UNIKASSEL VERSITÄT
Faculty of Organic Agricultural Sciences

Sultan Qaboos University

GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN
Faculty of Agricultural Sciences
Faculty of Forestry Sciences

Oman 2007 - Interdisciplinary Study Tour

Sustainable land- and resource use between tradition and modernity

Report of a student excursion to Oman
February 24th – March 10th 2007

Organised by:

German Institute for Tropical and Subtropical Agriculture - DITSL GmbH Witzenhausen

Centre for International Rural Development
University of Kassel / Witzenhausen

Centre for Tropical and Subtropical Agriculture and Forestry (CeTSAF)
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Sultan Qaboos University Muscat

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Preface

Studies of agriculture and forestry at the University of Göttingen and the University of Kassel at Witzenhausen are - among other topics - concerned with tropical and subtropical areas. Many of the students interested herein will eventually conduct research in tropical countries - often in the frame of their M.Sc. or Ph.D. theses – and their academic curriculum must prepare them for the task. It is well known that even the best lecture at a university located in a region with temperate climate cannot substitute a hands-on experience while visiting the tropics. Therefore, field trips to tropical countries must be part of the curriculum. Unfortunately, such trips are very expensive, and they require long term planning and intricate knowledge of the region to be visited.

Since 1999, Profs. Buerkert and Schlecht are conducting DFG-funded field research programmes in Oman in partnership with the Sultan Qaboos University in Muscat. In 2006, the DFG approved the proposal for the International Research Training Group 1397 on "Regulation of soil organic matter and nutrient turnover in organic agriculture", a joint undertaking of the University of Kassel at Witzenhausen, the University of Göttingen, Sultan Qaboos University and the Diwan of Royal Court in Oman. The longstanding cooperation in research also lead to discussions on how the partners can join forces in the field of academic training. Thus, the idea was born to organize interdisciplinary field excursions as means of student exchange. In a first step, an excursion to Oman for students from Witzenhausen and Göttingen was planned. Particularly through its geographical features, Oman offers interesting examples for small to large scale tropical agriculture and for particular aspects of forestry; it shows the different development pathways that different parts of the sector can take within the overall development of the national economy.

Hence, a preliminary excursion programme was drafted and the excursion and the accompanying seminar were announced in early 2006. After the participants were identified, a period of intensive preparation for the trip commenced. During the winter semester 2006/07, a regular seminar of 2 contact hours per week was held, during which the students presented seminars on different topics of the forthcoming field trip. Dr. Ingeborg Guba, a geologist and former professor at Sultan Qaboos University who has worked intensively in Oman, gave an excellent introduction into the fascinating geology of the country. Funds were acquired, logistics were organised and in February 2007, the group (21 students and 6 lecturers) set out for Oman. There we joined a group of Omani students and their senior lecturer, Dr. Sulaiman Al-Khanjari, who – apart for a few occasions where their presence was required at their university - accompanied the excursion for most of the programme.

Acquiring funds for such a trip is difficult and we are grateful for generous financial support by the German Academic Exchange Service DAAD, the University of Kassel through the Academic Affairs Office and the Faculty of Organic Agricultural Sciences in Witzenhausen, the University of Göttingen and the German Institute for Tropical and Subtropical Agriculture.

From February 24th until March 10th 2007 we followed through a very interesting and sometimes physically taxing schedule. Every aspect of the program moved exceptionally smooth, which was largely due to the excellent support received from the Diwan of Royal Court and Sultan Qaboos University - to both we express our sincere gratitude. We would also like to thank all our colleagues from Witzenhausen and Göttingen for their great support in preparing this trip. Finally, all participating students deserve a big "Thank You". They worked hard to achieve the predetermined goals. But besides the work we also had a lot of fun together. It was a great opportunity to have had a chance to travel with all of you!

Andreas Bürkert Eva Schlecht Christian Hülsebusch

Introduction

From February 24th to March 10th 2007, a group of 14 students from the University of Kassel (Witzenhausen) and 7 students from the University of Göttingen, accompanied by 6 lecturers went on a 2 weeks excursion entitled "Sustainable land- and resource use between tradition and modernity" to the Sultanate of Oman. The group consisted of students at the BSc and MSc and Diploma level enrolled in study programmes on "Tropical and International Forestry" (Göttingen), "International Organic Agriculture" (Kassel), "Organic Agriculture" (Kassel), "International and Tropical Agriculture" (Göttingen), and "Forestry Science" (Göttingen). Having arrived in Oman on 24th of February, the group was joined by Dr. Suleiman Al-Khanjari, a lecturer in agronomy at Sultan Qaboos University, Muscat, and by 17 Omani students. The Omani group joined the excursion wherever possible and an intensive exchange of thought developed between the German and the Omani students on many of the topics discussed on the tour.

Figure 1: The excursion group at Balad Seet primary school

A detailed list of participants is provided on page 118.

Figure 2: The expedition moves up Wadi Bani Awf with destination Balad Seet

Itinerary

The first few excursion days were spent in and around Muscat. The group spent a day at Sultan Qaboos University where they joined the Omani students and lecturers and were introduced to the research and training programme of the College of Agricultural and Marine Sciences. The team split up in smaller groups and accompanied their Omani counterparts to participate in lectures or practicals and were taken for a guided tour around the university's campus, experimental farm and dairy plant. After visiting – among others – Al Ghubrah Desalinisation and Power Plant, a modern mixed crop-livestock farm at the Batinah, the royal horse stables, the camel breeding centre, and also the Grand Mosque and the Mutrah Sooq (market) in Muscat, the excursion went into the Northern Omani Mountain ranges, visited oasis systems of Balad Seet, the town of Nizwa, the Al-Jabal Al-Akhdar and the oasis of Maqta, before descending again towards the North coast. From there, the path led into the interior, past the oil fields of Rima, irrigation agriculture at Marmul and the UNESCO world heritage frankincense reserve at Thumrayt down to Salalah and Wadi Hinna. The itinerary is depicted in the following map and the excursion programme is detailed below.

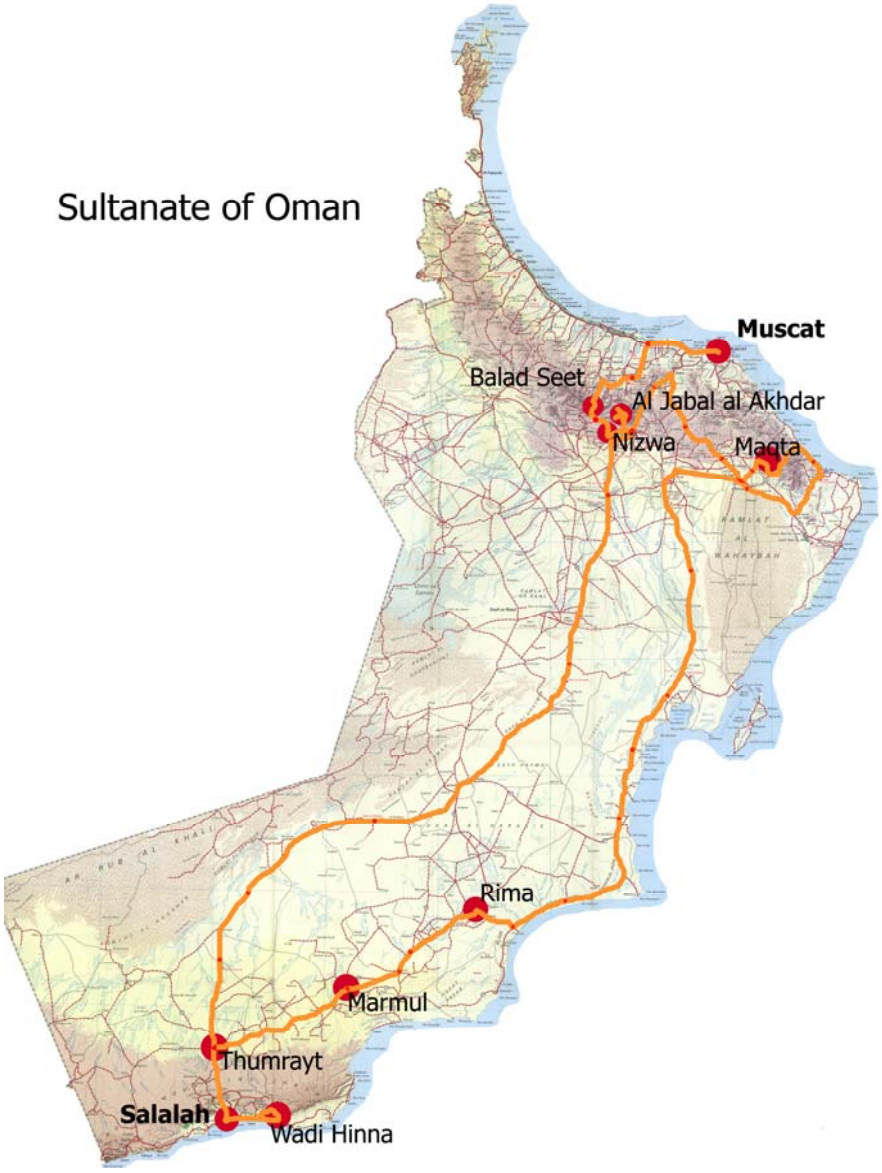

Figure 3: The excursion itinerary

Excursion programme

Day	Activity	Overnight location
24.02 (Sa)	Arrival in Muscat, OMAN from Frankfurt with GF 16 Q at 22:50 Check-in to Nazeem Hotel.	Muscat Nazeem Hotel
25.02 (Su)	*Morning* Sultan Qaboos University (SQU), exchange with SQU resource persons, faculty staff and students, visit of university research and training facilities. *Afternoon:* Grand Mosque and Mutrah Sooq (market) to gain a first impression of the country and society.	Muscat Nazeem Hotel
26.02 (Mo)	*Morning* Al Ghubrah Desalinisation and Power Plant (Muscat Municipality): Technical aspects of water desalinisation - costs and environmental problems. *Afternoon:* On-farm visit to a modern mixed crop-livestock farm at the Batinah: Economic and environmental aspects of modern Omani agriculture.	Muscat Nazeem Hotel
27.02 (Tu)	*Morning* Visit to the Royal Horse Stables, horse breeding strategies, horse racing and beauty horses, the modern role of horses in the Arabian societies. *Afternoon:* Visit to the Royal Camel Corps camel breeding centre: breeding and feeding strategies for racing camels, camel physiology, research activities.	Muscat Nazeem Hotel
28.02 (We)	*Whole day:* Trip via Wadi Bani Awf to the oasis Balad Seet: Introduction to the historic evolution of settlements in Northern Oman, within the context of the regional geology, pedology, flora and fauna.	Balad Seet (tent)
01.03 (Th)	*Morning* Introduction to oasis farming systems of Balad Seet. Aspects of sustainable crop-livestock integration and sustainable water use; discussion of current problems of life and agriculture in the oasis. *Afternoon:* Introduction into oasis – hinterland relationships, late afternoon drive to Nizwa, check in to Tanuf Residency.	Nizwa Tanuf Hotel
02.03 (Fr)	*Morning* Introduction into producer / trader / consumer product chains for livestock and livestock products at Nizwa livestock market and for staple crops and vegetables at Nizwa sooq; Visit of Nizwa Fort. *Afternoon:* Introduction to Nizwa historical town development and current urban planning, including township – hinterland relationships.	Nizwa Tanuf Hotel

03.03 (Sa)	*Morning:* Drive to Saiq and introduction into four oases of the Al-Jabal-al-Akhdar (Al'Ayn – Ash Sharayjah – Al'Qasha – Masayrat ar Ruwajah) at an elevation gradient from 1.000 – 2.500 masl. Discussion of oasis farming strategies under different climatic, geo-morphological, infrastructural and socio-economic conditions, from the valley to the Saiq plateau. *Afternoon:* Visit of juniper tree stands on the Saiq plateau and discussion of aforestation/reforestation options and forestry field methodologies.	Saiq (guesthouse)
04.03 (Su)	*Whole day* Drive to Maqta, introduction to the "dying" oasis system of Maqta, discussion of different factors and concepts of sustainability and of different possible development pathways for oasis farming systems. Tented overnight stay beneath the Shir towers.	Magta (tent)
05.03 (Mo)	*Whole day* Descent to Tiwi on the coast. Vehicle transfer to Salalah; on the way: Visit of a traditional desert Bedouin camp; discussion of extensive livestock systems and racing camel breeding as income opportunity for Bedouins.	Camp near Rima (tent)
06.03 (Tu)	*Morning:* Stop-over at an oil-field near Rima and an intensive centre pivot irrigation system at Marmul. Visit of the *Boswellia sacra* reserve at Thumrayt. *Afternoon:* Arrival at Salalah, check-in to the Salalah 'Beach Villas' hotel.	Salalah Beach Villas Hotel
07.03 (We)	*Morning* Wadi Hinna: introduction into the special character of the Dhofar region and its unique flora; traditional uses of wild plants and causes and extent of vegetation development and impact of grazing by sedentary livestock herds. *Afternoon:* Visit of Al Baleed archaeological site and museum at Salalah	Salalah Beach Villas Hotel
08.03 (Th)	*Whole day:* Visit to a private large scale farm under conversion to organic agriculture: Discussion of organisational, environmental and economic aspects of converting to organic standards. *Evening:* Drive back to Muscat, check-in to Corniche Hotel	Muscat Corniche Hotel
09.03 (Fr)	*Morning* Assembly with staff and students at Sultan Qaboos University to discuss about the different issues raised during the excursion. *Afternoon:* Farewell lunch at the SQU faculty club and individual tours in and around Muscat	Overnight air travel to Frankfurt
10.03 (Sa)	Departure to Frankfurt on GF 17 Q at 00:20 h local time Arrival in Frankfurt on GF 17 Q at 06:40 h local time	

Reporting during the excursion

Each student was assigned the task of taking notes and writing a protocol / report for at least one of the places visited, accounting the personal impressions gained and the major points of discussion raised. The following section of this document contains these individual reports in chronological order.

Al Ghubrah Desalinisation and Power Plant Muscat - Technical aspects of water desalinisation, costs and environmental problems

Julia Jawtusch

26.02.2007

On the 26th of February 2007 the student group visited the Al Ghubrah Power and Desalination Company near Muscat. The group was welcomed by the company's operations manager, Mr. Ali Baluchi, who gave a presentation on the history and organisational structure of the company. Afterwards, we were guided around the desalination plant site, equipped with safety helmets and ear plugs.

Figure 1: Google Earth Image of Al Ghubrah Power and Desalination Company

Technical Aspects of Water Desalination

There are different methods for water desalination. At Al Ghubrah, the multi-stage-flash (MSF) desalination technology is used. It is based on a very simple thermal process: Water is heated to convert it into steam. The steam moves up and passes a filter (distiller). The salt remains on the ground. Above the distiller, the steam is cooled down again to convert back into the fluid state of aggregation. MSF used to be the cheapest way to produce fresh water. As a second benefit it implies the opportunity of effectively combining water desalination with power generation. The heat from electricity production is used to create the steam in the desalination process.

Huge amounts of sea water are pumped into the plant at a temperature of 28°C with a water conductivity of 53,000 µs/cm (micro siemens per cm). This corresponds to a

particularly high salt content even for ocean water, which is due to the fact that it seldom rains in the Arabian Sea. After the MSF process, a certain amount of distilled water is obtained. It has a water conductivity of about 50 µS/cm. The remaining water has yet a higher salt content (95,000 µs/cm) and is led back into the ocean.

The distilled water is unhealthy for drinking due to a lack of minerals such as calcium, magnesium or sodium which normally occur naturally in fresh water. Therefore, the distilled sea water needs to be treated in such a way that some salts are added again. In the case of Al Ghubrah the distilled water passes through a limestone layer, where it picks up magnesium and sodium. Furthermore, chlorine and fluoride are added, the latter being an instruction by the World Health Organisation. The pH of the water is reduced by adding CO_2, which forms carbonic acid. There are several supporting "auxiliary plants" on the premises which have to do with the re-mineralization of the distilled water, such as three CO_2 plants and two hypochlorine plants.

The Al Ghubrah Power and Desalination Company

In 1970 the decision was taken to install the first desalination plant in Oman. The Al Ghubrah Company started in 1976 with one desalination plant unit constructed by a German enterprise. This is allegedly the oldest distiller in the middle east. During six phases of extension, the fresh water production was increased from initially 5 million gallons[1] per day to 42 million gallons per day in 2001. The oldest unit nowadays still produces 60% of the initial amount, but the costs to produce this amount have risen significantly.

The Al Ghubrah Company possesses water reservoirs of 12 million gallons. They are supposed to be used in an extreme case of need, such as a breakdown of the desalination plant. This amount lasts for the supply of Muscat for a period of two to three days. Nowadays the Al Ghubrah desalination plant supplies 60% of Muscat with fresh water. The production is subsidised by the government. Without this financial support, the company would be economically untenable. The production costs are too high to compete on the market. This is supposedly due to two causes:

Firstly, the plant itself is outdated and only operates at high costs. Secondly, the staff is too numerous and runs the company rather inefficiently. This is because of the fact that the company is government property and the staff is paid by the state. Thus, there is no need for profit making.

Environmental Problems

The desalination of water causes environmental problems. This has to do with the huge amount of highly saline water that is led back into the ocean every day. In order to reduce the salinity, some fresh water is mixed with the brine water before the release. Nevertheless, the salt content is almost double than natural. Furthermore, the brine water temperature of about 38°C is ten degrees above the ocean temperature. This may potentially harm marine ecosystems and marine animals, which have only limited capacity to adapt to the changes in water mineral content and temperature.

The future of the Al Ghubrah Power and Desalination Plant

When the Al Ghubrah plant was built, there were no environmental regulations. It was only in 2002 that the government decided on certain rules and regulations. Nowadays, every process in the plant has to be monitored monthly, which is an additional cost. The question came up whether the brine water could not be used to produce table salt. Mr. Al-Balushi

[1] 1 gallon ~ 4,55 litres

explained that there is a new technology which makes this possible, but that it is difficult to obtain the according license from the government. Since 1999 there is a new policy in Oman: Privatisation and "Omanisation" (promoting the assignment of Omanis for leading job positions). Currently, the private sector is booming. Also the Al Ghubrah Company is targeted to be privatised in the near future.

Once, the production units of Al Ghubrah were the most modern technologies available. In the last decades, other technologies have been developed and proven to be cheaper than the MSF technology used here. Therefore, the private investors are not so much interested in the plant itself. What arises their interest is the license to sell water that is implicated in the plant´s ownership. It is likely that the plant itself will be knocked down and substituted by more modern ones at other locations that allow for more expansion and economic profit.)

Figure 2: The entrance to Al Ghubrah Power and Desalination Company

Mixed crop-livestock farming at the Batinah on the coast: Economic and environmental aspects of modern Omani agriculture

Moritz Reckling

26.02.2007

Mr. Al Busaidi, a PhD student of the University of Kassel, made our visit on the farm of the family Bahwarn possible. The purpose of the farm is to provide food products for giving to the poor according to the Islamic rule of alms-giving, while the family earns its living with other businesses. This farm is one of many this family has to provide products being shared.

The farm is located in the Batinah Plain, a region in the North of Oman, between the Persian Gulf in the north and the Jebel al Akhdar and western Hajar mountains in the South and West. The mountains provide the groundwater resources for irrigation through aquifers. In a narrow strip of 300 km length and 10 to 30 km width, 80% of Oman's agricultural land is located. Main crops are dates, limes, alfalfa and vegetables and for livestock cattle, chicken and the popular Al Batinah goats. The farm has around 20-30 acres (around 10 hectares) and employs twelve workers.

First of all we had a look at the poultry farm. There are 1000 local Omani layer hens, including an unusually high number of cocks, and 500 male chicken. There was a little confusion about the yield, sales and consumption of the eggs and meat. Finally we found out that they are all distributed among poor people.

Figure 2: Layers and cocks on a Batinah mixed crop-livestock farm

The Batinah goats are kept in a stable with a run-out. They are fed Rhodes grass and alfalfa produced on the farm as well as a supply of mixed concentrates. The milk goats have a production of 0.2 l per day on average. There are also meat goats and in the whole around 1000 animals. There are problems with long and crooked claws, which can be explained as a mismanagement of handling the goats. The animals do not have the chance for abrasion of their claws by jumping on rocks etc. because they are kept inside the stables and on a run-out on very soft ground. Furthermore, the claws had never been cut and some goats are sitting on their knees to avoid painful standing. Some udders have an unhealthy appearance, suggesting mastitis problems. We realized that the animals are fed with high concentrations of protein, this can also be a reason for claw problems and mastitis.

The cattle are Jersey breed and maybe some Australian Milking Zebus. The animals are kept in a stable equipped with fans and a run-out with sand on the ground. The feed is alfalfa, Rhodes grass and a supplementary concentrate consisting of high protein and very little crude fibre. At around 7 liters per day and cow, the milk production is very low. The hooves and horns were not cut. The cows showed signs of anatomic problems especially back problems coping with the very long hooves. There is a milking parlor with one mobile milking machine. We observed that the cows are nervous in the milking parlor, because the measurements of the standing area are not adapted to them.

Figure 2: Milking parlour on a mixed crop-livestock farm at the Batinah

Figure 3: Batinah goats on a mixed crop-livestock farm at the Batinah

The mango plantation consists of local mango varieties which were in the flowering stage. The leaves showed signs of necrosis due to salt stress. The irrigation system is bubbler irrigation (micro irrigation), which favours the accumulation of salts, which is already visible on the ground surface.

The soil is a deep alluvial soil with a loamy sand texture (ca. 30% sand, 20% clay and 50% silt) and contains relatively high amounts of nutrients. The humus content is around 2-4% with a high variation, the pH is slightly alkaline between 7,5 - 7,6. The exchangers (with an exchange capacity of 200 mmol) are mainly occupied with sodium. The silt and clay in the subsurface horizons provide a high water-holding capacity. These fertile soils are most at risk of salinization because of their fine texture and an upward movement of water and salts into the rooting zone.

We saw a field of alfalfa grown annually with sprinkler irrigation, but no other cultivation of land.

In general it was very interesting to visit a modern mixed crop-livestock farm in Oman. The problems seen in animal keeping, especially with the hooves and claws, showed that there is a lack of management knowledge, as well as negative economic effects. To leave the claws and hooves of goats and cattle growing to the extent we saw has negative effect on animal welfare and health. Furthermore, production is depressed and the animals are at risk to infect with pathogens. Also, the mango trees with definite salt stress will not bring good yields. The salinization is a great problem in the Batinah Plain in general and therefore no alfalfa and Rhodes grass may be planted by law since October 2006, but the owner seems to have special permission. Management problems could not be properly discussed with the responsible employees, which is why there can only be speculations about the reasons. In summary, the fact that the farm does not need to be economically self sustainable and generate an income seems to be the main reason for management problems.

The Royal Stables – race and beauty horses

Christian Beuter

27.02.2007

On the third day of the Study Tour the group of students and lecturers got the chance to visit the Royal Horse Stables. Arriving at 9 a.m. at the entrance gate the group was guided for around two hours through the different sections of the horse stables, where the focus is on the racing horses and the beauty horses.

The Royal Stables, located not far to the west of Oman's capital Muscat were established in 1992. Today the stables are managed and directed by Omani and international horse experts; the German group was guided mainly by the British director of the cavalry section, a Greek veterinarian and an Omani senior jockey. The stables provide services, especially veterinary services, also for other livestock sections (cows, sheep, goats, ostriches, turtles and others) for other Omani farms and zoos.

International guests come to visit the stables: frequently Japanese, German and French guests are invited. While the major horse breeding work is done at the Stud Farm in Salalah (South Oman) mostly with the technique of artificial insemination (AI) the stables in the North accommodate approximately 1,400 horses. With a big financial support by His Majesty the stables are able to breed in different directions and select the best horses for tournaments. A main emphasis is laid on the breeding of traditional Arab horses, but different types of European horses are bred as well. The main and obvious difference between those two provenances is the head-shape: small, slim and convex in Arab horses, big and straight in European horses.

Due to the vast extended area of the stables and courses in total there are many possibilities to work with the horses in different ways. The stables are located proximate to the sea which gives the staff members the possibility to train the horses at the beach as well as cooling them in the sea water when the weather conditions get too hot. Additionally some boxes are prepared with air condition and the horses are cooled down with freshwater, especially the racing horses. Today the boxes are bedded with paper instead of straw which is too expensive in Oman. But since the paper is often eaten by the horses and causes in some cases colic it is planned to replace the paper by wood-chips in future.

All horses in the Royal Stables are marked with implanted microchips in the neck. That technique is nowadays international standard for tournament horses and brandings on the legs or the hooves are old fashioned.

Racing Horses

Within the area of the Royal Stables a race course extending 2 km is installed. Royal horses compete with other Omani horses as well as with international studs, such coming mainly from other Arabian countries like Saudi Arabia and the UA Emirates. Most of the carriages (the Sulkies) used in the races are made in Germany.

The senior jockey of the stable who is responsible for the training of the racing horses was worried most about the hot summers in Oman. As mentioned above, the horses have to be watered in that time and no races are conducted in Oman between May and September. In these months occasionally some jockeys from the Royal Horse Stables go to train and race in cooler countries, e.g. in France (2002) or in Great Britain (2007). During the Racing Period (October – April) the best racing horses participate in competitions usually twice a month. There are big and well paid racings in the Arabian world, especially in Qatar and Dubai were prize money can exceed US$ 180,000.

In the Omani Royal Stable there are 35 jockeys, four of them working professional. A jockey is usually asked to weigh not more than 56 to 58 kg otherwise he has to pay a fine of around 40 EUR / kg in races.

In former times horse breeders had their own recipes for the horse's nutrition. Today this art is outsourced to diet specialists, so, the special feed for the Royal horses comes from Europe.

Beauty Horses

According to one Omani staff member at the stables the breeding of beauty horses is not a matter of fashion. The criteria what makes a horse a beauty horse are rather traditional ones. First of all the shape of the head is very important: a slim head with big eyes is preferred. Further criteria the scoring judge looks at in tournaments are the type of the horse in general, the top line of the horse, the appearance of the horse's legs and of course the movement of the horse. The last criterion is a matter of intensive training. For example the horse has to learn how to extend the legs in different gaits and should show a straight line movement. Recently two women started to train horses for horse-dances.

In the Royal Stables the trainers begin the work with beauty horses at the age of two years. In total 15 people are employed in that section of the stables.

Tournaments and Shows

Besides the racing and the beauty horses the Royal Stables keep also other varieties like dwarf horses, rodeo horses, polo horses, circus horses and others. Every five years the Royal Equestrian Show is held, at which all these different kinds are presented. In total 600 horses and 800 camels are shown during the three hours lasting event.

On the 1st of January the big Royal Race takes place annually. For nearly 2 hours Royal horses compete with other studs.

The Royal Camel Corps camel breeding section

Elisabeth Hüsing

27.02.2007

In the afternoon of the third day of the excursion the group visited the Royal Camel Corps, a unit of the Royal Court Affairs. First the whole group got invited to listen to a presentation inside the Camel Breeding Center. Then the students and the lectures were shown around the camel stables with explanations by the staff. Two dancing camels performed for the group and some students got the chance of riding on a camel. After a tour of the laboratories of the Camel Breeding Center, the group got invited for some food and used this chance to talk with the staff more closely.

The Royal Camel Corps in general

The Royal Camel Crops is taking care of the 400 camels belonging to His Majesty Sultan Qaboos bin Said bin Taimur Al Said. It is responsible for the nutrition, health, training and taming of the camels. The accurate recording of the camels' ancestry and race results, the management of annual races and participation in special shows, music bands and dancing, and in local and regional races are other responsibilities of the Royal Camel Corps. To maintain its importance, the popularity of camel sports within the Sultanate is strengthened through national camel races and monitoring local, regional and international changes that take place in the field of camel sport.

Figure 1: Camel mounted based music band (left), camel racing sport (right)

The Camel Breeding Center (CBC) was founded on March 1st, 2001 and since then it is promoting standards of health care for camels in Oman and investigating methods of modern reproductive biotechnology to improve the Omani breed of camels by providing camels of superior genetic merit. Main goals are the improvement of the performance of racing camels and the establishing and maintaining of scientific connections with other organisations. There are three departments of the CBC. The Department of Animal Health and Management provides the herd with the best health care, for example with daily veterinary inspections, blood and serum samples for routine haematology, deworming, vaccinations and tick control programs. The Department of Laboratories provides all laboratories in the CBC with the needed examinations / analyses in the field of serology, haematology, microbiology, pathology and hormone assays. The Department of Reproduction deals with natural breeding, artificial insemination and embryo transfer.

Oman has a dromedary population of 98,000 camels out of the two million camels worldwide. The Omani camels are crossbred from Arab camels of the Arabian Peninsula and Yemen. To conserve the lineage of camels, crossbreeding has been stopped. Due to the mixed features of Arab Camels, the Omani camels are considered to be one of the best

pedigrees among camels from the Arabian Peninsula with most famous pedigrees Samha, Ghiziyla, Khwara, Shahbar and Dhibian. Generally the Omani camels weight 350- 450 kg and are two meters in height. They have strong limbs and different colours specific to regional areas, for instance the camels in the southern Dhofar tend to be darker than the ones from the north.

The herd in Muscat is divided into different groups for the various functions and activities. The camels are selected for racing music bands, ceremonial shows and dancing performance. All of the 400 camels have microchips inserted for identification and handling. The camels are kept in stalls with regularly provided food and water and consume between 20-40 kg fodder per day with grain supplement or energy supplement like dates, sugar, oil and milk for racing camels. In Muscat the camels are fed with 15 - 25 kg of fresh lucerne every day, a limited amount of dates and the males get oats in addition. All camels are also supplemented with minerals and multivitamins.

The camel stables are large in size and height and have a sandy floor to avoid injury, fear and distress of the animals. The roofing height is significant to provide a cool environment and enough light. The number of paddocks eases the handling of the herd. The camels are divided into different groups based on their purpose for racing, dancing, breeding, show performance and music band. The females are held in six spacey enclosures with numerous subdivisions. Show and dancing camels are housed separately with more sufficient space to move out. Males of high genetic merit are loosely housed in separate enclosures far away from the females.

Figure 2: Female camels in their paddock (reproduction section at CBC Muscat)

The breeding season starts in October and last until April. Natural mating is important, because for ovulation the female needs to be mated with a male. The camel corps provides a natural mating service for the citizen's camels of the Sultanate. Racing camels are characterised by their slim figure, straight legs, long neck and packed abdomen. Once they have proven their performance on the racetrack the breeding starts at the age of four. The plan of the next breeding season is planned in the nonbreeding time, based on the number of calves that are required. The selected animals are housed in smaller stalls. When the camels are in calf, they get placed with other pregnant females. Just before parenting the dams' ligaments are softening, the belly is at its largest size, the vulva is swollen and the veins are enlarged. At this stage of the pregnancy the camel get moved into a single enclosure for an undisturbed birth. In general calving takes place in the time from January to April. The calf is able to stand on his own right after the birth and drinks the first milk, the colostrum, from his mother. The calves are not weaned until the next breeding season and stay with the dam. In general female calves get to stay longer the dam, because females are the better racing camels. At a later stage the camels are divided into different groups depending of their purpose.

