Journal of Agriculture in the Tropics and Subtropics
Volume 102, May 2001, pp. 59 - 73

# Conflicts Between the Traditional Usage of Water for Irrigation and Drinking Purposes and "Modern" Development

**Bliss, Frank ***

**Abstract**
The traditional usage of water for irrigation and drinking purposes in many places of the world is severely affected by "modern" development. Construction of large dams and irrigation schemes or the modernisation of the water supply by drilling deep wells do not necessarily result in a general improvement of the water supply of the local population. Examples from various countries show that even if more water is made available, the water supply of the people living in a project area can deteriorate. In quite a few cases there is even less water available as the new schemes in question are, in general, not implemented in order to assist the local population, but to pursue quite different objectives. Even if "modern" water development tries to target the local population it is more than uncertain whether changes in the water supply technology and management would improve the socio-economic conditions of the people. As a consequence it is strongly recommended to adapt new water supply technologies strictly to the demand and the technical and management capacities of the target groups and, whether existing water rights are touched or not, to link every planning and implementation process with a far reaching participatory concept.

## 1 Introduction: Various types of interventions and their affects

Modern development affects the existing economic and social systems of the target populations. This is pure truism. However, government policy in general and development programmes in particular do also affect economies and societies which are not the prime target groups. People who sometimes live quite far from a project area could also suffer from the impact of the activities there. On the following pages the author would like to direct attention to some critical scenarios which often arise where modern development intervenes, directly or indirectly, in the (traditional) water supply sector.

After the description of some widely noticeable constellations two case studies from Egypt and Tunisia are presented. A few remarks then deal with social affects of interventions in (traditional) water supply systems. At the end some recommendations are formulated which are far from being complete. Generally the author would like to emphasise that this entire text is a preliminary summary of some conflict scenarios in

* Bliss & Gaesing, Ass. Gutachter, Sinziger Str. 4, 53424 Remargen, Germany

the water supply sector and that many aspects such as the international dimensions of the problem are not at all being considered.

Some scenarios where modern development and traditional forms of water usage could come into conflict are the following:

* Big dams, as McCulley shows, have the widest affects on the local population losing homes, lands and other resources (1996). Usually these dams do not improve the water supply of the adjacent farming areas. Either the water is used for the production of electric energy for the (urban) developed sector or the water is conducted to government schemes in other areas. Some of the most critical projects such as the "Three Gorges Dam" in China and the "Narmada Project" in India (four major and many "small" dams) do not only affect the water supply of the local population, but force hundred thousands of people to leave their homes by involuntary resettlement, resulting, as history has shown, in an unsafe future.
* The construction of big dams in many cases also negatively affects the population that lives downstream of the storage lakes. Seasonal floods for example on the shores of the Niger were the basis for the traditional agriculture in at least three African countries (Mali, Niger, Nigeria). We have to admit that in the past there was an uncertainty whether the water would come up to the higher areas or not, but today it is certain that it will not come at all. Without the seasonal flood people lack irrigation water. Being mainly subsistence farmers most of them are not able to purchase diesel pumps to lift the water onto the rich soils on the higher river terraces. On the one hand the concerned governments promised to provide thousands of hectares of new irrigated land to farmers by means of the dams, on the other hand at least the same number of farmers has lost their existence downstream because of the same dam.
* Big dams bear another risk for the population living downstream. Unexpected rainfalls in the tributaries to the storage lake could force the managing staff of a dam to open the lock gates, resulting in an unexpected flood downstream which could affect and completely destroy the crops on the lower terraces. There are examples when even normal flushing is never announced in advance and harvests get lost.
* Also small and "useful" dams (useful for people living near the dam) may create problems. The tributaries of the Volta river in Burkina Faso for example are more and more affected by those larger dams which provide water for the capital Ouagadougou or the other big towns of the Sahel country. In addition, the many micro-dams from various donor funded programmes (in 1997 there were more than 2,000 in the whole country) influence the water catchment of those streams and small rivers which flow into the Bougouriba, Mouhoun, Mazinon or other source rivers of the Volta. Upstream in Burkina the individual dam has its positive impact on the local population which has improved access to drinking water and water for small scale irrigation. However, hundred thousands of people in Ghana suffer severely from the decreasing water table of the river downstream.
* There is no need for constructing a dam to affect the water supply of the local population. If the water of small streams is diverted to "modern" irrigation canals by

a pile or a small concrete made wall, the traditional users of the water could also seriously be hit. In a few cases the new irrigation system improves the conditions of the stream dwellers. But in many more cases the water would not go to the original users.

