or empirical link between the indicator and insecurity;
- General availability of the data;
- Consistency of the data with other selected indicators to allow for future modeling of the system; and
- Adequacy of the spatial coverage based on the number of countries represented and adequacy of the time series available.

They selected four indicators each for the environment, economy, society and institutions. But these indicators exclude the vulnerability to natural hazards and income distribution. They established first a complete time series for all indicators and all countries, then the data were standardized and classified and the index calculated. In relating the IHI to indicators of human development such as the Human Development Index (HDI) of UNDP (1997) they found strong correlation between the IHI and the HDI and concluded that “significant increases in human security may occur with only small increases in development”. For policy purposes, the authors see two relevant applications: First, “the IHI can be linked to more specific sets of indicators (e.g., water security or food security) to assist in identifying how sector-specific problems may affect overall levels of human insecurity”, and second, “the IHI can be used to project how human insecurity may change over time”.

The additional value of the IHI appears to be limited and does not satisfy the requirements for an “early warning system”. The present IHI lacks security relevant data, on past conflicts, and arms transfers, but also on disasters, distress migration and on environmentally induced crises.

4.2. ECOMAN, ECONILE and NCCR IP7

As a follow-up to the ENCOP project, the Zürich research team conducted two research projects: a) ECOMAN: Environmental Change, Consensus Building and Resource Management in the Horn of Africa (completed); and b) Environment and Cooperation in the Nile Basin (ECONILE). A new research project on “Environmental Change and Conflict Transformation”, directed by Laurent Goetschel, Swiss Peace Foundation Bern, started in 2002. The projects were described as follows:

ECOMAN focuses on countries in the Horn of Africa…The project chiefly analyzes natural resource use and distribution conflicts in river basins, (semi-) arid lowlands, and in highland-lowland interaction systems. The main goal is to combine traditional mechanisms
(knowledge) in managing land and water resources with alternative dispute resolution methods adapted to the specific arenas in the Horn environment. The empirical studies carried out in Eritrea, Ethiopia, Somalia and Sudan concentrate on four major topics: a) Conservation and development interactions; b) The management of conflicts arising from contending demands for land and related natural resources; c) Water rights arrangements and conflict as well as conflict management; d) Traditional mechanisms of conflict management systems in relation to environmental problems in the Horn. The results...support stakeholders as well as decision makers at the national level in promoting sustainable resource use and non-violent distribution practices...ECOMAN aims at shaping a culture of ‘preventing deadly conflict’.

The second project: Environment and Cooperation in the Nile Basin (ECONILE) was directed by Kurt R. Spillmann and Andreas Wenger, ETH Zurich, Alexander Zehnder, Swiss Federal Institute for Environmental Science and Technology and Günther Bächler, head of Conflict Prevention and Transformation, Swiss Development Cooperation. The downstream research was carried out by Simon Mason, and the upstream research was conducted by Yacob Arsano, with these goals:

ECONILE aims to assess the present-day development of international water usage in the Nile Basin. The goal of the project is to enhance cooperation between the Nile countries and gather “lessons learned” from the ongoing Intergovernmental Nile Basin Initiative. Thus it will complement and expand the intergovernmental search for viable water management options in the Nile Basin. The project is to be carried out in close cooperation with partners in the Nile Basin (governmental organizations, research institutes and non-governmental organizations). The downstream and upstream perspectives will be examined separately by two research units that will: a) Assess the environmental situation. b) Examine the socio-economic and political aspects of water resource management. b) Gather the different perceptions and management options suggested by the various stakeholders in the downstream and upstream context. d) Form a synthesis from these perspectives. e) From this synthesis options for the management of the whole basin will be extrapolated and assessed in the framework of sustainable development.

The third project on “Environmental Change and Conflict Management” (IP 7) is part of the NCCR North-South research project on “Mitigating Syndromes of Global Change”. It is being carried out by Swiss Peace with the Center for Security Studies and Conflict Research and the Anthropological Department, University of Zürich. The geographical focus is on the Horn of Africa and Southeast Asia and on comparative studies on Africa, Asia and South and Central America. The project is carried out by several Ph.D candidates and it is sponsored by the Swiss National Science Foundation and the Swiss Development Cooperation with the goal:

to improve scientific knowledge about the prevention of violent conflicts related to syndromes of global change. This will include the development of conflict mitigation methods, exchange on conflict transformation strategies within the whole NCCR North-South (scientific platform), capacity building (north and south) and enhancement of decision basis for policy makers. The methodology used is both deductive and inductive: IP 7 will elaborate practical tools and instruments out of existing theoretical frameworks and concepts in the fields of conflict transformation, environmental conflict, peace-building, early warning and general conflict research. It will also test new as well as pre-existing tools in existing conflict settings. As a consequence, IP 7 follows a broad methodological path, which includes gathering field data, indicator research, experimental workshop settings as well as
literature and ethnographic/historical studies.

By end of 2004, ECOMAN (Bächler 2002) ECONILE (Simon 2004) are completed while the third IP7 project has been launched.

4.3. Syndrome Approach of the German Scientific Advisory Council on Global Change

In contrast to the case study approach of the Toronto and Swiss teams, the syndrome approach was developed in several reports by the Scientific Advisory Council on Global Environment Issues (WBGU) of the German government and in many publications by the Potsdam Institute of Climate Impact Research (PIK) as a tool for systematic analysis of the close interaction of different factors of global change (WBGU 1993: 197-200). The WBGU (1994: 196) argued that the symptom-oriented analysis of global networks should be supplemented with an interdisciplinary syndrome based regional analysis. This concept was further developed in a research project by PIK (1998). In 1996, the WBGU pointed to a relationship between the global and regional levels:

A regionalized analysis of the Earth System using this instrument shows clear indication that the interactions in certain regions between human societies and the environment frequently operate along typical patterns. These functional patterns (syndromes) are unfavorable and characteristic constellations of natural and civilizational trends and their respective interactions, and can be identified in many regions of the world...Syndromes are transsectoral in nature; while specific problems may affect several sectors (such as the economy, the biosphere, population), they are always related, directly or indirectly, to natural resources. Syndromes are globally relevant when they modify the Earth System and have a noticeable impact, directly or indirectly, on the basis of life for a major part of humankind, or when global solutions are needed to surmount the problems (WBGU 1996).

The WBGU Report (1996) identified globally 16 syndromes under which the earth suffers. The report states that the syndrome concept:

provides a new basis for global change research, which used to be organized according to the environmental media or core problems. Given the desiderata for global change research—interdisciplinarity, internationality and problem-solving competence—it is obvious that future environmental research should be structured along transdisciplinary lines. In this connection, the Council's syndrome concept offers new options for shaping research activities. It is therefore recommended that these syndromes be adopted as the central objects of future global change research.

A group of authors, led by Schellnhuber (1997: 19-34) claimed that several mega-processes have transformed the planet since 1945 that were among others driven by the dramatic increase in fossil fuel consumption and have resulted in processes of modifications of the atmosphere, in soil degradation, reduction of natural ecosystems, freshwater pollution, population growth and migration. Instead of the reductionist approach of the world models, Schellnhuber et al suggested a holistic approach of Earth System Analysis (Schellnhuber/Wenzel 1998) and integrated modeling on patterns of interactions with feedback characters. They argue that syndromes require innovative methods of investigation: 1) decomposition of complex networks, 2) qualitative reasoning concepts, 3) modeling of fuzziness and uncertainty, 4) knowledge acquisition
strategies and 5) set-value analysis. The basic units for the description of the syndromes are the symptoms of global change: urban sprawl, accumulation of waste, mobility, tropospheric pollution, and increasing energy consumption. Petschel-Held, Lüdeke and Reusswig (1999: 255-291) compared regional case studies of global environmental change utilizing the syndrome approach as regional patterns of global change looking for bridges between both in terms of actors, structures and the environment.