Photograph credits with thanks to the Royal Camel Corps and the Camel Breeding Center.

Via Wadi Bani Awf to the oasis Balad Seet: evolution of settlements in Northern Oman - regional geology, pedology, flora and fauna

Nina Stephan

28.02.2007

On February 28th, 2007, the group traveled from Muscat via Wadi Bani Awf to the oasis Balad Seet, witnessing on the way different geological formations and the associated changes in pedology, flora and fauna.

Figure 1: On the way to Balat Seet via Wadi Bani Awf

Agriculture in Oman depends on irrigation due to the dry climate. Therefore water availability is a precondition for human settlements. It is assumed that the first oasis settlement in the region is Hili 8 in the modern settlement of Al Ain in the United Arab Emirates, which was dated to the early 3rd millennium BC. The history of Oman is divided into 12 archaeological and historic time periods which are shown in the table below.

Table 1: Archaeological and historic time periods in Oman

Time period	Duration
Hafit	3100 – 2700 BC
Umm an-Nar	2700 – 2000 BC
Wadi Suq	2000 – 1300 BC
Iron Age I	1300 – 1100 BC
Iron Age II	1100 – 600 BC
Iron Age III	600 – 300 BC
Late Iron Age (Samad)	300 BC – 630 AD
Early Islamic	630 – 1055 AD
Middle Islamic	1055 – 1500 AD
Late Islamic	1500 – 1930 AD
Sub-recent	1930 – 1970 AD
Recent	1970 - today

Since the Umm-an-Nar period (2700 BC) many other oasis settlements were established at the eastern and western coast of Oman as well as at the south-western and southern foreland of the Hajar mountains.

In Wadi Bani Awf, Wadi Hat and Al-Hamra tombs of the Hafit period were found. In Balad Seet nothing similar was found. The settlement history of the Umm-an-Nar and Wadi Suq period is difficult to reconstruct because only few graves were found in Wadi Bani Awf and al-Hamra. In al-Hamra tombs and faint traces of a wall from the Early Iron Age and Late Iron Age could be found.

Balad Seet was probably founded by people coming from al-Hamra searching for grazing grounds. The surrounding rock formations consist of highly permeable dolomites and lime stones of the Mahil formation laying over impermeable silt- and clay-stones of the Muaydin formation. These geological particularity ensures a continuous water supply for Balad Seet.

First settlements in Balad Seet date from the Iron Age II period (1100 – 600 BC) as was concluded from findings at the village's rubbish dump (see presentation "From palm gardens to garbage dumps: an analysis of the structure of selected oasis settlements from satellite images"). It is most likely that the appearance of settlements is explained by the introduction of the falaj system. It is not clear whether the falaj system was developed in Oman or came from outside the country. With the falaj system the terraces in the so-called Madina Qadima area could be irrigated.

In the Early Islamic period (630 – 1035 AD) the cropping and housing area in Balad Seet increased. This expansion was possible due to the construction of additional aflaj. A further expansion of the agricultural area took place during the Middle Islamic and the first part of the Late Islamic period (1055 – 1500 AD and 1500-1650 AD). The aflaj were modified to take advantage of the abundant water from the falaj Kabir system. Probably a new basin to redistribute the water was built. Pottery sherds found in the rubbish dump indicate trade relationships with Iran. At that time Balad Seet, and the later abundant oasis Hat as well as al-Hamra were probably closely connected by two trans-mountain trade routes (see summary 7).

In the Late Islamic period (1650 – 1930) a new major falaj was laid out which formed the economic basis of al-Hamra The falaj was financed by the Ya'ariba dynasty to support the tribe of Abiryin. Al-Hamra became the local centre of this tribe.

Figure 2: The excursion group listens attentively as Prof. Buerkert explains the geological formations of Wadi Bani Awf

Most likely, the 2.5 ha terrace system (our camping ground) at the western slope in Balad Seet was built during this time. According to oral history these terraces were abandoned in the 1930s due to water shortage. After the terraces have been abandoned the 1.2 ha sized Hillhalia palm grove was built. In the early 1980s a road to Balad Seet was constructed leading to an increased influx in food commodities which lead to conversion of food land to fodder land. The recent history is characterised by the renovation of the aflaj and of many houses using cement and the establishment of a new housing area and the school building.

To put it in a nutshell, the settlement history of northern Oman is closely connected to the availability of water and land which is determined by the regional geology.

Figure 3: Prof. Schlecht gives an introduction into oasis livestock management and pasture itineraries as the excursion takes a rest on the escarpment before the final descent into the oasis of Balad Seet

Oasis farming systems of Balad Seet: Sustainability, crop-livestock integration and water use - current problems of life and agriculture in the oasis

James Lisle Thompson

01.03.2007

Introduction – discussion led by Prof. Dr. Andreas Buerkert

Balad Seet is one of 800-900 oases situated in the mountains of northern Oman. It is located at an altitude of 1000m ASL in the Hajar Mountains at the source of Wadi Bani Awf. The long history of settlement and agriculture at the oasis is connected to the quantity and reliability of its spring sourced water supply. The springs emerge where an underlying aquifuge of impermeable silt-stone and clay-stone creates a barrier to water draining through the immense permeable limestone and dolomite formation that acts as a reservoir for water draining from the surrounding mountains. Tests show that the water flowing from the springs would have fallen as rain in the catchment 6.5-7.5 years earlier.

Irrigation system – discussion led by Prof. Dr. Andreas Buerkert

The first irrigation at Balad Seet is thought to have been carried out using a bucket lifting system to extract water from wells dug in the wadi prior to the introduction of the aflaj system in Oman about 2500 years BP. The aflaj channel system, that may have had its origins in Persia, was adapted in Oman and applied in the development of oasis agriculture. Archaeological evidence at Balad Seet indicates that agriculture was practiced in the eastern part of the oasis prior to the advent of the aflaj. Limestone cement, eggs, animal manure, straw and clay were ingredients used to make the traditional Sarooj concrete that was used to construct the original aflaj systems.

Springs above the eastern part of the oasis were initially used to augment the supply from the wells using a falaj that ran down the eastern side of the wadi. It is suggested that the Mazra terraces on the western side of the oasis, that were built approximately 1200 years BP, were irrigated with water lifted from reservoir tanks until the construction of falaj Al Kabir higher up the western side of the eastern valley enabled water to flow to the central and western parts of the oasis. This falaj still provides about 70-80% of the water used in the oasis, with its springs showing only a 10-20% reduction in flow during extended drought periods. Pumping from wadi wells during peak cropping periods is also carried out to supplement the supply from the springs.

Irrigation management involves the regulation of flow in the intricate system of concrete aflaj and earth channels to flood irrigate terrace basins that are subdivided with earth ridges. Operation and maintenance of the system is labour intensive, and relies on the long experience of elders and community co-operation to co-ordinate water application for optimal crop performance and to achieve high levels of water use efficiency.

Water availability has always been the limiting factor to the expansion of agriculture at Balad Seet. Deserted terrace systems that can be observed in the vicinity of the oasis indicate previous production phases in the evolution of the current terrace configuration. Variation in water requirements between seasons influences the area of terraces under cultivation at different times of the year. In winter up to 80% of terraces are cultivated while in the hot summer period only about 40% of the terrace area is used for irrigation.

Allocation of irrigation water has traditionally been connected to the area of specific land holdings. Where an area of land is not being cultivated, a landholder may negotiate with

other farmers to lease the land or the water allocated to that land to irrigate another holding. As village households become modernised the diversion of water to domestic uses may impact on the amount available for agriculture.

Terrace soils – discussion led by Prof. Dr. Rainer Joergensen

It is estimated that 150,000 tons of material has been removed from the wadis at Balad Seet to construct the terrace systems. Careful creation of graded terrace soil profiles, using larger particles at the base and finer material as the topsoil, has ensured good water infiltration and avoided excessive accumulation of minerals in the profile.

At the Mazra terrace system the silt loam topsoil is non-saline and has a pH of 7.4-7.6. Organic carbon of 3% and a clay content of 20% contribute to the high cation exchange capacity of the soil. Organic matter sourced from animal manure applications, optimal soil temperatures and available moisture during cropping periods provides a suitable soil micro-climate for rapid carbon cycling by soil micro-organisms. Although cursory inspection of the soil surface did not reveal any earth worms it was suggested that the high level of organic matter in terrace soils would support a significant population and that earth worms may be found in cooler soil slightly deeper in the profile.

Research conducted at Balad Seet has shown that soil respiration increases following irrigation when the soil temperature decreases to 22°C and moisture is abundant. It decreases again as soil dries out and temperature increases to 32°C. It is estimated that in a typical wheat and alfalfa rotation terrace site 20% of respiration can be attributed to the decomposition of roots and 80% from rhizobial nodulation activity. Nitrogen fixation has been measured at 300-400 kg ha^{-1} $year^{-1}$.

Livestock – discussion led by Prof. Dr. Eva Schlecht

The manure that is applied to the terrace systems is derived primarily from livestock yards and housing within the village where cows are permanently hand fed and goats are housed at night. A survey carried out in 2005 counted 12 cattle and 200 goats. Three types of goats were recorded: Jabal Akhdar, Dhofar and Batinah. Cattle are medium sized and may be a cross between the local Dhofar breed and European breeds, though no scientific study data exists relating to their origin.

There is some variation in the arrangements made for the grazing of goats. Village agreements, family status and personal preferences all play a role in the decisions livestock owners make in regard to their animals. Some women graze small herds in the village hinterland for 3-4 hours each day, while larger community herds are taken to the mountains for the whole day to browse a more extensive rangeland. Rangelands are estimated to have an annual dry matter production of 100 kg ha^{-1} with seasonal variation according to rainfall events.

Observation of the remnants of an ancient wall, that may have been a demarcation line between the grazing areas of herder communities and those of the settlement, initiated a discussion regarding the conflict that still exists for grazing access in the surrounding mountains and the fragile nature of the rangeland ecosystem. As modern methods of transport replace animal power, an increasing number of feral donkeys add to the competition between village and pastoralist herds for feed resources in the rangeland. Despite such rivalry pastoralists traditionally trade with the village, providing extra animal manure for use in oasis agriculture and receiving oasis agricultural products.

Grazing provides approximately 50% of the daily feed ration of the goats with the balance coming from dates, imported fish and oasis fodder products such as alfalfa, cereal and grass herbage. Cattle are fed a reasonable diet their permanent stables; the housing conditions of low light and poor ventilation raise questions regarding animal welfare and optimal performance. Conditions in livestock stables contribute to the incidence of intestinal parasites and pneumonia in cattle and goats. Other livestock health problems such as abscesses and claw problems were noted during research work at Balad Seet, however no data on livestock mortality has been collected.

Livestock are used for the provision of meat and milk products; as a store of wealth and for trade; and for the provision of draught power in village activities. The role that goats play in the transfer and conversion of nutrients from the surrounding rangelands to the agriculture terraces through their manure is a vital component in the sustainability of the system. The roles of cattle for ploughing and donkeys for transport are also important but perhaps less critical in the overall function of the agro-ecological system of the oasis.

The value of goats for income has increased as contact with markets outside the village has led to a rise in demand for mountain raised goat meat. Local goats fetch a premium in livestock markets with prices of 80-100 € for small goats and 200-240 € for larger bucks quoted for the Nizwa market. Development of this business will require a balance to be determined between the benefits of income generated and the increased grazing pressure on rangeland vegetation and demand for oasis fodder resources.

Cropping – discussion led by Prof. Dr. Andreas Buerkert

The effectiveness of water and nutrient management in the terraces, combined with high levels of solar radiation, is indicated in annual alfalfa shoot biomass accumulation levels of 22-24 t ha^{-1} recorded at Balad Seet. This level was described as being three times that expected in European conditions and two times that of Californian production areas.

Crops are grown in full sun on the terraces and in the shade of date palms. At the time of our visit, during the late winter season, many of the terraces under the palms were being prepared for planting. These shaded areas provide a more protected micro-climate during the hot months of the year when a reduced level of cropping is carried out on the full sun terraces. There are 16 varieties of dates (*Phoenix dactylifera* L.) cultivated in the oasis each of which has distinct characteristics and uses. Besides irrigation other crop management tasks such as the propping of leaning palms to avoid falling; spreading and incorporation of manure in irrigation basins around trees; and the hand pollination of flowers were being carried out. Dates are dioecious plants that are cultivated with a male to female planting ratio of 1:40 at Balad Seet.

Other perennial crops noted were Omani limes (*C. aurantiifolia* (L.) Swingle), bananas (*Musa spp*. L.), grapes (*Vitis vinifera* L.), figs (*Ficus carica* L.), pomegranates (*Punica granatum* L.), and papaya (*Carica papaya* L.). A significant development at Balad Seet since 1998 has been the appearance of Witch's Broom disease in Omani lime trees. The impact of this vector spread phytoplasm disease is evident from the many dead and diseased trees in the oasis.

Terrace crops are grown in a managed rotation system that aims to provide appropriate soil nutrient conditions for rotation crops and to minimise the impact of pests and diseases. Annual food crops observed during the visit included garlic (*Allium sativum*), onions (*Allium cepa* L.) and coriander (*Coriandrum sativum* L.). Winter cereals and livestock forage crops noted were alfalfa (*Medicago sativa*), wheat (*Triticum aestivum, T. durum*), barley (*Hordeum vulgare*) and oats (*Avena sativa*).

Wheat and certified production – discussion led by Dr. Sulaiman Al Khanjari

The wheat varieties grown at Balad Seet are unique landraces that have genetic links to both European and Asian varieties. It was suggested that travellers passing from the coast to the interior may have carried seed of these varieties to Balad Seet many centuries ago. Recent research has identified nine unique soft wheat varieties, including *Triticum aestivum subsp. baladseetensis*, that are still cultivated in the Omani mountain oases. The conservation of these varieties for the future is at risk since no protocols exist for their preservation in international facilities and no local facility has yet been set up.

The relatively low grain yield of 2.5-3 t ha^{-1} and harvest index of 20% for the wheat must be considered in the context of the dual purpose of cereal production in the oasis for grain and straw. Straw has traditional uses for livestock feed and thatching. The tall growing varieties are prone to lodging which presents problems for farmers if windy conditions prevail during the later part of the production period. Dr. Sulaiman explained that excessively tall growth may result from excessive nutrient supply. He noted that no pest or disease problems were apparent in local varieties during the period of his research.

Despite the disadvantages of the local varieties compared to high yielding, short growing modern varieties local growers maintain their preference for traditional wheat varieties because of the dual purpose benefits, the general health of crops grown and the cultural tradition attached to their farming practices. Villagers prefer to consume local wheat for its superior flavour and perceived health benefits, particularly important in the diet of women during pregnancy and lactation.

The group discussed the need for the building of awareness amongst decision makers in Oman to enable importance of conserving the national agricultural heritage to be recognised. The organic and cultural certification of the Balad Seet products is being pursued in an Omani community products project being undertaken with co-operation from the University of Arizona, USA. It was stated that local wheat can fetch ten times the price of imported wheat, even without certification, and that there is a high level of demand for traditionally grown Omani products throughout the Middle East. It was suggested that the benefit of certification to promote the external sale of oasis products is questionable given that wheat production at Balad Seet supplies only 1-5% of the consumption needs of the growing village population. There may be export potential for other crops, perhaps dates, for which local production exceeds domestic demand.

Looking to the future

Rapid economic growth in Oman has resulted in the development of transport, communication and community infrastructure that connects Balad Seet with its wider community. While this may guarantee a future for the oasis within its region, its former isolation has been a major factor in preserving its unique social and agro-ecological system. Agriculture at Balad Seet appears to be quickly changing from a role of providing subsistence for the community to one of conservation of traditional culture. Though the current generation of older farmers may persevere with the assistance of expatriate labour, the long term conservation of terrace agriculture at Balad Seet depends on the economic empowerment, motivations and cultural awareness of the next generation of land owners and decision makers many of whom work outside the oasis.

Oasis – hinterland Relationships

Irma Mika

01.03.2007

The mountain oasis Balad Seet lies at the southern end of Wadi Bani Awf in the Hajar mountain range, on the northern side of Jabal Akhdar. To the south, a cliff of 1,000 m hinders travellers from an easy access to the villages of Misfa and Al Hamra, and further on to Nizwa. The unpaved road through the Wadi Bani Awf to Balad Seet was built in 1980. Up to then only donkey and foot paths existed. The main 27 km long donkey path connects Balad Seet via Hat in the east to al-Hamra. A 19 km long footpath leading directly southwards across the cliff leads to Misfa. The path consists partly of rock stairs. Another footpath leaves the oasis to the west in the direction of Salma. The footpaths are mainly used as a shortcut for personal visits and for the trade of smaller goods hat can be carried by a person. The donkey paths were used for common trade.

The paths lead mainly to the south because al-Hamra was for centuries the political and trade centre of the region. This connection is reflected today in the fact that families living in al-Hamra still own fields in Balad Seet. Also the first permanent settlement in Balad Seet during the first millennium B.C. was probably initiated by people from al-Hamra.

Water is the source that leads to oasis settlement. The oasis Balad Seet was probably used by herders to water their flocks before between 1100 and 600 B.C. the first settlement was found. Of course oases are main places for rest on trading routes because they provide water for the traders and their animals. There is a strong dependence between oasis settlers and the herders. The oasis settlers provide herders and their flocks not only with water, but also with crops (e.g. wheat, sorghum, onions, garlic, limes, bananas) for the herders and dates and fodder (e.g. barley, alfalfa) as nutrition supplement for goats and sheep. In return the herders sell their animal products like meat and milk and also provide the oasis with additional manure.

In Balad Seet goats and sheep are kept by the oasis settlers, but also by semi-nomadic families referred to as Shawawi, who herd small ruminants on separate grazing grounds in the surrounding mountains in heights above 1300 m. The mountainous grazing grounds are very poor, additional nutrition from the oasis for goats and sheep is obligate.

Figure 3: Aerial view of Balad Seet with adjacaent grazing grounds used by the oasis livestock

Oases depend also on trading their products with their hinterland to get all types of goods that cannot be produced in the oasis (e.g. tools, pottery). Pottery sherds can indicate trade connections between different sites and areas, for example in Balad Seet turquoise glazed vessels were found, which were probably imported from Iran or Mesopotamia. Also plaited baskets and containers, woven prayer and floor mats, cordage and ropes made from date palm leaves are sold from the oases to the surrounding villages.

From the coastal fisher villages dried fish is traded to the oases for everyday consumption. Also small dried fishes are brought into the oases. They serve as a special source of phosphorus for date palms and crops. Fish is also fed to goats to provide them with additional protein.

Archaeological research gives evidence that the number of settlers in Balad Seet always exceeded the possibilities of subsistence in the oasis so that probably additional grain was bought for example from al-Hamra, from trade gains. Today there are four times more village people than the agricultural capacity of the fields could carry. The reason therefore is money earned from trade or work in education and administration based on the oil and gas selling economy. With that goods and fertilizer can be bought from outside the oasis.

The oases along the Hajar mountain range were and are places at the border where coastal and inland people meet for trade. That means also that the oases had always to manage between the mostly diverging political interests of coastal and inland tribes. Evidence for the necessity to defend the oasis is given by the little fortress on the rocky outcrop above the main settlement. It was probably built between 1650 and 1930 A.D.

The Nizwa livestock market

Ute Gilles

02.03.2007

The livestock market at Nizwa sooq takes place every Friday morning. Livestock owners, often women from the region bring their animals – mainly sheep, goats and cattle – to the market. There they are registered which includes a cursorily check of the health condition that means they are judged by appearance and a quick look into the mouth.

The livestock owners hire a commercial seller, giving him their price. The seller then runs with the animal in a circle shouting out the price. Prospective buyers are looking at the animal, shouting in their offer. The commercial seller gets paid a provision when selling the animal. He has to include this beforehand in the price at which he offers the animal.

Figure 1: Livestock sellers and buyers at Nizwa market

In general, the appearance of the livestock at this market was not very well. The claws were not well cared for and the coat looked very shaggy and dishevelled. Most of the animals were infested by parasites. Unfortunately I could not find out, if the poor health of an animal has an influence on the price and if so of what kind.

The town of Nizwa

Oliver Hunkler

02.03.2007

In a former quarter of the town of Nizwa we visited an ancient mosque (approx. 15th century). Today the area is totally abandoned and one can only visit the still remaining ruins of some houses and the mosque. The mosque itself shows Persian influence and design. No serious restoration has been done and it is likely that even local people do not know the former mosque. A probable explanation for the abandonment of the mosque and the area is that Omani people might not like "old things", but prefer "modern things". Interestingly, the whole place is littered with old broken pottery. During the visit one could also observe a well right next to another mosque. An interesting explanation was that women could do their washing and were still able to go to pray without going long distances.

Figure 1: Livestock sellers and buyers at Nizwa market

Between the mosque and the city-centre of Nizwa, peri-urban agriculture is practiced, mainly managed by Pakistani labour. During this time of the year various kinds of agricultural products were observed: alfalfa as animal fodder, and vegetables such as egg-plants, potatoes, onions and pumpkins for human consumption. People also grow sugarcane for both human (stalks) and animal (upper part) consumption.

Figure 2: Scenes from the Nizwa fish and vegetable market

Afternoon drive to Sayh (Al-Jabal-al-Akhdar region)

The area around Sayh on the Al-Jabal-Al-Akhdar plateau was not accessible to public until recently due to the emplacement of a military base in that region. During an excursion in the 1990s, Prof. Buerkert was fascinated by the spectacular terrace agriculture systems. Three years ago the University of Kassel started to do research within the four oases (Al'Ayn, As' Sharayjah, Qasha', Masayrat ar Ruwayah) at three altitude ranges (1000 m asl, between 1000 to 1500 m asl and between 1500 and 2000 m asl). Due to the height differences of the four oases, their crop production systems vary as well:

1. Between 1500-2000 m asl: production of some wheat, barley, alfalfa, pomegranate, peaches and apricots, roses (for the production of rose water)

2. Between 1000-1500 m asl: no roses, few dates, citrus trees, pomegranate and peaches/apricots

3. Up to 1000 m asl: only dates, like in Balad Seet

Figure 3: Arriving at the oases of Al-Jabal Al-Akhdar

The University of Kassel is currently conducting detailed socio-economic research on 16 families in the four oases. Families produce crops and animals, however there is a need of non-agricultural activities to make a living. Alarmingly, young people do not want to work in agriculture any more. As a result, the youngest farmer of these oases is 45 years old.

Research also found out that it most likely global climate change has reached Oman. In the Al-Jabal-al-Akhdar region it used to be much greener and there were much more juniper and olive trees. Also fruit trees such as apricots and almonds were more frequent. Problems of low production maybe due to temperature rise, since there are chilling requirements for certain trees; these are a minimum number of chilling hours below 7.2 °C during one year. Over the last 15 years, chilling hours have declined continuously and do no more meet requirements of walnuts and apricots in every year. It is hypothesised that this reduction of chilling hours is one of the first effects of global warming in Oman. However, there are very few long term temperature records available for the area and it is therefore difficult to conclude on this aspect. However, one has to bear in mind that climate changes and therefore changes for agricultural production may occur in the near future. But will farmers adapt to these by changing their production systems, especially if young farmers do not want to work in agriculture any more? What are the alternatives for these people? May tourism be a source of income? If so, what kind of tourism?

The oases of Al-Jabal Al-Akhdar
Al-Ayn – Ash-Sharayjah –Qasha' – Masayrat ar-Ruwajah
Agricultural and Socio-economic Changes and Opportunities in Future

Rico Ihle

03.03.2007

"Al-Jabal Al-Akhdar" means in Arabic "The Green Mountain". The name gives already some indication about the, for Omani circumstances, lush vegetation which can be found on its higher altitudes, e.g., among others, in the four oases of Al-Ayn, Ash-Sharayjah, Qasha' and Masayrat ar-Ruwajah. The excursion group met two guides next to the village of Ash-Sharayjah, a couple of meters below the rim of the plateau of Al-Jabal Al-Akhdar. The group was split into a male and a female subgroup because of thoughtfulness for the gender separation in public which is particularly important in rural areas of Oman such as Al-Jabal Al-Akhdar. The male group was led by Uta Dickhöfer, a PhD student of Prof. Schlecht. The female group was led by Dr. Katja Brinkmann, a research assistant of Prof. Bürkert. This report gives a summary of the tour of the male group led by Mrs. Dickhöfer.

The tour started at the top of the village of Ash-Sharayjah. The group went down through the narrow alleys of the village into the terraced fields which lay on a steep mountainside falling down from the Al-Jabal Al-Akhdar plateau into a deep valley. The tour continued along the narrow and steep paths downhill into the terraces and up again for approximately two hours where explanations on the agriculture and the social-economic development of the region were given. Below Ash-Sharayjah, a number of further settlements is situated on different altitudes. Each one is characterized by a particular range of agricultural crops grown in the fields. However, the tour focused only on Ash-Sharayjah and its fields since walking distances between the villages were quite long and difficult along the steep mountainside.

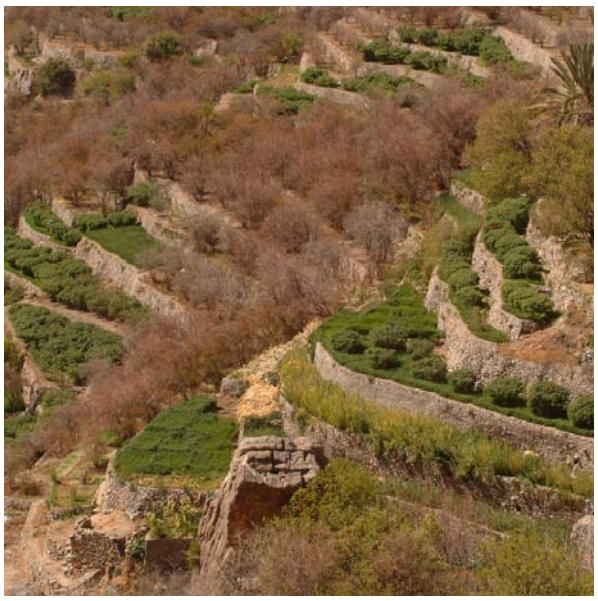

Figure 1: PhD student Uta Dickhöfer guiding the group through the Ash-Sharayjah terrace system

Around Ash-Sharayjah, garlic is the main culture. Products from the mountains such as garlic, pomegranates, limes and rosewater, but also goats are traded for high prices in the markets of the lowlands, e.g. in Nizwa,. The reason lies in the reputation of the products: produce from Al-Jabal Al-Akhdar is considered per se as more valuable. For example, highland goats are sold in the markets of the lowlands for prices up to 150 Omani Rial (OR), which amounts approximately to 300 €, whereas goats from the lowlands cost usually only

around 25 OR. However, a considerable share of the growing fruits such as limes, peaches pomegranates is not anymore harvested despite the high prices that the produce is able to realize. The main reason for this development is that people are not anymore willing to do the hard work in the difficult terrain.

The attitude particularly among the young generation towards work in the fields is changing although people tend to have less income in this remote region than the Omani average. Poor farmers may only possess 3 pomegranate trees. Nevertheless, during the last couple of years income alternatives emerged in the tourism business. The region is planned to be developed into a destination for tourists from the United Arab Emirates (U.A.E.). One local earns only about 300 OR which does not suffice to nourish a family. Fortunately, there are is a growing amount of job opportunities for sufficiently educated work force available in the area. Thus, two to three household members are able to contribute to the income. Also the families' daughters participate by working for example as secretaries for the growing number of tourism businesses. The employment of women resembles the employment of women almost everywhere else in the world. Despite that women have to (and tend to) graduate from universities with better marks than men, their employment depends stronger on connections and they are earning lower salaries. This represents one aspect of the general change of society and life style in the region. Not only that daughters work in business outside the house, but also traditional informal social security systems are rapidly changing, e.g. the traditional system of helping each other in the village. The government is aware of this development and tries to take it into account. Marketing cooperatives that would facilitate the sale of local produce do not (yet) exist. Nevertheless, in the course of the increasing tourism business in the area there emerge potential marketing opportunities particularly for old farmers who cannot anymore do the harvest work by themselves. Locals might sell fruits to tourists who would then harvest the trees themselves. Fruits from terraces close to the village might be sold for higher prices than from farer, more remote fields. Such a scheme would increase the income of some families whose members do not possess the skills to work in tourism.

The ownership of the terraces is very heterogeneous and depends mainly on wealth. The poorer a family is, the further away from the village its terraces are located. Large parts of the field are belonging to the mosque, the falaj system, i.e., the traditional irrigation system, and the government. However, the ownership of terraces is partly not anymore known nowadays. This represents another consequence of the above mentioned change of society. Considerable parts of terraces are already abandoned since a couple of years. The falaj system is experiencing a similar fate. Because of the disinterest of young people in the traditional farming and irrigation system, this knowledge is about being lost. Already nowadays the majority of the young generation does not know anymore about it. The government undertakes no efforts to maintain the old, extremely efficient, flexible and adapted system, but is trying to introduce new irrigation schemes. The mentioned irrigation system, the so called falaj system, is traditionally organized and maintained by a special council which consists of one member from each family. It pays particular attention to the main falaj by which most of the water is transported to the fields of not only Ash-Sharayjah but also of the other villages. The branch aflaj (plural of the Arabic noun "falaj") are to be maintained by each farmer independently. The water arriving in the main falaj is distributed on an hourly basis according to a fixed scheme which is based on the number of inhabitants in each settlement. Thus, Al-Ayn as the largest village receives water each day for 12 hours, Al-Aqor and Qasha' 6 hours each. The water transport of the main falaj was measured to reach up to 14 cubic meters per hour, but also volumes of only seven to eight cubic meters occurred. Each village is headed by one sheikh and a council of elders. Communication about important issues for example regarding the irrigation is typically done on Fridays after the main prayer. In recent years, less precipitation occurred which led to water scarcity and even water theft.

Al-Jabal–al-Akhdar: Oasis farming systems in Northern Oman

Anne Hoffmann

03.03.2007

The Ph.D. student Uta Dickhöfer and Postdoc Dr. Katja Brinkmann of the University of Kassel introduced the group from a perspective view into the oases system of the Al Jabal al Akhdar mountain range. After introducing the climatic, agricultural and socio-economic conditions of the oases we discussed the situation and focussed opportunities and threats of this agricultural system. Afterwards we realised the harsh conditions by a walk through the terrace gardens.

Along the scenic gorge west of the Sayh plateau, oases systems are bedded in the rock face. The harsh conditions, especially the limiting factor water, forced the people to settle and farm along the gorge where water is available. Water flows out of the rocks and is kept and guided in open channels (falaj) to the fields and households of the oases villages. The location of the terraces, the distance from the well and households, indicates the value of the terraces. According to the seasonal supply of water, decisions are made on what kind of crops to cultivate and where to cultivate those crops. The oases are connected to each other by small trails. Social exchanges among the oases communities take place during weddings, funerals and other festivals.

Figure 1: Traditional oasis agriculture with old falaj irrigation system (left) and manure application (right)

Terrace farming systems

Mixed farming systems of field crops, rose shrubs and fruit trees characterise the terraces of the Ash Sharayjah community. Small scale farmers mainly produce on fields with less than 1 ha, food for home consumption or fodder grasses for their livestock such as goats, cows, chicken and sheep. The goats are fed in the morning and evening with own produced fodder like oats, barley and even lower class dates or fodder which is bought on the Nizwa market. During the day they are taken out to feed on the natural vegetation in the area around the villages.