* Interventions in the subsurface aquifers by drilling (deep) wells could have a serious impact on the local and regional water table. Formerly artesian water wells would lose their natural pressure and in order to lift the required amount of water motor pumps have to be used. Costs would explode and make irrigation based agriculture economically not viable. Our examples from Tunisia and Egypt show that entire traditional irrigation systems could be damaged and productive agricultural areas be completely lost.
* The excessive usage of artesian water in many Saharan countries has another bad ecological affect. Most of these water resources are fossil. This means that the aquifers were created from rainfalls some ten thousands of years ago (cf. Shata et al. 1962 for the Western Desert of Egypt) and do not refill nowadays. Water taken from these aquifers is a limited resource such as mineral oil or coal. Even if an ecologically dangerous and economically useless project was stopped, the water supply could definitively be damaged[1]. What happens with the local population if a project destroys the artesian aquifers and withdraws? Either the local population has to be resettled to other areas or the government has to subsidise the agricultural and drinking water supply forever.
* It is not always the intervention of the government that has a negative impact on traditional water supply systems. Private water exploitation can also affect existing wells. In Madhya Pradesh and in other places in India private irrigation projects are more and more interrupting existing irrigation schemes and even the water supply of urban drinking water networks. Where government institutions are not able to prevent the misuse of water resources it is almost impossible for individuals to protect their claims. The wealthier and more influential the "newcomers" are the more the poorer water users have to take second place. Within traditional societies the customary law including the usage of water and individual rights is more or less well protected. However, if (often government backed) investors become neighbours of the long established local communities the latter for sure become losers.
* It is a fact that in many countries the existing, often in principle useful national water laws are not respected. Mainly in non-urban areas almost all control is lacking. In one and the other case this could be an advantage for traditional water users. If a new shallow well is needed people dig or drill it without asking for official permissions. These shallow wells are hardly able to cause damages in the aquifers. However, many more examples show that a badly developed law enforcement only favours those people which do not respect traditional property rights nor the needs of the poor or the requirements of the ecology. There are many examples from different countries that for example drilling a deep well for irrigation

[1] After decades of extraction there is still water left in the groundwater layers under the Sahara. However, the example of Libya (Kufra Projects) and Egypt (New Valley Project) show that it is almost not possible to lift the water under economically acceptable conditions.

could dry up all the surrounding shallow wells. Here the absence of law enforcement would have a very different impact on economy and ecology compared to the first case.

It would be not difficult to add other examples to these scenarios. It should be kept in mind that the international dimension of conflicts on water, which has not been referred to in this article, is a growing threat for peace.

## 2 Case study I: The Egyptian "New Valley"

In many cases "modern" land development does not consider the existing old farm land in the same area and does not respect the interests of its owners. Most conflicts resulting from ignoring this fact are related to water resources and irrigation. Government interventions could end in severe socio-economic faults. One example, studied by the author from 1979 to 1986 and again in 1996, comes from Egypt.

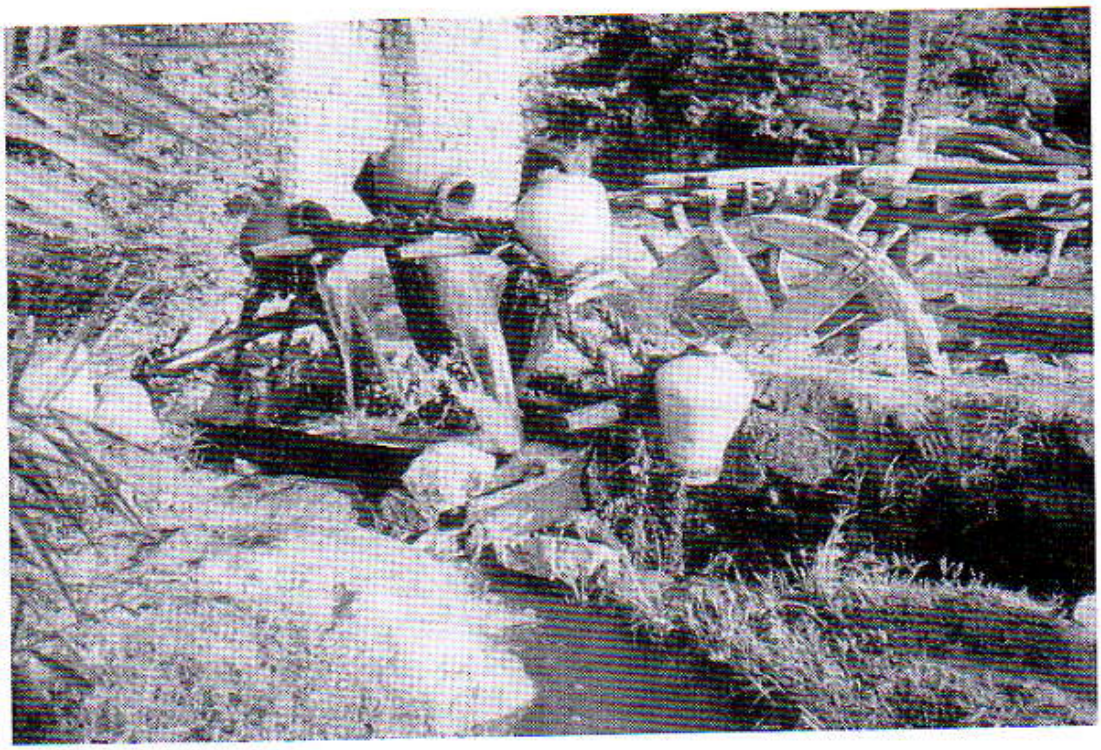
**Figure 1:** Traditional wooden drilling rack as being used until the 80ies in the Egyptian Dakhla Oasis.