4.4. Mitigating Syndromes for Global Change

The syndrome approach is used in a major research project on North-South Research partnerships (NCCR) for mitigating syndromes of global change that started in July 2001 and is funded as a transdisciplinary effort over a ten-year period. The project assumes that insecurity will increase due to global changes, globalization and global inequalities. In several regions key problems constitute clusters that will lead to syndromes.

The mitigation of these syndromes is a global challenge and a precondition for a sustainable development…To outline new ways for the mitigation of syndromes, the NCCR North-South examines the potential of societal systems, especially its dynamics, and the available innovative solutions. It thus contributes to an improved cooperation between Swiss research institutions and institutions in developing and transition countries. It will contribute to building competences and research capacities to develop socially robust knowledge for the mitigation of these syndromes.

This major development policy-oriented research project aims at knowledge and technology transfer, education, training and advancement of women aiming at research partnerships:

[These] activities and partnerships contribute to the development of partner institutions and societies in developing and transition countries and assist them in the search for sustainable solutions…The NCCR North-South will be active in eight regions on three continents and in Switzerland. A training program for graduates will be set up to guarantee that the concepts, methods and theories will be exchanged and forwarded among the researchers. Other tasks will be knowledge transfer, gender equality, and database management as well as communication.

The project aims at: a) high-quality disciplinary, interdisciplinary and transdisciplinary research to “contribute to improved understanding of the status of different syndromes of global change”, b) to enhance partnerships with third world institutions, and c) to contribute to developing capabilities in partner institutions in developing countries. The main political goal is to mitigate the impacts of syndromes of global change on Switzerland. The project addresses three syndrome contexts of global change in areas of Africa, Asia and the Americas: a) urban and pre-urban areas; b) semi-arid areas and c) highland-lowland areas. The project uses a ‘Pressure-State-Response’ model. Among the regions of application are Central and South America, West and East Africa and the Horn of Africa, and South and South-East Asia.

4.5. US State Failure Task Force Project

In 1994, the USA State Failure Task Force (SFTF) was set up at the request of Vice
President Al Gore to study the causes of civil and ethnic strife. Al Gore was particularly interested in the role that population growth, environmental degradation, and resource scarcity played in state failure. Phase I of this project included an environmental model, but no strong connection was found partly due to lacking systematic environmental data on different variables for a long time for enough countries. The SFTF’s model focuses on general state failure, ethnic wars, democratization, genocide and politicide, and regional and area specific models on Africa and Muslim countries. In September 2003, the Third Report of the SFTF was released.

Marshall and Gurr from the Center for International Development and Conflict Management (CIDCM), University of Maryland listed 128 cases of total and partial state failure since 1955 in countries with more than 500,000 people. The cases include revolutionary wars (48 cases), ethnic wars (61), adverse and disruptive regime transitions (87), and genocides and politicides (35). In 1994, Gurr and Harff prepared a list of state failures that was updated in 1997. The approach of the SFTF has been critiqued by social scientists and in the media:

The State Failure Task Force was led by Goldstone (Univ. of California, Davis), Esty (Yale Univ.) and Gurr (Univ. of Maryland). It built a global data set with more than 600 variables, including demographic, economic and environmental statistics, and developed ways to quantify concepts such as political structure and ethnic or religious divisions. The resulting database included more than two million entries. By 1995, the task force had developed a robust statistical model in which three variables (infant mortality, level of democracy, openness to international trade) correctly categorized states as failed or stable two-thirds of the time, two years in advance.

King and Zeng (2001) offered an independent assessment: “of the claims, forecasts, and causal inferences” of this project. They identified several methodological errors in its work “that cause its reported forecast probabilities of conflict to be too large, its causal inferences to be biased in unpredictable directions, and its claims of forecasting performance to be exaggerated.” But they acknowledged that the SFTF “has amassed the best and most carefully collected data on state failure to date”. King and Zeng demonstrate how to improve forecasting performance and they claim to “offer the first accurate forecasts of state failure, along with procedures and results that may be of practical use in informing foreign policy decision making”. They also describe a number of strong empirical regularities that may help in ascertaining the causes of state failure. Schrodt and Gerner (1994) are developing computer algorithms to analyze news stories to warn of imminent state collapse. The database uses three categories to classify these cases: a) revolutionary and ethnic wars, b) abrupt and disruptive regime transitions, and c) genocide and politicide, leaving environmental factors unmentioned. The role environmental factors have played in contributing to state failure remained unclear. So far the State Failure project found only a weak evidence for a direct influence of environmental degradation (Esty/Goldstone/Gurr/Harff/Levy/Dabelko/Surko/Unger 1998).

4.6. Classifications and Analyses of the Causes of War

Research groups in Germany, Sweden and Norway analyzed causes and intensity of
violent conflicts. Wallensteen and Sollenberg (2001: 629-644) listed among armed conflicts events with at least 25 battle-related deaths during a year and divided them into three categories:

- **Minor armed conflict**, where the number of battle-related deaths during the course of the conflict is below 1,000. In 2000 there were 9 such conflicts, while there were 10 in 1999;
- **Intermediate armed conflict**, with more than 1,000 battle-related deaths recorded during the course of the conflict, but fewer than 1,000 in a particular year. In 2000 there were 12 such conflicts, compared with 13 in 1999; and
- **War**, with more than 1,000 battle-related deaths during a particular year. In 2000 there were 12 such conflicts, down from 14 in 1999.

The Uppsala group defined an **armed conflict** as “a contested incompatibility which concerns government and/or territory where the use of armed force between two parties, of which at least one is the government of a state, results in at least 25 battle-related deaths”. They list among parties to a conflict “A government of a state or any opposition organization or alliance of opposition organizations”. However, both in the Kosimo and the Uppsala databases, environmental criteria were not used for coding violent events.

Gleditsch directed several research projects at PRIO on the linkages between environment, human security and conflict issues. In a project on Environmental Change, Good Governance, Development and Human Security Gleditsch contrasted a Neo-Malthusian model where scarcity generates resource competition and conflict with a Cornucopian (or technologically-optimist) model. Specific subprojects study a) how democratic government may improve environmental performance, b) the relationship between water scarcity and conflict, in particular how shared rivers may generate interstate conflict, c) how resource abundance could lead to Dutch disease, economic stagnation and conflict, and d) how demographic pressure may lead to conflict. At the PRIO Center for the Study of Civil War one of six groups studies environmental factors in civil war, including geography, resource issues and demography.

### 4.7. The Transboundary Freshwater Dispute Database

The Transboundary Freshwater Dispute Database, a project of the Oregon State University Department of Geosciences, was launched by Aaron T. Wolf in collaboration with a few individuals and supported by several sponsors, includes the following components:

- A searchable database of summaries and full text of the full text of more than 400 international, freshwater-related agreements, covering the years 1820 to 2001. The summaries are catalogued by basin, countries involved, date signed, treaty topic, allocations measure, conflict resolution mechanisms, and non-water linkages;
- A similar database of 39 interstate compacts within the United States;
- Negotiating notes and other primary and secondary sources for 14 case studies of the processes of international water conflict resolution;
- Descriptions of indigenous/traditional methods for the resolution of water disputes;
- News files and bibliographic entries of acute water conflicts;
A digitized inventory of international watersheds;
An annotated bibliography of the state of the art of Transboundary Freshwater Dispute Resolution.
Sites related to the Transboundary Freshwater Dispute Database Project.
Publications produced by the Transboundary Freshwater Dispute Database Project.