The fields are cultivated nearly year around with different crops and fruit trees such as garlic, reddish, wheat, almonds, apricots, grapes, lime, peaches, pomegranates and walnuts. Late March the *Rosa damascena* turns the terraces into blooming and fragrant gardens. The

roses flowers are picked before sunrise by women while the men distillate the rose fragrant and produce rosewater. Another well known product of the Al-Jabal-al-Akhdar are the pomegranates which start to bloom late March. The majority of the fruits are sold in the summer on the Nizwa market and reach prices up to 1 OMR (~1,96 €). Al-Jabal-al-Akhdar pomegranates are a very well known and valuable product by the Omani people.

The farmers of the terrace villages obtain 30-50% income from their agricultural products. Today hard work and traditional knowledge does not pay off for living expenses. As a result some family members work during the weeks in cities like Muscat to finance the families in the villages. Due to the higher off farm income the farmers abandoned their land and concentrate on other living opportunities. Other farmers, who can financially effort it, hire workers from Bangladesh or Pakistan who do the hard farming work in the terraces. Still a privilege to the Omani men is the irrigation of the fields and the distillation of the rose fragrant.

Tourism and consequences to the oasis community

Along the access road to the Sayh plateau, signs for "Don'ts and suitable behaviour" towards the people in the villages try to clear up the visitors behaviour in this unique area. Due to cultural and religious misunderstanding, problems with tourists arose since they intruded privacy, the traditional, cultural and religious life of the inhabitants especially of the women, went into the gardens and stole the valuable fruits. As a consequence the village people complained to the government that too many tourists are wandering in the villages and gardens. An opportunity to face these problems and to take an advantage of tourism could be a well established ecotourism concept where the people and the environment benefit from tourism. Endeavours of ecotourism strategies could introduce foreigners to this distinctive and vulnerable area.

Figure 2: The group discussing the opportunities and challenges of the growing tourism sector at a hotel construction site opposite the traditional oasis system

The visit of the oasis clarified the unique agricultural systems and traditional living in the oasis. Facing the status quo and problems, the oases are in a transformation process. Due to socio-economic changes traditional farming and irrigating knowledge may get lost. Climatic changes could also introduce problems in the future due a reduced availability of water.

The "dying" oasis system of Maqta: Factors and concepts of sustainability and of different possible development pathways for oasis farming systems

Marc Wolf

04.03.2007

Some shops and the gasoline station offered one more time the last smooth and tasty foods delivered by modern civilization. In the bakery store, the face of the clerk was framed by hair, peering under his typical Omani hat, similar to dreads. If he was not a Jew, what would have been a nice surprise in this region, this is perhaps some traditional type of hair style for one of the two neighboured Bedu-tribes in Ibra, who offended each others for a long time. After refreshing we drove into the Desert Mountains. First there was a normal, asphalted street accompanied by a power line, which led, always respectfully in some distance to the lowest point, through the wide Wadi Kabbah. In this valley of rare but huge water run offs with high speed, signs of 1.5 m high swelling liquid masses were eye catching. When the electric wires disappeared, we made a turn into northeastern direction. Continuing roads were cleared and rolled dense by a caterpillar, who was working just at time, when the convoy of six, in the sun white and silver shining Toyota-jeeps passed, as if it was a special offered service.

The oasis of Maqta is located on bare rock southern of the plateau ridge, below the bright limestone cliffs of the Jabal Bani Jabir Mountains, at an altitude about sea level of 1100 meters. Stopping the cars in some distance to the village, we got a curious welcome by the adolescents. Maqta is a scattered type of settlement, what means that beside the central village are also wide spread, just temporally used residential places of pastoralists, who are all inhabitants of Maqta. Standing above the village on a tall hill of rubble enabled to see some of these settlements. Not far away lay gigantic rocks which broke down from the peak in ancient times, when the climate was more humid, it was told. Today climate here is hot and arid. Annual precipitation is just 75 mm, while the potential evaporation reaches 2500 mm (Siebert et al., 2005).

First objects of inspection were two terrace systems located near to each other, gorgeously green glowing amidst the weathering dark grey stone garden. Its fertile soil had to be carried upwards from the wadis by hand. Small terraces construction walls were quite simply but solid stratified in an angle of 65° to avoid laborious repair after one of the rare but memorable heavy rainfall events. In the upper part date palms grow as a perennial crop, near to the water source. Lower terraces are used for wheat. From the 4.5 ha terraced land, 2.9 ha are cropped with date palms (Siebert et al., 2005). According to Prof. Buerkert, the area occupied by wheat was extended in spring 2007 as compared to the recent years, because of strong winter rainfalls. In dry years, like in 2005/2006, just one quarter of the available terraces were planted to wheat. The wheat growing in Maqta is a mixture of several landraces. Species of *Triticum durum* and *Triticum aestivum* are cultivated together, and one of the different varieties found here was absolutely new to the scientific audience: *Triticum aestivum maqtaense*. Its morphology is drought adapted due to long, diagonal awns which catch humidity from the air. These landraces mixtures improve resistance of the overall plantation against stress factors like drought, heat and diseases, guarantying a yield even under very harsh conditions.

Average date yield was reported to be 25 kg per tree, just half the yield compared to the trees at Balad Seet. Singular palms' basements were even surrounded by supporting protection walls. Date fruits protected the people at a place like Maqta against malnutrition in various vitamins and minerals.

Natural vegetation around the oasis settlement is xeromorph and extremely sparse. Herbal plants like *Indigofera sp.* or *Ocimum basilicum* are just able to grow after rainfall. It is possible that seeds of the latter species were introduced into the ecosystem by human activity.

Agriculture takes place on 16 terraces, fed with water from 22 sources. Outflow of springs varies between 5 and 1212 l/h. The water age is 2 - 8 years. Flood irrigation is supplied by outlets in the canals (aflaj) running downwards from the springs to the fields. In the past construction material for these canals was self made sarooj cement. At a special point one falaj was even bridged over a ditch, from the date palms to the wheat fields, by a plastic tube. Water flow varies widely. During dry periods water amounts used for irrigation can decline by 60% and more. This means that there was never assurance if the agricultural system is able to nourish the population at adequate amounts or not. However, there is a small basin of about 4x4 meters in diameter and 1.2 in depth for water storage, and even the smallest springs irrigate at last one palm isolated in bare rocks. Canals and the basins are not covered against the sun, and water is supplied at any day time, because it is just transported by gravity and can not be stored net to the fields. Equal distribution of falaj watering times during a 24 hour cycle is managed for each terrace by the elders.

Fertilization of the fields is done with collected manure; human feces are also used, sometimes. Nutrient import takes place through trading dried fish, fruits and other consumption goods from Ibra or the coastal areas into the oasis. Nutrient supply levels can be seen in recent scientific investigations concerning the ecological sustainability of the oasis system. With 2.2 t/ha they are quite low, compared to 3 tons in Balad Seed.

The huge labour efforts for agriculture are shared by all community members. The sportive children for example perfectly fit for yielding dates from the high palms. No migrants do the work of the indigenous population, like at richer oases. Size of community is a huge problem for further social sustainability. Including the pastoral groups, who are herding sheep and goats through the difficult mountain ranges, to find sparse wild growing feeding plants, population is at 200 individuals. Just 25 of these are living currently in the twenty, mostly empty houses in the central village of Maqta, which is more likely peripheral, if growing wheat should be unfavoured by local Bedu-culture compared to animal keeping and driving pick ups.

Figure 1: Date palms at Maqta

Agriculture was done for subsistence and for local nutrient supply of pastoral neighbors. Enough money could not be earned through it. Selling one head of livestock yields a better price than selling one sack of grain. Produced amounts of dates, grain or collected herbs, that are just seasonally growing, are not important enough to support a real marketing. Once the area was certainly a pastoral domain, and agriculture is just an addition in this area to improve pastoral diets. The oasis was never fully self sustaining. Today's income is generated by social welfare, offered by the state, at a scale of 320 Rial per family and year, and donors by a few traders and travellers. This is enough to pay daily basic consumption needs and to run an own car. But unfortunately it will not be enough to justify the exhausting work on the fields and the isolation from modern culture and comforts. There is neither television nor telephone in Maqta. Houses are extremely miserable, compared to the villa-like marriage houses spread in the towns in the nowhere of desert lowlands. The condition of the local roads is causing high abrasion costs for the vehicles. The next school is located thirty kilometres away, therefore a boarding school was build. A recently built dangerous street, first climbing the mountains and then steeply going down to the ocean replaces a dangerous 13 hours trip by feet and donkey. The road is passing a settlement of pastoralists that is much bigger than Maqta. At Maqta, there is no huge, flat parking ground for visitors' cars, like in Balad Seet, though the displacement of some less densely built house ruins in the western village-half would allow children to play soccer.

When a gang of perhaps eight elder children gave us a wondering welcome, their clothes were shabby, their physical constitution very meagre and some eyes were red, maybe because of keratitis. This does not mean they where not jolly jumping step by step behind and in front of the visitors group, laughing about our unskillful moves through the stones. They also threw buckthorn (*Hippophae sp.)*, high in vitamin C concentrations, from a tree in the villages centre, towards a participant, as if they wanted to check intelligence and reflexes of the apish strangers.

Village inhabitants who showed themselves to the visitors group were just those children and three adults, among whom Rashid seemed to be the eldest, and the preserver of agricultural practices in Maqta. A frugal ceremony of hospitality was provided. Dates, coffee, the sweet halwa and a glass of fresh water, either from a local spring or, practically, from the supplied $8m^3$- drinking water tank in the village, were served. Other old people, females or small children were invisible.

Thinking about possible future development pathways of Maqta is not that easy. The oasis is very small, located very isolated, the infrastructure is rudimental, water supply for irrigation is not sure and agricultural production too low for special commercialization. Otherwise this year's rainfalls were strong enough to produce a good yield. This should have made it possible to sell grain and dates down at the markets, what perhaps was a reason of pride for the residents. Showing the terraces built by the sweat of ancestors to foreigners perhaps also generated proud. Here a new motivation for hanging on the labour strains, and promoting them to the children might be found. If welcomed, adventure seeking travellers, minimally familiar with Omani customs like our student's excursion, and bringing an Arabic speaking leader with them, could have a break at this friendly place of specific beauty. Handcrafts or dates could be sold? Maqta is situated on one spectacular pathway towards the coast, Wadi Tiwi and the mystic, mighty chamber of Majlis Cave.

Taking the mentioned route toward the ocean permitted camping below the stars in the shadows of mysterious, over 2500 years old tomb towers on the Shir plateau. This place offered beautiful views on golden illuminated, bare mountain ridges. To attract visitors for this type of journey aside from mass tourism seems not to be impossible to do.

Visit of a traditional desert Bedouin camp

Natacha Crozet

05.03.2007

Presentation of the camp and the people situation

The visit took place in the settlement in the desert where they have a tent with two rooms. The family has also a house in the city. They are camel breeder for racing camels for generations. The male children go to school and learn the camel breeding, for the female one we don't really know if they can go to the school, they are raised by women and work with them.

They have some others animals: one cow, some sheep for their own consumption.

They began to breed camels in the United Arab Emirates before returning to Oman. Camel breeding and camel racing is for them more interesting economically than camel milk production.

At the time of our visit, they had five adult camels and two young camels, one of them was only ten days old. They don't have any male because the breeding cost is too high particularly due to the food spending. Moreover, according to the presentation in the camel breeding centre, natural camel mating are free for the citizens.

Camel breeding

They don't keep every young camel, they can know as soon as they are six months old if they have a good morphology for racing. The general morphology is important and many characteristics are taken into account but the two main characteristics are :

- the legs and particularly the front legs (they must be straight and strong)

- the width of the chest

The camels receive the best food and their diet is constituted by alfalfa, cereals (mainly barley), dates, honey and laban. They buy everything in the surrounding farms. This high quality diet allows the best body development and strengthens the camel's capacity. They receive also vitamins. Moreover, after each race, they are driven to the vet for a complete medical check.

They begin the training when they are six or seven months old. The age of a racing animal varies from the breeds between five and seven years which is the maximum. It is consequently a relatively short time of race activity. For the training, they use a race track to measure the performances in order to select the best camel.

Camels are free to move, they go sometimes to twenty kilometres far from the camp but they always come back. They have a sign, made by burning the hairs, on the head and inside one of the back leg. It is a different one for every camel breeder.

Camel Races

The races take usually place in the United Arab Emirates. They have a robot jockey for the official races for a question of security. Indeed camel riding has been forbidden for important events because of the high risk of accidents. One robot costs around 500-600 Rial, consequently several breeders buy it together. For the community races which are less important, they can ride the camel themselves

Figure 1: After a warm welcome including being served halwa, dates and tee in a bedouin tent, the group had the chance to inspect a fine example of racing camel breeding

Prices and income

Today, they have a female which can be sold at least 17,000 Rial but it is only the start price. They hope they will sell it for a quarter of a million. The price increase naturally if the camel wins races.

The question about the sources of income has not been clearly answered, the sale of camels is certainly the main money input, but the sale of handcraft objects made by women at the end of our visit, let us think that they have other sources of revenue.

Oil fields in the hinterland – the Oman oil industry

Peter Wolanski

06.03.2007

In 2006 Oman conveyed about 740,000 barrels of crude oil per day (CIA –World Fact book – Oman). Oman's oil is of medium quality, because it contains sulphur and is contaminated with aromatic hydrocarbonates, such as benzpirins and benzols. The oil is located in extreme depths, around 500 meters. It is highly viscous and water comes up with the oil. The water is heated and pumped down again to dissolve the viscose oil. It cannot be used for irrigation purposes because it is polluted.

Petroleum (crude oil) is a naturally occurring in a liquid form in porous rock formations in the upper strata of some areas of the Earth's crust. It is usually black or dark brown (it may be yellowish or even greenish) but varies greatly in appearance, depending on its composition. In its naturally occurring form, it may contain other non-metallic elements such as sulphur, oxygen, and nitrogen. It consists of a complex mixture of hydrocarbons of various lengths. Due to its high energy density and relative abundance, it has become the world's most important source of energy since the mid-1950s. 84% of the hydrocarbons present in petroleum are converted by distillation at an oil refinery to produce energy-rich fuels (petroleum-based fuels), including gasoline, diesel, jet, heating, and other fuel oils and liquefied petroleum gas. Petroleum is also the raw material for many chemical products. The 16 % not used for energy production are converted into solvents, fertilizers, pesticides, and plastics. Most geologists view crude oil and natural gas as the product of compression and heating of ancient organic materials over geological time. According to this theory, oil is formed from the preserved remains of prehistoric zooplankton and algae which have been settled to the sea bottom in large quantities under anoxic conditions. Over geological time this organic matter mixed with mud was buried under heavy layers of sediment. The resulting high levels of heat and pressure cause the remains to metamorphose, first into a waxy material known as kerogen which is found in various oil shales around the world, and then, with more heat in a process known as catagenesis, into liquid and gaseous hydrocarbons. Because most hydrocarbons are lighter than rock or water, these sometimes migrate upward through neighbouring rock layers until they become trapped beneath impermeable rocks, within porous rocks called reservoirs or Oilfields (wikipedia.org)

Figure 1: Oil field near Rima – Google Earth Image

Figure 2: Horsehead oil pump

Geologists use seismic surveys to search for geological structures that may form oil reservoirs. For the "classic" method an explosion in the nearby underground is needed to observe the seismic response that provides information about the geological structures beneath the ground. Another "passive" method extracts information from naturally-occurring seismic waves. Other instruments such as gravimeters and magnetometers are also sometimes used in the search for petroleum (wikipedia.org).

An oil field is a region with a large quantity of oil wells extracting petroleum (oil) from beneath the ground. Because the oil reservoirs typically extend over a large area (possibly several hundred kilometres across) full exploitation requires multiple wells scattered across the area. In addition, there may be exploratory wells probing the edges, pipelines to transport the oil elsewhere, and support facilities. Because an oil field may be remote from civilization, establishing a field is often an extremely complicated exercise in logistics. For instance, workers have to work there for months or years and require housing. In turn, housing and equipment require electricity and water. Excess natural gas needs to be burned off if there is no way to make use of it, requiring a heater and stacks, and pipes to carry it from well to furnace. The typical oil field looks like a small self-contained city in the centre of a landscape dotted with drilling rigs or in Oman because of the oil's high viscosity pump jacks known as "nodding donkeys" because of their bobbing arm (wikipedia.org).

"Horsehead" Pump jacks convert turning power, which is provided by an internal combustion or electric motor to reciprocating power. This power is delivered to the downhole production pump through the "rocking horse" and a string of sucker rods. Oil is collected in a perforated nipple at the lower end of the pump. The plunger, which is attached to the sucker rod, moves up in the barrel forcing the upper check valve into its seat. This movement creates a vacuum in the pumping chamber unseating the lower check valve and drawing oil in. When the action reverses, pressure is created in the chamber when the lower check valve is seated as the plunger moves down. This pressure opens the upper check valve releasing the oil into the tubing and the action repeats. The stroke rate of the pump is set to suit the flow character of the well (lloydminsterheavyoil.com).

1. Driving motor
2. Counterweight
3. Connecting rod
4. Balancer
5. Horse head
6. Plunger
7. Seal par of Christmas tree
8. Pipe
9. Concrete backfill of borehole
10. Outer borehole piping
11. Pump rods
12. Inner borehole piping
13. Deep pump
14. Pump outlets (perforated nipple)
15. Oil containing rock formation

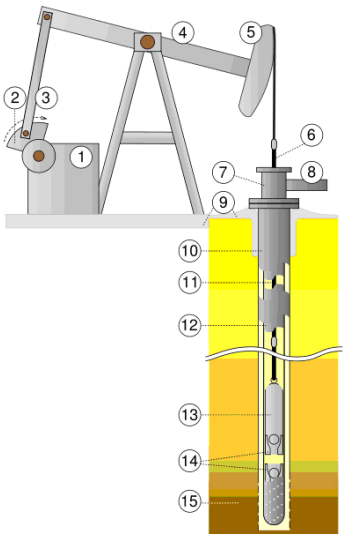

Figure 1: Sketch of Pump jack (www.wikipedia.org)

The world wide known reserves of petroleum are typically estimated at around 1.2 trillion barrels with at least one estimate as high as 3.74 trillion barrels. Consumption is currently around 84 million barrels per day, or 31 billion barrels per year. Because of pumping difficulties, usable oil reserves are only about 1/3 of total reserves. At current consumption levels the world oil supply would be gone in about 32 years. (wikipedia.org).

Visit of a large-scale forage-producing farm at Marmul

Felix Richter

06.03.2007

The keeping of dairy cows and the production of milk face certain problems in a country like Oman with a typical desert climate. One of these problems is the cultivation of fodder crops which meet the nutritional demands of the animals regarding fibre, protein and energy content. Different grass and legume crops which are usually fed to dairy cows have high water demands and can only be grown with continuous irrigation in Oman. Most of the dairy farms are therefore located in the Batinah coastal plain, where water and a certain infrastructure are available. However, the groundwater resources in the Batinah plain have decreased tremendously during the last years due to irrigation of large areas grown with alfalfa (*Medicago sativa*) or Rhodes grass (*Chloris gayana*). This led not only to a lower availability of fresh groundwater for humans, but also to an infiltration of the soils with salt water from the Arabian Sea. Therefore a law was passed that prohibited the irrigation of fodder crops in this region from October 2006 onwards.

Since dairy production is not only an economic issue and a necessity for the nutrition of the Omani people, but also a matter of prestige, the investors of large dairy farms wanted to keep their herds in the Batinah plain and looked for other regions to produce the fodder. Thus, the cultivation of desert areas in inner Oman with alfalfa and Rhodes grass began. Milk consumption in Oman has steadily increased since His Majesty Sultan Qaboos began to produce milk in the country. One result of this increase that can already be noticed is that the people are getting taller. The people want to buy local Omani dairy products regardless of the price and the sustainability of dairy production in a desert country. The animal welfare of Jersey or Holstein Frisian cows in a climate way beyond their physiological optimum is yet another issue that is not openly discussed.

The farm unit near Marmul, which we visited, consists of two large circles, each with a radius of 600 m, and a rectangular field of about 25 ha. The area of one circle is 78.53 ha, so the total area of the farm is about 180 ha. When we looked at the farm on the 6th March 2007 the two circle fields were grown with Rhodes grass. The plants were in the beginning of the ear development and had a fresh green colour without any signs of water or nutrient stress.

Figure 1: Centre Pivot Irrigation at Marmul – Google Earth Image (left) and Rhodes grass (Chloris gayana; right)

Rhodes grass forms strong bunch-type stools. Its runners rapidly cover the ground surface, anchoring at the nodes and producing plantlets. Therefore it is well suited for erosion control. Its vigorous root system gives a degree of drought resistance but it performs best in the 700-l000 mm belt. Rhodes grass shows moderate frost tolerance, but is primarily a summer grower. Rhodes grass is quite versatile in its soil requirements. It is quite salt tolerant, and is one of the best grasses for sowing on earthworks. Rhodes grass will combine with many legumes including alfalfa.

The two circular fields on the farm were both irrigated with a 500 m long centre pivot system. Centre pivot irrigation is a method of crop irrigation in which equipment rotates around a pivot. A circular area centred on the pivot is irrigated, often creating a circular pattern in crops when viewed from above. Central pivot irrigation is a form of overhead irrigation consisting of several segments of pipe (usually galvanized steel or aluminium) joined together and supported by trusses, mounted on wheeled towers with sprinklers positioned along its length. The system is fed with water from the pivot point at the centre of the circle. Most centre pivot systems now have drops hanging from a u-shaped pipe called a gooseneck attached at the top of the pipe with sprinkler heads that are positioned just above the crop, thus limiting evaporative losses. Drops can also be used with drag hoses or bubblers that deposit the water directly on the ground between crops. The crops are sometimes planted in a circle to conform to the centre pivot. This type of system is known as LEPA (Low Energy Precision Application). Originally, most centre pivots were water-powered. These were replaced by hydraulic systems and electric motor-driven systems. Most systems today are driven by an electric motor mounted at each tower. It is a very power-consuming way of irrigation and some farmers build their own Diesel generators for power supply, given the fact that Diesel fuel is cheap in Oman.

The water for the irrigation of the fields is fossil water that is pumped to the surface from a depth of between 100 and 200 m. It dates back to a time when Oman had a humid climate and has an excellent quality. Obviously the use of this water is not sustainable because under the current climatic conditions there is no collection of new water to fill up the old subterranean reservoirs. A huge part of the water is lost due to a very high evapotranspiration of the fodder crop. It is estimated that the fossil water lasts for about 100 years. In terms of the quick development of modern agriculture in Oman, this might be a long time and the people are not really worried about the exploitation of this finite resource because of their trust in new technologies for sea water desalination. At the moment the water is free and the land doesn't belong to anybody, but maybe some regulations like in the Batinah plain will follow for inner Oman as well. From an ecological point of view, there are no constraints for this crop system in the desert.

However, there is no scientific research that accompanies this form of agriculture. It is simply and solely in the hand of rich investors. Because of the high irradiation in the desert and the sufficient supply with water, the crops are highly productive and high yields seem to justify the enormous investments in technology and logistic in this cropping system. Another advantage of growing grass instead of crops that would have a higher water-use efficiency like cotton or tomatoes is that very little human labour and management is needed.

Despite all the drawbacks of this kind of agriculture, there is currently a "fodder boom" in Oman and as long as there is any benefit to get out of it, people will continue to grow grass and legumes in the desert in a not sustainable way.

Small scale orchards and vegetable gardens in Salalah: ecological and economic aspects of urban agriculture

Monika Nikisch

07.03.2007

Salalah is with around 100.000 inhabitants the biggest city of Southern Oman in the Dhofar province. The city is located at the shore of the Arabian Sea, surrounded by three mountain ranges. To the North there is Jebel Qara, to the East Jebel Samhan. To the West lies the mountain range Jebel Qamar and beyond the border to Yemen. The fertile plains around Salalah and parts of Jebel Samhan are known for its lush vegetation in summer. The reason is the summer monsoon. These rainfalls, coming from India, touch this very Southern spot of Oman and make "the desert green". The monsoon provides the possibility for an intensive agricultural production and is further an attraction for tourists. During our stay Omanis often recommended Salalah for spending holiday in summer and enthusiastically reported about the nice possibility to have a picnic outside in the rain or fog.

Reaching the city in springtime we tried to imagine how the dry mountains would look like in summer. Surprisingly, we entered a very green city. As periurban agriculture covers a part of its surface, green plantations caught our eye. North from the main road, Qaboos Street, one finds big stripes of lush plantations, which stretch also along the sides of other roads. The Al-Muntazah Street for example, reaching from the shore to the inner city, provides a scenic drive with view on plantations to both sides. One can also enter the fields through little paths, starting at the backyard of houses or smaller streets. On our excursion through these plantations we got an insight on the organisation of periurban agriculture in Salalah. First, entering a plantation from the backyard of houses, one finds little sheds and flocked animals, mainly single cows, sheep and goats. From the small number of animals one can conclude that animal husbandry is carried out for self-sufficiency. The space, limited through the cities expansion and possibly the fodder production in the plantations limits the extent of animal husbandry.

The little stables are built just to the border of the plantations, which provides easy access to the fodder. In the plantation one finds the crops grown in a multi-storey-system. The highest are the coconut palms, which are dominating South Oman in contrast to the Date palms in Northern Oman. Below one finds papaya and large areas covered with bananas. Single citrus and pomegranate trees are planted at free spots in between the different fields. On the ground grows mainly alfalfa, which is used for animal nutrition. Like in the oasis systems in the mountains in North Oman, irrigation is necessary and is organised through non-permanent flooding of the different fields through a system of channels. Back on the main road one can find several fruit market stands, where fresh fruits of the plantations are offered. Enjoyable is the sweet coconut milk.

Figure 1: A look into the plantations

Wadi Hinna – Dry Forest Vegetation and Baobab Trees

Sara Preißel

07.03.2007

Wadi Hinna is located at 240 m altitude within the Dhofar limestone mountains. The mists of the Indian monsoon supply the area with humidity during the summer months, enabling a unique dry forest vegetation to grow. These closed forests have a high biodiversity; about 200 wooden species have been classified here, of which many are endogenous species. Succulents and thorny shrubs are typical for this vegetation; besides the famous baobab (*Adansonia digitata* L.), we identified *Anogeissus dhofarica*, *Acacia*, *Ficus*, *Euphorbia cactus* and a flowering *Euphorbia balsamifera*, a species which can store water in its swollen trunk. As we could observe, the trees shed their leaves during the dry and hot winter. Due to these xeric conditions, a great majority of the trees grow not more than two to three meters tall, except for the baobabs. The forest is also an important habitat for animals. We could hear and see a great number of different birds, and observed termites for the first time during our trip in Oman. In a gorge with a small water basin, the trees retain their leaves, ferns and reeds grow close to the water, we heard cicadas and saw dragonflies and weaverbirds with their impressing nests hanging in the trees. We found pathways indicating that the area is grazed by goats, cattle and camels. Many shrubs and trees protect themselves with thorns and spines against the various animals feeding on them. Some branches of *Anogeissus* and baobabs have been torn down by camels and livestock herders. On the way we saw Bedouins herding Dhofari Goats, which are short-haired, showing a big variety of colours (brown, white, grey, black) and prints (speckled, dotted), and the Dhofari Cattle, a small landrace (maximum live weight 200 kg) with similar colours.

The tourist attraction of the region are the many baobab trees. While the tourist guide book mentions a population of about 40 trees growing here, we could find a much larger number, at least more than hundred of them. They grow in closest density on the tops of the rocky hills. The baobab tree belongs to the family of the bombaceae and is divided into nine species: *A. digitata* of tropical Africa, *A. gregori* of Western Australia and seven species of Madagascar.

Figure 1: Baobab fruit and its edible fruit pulp (left) and young Baobab trees at Wadi Hinna (right)

A. digitata mainly occurs in Savannah regions, but is distributed across a wide range of soil types, altitudes and rainfall areas between 200 and 800 mm. Western Sudan is supposed to be the northern limit of its natural distribution, but its occurrence in other regions, like Egypt, Yemen and Oman is not totally clarified. With the big genetic and phenologic variability, the existence of subspecies is very likely.

Baobabs can grow up to 25 m tall and 8 m in diameter. In Wadi Hinna they reach a height of 10 to 15 m and a trunk diameter of up to 2 m, thus overlooking the smaller vegetation of the area, and being probably the biggest (non-irrigated) trees in all Oman. Also a great number of smaller individuals could be found. The big pendulous flowers open over night to attract bats for pollination, but wind pollination is also possible. We found no indication that the trees are used except for grazing, even the fruits are not harvested, while in Africa they are used to provide fibers (bark), medicine, forage (leaves) and food (leaves, fruit pulp and seeds).

The baobab is in many different ways adapted to low and irregular water supply. It is able to store huge amounts of water between the xylem layers of its spongy wood. The trunk can expand and shrink up to one cm in girth in one season, depending on the amount of water stored. Baobabs develop an extensive root system to collect rainfall of a large area. The leaves are even more water effective than those of some sclerophyllous species. During dry seasons, they can be shed or a part may be retained. When they have to endure longer droughts without leaves, they can survive continuing a minimum photosynthesis through a green layer of their bark, using the water stored in the trunk.

There are different theories on how this small population of Adansonia came to Wadi Hinna. While some see it to be an endogenous population, some literature sources mention them to have been planted, being part of the African population. The latter seems less probable when looking at the irregular distribution of the trees in that remote area, but would explain their isolated appearance. Different methods to clarify these speculations were discussed. The first steps might be a mapping of the trees and the distribution of height and trunk size. This map could then be analyzed in terms of influence of humidity and altitude. An examination of the age structure of the population would be most helpful, but it bears some difficulties.

Baobabs are reported to reach an age of more than 1000 years, although they are mostly younger than their appearance suggests, because they develop a big trunk very quickly. According to Breitenbach, Baobab trees can be classified into four growth phases by their trunk shape, height and girth: Sapling (up to 15 years), Cone (15 to 70 years), Bottle (70 to 300 years) and Old (more than 300 years). If this classification fits also to the growth conditions in Wadi Hinna, all trees might not be older than 70 years. The large diameter of the trees makes it difficult to take core samples and cores are often rotten. Year rings of baobabs often show discontinuities, so that ring counts are within 2% of real age. Estimations of yearly cambial growth must be made with caution because of a declining growth rate with age and hydrostatic expansion and shrinking. Maybe genetic analyses or ^{14}C age determination could clarify the provenance and relation of the trees.

Altogether, visiting Wadi Hinna was a very interesting opportunity to get a grasp of how diverse the vegetation is in the different parts of Oman and of the influence of the local natural conditions. The dry forests in Dhofar are considered the only real forests of the country and the baobabs are its most prominent trees. It would be very interesting to find out if they are a planted part of the African population or even an endemic subspecies.

