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# Wasser

## als strategischer Faktor



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## Wasser – strategische Zukunft der Menschheit?

Seit dem Altertum setzen Grossmächte ihre Machtpolitik mit Hilfe der Strategie durch. Dazu gehört der Einsatz aller verfügbaren Mittel und Faktoren. Wasser ist ein solcher strategischer Faktor. Die Existenz verschiedener Regionen und Staaten wird aber zunehmend durch die begrenzte Verfügung von Wasser bestimmt. Es muss damit gerechnet werden, dass diese Staaten immer mehr den Krieg für die Kontrolle des begrenzten Wassers einsetzen werden.

Albert A. Stahel

### Strategische Faktoren

Strategie und damit strategisches Denken sind Bestandteile jeder Hochkultur. Bereits im China des 6. Jahrhunderts vor Christus und im Griechenland der Antike wurde die Kriegführung systematisch geplant und geführt. Der Begriff Strategie als solcher stammt denn auch aus dem Griechischen. Im Griechenland des 5. Jahrhunderts vor Christus war der Strategos ein Heer- oder Flottenführer. Demzufolge wurde die Strategie bis 1945 als die Bereitstellung und der Einsatz militärischer Gewalt im Krieg zur Erreichung festgesetzter Ziele definiert. Seit Beginn des Kalten Krieges wird diese Definition nur noch für die Ebene der Militärstrategie verwendet. Als Strategie wird seit den Fünfzigerjahren in den Industriestaaten die geplante, zielgerichtete Bereitstellung und koordinierte Anwendung aller politisch-diplomatischer, wirtschaftlicher, technologischer und wissenschaftlich-geistiger Kräfte eines Staates sowie seiner Streitkräfte in Frieden, Krise und Krieg bezeichnet. Dafür steht auch in Abgrenzung zur Militärstrategie der Streitkräfte der Begriff *Gesamtstrategie*, *Grosse Strategie* (Grand Strategy) oder *Nationale Strategie*:<sup>1</sup> «die Gesamtstrategie [stellt] die Kombination aller Möglichkeiten dar, die eine Staatsführung zur Erreichung der Ziele des betreffenden Staates aus dessen Machtpotenzial zu entwickeln vermag.» Als Strategie wird heute jemand bezeichnet, der nach einem genauen Plan handelt, um ein Ziel zu erreichen.<sup>2</sup>

Was den Begriff *Faktor* betrifft, so wird dieser im Brockhaus definiert als «bestimmendes Element, massgeblicher Umstand, Gesichtspunkt.»<sup>3</sup> Während in der Mathe-

matik ein Faktor das Glied eines Produkts ist, wird in der Ökonomie ein Faktor als eine wirtschaftliche Grösse bezeichnet. Es gehören dazu Arbeitseinsatz, Realkapital, Vorprodukte, Rohstoffe, Energie, «die im Produktionsprozess zur Erstellung anderer Güter und Leistungen eingesetzt»<sup>4</sup> werden. «Die einzelnen Faktormengen (Inputs) müssen im Produktionsprozess miteinander kombiniert werden, um zu dem gewünschten Produktionsergebnis (Output) zu gelangen.»<sup>5</sup> «Das Einsatzverhältnis der Produktionsfaktoren bei einer bestimmten Produktionsmenge wird als Faktorintensität, die Veränderung der Einsatzmengen der Produktionsfaktoren als Faktorvariation bezeichnet.»

Aufgrund der Verknüpfung der beiden Begriffe Strategie und Faktor sind strategische Faktoren offensichtlich die wichtigsten Elemente und Grössen eines strategischen Plans, die ein Staat zur Durchsetzung seiner Ziele formuliert und umsetzt. Diese Definition ist weitgehend identisch mit dem Begriff *strategische Güter*:<sup>6</sup> «Produkte, die unter bestimmten Gesichtspunkten von besonderer Bedeutung sind (z.B. Rohstoffe, technologisch hochwertige Erzeugnisse). Der Ausdruck wurde in den USA nach dem Ersten Weltkrieg geprägt, als deutlich wurde, dass der Ausgang künftiger kriegerischer Auseinandersetzungen zunehmend von der Wirtschaftskraft einer Nation abhängig wird.»

Die Begriffe strategische Faktoren und strategische Güter sind aufgrund der hohen Übereinstimmung der Definitionen als beinahe deckungsgleich zu bezeichnen.

### Süsswasservorkommen

Für den Chemiker ist Wasser die chemische Verbindung von Wasserstoff und Sauerstoff zu Wasserstoffoxid  $H_2O$ . Reines Wasser ist geruchs- und geschmackslos. Spätestens seit der sich abzeichnenden Erderwärmung oder gar der UNO-Erklärung, das Jahr 2003 als das Jahr des Wassers zu bezeichnen, dürfte jedem Einwohner eines Industriestaates bewusst geworden sein, dass Wasser nicht einfach nur als eine chemische Verbindung bezeichnet werden kann, sondern das lebenserhaltende und -fördernde Elemente der Menschheit überhaupt ist. Ohne Wasser gibt es auf der

Erde kein Leben mehr. Dass die Verfügbarkeit über Wasser keine Selbstverständlichkeit darstellt, beweist auch die Suche nach Spuren von Wasser auf dem Mars als Hinweis für ein mögliches Leben in einer Vorzeit dieses Planeten.

Aber auch auf der Erde sind die Wasservorkommen nicht einfach unendlich. Auf der Erde besteht unter Einrechnung der Weltmeere, von Eis und Schnee, Grundwasser (zum Teil versalzen), Oberflächengewässer (zum Teil versalzen), der Bodenfeuchte und Atmosphäre sowie den Organismen ein Wasservolumen<sup>7</sup> von 1 385 984 610  $km^3$ . Davon haben die Weltmeere mit 1 338 000 000  $km^3$  einen Anteil von 96,538%. Dies bedeutet, dass die Menschheit nur in begrenztem Umfang über Süsswasservorkommen verfügt. Von den 35 029 210  $km^3$  Süsswasser sind 69,554% durch Eis und Schnee gebunden. Das Grundwasser macht 30,061% aus, davon sind zwei Drittel in über 100 Meter Tiefe. Das Wasservolumen der Flüsse und Süsswasserseen beträgt mit 93 120  $km^3$  lediglich 0,266% des gesamten Süsswasservorkommens der Erde. Dieses fliessende Wasser ist aber für die Versorgung der Menschheit mit Trinkwasser primär relevant.

Offensichtlich besteht aufgrund der begrenzten Wasservorkommen, der ungünstigen klimatischen Bedingungen und der hohen Bevölkerungsdichte in vielen Gebieten ständig oder zeitweise Wassermangel, insbesondere an Trinkwasser für die ärmere Bevölkerung. Bevölkerungswachstum und die Wasserverschmutzung weisen auf einen zunehmenden Wassermangel hin. Diese Entwicklung könnte Konflikte zwischen Staaten und Bevölkerungen der betroffenen Regionen verschärfen und möglicherweise auch zu Kriegen führen.

### Überleben oder Untergang der Menschheit?

Zu Recht kann Wasser als der wichtigste strategische Faktor für das Überleben der Menschheit in der Zukunft bezeichnet werden. Das ungehinderte Wachstum der Erdbevölkerung in den zu entwickelnden Staaten und die gegenwärtige Erderwärmung könnten nicht nur die Wanderbewegung aus der südlichen in die nördliche Hemisphäre beschleunigen, sondern grundsätzlich die Existenz der Menschheit in Frage stellen. Die unbedachte Ausbeutung des Grundwassers und die zunehmende Verwüstung kritischer Zonen als Folge einer weitgehend selbst verschuldeten Erderwärmung wäre einem Todesurteil und damit dem Untergang der Menschheit gleichzusetzen. ■

<sup>1</sup>Brockhaus, Die Enzyklopädie in vierundzwanzig Bänden, Studienausgabe, Zwanzigste, überarbeitete und aktualisierte Auflage, F.A. Brockhaus, Leipzig und Mannheim, 2001, S. 237.

<sup>2</sup>Brockhaus, Einundzwanzigster Band, 2001, S. 237.

<sup>3</sup>Brockhaus, Siebter Band, 2001, S. 77.

<sup>4</sup>Brockhaus, Siebter Band, 2001, S. 77.

<sup>5</sup>Brockhaus, Siebter Band, 2001, S. 77.

<sup>6</sup>Brockhaus, Einundzwanzigster Band, 2001, S. 239.

<sup>7</sup>Brockhaus, Dreiundzwanzigster Band, 2001, S. 590.

## ... dem Direktor der EAWAG Dübendorf

## Prof. Dr. Alexander J. B. Zehnder über virtuelles Wasser und Realpolitik



Foto: ag

Dr. Alexander J. B. Zehnder ist ordentlicher Professor für Umweltbiologie an der ETH Zürich und seit 1992 Direktor der Eidgenössischen Anstalt für Wasserversorgung, Abwasserreinigung und Gewässerschutz (EAWAG) in Dübendorf. Seit Jahren beschäftigt er sich mit der Entwicklung von naturwissenschaftlichen, technologischen und ökonomischen Konzepten für die nachhaltige Entwicklung, insbesondere in Zusammenhang mit Wasser.

### Welche Rolle spielt Wasser in Zusammenhang mit Konfliktsachen?

Meines Erachtens gibt es eine direkte und eine indirekte Konfliktsache. Direkte Konfliktsachen kennen wir z. B. aus dem östlichen Einzugsgebiet des Nils, aus dem Zweistromland, also der Türkei, Syrien und dem Irak sowie Israel und Palästina. Es handelt sich dabei um quantitative Fragen, die direkt vom flüssigen Wasser abhängen. Fälschlicherweise bringt man das immer mit der Vorstellung in Verbindung, dass die betroffenen Menschen irgendwann einmal nichts mehr zu trinken haben und dann verdursten. In Tat und Wahrheit geht es aber um die aus dem vorhandenen Wasser resultierende Nahrungsmittelproduktion.

### Und was wäre dann die indirekte Konfliktsache?

Wenn man das vorher Gesagte in einen grösseren Zusammenhang stellt, ergibt sich daraus ein neuer, indirekter Konflikt. Es stellt sich die Frage, wo die Mehrheit der Menschen lebt, wo fruchtbare Böden vorhanden und günstige klimatische Bedingungen gegeben sind. Man erkennt dann relativ schnell, dass in Gegenden mit hohen Bevölkerungszahlen die Bedingungen für die Nahrungsmittelproduktion für so viele Menschen wegen Wassermangel schlecht sind. Auf eine einfache Konfliktform heruntergebrochen, bedeutet dies, dass der industrialisierte Norden über günstige klimatische Bedingungen, fruchtbare Böden und ausreichend Wasser verfügt, um Nahrungsmittel zu produzieren. Der Grossteil des nichtindustrialisierten Südens hingegen

hat zwar Arbeitskräfte, aber wegen des fehlenden Wassers keine günstigen Voraussetzungen für die Nahrungsmittelproduktion. Auf die nächsten Jahre hochgerechnet, sieht man, dass immer mehr Länder eine Schwelle erreichen, an der sie nicht mehr genügend Wasser haben, um ihre eigene Bevölkerung zu ernähren. Diese Länder müssen ihr fehlendes Wasser mit der Einfuhr von Nahrungsmitteln, so genanntes virtuelles Wasser, kompensieren.