The project has produced several publications including a book on “Transboundary Freshwater Dispute Resolution” (Beach/Hamner/Hewitt/Kaufman/Kurki/Oppenheimer/Wolf, 2000).

4.9. A Preliminary Assessment of the Third Research Phase

This survey is only a snapshot of research in progress that has been highly diverse in terms of concepts and paradigms used, methods applied, and the scientific disciplines from which they have been pursued. While the first phase of environmental security research focused on concepts and on their legitimization and critique, the second phase has been theory-oriented and empirically-based with a strong emphasis on case studies. In the third phase a plurality of methods have been applied: from qualitative case-studies, to syndromes of global change and scientific approaches to mitigate them, to quantitative analyses of state failures, and quantitative analyses of the causes of violent conflicts, to assessments of cooperative efforts in trans-boundary fresh water dispute resolution, to simulations of the interdependence between water availability and food crises.

While the latter quantitative methods may contribute to the recognition of complex linkages among structural determinants, and thus may contribute to an advance in our knowledge (heuristic function), they are nevertheless not sufficient because they exclude the complexity of the interactions between nature and humans that can neither be modelled nor predicted. In the view of a social scientist trained in qualitative methods, the method of structured, focused comparative case studies (George 1988) can reconstruct the complex interactions among the determinants of global environmental change, environmental stress and its fatal outcomes. Both reactive and pro-active or anticipatory learning for launching adaptive and mitigating responses requires knowledge and an understanding of these interactions that go beyond the competence of any discipline and can only be achieved by inter- and multidisciplinary research teams.

5. Recent Critiques of the Environmental Security Debate and International Activities

Several critiques of the environmental security debate were published since 2000 that have focused primarily on the work of Homer-Dixon while the work in other parts of the world and in other languages has been ignored. These critiques lack a synthesis of research, offer neither a methodology for comparative case studies nor a comprehensive alternative paradigm. Two focus on linkages between scarcity and conflict (5.1., 5.2.), a third deals with environmental peacemaking (5.3.) while the fourth focuses on abundance and greed as causes of domestic conflicts in developing countries (5.4.).
5.1. Critique of Research on Environmental Security and Conflict

Diehl and Gleditsch (2001) have pointed to limitations and gaps in the environmental security field, including insights without evidence (empirical and theoretical shortcomings), and on primary focus on environmental conflicts rather than cooperation. Their edited book offers empirical evidence on the influence of environmental factors on conflict, discusses the reduction of environmental conflict, and provides a retrospective review and outlook of the environmental security field.

The first part offers six empirical case studies on “environmental degradation as a source of conflict” by Percival and Homer Dixon on South Africa with an empirical test of their models arguing that many violent conflicts “have roots in the scarcity of renewable sources”. Hauge and Ellingsen conducted a large-N, multivariate study on environmental degradation and civil conflict discussing the relative importance of environmental factors for civil conflict while Tir and Diehl focus on interstate conflict, especially on the linkage between population pressures and international conflict involvement from 1930 to 1989. Goldstone reviews the debate on demographic developments and conflicts. Lonergan discusses links between water scarcity and water wars, while Lomborg critiqued doomsday predictions.

In the second part four chapters review the lack of knowledge on environmental conflict management and resolution. Midlarsky discusses whether democracies are more successful “in protecting the environment and therefore in limiting the violence-generating conditions from environment degradation”. Payne explores the regulatory role of GEF to meet the environmental challenges while Denoon and Brams discussed the dispute on the Spratly Islands as a territorial and environmental conflict and Conca concludes that environmental cooperation may have benefits but that it does “not help prevent or mitigate violent conflict” and that more conflict management may be needed.

In the third part the Homer-Dixon and his team and Gleditsch disagree on the maturity of environmental security research. While Gleditsch pointed to nine flaws in this field, Schwartz, Deligiannis and Homer-Dixon defend the progress reached so far but both see more convergence with regard to the future research agenda. This latter dispute is relevant for the assessment of the achievements, shortcomings and future research needs on environmental security issues.

Gleditsch pointed to five crucial resources over which wars may be fought: a) territory, b) strategic raw materials, c) sources of energy, d) water, and e) food. In the Malthusian tradition population growth (demand increase) contribute to resource scarcity where harsher competition over resources may result in violence. This environmental scarcity has been challenged from a Cornucopian perspective by Deudney (1991), Simon (1999) and Lomborg (2001) pointing to human inventiveness, the role of trade, substitution of raw materials, price increases encouraging technological change. Gleditsch note that environmental factors were excluded in most studies on the causes of war (e.g. Midlarsky’s (1989) *Handbook of War Studies* and Singer’s *Correlates of War* project). Others have argued that resource abundance is more likely to lead to conflict while scarcity fosters cooperation.

Gleditsch noted a lack of systematic research on the effects of resource and
environmental factors on armed conflicts. On environmental resource scarcity and degradation as a cause of conflicts of interests he notes that not all lead to conflict behavior and only a few to the use of force. Linking environment and security, even if politically successful, does not offer new theoretical or empirical insights, but the critical conceptual debate did not result in an alternative and improved research design. Often the literature ignores political (e.g. system of rule), economic (poverty, economic development) and cultural (ethnic, religious, linguistic fragmentation) variables. Many single-factor or complex studies cannot be tested in multivariate analyses. Many case studies have a selection bias and their results cannot be compared. Many studies have pointed to potential violence using the future as evidence and many did not distinguish between internal and international conflict. Nor has the level of analysis problem been dealt with in the environment security literature. Possibly environmental conflict should be analyzed as a development issue.

In their reply, in defense of the Toronto group, Schwartz, Deligiannis and Homer-Dixon point to Gleditsch’s selective critique of the literature giving preference to problems of environmental scarcity rather than degradation although both are closely linked and often reinforce each other negatively. After a detailed rebuttal, the Toronto group makes detailed suggestions for future research calling for: a) filling data gaps, b) operationalizing key variables, c) specifying contextual factors, d) dealing with complexity and e) encouraging methodological pluralism.

However, this general and quite eclectic critique (e.g. it totally ignores the work of the Swiss group and of many other projects of the third generation of environmental security studies) offers no alternative research design that could lead to a fourth stage of environmental security research. It ignores methodological weaknesses of quantitative methods, and the significant contribution of comparative case study methods such as structured focused comparisons using qualitative methods. It also totally excludes the knowledge and research in the natural sciences on the complex often nonlinear and chaotic linkages among the natural and human environments, and the supply and demand factors of global environmental change that cause, trigger, intensify or contribute to environmental scarcity and degradation; nor does he discuss their impact on environmental stress. Among the extreme outcomes, Gleditsch and his colleagues only focus at the least likely case: environmental conflict, ignoring the direct linkage between climate change and an increase of hydro-meteorological hazards and their potential socio-political consequences that often result in low-level violence below the level of conflicts and wars diagnosed and counted in the many projects counting and analyzing internal conflicts. The Toronto group offers valuable suggestions that are of relevance in the fourth phase of research.