Dhofar and the Frankincense Park of Wadi Dawkah

Philip Mundhenk

07.03.2007

Frankincense has been an object of trade since the antiquity and its use accompanied the development, the growth and the decline of numerous civilizations (Arabia Antica 2005). It was known and used by the ancient Egyptians, the Greeks and the Romans, as well as by many indo-oriental people. Around the first century AD until the third century AD, frankincense was as valuable as gold. However, commerce with the incense began earlier. Three thousand years ago frankincense was shipped to Mesopotamia and also to Egypt. Historical sources (e.g. Pliny the Elder) give clear evidence that Dhofar was a region of great importance for production and trade of frankincense. It was the key merchandise for this area. Frankincense is a natural rubber-gum exuded from the bark of trees of the genus *Boswellia* (also called Olibanum). The *Boswellia* trees belong to the family *Burseraceae*. *Boswellia sacra* (Flueck) only grows in northern Somalia, Yemen and south-western Oman. There are some other species of *Boswellia* which do not occur in Oman (e.g. *Boswellia serrata* (Roxb.) in India, *Boswellia papyrifera* (Del.) in Ethiopia). The tree reaches heights up to 5 metres. It has a papery peeling bark and single trunks or, more commonly, several from a disk like base (Miller and Morris 1988). Pinnately compound leaves cluster at the end of branches. Small white to pale pink flowers appear on the tree from September to November (Thulin and Warfa 1987).

To obtain the resin, trees are scored at various places along the main trunk and branches with a special designed tool (called mengaff) or an ordinary axe. The milky liquid which comes out of the tree hardens into droplets or tears. Those can easily be detached by collectors. After collecting the resin it is stored for approximately twelve weeks to harden again. The frankincense which is bright in colour is regarded to be of high quality, compared to darkish pieces. Frankincense has numerous traditional, religious, ceremonial and medicinal uses. Terracotta burners, whose design has not changed for centuries, are often used to burn the dried resin. The incense is also chewed to strengthen teeth, or stimulate digestion (Marshall 2003). Frankincense is used during festive events like weddings, or a birth. Dried frankincense resin may also be burnt to perfume clothes, or hair. Moreover, frankincense is simply used to demonstrating one's hospitality to visiting guests. Beside the resin, the bark of the *Boswellia* tree is also used for many medical purposes.

The southern region of Oman, extending from the Gulf of Hasik to the Yemen border is called Dhofar. The region is characterised by a mountain range running parallel to the coast. The highest mountain in this area, the Jabal Samhan, rises up to over 2000 m. From June to September, during the SW monsoon, the mountains form a natural barrier, stopping fog and rain from penetrating inland. Due to this the natural vegetation at the coastline is very different from the rest of the country. The northern slopes gradually sink into a dry plateau, followed by a succession of cliffs and gullies dissected by numerous wadis, northwards crossing a vast desert area (Arabia Antica 2005).

As it was already mentioned in the beginning, frankincense played an important role for the development of the Dhofar region. *Boswellia sacra* grows only in this province of Oman. The frankincense was transported either to the port of Aden (Yemen), or directly through the red sea north to Egypt or Gaza. Later on, when the camel was domesticated, people also transported goods across the Arabian Peninsula. Nowadays, huge amounts of frankincense are sold on the markets (souqs) in Salalah, the capital of Dhofar. But the value of the incense decreased over the years (around 10 Rial per kilogram; personal notes). That is one reason why the frankincense which is purchased in Oman comes mainly from Somalia, besides Ethiopia and Eritrea, the biggest exporter of this good (personal notes).

Approximately 40 km north of Salalah the Frankincense Park of Wadi Dawkah (UNESCO World Heritage) is located. The Wadi Dawkah Frankincense Park covers an area of 7.964 km^2. The central feature is a north-draining wadi on the edge of the desert. The frankincense trees are to be found in the flat bed of the wadi. The higher areas within the park are largely acacias and similar species that can tolerate the more extreme conditions (UNESCO 2007). Due to a Royal Decree of Sultan Qaboos the park is now a protected area.

The *Boswellia* trees within the park have a life span of around 150 years (personal notes). Some of them are suffering from camel browsing. The trees next to the road and the parking place are mostly irrigated. Recently 5000 new trees were planted in the area.

Figure 1: Boswellia sacra – the frankincense tree and its priced resin at the Frankincense Park of Wadi Dawkah

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The historical site of Al Baleed

Jim Ruppert

07.03.2007

Al Baleed, the historic port town of Dhofar, is situated at the eastern outskirts of the south Oman city of Salalah in the immediate vicinity to the Indian Ocean. Since its origin in the Bronze Age (2000 BC) and its continued rise during the Late Iron Age (300 BC- 630 AD), it was a key centre which dominated the East African, Indian and Chinese trade. Both Arab and European historical references indicate that it was rebuild a number of times from the 10th century AD to its final demise at approximately 1221 AD. It was mentioned by Arab historians and travellers like Ibn Mujawir (1232 AD) and by Ibn Battuta (1329 and 1363 AD) as one of the important Omani harbours who traded not only the Arabian Gold, the frankincense, but also horses and other to goods to Indian harbours. The archaeological finds prove that there was intensive trade with China, latest beginning with the 9th century along with the regular bi annual monsoon winds around India and through the Straight of Malacca.

Figure 1: Google Earth Image of Al Baleed, the historic port town of Dhofar

Al Baleed's layout is similar to other Southern Arabian ports, such as Sohar. A major lagoon or khor, created by a series of spring run-offs from the Dhofar hills, is situated immediately north of the city. Concerning its prosperity from foreign trade, smaller boats would enter the lagoon to a customs house off-loading the cargo from the ocean-going dhows anchored offshore. The formidable city wall with at least four gates and associated bastions (Ibn Mujawir 1232 AD) is at least 2 km long and about 4 m high in places, protecting the western sector of the city which covered about 25 ha.

The remains of the west city Gate were first exposed in 1962, the remains of the massive blocks forming the door jambs and the threshold can still be seen in situ. The south west city gate gave access to a projecting jetty some 50 m to the south along the coast. These gates are probably two of those four mentioned by Ibn Mujawir. The large urban area dominated by formal buildings such as mosques and houses can be seen along the western portion of the city. The large open spaces of the eastern part of Al Baleed may have held horse stables, sardine drying fields and frankincense storage areas.

The Al Baleed Grand Mosque goes back to the 10th century AD. Its size of 1,732 m^2 confirms the wealth of the city. The ablution area consists of four chambers with wash basins supplied by a well at the south end. The main prayer hall was the largest part of the mosque. The roof was supported by over 144 columns. During its last phase, the prayer hall was reduced to the area adjacent the Mihrab. The Mihrab is a semi-circular niche in the wall which indicates the direction of the Mecca and the direction to face for prayer. The courtyard measures 14 m x 12 m and was the main source of light and ventilation for the prayer hall. The Minaret, the tower from which the Muezzin intones the call to prayer five times each day, would have been at least 5 m high.

Figure 2: The Grand Mosque at Al-Baleed

Today it is the only one of many harbours who traded with China, which has been excavated and being turned into an archaeological park to be adding to cultural tourist attraction. With more than 64 hectares it is the only one and largest in the inter-region.

The park is clearly separated into two: one entrance area north to the site and separated by a water arm of the old harbour and the site itself, well protected as in old days by its moat on three sites. Both areas are connected by an elegant bridge. The entrance area being free of any archaeological remains consists of a frankincense centre as exhibition ground with administration, sufficient parking and a refreshment zone. The site itself has been equipped with a 2.2 kilometres long access path built on protective geo-textiles on top of the archaeological surface. It is planned to keep the excavation activities as part of the exhibition program for the visitors. With the landscaping, the natural surrounding has been integrated into the archaeological program.

Rasat Farm in Salalah

Julia Frenzel

08.03.2007

Before heading 1,000 km back to Muscat our last scheduled event in the Dhofar Region was the guided tour through the Royal Farm in Salalah. Salalah is the home town of His Majesty the Sultan of Oman (HM) and he gives special attention to his activities there. Here in the tropic south HM puts organic principles on his farm to the proof. This protocol gives first a general overview about the farm activities. The chapter crop husbandry describes the grown plants we saw whereas in animal husbandry the interview with the livestock manager afterwards is recapitulated.

The farm

The royal farm consists of 450 ha in total. This includes a residence for HM and ornamental plants and alleys for representative purposes. That is why the entrance is guarded and access for groups is only allowed with a guide. The farm operations manager who was native to Pakistan lead us around the farm in small buses.

Salalah's climate is characterised by high temperature through out the year and summer monsoon from June till September. The high quantity of rain during monsoon protects the cultivated soils from salinisation due to leaching. Through the dry months irrigation water is coming from one single water reservoir. In contrast to European agriculture nitrogen deficiency is usually not limiting plant growth.

Different irrigation techniques are used on the farm. There are flooding, sprinkler and drip irrigation. The irrigation system that is installed on one field determines the cultivated crop and the used cultivation techniques. E.g., in rotation systems the distance between the planted lines follows the consistent irrigation line which is installed for the crop with the widest distance between each plant. Labour intensive cultivation techniques are mostly done by foreign workers because they are cheaper. An ordinary farm worker earns around 150 €/month. There are also very well-paid foreign experts working like the British livestock manager and the Pakistani farm operations manager that answered our questions.

In 1995 HM ordered to start growing organic lettuce. Since his accession to power he is engaged in nature conservation and environment protection, and is e.g. growing some regional mountain trees on the farm. Now HM is interested in developing methods for an environmentally friendly agriculture that is adapted to the special conditions of his country. The farm started the experiments a century ago by decreasing the application of chemicals. Since 2005, 60 ha of the royal farm are certified organic by EcoCert (EU-standard). Beside extending the organic farm area the next target is to get certified by Demeter International to become premium organic.

An interesting opportunity for organic weed control in Oman is the so called solarisation. The soil surface where plants are unwanted is covered with transparent sheeting so that the sun burns the plants below. One problem is adding nutrients to the soil without having organic manure. This problem is solved with composting organic and non-organic plant residues and non-organic manure from the farm. According to the organic regulations, decomposition processes are assumed to destroy antibiotics and other chemicals. Due to high temperatures and added water, turn-over rates are quite high. The advantages are little ammonia emissions, quickly available nitrogen and a quick decrease of antibiotics. The big disadvantage is that the fast decomposition continues after the application to the soil and the organic matter is quickly demineralised. Regular applications of high amounts of organic material are needed to uphold/increase long term soil fertility. Nitrogen is not the limiting

factor but carbon is. In total 200 t of compost are produced per year (=10 – 20 t/ha organic fields/year). Patent kali and rock phosphates are added to the compost to increase plant availability of potassium and phosphorus. In addition to the compost, fish powder and sea weed are used as fertilizers and green manure crops like Sesbania and sorghum (no alfalfa) are grown.

Crop husbandry

Lime is a very popular fruit in the Sultanate. They are consumed fresh or dried as an additive to spices or tea. Different Omani varieties of lime are grown on the farm since 4 years. Fortunately they do not have any problems with the Witches' Broom Disease of Lime (WBDL) which kills trees in less than 5 years and has become a major limiting factor for lime production in Oman. The regional varieties posses a high acidity. From July to August the mature fruits are collected from the ground under 500 trees. The yield reaches up to 80 - 90 kg/tree (about 10 t/ha). In March chemicals are sprayed against the leaf miner.

Organic tomatoes are grown under a net greenhouse. That makes the pollination of the tomato flowers with bumblebees easier because they do not fly away. Pollination by hand is reducing the number of fruits, but the fruits are bigger. Due to availability of cheap labour, this method is also used. The net protects the plants from many insects. Only little amounts of neem extract are sprayed to combat insects. *Phytophtora* infestation is absent in tomato but present in cucumber. Altogether the organic tomatoes have fewer pests than their conventional sisters on the farm.

Before the tomatoes are planted sorghum is incorporated into the soil together with 25 t of compost, fish powder (2 x 200 kg/ha) and sea weed. The farm buys seeds from abroad. They harvest around 70 – 80 t organic tomatoes/ha. That is 10% less than in the conventionally produced ones. Throughout one year the following plants are grown in rotation on the same plot: tomato – cucumber – fallow – green manure – lettuce.

Omani tomato varieties are also grown outdoor in an extensive non-organic production system. Chemical fertilizer and pesticides are reduced to a minimum. After the tomatoes, papayas are grown for 2.5 years and then bananas for 3 years. The irrigation lines are adapted to the tree crops. Therefore the tomatoes are planted in an unusual large distance between each single plant. This cultivation system provides a small tomato yield per area but also needs less labour. Around Salalah a high demand for the red fruits exists. The farm sell them to the wholesalers for around 0.3 €/kg and the consumers buy them for around 0.5 €/kg.

The legume shrub Sesbania is grown as green manure. Before reaching a height of 2 m the plant is cut and incorporated into the soil. Yet after 45 days of growing an appreciable nitrogen fixation can be measured. The average of fixed nitrogen is about 100-200 kg N/ha/year. In contrast to Europe nitrogen is normally not the first or second limiting factor for agricultural production. Sesbania is propagated through own seed collection. Besides enhancing soil nutrition and structure the plant is also used as a windbreak.

Peppers are grown using a low amount of chemicals. They also use neem extract against insects. Birds are damaging the fruits.

Chico or Sapodilla (*Manilkara zapota*) is a long known tree crop in Oman but it is native to the tropics of the Americas. The apple-like fruits are popular in the Sultanate. The trees in the plantation were 18 – 20 years old.

Two groups of banana varieties are grown on the farm: the long varieties (mostly "William") and the traditional short varieties. "William" is providing a yield of 2 t/ha/year (= 45 – 50 kg/bunch) which is 1000 t of bananas in total. The healthy plantation is not sprayed against pests. The early cut off of male flowers also helps to reduce harmful insects. The difference between organic and non-organic bananas is mainly the lower plant density in the organic system. In banana husbandry one man is needed to care for 2 ha of plants including the own sucker production.

For establishing a papaya plantation, 5 seedlings are planted per spot. Later 4 of them are removed depending on the sex of the young plants. Male plants are only needed for pollination. Therefore just 8 % of trees are male and allotted in the field like ∞ . Hermaphrodites (trees harbouring both sexes) are unwanted because their fruits are smaller. 10 months after planting the harvest starts and continues all year round till the end of the plantation (normally 2 years of harvest). The farm harvests on around 20 ha 20 – 30 t of fruits/ha. The grown local variety increases in sweetness in case of high photosynthesis activity of the plant.

For potato cultivation, the farm buys planting material from the Netherlands. Potatoes are planted at the end of November. In the end of March 10 potatoes per plant, approximately 20 t/ha - can be harvested. Before potato, corn is grown on the field as animal feed (silage). As for carrots, the Californian variety is grown without any chemical sprays or fertilizers but however not yet certified as organic. Under the warm climate conditions through the whole year the young carrots grow quite fast and do not have a problem with faster growing weeds like in Europe, but high soil temperatures cause some problems. 40 t/ha of carrots are harvested every year. Narrow stripes of radish are grown alongside the carrots for phytosanitary purposes. The Brassicaceae catches nematodes and insects who therefore disregard the carrots. The minimum-of-chemicals method is also tested on onions, lettuce and cabbage.

On 10 -12 ha the red grape variety Cardinal is grown on the farm for 15 years. 15 – 25 t of grapes are harvested every year.

Animal husbandry

The farm keeps 160 milking Jersey cows plus calves and temporarily not milked cows. The fodder mainly consists of maize silage in a total mixed ration. The used feed-to-milk method recommends only a little amount of hay per day. The tropical climate provides a lot of stress for the temperate breed which can be noticed in fertility problems and low milk production. Cooling techniques like sprinkling with water are installed in the stables to improve milk yield and animal welfare. The average milk yield per cow is 5,700 l/year. 3,000 l of milk are processed daily on the farm into drinking milk, yoghurt, cream, cottage cheese and delicious ice cream. 11,000 l are consumed by the Diwan (HMs household) every year. The rest is sold in Salalah.

To meeting HMs demand for camel milk, a camel herd of the Dhofari milking breed is also kept on the farm. The feed consists of grazing on pastures and fodder crops.

800 Dhofari goats (regional breed) and other goats are kept for fattening and milking. The animals graze on pastures and are fed with additional fodder crops. 3 types of sheep are kept on the farm. Altogether they count around 600 heads.

7,000 chicken are kept for egg production and hatching.

Schedule of the preparatory seminar / presentations

Ten student presentations on political, social, economic, bio-physical, agronomic and ecological aspects of the host country Oman were held during a preparatory seminar in winter semester 2006/07. Each topic was jointly prepared and presented by two participants. The seminar schedule and topics are given in the table below.

Date/Time	Programme	Location
25.10.2006 Wednesday 18:00 – 20:30	Introduction to the excursion programme and the host country Oman, Introduction and assignment of seminar topics, Schedule of further meetings, Credits	Witzenhausen Alte Aula Nordbahnhofstrasse
17.01.2007 Wednesday 18:00 – 20:30	*Oliver Hunkler & Peter Wolanski* Governance and democracy in Oman *Priska Dittrich & Anne Hoffmann* Islam and the particularities of the Ibadi denomination	Witzenhausen Seminar room S1 Steinstrasse 19
27.01.2007 Saturday 10:00 – 15:00	*Julia Frenzel & Rico Ihle* The role of women in Oman and in the neighbouring states *Christian Beuter & Philip Mundhenk* Economic development in Oman: from Mangan until the 21st century *Jim Ruppert & Marc Wolf* The evolution of rainfall across the Arabian Peninsula *Irma Mika & Nina Stephan* Nature reserves and sanctuaries: Oman's efforts in conservation of biodiversity *Sara Preißel & Moritz Reckling* Irrigation and salinization: a comparison of traditional and modern irrigation agriculture	Göttingen Seminar room L03 Kellnerweg 6
01.02.2007 Thursday 18:00 – 20:30	*Invited lecture: Ingeborg Guba* The Geology of Oman *Ute Gilles & James Thompson* From palm gardens to garbage dumps: an analysis of the structure of selected oases settlements from satellite images *Natacha Crozet & Julia Jawtusch* Camels, horses and goats: scientific and spiritual characterization of Oman's major livestock species and breeds	Göttingen Seminar room L03 Kellnerweg 6
17.02.2007 Saturday 10:00 – 12:30	*Organisational Meeting* *Elisabeth Hüsing* The vegetation of northern and southern Oman *Film* The geology of Oman	Witzenhausen Seminar room S1 Steinstrasse 19

An introduction to Oman

Felix Richter

Sultanate of Oman fact sheet

Form of government:	Monarchy (Sultanate)
Head of State (Sultan):	Qaboos bin Said al Said
Capital:	Muscat (650,000 inhabitants in the Capital Area)
Official languages:	Arabic
Area:	309,500 km² (70th)
Population (July 2005) / population density:	2,567,000 (140th) / 8.3/km² (211th)
Independence:	1650 (Portuguese expelled)
Currency:	1 Omani Rial (1000 Baizas) = € 2.15
Gross Domestic Product (GDP) (2005) Total / per capita:	US$ 40.923 billion (85th) / US$ 16,86 (41st)
Human Development Index (HDI) (2004):	0.810 (high) (56th)
Literacy Rate (2003):	male: 83.1% / female: 67.2%
Time Zone:	CET + 3 (Central European Time) CEST + 2 (Central European Summer Time)
National Holiday:	18th November (birthday of Sultan Qaboos bin Said)
Member of International Organisations:	UN (since 07.10.1971) Arab League (since 29.09.1971) Gulf Cooperation Council (since 25.05.1981) WTO (since 09.11.2000)

History

In the Bronze Age, about 2300 BC, the northern part of Oman was already known by the Sumerians under the name Magan. It was rich in resources like copper or diorite and traded them by ship from Sohar, a town 230 km north-west of Muscat, with the Sumerians. Later Oman constituted one of the "Satrapies", the provinces of the ancient Achaemenid Persian Empire (648 BC - 330 BC). It was incorporated into that empire around 563 BC. This earlier empire was succeeded by the Sassanian Empire in the third century AD (226 – 651 AD). In the 6th century BC the Persians introduced the aflaj (singular: falaj), a water management system used to provide a reliable supply of water to human settlements or for irrigation in hot, arid climates. Some sources, however, believe that the ancient Persians adopted this technology from Oman because there were settlements from around 1000 BC found close to aflaj, while the Persian irrigation canals were first known in the 6th century BC.

By the beginning of the first century of the Common Era, Arab tribes began to settle in Oman. In 632, the Sassanids lost power and Arab dominance in Oman was established. In the 7th century the Islam was adopted in Oman and the area became part of the caliphate of the Umayyads (661 – 750) and the Abbasids (750 – 1258), which were both Sunni dynasties. In Oman, however, Ibadi Islam, a form of Islam distinct from Shia and Sunni Islam, became the dominant religion in the 8th century. The Ibadi Muslims established an Imamate, where the Imams exercised spiritual leadership and secular power over the country. Sohar grew in this time to one of the most important trading places in the Islamic world with maritime trade to India, China and East Africa and was said to be the birthplace of Sindbad the Sailor. It was destroyed in 965 by the Buwayhids, a Persian-Shiitic dynasty, and Persian conquerors occupied the country several times before the Portuguese captured Muscat in 1508, which was then the main port. They held control over the coastal cities and the maritime trade for over a century before they were expelled in 1650, after Nasir bin Murshid (1624-1649) had unified the tribes

of Oman in the fight against the Portuguese. He was elected as Imam and transformed this office into a hereditary title, which was the beginning of the Yaruba-Dynasty (1624 -1743). In this time Oman began to become a powerful seafarer and trading nation and frankincense, gold, ivory, spices and slaves were shipped to India, China and East Africa. During the struggling for power after the last Yaruba-Imam, Oman was again occupied by Persia between 1743 and 1746. Ahmad bin Said unified all tribes and drove away the Persians in 1746. He was the founder of the Said-Dynasty which still governs Oman.

In the early nineteenth century, Muscat and Oman grew to be a major power, having possessions in East Africa, mainly the island Zanzibar and in Pakistan. In 1861 the empire was divided into the Sultanate of Oman and the Sultanate of Zanzibar. Muscat and Oman became a British protectorate and with the loss of the East African possessions and the ban of slave trade the fast economic decline began.

During 1970, while Oman was still a protectorate, Sultan Said bin Taymur was ousted by his son, Sultan Qaboos bin Said al Said, who has reigned since then. Sultan Qaboos has greatly improved the economic situation of the country with the help of the money from oil production, which began in 1967. He modernised the country, which was plagued by endemic disease, illiteracy and poverty and transformed it into a modern industrial nation within a few decades. In 1996, the Sultan presented the "Basic Statutes of the State", Oman's first written "constitution", that clarifies the royal succession, provides for a bicameral advisory council with some limited legislative powers and a prime minister and guarantees basic civil liberties for Omani citizens. Military bases in Oman were used in 2001 by US forces involved in ground raids against Taliban forces in Afghanistan. In 2003, the lower house of the advisory council was freely elected for the first time. Oman's moderate, independent foreign policy has sought to maintain good relations with all Middle Eastern countries.

Geography

Oman is located in the south-eastern quarter of the Arabian Peninsula. The Sultanate is flanked by the Gulf of Oman in the northeast, the Arabian Sea in the southeast and south, the Rub al Khali (Empty Quarter) of Saudi Arabia in the west and Yemen in the southwest. The border to Saudi-Arabia was not determined until 1999. These geographical factors contributed to the isolation of the inner Oman. Historically, the country's contacts with the rest of the world were by sea, which not only provided access to foreign lands but also linked the coastal towns of Oman. The Rub al Khali, difficult to cross even with modern desert transport, formed a barrier between the Sultanate and the Arabian interior. The Al-Hajar Mountains with the highest peak Jabal Shams (3,074 m) form a barrier between the fertile coastal plain Al-Batinah and the desert from the Musandam Peninsula to the city of Sur at Oman's easternmost point. The most important cities of Oman Muscat, Sohar and Sur are located along the coast in the northern part of the country. In the southwest part of the country is another fertile coastal region with the city Salalah, the province capital of the province Dhofar.

The land area of Oman shows varying topographic features: valleys and desert account for 82% of the land mass; mountain ranges for 15%; and the coastal plain for 3%. Natural features divide the country into seven distinct areas: The peninsula Musandam, the Al-Batinah coastal plain, the Muscat-Matrah coastal area, the Al-Hajar Mountains, the inner Oman, the eastern coastline including the island of Masirah and the Dhofar region.

The exclave Musandam is an extension of the Al-Hajar Mountains and borders the Strait of Hormuz, which links the Persian Gulf with the Gulf of Oman. It is separated from the rest of the Sultanate by a strip of territory belonging to the UAE. This area consists of low mountains and two inlets, Elphinstone (Khawr ash Shamm) and Malcom (Ghubbat al Ghazirah). The coastline is extremely rugged, and the inlet, 16 km long and surrounded by cliffs have frequently been compared with fjords in Norway. The capital of this region is Khasab.

The narrow, well-populated coastal plain Al-Batinah runs 140 km from the northern border of the Sultanate southeast to the town of As Seeb, which is about 50 km west of Muscat. Across the plains, a number of wadis descend from the Al-Hajar Mountains, conducting enough water to enable fruit and vegetable growth.

South of As Seeb, the coast changes character. For about 175 km, from As Seeb to Ras al Hadd, it is barren and bounded by cliffs almost its entire length. There is no cultivation and little habitation. Although the deep water off this coast renders navigation relatively easy, there are few natural harbours or safe anchorages. The two best are at Muscat and Matrah, where natural harbours facilitated the growth of cities centuries ago.

The Al-Hajar Mountains form two ranges, the Al-Hajar al Gharbi Mountains (western part) and the Al-Hajar ash Sharqi Mountains (eastern part). They are divided by the Wadi Samail, the largest wadi in the mountain zone, which forms the traditional route between Muscat and the interior. The general elevation is about 1,200 meters, but the peaks of the high ridge Jabal al-Akhdar (Green Mountain) rise to more than 3,000 meters.

South of the coastal plain on the other side of the Al-Hajar Mountains lies the inner Oman with parts of rocky desert and sand dunes leading west into the Rub al Khali, the largest sand desert in the world. The eastern coastline, where low hills and wastelands meet the Arabian Sea, is desolate for long distances. Midway along this coast and about 15 km offshore lies the barren Masirah Island. It is about 70 km long and sparsely populated.

The Dhofar region forms the south-western part of the Sultanate and borders to Yemen. Its exact northern limit has never been defined. From the coast the land rises to he highest peaks about 1,000 meters a.s.l. Located on the fertile coastline is the province capital Salalah, which was the permanent residence of Sultan Said bin Taimur Al Said and the birthplace of the present Sultan, Qaboos bin Said.

Climate

The climate of Oman has two basic specifications: arid subtropical climate. In most parts of the country it is extremely hot and dry throughout the year. Four climatic regions can be distinguished:

The northern coast:

In this area, the climate is subtropical with warm winters (22-25 °C) and hot summers (36-39°C and peak values of 45°C). There is no great variation between day and night temperatures, so that summer night temperatures are rarely below 30 °C. Humidity is very high throughout the whole year (60-80%), but the annual precipitation is only about 100 mm (10-20 days with rain). Most rain falls in form of downpours between December and March with high flooding risk, because of the slow water uptake of the dry dusty ground. The water temperature in the sea is between 24°C in the winter and 31°C in the summer.

The Al-Hajar Mountains:

In this area the winters are cool and the night temperature can drop below 0°C in January and February, sometimes with snow. Precipitation can be up to several hundred mm, but the mountains are bare without vegetation. During the summer there is no precipitation and the day temperatures can climb up to 30°C and more. The nights can be very chilly though.

The inner Oman:

This area has a typical desert climate with cool to warm winters and extremely hot summers. In January the day temperatures are about 25°C but in the night they can drop to 10-12°C. The rare rainfalls occur also during this period. The day temperatures in the summer can be as high as 52°C

with mean values of 41-44°C. In spite of considerable day-night fluctuations, the night temperatures drop rarely below 25°C. Humidity is very low throughout the year with summer values of about 20%.

The South / Dhofar:

This region has a completely different climate. The air is warm and humid during the whole year. The winter temperatures are about 27-28°C during the day and 20-22°C at night. In this period there is only little rainfall and humidity is about 50-60%. The early summer is the hottest period with day temperatures of 31-33°C and similar night temperatures. Peak values of over 40°C can occur when hot winds are blowing from the inner Oman. In July, August and September the monsoon brings about 22 days with rain each month, mostly drizzle associated with low clouds and fog. Humidity is about 80-90% in this time and the temperatures drop to an average of 25°C. There are no day-night fluctuations during this period. The sea water temperature is between 24°C in the winter, 29°C in early summer and about 25°C during the monsoon period.

Flora and Fauna

Due to low rainfalls the natural vegetation in Oman is sparse and dominated by resistant Acacia trees. In the mountains, however, trees like cedars and olives are growing. In Dhofar, dependent on the monsoon, a lot of different and for the Arabian Peninsula untypical plants are growing. This region is also the source of frankincense, which is a resin from the *Boswellia sacra* tree.

Oman has about 85 indigenous bird species, but also migratory birds can be watched. In total more than 450 bird species have been recorded. The coastal waters are the home of many fish and whales and dolphins can be watched there. Sea turtles lay their eggs on the beaches of Oman and there are several sanctuaries to protect them. The Arabian Oryx, an antelope species of the deserts, which was extinct in the wild in 1972, was resettled in the 1980s in a sanctuary. This Arabian Oryx Sanctuary became a UNESCO world heritage site in 1994.

Population

In Oman, about 50% of the population lives in Muscat and the Al-Batinah coastal plain. Some 600,000 expatriates live in Oman, most of whom are guest workers from India, Pakistan, Bangladesh, Egypt, Jordan, and the Philippines. Some demographic estimates from 2005 are shown below:

Age structure	0-14 years:	42.6%
	15-64 years:	54.9%
	65 years and over:	2.5%
Birth rate:	36.73 births/1,000 population	
Death rate:	3.86 deaths/1,000 population	
Infant mortality rate:	19.51 deaths/1,000 live births	
Life expectancy at birth:	male:	70.92 years
	female:	75.46 years
Urbanisation:	About 78% of the population is urban.	

Religion

Ibadi Islam is a form of Islam distinct from Shia or Sunni Islam and is one of the oldest schools, founded less than 50 years after the death of Muhammad. Oman is the only country in the world where the Ibadis form with 75% the majority of the population. The school derives its name from Abdullah ibn-Ibad at-Tamimi. The followers, however, claim its true founder was Jabir ibn-Zaid al-Azdi

from Nizwa. Ibadi communities are generally regarded as conservative. They believe that the attitude of a true believer to others is expressed in three religious obligations:

walayah: friendship and unity with the practicing true believers, and with the Ibadi Imams.
barah: dissociation and hostility towards unbelievers and sinners, and those destined for hell.
wuquf: reservation towards those whose status is unclear.

Ibadis regard other Muslims not as kuffar, "unbelievers", but as kuffar an-nima, "those who deny God's grace" and they deny walayah to those other Muslims. Ibadis also have several doctrinal differences with orthodox Sunni Islam, chief among them:

Muslims will not see Allah on the Day of Judgement. This is contrary to the mainstream Sunni belief that indeed Muslims will see Allah with their eyes on the day of Judgement.

Whosoever enters the hellfire, will live therein forever. This is contrary to the Sunni belief that those Muslims who enter the hellfire will live therein for a fixed amount of time, to purify them of their shortcomings, after which they will enter Paradise. Sunnis also believe that unbelievers will remain in hell forever.