### Was muss man sich denn unter virtuellem Wasser vorstellen?

Veranschaulichen lässt sich virtuelles Wasser anhand der Faustregel, dass zur Produktion eines Kilos Brot ein Kubikmeter Wasser benötigt wird. Logischerweise ist es einfacher, den entsprechenden Weizen für ein Kilo Brot als einen Kubikmeter Wasser zu transportieren. Daraus erwächst eine Nahrungsmittelabhängigkeit des nichtindustrialisierten Südens vom industrialisierten Norden, wobei fünf grosse Nahrungsmittelproduzenten existieren: die USA, Frankreich, Kanada, Australien und Argentinien. Man könnte diese Länder auch die «Virtuelles-Wasser-OPEC-Staaten» nennen. Sie sind die grössten Nettonahrungsmittelexporteure der zwei weltweit bedeutendsten Grundnahrungsmittel, Weizen und Soja.

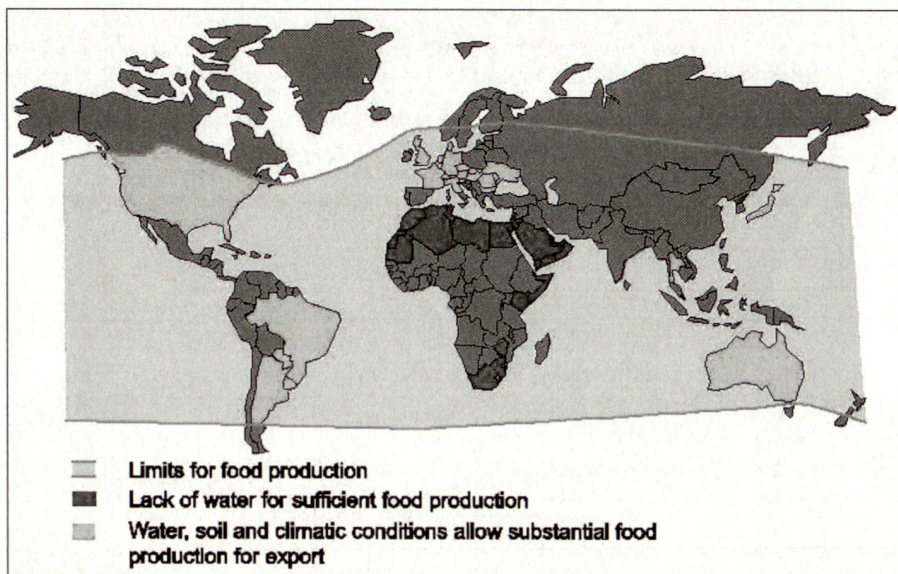
### Aber es müssten doch noch andere grosse Nahrungsmittelproduzenten existieren, z. B. Südafrika oder Staaten in Zentralafrika?

Südafrika stösst bezüglich Wasser bereits heute an seine Grenzen und wird in zehn

Jahren eines der Länder sein, die verstärkt virtuelles Wasser einführen müssen. In Zentralafrika haben wir ein tropisches Gebiet, das sich aufgrund seiner Bodenqualität nicht für Landwirtschaft im grossen Stil eignet. Darüber hinaus sind in Zentralafrika grosse Flächen Urwald. Schlussendlich gilt es zu betonen, dass intensiv betriebene Landwirtschaft ein hohes Mass an politischer Organisation voraussetzt. Die von einigen Ökonomen vertretene Theorie, man müsse den Entwicklungsländern nur die Möglichkeit geben, Landwirtschaft zu betreiben, damit sie sich in Zukunft selbst ernähren, ja sogar grosse Mengen Nahrungsmittel exportieren könnten, geht rein schon aufgrund des fehlenden Wassers und der Bodenbeschaffenheit nicht auf.

### Und wie würden Sie aufgrund dieser Ausführungen die Situation im zweitbevölkerungsreichsten Staat der Welt, Indien, einschätzen?

Indien kann heute seine Bevölkerung noch knapp ernähren, in naher Zukunft aber nicht mehr. Aufgrund der demografischen Entwicklungen wird Indien zunehmend zu einem Problemgebiet und muss in Zukunft immer mehr virtuelles Wasser einführen. Es wird zwar versucht, Wasser vom Norden in den Süden umzuleiten, um dort Landwirtschaft zu betreiben, wovon die lokale Landwirtschaft sicherlich profitiert. Im Grunde genommen handelt es sich dabei aber nur um eine Umverteilung des Wassers. Das Problem des totalen Wassermangels wird so nicht gelöst. Wasserstauung, also eine Speicherung natürlicher Ressourcen, würde das Wasserprob-



#### Situation 2000

Source: Zehnder, Wasserressourcen und Bevölkerungsentwicklung, Nova Acta Leopoldina, 2002, NF 85, 323:399-418. Data: FAOSTAT (FAO) (2001) and World Resources Institute (WRI) (2001).

lem, zumindest für einige Jahrzehnte, schon eher verringern. Aus Sicht der Nahrungsmittelproduktion macht der Bau von Staudämmen zuweilen eben Sinn.

#### Könnte denn Indien sein Wasserproblem mithilfe Kaschmirs lösen?

Nein. Die Wasser aus dem Kaschmir fließt ohnehin bereits in Richtung Indien ab. In erster Linie ist der Kaschmirkonflikt ein religiöser oder weltanschaulicher Konflikt, in dem Wasser nicht die treibende Kraft spielt.

#### Und wie beurteilen Sie die Lage in China?

China gehört auch zu jenen Ländern, die, sofern der Abfluss des Wassers ins Meer gleich bleibt, in rund zehn Jahren Probleme haben werden. Bekannterweise versucht China, dem entgegenzuwirken. Wasser soll dort vom Süden in den Norden transportiert werden. Das gestaute Wasser wird dann für die landwirtschaftliche Produktion im fruchtbaren Nordosten verwendet. Hinzu kommt, dass die grossen Bevölkerungszentren Chinas mit Wasser versorgt werden müssen. Die mit der Umleitung und Stauung zusammenhängenden Auswirkungen auf die Küstengebiete lassen sich aber nur schwer voraussagen.

#### Lassen Sie uns einen Blick auf den Mittleren Osten werfen. Bauen die Türken aus ähnlichen Gründen wie die Chinesen Staudämme?

Ja, denn dadurch soll sich v.a. die Landwirtschaft in Südostanatolien besser entwickeln. Gleichsam als Nebenprodukt erhofft man sich davon, die Kurden etwas besser in den Griff zu bekommen.

#### Inwiefern ist denn der Irak davon betroffen?

Lassen Sie mich dazu etwas ausholen. Wenn man die Einzugsgebiete von Nil einerseits und Euphrat und Tigris andererseits

einander gegenüberstellt, erhält man eine gegensätzliche Situation. Im Nil-Einzugsgebiet sind jene, die Wasser haben, also die Äthiopier, militärisch und wirtschaftlich schwach und diejenigen, die kein Wasser haben, also die Ägypter, im Vergleich militärisch und wirtschaftlich sehr stark. Im Fall von Euphrat und Tigris ist es genau umgekehrt. Die Türkei ist militärisch viel stärker als der Irak und zudem noch im Besitze des Wassers. Deshalb handelt es sich in letzterem Fall um eine viel explosivere Situation, weil die Türkei in keinem Fall gezwungen ist, mit dem unterliegenden Staat zu verhandeln. Ägypten dagegen ist gezwungen, mit Äthiopien des Wassers wegen zu verhandeln, und umgekehrt kann Äthiopien von der Entwicklung Ägyptens und einer regionalen Stabilität profitieren.

#### Das würde übrigens die Ansicht untermauern, dass die Türkei an einem stabilen Irak kein Interesse hat. Aber wie sieht denn die Lage in Israel aus?

Israel diktiert die ganze Wasserverteilung. Es zieht Wasser aus verschiedenen Gebieten ab und leitet es um, so z.B. im Falle des Jordans. Was zurzeit jedoch viel schwerer wiegt, ist das Recht der Israelis, in der Westbank und im Gazastreifen viel tiefer nach Wasser bohren zu dürfen als die Palästinenser. Somit findet ein Nettotransfer an flüssigem Wasser aus den besetzten Gebieten nach Israel statt.

#### Und diesen Nettotransfer benötigen die Israelis?

Nein. Sie behaupten zwar immer, dass sie das Wasser zum Überleben brauchen, aber rechnerisch betrachtet – wobei die Israelis kaum Zahlen veröffentlichen – erkennt man, dass Israel mindestens doppelt so viel virtuelles Wasser importiert, als es überhaupt Wasser zu Verfügung hat. Ein Wasserkompromiss wäre also durchaus

denkbar, aber Israel hat gar keinen Anreiz, einen solchen einzugehen. Die Palästinenser haben deshalb Angst vor einem so genannten «trockenen Frieden». D.h., dass die Wasserfrage gar nie gelöst würde und die Israelis den Palästinensern alles Wasser unter den Füßen wegpumpen, obwohl sie es, so wage ich zu behaupten, zum Überleben gar nicht brauchen. Aber gerade in diesen Ländern hat Wasser eine sehr emotionale Komponente, und seine Kontrolle bedeutet zusätzliche Macht.

#### Welche Bedeutung hat denn der Golan in diesem Zusammenhang?

Nebst der militärstrategischen Bedeutung sind die Golanhöhen v.a. das Mittel zur Kontrolle der Jordanquellen.

#### Wie sieht es in Nordafrika aus? Bekannterweise pumpt Libyen in grossem Masse Wasser aus der Tiefe herauf, und auch Marokko, Algerien und Tunesien kämpfen mit Problemen.

Die Niederschlagsmengen und das zur Verfügung stehende Wasser nehmen von Westen (Marokko) nach Osten (Libyen) ab und damit auch die inländische landwirtschaftliche Produktion. In Marokko gibt es gute Jahre, in denen es seinen Nahrungsmittelbedarf selber decken kann, und schlechte, in denen es Nahrungsmittel importieren muss. Bereits aber in Algerien macht der Nahrungsmittelimport wertmässig 25% des Gesamtimports aus. Tunesien bewegt sich mit 15% ebenfalls im zweistelligen Prozentbereich. In Libyen lassen die Zahlen keine klaren Schlüsse zu. Es sieht ganz danach aus, als ob Libyen mehr virtuelles Wasser importiert als es benötigt. Gaddafis «man made river» hat einerseits zum Ziel, Nahrungsmittelunabhängigkeit zu erreichen und andererseits sich selber ein Denkmal zu setzen. In Ägypten wird praktisch alles Nilwasser für die Landwirtschaft gebraucht. Zirka 50% der Nahrungsmittel müssen trotzdem importiert werden. Die dortige Bevölkerungsentwicklung lässt aber erahnen, dass der Import von virtuellem Wasser immer grösser wird. Alle diese Länder bewegen sich damit in eine immer grössere ökonomische Abhängigkeit.