The Egyptian oases of the Western Desert, Kharga, Dakhla, Farafra, Bahriya and Siwa have an old agricultural tradition. Since Neolithic times people use the water of artesian wells to grow almost all known subtropical fruits and vegetables. Oases and water

sources are closely linked. As the agricultural production depends completely on artificial irrigation traditionally cropping is only possible where water can be extracted and easily directed to the gardens. As a consequence an Egyptian oasis is not a large agricultural area, but a cluster of many small palm gardens and fields each irrigated by one or more hand drilled artesian wells.

Until the seventies of this century artesian pressure was always high enough to bring the water to spots which were a few metres higher than the bottom of the oasis depression. Only in Dakhla farmers had used the Persian water wheel (saqya) since the middle ages in order to lift the water one or two metres. The reason for selecting these higher places for establishing gardens and fields is very clear: artificial irrigation requires drainage and the best and cheapest method in the traditional system was to have natural drainage by the relief of the soil itself. The salty water trickled down from the fields to the lowest areas of the depressions where it evaporated, leaving only barren salt marches (arab.: sekha, birka or karshîf). Any agriculture in the oasis depressions had to respect these requirement for drainage. As a consequence suitable areas for agricultural usage were always very limited.

**Figure 2:** For thousands of years the Egyptian saqya has been a highly efficient tool for lifting water.



Water in the Western desert comes from underground artesian aquifers from depths from about 40 m (in Siwa even less than 20 m) to more than 1,200 m. In order to reach the aquifers the population used a simple but effective drilling technology (cp. BLISS 1983, 1998, 1999, WOLFF 1980) which is used in all five oases: the work is performed with a walking beam mounted on a support frame, both manufactured from locally available acacia or olive wood. The support frame is made up from two sturdy tree

trunks approximately 3 m long which are partially embedded in the ground. A cross beam of acacia wood is attached to complete the construction of the frame, on which an about 5 m long beam made from the hardest available wood, usually babul (*Acacia arabica*), is flexibly mounted as the walking beam. The longer end of the lever, at which up to 12 men will later on move the drill rod up and down, points away from the borehole. Under the guidance of the mu'allim (master craftsman), the drill rod consisting of several segments (each 3 m long) screwed together is rammed into the ground by first moving it up and down manually.

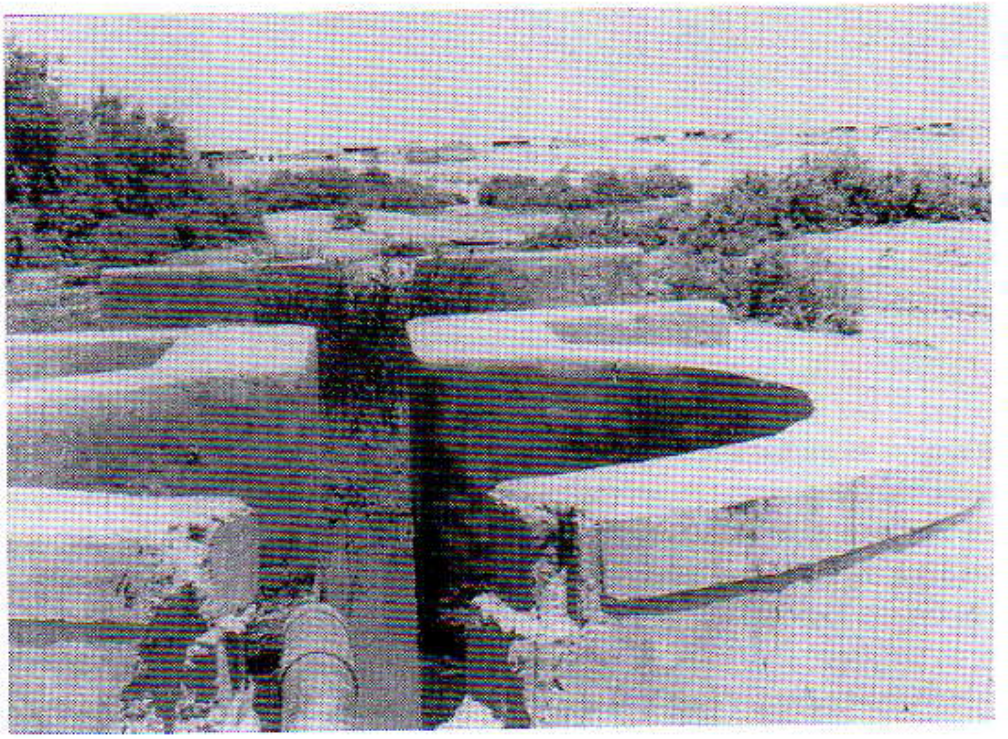
In Siwa this method is used for drilling wells with a depth of not more than 50 m. In Bahriya normally between 40 and 70 m, in Dakhla up to 120 m and in Kharga in the most impressive case a depth of more than 250 m have been reached. In both oases for drilling these deeper wells the mu'allim uses a wooden derrick instead of the beams and the drillers work with a winch in order to lift the rod. The loose material (drill cuttings) is removed from the borehole by a brilliant but simple technology described in the references cited above. Once the artesian aquifer has been reached, the finished well is usually cased with a 4-inch iron tube. Probably in former times artisans used acacia wood for the casing. The whole drilling procedure can be finished after two weeks (e.g. in Siwa) or only after six month and more (in the southern oases with deeper aquifers).