Ibadis have also a different belief about the legitimate succession of Muhammad than other Islamic schools. They keep extremely close to the Holy Scripture, but are today a very pluralistic and tolerant group. Ibadi Muslims are also found in East Africa (especially Zanzibar), Libya, Algeria and Djerba Island in Tunisia.

Politics

Since Oman is an absolute monarchy, the hereditary sultan is not only head of state but also head of the government. He rules the Sultanate with the help of ministers. As a kind of constitution serves the "Basic Law of the State", which was presented by Sultan Qaboos in 1996. The sultan does not designate a successor when alive. Instead, the ruling family tries to unanimously designate a new sultan after his death. If they do not designate a new ruler after three days, then they open a letter left to them by the deceased sultan, containing a recommendation for a new sultan. It is assumed that the ruling family will agree on this person as the successor.

The Sultanate has neither political parties nor legislature, although the representatives in the bicameral parliament provide the government with advice. Universal suffrage for those over 21 was instituted on 04.10.2003. Over 190,000 people (74% of those registered) voted to elect the 83 seats, amongst them two women, of the Consultative Assembly (Majlis al-Shura) for three years. However, the monarch makes the final selections and can negate election results. The other chamber, the Council of State (Majlis al-Dawla) has 41 members, who are directly appointed by the sultan. Oman's judicial system traditionally has been based on the Shari'a, the Koran laws and the oral teachings of the Islamic Prophet Muhammad. Recent royal decrees have placed the entire court system under the control of the Ministry of Justice and a supreme court is under formation.

Oman is divided into five regions (mintaqah) and four governorates (muhafazah). The regions/governorates are further subdivided into 59 districts (wilayats), presided over by governors (walis) who are responsible for settling local disputes, collecting taxes, and maintaining peace.

Regions:

Al-Batinah
Ad Dakhiliyah
Al-Wusta
Ash Sharqiyah
Ad Dhahirah

Governorates

Muscat
Musandam
Dhofar
Al Buraymi
(split in 10/2006 from Ad Dhahirah; located in the north west corner of Oman, adjacent to the border with UAE)

Economy

Since 1967 the economy of Oman has been dominated by its dependence on crude oil. Today oil represents about 90% of Oman's exports. In addition natural gas has been produced since 1978. The income generated was quickly deployed into building infrastructures of roads, schools, hospitals, water and electricity generating plants. All of these activities have made Oman a major success story for economic growth despite being the only oil-producing nation in the Middle East that is not a member of OPEC. Other exports are fish, metals and textiles.

Agriculture and fishing are the traditional way of life in Oman and 42% of the population is still working in this sector. Dates, limes, pomegranates and tobacco are grown, mostly in the Al-Batinah coastal plain and in the region around Salalah. Coconut palms, wheat, and bananas also are grown, and cattle are raised in Dhofar. Other areas grow cereals and forage crops. Poultry production is steadily rising. The coastal waters around Oman have large fish populations. The main fish exports are tuna, swordfish and shark.

Education

Although there is no compulsory education, 90% of the children go to school which is free of charge. Education is a main responsibility of the government but private initiatives are supported as well. When Sultan Qaboos began his reign in 1970, only three boy schools existed in the whole Sultanate and there only the Koran was taught. In 2004, there existed by contrast 1,038 schools, of which 430 were primary schools, 608 secondary schools, 142 private schools and 3 schools for handicapped children. Almost 600,000 children of both sexes went in 2004/2005 to school. This reflects, at a total population of 2.6 million, the young age structure of Omani society.

The system of higher education in Oman is quite recent. The first state university, the Sultan Qaboos University in Muscat, was founded in 1986. The system is binary with universities and colleges. There is one state university, three private universities, six state colleges and twelve private colleges. The colleges educate only at undergraduate-levels and no research is carried out there. The language in all institutions is mainly English. The demand for places in the higher education is bigger than the supply and the selection of students is highly competitive.

Governance and Democracy in Oman

Oliver Hunkler & Peter Wolanski

The Omani History

"The Sultanat of Oman is a country in Southwest Asia, on the southeast coast of the Arabian Peninsula. It borders on the United Arab Emirates in the Northwest, Saudi Arabia in the West and Yemen in the Southwest. The coast is formed by the Arabian Sea in the South and East, and the Gulf of Oman in the Northeast. The country also has an enclave enclosed by the United Arab Emirates." (wikipedia.org)

Early History

Until the revelation of Islam, Persian rulers shaped and determined the cultural and trading environments of Oman (Kechichian, 1995: 20). The first Arab settlers entered in the second century AD. Others followed those first migration from Western Arabia (Kechichian, 1995: 21). In 600 AD the interior population belonged mainly to the mountain Bedouins. On the coast the Arabs settled and became fishermen, sailors, and traders (Kechichian, 1995: 22). The approaching of Islam resulted in the eviction of the Persians from Oman and the transfer of power to the Arabs (Kechichian, 1995: 22).

The First Imamate

The Fist Imamate unified Oman as a nation by the Ibadhi1[2] theology (Kechichian, 1995: 24). The period between the 9th and the 17th century brought a development in which the interior was literally cut off from the wealth of the coast (Kechichian, 1995: 27). From interior isolation unique introspection qualities were developed that further shaped the Omani national character (Kechichian, 1995: 27). It is important to mention that tribal alienation occurred during this period that confirmed interior isolation. Tribes of the United Arabian Emirates, Qatar, and Bahrain sought political independence from the British while refusing to adhere to the historical Omani community (Kechichian, 1995: 27). Oman disintegrated as the Portuguese fortified their presence along the coast (Kechichian, 1995: 28).

The Imperial Age

The period of political decay was capped by the Iranian occupation of Muscat and Sohar in 1743 (Kechichian, 1995: 29). The occupation resulted in the rising of the remarkable Leader Ahmad bin Sa'id. His objectives: independence of Oman, restoration of empire and supremacy in the Persian Gulf, to reassert the realm's unity (Kechichian, 1995: 29). Having expelled the Persians and brought an end to bitter civil war, his authority was based on widespread support. As a result he achieved a greater measure of unity than the country had ever known (Kechichian, 1995: 29). As Imam Ahmad he imposed unity on Oman using whatever methods he deemed appropriate to achieve his objectives. Having consolidated his dominance within the country, he carried on his successful struggle to restore Oman's dominance in the Persian Gulf. By the time of his death in 1783, Ahmad had reached all his objectives (Kechichian, 1995: 29).

Under his rule, Muscat prospered. Upon his death, the Imam's second son, Sultan bin Sa'id, was elected Imam. He moved the capital from Rustaq to Muscat, where he ruled using the title "Sayyid"[3]. The name of the country was changed from "Oman" to "Muscat and Oman," thereby planting the seeds of another future division of the country, between traders and traditionalists (Kechichian, 1995: 30).

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[2] Dominant form of Islam in Oman. Founded less than 50 years after the death of Muhammed (wikipedia.org)

[3] The word means literally "master" ; the closest English equivalent would be "sir" or "lord". (wikipedia.org)

Because it lacked in strong leadership and military strength Oman fell prey to two invasions between 1803 and 1807, both originating in the Najd, what is today Saudi Arabia. Were it not for an internal feud, resulting in the assassination of the Saudi Leader, Oman might well have fallen under Saudi Arabian rule (Kechichian, 1995: 31).

Sultan bin Sa'id encouraged the spread of Arab influence along the East African coast, where Oman had colonies, and developed one of the most lucrative trading axes in Asia. French and especially British interferences would have eventuality clipped Sa'id bin Sultan's wings but at the time, Oman was a significant economic power (Kechichian, 1995: 31). The architect of the Omani Empire died in 1856, his realm was divided into a Asian and a African domain, each under the rule of a rival son. Grievances and foreign interferences compounded the hostility that arose between the two brothers. Further ambitions of tribal leaders led to open warfare (Kechichian, 1995: 31).

The Second Imamate

Faysal bin Turki was the first Al Bu Sa'id ruler to mount his throne peacefully in 1888. The young man wanted to be the monarch of a united Oman truly independent of foreign influence, especially of excessive British authority (Kechichian, 1995: 31). In 1895, the tribes of the interior launched a major attack on Muscat. Because of his anti-British tone, the Sultan was denied military help. Tribal forces captured the city. But the Sultan bought off the rebels from his enemies and his upgraded forces recaptured Muscat (Kechichian, 1995: 31).

The British supported tribal efforts to revive the Imamate. The tribes united and a new Imam, Shaykh Salim bin Rashid Al-Kharusi, was elected (Kechichian, 1995: 32). Sultan Faysal died later in 1913 and his son Taymur bin Faysal received messages of loyalty from a number of tribal leaders in the interior (Kechichian, 1995: 32). But in January 1915 they attacked the capital another time. Thanks to British assistance, the new Sultan was able to repel the attack but unable to oblige his will on the tribal leaders (Kechichian, 1995: 32).

What developed served British interests quiet well. The Sultan ruled Muscat and the Imam controlled the interior. In July 1920, a disgruntled Al-Wahibah tribesman assassinated Imam Salim bin Kashid Al-Kharusi (Kechichian, 1995: 33). The then newly elected Imam Al-Khalili signed a peace agreement in September 1920 at Seeb. The country enjoyed relative peace and stability for the next three decades. The Sultan ruled the coast from Muscat, whereas the Imam ruled the interior from Nizwa. Two powerful rulers dominated the nation and worked and cooperated closely whenever needed (Kechichian, 1995: 33).

Short on resources and mired in internal challenges, Taymur bin Faysal abdicated in favor of his son in 1932 and moved to India (Kechichian, 1995: 34). The new sultan Sayyid Sa'id bin Taymur realized that the prime reason for the erosion of Oman's independence was its chronic insolvency and consequent dependence on financial support from outside powers, especially Britain (Kechichian, 1995: 35). He was eager to become economically independent, which led him to search for oil. In 1937 the first concession was granted. But a full development was prevented by lack of delineated borders between Oman, the UAE, and Saudi Arabia (Kechichian, 1995: 35). The Sultan had failed to consult the Imam before granting the concessions, knowing well that the exploration would be carried out in areas of the Imam's influence. Muscat had calculated that the Imam's death would come sooner than the oil. The new Imam in charge Ali bin Hilal Al Hinai cancelled the oil concessions granted by the sultan and with Saudi support declared his independence. He launched a mayor political opposition to Sayyid Sa'id bin Taymur by establishing the Oman Liberation Army (Kechichian, 1995: 35).

The Broken Rule of Sayyid Sa'id bin Taymur

Sayyid Sa'id lost sight of his earlier objective, to make Oman's independence. Circumstances required that he welcomed the British Royal Air Force (RAF) and the Special Air Service (SAS) to help him keep

the country united (Kechichian, 1995: 35). London snatched several concessions from the dependent Sultan, including a lease agreement of Masirah Island to establish an airbase near the strategic Arabian Peninsula. After having defeated the rebels, Sayyid Sa'id moved to Salalah, from where he ruled in most disinterested fashion. The isolated ruler grew tired of his responsibilities and left his country's governance to British officers serving him on secondment. The throne was occupied even if its authority was unrecognizable (Kechichian, 1995: 36).

The Modern Omani State

Domestic Policy

The Overthrow

Sultan Qaboos bin Sa'id dispossessed his father Taymur in July 1970. His determination was to open the country to the world and to rejuvenate Omani society through the policy of openness and modernisation. These were difficult tasks, though, for what was then a rather fragmented country without any governmental structures in place (Informationsministerium, 1992: 172).

After being in power Sultan Qaboos bin Sa'id immediately remained as an absolute monarch and was surrounded at that time by British and US advisors (Owtram, 2004: 141). This was due to the fact that these allies helped the Sultan in the coup against his father. Later in the 1970s, however, and against British objection, Qaboos brought in several Arab advisors with the result that British influence over Oman diminished gradually (Kechichian, 1995: 50). In the meantime, Sultan Qaboos created several ministries, while he himself kept bearing key posts, such as internal security, defence, finance and oil affairs (Kechichian, 1995: 50). By the mid-70s, however, there was less political progress made than expected and Oman did not have a written constitution or a parliament and political parties were not even allowed (Kechichian, 1995: 50).

The State Consultative Council

It took Oman until 1981 to establish its first State Consultative Council (SCC). This council had originally 43 members and for the first time in Omani history members were guaranteed freedom of speech during their meetings, but it was not allowed, however, to discuss any issue outside the Council (Manea, 2001: 101). At the SCC first session, Qaboos defined the Council as a continuation of the policy to achieve a greater range for citizens to participate in the efforts of the government (Kechichian, 1995: 52).

The Oman Council

In 1991, the new Consultative Council (Majlis al-Shura), replaced the former State Consultative Council (Manea, 2001: 102). The Consultative Council is nowadays one of the two chambers within Omani's bicameral system, the Oman Council (Majlis Oman). The Consultative Council today counts 82 elected members from all the provinces (wilayats) of Oman and according to Owtram, the council now provides an element of increased political participation (Owtram, 2004: 180). Members are elected every three years (http://www.omanet.om). Although the council seems to be more democratic than other forms of governance in Omani history, one has to bear in mind, that the council has no legislature power and does only assist the sultan in questions about economic, social and developmental issues (Riphenburg, 1998: 104). The sultan, in contrast, still remains the absolute monarch in Oman, and he holds the most important posts, such as Head of State, Prime Minister, Minister for Foreign Affairs, Defence and Finance (Manea, 2001: 101).

The other institution within the Council of Oman is the State Council (Majlis al Dawla), which acts as an upper chamber and was established in 1997 (www.omanet.om). The State Council has currently 53 members, including five women. Its function is to prepare studies on Omani development and solving problems; it further promotes cohesion and unity, but as the Consultative Council it has not any

legislature power. In contrast to the Consultative Council, members of the State Council are chosen for their knowledge and seniority and appointed by Royal Decree (www.omanet.om).

Administrative Divisions

As already mentioned above Oman is divided in severel provinces and today there are 59 of these so-called wilayats (www.omanet.om). These provinces are actually sub-divisions of nine governorates and regions within Omani territory.

Foreign Policy

Diplomacy

Before 1970, there were hardly any diplomatic relations with other nations. This had its origin in the fact that Sultan Sa'id bin Taymur had chosen to conduct all foreign relations through London (Kechichian, 1995: 47). Soon after Sultan Qaboos came into power in 1970, he then started immediately diplomatic relations with Arab nations with the result that Oman became a member of the Arab League of Nations in 1971. Soon after in the same year Oman became also a member of the United Nations (Kechichian, 1995: 48). Ten years after, in 1981, Oman was one of the six countries, which established the Gulf Cooperation Council (GCC). Objectives of the GCC are formulating regulations in fields such as economy, finance, trade and legislation, setting up joint ventures and strengthening ties between their peoples and to live in peace (www.wikipedia.org).

Regional Security

One important issue in seeking peace and security for Oman was boarder demarcation with its neighbours. Thus agreements of borderlines were signed in the 1990s with Saudi Arabia, Yemen, the UAE and in 2001 the maritime border with Pakistan. Another important Omani foreign policy objective was and still is to maintain and strengthen its control over the strategic Straits of Hormuz (Kechichian, 1995: 113). For Oman the Straits of Hormuz symbolise unique strategic and political opportunities, because they are tremendously important for the industrialised world, due to the fact that currently ¼ of the world crude oil production is shipped through the 24 miles wide waterway (Owtram, 2004: 147).

The importance of the strategic geographical position of Oman for the West is also reflected in the military support for Oman. Mainly in 1980s and 1990s Oman purchased military hardware, such as strike aircrafts and missiles from Britain and the US (Kechichian, 1995: 133). In addition to this, Britain and the US also performed several military trainings together with the Omani Armed Forces in the Omani desert. This was of particular interest for the allies in 1991 during the operation Desert Storm (Kechichian, 1995: 133).

Conclusions

After we have examined the earlier and the contemporary Omani history, the latest Omani development after 1970 seems almost like a fairytale. Since Sultan Qaboos bin Sa'id is in power many things have changed in a positive way: The state has reinvigorated its diplomatic relations with foreign countries and is nowadays an important player in the Arab world. As far as domestic policy is concerned, Oman has developed tremendously, too, despite the fact that there does not exist a powerful legislation and Oman is still a constitutional monarchy with its Sultan as the only executive.

Concerns could be made, however, over some Human Rights issues. According to Amnesty International (AI), the death penalty is still in use in Oman. Furthermore, AI mentions that Omani laws and common practices continued to discriminate women. These discriminations include the personal status of women, their possibilities of employment and their overall participation in public life (http://web.amnesty.org).

Another concern could be made over the future of the Omani nation, because there is no succession of the Sultan, due to the fact that he has no children, so far, and the Sultan has to come from the ruling dynasty (Allen, 1987: 121). Thus, further positive development might be at stake at some point in the future for the Omani state.

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References listed below cover a wide range of subjects dealing with Omani history and its modern state. Even if not quoted in the text above, all were consulted. The idea behind was to offer other fellow students a more complete bibliography to facilitate their own research.

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Islam and the particularities of the Ibadi denomination

Anne Hoffmann & Priska Dittrich

The Islam is one of the 5 main religions of the world which is based on the teachings of Muhammad in the 7th century. World wide more than 1.2 billion Muslims dominating in East-and North Africa, Middle East, Central Asia and Indonesia belief in their one and only God Allah. According to Paret (1957) the translation of the word roots "salima" means "to be entire", "to be completed" and "to be salvaged" meaning the "total surrender of one's self to God". Islam means getting salvation under the will and guidance of God referring to the original Arabic word (s-l-m) which carries the basic meaning of "salam," peace, and "salama" safety and security (Lexicorient).

Origins of Islam

In 570 Muhammad was born as son of Abdallah and Amina in Mecca. With the age of 40, during the month of Ramadan in 610, he received the revelation of God through the archangel Gabriel. The revelation was dictated to him through verses which he had to memorize and to pass on (Bihl, 2003). The authenticity and reliability towards Muhammad's words was strengthened through the circumstance that Muhammad was not either introduced to poetries nor in writing, he was an Analphabetic.

The Muslims belief, that Muhammad is the restorer of the original monotheistic faith other than Judaism and Christianity which have been misinterpreted over time by the people. Islam is seen as the original heavenly message where God sent Muhammad as the only and last prophet who announced God's final message. Therefore Muhammad is not seen as the founder of a new religion but as the finisher of the present belief in God.

Referring to Bihl (2003) and Küng (2004) the basic message which was brought to Muhammad was to call attention to polytheism and the lack of ethical norms of the society in Mecca which strongly developed disadvantages for the defenceless poor, woman and orphans. His revelation which he brought to the people in Mecca caused distrust to the wealthier inhabitants because they achieved financial benefits from religious celebrations and trade in and around Mecca. Muhammad had to leave Mecca and found supporter. Years later, in 630 the inhabitants of Mecca finally accepted Muhammad and his followers unresisting.

From now on, to be different from Christians and Jews, Muhammad enforced to change the praying direction facing not Jerusalem but Mecca which became the centre of Islam, where Abraham once built the Ka´ba, the first place to worship God.

After Muhammad's religious, political and exemplary life he died after his pilgrimage from Medina to Mecca and was buried in Medina 632. Muhammad had several wives but no legal male offspring to be his follower. The night after his death this certainty caused discussion about the righteous follower and later pushed the development of numerous denominations.

The basis of Islam

Muhammad's messages were collected in the Quran in 853 (Bihl, 2003). The central religious text of Islam, the literal words of God enfolds today 114 chapters (Sura) which are divided into 6666 verses. The Quran is the origin, source and normative differentiation of all Islamism, Islamic believes and life which is the absolute authority (Küng, 2004).

Amongst others the Quran describes the five core aspects which affect and order the life of Muslims. The "pillars of Islam" represent the creed, the daily prayers, fasting, financial alms and the pilgrimage to Mecca once in a Muslims life. The intentional aspects are oriented to the social community. A Muslim believes in the only God, his angels, his holy books, his prophets and the last judgement and predestination (Küng, 2004). The primary sources of Islam are the Quran and the Sunnah which

literally means "trodden path" (Wikipedia) describes the exemplary path of the prophet Muhammad within the community and how to fulfil the duties being an exemplary man. Sunnah is seen as a measurement to live a religious and faithful life as a Muslim. The basis for the Sunnah refers to a large collection of scriptures (Hadith), theological works, law scriptures (Sharia) and commentatory scriptures (Lexicorient). Muhammad's ordinances, directives, valuation, comments and opinions of several questions which refer to reports and narratives of accompanists are recorded in the Hadith (Bihl, 2003). The Hadith is the theology and moral of Islam (Lexicorient).

The law scriptures, the Sharia, are based upon the core Islamic text, the Quran. The issues, several public and private aspects, of the Sharia or 'Muslim Law' are a legal framework to a Muslims life.

Central elements in a Muslims life

The first pillar of Islam is the creed, where the Muslim states that "There is no God but God, and Muhammad is his messenger" (Paret, 1957). The daily ritual prayers are the second main duty in a Muslims life. Five times a day following the official call of the Muezzin before sunrise, noon, afternoon, around sunset and in the evening, Muslims pray. The precondition for praying is the lustration of any sins symbolized by the ritual lustration of the face, hands, forearm and feed symbolizing the lustration of the soul from sins. According to Küng (2004) the daily praying ceremonies are disciplined, concentrated and universal. To be thankful for the goods in life, Muslims are committed to give alms. It is seen as a "social tax" symbolizing also to be repentant for omission and to ask for forgiveness, for mutual respect and solidarity and as compensation between the poor and wealthy Muslims. The fourth pillar is the religious fasting, the entire abstinence of food, drinks and intercourse which is held during the month of Ramadan. During the day, from sunrise to sunset, the Muslims practise the abstinence but celebrate eating during the nights. Collective fasting and celebrating socializes the Muslim community. The fifth pillar is the pilgrimage to the Ka'ba in Mecca. It is an obligation to Muslims, adult men and women of a mighty mind and free according to health and sufficiently good economic situation. The pilgrimage is only valid if the pilgrim follows strict ritual rules from the start to the end in Mecca (Bihl, 2003 and Küng, 2004). Other daily commandments concerning the consumption of alcohol and blood, meaning carnivores and animals which not have been killed under the ritual of shehitah, are recorded in the sharia.

The denominations of Islam

Discordance arose after Muhammad's death concerning the right follower of Muhammad's messages and community.

Different divisions of the Islam developed characterized through different theological and legal differences but related beliefs. The main branches of Islam are the Sunni, Shi`a and Sufi Muslims but numerous schools, sects and traditions belong also to the Islam.

The Sunni are in number the biggest division with more than 1.2 billion Muslims world wide (Lexicorient). They belief that there was no one appointed by Muhammad to be his representative and to guide his community. Therefore Muhammad's faithful accompanists, his father in law named Abu Bakr was elected to lead the Muslim community. The further representatives of the prophet Muhammad are called Caliphs. Meanwhile an originally democratic election of Abu Bakr became a hereditary rule for the caliphate (Küng, 2004).

The Shi`a denomination is the second largest branch of Islam. Shi`a Muslims believe that Muhammad appointed Ali as his righteous representative and consider him as the Imam, which is also a hereditary position.

The Sufi Muslims belong to an Islamic school which developed out of a state with political compulsions, with an own piety, institutions and theology. In the 10th -14th century it became one of the most widespread and known denomination. Sufis believe to find Gods salvation and unity in ones

own intuitive mind. The origin leads to Muslims who lived an ascetic life, people who spurned society (Küng, 2004). Today Sufis define themselves by a more Sunni oriented or Shi`a oriented view therefore they do not belong to a separate major branch of Islam.

Ibadism

What is the importance of the Ibadism in Oman and the rest of the world?

Ibadism is a denomination of Islam distinct from the two main denominations Shi'ite and Sunni and exists mainly in Oman (Hoffmann, 2004). In Oman 86 percent of the population are Muslims. Three-fourths of the Muslims are Ibadis. The other Muslims belong to Sunni Islam and the rest to Shia Islam. Moreover, Indian Hindus account for 13 percent of the population and there live also small numbers of non-Omani Christians in Oman.

Apart from the Ibadhis in the Sultanate of Oman some smaller communities can only be found in Zanzibar, in Libya, Tunisia (Jerba Island), and in Algeria (Hoffman, 2001). According to Lexicorient only 1,325,000 adherents distributed over the whole world belong to this branch of the Islam.

Where does the Ibadism originate from?

The origins of the Ibadis go back to not much more than twenty years after Muhammad's death. The Ibadism developed out of the seventh-century Islamic sect known as the Khãrijism (Hoffman, 2004). The basic doctrinal beliefs of the Kharijites were the same as those of all Muslims: the five pillars of Islam. According to Jones (2005), what split the early Islamic community in the first instance were views about the actions of the third caliph, Uthman (raa), and the fourth caliph, Ali (raa). There was much opposition to both of them and Ali (raa) was even killed by a Kharijite activist in 661 CE. Following, the Umayyad dynasty came to power, and for a time some stability was imposed. It appears that this was the period when there was a growth in the number of the adherent of the Kharijism. Only, by the time of the Second Civil War (688-692 CE), the principal quietist group, living mainly in Basra, had become known as the Ibadiyya (Jones, 2005). This name derives from Abdallah b. Ibad, who appears to have been the political mentor of the group, though its spiritual leader was Jabir b. Zayd, a man universally recognized for his learning and piety, who became the first imam of the group (Hoffman, 2001, Hoffmann 2004, Jones, 2005 and Wikipedia).

How does Ibadism differ from Kharijism?

Although Ibadism emerged from Kharijism, the Ibadis see themselves as quite different from the Khawarijites: They - in contrast to the Khawarijites - regard other Muslims not as kuffar "unbelievers", but as kuffar an-ni ma "those who deny God's grace" (Wikipedia and Hoffman, 2001). The Ibadi attitude toward "those who deny God´s grace" is that one should practice "dissociation". However, the practice of dissociation does not imply enmity (Hoffman, 2005) and the Ibadis reject violent methods of promoting their interests. The only circumstance in which an Ibadi is allowed to use violence is when there is a need to remove an unjust despot from power (Lexicorient).

What is special about the prayers of the Ibadis?

There are minor differences between the prayer observance of Ibadis and other Muslims. The Ibadis pray with their arms down at their sides. Moreover, they do not say Amin after the Fatiha (main prayer in the Islam), and they do not say the qunut (invocation) in the fajr prayer. In addition, they believe that Friday prayer should be held only in major cities in which justice prevails (Hoffman, 2004). Ibadis may pray together with Muslims of other branches, sharing their food and even marrying them (Lexicorient). Ibadis - like other Muslim groups - have mosques, minarets and religious leaders in mosques.

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Economic development in Oman - From Magan until the 21st century

Philip Mundhenk & Christian Beuter

The Oman has always benefited from its location at the entrance of the Persian Gulf. In the early history the northern coast of Oman has been a "commercial way station" between Mesopotamia and the Indus Valley. The southern part of Oman has been an important region for frankincense. Nowadays huge tankships transporting oil all over the world have to pass the Strait of Hormuz.

However, the discovery and exploitation of oil has rapidly changed Oman's economy. On this account, this handout is divided into two parts. The first one contains the time period before oil was discovered; the second part is about the subsequent period.

First Part: From Magan until the discovery of oil

Trade in Magan

Magan was an ancient region which was mentioned for the first time in Sumerian cuneiform texts of around 2300 BC as a source of copper and diorite for Mesopotamia. Most of the evidence though - archaeological and geological - seems to suggest that Magan was part of what is now the area of northern Oman (Lawton 1983).

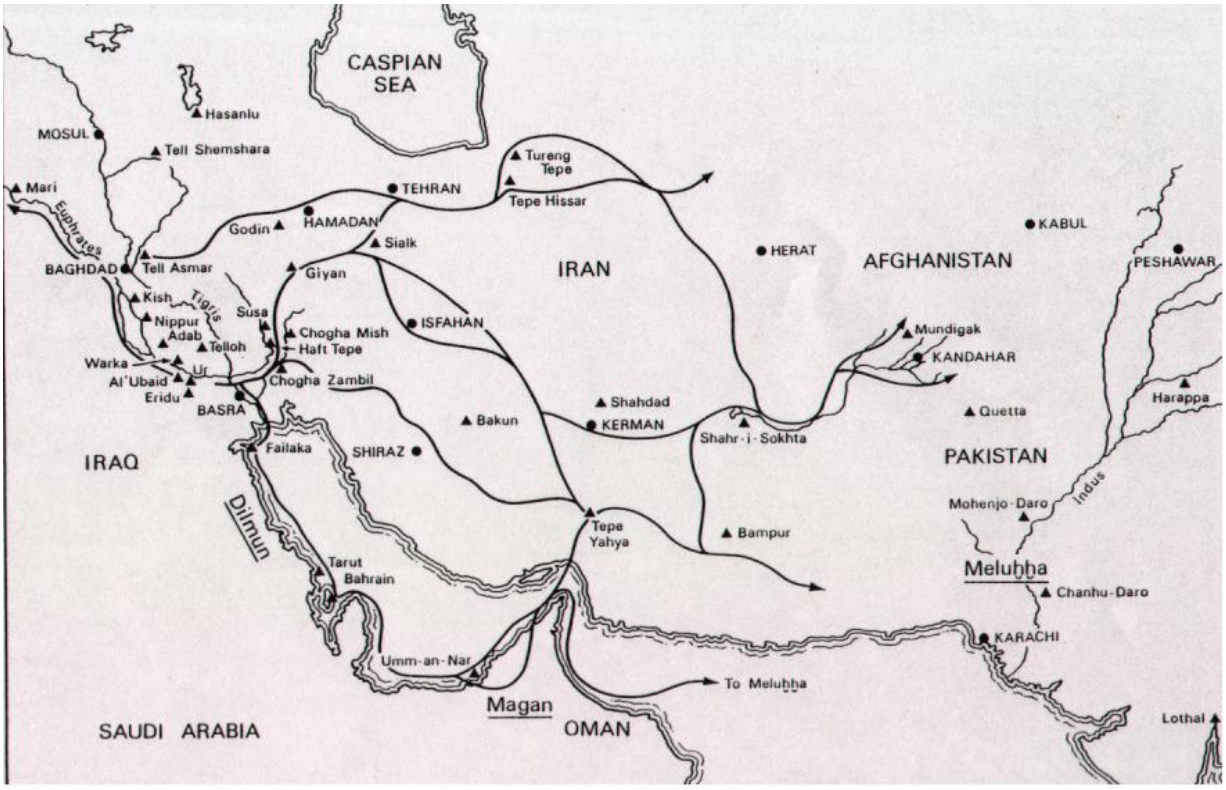

Figure 1: Trade in the Persian Gulf (2000 BC)

At that time trading cities in the Persian Gulf were closely linked with Mesopotamia. In the area between Euphrat and Tigris (Mesopotamia ="land between the rivers") fertile soils could be found, but the region suffered from a lack of mineral resources and lumber. Due to the fact that they had to import these goods they came into "commercial contact" with Magan to get copper and diorite.

Also Timber was imported from the Indus Valley by ship. As one can see from figure 1, Magan was therefore a kind of "commercial way station" between Mesopotamia and the Indus Valley.

