German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)

Bonn, 10 June 2002, 1 pm – 3 pm

Special Event

"Climate Change and Conflict Prevention"

Can climate change impacts increase conflict potentials ?

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Climate Change, Environmental Stress and Conflict

Climate Change, Environmental Stress and Conflict

➔ Socio-Econ. & Political Impact of Climate Change

➔ Objects of analysis are:

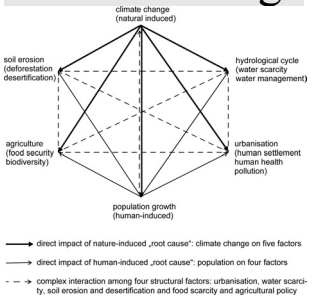
- **Causes:** Global Environmental Change: *Hexagon*
- **Effects:** environmental *degradation, scarcity, stress*
- **Outcomes:** *disasters, migration, crises, conflicts*

➔Research questions:

- What are the linkages between climate change impacts, environmental stress and conflicts?
- What are the results of social science research on environmental security on these linkages?

➔ Focus: climate change impacts and interactions with water, soil, population, urbanisation, food.

Figure 1: Causes, Effects and Outcomes of Environmental Stress

Causes (Hexagon)	Effect (Interaction)	Environmental Stress	Probable Outcomes
Climate change 	**environmental** ➔ **degradation** (soil, water) ↓ ↑ ➔ ➔ **scarcity** (water, food, housing)	global cond. ↓ Environmental stress ↑ nation. cond.	**disaster** conflict avoidance ↗ ↗ ➔ **Crisis** ↘ ↘ **migration** **conflict**

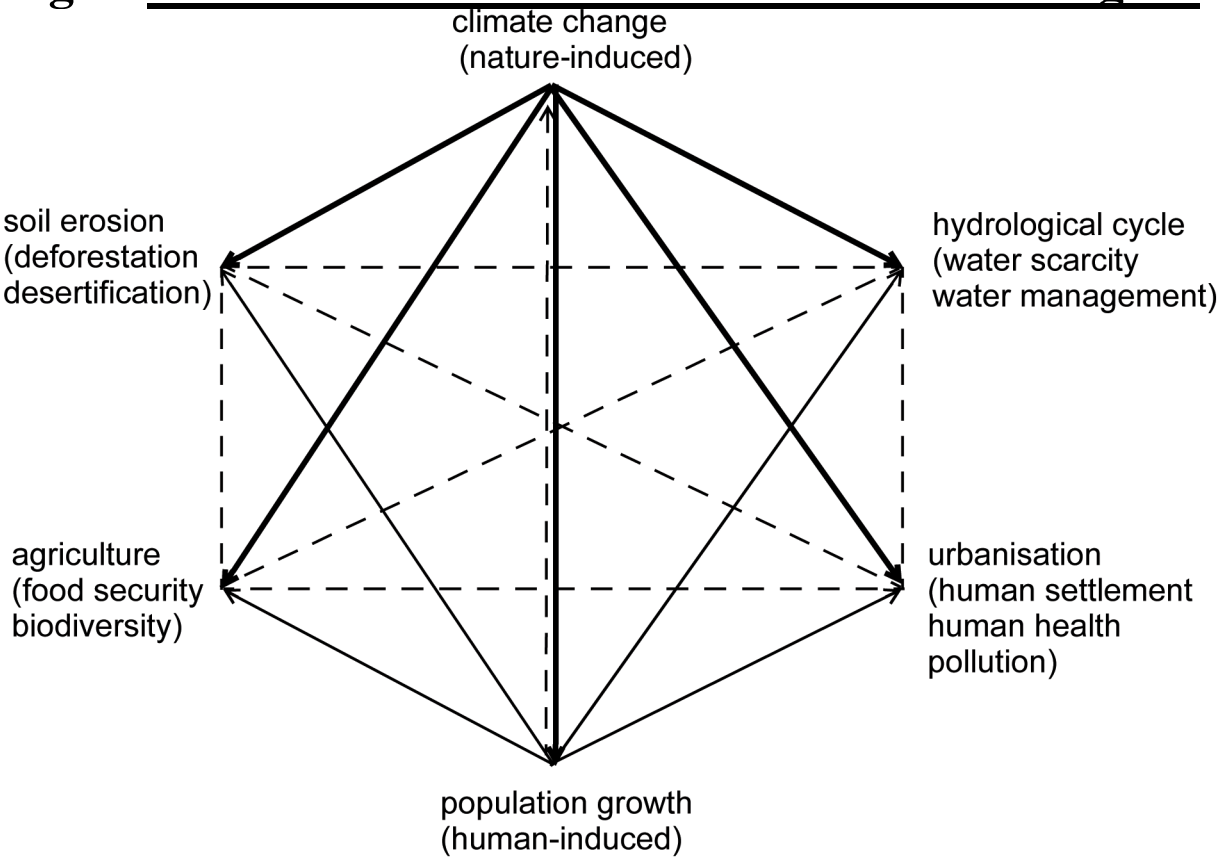
- **Case for the interaction of Hexagon: Mediterranean**
- **Disaster and distress migration: Bangladesh**
- **Long-term impact of climate change and population growth: human catastrophe ➔conflict potential: Egypt**