5.2. U.S. Challenges of USA Environmental Security Debate

Peluso and Watts (2001) challenged the North American environmental security school represented by Homer-Dixon and his associates and they rejected “automatic, simplistic linkages between ‘increased environmental scarcity’, ‘decreased economic activity’, and ‘migration’ that purportedly ‘weaken states’ and cause ‘conflicts and violence’”. Instead they focus on “ways that resource environments (tropical forests or oil reserves) and environmental processes (deforestation, conservation, or resource amelioration) are
constituted by, and in part constitute, the political economy of access to and control over resources.” They claim that both shortage and abundance and processes of environmental rehabilitation and amelioration are often associated with violence. They offered a critique of Neo-Malthusian thinking (of both the Canadian and Swiss project) linking Marxian political economy, cultural studies with a new political ecology, focusing on the power relations in defining, controlling and managing nature and trying to re-map the relationship between the environment and security. They do not look for environmental triggers of violent conflicts rather they offer “accounts of the ways in which specific environments, environmental processes, and webs of social processes are central parts of the way violence is expressed” (p. 25).

Hartmann (2001: 39-62) offered a detailed critique of Homer-Dixon’s environmental scarcity approach, pointing to weak definitional foundations, a one-sided case study selection (where scarcity led to violence), a moderate Malthusian thinking combined Cornucopian hopes in human ingenuity, to cultural biases with regard to Third World cases that localized the blame instead of analyzing the global context, an old-fashioned view of the state as a solitary actor, and lacking gender perspective. Hartmann suggested crossing disciplinary boundaries and including the results of political economy and ecology, as well as anthropology and development studies.

The remaining 14 different case studies of violent environments—on forest wars in Sierra Leone (Richards), on ethnic war in West Kalimantan (Peluso/Harwell), on nature and environmental enclosure in the American West (McCarthy), on the new genetic enclosures (Boal), on violence and scarcity in Chiapas (Bobrow-Strain), on petro-violence (Watts), on natural resource conflicts (Fairhead), on cold war militarized landscapes (Kuletz), on violence and industrial shrimp farming (Stonich/Vandergebnet), on Russia’s nuclear sites (Garb/Komarova), on disciplining peasants in Tanzania (Neumann), violence on the margins of new legal geographies (Sudner), on violence and environmental struggle in India (Baviskar), and on the Bhopal Gas Disaster (Rajan)—analyze three dynamic modalities of violent environments: 1) the forms, periodicities and repertoires of environmental violence, 2) the intersection of violent extraction with resource and environmental characteristics, and 3) the normalization of environmental violence. They focus on the patterns, tactics, or rhythms of violence and the changing technologies of extraction and changing loci of resource control.

However, these 14 case studies do not offer any joint methodology, approach or research design nor are they able to contribute to an alternative model. The editors have not even attempted to interpret these diverse results from the vantage point of their critical perspective on Homer-Dixon’s work. These monographic case studies lack a method that permits valid comparison and drawing of comparative conclusions that may lead to an alternative model of analysis to that suggested by the Canadian and Swiss teams.

5.3. From Environmental Conflict to Environmental Peacemaking

Conca and Dabelko (2002) suggested shifting the focus of research and of the policy debate from “ecological security” from “violent outcomes” of environmental stress to environmental peace-making. Conca justified this refocusing from environmental
conflict to peacemaking because “the ecological security agenda has not played well on the broader global stage”. He argued that the ecological security agenda in OECD countries has “constituted an obstacle to international cooperation” in those countries where the ecological insecurity is most severe. Conca suggested shifting from the linkage between environmental degradation and conflict to the question “whether environmental peacemaking can trigger broader forms of peace”. He distinguished between two pathways by transforming mistrust, uncertainty, suspicion, divergent interests and short horizons by environmental cooperation; and viewing peace not as stable interstate relations but as shared identities. Environmental peacemaking should lead to confidence building and should lay the “foundation for transforming the national-security state itself”. According to Conca, research should focus on: a) deepening and broadening trans-societal linkages; b) on emergence and strengthening of regionally grounded identities; and c) on the transformation of state institutions to foster cooperative interactions. These questions are analyzed in six case studies dealing with environmental cooperation 1) in the Baltic (VanDeveer), 2) in South Asia (Swain), 3) in the Aral Sea Basin (Weinthal), 4) South Africa (Swatuk), 5) the Caspian Sea (Blum), and 6) USA-Mexico border region (Doughman).

Instead of analyzing the complex interaction between factors of global environmental change, environmental stress and extreme or fatal outcomes, Conca and Dabelko deal only with the most optimist cases where environmental issues have been resolved by cooperation. However, the crucial question when and why the environment security linkages are being resolved by the policy process and when they result in violence is not addressed.

5.4. Critiques for and by the World Bank

The World Bank’s Governance and Natural Resources Project analyzed linkages between natural resources and conflict (Bannon/Collier 2003). They argue that abundance and greed rather than scarcity and grievance were conducive to civil wars that were often financed by the export of commodities, e.g. diamonds (Angola, Sierra Leone), tropical timber (West Africa), gold, drugs and oil that often financed violent secessionist movements, as well as poor governance and corruption. Bannon and Collier (2003: 8-16) mentioned as the best protection against civil war, economic development, by raising economic growth, diversification of dependence on one commodity, and reducing the exposure to price shocks as well as higher transparency of natural resource revenues, exclusion of rebel organizations from markets, ending the finance of illicit commodities, tightening scrutiny of illicit payments, and attracting reputable companies to risky environments.

In a second publication: Breaking the Conflict Trap. Civil War and Development Policy, Collier et al (2003) focus first on the economic costs during conflict and the legacy effects of civil wars (e.g. decline in GDP per capita, refugees and internally displaced persons, psychological trauma) as well as on the global effects of civil wars (economic and social spillovers, refugees and diseases, drug production and trafficking) before the turn to the causes of civil wars. They discuss the role of rebel groups as political and business organizations, the role of ethnic factors and of the availability of natural resources but they ignore environmental factors and the results of the environmental
security research. In the literature they only refer to a few selected and old publications on resource scarcity and abundance.

5.5. From Research to Action: International Policy Activities since 1990 in the UN and EU

Since the 1990s, the widening of the security concept has progressed and concepts of “environmental security” (UNEP, OSCE, OECD, UNU, EU) have been widely used. In 1987 President Gorbachev “proposed ecological security as a top priority that de facto would serve as a forum for international confidence building”. The Brandt-Report (1980) noted that “few threats to peace and survival of the human community are greater than those posed by the prospects of cumulative and irreversible degradation of the biosphere on which human life depends”. The Brundtland Commission (1987) argued that the security concept “must be expanded to include the growing impacts of environmental stress—locally, nationally, regionally, and globally”. The Commission on Global Governance (1995) called for a broader concept of global security for states, people and the planet. It claimed a linkage between environmental deterioration, poverty and underdevelopment as causes of conflict. These reports put the linkage between environmental stress and conflicts and conflict resolution on the political agenda of international organizations.

The Millennium Report of the Secretary General mentioned several international organizations that have addressed the linkages between environmental stress and conflicts. The World Summit on Sustainable Development in Johannesburg (2002) in its political declaration and plan of implementation referred to “food security” but “environmental” or “human security” were not included. UN Secretary General Annan (2003) pointed to the potential threats posed by environmental problems and he suggested that the UN system should “build additional capacity to analyze and address potential threats of conflicts emanating from international natural resource disparities”.

In this regard, UNEP has been active in three areas: a) Disaster Management Branch (DEPI), b) UNEP’s Ozone Action Program (DTIE), and c) UNEP’s Post Conflict Assessment Unit (Haavisto 2003). In January 2004 UNEP identified a “need for scientific assessments of the link between environment and conflict to promote conflict prevention and peace building” (Topfer 2004). UNEP’s Division of Early Warning and Assessment (DEWA) launched an “Environment and Conflict Prevention” initiative to stimulate “international efforts to promote conflict prevention, peace, and cooperation through activities, policies, and actions related to environmental protection, restoration, and resources (Lonergan 2004).