The described technology for water development has some important social implications. As most of the input consists of labour and only some money is required for purchasing the rod and the tubes poor farmers can also participate in a new drilling project. Later on, in case of success, the amount of available water will be distributed to each farmer according to his individual contribution, either labour, money or implements. Before the project starts these contributions are always fixed in a written contract. The percentage of each input is described in this contract, for example that a farmer who invests labour for the whole drilling period would receive 1/16 or 1/24 of the water, the provider of the rod 1/6, the master driller for his supervising work 1/8 and so on.

In an economy where land without irrigation facilities is almost worthless and only the access to and the ownership of water rights constitutes usable farm land the described way of obtaining water provides almost all families which have at least some available labour force access to a minimum of irrigation water. Even the poorer farmers shared irrigation rights from one or two artesian wells and the normal and wealthier farmer owned shares from three, four or even a dozen different well.
This systems of water development and irrigation has been severely affected by various Egyptian desert development projects executed by government agencies since the late 50s. A comprehensive history of these projects and their social, economic and ecological impact has been published by the author in 1989. In summary the following happened:

In order to develop some ten thousand hectares of new land aiming to resettle some hundred thousand farmers from the overpopulated Nile Valley to the oases the Desert Development Organisation started drilling hundreds of deep wells in various areas of Kharga, Dakhla and Farafra. No groundwater study was made before in order to analyse future effects of the deep wells on the existing water resources. There were also no studies on the required drainage, although most of the newly drilled deep wells were located in low areas which because of the above mentioned reasons were not used by

**Figure 3:** A modern deep well in the Egyptian Bahriya Oasis. The well broke down after only a few years of operation.



the local population.

20 years later studies showed that the desert development was a complete failure. Only little more than two or three thousand people from the Nile Valley were willing to built up new farms in the Western Desert. Nowadays many of them do not do farming, but work in government offices. In the same time the impact of the desert development activities on the existing agriculture and on the socio-economic system of the oasis societies was enormous. Although instead of projected 2,000 wells only some more than 250 have been drilled in Kharga and Dakhla, the extension of the water exploitation created an ecological disaster. Most of the artesian shallow aquifers between 50 and 200 m lost their natural pressure and the old hand drilled wells of the private farmers ceased to flow up to the level of the depression. After a couple of years also the new deep wells ceased to flow by their artesian pressure, and the government had to install diesel water pumps in order to pump the water from a decreasing water table. The more the table decreased - between 50 cm and some 10 m per year - the more the pumping costs increased.

**Figure 4:** A costly drilled artesian deep well in Kharga (Egyptian Western Desert). After a few meters the water runs unused into the desert.

Today there are no more naturally flowing artesian wells in the Kharga oasis. It is true that the Desert Development Organisation in the seventies started to provide water from the new drilled deep wells not only to the project farmers but also to the owners of the old lands. However, this government assistance was far from being a satisfying compensation for the losses:

* First, water was only distributed after the old wells felt dry. By the time the compensation water arrived, many of the productive palm gardens were already lost.

* Secondly there was an enormous loss of water in the long, but not properly built water canals by infiltration which in some cases exceeded 80 per cent of the total available water amount. Compared with these new wells the old artesian shallow wells were located near the palm gardens. Water wasted in the traditional canals made from soil could directly irrigate the palm trees. So almost the whole supply was used in a most efficient way. The result of the newly drilled deep wells was that farmers who had lost their old well received water from a new well, but the amount of water which really arrived on the fields and in the palm groves was much less than the required quantity. As a consequence also some of the old garden land which got its substitution water in time had to be given up.

* The third effect of the deep wells touched on the oasis societies. In the old system, as mentioned above, even poorer farmers were able to acquire water rights by participating in drilling a new well. After the desert development project had shown its negative effects on the artesian pressure of the shallow wells it was no longer

possible for a farmer to get water by his own decision. If he was able to receive water from the government authority he could survive. If there was no additional water from a nearby new well he had to reduce his agricultural activities according to the dropping amount of water available.

First the newly reclaimed land was to go only to the settlers from the Nile Valley. Later it was decided to provide land also to the local population as a compensation for the destroyed palm groves. However, this newly developed land based on deep well irrigation was no real compensation for the old palm groves. First, there were only a few influential farmers who received some of the land. If the soil was suitable these farmers were able to grow wheat. Soon it came to light that, in terms of the return, growing wheat proved to be much less productive than gardening within the traditional cropping system (palm and fruit trees, vegetables, fodder, and wheat). Secondly, most of the newly reclaimed land was situated on the lower areas of the depressions where a (still insufficient) drainage system was only built years later and large areas were lost as the soils became oversalted. Other unprofessionally selected schemes were lost by moving sand dunes of the Abu Mahariq chain.