2. Root Causes of Global Environmental Change: Six Structural Factors of a "Survival Hexagon"

Six factors of *Global Environmental Change* (20-100y.)

- **Nature-induced** (Earth system, physical, chemical dimensions of GEC, or **supply-side**): climate change, water, soil contribute to *environmental degradation* (object: **natural** sciences)**;**
- **Human-induced** (biological, ecological dimensions of GEC or **demand-side**): population growth, urbanisation, food contribute to *environmental scarcity* (object: **social** sciences).

Fig. 2: Interactions of Six Factors of "Survival Hexagon"



2.1 Climate Change: Root Cause of Global Env. Ch.

Knowledge: *IPCC-Reports: 1:1990, 2: 1995, 3: 2001*

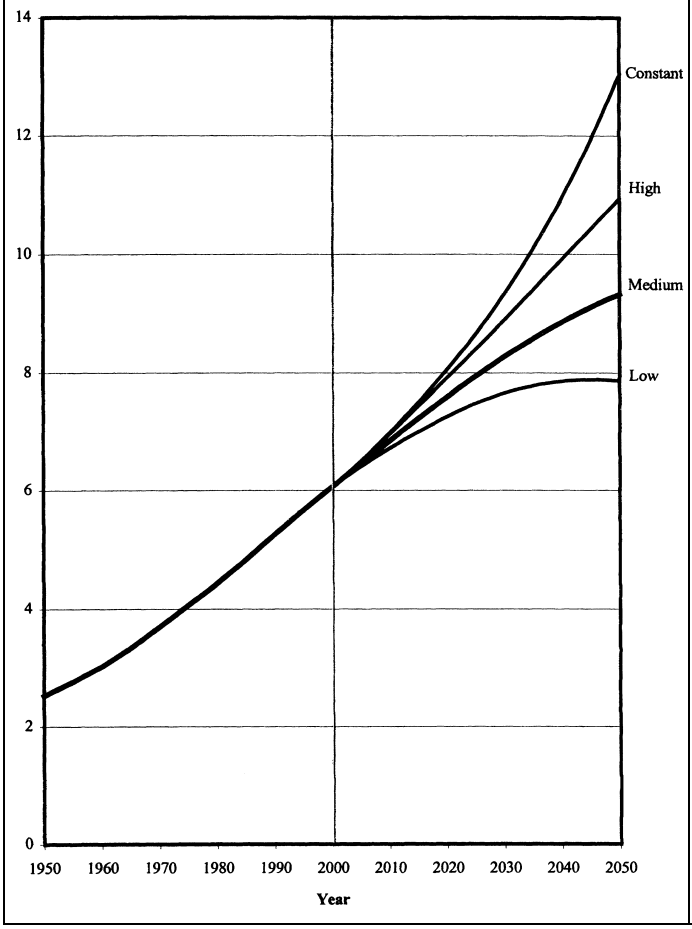
2.2 Global Consequences: Temperature & Sea Level Rise

- Global average **temperat**. rise in 20th cent.**: + 0.6°C;**
- **Sea level** rise in 20th century**: 0,1 - 0,2 m;**
- **Precipitation** increased by **0,5-1%** per decade,
- **Temperature** increase: 1990-2100: **+1.4 – 5.8°C**
- **Sea level rise**: 1990-2100: + **0.09 - 0,88 m**

2.3 Population Growth (UN Pop. Div. 1950- 2050)

- **Population Assumptions:** 1900: 1.6 mio; 1990: 5.3 mio.;
- **2000: 6.1; 2050: 8.4-11.3 mio.; 2100: 7.0-15.1 mio.**

Figure 3: Growth of World Population (1950-2050)



World Population, Medium Scenario 2000-2150 (UN, 1998 Rev.)