The Organization for Security and Cooperation in Europe (OSCE) has dealt with security risks from environmental stress. Among the non-traditional security risks confronting OSCE countries in Central, Eastern and South-Eastern Europe, in the Caucasus, in Central Asia and other parts of the former Soviet Union are trans-boundary pollution, shortage of drinking water, disposal of radioactive waste, reduction of human losses in man-made disasters and natural catastrophes, among them several hotspots in the Baltic Sea region, the Balkans, Central Asia, in the Black and Caspian Sea as well as in the Caucasus. The OSCE Economic Forum organized several meetings on
environmental security issues. In late 2002, OSCE, UNEP and UNDP launched a joint initiative to promote the use of environmental management as a strategy for reducing insecurity in South-Eastern Europe and in the Caucasus. The results were presented to the 5th ministerial conference in Kiev in May 2003 that adopted an environmental strategy for the countries of Eastern Europe, the Caucasus and Central Asia. After Kiev, the ENVSEC Initiative has focused on:

1. Vulnerability assessment and on monitoring environment and security linkages,
2. Policy development and implementation, and
3. Institutional development, capacity building and advocacy.

In October 2004 a report on cooperation over environmental risks in the South Caucasus was released that focused on a) environmental degradation and access to natural resources in areas of conflict; b) cross-border water resources, natural hazards and industrial and military legacies and c) population growth and rapid development in major cities.

The Organization for Economic Co-operation and Development (OECD) has addressed the linkages between development, environment and conflicts in several policy statements, such as “Development Assistance, Peace and Development Co-operation of the 21st Century” (OECD/DAC 1997) and in a scoping paper on the economic dimension of environmental security that are reflected in the “Guidelines on Conflict, Peace and Development Co-operation” (OECD/DAC 2001).

The European Union has pursued two strategies for “environmental security”: a) integrating environmental goals into all sectoral policies (Cardiff process), including development, foreign and security policies; and b) stressing conflict prevention and management in its activities in international organizations (UN, OSCE) and for specific regions. At the Barcelona European Council in March 2002, a sustainable development strategy was adopted that emphasized the integration of environmental concerns into sectoral policies. The European Council in Seville (June 2002) approved a conflict prevention program that aimed both at short-term prevention and at the root causes of conflict, in its development cooperation with poverty reduction, and in its strategy against terrorism. The European Council meeting in Thessaloniki in June 2003 approved a green strategy of the EU.

6. Towards a Fourth Phase of Human and Environmental Security and Peace (HESP)

A model for an integrated analysis of causes, impacts and outcomes of environmental stress was introduced, a human security perspective was outlined and the normative context for an action-oriented approach was developed with ten essentials for a fourth phase of research on Human and Environmental Security and Peace (HESP). The policy relevance of such a research program will be developed further in the framework of a “culture of prevention” (Annan) with the goals:

1. To reduce the exposure and impact of and vulnerability to disasters and to build resilience;
2. To address the root causes of environmentally-induced distress migration that produce
internal displacements and environmental refugees;

3. To focus on linkages between disasters and distress migration and how they may trigger, contribute to and intensify severe domestic socio-economic and political crises constellations;

4. To analyze the causes and the process that resulted in violent environmental conflict;

5. To develop policy relevant strategies to resolve environmental crises, to prevent them escalating into violence, civil strife and wars, and to prevent conflicts occurring by addressing the long-term and slow-onset environmental root causes.

One policy strategy may be to use international environmental agreements, cooperation, regimes and governance as a tool for conflict prevention and peacemaking. This requires an equity-oriented perspective of the analyst and multilateral international organizations and regimes as key actors for the development and implementation of such a longer-term oriented normative strategy that is based on the three pillars of a people-centered human security perspective: a) poverty eradication, b) freedom (good governance, human rights), and c) equity (fair international exchange rates, justice).

The realization of these goals requires an interdisciplinary cooperation of scientists from North and South, from the natural sciences (global environmental change) and the social sciences (policy process and outcomes), of environmental specialists, disaster and migration experts, with the peace and conflict research community and policy relevant initiatives in close consultation with practitioners.

6.1. Essentials for Research on Human and Environmental Security and Peace (HESP)

A fourth phase of social science research on human and environmental security and peace (HESP) may aim at the following ten conceptual and policy-relevant goals:

1. Orientation: The research of any analyst is influenced by different worldviews and ecological standpoints. An equity-oriented pragmatic Grotian perspective may be best suited to support multilateral environmental efforts in the framework of international organizations and regimes with the goal of avoiding harmful and conflictual outcomes.

2. Causes: The research should broaden the scope to include processes of global environmental change and their interactions, environmental degradation and environmental scarcity and their impact on environmental stress. This requires a close interaction between social and natural sciences and a multi- and interdisciplinary approach.

3. Policy Process: Case studies should include the policy processes, i.e. how the state and the society have responded to these challenges and outcomes, they should emphasize the role the knowledge factor (learning, capacity building) has played in developing adaptive and mitigation strategies to reduce vulnerability and to strengthen resilience.

4. Outcomes: The research should focus not only on environmental conflict but it should include disasters, environmentally-triggered migration and refugees and the complex interactions among these outcomes.
5. **Regional Orientation**: A regional perspective on causes, the policy process and on outcomes is needed. This requires regional models (climate, soil, hydrological cycle), and comparative social science case studies on the policy processes within the region.

6. **Spatial Approach**: The analysis of environmental security issues on a regional level requires a spatial approach. As neither globalization nor geopolitics include environmental factors and problems of environmental security, a new approach of a political geo-ecology is needed.

7. **Human Security Focus**: The reference for both research and policy should be human beings, in particular the individual victims and communities hit by distress migration, disasters, crises and conflicts. The human security approach of UNDP remains too broad, while the approach suggested by GECHS (1999) and UNU-EHS (2004) on the environmental dimension of human security is more promising (Bogardi/Brauch 2005).

8. **Policy Goals on the individual level**: Environmental security studies should aim at contributing to strategies for reducing the impact of outcomes of environmental stress, decreasing the vulnerability and strengthening the coping capacities and resilience.

9. **Policy Goals on the national and international level**: Strategies should be developed for coping with national and regional outcomes of environmental stress by improving disaster response and integrating disaster reduction into national and local development planning. The resolution, prevention and avoidance of violent outcomes from environmental stress as well as the containment of the societal impact of extreme weather events should become major policy goals.

10. **Sustainable Development and Sustainable Peace**: A human security perspective for the analysis of environmental security issues may aim at an enduring “sustainable peace”, as was suggested by U.N. Secretary General Kofi Annan.

These ten essentials for a fourth stage of research on human and environmental security and peace (HESP) will be further developed conceptually with a focus on the three crucial praxeological goals of creating awareness for the challenges, putting them on the scientific and political agenda (agenda-setting) and initiating a scientific process of anticipatory learning that builds on culturally-specific, indigenous knowledge that must be translated into preventive action to reduce the impact of and exposure to disasters as well as the social vulnerability, especially of the marginalized poor.