Frankincense

Besides copper and wood, Frankincense (or incense) was a very important commodity for ancient Oman. While Magan covered the northern part of the country the region were the "frankincense tree" (Boswellia sacra) grows can be found in the southern area (Dhofar). The dried resin of the Boswellia tree was – and is even now – highly precious. During the trade peak – around the first century AD – frankincense was as valuable as gold. The Incense had/has many uses e.g. for religious ceremonies, as medicine, for embalming dead bodies, etc. It was transported through the Red Sea to Egypt and the Mediterranean Sea. When the camel was domesticated – approximately 1000 BC - it was also transported on the Incense Road through the Arabian Peninsula. The trade declined when demand in the west declined, especially when the Roman Empire fell.

Just to be mentioned in 1946 an artificial substitute for frankincense was developed in Rome – the centre of the Catholic Church and in former times one of the best customers – after that was possible to create "frankincense" with cheap chemicals.

Trade in the Middle-Ages

As it was already mentioned in the beginning the people at the Omani coast have been gifted sailors since a long time. Due to the fact that the coastline of Oman is surrounded by high mountains and deserts it is easy to understand that for the people – who were used to live at the seashore – the Oman was more or less like an island. Because of that they began travelling around the Indian Ocean very early. In the 8th century an Omani trader – Abu Ubaida` Abd Allah ibu al-Qasim – made the first sea voyage to China. In the 10th century Omani merchants founded a trading centre on Kilwa an island at the Tanzanian coast. Among other events this incident indicated the roots of the Arabian influence on the East African coastline which is well-manifested until now. Since the 12th century clans from Oman – the first one was the Nabhani clan – are permanently resident in East Africa.

At the end of the Middle-Ages Vasco da Gama rounded the Cape of Good Hope (1498 AD) and the Portuguese got access to the Indian Ocean. In 1507 Muscat was occupied. The Portuguese dominated the trade along the East African Coast and the southern coast of the Arabian Peninsula for the next 150 years.

After the Portuguese occupation

Under Sultan ibn Saif Muscat was recaptured in 1650. He built up a huge and powerful fleet and ejected the Portuguese from Zanzibar and from all other coastal regions north of Mozambique. Around 1700 AD Oman was the dominating sea power in the Indian Ocean. Merchants from Muscat were in close trade relations with Western India and East Africa, especially with Zanzibar. The island at the Tanzanian coast emerged as a trading-centre which was controlled by the Oman. Particularly the slave trade constituted an important income source for the Oman.

At that time there was already a flourishing trade between Oman and the British which expanded their influence in the Indian Ocean since the 16th century. The first trade treaty between these two countries was signed in 1646 (Bhaker 1992). And it was some 152 years later (1798 AD) that a full-fledged commercial treaty giving extensive facilities to the British (East Indian Company) was signed between Oman and Britain. According to Bhaker (1992) this treaty "turned out to be the first step towards the political and economic stranglehold that Britain was to exercise over Oman throughout the nineteenth century and for the best part of the twentieth".

At the beginning of the nineteenth century the slave trade was abolished in Europe. The Slavery Abolition Act (1833) in Britain outlawed slavery itself in the British colonies. In fact, Oman was not a colony, but because of the dependence of Oman on the British Empire (economically and politically), they were forced to give up slave trade. In 1856 the ruler (Said ibn Sultan) of Oman and Zanzibar

died and in result of British pressure the country was divided into the Sultanate of Oman and the Sultanate of Zanzibar. These two events led to an economical decline in Oman.

The twentieth century

At the end of the nineteenth and the beginning of the twentieth century Muscat was attacked by "rebels" from the interior several times. The British helped the Sultan militarily and in addition they loaned him money, so that the government's dept rose and the British influence in Oman increased. In 1920 a British political agent in Muscat arranged a peace treaty between the Sultan and the rebels (the treaty granted the imam autonomous rule in the interior Imamate of Oman, while recognising the nominal sovereignty of the sultan).

The financial disarray of Oman led to the appointment of financial advisers to the Sultanate by the British. Their efforts to impose order were unsuccessful (Lunde 1983). In 1932 when Sultan Sa`id ibn Taimur took power Oman was a poor country, debilitated by debts.

The conflict between the Imamate and the Sultanate arose again in 1954, when the Imam led a rebellion against the Sultan's efforts to extend government control into the interior. The Sultan defeated the Imam in 1957 with British help (the last troops surrendered in 1959). This expensive war was partly paid by the selling of the enclave of Gwadar (Balochistan) to Pakistan. With this disposal the Oman lost an important trading outpost again. Until 1970 when Sultan Qaboos bin Said took power Oman was an isolated and indigent country.

Second Part: Modern economy in Oman

History of oil exploration and extraction

Since the country of the Arabian peninsula belonged to tribal leaders that controlled the gulf region these leading families became very rich with the discovery of oil in the early 20th century. Already in these days especially British oil-companies paid high prices for the "black gold".

But even if the traditional leaders kept a lot of money for themselves and their families they spend also some amount of money for gifts for friends and food for poor people. These traditional customs and methods can still be recognised in the modern structures of these countries: Rich people finance infrastructure-, school-, hospital- or other charitable projects. But that of course the tribal leaders gain a lot of influence in their regions.

The Discovery of oil:

The first oil was found in Iran where from 1911 on the Anglo-Persian Oil Company (APOC) produced oil. Further on oil wells were installed for example in Iraq (1918), in Bahrain (1932) and Saudi Arabia (1933). In the 1930s started a hard competition between the United States of America and the United Kingdom for the oil resources in the gulf region. In this time oil was still quite scarce on the world market; first commercial amounts were produced - mainly with technical support by British companies - in the 1950s. Kuwait was the largest oil producer in 1953. The first offshore oil was found in 1960 in the Persian Gulf within the territorial waters of Dubai.

First oil in Oman

In Oman the first oil was found also before the World War II started: but in 1924 only small amounts of oil were produced in the inner country and only used on the regional and national level. The historical split between the coastal and the interior tribes of the country were the main reason for the conflicts in oil exploration as well. The interior tribes claimed sovereignty and attacked over decades the oil producing companies from the coast.

The first oil in commercial amounts was exported from Oman in 1967. But until the middle of the 1970s new conflicts and military conflicts took place. While the Omani Sultan was supported by the British air force the "rebels" of the interior got help from Yemen.

In this time the old Sultan Said ibn Taimur got unpopular and the new one, Sultan Qabus ibn Said, took over the power. He solved the national conflicts with the help of Arabian troops and less British support. From that time Oman was able to install a well ordered national economy, but many other Arabian countries were and are still one step ahead concerning the economical development.

Most important economic sectors

Crude oil and petrols

Today the production and the export of crude oil and oil- and petrol-products create with more than 80% the most important branch in the Omani economy. Responsible for the foreign oil-trade is the Ministry of Petroleum and Minerals and the Oman Oil Company (OOC). Geological and technical problems caused a decreasing oil-production in the 1990s. Today a lot of research is done on new technologies for oil-production. In this research industry Oman is one of the leading countries.

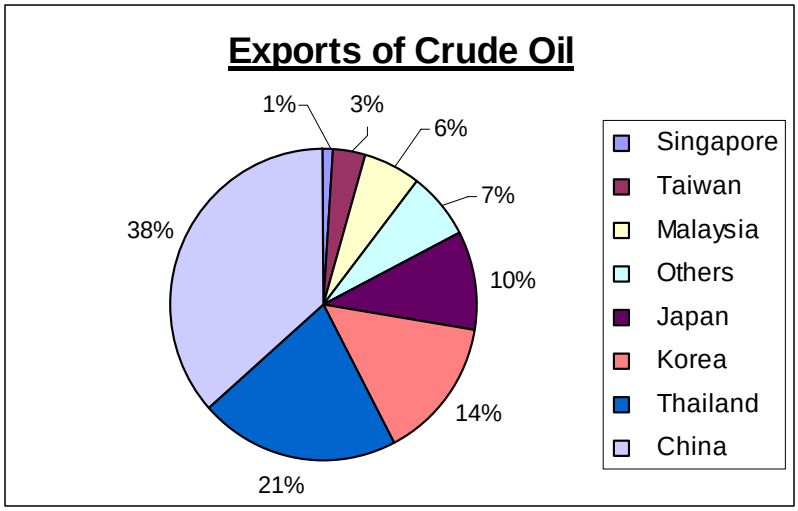

Figure 2: Exports of crude oil from Oman to foreign countries in 2006

Oil production in Oman depends on new techniques because the most oil found in Oman is heavy oil that is difficult to pump.In recent years the oil-prise rose, and by that the lower amount of extracted oil could be compensated. So imports and the national budget grew a lot. To ensure crude-oil-sales Omani companies invest in foreign countries in refineries and other oil-based industries. In figure 2 the Exports of Crude Oil from Oman are demonstrated. The total amount of oil-exports in 2006 was 177,839,800 Barrels of which around 75 % were transported to China, Thailand and Korea.

Natural gases

Since the 1970s the Omani government started projects to search for resources of natural gas. It was found in big amount in the interior of the country. Today the gas reserves of the country are estimated to last for some 80 to 100 years more.

Natural gas is mainly used as a substitution for oil in electric power generation that is needed itself by the oil producing firms. So the amount of gas production is highly correlated with the oil production.

The produced gas is transported in elongated pipelines to the southern and to the eastern parts of the country. Some gas is there also used in other gas-based gas-based industries for the production of methanol, fertilizers, or methyl tertiary-butyl ester (MTBE). A large amount of gas is also exported to other countries in the form of liquid natural gas (LNG).

In table 1 the extreme increase of the oil-price within one year (2005-2006) can be seen as well as the increase of the amount of produced natural gas in Oman. The importance of both goods is quite obvious.

Table 2: Production, exports and prices of oil and natural gases in 2005 and 2006

	%	2006	2005
Oil Production (000 BBL)	- 4.1	202,544.00	211,205.80
Crude Oil	- 4.8	185,357.70	194,782.30
Total Exports	- 9.0	177,839.80	195,427.80
Average Price (US$/BBL)	**28.5**	63.270	49.25
Natural Gas	**25.2**	778,770.0	621,824.00

Agriculture and fishing

Besides the production of crude oil and natural gases there are two industry-branches that play still an important role in the national economy of the Sultanate Oman: on the one hand agriculture on the other hand the marine fishing industry. Both played major roles in the past before the first oil wells were discovered in the early 20th century. But even today these two sectors employ more than 40 % of the Omani working population, 27 % are employed in agriculture and food industry.

The agricultural production centre of Oman is located in the northern Batinah-plains that are the base for the export-oriented Omani agriculture. Important products grown on the watered fields are besides many others maize, wheat, alfalfa, dates, limes and other citrus fruits, pomegranates, in some places tobacco and coffee. In the southern region of the country frankincense is even today a good source of income. Also animal husbandry is common: goats, sheep, camels are the main groups.

Fishing takes place in the Gulf of Oman and the Arabian Sea. Different species like swordfish, tuna, shark, sardines, bluefish, lobsters or oysters are caught by both traditional small boats with outboard motors and big scale fish industry trawlers. Although there are strict fishing quotas given by law over-fishing is a big problem like in most other seas of the world.

Non-oil minerals

Copper was found in Oman already thousands of years ago. Today it is the Oman Mining Company which is owned by the government that searches for the copper ore. Main export markets for copper as raw material are again countries in the Far East, namely Taiwan, Japan, South Korea.

The Oman Chrome Company (OCC) that is mostly private but by 15 % governmental-owned produces chrome in surface mining. The first geological research concerning this element was supported by French and British geologists. Other mined metals found in Oman that are of economical importance are iron, manganese, nickel, lead, zinc, gold and silver. The latter ones are mainly used for jewellery handicrafts.

For construction and house building purposes tile and marble are produced. Limestone is used for cement production.

In some regions of the Oman coal was found. Like natural gas coal is used in the domestic economy to replace oil in electric power generation, but is not exported to foreign countries.

Other Omani industry-branches / "Omanisation"

It is a known fact that the oil resources in Oman will become scarce within the next 40-50 years. Oil production will stop in Oman even earlier than in its neighbouring countries. That is why the Omani government tries to diversify the industrial sectors: with enormous subsidies the large scale industry (like e.g. the natural gas industry) is, besides the oil producers, supported by governmental help as well as the more small- and medium-sized industries and manufactures. In the 7th five-year plan (2006-2010) most goals aim in that direction: The installation of medium-sized industrial estates should be promoted as well as the sector of tourism. For these and other goals the government tries to attract domestic as well as foreign financiers to invest in Omani industry. To raise the living standard in the country the government spends more money on the development of infrastructure and, especially in the remote regions, on water supply for people and the field irrigation. The promotion of human resources, i.e. basic education, education at highschools and universities, is another important point in the five-year plan.

In this context an often used keyword is "Omanisation", by which is meant that more jobs should be created for Omani people, especially young people coming from university and school. Responsible for that programme is the Ministry of Manpower (2005) and was supported by e.g. the German Association for Technical Cooperation (GTZ). Some further goals of the "Omanisation" are the following:

- Promotion of private economy
- Higher efficiency in public administration
- Improvement of the living standard and price stability
- Protection of the environment and the national heritage

Tourism

Responsible for the upgrading of tourism in Oman is the Ministry of National Heritage and Culture. In the recent years big hotel complexes were built in the surroundings of bigger cities, especially in Muscat and other coastal towns in the north. International tourists (mainly from India, UAE and Germany right now) should be attracted by new sports facilities, restoration of historical sites and others. Ecotourism is another sub-branch people think about. The goal is to increase the proportion of tourism in the GDP from 1% by now to at least 3% in the year 2030. By that a lot of jobs could be created, especially for young Omani people.

Transportation

With the development of all economical sectors in the country infrastructure was a big issue starting after 1970. Today in Oman there is a street network with more than 32,000 km; most streets are paved today. For public transport these roads are used by overland bus companies that are frequently used since there is no running railway in Oman. There are two deepwater ports for container shipping and one oil port that is connected with the oil pipeline network of 7,000 km. Additionally there are two international and several smaller airports.

Military

The expenditures for military participate with the quite big number of 11.4% (2003) in the Gross National Product of Oman. In 2004 the total spending on military was around US$ 252.99 million. In this economical sector there is still a big cooperation with the British armaments industry; e.g. the British tank "Challenger 2" is in use in the Omani army.

Oman in international economical Organisations

With the development of the modern Omani economy the country aspired to participate in several International Organisations to profit from these networks in terms of security and especially new

export markets for goods produced in Oman. Following some important organisations this context are just mentioned but not further described in detail:

- Oman joined the League of Arabic States since 1971. In these organisations 22 members participate today, i.e. countries from Northern Africa and the Arabia.

- In the same year (1971) Oman became a member of the World Bank. Within the Technical Cooperation Program the World Bank financed mainly in the 1970s and 80s several projects in Oman concerning infrastructure, industrial policy, health, education, water, power creation of multi-annual development plans.

- Together with five other Arabian countries (namely Bahrain, Kuwait, Qatar, Saudi Arabia and UAE) Oman found the Cooperation Council for the Arab States of the Gulf (GCC) in 1981. The goals of this cooperation are regional defence, the coordination of policies on trade and economic issues.

- Since the year 2000 Oman joins the World Trade Organisation (WTO) which is an important partner to establish new economical markets worldwide.

Appendix

National budget 2006 bases on an oil price of 32 US$/Barrel (2005: 23 US$).

Revenues:	3.64 bn. R.O. = 9.36 bn. US$	+ 14,2%,
Expenditures:	4.24 bn. R.O. = 11.04 bn. US$	+ 15,1 %
Investments:	914 mill. R.O. = 2.38 bn. US$	
Budget deficit:	650 mill. R.O. = 1.69 bn. US$ (6 % of GNP)	

The deficit is compensated by the "State General Reserve Fund" which earns the surplus of the oil-revenues and by raising of capital in the home and foreign countries.

Categorisation of national economies by the World Bank (examples):

Low income economies	(Ethiopia, Malawi, Yemen)
Lower-middle-income economies	(Brazil, Cameroon, Ukraine)
Upper-middle-income economies	(**Oman**, Poland, South Africa)
High income	(Canada, Norway, Japan)

Table 3: Gross National Income (GNI) in 2005

	GNI (mill. of US$)	Per capita-GNI (US$)
Oman	22,994	9,070
Germany	2,852,337	34,580
Rwanda	2,067	230

Table 4: Economic relations: Oman - Germany

	2004* (1. Half)	2005* (1. Half)	
Exports: Germany → Oman	152,1	215,7	➔ + 41,8 %
Exports: Oman → Germany	4,5	6,9	➔ + 51,5 %

** Values in mill. EUR*

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Nature conservation and Sanctuaries: Oman's efforts in conservation of biodiversity

Irma Mika & Nina Stephan

When thinking about nature conservation in Oman one might have the impression that nature conservation is not a very urgent topic in a country that is mainly covered by deserts. But despite to this first impression the country Oman has a relatively high biodiversity especially in regions with higher precipitation.

One thousand two hundred eight plant species are found in the country including 78 endemic species. Thus, it definitely makes sense to undertake efforts for nature conservation in Oman. A national biodiversity strategy was developed taking into account the Islamic vision on biodiversity.

The National Biodiversity Strategy and Action Plan

In 1995, Oman ratified the Convention on Biological Biodiversity. The Islam asks mankind to understand and know the creation of God. Oman's vision is "a society that is conscious of the role and issues related to biological diversity, convinced of its responsibilities toward future generations and determined to sustainably use natural resources in harmony with all other living things in accordance with the laws of Islam".

Major threats to nature in Oman

The major threats to Oman's nature are the destruction of habitats and the introduction of alien species which outcompete the native species. Habitats are destroyed by inappropriate land use form e.g. overgrazing, over fishing or salinization due to irrigation. These are globally the two major reasons for the loss of biodiversity.

Nature reserves and sanctuaries in Oman

National Park Al Saleel

The Al Saleel National Park is located in the Wilayat of Al Kamil w'al Wafi in the Sharqiyah Region of Oman, at a distance of about 310 km from Muscat. It covers an area of 220 km². Concerning the ecosystem the park lies in the biome of cold winter deserts, being a part of the Anatolian-Iranian Desert province in the palaearctic realm.

The National Park Al Saleel was established on June 28, 1997 by Royal Decree No. (50/97) to protect gazelles and plantations of Samr (Acacia tortilis) and Ghaf (Acacia cineraria) trees. Other species are Acacia ehrenbergiana, Zizphus spina-christi and the shrub Maresaraas (Maerua oblongifolia) which has got cream, scented flowers.

There are three main areas of the park: The alluvial plain covered in acacias (Acacia tortilis woodland), the wadis in the mountains and the sparsely vegetated hills and rocky outcrops which form the northern boundaries and the higher elevations. The park mainly consists of acacia woodland, providing a safe habitat for many of Oman's indigenous mammals. Presently over 40 Arabian Mountain Gazelles are roaming through the park. Six subspecies of the mountain gazelle are currently recognised, with five of these listed on the IUCN Red List 2006: The Arabian Mountain gazelle (G. g. cora) and Farasan gazelle (G. g. farasani) are classified as vulnerable (VU), the Palestine Mountain gazelle (G. g. gazella) is classified as endangered (EN), the Muscat gazelle (G. g. muscatensis) and the Acacia gazelle (G. g. acaciae) are classified as critically endangered (CR). Other mammals are the rare Gordon's Wild Cat (Felis silvestris lybica), wolves (Canis lupus) and a small number of Red Foxes (Vulpes vulpes arabica).

Future plans for the park aim to achieve sustainable use of the vegetation for feeding Arabian Oryx and the Reem Gazelle, which will be introduced once the vegetation improves. Also more Arabian Mountain Gazelles may be introduced later in order to enhance the genetic base of the species within the park. Studies will be carried out to establish permanent watering points for the animals, enabling visitors to view them.

Nature Reserves

Ad Dimaniyat Islands

The Ad Dimaniyat Islands are located in the Gulf of Oman along the coast of the wilaya of Seeb and Barka north of Muscat and east of Barka at a distance ranging from 16-18 km from the beach. The total area of 203 km² is distributed over 9 main islands that can only be reached by boat. Concerning the ecosystem the nature reserve lies in the biome of cold winter deserts, being a part of the Anatolian-Iranian Desert province in the palaearctic realm.

The Nature Reserve Ad Dimaniyat Islands was established on April 3, 1996 by Royal Decree No. (23/96) primarily to conserve the coral reefs and to provide safe nesting conditions for turtles and birds. Many migratory birds nest here in the summer as well as thousands of marine birds, e.g. terns, ospreys and Red-billed tropic birds, do so throughout the year. The islands are free from predators such as foxes, cats and dogs.

The Ad Dimaniyat Islands are Marine Protected Area (MPA). 22 species of Whales, Dolphins and Porpoises visit the surrounding sea, including endangered species like Spinner Dolphin (Stenella longirostris), Long-beaked Common dolphin (Delphinus capensis), Bottlenose Dolphin (Tursiops truncatus), Bryde's Whale (Balaenoptera brydei), Humpback whale (Megaptera novaeangliae), and False Killer Whale (Pseudorca crassidens). Large numbers of Hawksbill turtles (Eretmochelys imbricata), a globally endangered species, and Green turtles (Chelonia mydas) also nest on the islands' sandy beaches. Turtle breeding reserves are located at the Ad Dimaniyat Islands and Ras al-Jinz, which is part of the Turtle Reserve Ra's Al Hadd. The reserve encourages environmental research and ensures sustainable use of the marine environment by local fishermen.

Turtle Reserve Ra's Al Hadd

The Turtle Reserve Ra's Al Hadd is located in the Wilayat of Sur in the As Sharqiyah Region, at a distance of 390 km from Muscat. The total area of 120 km² has got a coastline of 42 km. Ras al Jinz is part of the reserve. It was proclaimed as a reserve in 1996 by Royal Decree No. (25/96). Concerning the ecosystem the nature reserve lies in the biome of cold winter deserts, being a part of the Anatolian-Iranian Desert province in the palaearctic realm.

The Ra's al Hadd Peninsula attracts every year between 6000 - 13000 turtles from the Arabian Gulf, the Red Sea and the East African coast. The physical resources of the reserve are sandy beaches, mountain ranges and archaeological sites. The biological resources are, besides the sea turtles, coral reefs, mangrove trees, Ghaf tree (Prosopis cineraria) woodlands, many bird species, Arabian gazelles, Red foxes, hedgehogs and wild hares.

Jebel Samhan

The Nature Reserve Jebel Samhan is located in the Dhofar Governorate, at a distance of about 150 km from Salalah. It covers an area of 4500 km². The Nature Reserve Jebel Samhan was established on June 28, 1997 by Royal Decree No. (48/97). Concerning the ecosystem the nature reserve lies in the biome of warm deserts/semi-deserts, being a part of the Arabian Desert province in the palaearctic realm.

It is predominantly made of limestone highlands rising from the coastal plains. Jebel Samhan forms a range of craggy peaks, which are separated by wadis and canyons. Hasik village, accessible only from the sea, lies on a small gravel area east of the Jebel. The sea has eroded much of the coastline so the limestone cliffs are sculptured and undercut at the base. The area provides perfect habitats for the Arabian Leopard, Nubian Ibex, Arabian Gazelle, striped hyenas, caracal, wild cats, foxes and wolves. The steep cliffs make ideal breeding sites for rare species of birds and the surrounding sea provides food for Masked Boobies, Socotra Cormorants, whales, Green turtles and Loggerhead turtles.

Jebel Habrer receives the monsoon mists for which Dhofar is famous. Due to the humidity and rainfall, it is the only Arabic location of the African tree Papea capensis. It is a long-lived, hardy, evergreen tree with a height of 2-8 m. The red fruit is edible.

There is no resident human population in Jebel Samhan, although it is used by shepherds for grazing their animals, and locals gather frankincense from the trees in the wadis. These activities are allowed when carried out in a sustainable way.

Reserve The Khawrs of the Salalah Coast

The Nature Reserve The Khawrs of the Salalah Coast is located in the Dhofar Governorate. It consists of several areas at a distance ranging from 5 – 40 km. The area of the Khawrs varies from few hectares to more than a hundred hectares. Concerning the ecosystem the nature reserve lies in the biome of warm deserts/semi-deserts, being a part of the Arabian Desert province in the palaearctic realm. The Khawrs of the Salalah Coast were proclaimed as 'Reserves' on June 28, 1997 by Royal Decree (49/97). The reserves physical resources are Khawrs, springs and archaeological sites. The biological resources of the reserves are Mangrove trees and vast numbers of birds and fish.

Sanctuary Arabian Oryx

Jiddat al Harasis is located within the central region of Oman between the desert Rub' al-Khali in the northwest and the Arabian Sea in the southeast. The site is surrounded to the north by the Hajjar mountains and to the south by the Dhofar mountains. The nearest large settlement is Haima to the west. In the southwest are the Rima and Marmul centres of oil extraction. The sanctuary encloses an area of 27,500 km². In 1976 the Ministerial Decision No. 40 provided for the protection of selected species. In 1979 the Royal Decree No. 26 established national parks and nature reserves, but has never been implemented. Therefore the site is not legally protected and site boundaries and management zones remain undefined. In 1994 the Royal Decree No. 4 gave responsibility for the Sanctuary to the Ministry of Regional Municipalities and Environment. It is inscribed on the World Heritage List. The Sanctuary Arabian Oryx is owned by the Government of the Sultanate of Oman, and administered from Haima, the nearest large settlement to the west.

Jiddat al Harasis is a plateau at an altitude of 100-150 m, consisting mainly of karst limestone. Areas of fossil wood occur on limestone surfaces of the Jidda', and escarpments are locally highly fossiliferous. An unusual desert climate with thick fog banks occurs. Considerable precipitation at night and early morning occurs from fog moisture and dew. This precipitation helps significantly to sustain the vegetation and wildlife between the unpredictable rains. Temperatures in July rise up to 34°C, in January and February they can drop to 15°C. Mean annual rainfall is less than 50 mm, with the possibility of several consecutive rainless years. Plant biomass is very low. The greater part of the Jiddat al Harasis is sparsely vegetated with small trees and dwarf shrubs growing in haylah depressions. The most common vegetation of this type is Acacia tortilis and A. ehrenbergiana, along with Prosopis cineraria. Very extensive woodlands of Acacia tortilis and Prosopis cineraria grow near the large wadis on the southern borders of Jiddat al Harasis. Many of these trees which evidently extend their rooting system down to the water table are very old, the regeneration is sparse.

The fauna of the region is typical of the Arabian Peninsula. The Jidda' is the only place in the Middle East where the houbara bustard receives total protection throughout the year. Some of the most

frequent predators are the red fox (Vulpes vulpes arabica) and Ruppell's sand fox (V. rueppellii). Other carnivores are caracal (Felis caracal) and Arabian wolf (Canis lupus arabs) which is occasionally reported. Wild cat (Felis sylvestris) and ratel (Mellivora capensis) have been reported but may no longer exist. Hares (Lepus capensis) and hedgehogs (Paraechinus aethiopicus) are widespread but rarely seen. The most numerous large herbivores are the Arabian mountain gazelle (Gazella gazella gazella) and Sand gazelle (G. subgutturosa marica). A small but viable population of Nubian ibex (Capra ibex nubiana) lives on the Huquf escarpment. The Arabian oryx (Oryx leucoryx) is the largest indigenous mammal species inhabiting the Jidda'. In 1961 the 'Operation Oryx' ensured that a small number of animals were transferred to zoos for captive breeding. In 1963 the 'World Herd' at the zoo in Phoenix, Arizona was formed with ten oryx from which three were originally captured in Yemen PDR. In 1972 the last wild Arabian oryx (Oryx leucoryx) in Arabia were killed on the Jidda'. In 1982 the descendants of the World Herd animals were reintroduced in the deserts of central Oman. The size of the herd increased up to 400 individuals in October 1996. Since then heavy poaching threatens the existence of the free herd. By 2002 the free herd was almost poached out, but a fenced herd remains. Unfortunately, this herd consists of only 12 female and 28 male oryx.

The Jiddat al Harasis is now heavily used by oil companies, vehicles and the native people. The perennial vegetation is heavily exploited by livestock. Serious problems are apparent for important Prosopis cineraria and Acacia tortilis woodlands. They are dying off due to a combination of old age and heavy browsing by livestock. The lack of regeneration is however more serious, there are few young trees to replace the mortality.

Discussion

Oman has quite ambitious goals regarding nature conservation. The need to diversify the economy leads to the search for alternative source of income. One hope is that eco-tourism could be one of those sources. Environmental factors should be taken into account in the development of a tourism strategy. Effective protection must be established before tourism activities are allowed and may damage the ecosystem. Law enforcement and the implementation of the National Biodiversity Strategy seem to be the key issues in the question whether Oman will be successful in nature conservation.

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(Eco-) tourism in Oman and the neighbouring Arabian countries

Felix Richter

Ecotourism is a form of tourism with environmental and social aspects. The International Ecotourism Society (TIES) defines ecotourism as "responsible travel to natural areas that conserves the environment and improves the well-being of local people." In addition it sets up some basic principles that people who implement or participate in this form of tourism should follow (TIES, 2005):

- minimise impact
- build environmental and cultural awareness and respect
- provide positive experiences for both visitors and hosts
- provide direct financial benefits for conservation
- provide financial benefits and empowerment for local people
- raise sensitivity to host countries' political, environmental, and social climate

Ecotourism focuses on local cultures, wilderness adventures, volunteering, personal growth and learning new ways to live on the planet. The travel destinations are usually where flora, fauna, and cultural heritage are the primary attractions. By travelling in this responsible way, the negative effects of traditional mass tourism, at the other end of the range, are supposed to be minimised. As part of that, the providers of accommodations try to promote recycling, energy efficiency, water re-use, and the creation of economic opportunities for local communities. Many global environmental organisations and aid agencies favour ecotourism as a way to sustainable development.

For many countries, ecotourism is not only a marginal activity intended to finance protection of the environment, but a major sector of national economy and a means of attracting tourists. Unfortunately the concept of ecotourism is in practice often simply used as a marketing tool to promote a form of tourism that takes place in natural surroundings. In the critics' opinion ecotourism has often mostly negative impacts on nature and ecosystems, by allowing tourism to explore these areas at all. According to them, some operators build up a normal mass-tourism shaped infrastructure in a natural ecosystem and use the label of "ecotourism", while behaving in environmentally irresponsible ways. Above this there are some destinations visited by ecotourists which are extremely sensitive to environmental impact from human use and can be damaged even by careful travellers.

The classification of someone as an "ecotourist" is also very ambiguous and there is little statistical data available. According to a fact sheet from TIES, however, ecotourism is growing 20-34 % per year and in 2004 it was growing three times faster than tourism industry as a whole (TIES, 2005). Currently there are various efforts to create national and international ecotourism certification programs, but these processes are always a matter of debate. For example was a program of ecoturism certificates, which had been set in place in Costa Rica, dismissed as "green-washing" by critics.

Tourism in Oman

Tourism is a relatively young branch of the economy in Oman. Under Sultan Said bin Taymur (1932-1970), the father of the present Sultan, the country was isolated from the rest of the world because negative western influences were feared. Even listening to the radio was prohibited and no tourists were allowed to enter the country. Sultan Qaboos bin Said began 1970 with the modernisation of the country and the building of an infrastructure. First in the beginning of the 1990s, after a certain standard of infrastructure had been reached, the country was willing to welcome tourists. Ever since, emphasis has been placed on quality rather than on quantity in order to avoid the negative impacts of modern mass tourism. That's why mainly hotels of higher category were built and the total hotel capacity was kept down. The first visitors could only visit the country with guided tours, but this situation has changed and at present individual tourists can travel Oman by their own.