	2000	2050	2100	2150
Tot	6.01	8.91	9.50	9.75
Af.	0.78	1.77	2.22	2.31
Eu	0.73	0.63	0.52	0.52
LA	0.52	0.81	0.88	0.91
NA	0.31	0.39	0.39	0.40
Oc	0.03	0.05	0.05	0.05
As.	1.40	2.27	2.48	2.56
Ch	1.28	1.48	1.34	1.36
In.	1.01	1.53	1.60	1.64

Regional perspective is needed for climate change (supply) and population growth demand factors)

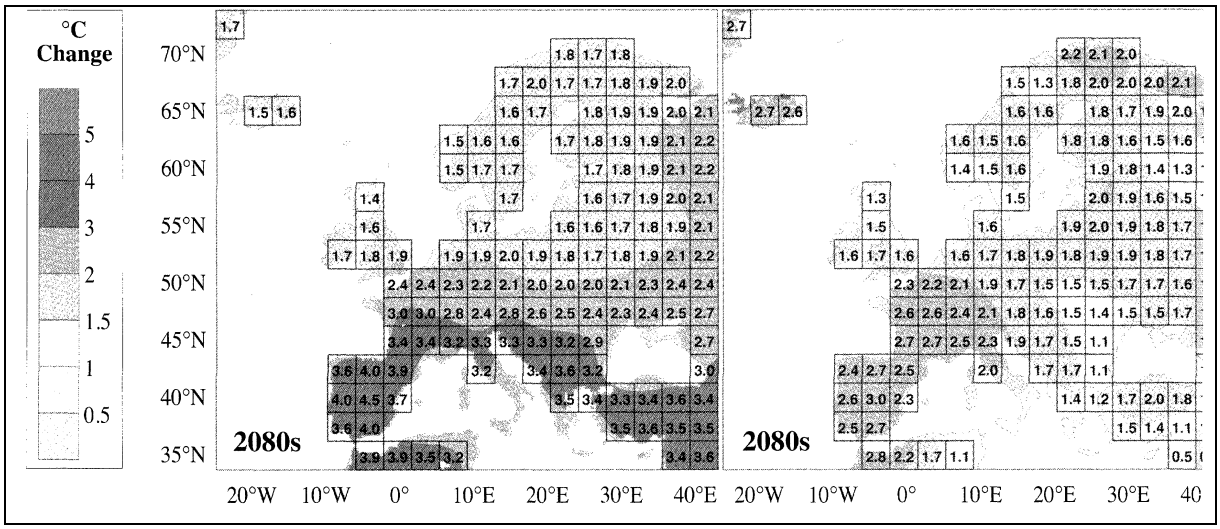
3. Linkages Among Factors of the Survival Hexagon based on Evidence of IPCC Assessments

3.1 Supply-Side Factors: Climate, Water, Soil

- **Climate Change temperature increase (summer) is higher:** North America, Mediterranean, Central Asia
- **Precipitation decline is larger:** Cent. Amer., Mediter.
- **Soil**: deserts more extreme, desertification irreversible
- **Environmental degradation**: from the changes & interact. of 3 factors is **likely to increase in 21st century**

3.2 Example: Impact for the Mediterranean Region

Fig. 4: Summer Scenario Maps for Mean Temp. Inc.



Conclusions:

- **Temperature** will rise more in the Mediterranean;
- **Precipitation** will decline more in Mediterranean.