### 6.2. Pragmatic Grotian View on Security and Equity-oriented Standpoint on the Environment

A pragmatic Grotian perspective on security tries to avoid an exclusive focus on power (Hobbesian) or on law (Kantian), looking for a middle-ground that permits multilateral cooperation in an imperfect world. From this perspective, multilateral approaches matter, are possible and the most promising approach for dealing with the environmental dimension of human security. This perspective comes closest to the policy goals of international organizations and regimes that have addressed environmental security challenges conceptually since the Stockholm conference (1972).
6.3. Normative People-centered Human Security Perspective

Four different approaches to human security have been distinguished—as a level of analysis, as a normative analytic perspective, as an end-stage or outcome and as an all-embracing concept. This author has argued for a normative human security perspective on environmental stress and outcomes that extend from the human to the global level of analysis, and permit analysis of the impact of global climate change on human beings affected by extreme weather events due to human activity.

6.4. Interdisciplinary Regional Focus of a Political Geoecology

In order to analyze the causes for and the interrelationship among environmental degradation, scarcity and stress, knowledge of many disciplines is needed. Cooperation between different scientific fields and perspectives (multi-disciplinary) is required and these must be integrated in interdisciplinary approaches and strategies. With regard to the spatialization of political processes, both globalization and geopolitics are insufficient to deal with environmental security issues. A new approach of political geoecology has been proposed linking geoecological processes in nature to those of the human world and its actors in state, society and in the economic realm. A regional perspective is suggested because geoecological processes ignore state boundaries while the coping capacity of states, societies and economies are needed to deal with extreme outcomes. Both basic and applied knowledge are needed to build capacities for strengthening resilience of societies in dealing with disasters.

6.5. Multilateral International Organizations as Key Actors

International cooperation is needed to cope with the outcomes of environmental conflicts. After the first Earth Summit in Stockholm in 1972, UNEP was established as the key international organization that launched international efforts on many challenges in separate environmental regimes. At the Earth Summit in Rio de Janeiro in 1992, three regimes were launched: the UN Framework Convention on Climate Change (UNFCC), the UN Biodiversity Convention, and in 1994 the UN Convention to Combat Desertification (UNCCD). At the World Summit on Sustainable Development (WSSD) in 2002, a political declaration and a plan for implementation were adopted. These environmental institutions, regimes and action plans are supplemented by four programs on global change research.

6.6. Policy Goal: Contributing to a “Culture of Prevention”

Since the 1990s a “culture of prevention” has been called for by social scientists, research programs, international organizations and national governments. It has been proposed in reports by the Secretary Generals of the United Nations Boutros-Ghali and Annan, and it has become an important theme of policy papers and proposals of the OSCE and the European Union. While the list of policy proposals for strategies of conflict prevention have been numerous, there have been only few successes. Nevertheless, the prevention of violent conflicts, the reduction of the impact of disasters and of the vulnerability of the marginalized poor, the early recognition of environmentally-induced distress migration and the management of socio-economic and
political crises remain major challenges for foreign, security, development and environment policy.

6.7. Creation of Knowledge that Contributes to Pro-Active Policy Initiatives

Research on environment and security linkages is not only of academic interest. For policy-relevant and action-oriented research, with a focus on preventing violent outcomes to challenges caused, triggered or intensified by environmental stress, the production of knowledge is a major task for proactive initiatives. Homer-Dixon (2000: 1) argued that in dealing with the severity of global environmental stress our societies “need more ingenuity, i.e. more ideas for solving their technical and social problems” but he also noted that both rich and poor societies often “face an ingenuity gap: a shortfall between their rapidly rising need for ingenuity and their inadequate supply”. However, the perception of the priorities for dealing with global and regional environmental challenges is determined by our mindsets and standpoints on international security and environment policy.

With scientific progress our knowledge has increasingly fragmented due to the artifacts of scholarship. For Edward O. Wilson (1999: 8) the greatest challenge remains the “attempted linkage of the science and humanities”, with “consilience” as the “key to unification” by bringing together environmental policy, ethics, social science and biology. For him science is “neither a philosophy nor a belief system” but a “combination of mental operations” that have enabled humanity to escape the confinements of physical reality while people expect from the social sciences “the knowledge to understand their lives and control their future. In his search for consilience Wilson has called for a “united system of knowledge” as the surest means to identify “the still unexplored domains of reality” that “frames the most productive questions for future inquiry”. Wilson emphasized that consilience is the interlocking of causal explanations across disciplines whereby interfaces of disciplines become more important. Munn argued: “that this interlocking amongst the natural sciences will in the twenty-first century also touch ‘the borders of the social sciences and humanities”. Anticipatory learning must acknowledge this need for a growing consilience that causal explanations across disciplines may contribute to new understanding and knowledge that is needed to cope with the challenges of the “world risk society” (Beck 1999). To enhance the coping capacity of the most vulnerable human beings in developing countries, a combination of indigenous and culture-based knowledge, local self-reliance with modern scientific knowledge and complex technical means is needed to support livelihood security. This requires a dual scientific dialogue across disciplines and cultures involving scientists and practitioners from North and South.

Peter Haas (1990: 52) has introduced the concept of an epistemic community for knowledge-based groups, by analyzing the role “of experts and knowledge-based communities on governmental learning and the development of new state objectives”. For Haas (1990: 55) an epistemic community is:

a professional group that believes in the same cause-and-effect relationships, truth tests to assess them, and shares common values. As well as sharing an acceptance of a common body of facts, its members share a common interpretative framework, or ‘consensual knowledge’, from which they convert such facts, or observations, to policy-relevant
conclusions. They identify problems in the same manner and process information similarly. They also share a common vocabulary, common political objectives to which such policies should be addressed, and a common network in which findings are exchanged and shared concerns are formulated. Although members of an epistemic community may be drawn from different scientific disciplines, all will share some common world view and concern about the same subject matter. … An epistemic community … must share a common approach to understanding…An epistemic community’s power resource, domestically and internationally, is its authoritative claim to knowledge…Ultimately, epistemic communities may contribute to policy change made in response to new causal understandings, or governmental learning.

Such knowledge-based communities focusing on the linkages between environment and security are needed to contribute to an early recognition, a public awareness, an agenda-setting and an anticipatory learning about likely impacts of regional environmental change, its effects on environmental degradation, scarcity and stress and possible outcomes. These discussions must be based on equality, scientific excellence and respect for other civilizations, cultures and religions.

6.8. Institutionalization of Basic and Applied Research

To pursue such an ambitious agenda, occasional meetings are not sufficient. They require a firm institutional base where scientists and practitioners can cooperate on a few themes of research and training of high policy-relevance from different backgrounds, practical experiences, from both South and North. To illustrate this need with regard to environment and security linkages several recent scientific efforts will be briefly mentioned.

6.8.1. GECHS: Global Environmental Change and Human Security

GECHS provides “interdisciplinary and integrative perspectives on the relationships between environmental change and security”. GECHS promotes research that addresses questions such as:

a) When and how does global environmental change (GEC) threaten human security? b) Why are some regions and communities more vulnerable to GEC? c) Can future insecurities be predicted? d) What strategies would reduce the potential effects of GEC on human security? and e) What facilitates the implementation of some strategies and how can obstacles be overcome?

GECHS adopted the following criteria for endorsing a project: a) interaction between global environmental change and human security, b) consistency with GECHS research priorities, c) interdisciplinary research team, d) linking place-based research to broader informed consent.

6.8.2. UNU-Institute on Environment and Human Security UNU-EHS

In December 2003 the Institute on Environment and Human Security of the United Nations University (UNU-EHS) was established in Bonn. UNU-EHS focuses on “all steps involved in planning and operation for prevention or mitigation of disasters. Its tasks include research on extreme natural events, and transfer of knowledge on
management and planning in the field of disaster management.” UNU-EHS (2004) focuses from an interdisciplinary perspective on the impact of rapid-onset natural disasters (floods, storms) and on the vulnerability of people in developing countries, and on practical measures of disaster management to cope with the effects, and to enhance resilience. The goal of this center is to contribute to human security.