#### Verfügt denn Russland über genügend Wasser?

Das hängt davon ab, von welchem Teil Russlands wir sprechen. Der zentralasiatische Teil, also die Aralregion, hätte, würde man es etwas geschickter anpacken, im Prinzip genügend Wasser aus dem Hindukusch. Sibirien hingegen leidet unter den klimatischen Bedingungen. In Südrussland und der Ukraine wiederum liegt das Problem weder beim Wasser noch beim Boden, im Gegenteil, die schwarzen Lössböden sind äusserst fruchtbar. Wie bereits erwähnt,

liegt das Problem beim Grad der politischen Organisation. Wäre die Ukraine politisch stabiler und würde die persönliche Initiative erleichtert und unterstützt, könnte sie wieder ein wesentlicher Nahrungsmittelexporteur werden. In Osteuropa ist vielleicht noch Polen erwähnenswert, das eigentlich zu wenig Wasser hat und wahrscheinlich eines der ersten Länder in Europa sein wird, das Probleme mit dem Wasserhaushalt und somit auch mit der Nahrungsmittelproduktion haben wird.

**Lassen Sie uns noch etwas in die Zukunft blicken. Mit welchen Problemen werden sich Indien und China, die beiden bevölkerungsreichsten Staaten der Erde, konfrontiert sehen?**

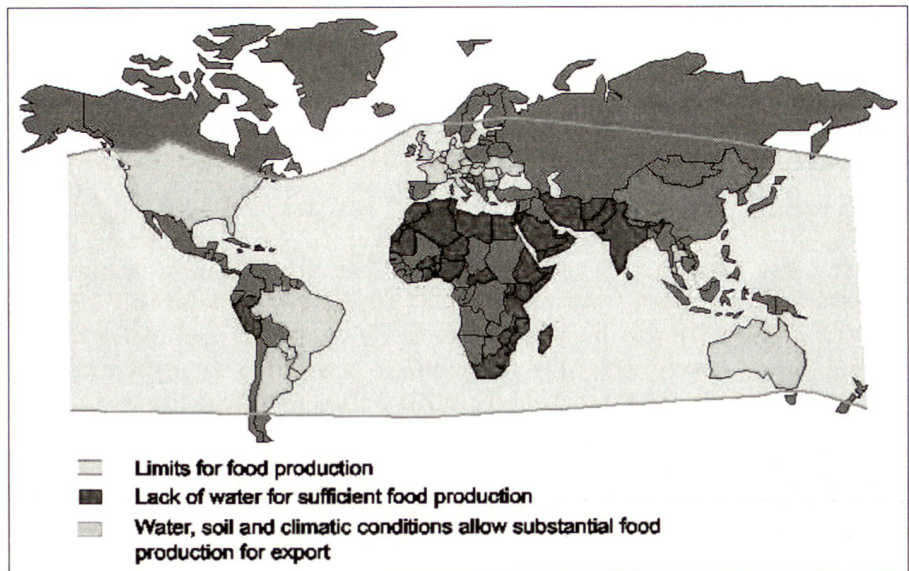
Wenn wir von den publizierten UNO-Zahlen für das Bevölkerungswachstum ausgehen, dann wird Indien in Zukunft ein landwirtschaftliches Wasserproblem haben und vermehrt auf Nahrungsmittelimporte setzen müssen. In Zusammenhang mit China sollte aber noch auf einen weiteren Aspekt verwiesen werden, den wir bisher noch nicht angetönt haben. Es gibt auch Pflanzen, die weniger Wasser benötigen als Weizen. China hat deshalb seine Politik innerhalb eines Jahres umgestellt, indem es einerseits die Nahrungsmittelexporte einschränkte und andererseits von Weizen auf Mais umstellte. Mais braucht pro gewonnener Kilokalorie weniger Wasser als Weizen. Die Nahrungsmittelimporte nahmen in der Folge drastisch ab. Ein Schönheitsfehler dabei ist, dass Weizen erstens vielseitiger einsetzbar ist als Mais und zweitens einen besseren Nährwert aufweist.

**Würde man nun in Bezug auf das Wasser aktiv die Zukunft mitgestalten wollen, was müsste denn z. B. Indien machen?**

Kurzfristig kann man das Bevölkerungswachstum nicht mehr bremsen. Mittelfristig, also bis ca. 2030, ist eine aktive Bevölkerungspolitik aber umso wichtiger. Daneben weisen aber sicherlich auch die Bestrebungen Indiens, sein Wasser anders zu verteilen und zu stauen, in die richtige Richtung, und zwar mit all seinen Nebeneffekten. Zudem wird sich Indien mittelfristig wohl oder übel darauf einstellen müssen, nicht mehr autark zu sein.

**Und etwas allgemeiner betrachtet?**

Ganz allgemein müssen wir einfach von unserer mittelalterlichen Vorstellung der Nahrungsmittelautarkie wegkommen. Das aber schaffen wir nur, wenn der Zugriff auf Nahrungsmittel frei wird, d. h., dass ein offener Markt besteht. Unabhängig davon, ob ein Käufer politisch genehm ist oder nicht. Man müsste also die fünf «Nahrungsmittel-OPEC-Staaten» dazu bringen, eine



**Situation 2025**

Source: Zehnder, Wasserressourcen und Bevölkerungsentwicklung, Nova Acta Leopoldina, 2002, NF 85, 323:399-418. Data: FAOSTAT (FAO) (2001) and World Resources Institute (WRI) (2001).

Plattform zu schaffen, auf die jeder Zugriff hat, der Nahrungsmittel kaufen will. Momentan ist dies noch überhaupt nicht der Fall – im Gegenteil. Es hängt zurzeit alleine vom Goodwill der Verkäufer ab, und wir können deshalb froh sein, dass neben den USA auch noch Frankreich zu diesen fünf Staaten gehört, das zuweilen kompensierend auftritt. Aber leider wird die neue EU-Politik dies erschweren, da auch in Frankreich die Überproduktion vermindert werden soll. Dies läuft der benötigten Entwicklung diametral entgegen. Es bedürfte wahrscheinlich einer politischen Organisation, wie z. B. der WTO oder FAO, die quasi als Trader ohne politische Vorurteile auftritt, damit auch ein Gaddafi Nahrungsmittel kaufen könnte. Es gibt freilich Länder, die immer arm bleiben werden, wie z. B. Burundi oder Ruanda, die von der internationalen Gemeinschaft unterstützt werden müssten. Aber die anderen Länder, wie z. B. Ägypten oder Äthiopien, deren Wasser zum grössten Teil für die Landwirtschaft eingesetzt wird, könnten, wenn sie plötzlich den Rücken frei hätten, etwas anderes mit ihrem Wasser machen und hätten so einige Freiheitsgrade mehr in der politischen Entscheidungsfindung.

**Brechen wir doch das Problem noch einmal auf die Ebene der Realpolitik herunter. In Anbetracht dessen, dass sich die Türkei um den Irak foudert, welchen Rat würden Sie denn den Irakern geben?**

Zurzeit den Irakern einen Rat zu geben, ist alles andere als einfach. Angenommen, wir hätten einen unabhängigen Irak, dann müsste sich der Irak mit der Türkei auf einen Modus einigen, wie das Kurdenproblem unter Kontrolle zu halten sei. Im Moment ist das, losgelöst davon, ob wir nun für oder gegen ein unabhängiges Kurdistan sind, der Trumpf, der sticht. Denn die Türken haben aus ihrer Sicht dieses Problem und wollen es unter Kontrolle halten.

Wenn die Türkei nun im Irak einen starken Nachbar sieht, der seinerseits die Kurden unter Kontrolle behält, dann könnte man zu handeln beginnen. Konkret: Was erbringen wir als Gegenleistung, wenn wir so und soviel Wasser erhalten? Ähnliche Verträge über die zu liefernde Wassermenge existieren ja auch zwischen dem Sudan und Ägypten. Solche Verträge gibt es freilich auch zwischen der Türkei, dem Irak und Syrien, nur kümmern sich die Türken nicht darum. Und deshalb müsste der Irak versuchen, gemeinsam mit der Türkei die Probleme in Südostanatolien in einer win-win-Situation zu lösen.

**Aber das gab es ja bereits, nämlich unter Saddam Hussein. Aber jetzt, wo das Regime zerstört ist und der Irak eventuell vor einer Föderalisierung steht, können die Iraker den Türken nichts anbieten. Zudem haben die USA den Kurden noch Versprechungen gemacht.**

Das stimmt, und deshalb kann ich den Irakern zurzeit auch keinen wirklich guten Rat geben. Und die Situation wird nur noch schlimmer, denn die Kurden wären aufgrund der Geografie die Ersten, die in den Genuss des türkischen Wassers kämen, und das würden die Türken nie zulassen. Es gibt aber noch ein zweites Problem in der Region. Durch die primitive Bewässerungstechnik in der Türkei und Syrien wird das Wasser des Euphrats versalzen und kann daher in der irakischen Landwirtschaft nur noch sehr beschränkt verwendet werden.

**Man kann also sagen, dass wir in Bezug auf das Wasser zwei grosse Verlierer haben, das wären zum einen die Iraker und zum anderen die Palästinenser.**

Ja.

Herr Kollege, wir danken Ihnen für dieses Gespräch!

# A drop of Water is like a drop of gold

## Water and conflict in Central Asia

Die Autorin argumentiert, dass das Erbe der Sowjetunion, mangelnde regionale Kooperation und ökologische sowie sozio-ökonomische Veränderungen die Allokation von Wasser in Zentralasien nachhaltig beeinflussen. Die ausgeprägte Interdependenz zwischen den zentralasiatischen Staaten erhöht dabei die Konfliktwahrscheinlichkeit. ag

Sarah O'Hara

In recent decades much has been written on the subject of "resource scarcity" and "resource wars" with many observers being of the view that competition for resources can result in individuals, groups of people, or states, fighting each other in order to secure access to those resources that are essential to their survival. Inevitably attention has focused on water with areas considered to be particularly vulnerable to water-related conflict being those where water is scarce, shared by more than one state, and where population and per capita demand for water is growing. Following the break-up of the Soviet Union in 1991, access to, and control of water resources, became an issue of considerable importance to the Central Asian Republics (CAR) of Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan (Karte siehe S. 12). Water is a key resource in Central Asia and contributes significantly to agricultural and energy production. But while the region boast substantial water resources they are both unevenly distributed and have been poorly managed. Consequently water is a highly contested resource and the competition for the Central Asia's water resources, could according to some authorities act as a catalyst for conflict at the intra- and inter-state level.

Stausee ausserhalb von Kabul.

Fotos: Albert A. Stahel

### Central Asia's water resources

With the exception of Kazakhstan, the Central Asian States lie almost entirely within the Aral Sea Basin, a large internal drainage system with its terminus at the Aral Sea. The region is dominated by low-lying deserts, flanked by extensive mountain ranges to the south and south-east and has a marked continental climate. Annual precipitation is low, generally less than 200 mm in the desert lowlands and reaching a maximum of 800–1600 mm in the high mountain areas of the Pamirs and the Tien Shen. Evaporation varies accordingly from over 2250 mm in the most arid region to less than 500 mm in the mountainous zones. As a result much of the region experiences a significant moisture deficit and it is highly reliant on waters generated in the mountains of Central Asia.