Population growth will differ on both sides:

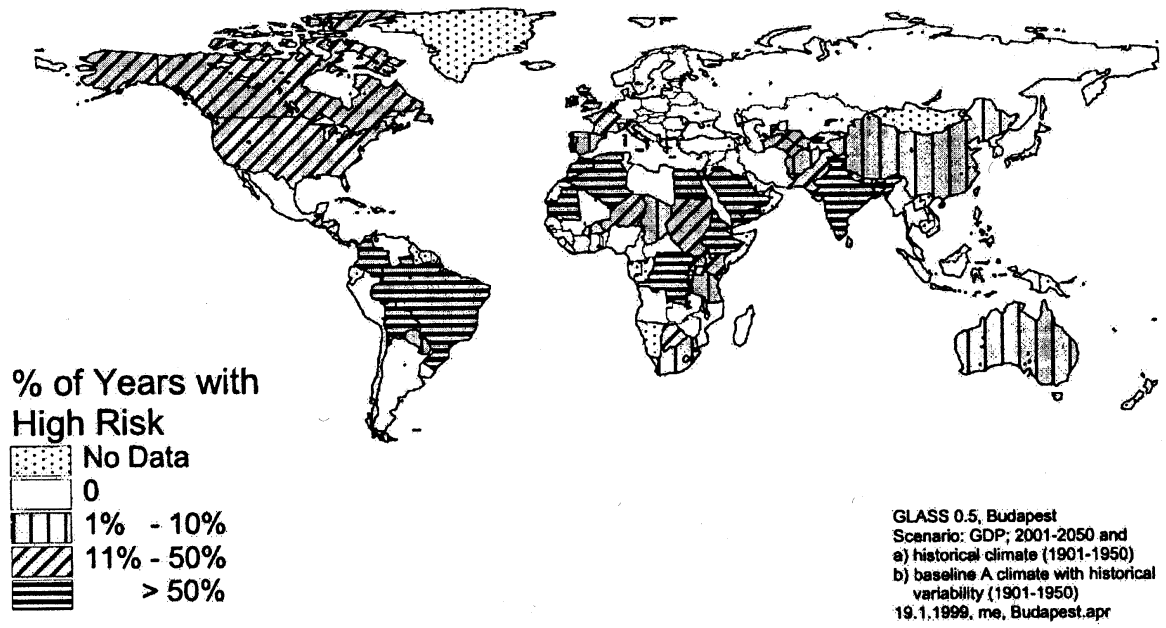
- **North: *decline*: 2000-2050: - 23 mio. (Italy, Spain)**
- **South: *increase*: 2000-2050: + 181 mio. (NA + 96 m.)**

MENA: will be affected both by ***climate change*** (supply decline) and ***population growth*** (demand rise).

3.3 Demand-Side: Population, Urbanisation, Agriculture

- In some regions *environm. degradation* will increase & affect supply-factors for food production: **soil & water**
- Environmental *degradation* will contribute to scarcity: demand for **food** and for **food imports will rise**

Fig. 5: High Potential for Food Crisis 2001-2050



***Source*: Joseph Alcamo: GLASS Security Diagram**

Conclusion: Mediterranean, MENA Region will experience in 21st century ***high potential for food crises*** due to opposite trends: *increasing demand* (population) and *declining supply* factors (precipitation, yield).

Table 2: Cereal balance by devel. regions, cereals (FAO)

	Self-sufficiency rate (%)			Net trade (mio. tons)		
	1964/66	1995/97	2030	1964/66	1995/97	2030
SS-Africa	95	86	84	-2	-10	-32
South Asia	86	97	94	-10	-1	-26
East Asia	98	94	90	-5	-37	-79
L.America	109	90	87	5	-16	-32
➔MENA	86	65	56	-5	-43	-102