6.8.3 PRIO-Center for the Study of Civil Wars (Oslo)

In January 2003 the International Peace Research Institute Oslo (PRIO) launched a new Center for the Study of Civil Wars (CSCW) as “a long-term, multidisciplinary initiative that aims to understand: a) why civil wars break out, b) how they are sustained, and c) what it takes to end them”. The center focuses on civil war that may also be caused, triggered or intensified by environmental stress.

Center staff includes PRIO researchers and eminent scholars from other institutions who bring the insights and complementary strengths of economics, history, political science, philosophy and sociology to bear on related research questions. The Center’s methodological toolkit includes game theory, micro- and macroeconomics, quantitative statistical analysis, comparative case study, and historical criticism. The work of all groups, and of the Center as a whole, has an iterative dynamic, going from theory building to empirical case materials and back.

6.8.4. Science Partnerships on Mitigating Syndromes of Global Change (Bern)

This Swiss project is based on the assumption that “the world is threatened by increasing insecurity caused by globalization, global disparities and processes of global change. In some regions, core problems occur in characteristic clusters that can be perceived as syndromes. The mitigation of these syndromes is a global challenge; it is also a precondition for achieving sustainable development.” This National Center of Competence in Research (NCCR) North-South focuses on:

international research cooperation and promotes high-quality disciplinary, interdisciplinary and transdisciplinary research with the aim of contributing to an improved understanding of the status of different syndromes of global change, of the pressures these syndromes and their causes exert on different resources (human, natural, economic), and of the responses of different social groups and society as a whole. By identifying the potential of social systems to mitigate syndromes, by considering their dynamics, and by adopting existing innovative solutions, the NCCR North-South aims primarily to help design ways to mitigate syndromes…Through its activities and partnerships, the NCCR North-South also contributes to developing the capabilities of partner institutions and societies at large in developing and transition countries, thus eventually helping these institutions to find sustainable solutions with the means available in their own local contexts.

The project aims at a highly integrated approach that involves several scientific disciplines.

The program consists of eight Individual Projects (IPs). Each of the IPs contributes to mitigation strategies at different levels of intervention…and through many disciplines ranging from political and social sciences to natural sciences…Each IP is led by a Swiss core institution that provides scientific competence in a particular realm and has a long-term
record of, and experience in, research collaboration with institutions in many developing and transition countries…The integrated approach generates added value by establishing creative links between the different IPs and scientific realms, as well as within each syndrome context.

In September 2001, the project organized an international conference on Regional and Global Perspectives of Syndrome Mitigation Research, and in 2002 an integrated training course on “family building”.

6.9. Networking among Scientists and Practitioners

Most projects aim at a cooperation between scientists and practitioners to facilitate the creation of policy relevant knowledge and its transfer to decision-makers. The PRIO center focuses exclusively on social science research but its results will be of importance for international humanitarian and development organizations. GECHS and the Swiss project plan to enhance networking among scientists and to support North-South science partnerships while the UNU-EHS wants to enhance the knowledge transfer among natural and social scientists working on preparedness and risk reduction in government institutions and non-governmental humanitarian organizations.

6.10. Dissemination of Policy-Relevant Information

A major intention of interdisciplinary research on linkages between environment and security, on environmental stress and environmentally-induced extreme outcomes is to contribute to early-warning, and the knowledge creation and transfer to reduce vulnerability and to enhance resilience. The users are governments and international organizations dealing with human and nature-induced environmental outcomes. The research can help them to search for strategies to cope with these challenges, and to reduce fatalities, number of persons affected and economic losses. Five stages are crucial: a) the early recognition of knowledge that is relevant for societal, political and economic decision-makers, b) the creation of public awareness, c) agenda-setting, d) anticipatory learning, and e) building coping capacities.

A major goal of the fourth phase of research on human and environmental security is to contribute to early recognition of extreme environmentally-induced, triggered or intensified outcomes. One major audience is the scientific community at universities and research institutes and the educational sector. Research on human-induced natural hazards and on distress migration is relevant for humanitarian organizations and governmental agencies dealing with emergency planning, risk management and disaster relief. Recognition of environmentally-triggered societal crises at an early stage and sending early warning messages has often failed to lead to pro-active policy decisions because warnings often do not reach policy-makers due to information overload in complex organizations.

To create awareness requires a transfer of knowledge to decision-makers. For rapid-onset disasters, such as volcanic eruptions, earthquakes, tsunamis triggered by earthquakes, heavy storms and flash floods, the timeliness for the initiation of local responses is crucial to evacuation of people and rapid responses to save as many people as possible. Due to satellite data and weather modeling, the warning time for most
hydro-meteorological hazards has increased. Periods of drought can be recognized early and warning messages can be conveyed to the international community on time. But it often takes the presence of TV networks to create public awareness on existing catastrophes to launch disaster response activities. Long-term structural developments that may lead to crises have difficulties in catching the attention of the daily media and thus contributing to public awareness and preparedness. To implement early warning into preventive action also requires resources that are scarce and often lacking in developing countries.

The Brundtland Report of 1987 was instrumental for putting environmental security challenges both on the scientific and the political agenda. Robert Kaplan and Thomas Homer-Dixon significantly contributed to the agenda-setting of environmental security challenges in the Clinton Administration. Whether these efforts are being perceived by governments and policy-makers depends on their mind-set that determines their priorities and means.

The task of both the natural and the social sciences is to produce knowledge with generally accepted methods that can be verified, tested or falsified. According to Haas, “effective responses to environmental problems require fairly sophisticated learning about the social and environmental contexts of decisions”. A positive case has been ozone depletion in the southern hemisphere that was detected in the early 1970s by Crutzen, Molina and Rowland. Within twenty years major policy responses were launched, an international policy framework was created and several chemicals were phased out. The response to climate change is another major example. While in 1896 Arrhenius hypothesized a linkage between burning of fossil energy sources and global warming, it took the scientific community 75 years to acknowledge this hypothesis. A severe drought in USA in 1988 was instrumental in putting climate change for the first time on the political agenda. Four years later in 1992, the U.N. Framework Convention on Climate Change was signed, and the Kyoto Protocol was adopted in 1997 and entered into force in February 2005, with the major producer of greenhouse gases opting out. There has been much support from the mainstream of the global scientific community for the work of the IPCC and the goals of the Kyoto Protocol.

The IPCC has become a powerful epistemic community contributing to a synthesis of scientific knowledge and to anticipatory learning by proposing adaptation and mitigation measures to modify the trends the models foreseen if business as usual continues. Learning has already occurred in the energy sector: Since the oil shocks of the 1970s, in most OECD countries economic growth has been decoupled from energy consumption, and investments into energy efficiency and renewable energy sources have significantly increased. The Kyoto flexible mechanisms, especially the Clean Development Mechanism, and the funds approved with the Marrakech Accord can become instruments to introduce this anticipatory learning into the energy markets. Knowledge-based epistemic communities, such as the IPCC, may be instrumental for initiating an anticipatory learning process. Haas has distinguished between a) learning as a psychological process, b) tactical or trial-and-error learning, or instrumental learning, and c) learning by pursuing new objectives and by adopting new patterns of reasoning. Haas argued that UNEP and many environmentalists preferred the last type of learning:
because it is the only type of learning that would enable societies to manage the environmental crisis. They felt that new attitudes and more comprehensive decision-making practices were necessary to deal with environmental issues and to manage the tradeoffs between discrete objectives that such problems create. Leaders must come to recognize that cooperation, coordinated policymaking, and more integrated domestic policy was necessary to manage and relate the multiple interdependent forces involved in environmental protection. The most sophisticated form entails the shift to extreme new conceptions of cause-effect relationships, which can often be called a shift in ‘consciousness’. It is the most commonly analyzed by writers discussing environmental issues. Actors would adopt systems thinking rather than reductionist thinking. Actors would recognize their position within the system, and treat problems as they interrelate rather than as distinctive cases … Key ‘leitmotifs’ of new views of nature are ‘non-linearity, instability and fluctuations’. When the world is viewed in terms of connections, policies may be framed in terms of responsibilities rather than rights. … All of these are types of learning in which governments may engage as a result of political involvement by an epistemic community.