Under the keyword eco-tourism the Ministry of Information in the Sultanate of Oman describes four types of sights which are of interest: beaches, wadis, aflaaj and springs. (www.omanet.om/english/home.asp). Oman has a coastline of 1700 km and a lot of beaches, which are accessible for the public and tourists. A wadi is a dried up riverbed found in the mountain valleys. Wadis contain water only after heavy rains, when the rivers start running again and the vegetation is restored. However, some wadis have year-round running water, with deep, cool pools in which it is quite safe to swim if the currents are slow. In Oman there are a many wadis to visit, but they are only accessible with a four-wheel drive vehicle. Aflaaj (singular: falaj) are the historic water management systems used to supply settlements with water and for irrigation. They can be divided into Falaj Ghayl with aboveground canals and Falaj Qanat with underground canals. The latter ones conduct water from the mountains subterraneously to the agricultural land, where it is distributed to the fields with the use of Falaj Ghayl. The length of the underground canal system can be up to 10 km, which guarantees a regular supply with fresh water, while the evaporation is minimised. There are about 4,500 aflaaj in the country, most of them still in use. Oman has hot and cold springs in several regions of the country, which can be visited.

Oman has on the one hand the typical desert vegetation including oasis with date palms, but on the other hand the special monsoon-caused vegetation of the Dhofar region, which is untypical for the Arabian Peninsula. These two extremes are both suited to attract ecotourists and especially the Boswellia trees, which contain the resin that is known as frankincense, are a famous natural sight. The fauna is even more outstanding with the Arabian Oryx Sanctuary, which became a UNESCO world heritage site in 1994. The Arabian Oryx was extinct in the wild in 1972 and can now be seen in this sanctuary. The coastal areas are of major interest for ecotourists who want to watch whales, dolphins, sea turtles or birds.

It is also possible to go on walks in the mountain regions. Mostly these walks are along small roads, which run through the wadis. On the Jabal Schams there is even a signed way and there is a two-day walking tour from the pools at Mukal in the wadi Bani Chalid to the wadi Tiwi at the coast.

Oman was the partner country on the 8th German-Arabian tourism forum, which took place within the ITB (international tourist trade fair and exhibition) in Berlin, the 9th March 2006. In her opening speech highlighted the tourism minister of Oman, Dr. Rajiha bint Abdulamir bin Ali, the importance of tourism within the Omani economy. She made clear that the development of the tourism sector is going to be socially balanced, sustainable and in line with the traditions of the country. A close cooperation with the neighbouring countries, the airlines and the whole private sector will also be important, according to her (Ghorfa, 2006).

The tourism sector achieved an annual growth of 9 % during 2000-2005. A National Tourism Development Plan has been prepared for the development of tourism sector within the next five years (2006-2010). The objectives suggested for tourism sector for the period 2006-2010 are as follows (Ociped, 2006):

- Increase the level of employment of Omani nationals in the sector to 80 % by 2010
- Achieve an average annual growth rate for the tourist income by about 7 % for the period 2005-2010
- Bring substantial economic benefits to local communities and residents;
- Conserve and protect the natural environment as well as assuring respect of customs, traditions and cultural heritage
- Create community awareness, understanding and support for tourism development
- Promote close cooperation between the government and the private sector, and
- To increase Oman’s share of visitors to the GCC and increase its recognition as a high quality tourism destination in its own right

Tourism in other Arabian Countries

Dubai (United Arab Emirates)

Dubai has in the last ten years experienced a continuous increase in German tourists visiting the country. While most Arabian countries had less tourists in 2002 compared to the years before, probably as a result of the post-9/11 tensions between the western world and the Islamic countries, Dubai could record an increase in this year as well. Because of the boom that this emirate experiences the number of tourism-projects has soared. The most remarkable ones are without doubt the creation of artificial islands in the shape of palm trees or continents. In addition new hotels, amongst them the famous Burj-al-Arab, theme parks, holiday villages and beach installations have been built (Ghorfa, 2003).

In the past the United Arab Emirates (UAE), in particular Dubai, have disregarded ecotourism and opted for mass tourism. To support this, massive infrastructure development is taking place on the coast and off it. In doing so, the integrity of marine and coastal biological resources is being compromised and is destroying valuable ecosystems such as coral reefs. As more and more resorts come up, additional pressures will be exerted on critical water resources, soil and atmosphere; while the generation of even larger quantities of waste will have to be dealt with, and landscapes will alter drastically as buildings replace unspoiled beaches. Although a tiny country, the UAE supports impressive biodiversity and has some of the most important coastal and marine habitats of the Arabian Gulf as well as mountain ecosystems such as freshwater wadis. The outdoor activities practiced there are often confused with ecotourism because they take place in a natural environment but, in reality, they are far removed from it. Off road vehicle driving, camping and picnicking (with attendant littering), water sports and other such recreation are the products of mass tourism. Ecologically insensitive schemes will not be viable in a market in which the 'green minded' tourist is becoming increasingly important. There is still scope to introduce ecotourism as a means to protect ecosystems, while generating awareness of, and support for, conservation among local people and visitors. One existing example is the bird watching tour business that brings over a million dirham a year to the UAE's travel industry. Reserves at sensitive sites with programmes for visitors involving nature appreciation, education and interpretation are a way forward. Considering environmentally responsible tourism is a more appropriate, sustainable development approach (AME, 2003).

Morocco and Tunisia

In a speech in January 2001 in Marrakech King Muhammad VI presented the new tourism strategy for his country, called "Vision 2010". Following his the hotel capacity should be increased from 80,000 to 115,000 with two thirds of it in coastal cities. A new tourist infrastructure on the base of private-public-partnership should ensure a tourism which is independent from the seasons and create employment. The aim is to have 10 million tourists every year (2002: 2.2 million) visiting the country and proportion of 20 % of the GDP (Ghorfa, 2003).

Tunisia is the most important destination for tourists on the southern Mediterranean Sea. Between 1996 and 2001 there was a big increase in tourism with 35 % more overnight stays. The terrorist act against the synagogue of Djerba in April 2002 had negative impacts on tourism, but the country recovered soon. The government emphasizes in their future plans wellness-, culture- and eco-tourism, e.g. travels to the desert in the south of the country, and the improvement of the infrastructure. Additionally a comprehensive program for the protection of the environment is run and Djerba hosted the "First International Conference on Climate Change and Tourism" in April 2003 (Ghorfa, 2003).

Bahrain and Qatar

As a tourist destination Bahrain is mainly known to the people of the other countries of the Gulf Cooperation Council (GCC). In 2000 94 % of the 3.1 million visitors came from these countries. A main group amongst them are Arabian families who come to visit Bahrain for a weekend. Therefore

many weekend houses and leisure centres were built, but the tourist infrastructure is about to expand in general to attract more tourists from western industry nations (Ghorfa, 2003).

Like many of the other Arabian countries Qatar wants to attract more tourists from all over the world. In 2002 the German-Arab Tourism Organisation presented a program for the further development of tourist infrastructure. According to this plan it should be possible to reach the sights of the peninsula from the capital Doha on three thematic axes. The first one, the "axis of cultural heritage", leads in north-west direction to excavations, culture-villages, forts and beach-clubs. The second one the "axis of discovery", leads in western direction to theme parks, oryx-farms, horse breeding stations and camel races. The third one, the "axis of nature", leads in southern direction to the Sealine Beach Resort and over sand dunes to the Inland Sea with views on the mountain panorama in Saudi-Arabia (Ghorfa, 2003).

Syria

The tourism sector in Syria is growing as well, mainly due to day tourists from the neighbouring countries Lebanon and Jordan, but also from Turkey, Saudi-Arabia, Kuwait, Bahrain and Iran. The main concentrations of tourism and infrastructure projects are in the capital Damascus, where an underground railway and many new first-class hotels are about to arise (Ghorfa, 2003).

Egypt

Tourism was a strongly increasing branch of industry in Egypt during the 1990s and after a period of planning directives from the government, the common model is now with private-public-partnerships. The strategy is now a diversification from culture tourism and mass-tourism in big beach resorts to ecotourism (mainly wildlife watch) and therapeutic tourism. Additionally the government promotes a so-called "Islamic tourism", to attract people from the gulf region. The main promotion within this program is the restoration of old Islamic quarters and houses in Cairo (Ghorfa, 2003).

Algeria

The "strategy for a sustainable extension of the Algerian tourist sector until 2010" aims to turn the country into a competitive and attractive destination for tourists. Especially the beach tourism, the business and conference tourism, the Sahara and thermal tourism as well as the culture and sport tourism should be stimulated. For this purpose the tourist areas will be used more efficiently and privatisation will be encouraged (Ghorfa, 2003).

Yemen

The main emphasis of the government in Yemen is on the extension of infrastructure on beaches and islands as well as other destinations of ecotourist interest. Very important in this context is the island of Sokotra with a unique flora and fauna. Besides there are a lot of archaeological sites and the government plans to create archaeological parks. The extension and modernisation of the airline Yemenia is another way to bring more people to the country (Ghorfa, 2003).

Saudi Arabia

Saudi Arabia is not a typical tourist country. Visa for travellers are only available in low numbers and under strict obligations. They are for example not obtainable for unmarried women younger than 45 years. Foreigners must hand in their passport, when they enter the country, and get an inland passport for foreigners. Usually a formal written invitation of a Saudi is necessary in order to enter the country.

However, the government is planning to extend the pilgrim tourism and there special pilgrim visa. The two most important sanctuaries of the Islam, Mecca and Medina, are in Saudi-Arabia and attract about two millions of Muslims each year.

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Irrigation and Salinisation: A Comparison of Traditional and Modern Irrigation Agriculture

Sara Preißel & Moritz Reckling

Agriculture in Oman is diversely structured and gives, due to its history, examples for traditional agricultural systems which have been sustainable over millennia, as well as for ecological and economical effects of fast and sudden modernization processes. Although agriculture earns only 3.3% of the country's Gross Domestic Product (FAO 2003), 42% of the small Omani population (2.5 million people) are employed in agriculture and fisheries (MOI 2003). They produced 48% of the food used for human nutrition in 2002 (MOI 2003), thus food security and food imports are a major issue in Oman. The country's area includes only 2.2 million hectares of cultivable land, including arable land, grazing area and forests. For the cultivation of crops, only 61 550 ha (0.2% of the total area) were used in 1993, and all this area has to be irrigated (FAO 1997). This number may have risen since, as there has been a constant increase in irrigated area since 1970 (see figure 1).

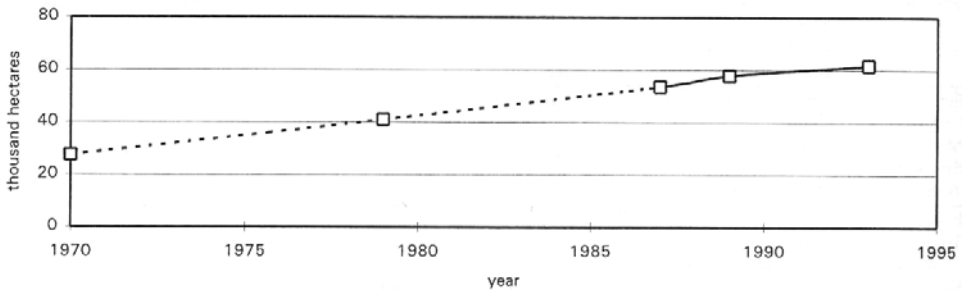

Figure 1: Evolution of the irrigated area in Oman (FAO 1997)

The most important crop grown is dates (44% of the agricultural area in 2000, MOI 2000), followed by 23% vegetables (e.g. tomatoes, potatoes, cabbages), 16% alfalfa, 15% fruit (lemons, mangoes, banana, pomegranate and in Dhofar coconuts) and only 2% wheat and tobacco (FAO 1997). Most of the agricultural production is concentrated along the coastal plains (compare figure 2), Al-Batinah in the north being the largest and Dhofar in the south the second largest agricultural region (Nagieb 2004). In these regions, irrigation water is mostly taken from wells, and a fast process of modernization has taken place since the 1970's (Nagieb 2004). In the mountainous region of the north, oases settlements have developed where water from springs can be used through the aflaj irrigation system, which has been preserved up to today to a large extent (Nagieb 2004). Some agriculture exists in the deserts, for example the country's only coffee plantation near the jebel akhdar. Rainwater retention dams and springs provide the source for irrigation (Nagieb 2004).

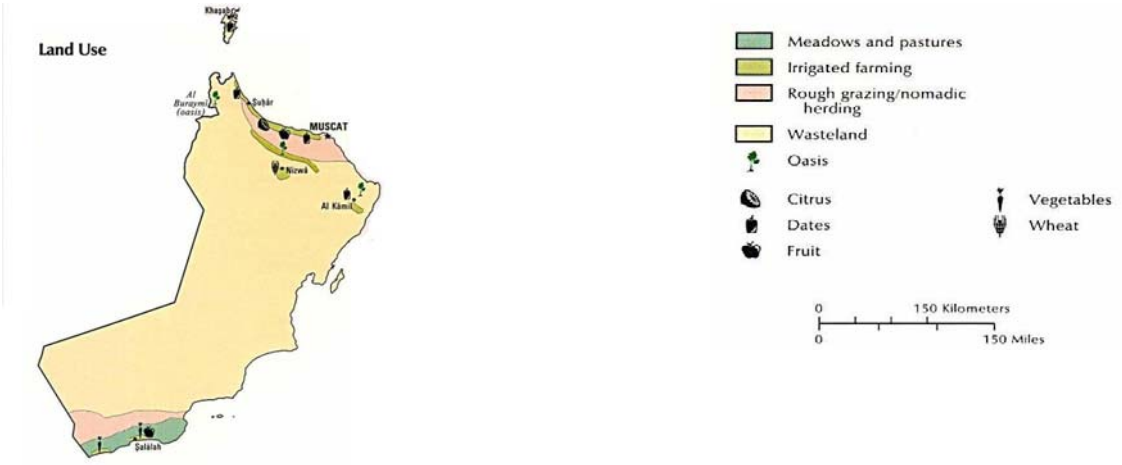

Figure 2: Land Use in Oman (CIA-Atlas of the Middle East 1993)

Water Resources

Natural renewable water resources, which satisfied all water requirements before 1976 (Al-Ismaily & Probert 1998), consist of rainwater recharging aquifers and amount to 985 million m3 in 1995 (FAO 1997). Today, they are supplemented by treated wastewater (26 million m3 in 1991), mainly used for the irrigation of ornamental trees (FAO 1997) and energy-intensive seawater desalinization (34 million m3 in 1995, FAO 1997), mainly used for drinking (Al-Ismaily & Probert 1998). Rainwater retention dams increase groundwater recharge by supporting infiltration (FAO 1997).

The main water withdrawer is with 94% of all water the agricultural sector (see figure 3), while domestic and industrial uses make up only a minor amount. The water withdrawal exceeds all renewable water resources by 181% (FAO 2007). This figure should be expected to have risen since the latest available data of 1991. This leads to an estimated yearly groundwater depletion of 240 million m3 (FAO 1997).

Irrigation

About 160 000 wells (Al-Ismaily & Probert 1998) and 3000 aflaj provide each about half of the agricultural irrigation water (Nagieb 2004), with a growing trend for wells (FAO 1997). Thus, all irrigation water is groundwater, used with powered pumps (FAO 1997). While the spring water lead by aflaj is of very good quality in most springs of Oman (Al-Ismaily & Probert 1998), the water from wells is increasingly affected by salinization. The construction and use of wells underlie strict regulations since 1988 (FAO 1997). Figure 4 shows that the traditional irrigation technique of surface irrigation dominates, while the use of modern irrigation technologies is growing.

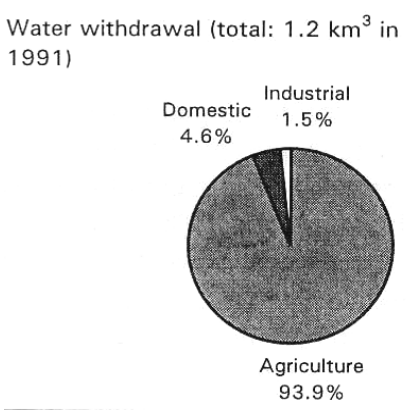

Figure 3: Water withdrawal by sectors (FAO 1997)

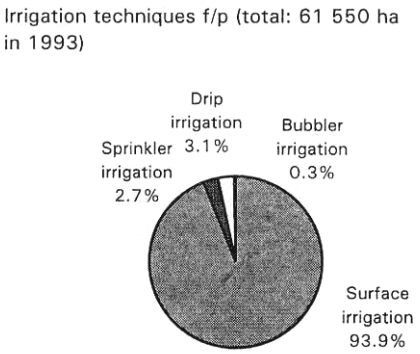

Figure 4: Distribution of irrigation techniques in 1993 (FAO 1997)

A Traditional Irrigation Method: The Aflaj in Mountain Oases Systems

History

The traditional irrigation system aflaj was probably introduced to Oman by the Persians, but may also be an own invention (Nagieb 2004). It first appeared earlier than 500 BC, allowed earlier settlements to grow and largely influenced settlement structure (Seckler & Schindler 2007). Similar irrigation systems exist in Iran, China, Japan, Egypt, Marocco, Spain, Mexico and Peru (Nagieb 2004).

Today, of Oman's about 4000 aflaj, about 3000 are in a healthy state, while about 1000 have more or less dried out because of a lack of maintenance and giving up of oases settlements and mountain agriculture (MOI 2000). Existing aflaj are supplemented by water from wells and boreholes (Al-Ismaily & Probert 1998).

Functioning

The functioning of a falaj (singular of aflaj) is sketched in figure 5. Rocks collect the rainfall of a large area and store it, buffering short-time water fluctuations (Luedeling et al 2005). The size of the catchment area and the retention time of the water determine the stability of water availability (Nagieb 2004). From the aquifers at the foot of the mountain, water is drawn and led to the settlements by open canals 100m-15km in length (Al-Ismaily & Probert 1998), which may be underground and staffed with access holes every 15-30m for cleaning and maintenance (MOI 2000). There are three different types of aflaj: the da'ndi, which is a long underground canal artificially drawing water from springs, producing the biggest and most constant outflow of between 15 and 20 liters/s (MOI 2000). The aini is an open canal above ground, leading water from natural access to mountain springs and producing a relatively constant outflow. The ghiayl is also an open canal above ground; it leads rainwater from wadis only seasonally (MOI 2000).

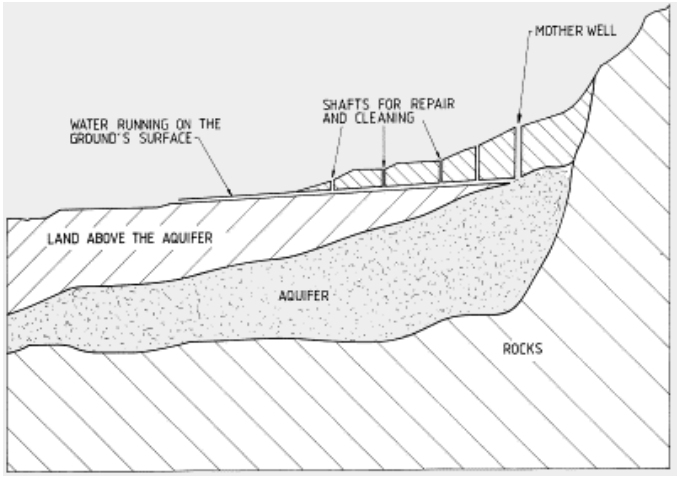

Figure 5: Sketched cross-section through a falaj (Al-Ismaily & Probert 1998)

Water Distribution

In the settlement, the cleanest water is first led to a communal collection point for drinking. Next it passes the mosque, for the ablutions and religious washing before the prayers. After that it is free for domestic use in the settlement, like washing, which is often done in the retention basins called lajal. Only after running through the settlement it may be used for irrigation (Al-Ismaily & Probert 1998). Privately owned wells supplement terrace drainage water and rainwater from wadis for domestic use and irrigation (Nagieb 2004).

For the distribution among farmers, a member of the community is elected. The time needed to irrigate each field belonging to the falaj once is one rotation or dawran and may last 7 to 12 days. The irrigation days (maqfool) are divided into day and night half (badda), which are again divided into half hours (athar) (Al-Ismaily & Probert 1998). Special clocks have been developed for the supervision of these exact time spans. Irrespective of his social importance, each farmer is assigned an exact time span for irrigation, proportional to the area he owns (Nagieb 2004). During nights, palm gardens are irrigated or, if the falaj outflow is poor, the water is left to fill retention basins to be available for irrigation during the next day (Nagieb 2004).

Water availability

Water is the limiting factor for most yields and determines which crops can be farmed in different oases and seasons (Norman et al 1998). As the water led by the falaj can not be drawn by force, the water availability is restricted to the renewable resources (Al-Ismaily & Probert 1998). The water use efficiency (irrigation demand/supply ratio) and water use index (maximum cultivable area/cultivated

area ratio) were found to be very high in examined oases of Wadi Bani Kharus and Wadi Bani Awf (Norman et al 1998, Luedeling et al 2005). This may also be explained by the high costs for water share, system maintenance and irrigation labor, which has been estimated to be 0.10 to 0.15 Rial Omani per cubic meter (0.26 to 0.39 Euros) in Wadi Bani Kharus (Norman et al 1998). These costs are paid by a portion of the yield. Close cooperation within the community is needed.

Salinization

The amount and quality of the spring water provided by aflaj is generally very high, although minor salt problems and pollution through domestic use may occur (Nagieb 2004, Luedeling et al 2005, Al-Ismaily & Probert 1998). The upper soils in Wadi Bani Awf are rich in lime and organic carbon through organic manuring (Nagieb 2004), stabilizing the soil structure against the influence of sodium. They have been found to store most irrigation water (Luedeling et al 2005), while the deeper soil layers of the artificially built up terrace soils have a high water leading capacity due to low packing density (Nagieb 2004). This ensures little but regular drainage (30% to 33% of irrigation water), which mainly occurs during the rainy season (Luedeling et al 2005). There is no salt accumulation in the upper 45 cm of soil, but a low build-up of salts below that depth (Nagieb 2004). There are no visible symptoms of water stress on plants in the two examined oases (Nagieb 2004).

Sustainability

Agriculture in mountain oases in Oman has been sustainable over millennia due to avoidance of salinization, prevention of erosion by terrace structures, efficient and adapted water use and production for local consumption and trade (Seckler & Schindler 2007). Today, the challenge of a rapid population growth, especially in urban areas, leads to a higher food demand, which cannot be satisfied by oases agriculture (Al-Ismaily & Probert 1998). Although mineral fertilization increased yields (e.g. doubled the yield of grain in Wadi Bani Awf, Seckler & Schindler 2007), it also made nutrient losses very likely, due to high nutrient surpluses (Buerkert et al 2005) and high mineralization rates caused by alternate wetting and drying, high temperatures and pH levels (Nagieb 2004). Wells provide a cheaper but less sustainable water supply in many areas. Rising labor costs in other sectors led to labor shortages and a decrease in local investment (Norman et al 1998). The aflaj are in many cases abandoned and dry out, especially when rebuilding is necessary (Al-Ismaily & Probert 1998). The Ministry of Water Resources financially supports the rebuilding of some aflaj, stating to put a high priority on their preservation (MOI 2000). The use of cement ensures a longer durability and lower maintenance costs (Al-Ismaily & Probert 1998). The key for preserving this millennia-old agricultural system seems to lie in keeping up high organic matter contents in the soils, providing for sufficient leaching of salts and support local investments to keep the aflaj functioning (Seckler & Schindler 2007, Al-Ismaily & Probert 1998).

Agriculture in the Coastal Plains - Modernization of an Irrigated Agricultural System

Agriculture at Batinah Plain

The Batinah Plain is located in the North of Oman, between the Persian Gulf in the North and the Jebel al Akhdar and western Hajar mountains in the south and west. These mountains provide the groundwater resources for irrigation through aquifers. In a narrow strip of 300 km length and 10 to 30 km width, 80% of Oman's agricultural land is located (Cooksen et al 2001). Main crops are dates, limes, alfalfa and vegetables. Near the coast are the best soils found in Oman. These fluvent soils are deep (more than two meters) with loamy textures. Silt and clay in subsurface horizons provide a high water-holding capacity. They are most at risk of salinization because of their fine texture and an upward movement of water and salts into the rooting zone. Further inland, salts rarely accumulate due to a coarse texture of the soil and good drainage (Cooksen et al 2001).

History

The Batinah Plain is cultivated since the 3rd century AD. Smallholdings ranging between 0.5 ha and 2.5 ha used animal-bailed wells for traditional surface irrigation (Norman et al 2001). A high biodiversity was maintained and intercropping systems were commonly used. The export of limes and dates to markets in East Africa and India, together with local fishing and almost self sufficient agriculture ensured a stable economy to the region (Stanger 1985). With the economic development in 1970 and higher investments in agriculture, the use of modern irrigation technologies introduced and the agricultural area increased. In 1974, all wells of were mechanized (Stanger 1985). Improvements in infrastructure, e.g. the construction of a coastal road, led to the settling of large scale farms. These changes caused an extraction of groundwater exceeding natural recharge. The irrigation costs are very cheap with 0.03 – 0.05 € for access only (Norman et al 2001). Finally, sea water intrusion led to high concentrations of salt in the groundwater. Farming close to the coast was not possible anymore and even very salt tolerant date palms died due to water scarcity caused by the effects of salt.

Figure 6: Satellite image of the Batinah Plain (www.google-earth.de, 2007)

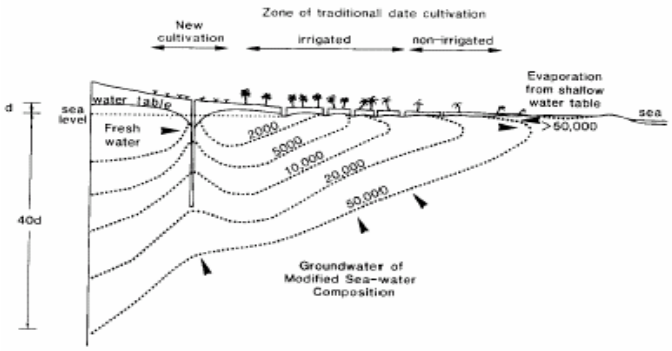

Figure 7: Schematic section of the Batinah coastal area (Stanger 1985)

Coastal Salinization

Salinization is affecting what are potentially the most fertile soils near the coast, leaving poor, stony soils for farmers to cultivate (Cooksen et al 2001). 35% of the cultivated area in south Batinah is considered to be slightly up to very strongly saline (>4 up to 64 dS/m) and 15% are extremely saline (>64 dS/m) (MAF 1990). In 1990, 20% of the date palms where abandoned in south Batinah (MAF 1990). Figure 7 illustrates seawater intrusion, showing the zone of traditional date cultivation and the newly cultivated zone. The numbers indicate the electrical conductivity (EC).

Modern Irrigation Technologies

Modern irrigation technologies are "... considered to be any irrigation system using piped distribution under pressure or gravity at the farm or field level" (Cornish 1998). The general aims of modern irrigation technologies are to increase food production, reduce the demand of labor, improve control and timing and finally the water use efficiency (WUE) (Cornish 1998). Modern irrigation systems are largely confined to commercial, medium and large-scale, high-input agriculture. There is a high risk of miss-matching irrigation hardware, developed for one set of physical and socio-economic conditions, with circumstances in an entirely different environment (Cornish 1998). Therefore the choice of modern irrigation system is very complex and should consider many aspects such as the availability of water, investment, WUE, labor demand (skilled and unskilled), risk of failures etc. The different modern irrigation technologies can be roughly divided into sprinkler-, micro- and pumped surface irrigation.

Micro-irrigation systems (such as drip lines) can be used to expand agricultural production at marginal desert soils rather than sprinkler irrigation (Cornish 1998). The WUE as well as the investment for micro-irrigation is very high, the labor demand is low. The last criterion explains why such systems are only available for large scale projects. Smallholders still use the traditional surface irrigation methods, today in combination with pipes and pumps. Evaporation is reduced when pipes replace open conveyance channels between the water source and field plots (Cornish 1998). Pumps allow deeper wells and reduce labor demand. The system is relatively cheap but in general there is a high risk of over pumping water resources if no strict regulations are given and the prices for oil and water are cheap.

Centre pivot irrigation systems are a kind of sprinkler method using a long lateral with a length up to 400 m and an irrigation circle of up to 50 ha. They are suited for large, flat fields of uniform soil texture, little labor is required for routine operation, design, installation and maintenance, but highly skilled staff is required. These systems are high in investment and have a very low WUE. The water is distributed by sprinklers from above the crop canopy and a wets large area, leading to high evaporation and especially interception, and causing high water losses (Cornish, 1998).

Desert Farming

Large scale farming projects at Batinah Plain and in the deserts use centre pivot irrigation and fossil water basins. The production of animal fodder such as alfalfa and rhodes grass at the Batinah is not allowed anymore, but these projects are now transferred to the desert. They are grown according to ecological agriculture regulations for the production of ecological milk, although Oman can only produce about 50% of its consumed food. The use of fossil water, especially with the centre pivot system, is not sustainable but the ecological agriculture regulations do not control it.

Comparison of the Irrigation Systems:

If we compare the traditional Aflaj system with the modern irrigation technologies at Batinah Plain, we come to very opposite conclusions. The problem of salinization at the coast does hardly exist in the mountain oases. Modern systems lead to severe depletion of the groundwater. There is a sustainable management of expensive water in the oases as well as a limited and community based access, in contrast to unlimited and individual access to a lot cheaper water at the coast. The traditionally closed nutrient cycles are very productive on a restricted area, but have no potential for expansion. The high input and area intensive monoculture at the coast has an open nutrient cycle with little recycling and much potential for expansion.

Looking at the end of the food chain with the question "Who eats the yields?" we realize that the traditional system in the mountain oases is used to produce food and animal fodder for local people, goats, sheep and cattle. Agriculture at the coast instead is used for the production of vegetables, fruits and animal fodder for the urban population, milk production (cattle) and export (dates, fruit). The people who profit from the intensive agriculture at Batinah plain are a few business men. The mountain oasis agriculture is community based because of the aflaj system and therefore many smallholders profit.

Conclusion

Agriculture in Oman can be described as intensive in labor and mainly restricted by water availability due to the need for irrigation. It can only sustain if high-quality water resources are used according to recharge, and if appropriate management is followed seriously. There is a conflict between the issue of the currently low food security and costly food imports on the one hand, and the threatened agricultural sustainability on the other.