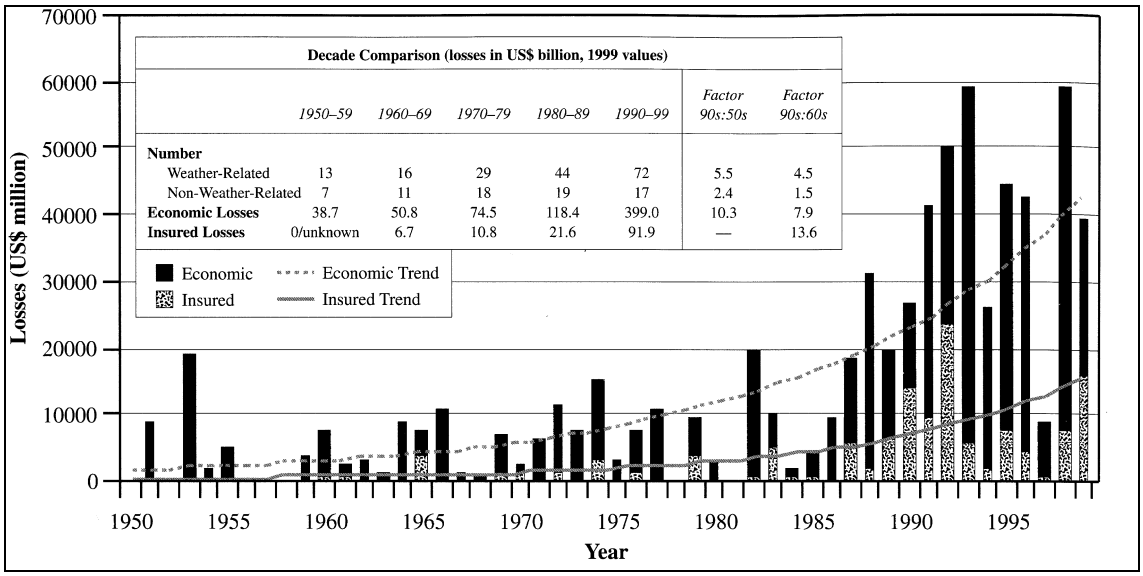
4. Outcomes: Disasters, Migration, Crises & Conflicts

Environmental security studies focused on environm. conflicts and migration, **less on disasters and crises**.

4.1 Climate Change, Extreme Weather and Disasters

- **IPCC (TAR, WG 2, 2001):** Insurance Industry
- **Dramatic increase in damages and costs**

Figure 6: Costs of Catastrophic Weather Events (1950-1999)



Decade Comparison (losses in US$ billion, 1999 values)

	1950–59	1960–69	1970–79	1980–89	1990–99	Factor 90s:50s	Factor 90s:60s
Number							
Weather-Related	13	16	29	44	72	5.5	4.5
Non-Weather-Related	7	11	18	19	17	2.4	1.5
Economic Losses	38.7	50.8	74.5	118.4	399.0	10.3	7.9
Insured Losses	0/unknown	6.7	10.8	21.6	91.9	—	13.6

- Most **insured damages** were in the North (Europe, NA)
- Most **people were killed & affected** in the South

Table 3: People Killed and Affected by Disasters

Countries		1981-1990		1991-2000		2000
		people	average	people	average	people
Mexico	killed	11,961	1,196	4,902	490	32
	affected	753,887	75,389	2,851,231	285,123	73,49
Bangladesh	killed	27,903	2,790	147,753	14,775	68
	affected	228,794,460	22,879,446	90,473,239	9,047,324	2,826,12
Egypt	killed	1,054	105	2,696	270	16
	affected	163	16	204,096	20,410	24

Bangladesh has been a *primary victim of extreme weather events*: of cyclones, floods but also of drought that forced people to leave their homes, rural areas & country.

Table 4: Impacts of Climate Change on Security & Survival

	II: Bangladesh	III: Egypt
Climate zone	tropical zone	semi-arid, arid
Impacts	SLR, flooding, water scarcity	SLR, tempera-ture rise, drought
Impacts on soil, water, agriculture, settlements, health	loss by SLR cyclones, water diseases	loss of best land, yield decline, heat waves, diseases
Sec. policy impact	human security	nat. & region. sec.

Table 5: Popul. Growth in Million, 1950-2050 (Med. V.)