The Social Learning Group (2001, 2001a) has reviewed learning to manage global environmental risks in case studies of social responses to climate change, ozone depletion and acid rain by addressing three questions: Who learns? What is learned? What counts as learning? Clark, Jäger and van Eijndhoven (2001) included learning within organizations and institutions. They stated that the literature on learning “concentrates on the incorporation of new knowledge or experience into existing practices, causal models, and decision-making processes’. For them it is obvious “that some of the most important learning involves changes in the higher-order concepts including norms, goals and overall interpretative frameworks” or policy paradigms. They treat learning as a process that may help to bring about cognitive changes at multiple levels ranging from issue frames…and belief systems…through goals…strategic perspectives on one’s relationship with other actors…and behavioral intentions…to more elemental concepts including cause-and effect relationships, appraisal of the efficacy of particular management interventions, and basic skills of management practice.

They define learning as “processes that lead to better outcomes”. According to Sabatier learning focuses on cognitive changes “that result from experience and are concerned with the attainment (or revision) of policy objectives”. They expanded the scope to encompass “experience and new information” and counted as learning “those processes that deliberately utilize experience or information to bring about cognitive changes that are concerned with global environmental management”. Furthermore, they left questions on “the instrumental effectiveness and normative implications of learning to be treated empirically rather than definitionally”.

Anticipatory learning as a tool of crisis prevention is far more ambitious and difficult than the requirements of crisis management as a centerpiece of national emergency planning. Hart, Stern, and Sundelius argue that learning from past experience remains an important building block for efforts to cope with future crises. From past successes in crisis prevention, they point to three obstacles: a) the problem of complacency that excludes the unconventional challenges; b) the vulnerability paradox; and c) the balance between prevention and resilience. As national priority areas for upgrading
crisis management, they pointed to several major tasks: a) a wider innovative risk assessment; b) a better integration of national regulation and design into international structures, and c) an intensive planning and preparedness involving large-scale operations and transcending the civil-military divide as well as the management of uncertainty and complexity. The authors see the knowledge production in social science research and transfer to operating units as crucial.

Joint North-South anticipatory learning requires as a first step a debate on longer-term challenges and a mutual understanding of their relevance, and as a second step a multidisciplinary search for complex strategies to cope both with the root causes and their effects and socio-economic implications. The task of anticipatory learning must be on three different levels: a) across the boundaries of scientific disciplines; b) across the North-South cultural and political divide and c) between conceptually oriented academics and action oriented decision-makers.

One link between anticipatory learning and pro-active behavior in disasters, distress migration and environmentally-induced crisis is to build local capacities by enhancing the knowledge-base, experience of disaster managers by introducing new ideas and practices that are adapted to the local culture, experience, traditions and capabilities. Capacity building is a major goal of UNU-EHS and of the Swiss project to build science partnerships on mitigating the syndromes of global change.

7. Conclusions

During the first three phases of research on environment and security, issues related to global environmental change, environmental scarcity, degradation and stress as well as their possible socio-political consequences were put on the scientific research agenda, both in the social sciences and in the natural sciences, but also on the political agenda of governments and international organizations.

However, most studies in the environmental security debate since 1990 have ignored or failed to integrate the contributions of the global environmental change community in the natural sciences. To a large extent the latter has also failed to integrate the results of this debate. In the first three assessments of the Intergovernmental Panel on Climate Change (IPPC) the past and potential future socio-economic and political impacts of climate change have not been reviewed (BMU 2002).

Thus, there is now a need for moving towards a fourth phase of research on environment and security linkages that builds on the available evidence and tries to overcome the shortcomings. The ultimate goal of a fourth phase of research on human and environmental security and peace (HESP) is to induce policy-makers to anticipatory learning by accepting new paradigms leading to proactive environmental initiatives and behavior that recognize and address the root causes of the fatal outcomes of environmental stress before they result in severe crises that escalate into violent strife. The specific strategies to be launched will differ from case to case and they must take the specific context, history and conflict-proneness of each case into account.

The complex relationship between these factors are analyzed in The Model: Global
Environmental Change, Political Process and Extreme Outcome. The debate on the reconceptualization of security—from national to environmental and human security—is covered under *Reconceptualising Security From National to Environmental and Human Security*; and a review of the definitional debate on security threats, challenges, vulnerability and risks can be found under *Security Threats, Challenges, Vulnerability and Risks*.

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The conceptual debate on the fourth phase of research will be developed further in:


Glossary

**CIDCM:** Center for International Development and Conflict Management.

**CSCW:** Center for the Study of Civil Wars.

**CVA:** Capabilities and Vulnerability Analysis.

**DEPI:** Disaster Management Branch of UNEP.

**DEWA:** UNEP’s Division of Early Warning and Assessment.

**DIVERSITAS:** Program on biodiversity science.

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DTIE: UNEP’s Ozone Action Program.
ECOMAN: Environmental Change, Consensus Building and Resource Management in the Horn of Africa.
ENCOP: Environment and Conflicts Project.
ENVSEC: Environment Security initiative of OSCE, UNEP, UNDP.
EPS: Environment, population, and security.
EU: European Union.
GECHS: Global Environmental Change and Human Security.
GNP: Gross National Product.
HDI: Human Development Index.
HESP: Human and environmental security and peace.
IGBP: International Geosphere-Biosphere Program.
IHDP: International Human Dimensions Program on Global Environmental Change.
IHI: Index of Human Insecurity.
ISSC: International Social Science Council.
LUCC: Land-use and Land-Cover Change.
MENA: Middle East and North Africa.
NATO: North Atlantic Treaty Organization.
NCCR: North-South : North-South Research partnerships.
NCCR: National Center of Competence in Research.
NGOs: Nongovernmental organizations.
OECD: Organization for Economic Cooperation and Development.
OECD/DAC: Development Assistance Committee of OECD.
PIK: Potsdam Institute of Climate Impact Research.
PRIO: International Peace Research Institute Oslo.
SFTF: U.S. State Failure Task Force.
START: SysTem for Analysis, Research and Training.
TAR: Third Assessment Report.
UN: United Nations.
Four Phases of Research on Environment and Security

- Hans Günter Brauch

**UNDP:** United Nations Development Program.

**UNEP:** United Nations Environment Program.

**UNESCO:** United Nations Educational, Scientific and Cultural Organization.

**UNU-EHS:** Environment and Human Security Institute of the United Nations University.

**UNU:** United Nations University.

**WBGU:** Scientific Advisory Council on Global Environment Issues of the German government.

**WCDR:** World Conference on Disaster Reduction.

**WCRP:** World Climate Research Program.

**WG II:** Working Group II.

**WHO:** World Health Organization.

**WTO:** World Trade Organization.

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Biographical Sketch

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