Numerous rivers rise in the mountains of the Tien Shen and the Pamirs and compared to many other parts of the world Central Asia has abundant water supplies. Central Asia's largest river, the Amu Darya, originates in the highlands of Tajikistan and Afghanistan, flows through Uzbekistan and Turkmenistan (and back into Uzbekistan) before discharging into the southern Aral Sea. The other major river is the Syr Darya, which rises in the mountains of Kyrgyzstan. It has two main tributaries, the Naryn, which is fed by over 700 glaciers high in the Tien Shen, and the Kara Darya, which sources in the Fergansky and Alaysky Mountains. The two rivers merge in eastern Uzbekistan to form the Syr Darya and

from there the river flows into Tajikistan before re-entering Uzbekistan and finally flows in to Kazakhstan where it discharges into the northern Aral Sea. Taken together, the Amu Darya and Syr Darya account for nearly 90% of the usable water in the Aral Sea Basin, which averages 125 km<sup>3</sup> per annum. The remaining 10% is derived from the region's numerous smaller rivers and streams such as the Murgap, Tejen, Zarafshen, Chu and Talas Rivers. These rivers have long being exploited by the peoples of Central Asia who for more than 7000 years have modified and diverted their flows for irrigation purposes. Consequently water management has long been an important component of Central Asia's way of life and became intrinsically entwined with social and political hierarchies. Water was viewed as a "Gift from God" which could not be owned or controlled by an individual and within central government the most important official was the "mirab bashi" who had considerable power being responsible for the highly important and often contentious decisions of water allocation and distribution. Indeed the success of political officials often hinging on their skill at managing water resources.

### Maintaining the status quo: the division of Central Asia's water

The current agreement on water sharing within the Aral Sea Basin dates from the 1992 Almaty Agreement when representatives from the newly independent countries agreed to adhere to "established pattern and principles of allocation". This agreement was made only a few weeks after the CARs found themselves unexpectedly cut loose from Moscow and was signed in haste with little if any thought of the long term consequences. By signing the agreement the CARs left Soviet determined allocations in place, which meant that the bulk of Central Asia's water is allocated to Uzbekistan, Turkmenistan and Kazakhstan who together receive 86% of withdrawals from



the Amu Darya and 89,6% from the Syr Darya. At the other end of the spectrum Kyrgyzstan is allocated less than 2% of the basin's water resources despite the fact that it contributes 25% of flows. Significantly, the Almaty agreement made no provision for Afghanistan, even though runoff generated on its territory represents a significant proportion of the Amu Darya's total discharge. It soon became apparent to the upstream states that their water entitlements are inadequate and there have been calls for the allocations to be revised.

## Maintaining the regional water distribution system

The maintenance requirements of Central Asia's water storage and distribution system is enormous and even at the best of times would be a huge financial undertaking for the republics. The precipitous decline of the region's economy, however, has made it an almost impossible task. This has raised the issue of who pays for the maintenance of those parts of the system, which benefit more than one republic. Kyrgyzstan has been especially vocal on this point and resents the fact that waters rising on its territory and flowing into the Syr Darya mainly benefits Uzbekistan and Kazakhstan, yet it must pay for the maintenance of many of the dams and reservoirs that regulate flows. In July 1997, the Upper House Assembly of the People's Representatives of Kyrgyzstan passed a resolution demanding that neighbouring states should pay them for the water they receive with the money going towards essential repairs. Then in July 2001 the Kyrgyz President Askar Akayev signed into law "The interstate use of water objects, water resources and water-management constructions of the Kyrgyz Republic." The law defines water from Kyrgyz water reservoirs as a commodity, that has a price, and created a legal base for Kyrgyzstan to sell water to its neighbours. Uzbekistan and Kazakhstan have condemned this move arguing that requiring downstream nations to pay for water is unprecedented in the international community. However, the 2001 law draws directly from the 1992 Dublin Statement on Water and Sustainable Development which states that "water has an economic value in all its competing uses and should be recognised as an economic good". Kyrgyzstan has taken this to mean that while it is honour bound to provide downstream users with sufficient water to meet basic human needs it is not required to supply large-scale and highly wasteful irrigation schemes with water free of charge. This point is highly significant and will be used by Kyrgyzstan to push the downstream states for compensation to cover the cost of infrastructure



Trockenheit  
in Afghanistan.

upkeep for the waters they receive in excess of basic human needs. Tajikistan is now looking at the Kyrgyz model and is likely to present a similar argument to support their claims for greater help with infrastructure upkeep. If Kyrgyzstan (and with it Tajikistan and in the longer term possibly Afghanistan) can force the issue on water payments it means that the 1992 Almaty Agreement is no longer valid.

## Afghanistan enters the picture

The situation has been further complicated by recent events in Afghanistan. Afghanistan borders three of the CARs, Tajikistan, Uzbekistan and Turkmenistan and shares a number of rivers with them, most notably the Amu Darya. Approximately 6-7% of the flows of the Amu Darya are generated on Afghan territory and the Afghans have long diverted water from the river for irrigation, although much of the system has fallen into disrepair because of the long period of civil unrest. Since the end of the US-led War on Terrorism in Afghanistan the international community has made a commitment to reconstruct the country. Considerable attention is now focusing on its agricultural sector and in late 2002 an Afghan official announced that one of the country's long-term goals is the development of the Khushtapa Project which will divert water from the Amu Darya River to irrigate lands around Mazar-i-Sharif. Although Afghanistan does not currently have the financing for this project it is working with the World Bank, the Asian Development Bank and donor nations to develop Afghanistan's water resources. If the Khushtapa project goes ahead there will be a significant increase in the amount of water Afghanistan withdraws from the Amu Darya with one

authority suggesting that Afghanistan will increase its level of abstraction from its current level of 2 km<sup>3</sup> per annum to 9-10 km<sup>3</sup> per annum by 2020. Clearly such a development will have immense implications for the downstream state of Uzbekistan and Turkmenistan and could create significant tension in the Amu Darya basin.

## Energy or agriculture?

Without Moscow's intervention the Central Asian states have also assumed the responsibility of negotiating how reservoirs are operated and this has proved extremely problematic. The old system, whereby the downstream countries provided those upstream with energy during the winter, collapsed in the early 1990s. The Kyrgyz response to this situation was to release waters from the massive Toktogul reservoir during the winter months so that its energy needs could be met. Disruptions in water supply caused considerable consternation in Uzbekistan and Kazakhstan, who argued that Kyrgyzstan's actions were irresponsible and had both serious economic and environmental consequences. In an effort to resolve the situation the three countries, prompted by international donor organisations, began negotiating various protocols and agreements on the use of water and energy resources in the Syr Darya Basin. Under such agreements the downstream countries agreed to deliver a specified amount of coal, electricity and gas to Kyrgyzstan in exchange for water releases in the summer. Although such agreements have resulted in improved co-operation between the three states they have not solved the problem entirely. In 1999, for example, Kyrgyzstan shut off water supplies to parts of southern Kazakhstan in an attempt to force that country to fulfil a promise to provide coal and as discussed now wants to replace barter agreements with cash compensation for water.





**Steppe von Kohsan, Afghanistan (westlich von Herat, an der Grenze zum Iran).**

Although energy production is important it is irrigated agriculture that remain the mainstay for much of Central Asia's society. Output from agriculture accounts for between 10 and 39% of GDP and nearly 45% of the population is directly employed in the agricultural sector.

### More people, less water

Demographic pressures have, and will continue, to increase further the contested nature of Central Asia's water resources. Between 1959 and 1989 the population of the basin states increased by 140% and it is expected that it will increase by a third again by 2020. The relationship between population pressures and competition for limited access to water and fertile land has long been an issue in the region. Disputes between Uzbek and Kyrgyz in the Fergana Valley, for example, are not uncommon with over 20 reported clashes between the two groups during the 19th century. Although tensions between the different groups were suppressed throughout much of the Soviet period, by the 1980s water shortages became acute and meeting targets set by Moscow became more difficult resulting in heightened tension particularly in more ethnically mixed areas. In 1990, for example, Uzbeks and Kyrgyz fought over land rights in the city of Osh after a Kyrgyz co-operative was given official permission to use irrigated lands on an Uzbek Kolhoz to build residential buildings.

More recently there has been increased tension between Tajik and Kyrgyz in the Bakten region of Kyrgyzstan with the latter accusing the former had diverted all the water from the Andarak-Sai leaving them with no water for irrigating their garden plots, but more importantly for drinking.

The Kyrgyz also accused the Tajiks of living on Kyrgyzstan's territory but of failing to share their water with the native population. At the same time the Tajiks accused the Kyrgyz of discrimination against them. The dispute was only resolved when an international donor paid for the construction of an additional pipeline to bring water to the downstream settlement.

Further pressures will result from changes in the climate. During the 1990s, Central Asia experience climate conditions that were wetter than the norm and until the late 1990s the CARs did not have to deal with the consequences of major water shortages. But starting in 1998 dry conditions prevailed and the region suffered one of the worst droughts in decades. Within the Central Asian region, Tajikistan was hardest hit with the almost complete failure of rain fed crops. The chronic shortage of water not only had a devastating impact on agriculture but served to heighten tensions not only between the upstream and downstream states, but also between different regions and groups of people within a country and renewed speculation over regional security. Although the situation has now improved it is widely believed that over the medium to long term climate change will have a profound impact on water availability, with some reports suggesting that water shortages will become a typical occurrence for the Central Asian region. Much of the expansion in the irrigation system since the 1960s has been achieved by the use of non-renewable fossil water resources. But, as mountain glaciers begin to disappear, the volume of summer runoff will decline significantly. The consequences for downstream agriculture, which relies on this water for irrigation, will be immense with low- and mid-lying parts of Central Asia likely to change into more arid, interior deserts.