Only recently the Egyptian government decided to start a second large land reclamation project in the oases of the Western Desert, no longer based on artesian wells, but on water which is to be carried to the areas by a large canal from the Assuan High Dam (from the so called Toshka overflow). It is doubtful whether this new project will compensate the old farming population for their losses in the past, or, as it is intended by the state, whether it will be a successful attempt this time to resettle more families from the Nile Valley to the oases.

## 3 Case study II: South Tunisian Oases

Another example shows that non-adapted government interventions can badly affect traditional agricultural and irrigation systems without offering reliable economic alternatives. Zarzis is a small oasis at the shore of the Mediterranean sea near the island of Djerba in south-eastern Tunisia. According to the national statistics from the early nineties there should be still 150 ha of cultivated land (i.e. palm gardens) in Zarzis irrigated by natural artesian wells. Although the sea is only between three km and a few hundred metres away these wells are supposed to have very little salinity. Reality is quite different. During our visits 1991, 1992 and 1995 less than 30 ha of land were used for farming. Most of the palm trees have gone and the fields (with henna, alfalfa and very little vegetables) were only very extensively used. Instead of the small privately owned artesian wells water was pumped from a state owned deep well and distributed by a rotten system of open conduits. Agricultural production nowadays plays only a minor role in the oasis economy of Zarzis.

What has happened? Within the traditional farming system water had, if necessary, to be extracted by drilling. The distribution of irrigation water was organised by the farming community itself. The individual farmer got his water from his individual well or from a community owned well according to the number of his palm trees, the

amount of arable land, invested labour and financial contributions for the maintenance of the distribution system. The farmers were organised in a water council, and all conditions for the water distribution, the irrigation schedule, procedures in case of quarrels etc. were written down in a contract. Representatives of the users controlled the water distribution 24 hours a day. Without any exception they had the authority to settle any kind of conflict between individual farmers without the interference of government institutions.

Since 1885 under the French protectorate, the authority of local user committees had been increasingly reduced. Finally in 1936 the government took over full responsibility for the water sector. From that time onwards it was strictly forbidden to develop private water resources. The distribution system came under government control and was operated and maintained by the irrigation department. Farmers became pure customers of the water authority.

After 1956 the independent Tunisian state did not change this situation which was retained without major reforms until the late eighties. During these last more than 40 years the responsibility of the farmers has declined to almost zero: "L'état donne de l'eau" ("the state provides water") became a proverb when visitors pointed out the poor condition of the irrigation network and the agricultural system in general. However, the state had neither the interest to support the - from its viepoint "old fashioned" - traditional farming systems of the oases nor was the bureaucratic system able to organise an effective water supply management. In addition prior to an oases rehabilitation project in the late eighties (funded mainly by Kuwait and other Arabic states) there was almost no budget for maintaining older irrigation schemes. Most of the national irrigation budget was spent on the development of new land and on establishing new irrigation schemes in the Djerid and Nefzauoa oases. As a consequence the amount of irrigation water dropped, the distribution systems suffered serious leakages and a lot of remaining water was wasted. At the end one hectare after the other had to be abandoned.

The perception of the state did only change recently when it was almost too late for the rehabilitation of the Zarzis oasis. In 1987 a decree on the creation of AIC (Associations d'Interêt Collectif) was issued, enabling the farmers to organise themselves in newly created water committees. These committees were given the right to manage the water distribution system on their own. They could collect user fees and employ guards and workmen. However, due to discouraging and incapacitating the self management capacities of the peasants for a hundred years, the old tradition of farming in Zarzis has almost ceased and only a few elder men have adopted the possibilities offered by the

[2] It is evident that in general more water is wasted in so called modern irrigation schemes than in traditional systems.

[3] An increase in the amount of available water could have the effect that land becomes marshy or soils become oversalted; stagnant water could result in an increase of malaria, it could support introducing the guinea worm or bilharzia.

decree. 80% of the farmland has been destroyed. The soil became spoilt by salt and quite a few people had already used former farmland for constructing their houses. As a consequence even those many unemployed young people asked about their future can hardly imagine becoming farmers.