Years ➔	Real Growth			Projections	
Countries⬇	1900	1950	2000	2015	2050
Bangladesh	29.0	41.783	137.439	183.159	265.432
Egypt	10.0	21.834	67.884	84.425	113.840

4.2 Urbanisation, Distress Migration, Environm. Refugees

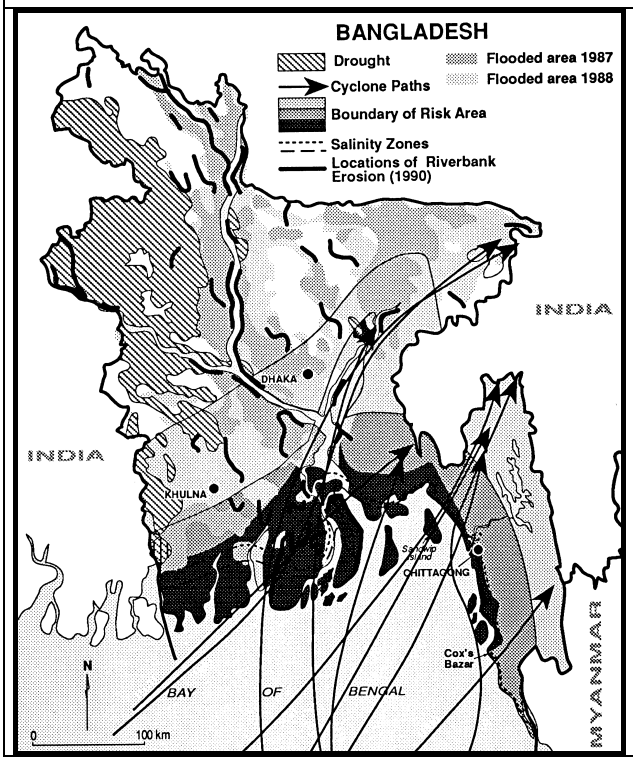
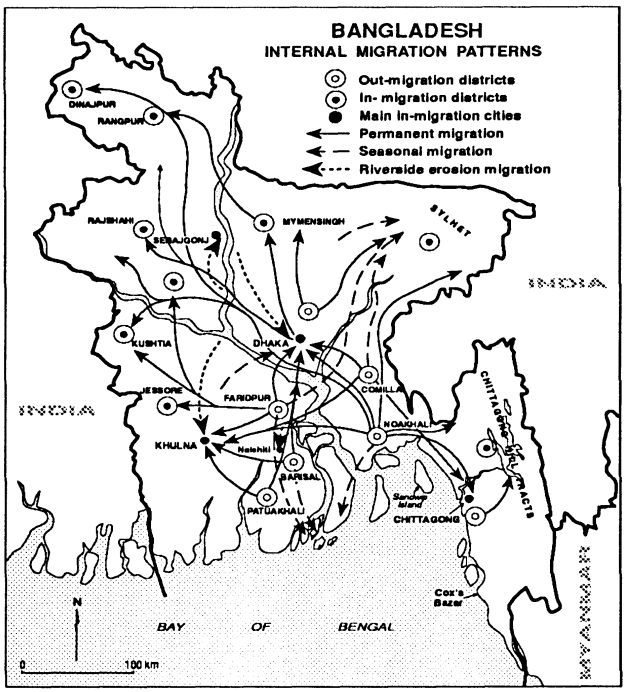
Urb.: Bangladesh, 1950: 4,2%, 2000: 21,2% , 2030: 40.6%
Urb.: Egypt 1950: 31,9% , 2000: 45.9%, 2030: 61,8%.

Table 6: Growth of Mexico City, Dhaka, Cairo, 1950-2015

City	1950	1975	2000	2005	2010	2015	1975-2000	2000-2015
Dhaka	0.42	2.17	12.3	15.4	18.4	21.1	6.9%	3.6%
Cairo	2.4	6.1	10.6	11.6	12.7	13.8	2.2%	1.7%

- ***Environmental refugees*** (El-Hinnawi, 1985, **Myers**): **1995: 25 mio.,** 5 m. Sahel to double by **2010;**
- **People at risk by SLR** by **2050:** Bangladesh: 26 m., Egypt: 12 m.; China: 73 m.; India: 20 m., SIS: 31 m., total of 162 m., **globally up to 200 million people**
- desertification: **135 mio.;** sev. water shortage: **550 m.**

4.3 Climate Change Impacts in Bangladesh on Migration

7: Climate-related Natural Events	8: Migration in Bangladesh
	

4.4 Environmental Distress Migration: Bangladesh

- **Suhrke:** 3 env. push factors: deforestation, SLR, desertification, drought, **internal conflicts:** Chittagong Hill tract
- **Different effects of migration to India:**
  - **Assam:** 1983 massacre in Bramaputra v., 3000-5000 died
  - **West Bengal:** no violence, soc. conflict in Calcutta

Ecological degradation, social effects led to conflicts:

- Water sharing and management dispute on the **Ganges** water involving **Nepal, India and Bangladesh**;
- Chittagong Hill Tract problem involving India.