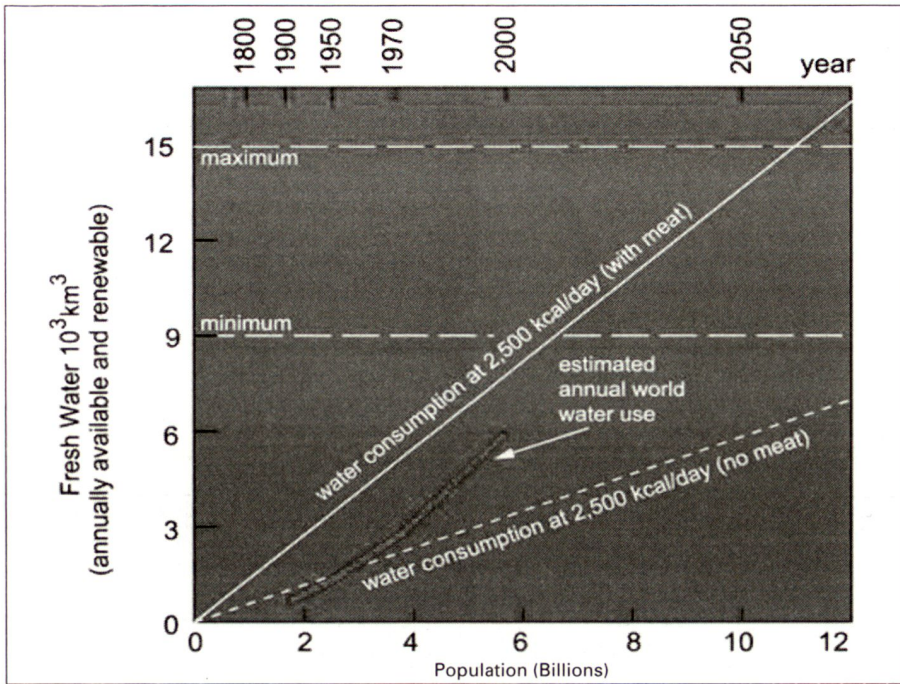
Increases in population alone will result in a significant increase in the demand for water and could result in water becoming stressed. One means of assessing whether a

country is water stressed is the number of people per million cubic meters of water a year (MCM). When there are less than 100 people per MCM, water supply is generally not a problem, but at 600 people per MCM signs of stress begin to appear unless water supplies are efficiently managed. Chronic water shortage is said to occur at 1000 with extreme scarcity occurring above 2000 people per MCM. Based on present water availability there are currently less than 350 people per MCM of water in Central Asia as a whole, but with the predicted increases in population this figure will increase to 727 people by 2025 and efficient water management will be essential. A very different picture emerges, however, when the republics are considered separately. Based on existing water allocations there are 130 people per MCM in Turkmenistan and 500 in Kyrgyzstan. By 2010 these figure are predicted to rise to 184 and 883 people respectively, and in 2025 there will be nearly 1500 people per MCM in Kyrgyzstan compared to only 361 in Turkmenistan. Although not as severe as Kyrgyzstan, Tajikistan will also experience chronic water shortages, with the situation in Uzbekistan being stressed but not chronic. Thus ironically the upstream water-rich republics will experience severe water shortages, while the water-poor downstream republics will not, a situation that neither Kyrgyzstan nor Tajikistan is likely to tolerate.

### Conflict or co-operation?

Given the importance of water to Central Asian society it is not surprising that water-related conflicts have emerged. Disputes have occurred at a number of levels although prior to the Soviet period these tended to be localised and were mainly concerned with gaining control over irrigated lands rather than water *per se*.

Following independence in 1991 there was much speculation over the possibility of water-related conflict in Central Asia. Certainly the activities of the CARs have done little to help the situation. The almost total lack of co-operation between the Central Asian governments particularly in respect to data and information exchange combined with a continuation of the Soviet mentality of output at any cost has heightened tensions in the region. The "tit-for-tat" actions of Kyrgyzstan, Uzbekistan and Kazakhstan over the allocation and use of waters from the Syr Darya has only served to highlight the issue. Similar problems are beginning to emerge in the Amu Darya basin, which until now has been relatively unproblematic. The fact that the two upstream countries want to make greater use of the waters that are generated



**Zukünftige weltweite Verfügbarkeit von Wasser.**

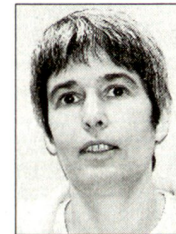
Source: Zehnder, Wasserressourcen und Bevölkerungsentwicklung, Nova Acta Leopoldina, 2002, NF 85, 323:399-418. Data: FAOSTAT (FAO) (2001) and World Resources Institute (WRI) (2001).

on their means that both the timing and the total availability of water to the downstream states will change, a situation that will anger Turkmenistan and Uzbekistan. Moreover as population increases and water availability decreases the situation is likely to deteriorate further. Reduced

water availability will also have implications within the republics themselves especially in the more densely populated areas, such as the Ferghana valley, the lower reaches of the Amu Darya and the Zarafshen valley, with conflict at the local level creating instability within the individual countries themselves.

The management of water resources in the Central Asian region represents an enormous challenge and one that is becoming increasingly more complex. Such complexities are partly historical in nature and partly a result of the activities of the CARs since independence. The almost total lack of cooperation between the five states coupled with a failure to tackle some of the underlying problems of the water management sector mean that the situation is likely to deteriorate further and will effectively undermine the social, political and economic development of the entire region threatening regional security.

Literaturnachweise können bei der Autorin eingeholt werden. ■



**Sarah O'Hara, Dr.,**  
**Professorin am Institute**  
**of Environmental**  
**Sciences in Nottingham,**  
**England, und Mitglied**  
**in der Forschungs-**  
**gruppe Environmental**  
**and Geomorphological**  
**Science.**

## Cooperation or confrontation?

### Sustainable Water Use, Property Rights and Transboundary Conflicts

Die Autoren gehen in ihrem Beitrag davon aus, dass das weltweite Wasserdefizit weiter zunimmt. Bleibt dieses Problem ungelöst, könnten gewaltsame Konflikte in den entsprechenden Regionen das Resultat sein bzw. sind es bereits. In diesem Zusammenhang wird auf die Fallbeispiele «Mittlerer Osten» und «Zentralasien» eingegangen. ag

Urs Luterbacher and Ellen Wiegandt

#### The Project Goals and Approach

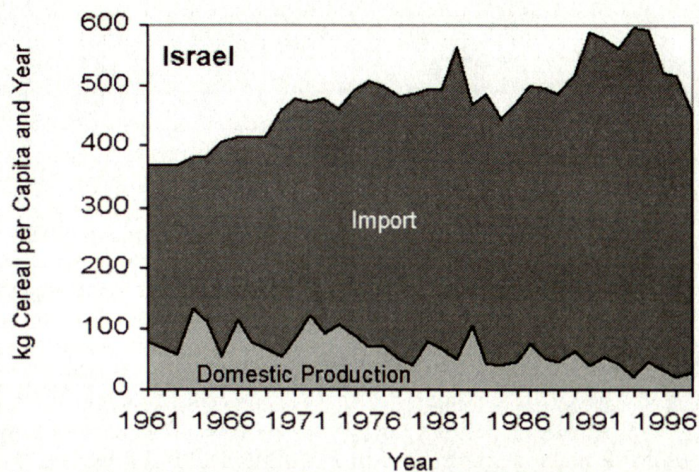
“The world is incurring a vast water deficit. It is largely invisible, historically recent, and growing fast.” Social conflict, food shortages, disease are all potential consequences of water scarcities. Vulnerability of water resources is a thus major challenge to the international community. The problem is even more pressing because ques-

tions of future quantity and quality of water are linked to other critical issues such as climate change, property rights, and economic development. Numerous regions of the world are particularly at risk of potential shortages due either to physical or social causes or because of uncertainties about access generated by rapid and far-reaching political changes. The Middle East immediately comes to mind because water shortages are invariably linked to the broader conflict in which water has become a weapon. Similarly, Central Asia, particularly

the Republics of Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan, is of particular concern because property rights issues related to water have emerged and become acute since the dissolution of the Soviet Union. Unresolved, these issues may provoke deadly conflicts in this volatile region.

Water availability is largely governed by physical processes, but water use is intimately tied to population size and density, technology, and life styles. Confronting scarcities thus depends first on understanding the evolution of social, economic, political, and environmental conditions as they affect water use. In this context, Switzerland has a special role to play because of its long experience in managing the vast water resources held within its mountains and because of its historic role in conflict resolution.

In this spirit, the project that we have undertaken examines current water use in the Central Asian republics and examines how it will evolve under various demographic, economic, and environmental scenarios. The analysis of factors that will influence



Source: Yang and Zehnder, Water Scarcity and Food Import: A Case Study for Southern Mediterranean Countries, *World Development*, 2002, 30:1413-1430. Data: FAOSTAT (FAO) (2001)

Changes and sources of per capita cereal supply, 1961–1998 (kg/per capita).

future levels of water use are also put in the context of the institutional and regulatory structures that determine its distribution, both within and between the Central Asian republics. **Our first objective is to understand what factors are the primary determinants of water use in the different regions of Central Asia and to predict how this water use is likely to evolve. The main goal is to provide tools to achieve peaceful distribution of scarce water resources throughout the region and to remove potential sources of conflict among the republics.**

To achieve this, we have developed a model of water use and management that includes not only social and economic factors influencing water use but also incorporates aspects influencing supply, such as geographic and climatic factors that determine the physical availability of water. The general model structure already exists and has been used to explore various resource and society interactions. In particular, it has been adapted to analyze the complex situation of the Jordan River Basin and can be applied to other specific examples, including but not limited to the Central Asian case that we propose to study here. The underlying notion is that it is necessary to provide an accurate representation of the evolution of water use in each case in order to develop scenarios of different population, climate or technology trajectories. The main value of the approach is that it allows for the introduction of different policy choices. These can then be evaluated in terms of their effectiveness in producing an optimal distribution of water in the region or on the contrary, their aggravation of water-related transboundary conflicts.

The ultimate goal of the project is to provide decision-makers with the means to prevent conflict through the design of management, regulatory, and pricing strategies for efficient use and equitable distribution of water.

To this end, a comprehensive view is essential: climatic, economic or demographic conditions influencing the physical supply of water must be seen in the context of socio-political factors determining how much water is available and where. The conjunction of these two processes will determine the future peace and prosperity of the Central Asian region as well as others faced with grave water shortages.

### Characteristics of Water Resources

Because water is essential for survival and nothing can be substituted for it, societies have always been concerned with the best way to allocate it. Its very nature poses particular management problems, however. It is difficult to define it as a separate commodity and assign private property rights to it because as water flows, it is in a "constant state of diffusion" or movement and therefore a precise unit cannot be allocated to a single individual. Moreover, upstream regions have an advantage because they can help themselves first, leaving downstream users with insufficient quantities. Or, water may be found in pools of underground water, which means that property rights can be defined as an area of land above it, but it will not be clear whether the water extracted really comes from the area below this surface given the fluid nature of the resource. As a result, arrangements must be devised to prevent some groups or individuals from over-using water resources at the expense of others. Frequently the solution has been to define water as common property and to have a collective or central management structure. This poses its own problems of "free-riding" when users take the benefits from access to this common resource without paying their fair share of the costs. These kinds of problems become particularly acute when they are intermingled with other kinds of unequal

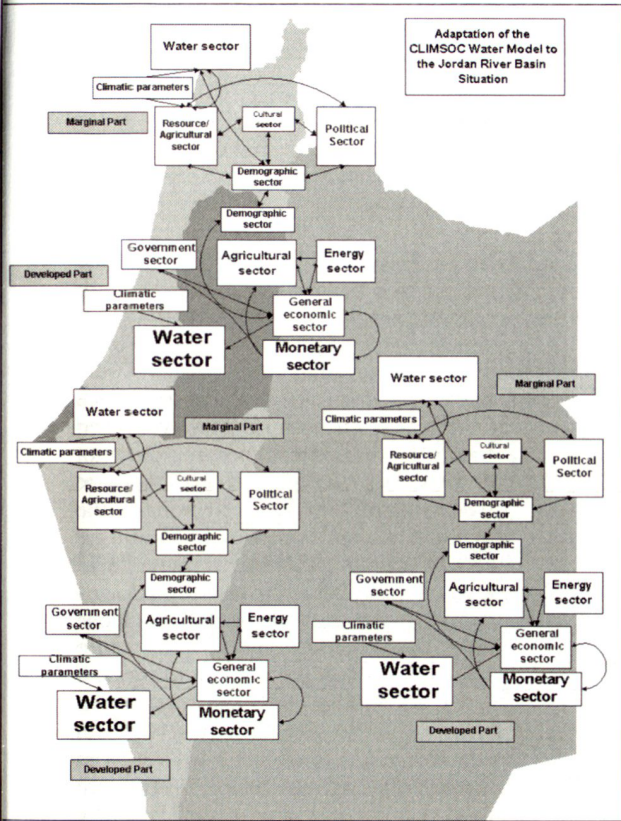
economic or power relations. This Middle East situation is one example. Our model has proved capable of describing the complexities of the existing situation and providing scenarios that could reduce conflict over water between Israel and the Palestinians and Jordanians.