## 4 Socio-economic consequences of non-adapted water development

Some negative effects of external interventions in the existing water supply systems have already been discussed in the context of our examples above. Here it is therefore only intended to give a general overview on some possible socio-economic and ecological faults resulting from the interventions:

* Involuntary resettlement should be considered world-wide as the worst effect of interventions in the water supply sector. Here we are not only talking about those people who lose their homes from flooding the storage lakes, but also about those who have lost their entire water resource base both for irrigation purposes and for drinking.
* Economic losses are almost everywhere in Third World countries a "normal" consequence of external (governmental) interventions in the water supply sector. Even if some people win from receiving newly developed land it happens that other people lose at least a part of their resources - and their income.
* External interventions in existing water supply systems and/or their ecological bases often limit the potential of the local communities for expanding their economic activities (as often the interventions are in favour of third groups, but not in favour of the local communities).
* Projects and legal changes in the water supply sector often cement the social structures within an agrarian society. The case study from Egypt shows (and it is proved by examples from other Maghrib and Middle East countries) that an interference in the traditional legal system could prevent poorer farmers from taking up their traditional rights of access to resources, i.e. irrigation water. The Islamic law in principle guaranties free access for farmers to the next water stream. If a poor man has been able to obtain a plot of arable land, nobody can prevent him from digging an irrigation canal to the stream or to connect his individual canal to another distribution system. From an newly introduced government irrigation scheme the same farmer would have to buy water if he was to get some water at all.
* Interventions on the legal level (clarifications of how to gain access rights to water, regulations how to exploit water, water protection regulations, etc.), although they could be very useful for the protection of limited resources such as water, generally favour the modern sector and discriminate the traditional economy. In some countries it is almost not possible for a small village community to obtain the permission for digging a 10 m deep shallow well in order to take 3,000 l water per day. An urban based absentee farmer with 100 ha irrigated land, on the other hand, would have no problems to follow the rules (and pay the fees) in order to receive the

official permit for extracting another 5,000 cubic metres water per day from a newly drilled deep well.

* If a government intervention such as the construction of a modern irrigation scheme targets only the local population, in many cases the bigger and more influential farmers profit much more from an increasing and safer amount of water than the poor. Sometimes it happened that poor subsistence farmers were not able to purchase water from a newly established scheme (taking the place of the old one) and had to give up.

In quite a few cases government interventions in the water supply sector, at least in principle, try also to favour only or mainly local communities and, less often, especially the poorer strata of the society. We have to admit that assisting only or mainly the poor, in traditional or in transforming societies, would not be easy. Upper-class people in every society keep hold of their privileges. It could be the purpose of further research work to study whether and how interventions in the water supply sector could come up to fulfil all legitimate expectations while respecting ecological requirements.

## 5 Requirements of an environmentally and socially adapted water development

We do not deny that in various areas, mainly in arid and semi-arid zones, water development, i.e. the exploitation of additional water resources and/or the modification of current water distribution systems, could be a precondition for both economic and social development. The need for additional irrigation and drinking water is obvious, but on the other hand meeting the needs should not negatively affect existing ownership and user rights. Even if farmers in traditional irrigation systems do not use water in the most efficient way[2] the interest of these users should be taken into consideration while striving for any improvement. The following recommendations constitute a general basis for evaluating proposed measures, but they have to be adapted to the specific situation:

* Groundwater and surface water resources should be viewed in the wider ecological and economic context. Any intervention should be preceded by studies on the various possible effects resulting from any planned water extraction, diversion, reduction or increase[3].
* Any intervention in the water supply sector, whether direct or indirect, should respect the usage rights of the local population. These rights are not always unchangeable, especially if the distribution of water is the result of previously illegitimate acquisitions (we know that sometimes it is difficult to decide what is legitimate and what not). However, planners should consider customary rights equal to entitlements from the modern state law (concerning the legal binding, claims for compensations, etc.).
* Traditional irrigation systems do waste water (as many modern systems do). It is indisputable that in most countries of the Middle East, of North Africa, in South Asia and in many other regions water saving irrigation technologies could contribute

to an economic development. For guarantying sustainability of future water supplies, economising water resources is a must, too. However, in order to avoid failures of any so called development activities it is strongly recommended to adapt new water supply technologies to the demand and the technical and management capacities of the local population.

* People do accept changes. They also accept, if it is reasonable, economising and/or even financial (additional) contributions for water. On the other hand top down approaches do not contribute to understanding and acceptance of innovations. As a consequence any planning and implementation process should be as much participation oriented as possible. However, sustainability of innovations is always in danger if participation of the target population is taken only as a means to an end. Granting people equally the right of participating in decision making creates confidence and responsibility.

In view of environmental issues there are some additional necessities to be observed in the water development sector:

* Artesian aquifers should only be exploited with great care and after a sophisticated study of the future development of the water conditions. Economic analyses have to evaluate the future irrigation costs.
* With certain regional exceptions fossil water resources should not at all be used for large scale irrigation purposes. In quite a few areas this water constitutes the only available water resource for an indefinite period. Future generations could strongly depend on it. Unlike even larger dam projects (which could be dismantled somehow or other) the exploitation of fossil water resources is irreversible.