- **Future: PG: 2000: 137 mio.; 2050 (MV): 265 mio.,**
- **2100: 1 m SLR: 17% of Bangladesh will disappear**
- **Outcomes of climate change in 40-60 years:** Cyclones, floods, riverbank erosion, salinity problems; droughts,
- **Conflicts: Pentagon of Potential Conflict Constellations**

5. Case Study of Egypt based on Egyptian Sources

„Given Egypt's growing **population**, its limited **fertile land**, & its large area of **desert**, and the concentration of its econ. activities in the coastal zones, the potential social and econ, **impact of climate change** ***could be devastating*** for the country's future."

Egypt, Initial National Comm. on CC, June 1999, p. j

5.1. Impact of Sea Level Rise for the Nile Delta

El-Raey concluded: "a **0.5 m sea level rise** would cause migration of more than **2.0 million people**, loss of more than **214,000 jobs** and a value loss of more than **$40.0 billion**, mainly in Alexandria Governorate".

5.2 Temperature Increase: Impact on Agriculture

- **Initial Nat. Communication, Egypt: yield changes** by 2050 due to climate ch.: wheat –18%, maize: -19%, sorghum: -19%, barley: -18%, rice: -11%, soybean: -28%.
- **Egypt's water supply**: **95%** from **Nile** (10 countries)
- **climate change impact** on Nile Basin cannot be predicted
- **SLR in Nile delta**: 2 million people need resettlement
- **Health impacts**: skin cancer, eye cataracts, heat strokes,
- **Indirect impacts**: demographic dislocations, socio-econ. disruptions, ecological system, air pollution impacts.

5.3 Integrated Climate Model: Egypt until 2060

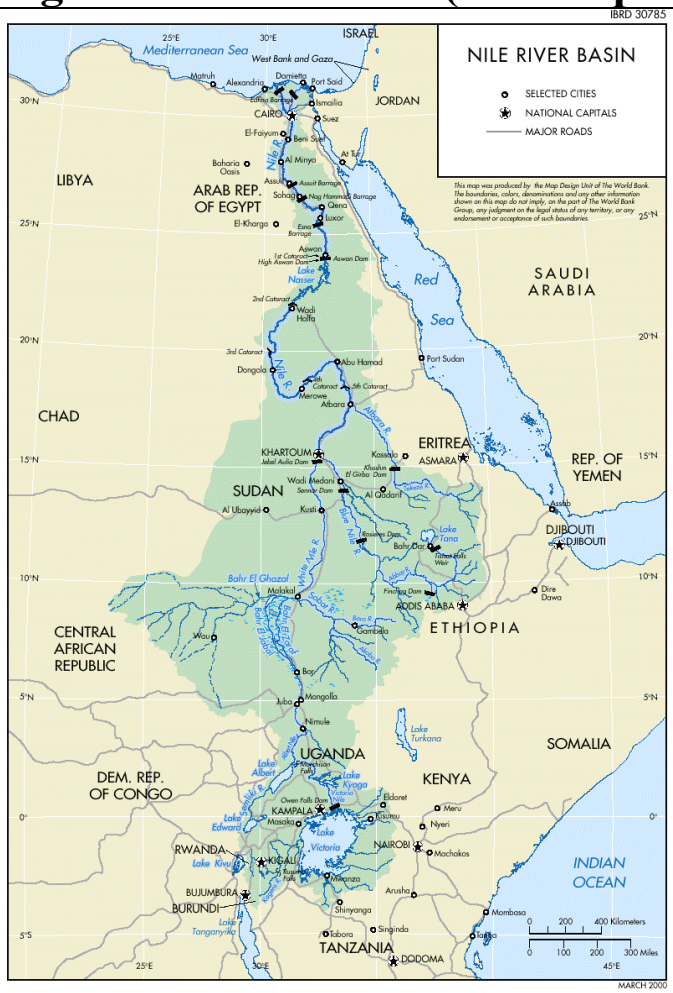
Strzepek/Onyeji/Saleh/Yates, **1995:** „An Assessment of Integrated Climate Change Impacts on Egypt" (1995).