**It is our contention that Central Asia is poised to become another region where structural problems become mixed with environmental issues related to water to set the stage for intense conflict. Adapting our model structure to this case will provide a tool for conflict resolution in the region.**

In our proposed research, we apply a simulation model called **CLIMSOC** to the specific example of the Central Asian Republics. The model provides a general framework linking societal and environmental processes that has been expanded to include a sector-specific model, **CLIMSOC-Water**. It describes relations between climate and societies, derived from the general CLIMSOC model, and allows an analytical exploration of various issues related to water use. Underlying the model structure are several hypotheses concerning social systems, global climate change, and water resources. The model can thus capture the crucial interactions among both social and natural processes and can be used to examine various scenarios about future use. These scenarios in turn highlight implications for future conflict, economic development, and environmental degradation.

### The Tools: Simulation Models

The hydrological system and its interactions with society's use of water are highly complex and contain many uncertainties. Therefore, the description of the key processes and interactions preclude use of empirical or statistical models. Instead, we construct *quantitative simulation models*, i.e. those that use mathematical formulations to express key relationships within the system. Theories about the function of physical and social systems are the basis upon which these models are developed. They are elaborated in quantitative terms so that it is possible to test hypotheses about the importance of changes in key variables for the evolution of other aspects of the system and to explore different trajectories they may take in the future. Such an approach can provide important insights for decision-making about global environmental change because it permits an analysis of impacts of physical change for social processes and vice versa. Modeling policy alternatives also allows for the assessment of consequences of political and economic



ways, by their consumption and thus degradation, which will eventually become part of the water cycle. General water consumption can be decomposed into three parts that affect rural and industrial regions differently:

- Consumption by households.
- Consumption by agriculture, mostly in the form of irrigation.
- Consumption by industry.

These three types of consumption take fresh water as an input and emit degraded forms of water in a variety of ways that then make their way into the water cycle. Each type of consumption is described in terms of the factors which influence its levels and evolution: 1) Population, 2) Economy and Resources, 3) Cultural organization, and 4) Government.

A demographic structure (1) divides population into age cohorts. Birth, death, and migratory processes drive the evolution of this structure. Births and migration are partially influenced by economic and resource conditions and by the cultural organization of land structures and institutional arrangements that include or exclude outsiders from the use of local resources.

The economy and resource sector (2) describes, on the one hand, a traditional mixed agricultural system that includes both grain and animal production. This type of system is dependent on the establishment of relatively large inventories for survival and to some extent on the availability of government subsidies. Land, agricultural capital, the size of herds, manpower, and technology constitute the inputs for potential agricultural production. Manpower provides the link with the population sector since it is made up of the cohorts that are of the age to work (the active population). Actual agricultural

production also depends on climatic factors such as moisture, temperature, and solar exposure. These data are derived from climate models. On the other hand, an industrial region is also modeled, focusing on the way water is used for energy, its direct role in industry, and domestic consumption. The two sectors are linked to provide a comprehensive view of the role of water in the economy.

Cultural organization (3) accounts for property and land tenure arrangements determined by inheritance rules and cultural factors that shape the size and distribution of plots of land and establish rules of access to land and water resources. Water rights, for example, are an essential resource that may be regulated locally or at higher levels of social integration. Availability is partly due to climatic features but more important for our study are the competing uses for water among different types of use: domestic, agricultural and industrial. This distribution is determined by property arrangements, prices, and regulations. These forms of distribution can vary over time. Even if rules themselves do not officially change, their enforcement can vary, so practice as well as theory must be carefully studied.

The government sector (4) collects taxes, distributes subsidies, and spends resources on some types of capital (such as collective equipment). It is obviously connected with the economic and resource sector. It also has the power to modify some forms of property arrangements and therefore influences water availability not only internally but also internationally given the fact that water flows across international borders.

Simulation and validation runs using this model show that it can track demographic evolution and water consumption rather well (See sample output presented below). Agricultural production is subject to diminishing returns and tends to level off. Population growth and migration obvious-

measures on the physical system and on society.

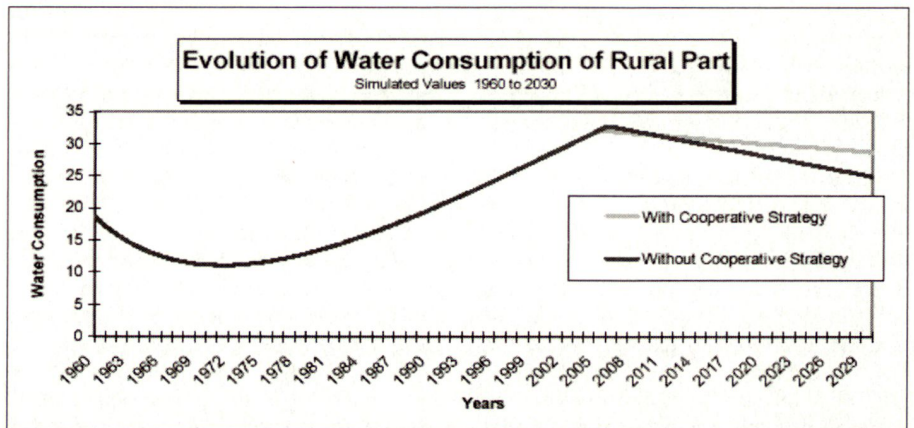
Therefore, in contrast to simple empirical or statistical testing procedures, simulation has the advantage of providing the decision-maker with a tool that can be adapted to answer specific questions about the effectiveness or consequences of policy choices.

Its features are particularly important when looking at the interactions between social systems and the environment. Many environmental changes cannot be based entirely on extrapolation from empirical observations. Modeling plays an important role in the prediction process itself, which is highly dependent on assumptions about some physical aspects but especially about social trends. Such social trends are often considered exogenously within natural science models of global environmental change but are best analyzed in terms of their feedback structures with natural processes.

### The CLIMSOC-Water Model

The model's basic approach is to link water resources to climate change because alterations in temperature and precipitation affect the hydrological cycle as well as water use. It is a paradox that fresh water usage tends to increase when temperatures are high and in periods of drought. The study of water resources is thus closely tied not only to climate but also to all aspects of global environmental change. These resources are affected in both rural and industrial regions, and affected in different

### Jordan River Basin





Central Asia.

ly affect water use but the shift between production sectors and policies on industrial development have a particularly strong impact. Thus, the model will identify weak points in the system where conflicts among uses and, therefore, users could erupt.

As illustration, we present an example of how the model was previously applied to the Jordan River Basin. In this case, we analyzed water needs and water consumption in Israel, the Palestinian regions of the West Bank and Gaza, and Jordan, representing the empirical situation and suggesting ways to avoid conflicts over water (siehe S. 11).

## Central Asia

Reports from Central Asia regularly alert the international community to worsening ecological conditions, the dire social and economic status of its population, and the ensuing potential for serious civil and interstate conflicts. The situation is particularly complex and delicate because familiar problems of over-extensive irrigation agriculture and population increase have become mixed with interstate politics as a result of the collapse of the USSR, as a consequence of which, "a very complex water management problem became a very complex transboundary water management problem".

Riverine water resources, especially from the Amu Darya and Syr Darya rivers play essential roles in the economy and society of the Central Asian states of Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, and Kazakhstan, all dependent in varying degrees on irrigated crops for survival. Cotton, for example, the most important irrigation crop, is the major source of income and employment in Turkmenistan

and Uzbekistan. In direct conflict for this same water is energy production. Kyrgyzstan and Tajikistan rely on hydropower for 50% of their electricity production.

These competing water uses are aggravated by demographic pressures.

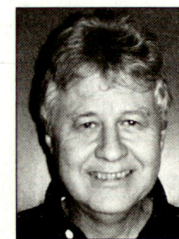
Although tensions over water allocation are not new, they have taken on new significance since the collapse of the Soviet Union. Previously managed from Moscow by a centralized administration, water systems have suddenly come under the control of separate sovereign states that have no history of agreements or coordination structures. This poses important allocation problems because of the nature of water resources and the weakness of new state institutions in the Central Asian republics.

Indeed, there are important downstream/upstream issues that have emerged since the regions have gained the status of independent republics. Upstream states Kyrgyzstan and Tajikistan need water for hydroelectric production as well as irrigation, while Kazakhstan and Uzbekistan use water mostly for irrigation. The upstream republics have held up release of water or threatened to charge for delivery downstream in order to pressure downstream users to compensate for energy production forgone when water is released for downstream irrigation. It is important to note that despite their control over the source of water, upstream states are implicated in allocation schemes that oblige them to provide water downstream. In breaching their commitments, which they do or threaten to do, they become vulnerable to reprisals from downstream states that can, and have, refused to provide energy in the form of natural gas and coal in return for water.

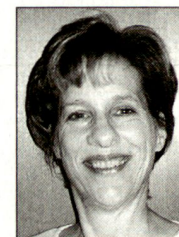
It is common wisdom that resources whose allocation proves problematic because of the difficulty of assigning clear,

unambiguous property rights are generally managed through common or centralized property institutions. This was the case under Soviet rule. The central state was able to enforce exchanges of water and energy between upstream and downstream users. At present, the previous patterns are maintained but they are not perceived to be equitable. Kyrgyzstan and Tajikistan would like to expand irrigation agriculture as well as electricity production. However, even their dominant upstream position does not permit them to achieve their goals because of their political weakness in front of the downstream users' control over coal and gas and the energy produced by these fuels. However inequitable an upstream/downstream relation may be, it will be stable unless the downstream user has other resources or power with which to pressure those upstream that control access to water. The asymmetric distribution of resources in the Central Asian republics is just such an example of an unstable relationship between users of a same natural resource with unclear property rights. **There is no obvious solution that is both equitable and efficient. Management schemes must therefore be negotiated and again here use of techniques outlined above will be very helpful.**

Literaturnachweise können bei den Autoren bezogen werden. ■



Urs Luterbacher, Prof. Dr., seit 1973 ordentlicher Professor für Politikwissenschaft am Graduate Institute of International Studies, Genf.



Ellen Wiegandt, Dr., Graduate Institute of International Studies, Genf, und am Universitätsinstitut Kurt Bösch in Sion.