**Zusammenfassung**

Traditionelle Verwendungsformen von Wasser zu Bewässerungszwecken und für den Haushalt werden vielerorts auf der Welt durch eine angeblich „moderne" Entwicklung beeinträchtigt. Der Bau von großen Dämmen und von Bewässerungsperimetern oder die allgemeine Modernisierung der Wasserversorgung durch die Bohrung von Tiefbrunnen tragen nämlich nicht automatisch zu einer Verbesserung der Versorgungssituation der lokalen Bevölkerung bei. Beispiele auch verschiedenen Ländern zeigen, dass sich sogar dann, wenn insgesamt mehr Wasser zur Verfügung steht als vorher, die Wasserversorgung der Menschen innerhalb eines Projektgebietes verschlechtern kann, da mit den Wasserprojekten unter Umständen völlig andere Ziele verbunden sind als die Besserstellung der ansässigen Bevölkerung. Aber auch dort, wo die moderne Entwicklung im Wassersektor unmittelbar auf die Nöte der lokalen Bevölkerung zielt, steht keineswegs fest, dass mit einer neuen Wasserversorgungstechnologie und neuen Managementformen sich auch die sozio-ökonomischen Bedingungen der Menschen verbessern. Daher wird generell empfohlen, neue Wasserversorgungstechnologien nur nachfrageorientiert einzuführen und in Bezug auf die technische Komplexität und hinsichtlich des Managementbedarfes an den

Möglichkeiten der Bevölkerung zu orientieren. Auch wenn keine bestehenden Wasserrechte tangiert werden, sollten derartige Maßnahmen nur auf der Grundlage weitgehender Bevölkerungsbeteiligung erfolgen.

## 6 References


AMINI, S./FREMEREY, M. (Ed.) (1998): Nachhaltige Wassernutzung in der Landwirtschaft (Sustainable Use of Water in Agriculture). Der Tropenlandwirt Beiheft 63. Witzenhausen.

BERRY, BRUCE/NEL, ETIENNE (1993): Operation Pipeline - Bulawayo's search for water, in: Geography 78(3), 312-315.

BISWAS, ASIT K. et al. (1997): Core and periphery: A comprehensive approach to Middle Eastern Water. New Delhi.

BLISS, FRANK (1983): Die Oasen Bahriya und Farafra (Bahriya and Farafra Oases). Bonn.

BLISS, FRANK (1989): Wirtschaftlicher und sozialer Wandel im 'Neuen Tal' Ägyptens (Economic and Social Change in the Egyptian 'New Valley'). Bonn.

BLISS, FRANK (1998): Siwa - die Oase des Sonnengottes (Siwa - the Oasis of the Sun God). Bonn.

BLISS, FRANK (1999): Changes in the Development of Water Resources and Irrigation Methods at the Siwa Oasis (Egypt), in: Natural Resources and Development 49/50. Tübingen (Institute for Scientific Co-operation)

BRAADBAART, OKKE/BRAADBAART, FREDERICK (1997): Policing the urban pumping race: industrial groundwater overexploitation in Indonesia, in: World Development 25(2), 199-210.

BROHIER, R. L. (1934/1979): Ancient Irrigation Works in Ceylon. Colombo.

BURKEY, STAN (1993): People First. A Guide to Self-Reliant, Participatory Rural Development. London.

FRANZEN, H. et al. (1998): Water resources: research and development in the Tropics and Subtropics. Bonn (Documentation on research and development activities of German institutions).

GARBRECHT, GÜNTHER (1985): Wasser. Vorrat, Bedarf und Nutzung in Geschichte und Gegenwart (Water. Resources, Needs and Usage in History and in the Present). Reinbek.

GUPTA, AVIJIT (1998): Ecology and development in the third world. London.

HARTJE, VOLKMAR et al. (1998): Wasser - Kultur -Politik (Water - Culture - Politics). Wechselwirkungen und Optionen. Berlin.

HOFFMANN, THOMAS (Ed.)(1997): Elementare Konflikte (Elementary conflicts [on water in Asia]). Osnabrück.

LANZ, KLAUS (1995): Das Greenpeace Buch vom Wasser (The Greenpeace Book of Water). Augsburg.

MANIKUTTY, S. (1998): Community participation: lessons from experiences in five water and sanitation projects in India, in: Development Policy Review 16/4), 373-404.

MCCULLY, PATRICK (1996): Silenced Rivers. The Ecology and Politics of Large Dams. London.

MITCHELL, JOHN G. (1993): James Bay: Where Two Worlds Collide. National Geographic Special Edition Water. Washington.

MOHSIN, ABDUL QAYYUM: The impact of irrigation and agricultural policy measures on the socio-economic situation of farmers in the rice zone of the Punjab Province (Pakistan). Münster.

NAFF, THOMAS/MATSON, RUTH C. (1984): Water in the Middle East. Conflict or Cooperation? Boulder.

PEARCE, FRED (1992): The dammed. Rivers, dams, and the coming world water crisis. London.

POSTEL, SANDRA (1993): Die letzte Oase. Der Kampf ums Wasser (The last oasis. Fight about water). Frankfurt.

REDDY, V. RATNA (1999): Quenching the thirst. The cost of water in fragile environments, in: Development and Change 30(1), 79-113.

ROY, ARUNDHATI (1999): The Greater Common Good. Bombay.

SCHIFFER, MANUEL (1998): The economics of groundwater management in arid countries. Theory, international experience and a case study of Jordan. London.

SCUDDER, THAYER et al. (1993): The IUCN Review of the Southern Okavango Integrated Water Development Project. Gland.

SUDAN, Republic of. National Council for the Development of the Jonglei Canal Area (1980): Jonglei Canal. A Development Project in Sudan. Kahrtum.