- Temp. increase: +**4°C** for Cairo**, + 3.1°-4.7°C** for rest
- Water/cap.: 1990: **1005 m^3,** 2060: **452 m^3** (World Bank)
- **Agriculture:** decline of self-sufficiency: **60% to 10%.**

5.4 Impact of Climate Change & Water Scarcity on Conflicts

- **2001:** FAO: 8 of 10 riparians of 29 countries with famine;
- **In Egypt:** distress migration from Sahel has increased;
- **Water supply:** precipitation, water flow of Nile ***may decline*** due to climate change (evapotranspiration);
- **Water demand**: ***will rise*** due to population growth;
- **Water sharing and management:** among riparians, crucial for security & survival and for conflict avoidance;
- **Nile Basin Initiative**: riparians adopted: *Nile River Basin Action Plan* (1996) with World Bank support
- **Future security challenges:**
  - **demand increase** for food due to **population growth**
  - **supply decline** of food due to **climate change**
  - **distress migration** to and from Egypt will grow!!

Figure 11: Nile Basin (at: <http:// www.nilebasin.org/>



Wolfensohn (WB Pres.): population of ten Nile countries will grow from 300 mio. within 20 years to about 500 million.

Until 2050, population projected to increase from 280.8 million (2000) by 575 mio. to 855.6 mio. by 2050 (UN 2001, table 7).

Key instrument of conflict avoidance: **water sharing** but also: "**virtual water**": increasing food imports to the whole region.

Table 7: Pop. Growth of 10 Nile Basin Countries, 1950-2050

Nile Count.	1950	2000	2050 MV	Population Growth	
				1950-2050	**2000-2050**
Egypt	**21.834**	**67.884**	**113.840**	**92.006**	**45.956**
Sudan	9.190	31.095	63.530	54.340	32.435
Ethiopia	18.434	62.908	186.452	168.018	123.544
Uganda	5.210	23.300	101.524	96.314	78.224
Eritrea	1.140	3.659	10.028	8.888	6.369
Kenya	6.265	30.669	55.368	49.103	24.699
Tanzania	7.886	35.119	82.740	74.854	47.621
Rwanda	2.120	7.609	18.523	16.403	10.914
Burundi	2.456	6.356	20.218	17.762	13.862
Congo	12.184	50.948	203.527	191.343	152.579
Total	**86.719**	**280.783**	**855.750**	**769.031**	**574.967**

6. Results of Research Review on Linkages of Climate Change Impacts, Environmental Stress and Conflict

1. **No mono-causal linkage** between climate change & conflicts.
2. **Climate change impacts do not pose a military threat** nor can they be solved with means of military services.
3. **Climate change impacts will contribute to environmental stress** and become a potential cause of conflict constellations.
4. Climate change impacts may **challenge the survival of human beings** and are a challenge to **human security**.
5. Climate change impacts **force human beings to leave** their rural home for the next major city (**urbanisation**) or to take refuge in a neighbouring country or overseas (**migration**).
6. Climate change impacts pose **severe challenges** for countries with most severe effects of **sea level rise** in **delta areas** but also by complex interactions of **increasing temperature** and declining precipitation in **arid- and semi-arid regions**.
7. Climate change impacts **may contribute to escalation of social, ethnic or religious tension** that may erupt in violent riots or result in domestic civil strife or civil war.
8. Climate change impacts and disputes on **scarce resources** – **access to water** or country-crossing **aquifers** – may contribute to bilateral or regional non-violent or violent conflicts.
9. Climate change impacts and international *environmental refugees* may lead to **international tensions** on **migration**, on **admission of refugees** in neighbouring or in industrialised countries and on **treatment of immigrant** communities.
10. The **mitigation of challenges** posed by the impact of climate change requires **bilateral or multilateral international cooperation**, support for adaptive capabilities and a massive technology transfer.