## Learning from Africa

### What Can Be Learned From Conflict Management In The Nile Basin

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What can civilian peace-building experts learn from Africa? The following article answers this question with four theses, based on lessons learned from international cooperation over scarce water resources in Africa.

Simon A. Mason  
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#### Conflict Theoretical Background

Three dimensions with which conflicts can be analysed will be presented below, to be used in section two on the Nile Basin: 1) Glas's conflict escalation model, 2) the role of power, law and negotiations in conflicts, and 3) the multi-track approach to conflict management. These approaches and their underlying theories can be viewed as a distillation of experiences from practice. As in much of social science, they are debated. The reason why we use these approaches and not others is because they have proven to be useful by practitioners dealing with conflicts in the field. There are many definitions of the word "conflict". We will use the term "social conflict" in the following to mean a situation that arises when: 1) at least two parties interact in an incompatible way; 2) at least one of the involved parties intends or ignores the negative impacts on the other party stemming from the interaction; and 3) at least one of the involved parties experiences damage from the interaction.

#### 1) Conflict Escalation Model

One of the main ideas of the above conflict definition is that there is a continuum from a simple debate to an all out war. The continuum or intensification of tension in a conflict is termed "escalation". Glas differentiates between nine escalation steps. During this process, conflict parties capacity to differentiate decreases, "black and

white" and "wrong and right", forms of thinking take over hand. Conflict parties start by wanting something, and end by also wanting to hurt the opponent. In order to make it acceptable to inflict suffering on other people, we go through a process termed "moral disengagement". The last escalation step is mutual destruction.

The aim of analyzing the escalation level is that the method of intervention should be adapted to the level of escalation. The more escalated the conflict, the more force is needed by a third party (person or organization who gets involved in the conflict to support de-escalation) to bring about change in the system. Thus military conflict management has a role to play in highly escalated conflicts, whereas civilian conflict management efforts have the key role to play in low escalated conflicts. An image should clarify the difference: a conflict between two people arguing with each other may be facilitated by an all-inclusive "fair" third party. If the two same people are hitting each other on the head, however, forceful separation is more appropriate.

Military, police and civilian conflict management needs to consider the differences and similarities between micro-level, and macro-level conflicts. It is, for example, misleading to think that micro-level conflicts are less escalated than international ones. 15 530 people were killed by intentional killing ("micro-conflicts") in the USA (86 in Switzerland) in 1999. A terrorist attack of the magnitude of September 11 (a "macro-conflict") would have to occur every two months to have a similar death toll in the USA. The impor-

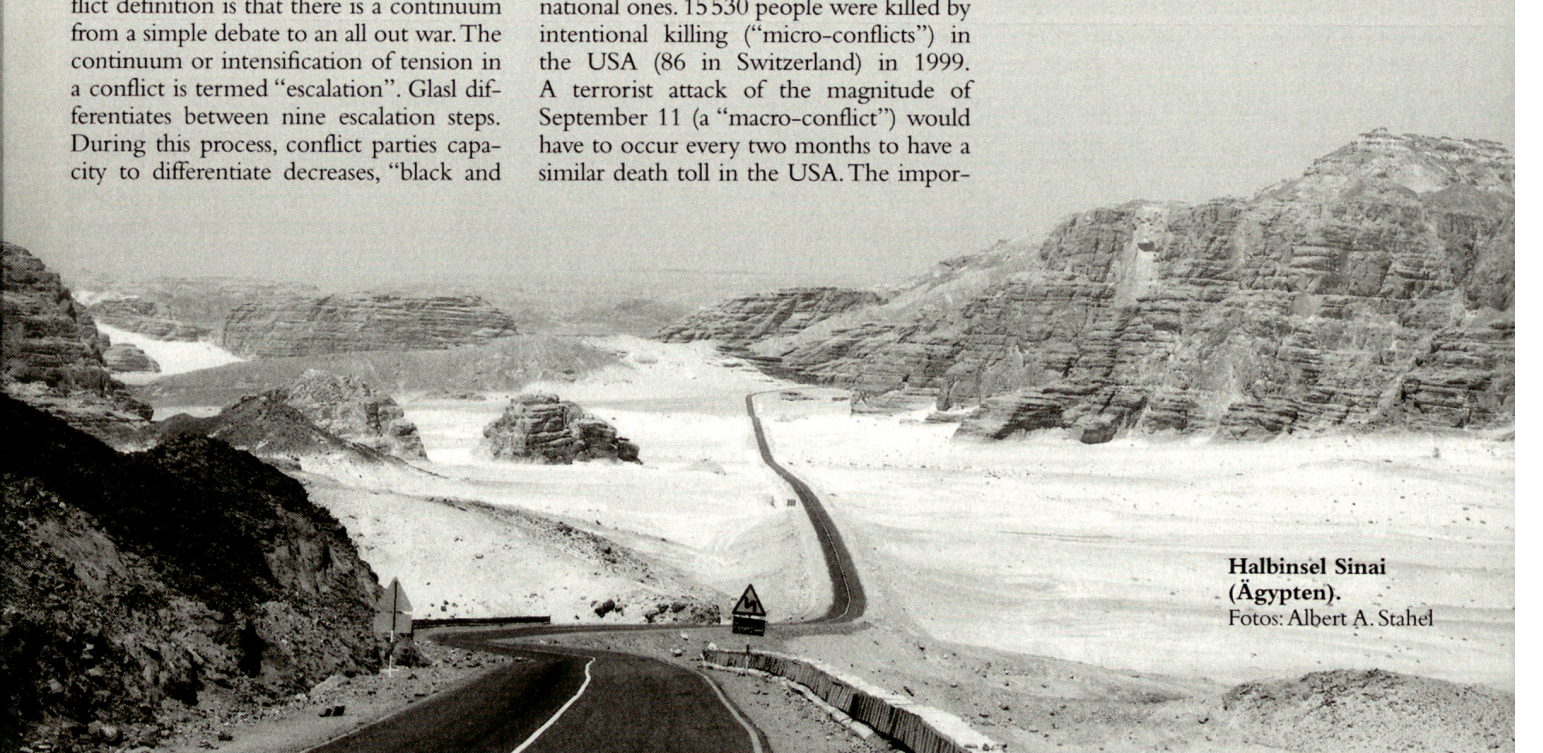
tance given to international conflicts and terrorism is therefore disproportionate to their death toll, and can rather be explained by other factors, such as fear of the unknown and uncontrollable.

A key finding of escalation models is that no intentional murder or war occurred without one or both of the conflict parties beforehand going through all the escalation steps. The conflict parties, society and/or the international community would have signs to react on to de-escalate conflicts if they chose. Often, however, this does not happen.

#### 2) Power, laws and negotiations

All relationships, be they in conflict or not, have elements of power, are regulated by rules and laws, and have elements of negotiations (a mutual give and take, considering the interests of those involved). According to Fisher, Ury & Patton, conflicts are likely when the mixture of these three elements do not fit the task at hand. Thus a military, fire brigade or hospital organization based only on negotiations would not work. Without some degree of negotiations, however, these organizations are also dysfunctional.

In 1996 the World Game Institute estimated the annual global military spending at about 780 billion USD. They estimated that 30% of this would suffice for global programs to solve major human need problems (see first figure). The comparison of the annual world military spending with the annual costs of programs to alleviate some of the major sources of human suffering, as mentioned above, indicates that the international community puts its trust in military power, and to a lesser degree in international law, negotiations and civilian conflict prevention. Why the world chooses what it chooses, however irrational this



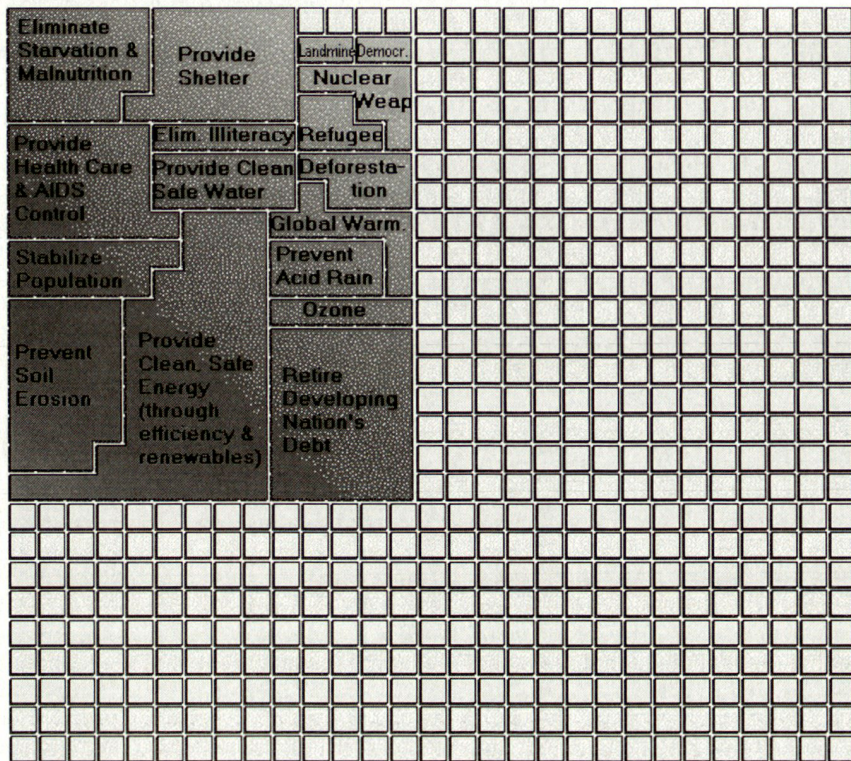
Halbinsel Sinai  
(Ägypten).

Fotos: Albert A. Stahel

**WHAT THE WORLD WANTS  
AND HOW TO PAY FOR IT USING MILITARY EXPENDITURES**

Below are annual costs of various global programs for solving the major human need and environmental problems facing humanity. Each program is the amount needed to accomplish the goal for all in need in the world. Their combined total cost is approximately 30% of the world's total annual military expenditures. ■ \$1 billion. □ Amount that was needed to eradicate Smallpox from the world.

**Total Chart represents Annual World Military Expenditures: \$780 billion**



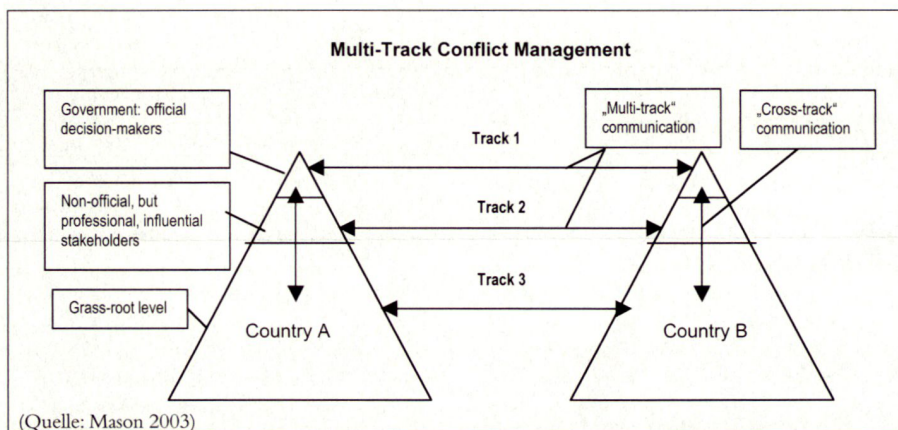
Source: © 2000, Medard Gabel and the research staff of the World Game Institute <<http://www.oearth.com/resources/wwwproject/index.shtml>>

may be for the welfare of humanity, is a question for further research.