SHATA, A. et al. (1962): The Geology, Origin and Age of the Ground Water Supplies in some Desert Areas of the U.A.R., in: Bulletin de l'Institut du Désert d'Egypte XII(2), 61-124.

SLUITER, LIESBETH (1993): The Mekong Currency. Utrecht.

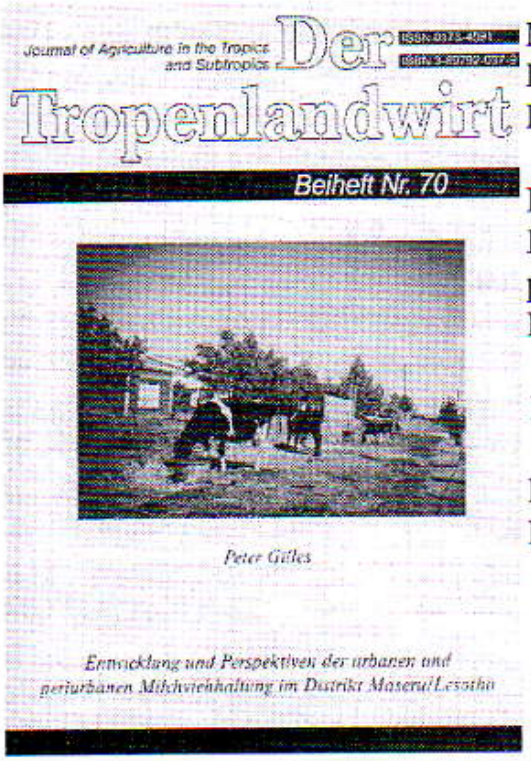
SMITH, NORMAN (1976) Man and Water - A History of Hydro-Technology. London.

STARKLOFF, RALF (1998): Water scarcity in Kitulwatte. The social cause and consequences of environmental degradation in a highland Uva village in Sri Lanka, in: World Development 26(6), 913-932.

SWAIN, ASHOK (1998): Fight for the last drop: inter-state river disputes in India, in: Contemporary South Asia 7(2), 167-180.

UNEP (1998): World resources 1998-99: A guide to the global environment. Oxford.

WOLFF, PETER (1980): Ein einfaches Bohrverfahren zur Erschließung von Grundwasservorkommen in den Oasen der Westlichen Wüste Ägyptens (a simple drilling method for the development of subsurface water resources in the oases of the Western Desert of Egypt), in: Der Tropenlandwirt 81, 88-93.




**Neuerscheinung in der Schriftenreihe**
Beihefte zu Der Tropenlandwirt
Beiheft Nr. 70

**Peter Gilles:**
Entwicklung und Perspektiven der urbanen und periurbanen Milchviehhaltung im Distrikt Maseru/Lesotho

168 Seiten, Preis DM 24,–

ISSN 0173-4091
ISBN 3-89792-037-9

Die Daten der durchgeführten Untersuchungen wurden von 1997 bis 1999 in Lesotho für die vorliegende Arbeit gesammelt und ausgewertet. Ziel dieser Untersuchungen in Lesotho war ein ausführlicher Bericht über die Entwicklung und die Perspektiven der urbanen und periurbanen Milchviehhaltung im Distrikt Maseru und über den allgemeinen landwirtschaftlichen Sektor.
Dabei standen zwei Aspekte im Mittelpunkt:
a) die Frage, wie weit das Potential von Hochleistungsrassen mit den zur Zeit gebräuchlichen extensiven Haltungsmethoden ausgeschöpft werden kann,
b) die notwendige Anpassung an die wirtschaftliche Entwicklung Lesothos im allgemeinen und an deren Milchviehsektor im besonderen.
Die Untersuchungen fanden in zwei Phasen statt.
In der ersten Phase wurden zahlreiche Interviews in Milchvieh haltenden Betrieben im urbanen und periurbanen Raum durchgeführt, wobei Grunddaten erhoben wurden.
In der zweiten Phase wurde sich ausführlich mit Milchkuh haltenden Betrieben befasst, wobei sowohl sozio-ökonomische Aspekte wie auch Management in Betracht gezogen wurden. Ausführliche Betriebsdaten und Informationen über unterstützende Organisationen wurden ermittelt, diskutiert und dargestellt.
Durch die Auswertung der gesammelten Daten wird ein repräsentativer Überblick über Produktionsbedingungen der Milchviehwirtschaft im Untersuchungsgebiet gegeben. Die Probleme der Milchviehwirtschaft im Untersuchungsgebiet werden dargestellt und die. Möglichkeiten, die vorherrschende Milchwirtschaft in den städtischen Zentren zu verbessern, werden aufgezeigt.

**Zu beziehen über:**
Universität Gesamthochschule Kassel,
FB 11 , Tropenzentrum, Steinstr. 19
D- 37213 Witzenhausen
oder über den Fachbuchhandel

Tel: 05542 / 98 12 12
Fax: 05542 / 98 13 13
Email:tropen@wiz.uni-kassel.de