**3) Multi-track conflict management**

Multi-track conflict management focuses on the synergies between conflict management by officials (track one), unofficial, informal representatives of society (track two), and efforts on the grass-root level (track three) (see second figure). Track two has been defined as "informal interaction between members of adversarial

groups or nations which aim to develop strategies, influence public opinion, or organize human resources in ways that may help resolve the conflict". The advantages of each track are used in order to develop and implement solutions accepted by all levels of society. Unofficial experts, who meet each other in informal settings, are often more flexible about developing and brainstorming management options, as they do not need to defend fixed official policies. While Track 1 conflict manage-



ment focus on issues and often positional bargaining, Track 2 conflict management can often focus more on relationships and interest based interaction. The importance of Track 3 activities, as well as dialogue across tracks ("cross-track" conflict management) is important as no international peace agreement can be implemented without a wide acceptance in the society.

**Water Conflict Management in The Nile Basin**

With the above theoretical approaches in mind, we will now examine a real world case, specifically concerning water conflict management in the Nile Basin, where both civilian and military means were explored by the stakeholders to defend national interests. The section is divided into a part on the Nile conflict and a part on conflict management in the Nile Basin since 1999.

**1) The Nile Conflict**

The Nile River is shared by ten countries (Egypt, Sudan, Ethiopia, Eritrea, Tanzania, Uganda, Burundi, Rwanda, D.R. Congo, and Kenya) and is home to more than 160 million people; the population is growing by 2-3% per year. Measured at Aswan, the Nile River has a yearly flow of 88 km<sup>3</sup>/year. 86% of the Main Nile's water stems from the Ethiopian highlands in the Eastern Nile Basin, the rest originates mainly from the watersheds of the equatorial lakes. Many countries in the Nile Basin are highly dependent on the Nile's water, as they are situated in an arid or semi-arid region. More than 95% of Egypt's water stems from the Nile, which means that it depends on rainfall outside of its territory. Egypt has therefore always closely observed Ethiopia's water development plans. Ethiopia's irrigation plans are of great concern since they could reduce the water flow in the Nile. Currently, Ethiopia's economic capacity does not yet allow full implementation of its irrigation plans. Ethiopia's present food production is dependent on rain-fed agriculture, which is unreliable because of the irregularity of the seasonal rains.

The national capacity to address the issues of water scarcity, erosion, sedimentation, floods and droughts is limited. Eight of the ten countries of the Nile Basin (Egypt and Kenya are the exceptions) are among the category of the 47 "least developed countries" world-wide. On the international level, the absence of a basin-wide water agreement has caused tensions between the riparian states and hindered access to international development support. Egypt and Sudan are committed to the only non-colonial water agreement in the basin, the



Agreement of 1959. The agreement allocates 55,5 km<sup>3</sup> water/year to Egypt and 18,5 km<sup>3</sup> water/year to Sudan, under condition that the Nile flow, measured at Aswan, remains the same (Agreement 1959). The upstream countries, however, do not consider the Agreement of 1959 to be relevant for them, as they were not invited to the negotiations that led to the agreement and did not sign it. Many international development banks require the consent of downstream countries before financing development projects on international rivers, thereby protecting the geographically weaker downstream states. A lack of consent from the downstream states can hinder development upstream, one of Ethiopia's main concerns.

The most escalated conflict is in the Eastern Nile Basin, between Egypt (the main runoff consumer), Sudan and Ethiopia (the main source).

The challenges posed by the water conflict in the Eastern Nile Basin can be summarized as follows:

1. A finite amount of water resources stands to be used by a population that is increasing by 2-3% annually.

2. The Nile countries' national socio-economic and political capacity to find alternatives to present water use trends is limited.

3. There is no agreement on water allocation between the riparian countries that is accepted by all. Egypt and Sudan uphold the validity of the Agreement of 1959, the upstream countries seek to negotiate a new Nile waters agreement.

4. There have been diplomatic tensions and instances of threatening and concerned rhetoric between the countries of the Nile, especially between Egypt and Ethiopia.

5. International investment in water resource development has been blocked, due to disagreement between the countries.

6. The downstream countries are concerned about a decrease in water flow due to upstream water resource development.

7. The upstream countries are concerned about the downstream countries hindering their water resource development.

## 2) Successful Water Conflict Management

Cooperation in the Nile Basin started moving in the 1990s because Ethiopia accepted a project-by-project approach (an Egyptian proposition), and Egypt accepted talking about a legal framework (an Ethiopian proposition). The Nile Basin indicates that the shift from a focus on positions to interests requires a "this at the same time as that" approach, instead of a "this on condition of that" approach. A discussion and

negotiation forum was created in the "Nile Basin Initiative" to talk about legal issues, while simultaneously cooperation in the form of concrete projects has started, e.g. hydroelectric power production. Official and non-official representatives of the Nile countries met in different fora, e.g. in the series of Nile 2002 Conferences, enabling mutual learning about each other's perceptions and interests. These can be seen as examples of multi-track conflict management. A key point of multi-track conflict management on all levels in the Nile Basin is that by focusing on interests (underlying reasons for what people want) rather than on positions (fixed way of reaching what one wants) the number of options that can satisfy the different interests are increased and compatible solutions can be developed more easily.

A further contribution to the ongoing cooperation process was carried out by the Center for Security Studies of the ETH Zürich, together with the Swiss Federal Institute for Environmental Science and Technology (EAWAG), and the Conflict Prevention and Transformation (CO-PERT) section of the Swiss Agency for Development and Cooperation (SDC). In the "Environment and Cooperation in the Nile Basin" (ECONILE) project, they organized two Track 2 workshops between participants of the Eastern Nile Basin Countries. One of the outcomes of the first workshop was a publication written by the participants giving an all inclusive view of the different interests, perceptions, concerns and needs. In the second workshop at least one participant from each country was a member of the official negotiating teams, thus the workshop was a form of Track 1 and 2 conflict management effort, where officials interact on the Track 2 level.

Besides changes in the context, e.g. the end of the Cold War, the shift towards interest-based cooperation in the Nile Basin occurred, according to many of the experts interviewed in the ECONILE project, through a process of "dialogue accumulation". Dialogue accumulation refers to the result of numerous meetings between representatives from the different conflict parties over the years in various formal and informal settings. While one meeting may have little impact, together they have an influence. The coordination of the third party (the World Bank, UNDP (United Nations Development Programme) and Canadian International Development Agency [CIDA]) that supports the Nile Basin Initiative (Track 1 activities, but also capacity building and investment projects), has played an important role both in facilitating communication and in providing financial resources.

It is not obvious that the countries of the Nile Basin focus mainly on cooperative





Halbinsel Sinai (Ägypten).

conflict management. Egypt has frequently considered the role of military power when it comes to defending its water resources, the life line of Egypt, yet it also realized that negotiations and a consensual framework is more expedient to the present situation.

Some of the reasons why civilian conflict management could work in the Nile Basin are summarized below. These points also explain, in part, why Egypt's consensual communication strategy under President Mubarak's regime was more successful in securing Egypt's water than was the former military threatening strategy of President Sadat. The Nile example demonstrates that communication can lead to cooperation, even if a legal system is missing, as in the Nile Basin. It seems that the following pre-conditions for communication to work are needed: 1) there is a potential benefit for each actor, 2) there is a certain power symmetry, and 3) the conflict is not too highly escalated.

First, the benefits for the Eastern Nile countries is that they can more effectively deal with environmental issues, better access financial resources, and in the long term safeguard their water resources, through cooperation.

Second, the power symmetry is given to a certain degree in the Eastern Nile Basin in that Egypt is economically more powerful, and Ethiopia as the upstream country is geographically more powerful. It is important to note that the power of Ethiopia does not consist in military power, but rather in geographic power.

Third, the Nile conflict can be viewed as a low escalated conflict. According to the Glasl escalation model, level three is

reached when actors no longer believe that talking helps and when they go ahead with unilateral actions. While the Toshka project in Egypt and the micro-dam developments in Ethiopia can be seen as such unilateral actions, these are not directly aimed at harming the other party. Hindering development upstream can, however, be viewed as an action indicating level three escalation. Ethiopians could also view the dominance of Egyptians in international water fora as an example of Egypt seeking to form coalitions supporting their downstream position. Images and coalitions are an indication that level four has been reached at times. Thus, the Nile conflict is viewed as being on a low level, on level one, two, to maximum four, where direct communication can be used.

The dimensions of power, law and negotiations also shape the intra-national arena. No major foreign policy change is possible without public support. At the beginning, the Water Ministries were viewed skeptically by the general public. With the change in strategy towards cooperation during the late 1990s, the media in both Egypt and Ethiopia criticized the Water Ministries for "selling out" to the other country, of being soft. Hardliners were seen as more patriotic than moderate experts, willing to cooperate. Only through an intensive public information campaign, could the Water Ministries of Egypt and Ethiopia convince the wider public that cooperation would serve the national interests better than sitting and waiting, or even than using military threats. The lesson learnt is that greater transparency and public informa-

tion is needed already at an early stage of a negotiation process. Besides these problems, Sudan faces the major obstacle of an ongoing civil war. There the success of the peace process is a key requirement for any long term stability and implementation of international water development projects. The case of Sudan goes in line with the global situation since the Cold War, where violent conflicts are intra-national, rather than international. Of the 25 major armed conflicts in the year 2000, all but two of them were internal.

## Conclusion

The following theses conclude this text:

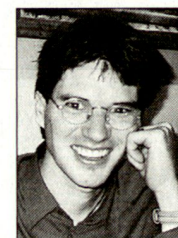
1) Most international conflicts are of a low escalation level. In most cases Track 1 (official, diplomatic), Track 2 (international exchange between non officials) and Track 3 (grass root, civil society) conflict management efforts are more suitable to safeguarding national interests than military strategies.

2) Dialogue can lead to cooperation if there is a certain degree of power symmetry and mutual gains can be expected. Military power is only one aspect of a country's "power". Its importance is often over-estimated, especially in low escalated conflicts. The economic capacity, political stability, geographic position and international Track 1, 2 and 3 networks and participation in international organizations are other crucial aspects that give a country leverage.

3) Any national policy change versus the international community has major challenges to face from the internal public opinion. Media and public participation in this process can enhance acceptance for policy reforms. Peoples' fears need to be taken seriously. Elected leaders should not shy away from leading.

4) Highly escalated conflicts, where military intervention is required, are mainly found in the intranational arena.

Literaturnachweise können beim Autor eingeholt werden. ■



Simon A. Mason,  
Umweltwissenschaftler  
und Mediator,  
wissenschaftlicher  
Assistent am Center  
for Security Studies  
an der ETH Zürich.