First of all, productive traditional irrigation methods with high water use efficiency, as the aflaj system, must be maintained for providing income and part of the nutrition for the rural population in the

mountains. Governmental support for local investment is needed, although an overall increase in agricultural production cannot be expected of these traditional methods. Still, there are some possibilities for a sustainable increase in food production:

The availability of renewable water resources can be increased. Alternatives to using up excessive amounts of fossil energies, such as desalinization by solar energy, osmosis and wind-power must be considered. The construction of rainwater retention dams as well as the recycling of wastewater are already in use, but may be expanded. Modern irrigation systems have enlarged agricultural production and productivity significantly (MAF 1995) and enabled farming under very harsh conditions. They must be chosen by their efficiency of water use, labor need, productivity and costs. Water may be saved through improving the efficiency of application. Even if water is applied in the most effective ways, to sustain agriculture at the Batinah plain under the current threat of salinization, a reduction of farmland up to 3,400 ha in the area of land cultivation is recommended (Cooksen 2001), and may be unavoidable.

The high demand for investment or even fossil water use by intensified agriculture has to ensure high returns with respect to income and food security. Producing fodder crops for milk production should be of second interest to the production of high-value and high-quality crops for the reduction of imports of expensive foods, or for export (e.g. winter vegetables, quality dates and cut flowers, Omezzine 2001). Aspects of traditional oasis farming could make a contribution to modern sustainable farming systems. For example traditional cropping systems, like intercropping of annual and perennial crops, as well as the organization of irrigation water distribution, may be equipped with a modern irrigation technology such as drip irrigation. This can lead to very high water use efficiency and an intensive and sustainable production.

Figure 8: Satellite image of desert farms (www.google-earth.de 2007)

Figure 8: Satellite image of Salalah Coast (www.google-earth.de 2007)

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From palm gardens to garbage dumps: an analysis of the structure of selected oasis settlements from satellite images.

Ute Gilles & James Thompson

Interpretation of satellite images has proved to be a valuable means for the evaluation of the land resources of four mountain oasis study sites in northern Oman. Other sources of geographic information, photographs and research literature have further enriched our understanding of the sites, three of which will be visited during the 2007 Oman study tour.

Traditional oasis settlements vary according to location and available resources, though each study site has distinct areas allocated to date palm gardens, crop terraces and urban development. Our aim is to gain a deeper insight into traditional systems, and the changes and environmental pressures associated with the current modernisation trend.

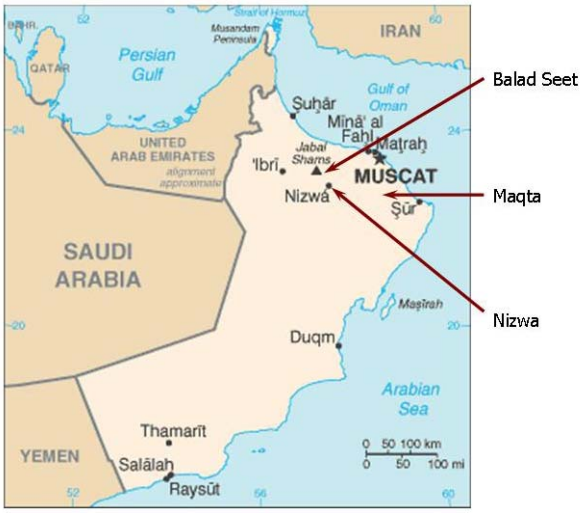

Figure 1: Location of mountain oasis study sites (Source: CIA 2006)

Land interpretation resources and methods

Google Earth images supplied to us by the Institute of Crop Science, University of Kassel, Witzenhausen, have provided the basis for our interpretation of the Balad Seet, Maqta and Nizwa sites, as well as for what we have dubbed the Deserted Oasis site. The interpretation of the Balad Seet site has been aided by the site map that is presented by Nagieb et al. (2004). This three dimensional digital base map was established in the development of a geographic information system (GIS) initiated in April 2000. Other images that have been utilised in the interpretation have been made available in excursion pre-departure communications. Further information has been drawn from journal articles relating to the study sites.

Balad Seet (23.19°N, 57.39°E, 996 m a.s.l) - Interpretation of satellite image

Interpretation of the Google Earth image of Balad Seet is presented in Figures 2 and 3. The winding nature of roads and streams marked on Figure 2, together with shadows on the image that reveal deeply eroded geomorphic features, provide evidence of rugged terrain. This interpretation is supported by our other references described in Section 1.2. In Figure 3, Balad Seet land resources are identified and categorised as: date palm gardens, field crop terraces, urban settlements, and degraded land. Shadow bands in Figure 2 provide evidence of the relative heights of various features. The height of palms, interpreted from the shadows along the northern edges of each grove, can be compared to heights of features such as other broad canopy vegetation and buildings. The location and relative heights of terrace walls in agricultural zones can also be discerned.

Insights gained from secondary geographic information references

Agriculture

Gebauer, Nagieb & Buerkert (2006) provide details of the date palm gardens at Balad Seet. Sixteen varieties of dates (Phoenix dactylifera L.) have been identified in 2 large and 1 smaller areas. The

2,690 palms cover an area of 8.8ha. Other perennial crops that are not visible in the Google image are inter-planted beneath the palms or in other zones.

Figure 2: Aerial photograph of Balad Seet showing vehicular roads, major intermittent streams and location of historic garbage dumping site

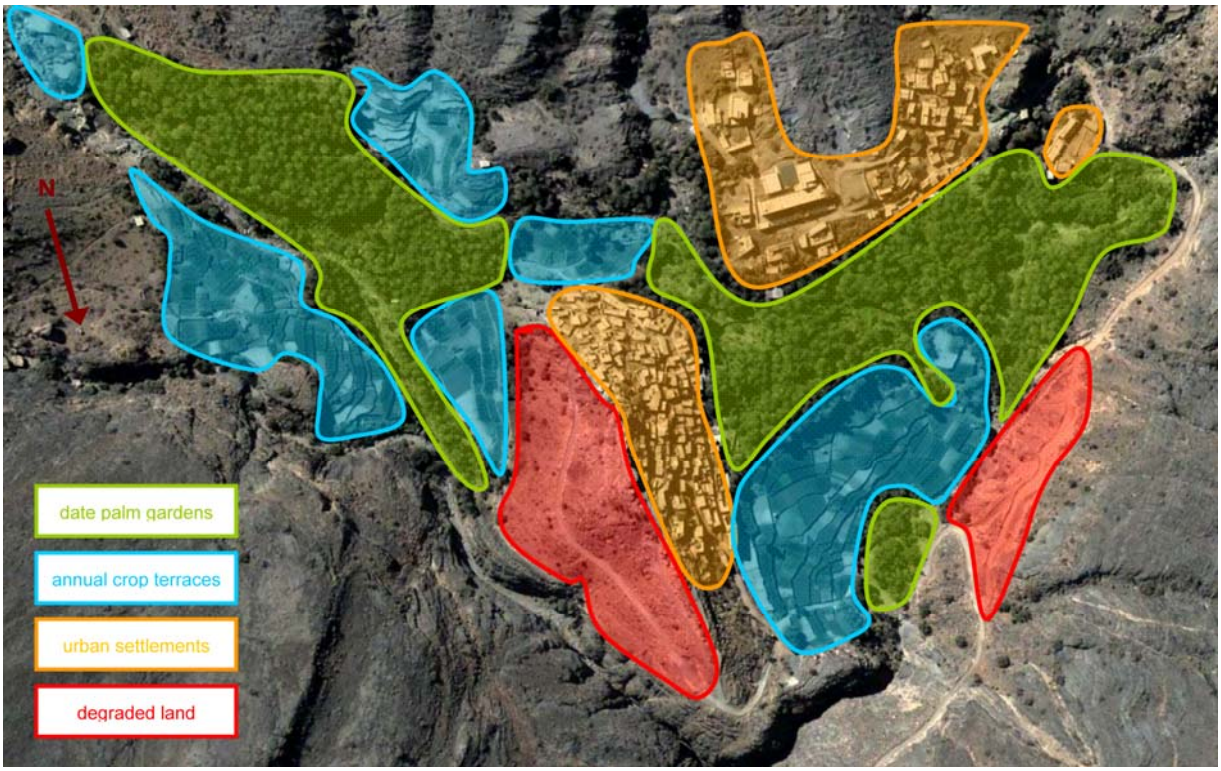

Figure 3: Aerial photograph of Balad Seet showing identified land use zones

Significant among these crops are limes (C. aurantiifolia (L.) Swingle), sour orange (C. aurantium L.), bananas (Musa spp. L.), grapes (Vitis vinifera L.), figs (Ficus carica L.), pomegranates (Punica granatum L.), and papaya (Carica papaya L.). Annual crops are grown in 6 terrace systems (4.6ha). Cereal crops include wheat (Triticum aestivum, T. durum), barley (Hordeum vulgare), oats (Avena sativa) and sorghum (Sorghum bicolor) (Nagieb et al. 2004). Alfalfa (Medicago sativa), garlic (Allium sativum), onions (Allium cepa L.) and coriander (Coriandrum sativum L.) are also grown (Gebauer, Nagieb & Buerkert 2006). Nagieb et al. (2004) report varied seasonal crop production with a fallow rate of 15-20% in winter and 50-70% during the summer. Visual interpretation of the crop terraces in Figure 2 indicates the image has been taken during the winter season as the fallow rate appears to be that of the winter period. Temporal interpretation could be extended to analysis of the angles and length of shadows to give an indication of the time of year and time of day that images have been taken. In Figure 2, shadows on the north-western sides of the palm gardens suggest that the image was captured in the early morning.

Urban settlement

The current village layout, evident in the Figures 2 and 3, originates from the Late Islamic period (1650–1930), with later distinct phases of development in the periods 1930–1970 and 1970–current time. However archaeological evidence, including pottery shards found in the village garbage dump site indicated in Figure 2, suggests that settlement dates back to the Iron Age II period (1,100–600 BC) when a village was constructed on the ridgeline on the eastern side of the central urban area. This may have corresponded with the advent of falaj technology (Nagieb et al. 2004). Larger buildings in south-western urban cluster appear to be of a scale that suggests more recent construction. The 2003 population of 650 exceeds the actual human carrying capacity 156 adults. Importation of food into the village is thought to have been a long term characteristic of the settlement. Currently there is a trend towards decreasing agriculture as a growing number of residents work outside the village and treat the village as a home base for vacations, traditional family celebrations and ceremonies (Nagieb et al. 2004).

Maqta

The oasis of Maqta is situated in the Jabal Bani Jabir mountains at the upper end of a Wadi called Khabbah. (59.00°E, 22.83°N; 1,050 m a.s.l.). Maqta is a very scattered settlement within a radius of 800 m with a central village area of 59 houses and 12 widely spread temporary settlements in a vast rocky grazing area. About 200 semi-nomadic inhabitants and about 900 sheep and goats are living around. Through a newly built road regular transport of water, agricultural goods and fodder into the area, in form of government subsidies is provided.

There are 16 terrace systems totalling 4.5 ha of which 2.9 ha are planted to date palms (Phoenix dactylifera L.) and 0.4 ha to wheat landraces (Triticum durum and Triticum aestivum). These terraces are watered by 22 small springs with a flow rate between 5 and 1212 l/h according to availability that feed the aini-aflaj. The fields are on widely scattered terrace systems and are between 2 and 160 m² in size mostly squeezed between cliffs in rugged mountain escarpments and headed each by a tiny spring. Below the spring there is a hierarchy in planting: The most water demanding date palms are immediately below the spring, followed by fields planted to wheat landraces only during the rainy season in winter and left fallow the rest of the year. Fodder production only occurs during years of abundant rainfall. During the summer months only the date palms are under cultivation. The outflow of 22 springs was mainly used to irrigate the palm groves. Water is the limiting factor in this oasis as it lies on the western side of the Jabal Bani Jabir which represents one of the driest areas worldwide. The following table shows a comparison between Maqta and Balad Seet. The conditions are different as Balad Seet has more water available and more fields per ha as the landscape is more adequate for farming. Although Balad Seet has five times more inhabitants the average agricultural area per inhabitant is slightly higher in Maqta. The fraction of palm grove area is nearly the same.

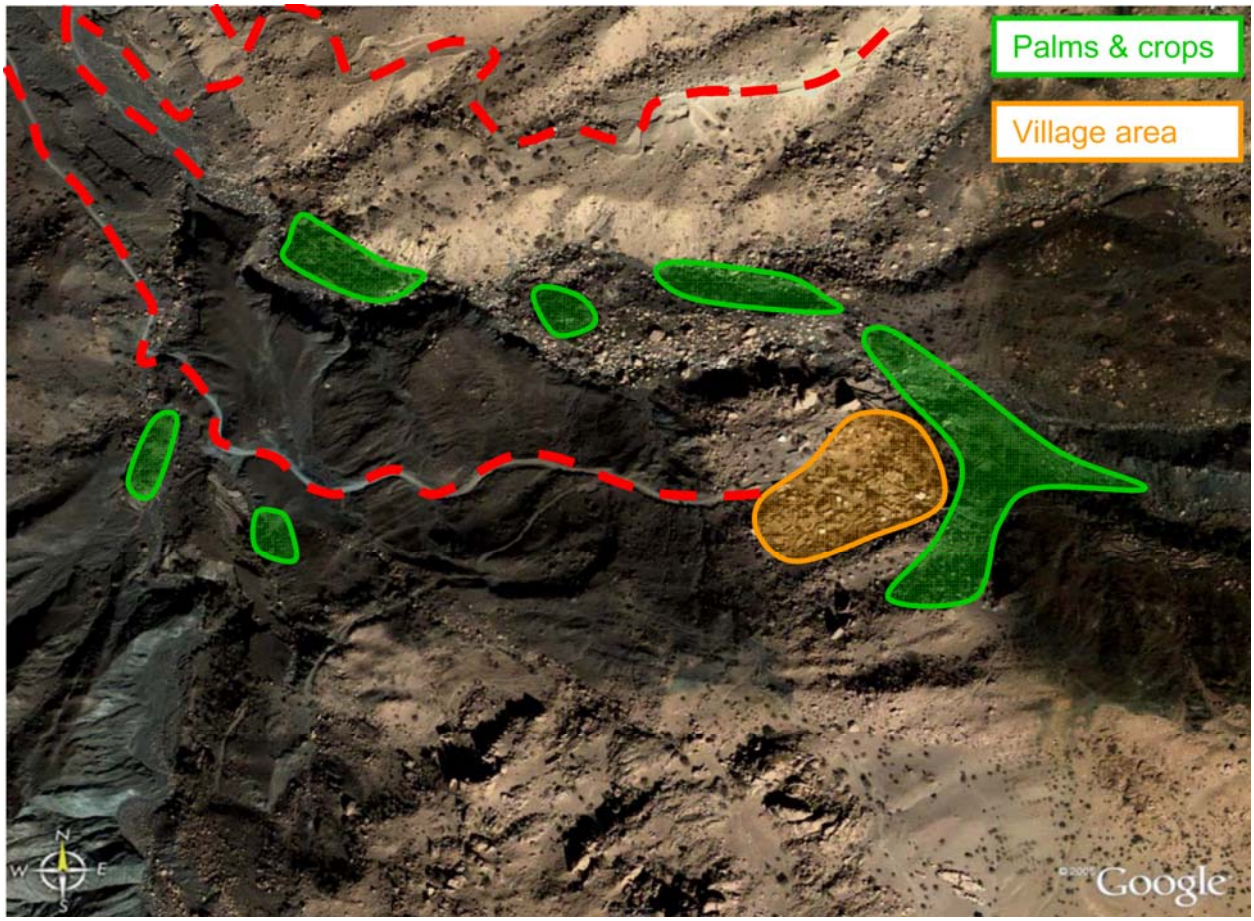

Figure 4: Google satellite photograph of Maqta showing roads, village area and palm & annual crop areas

Table 1: Comparison of Balad Seet and Maqta (Siebert et al. 2005)

Natural resource	Balad Seet	Maqta
Palm grove area (ha)	8.8	2.9
Terraced fields (ha)	4.6	1.6
Available water (m^3d^{-1})	601	115
Number of inhabitants[b]	650	200
Average agricultural area per inhabitants (m^2)	207	225
Fraction of palm grove area	0.66	0.64
Cropping intensity[a] in 2002/2003	0.85	0.66
Available water per inhabitant (l d^{-1})	925	575

[a]: agriculturally active area / total agricultural area; [b]: total population in 2003 comprising adults and children

Nizwa: mountain oasis town

Nizwa is located in the interior province about 165 km from Muscat and is one of the largest cities in Oman. Nizwa differs to the before mentioned settlements as this is an urban oasis. On the aerial photo one can see in the right hand corner the Nizwa fort and the mosque. Two main roads with cars a roundabout and a river like water canal as well as modern building alignments. Here the dark green

areas mark the date palm gardens that seams more degraded closer to the fort and mosque area. According to the Nizwa official website (Nizwa n.d.) the town's immense palm oasis stretches for eight kilometres along the course of two wadis. One wonders why they outpoint these palm gardens while the ones close to tourist attractions are degrading. We only can speculate the reasons: water shortage, urban settlement plans as the mosque and the fort are as well tourist attractions.

The Deserted Oasis

On the way at the Shir Plateau there is another example for degraded palm gardens. Here we see on the left a mountain followed by degraded palms. The greens are still intact palm trees with houses in between. In the right upper corner one can see a relatively new road, maybe paved. At a closer look degraded palms are lying around, neglected. New and modern style concrete houses are built. Even at this scenario it is not clear to the viewer what the intention is behind the change. Be it that the inhabitants came to money and invested it into new modern housing. They do not want to work anymore in the palm gardens as it is physically hard work. Maybe the younger generation migrated to Muscat seeking for better paid jobs and for a more comfortable life, leaving the elder behind not able to maintain the palm gardens. Are these the future garbage dumps?

Conclusion

It is apparent that the distinctive character of each oasis in the current era is tied not only to physical environmental factors such as water supply and topography, but also to anthropological factors such as the political, economic and trade history of the region. While rapid change is evident at Nizwa and the Deserted Oasis site, where loss of date palm vegetation has been observed, reference sources have shown that historically change has been a common aspect of each site. The garbage dump at Balad Seet and other archaeological relics show that settlement has been long and varied. It is of concern that after having endured centuries of change the unique agro-ecological systems of the remnant oasis settlements are being threatened by rapid modernisation and may be relegated to garbage dump status in the future. Survival in this modern era may depend on each settlement finding a relevant and sustainable role for itself in Omani society.

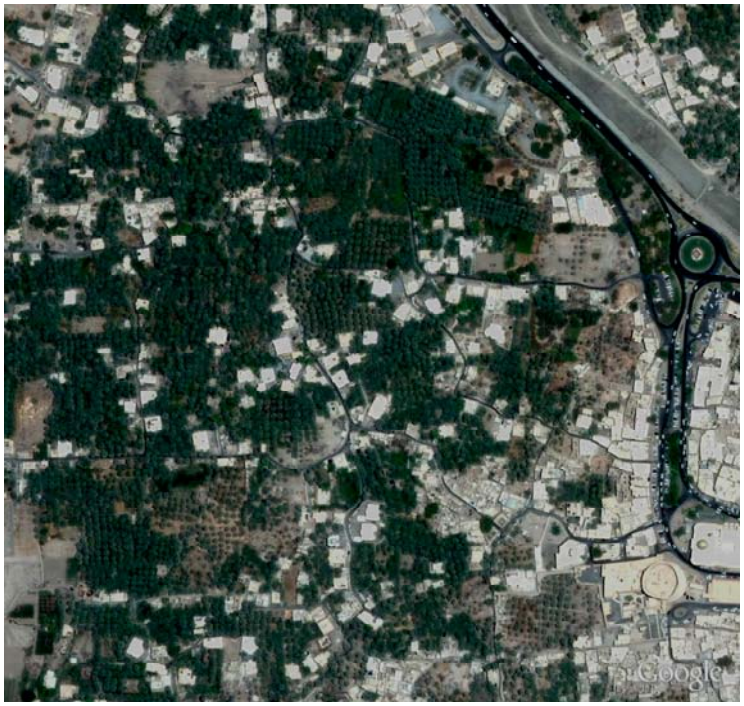

Figure 5: Google satellite photograph of central Nizwa

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Camels, Goats and Horses - the most important livestock species in Oman

Natacha Crozet & Julia Jawtusch

The aim of this contribution is to introduce three livestock species of Oman – camels, goats and horses. Even though cattle and sheep are nowadays very numerous in Oman, too, the three mentioned species were identified as being part of the country's long tradition of nomadic and semi-nomadic livestock keeping and can thus be called the most important livestock species of Oman. FAO data from 2004 state that there are about 854,000 goats and almost 99,000 camels in Oman. There are no figures on horses available.

The conditions for livestock keeping in Oman

Oman is characterised by dry and hot conditions in most of the country during most of the year. Only 0.2 % of the area of Oman is used for cropping. Despite this fact, 40% of the population is engaged in agriculture or fishing. It can be deduced that livestock keeping plays a major role as in most parts of the world that have harsh conditions – like water and food scarcity. In order to find enough resources for feeding the animals, large areas have to be used. That is how the nomadic lifestyle evolved.

Nomadism

Nomadism exists since thousands of years. The herds follow the fodder and the herders follow the herds. It is a well-adapted lifestyle for marginal areas (arid and semiarid regions). Nomads are interested in gaining wealth just as most humans, but since they do not have any permanent settlements, it needs to be "movable wealth". The animals are this movable wealth. Under nomadic conditions, certain skills and adaptation mechanism are requested by the animals. Not every species is suitable for a life under such harsh conditions. Among these specific requirements are the adaptation to water scarcity: Whereas cattle and sheep need to drink water every two to three days, goats can cope without water for four to five days. Camels can do so even for up to two weeks. Due to that, the grazing radius of camels and goats around a water source is much larger than that of cattle or sheep.

Goats

Goats are so-called intermediate feeders. They are rather selective and, in contrast to cattle and sheep, they do not only graze from the ground, but also browse bushes and trees by standing on the behind legs or by climbing, if possible. As mentioned already, goats are very adaptable to harsh conditions. The have a high dry matter intake and high crude fibre exploitation. They are good climbers. Their ability to cope with water scarcity is second best after the camel – they can, for instance, stop water loss through the kidney. Goats are also quite heat tolerant. There are many different goats breeds that differ in colour, size and length of hair according to their adaptation to certain climatic conditions. Goats from hot, humid climate often have a rather small frame and short hair. Goats from arid climate of climate with high temperature variations are often bigger and have long, thick hair. "The goat is an ideal animal for keeping in harsh arid areas of the world. Its ability to survive under such conditions and produce high quality animal protein in the form of milk and meat is unparalleled except probably by the camel. The ability of goats to achieve this is attributed to their low body mass, low metabolic requirements, skilled behaviour and efficient digestive system" (O. Mahgoub et al., Sultan Quaboos University, 2004).

Different goat breeds in Oman

Goats fulfil many different functions in Oman. They are an important provider of animal protein in the form of meat and milk. Especially selling the meat is an important source of income to small holders, as goat meat is the most preferred by the Omanis. On social and religious occasions it is a custom to slaughter a goat. Goats in Oman feed on acacia shrubs and trees or seasonal range grass, Rhodesgrass hay, by products such as dates, fish, banana stems and household leftovers.

Three different breeds of goats are distinguished in Oman. They are named after the regions from which they originate: The Batina goats from the Al Batina plains, the Dhofari goat from the Dhofar region in the South of Oman and the Jebel Akhdar goat from the Jebel Akdar mountains in the North.

The Batina goat widely distributed in most of Oman with the majority in the Batina costal plains. It is generally kept in small flocks of about ten animals by nomadic, semi-nomadic and settled farmers. Batina goats have a rather large frame, are horned and have medium sized pendulous ears. Their hair is long and they are of a variety of mostly dark colours.

The Dhofari goats live in most of Southern Oman, with few numbers scattered in the North. They are generally found in large flocks of about 50 to 300 heads, but smaller flocks are kept by settled farmers in Salalah plains. They are sabre-horned, have short erect ears, short hair and a variety of colours (with the white colour most dominant). They have a small frame which enables them to climb and graze on the mountain slopes easily.

The Jebel Akhdar goats are mostly located in the Jebel Akhdar montains and the interior. They are usually kept in medium to large herds of about 50 to 300. Sedentary farmers in the interior plains have smaller herds. Jebel Akhdar goats have back-twisted horns, long pendulous ears, long hair and predominantly golden to brown colours. They are the biggest breed in size in Oman and at the same time with about 20% of all goats the least numerous.

Social and Spiritual Meaning of Goats

Traditionally, sacrificing a goat has a strong religious meaning in Islam because it symbolizes Abraham´s son being saved by God (and a goat being sacrificed instead of him). For instance, the end of Ramadan is celebrated by slaughtering a goat. Goat management is a part of Omani heritage and tradition. Goats used to be an important factor in deciding dowries. Women played (and still play) a major role in controlling the goats as well as taking decisions with regard to this wealth.

Camels

There are two chief kinds of camels: (1) the Dromedary Camel Camelus Dromedarius or Arabian camel, also called dromedary, which has one hump, and (2) Bactrian Camel Camelus Bactrianus , which has two humps. In the past, hybrids (crossbreeds) of the two species were used widely in Asia. These hybrid camels had one extra-long hump and were larger and stronger than either of their parents. The Camels have been domesticated thousands of years ago by frankincense traders, who trained the gangly cud-chewer to make the long journey from southern Arabia to the northern regions of the Middle East. Dromedaries were first associated with nomadic Semitic cultures and did not become important until the rise of the Arabian culture. They became important domestic animals only with the Moslem conquests of Egypt in the 7th to 11th centuries A.D. It even went on to become the most important of all the animals to the medieval Muslims. They were called "the Gift of God" and "the Ships of the Desert" thanks to their ability to withstand arid conditions. Camels were consequently used for transport, Camel caravans carried goods and people across the Arabic world to trade, nomadism or Pilgrimage. Some caravans were from 1,000 to 2,000 camels long.

The important place of camels is also due to its different possible uses. First, camels were an important source of food in the desert. People eat the meat of young camels, though it can be very tough. They melt fat from the animal's hump and use it as butter. People drink camel's milk and also make cheese from it. Camels can also supply wool and leather for clothing and shelter. Camel droppings can provide fuel after being dried. They can practice agricultural work as pulling ploughs, turning water wheels, and carrying grain to market places. Deep in the deserts, camels are almost the only source of transportation, food, clothing, and shelter. But their strength and their resistance were also used for other purposes. For example, at the time of the Prophet Muhammad, the camel was the most important animal in war. The earliest wars were attacks with warriors mounted on camels' backs. The other activities using the camel’s speed is Camel racing which has been a traditional desert

sport of Bedouin tribes for many centuries. Camel is a really useful animal because of its complete adaptation to its environment and it played a fundamental role for the development of the Arabic world. A such beneficial animal became consequently highly valuable. The possession of camels was a sign of richness and power within the tribes and it could help to acquire respect. We understand easily when we know the status of camels, that they were called "gift of god". The camel is also quoted in the holy qu'ran and that gives it even more importance.

The oil has been discovered and exploited in the sultanate of Oman around 1950. Consequently the Omani economy knew an high growth and an important diversification but these changes were coupled with a decrease in animal breeding throughout the country and especially in camel breeding. The traditional nomad movement have been limited in terms of frequency and distance. A lengthier stay in one location, the construction of semi-permanent or permanent housing and the movement from one location to another by Landrover are common today. Camps are established near surfaced and unsurfaced roads and where they are accessible by vehicle. The camels lost their monopoly as "transport of the desert". Moreover Traditionally, policymakers have seen camels as old, out-dated and destructive to vegetation. They are often considered responsible for overgrazing and desertification because they eat not only the upper part of the plant but also the roots. Consequently They have been linked with under-development. the few camels that are still raised are turned out to free pasture. But this is no longer true. "Camels have an important place in the 21st century. In fact I'd say they are becoming more important," says Professor Babiker Elhag Musa, who oversees the breeding and management of more than 400 camels at the Camel Breeding Centre of the Royal Camel Corps of the Sultan of Oman.

Camel racing is particularly important in Oman because Omani thoroughbreds are more in demand than other Arabian camels. With their medium size, their speed and their strength, they are appreciated sprinters. Camel racing are becoming more and more renowned all around the arabic world and consequently racing camels are more and more valuable. They can command fabulous prices ranging from RO60,000 (120 000 Euros) to RO100,000 (200 000 Euro) a head . To keep camels at the top, they receive special treatment, they are scrubbed and shampooed twice a week, any bruis daubed with expensive ointments, and at night, kept warm with blankets and sheets. Their diet is not the usual thorny shrubs of desert vegetation. Instead they are reared on rich fibre-based fare, which includes the finest honey and dates, fresh cow milk and ghee, wheat and freshly harvested alfalfa grass. In summer, they are fed the tender leaves of the sidr tree. This diet with weekly stomach purges keeps camels in fine fettle.

Camel breeding is a traditional activity in Oman and to preserve this heritage, a Directorate-General of Camel Affairs was established in the Diwan of Royal Court in 1989 to accord with the wish of His Majesty Sultan Qaboos. Located in the wilayat of Barka at Fulaij, it is equipped with the most modern race tracks and camel pens. High-technologies are now common used like artificial insemination, frozen embryos, sex semen etc… This development doesn't concern all camel breeders yet but for traditional camel-keepers, the renewed interest in camels and breed improvement can be highly beneficial. "If camel owners shift from quantity to quality, from subsistence to supplying the new markets, then they can get a lot of money," Professor Musa says.

The Arabian Horse

The spiritual meaning of the Arabian horse has been very high to Bedouins for hundreds of years. The care for a horse is described by the Koran as a „holy duty". For example, it is forbidden by the Koran to clip a horse's mane and tail (the horse's protection against insects). Horses are treated like a „family member" by the Bedouins. Each horse is said to have its own personality. They are a sign of greatest wealth and a topic for many conversations and poems. Many positive characteristics are accredited to the Arabian horses. Among these are courage, patience, loyalty, docility, a quiet temper and a very good memory. They are also said to be gentle, affectionate, familiar, brave, very intelligent and eager to learn. Arabian horses have the oldest tradition of pure breeding of the world. Certain laws for pure breeding ("Asil Arabians") were introduced by the prophet Mohamed in order to

encourage the improvement of the race. For example, Moslems were forbidden by the religion to demand money for the mating of a mare with a stallion. The „Bloodline" of each animal is passed on by oral tradition - sometimes 500 years of knowledge about heritage. The following quote from the Koran illustrates very well the outstanding value of the Arabian horse:

„He who is not able to fulfil all his religious obligation may keep
an asil horse for the honour of God and all his sins will be forgiven.
No tent that houses an asil horse is ever entered by demons.
He who rears an asil horse for the Holy War will be spared
purgatory on the Last Day"
(Köhler et al., 1980)

Today, in the Sultanate of Oman there are currently about 2,000 horses, of which approximately 350 are pure-bred Arab horses, 150 are thoroughbreds, and 1,500 are pure-bred Omani horses. Horses are high valuable and Oman is well-known for its pure-bred Arab horses. The situation was not always as good as the present one, during hard drought spells which became more common over the last few centuries, the number of horses decreased dramatically. In 1970, with His Majesty Sultan Qaboos bin Said's accession to the Omani throne, new directives were implemented pertaining to the breeding and care of Arab horses. A Directorate-General of the Royal Stables has been established under the Diwan of Royal Court which supervises the breeding and rearing of horses using scientific methods in conformity with international standards (artificial insemination, frozen semen..). A horse-breeding department was set up in Salalah which concentrates on the breeding of pure-bred Arab horses. In general, the Royal Stables breed a variety of pure bred and thoroughbred horses from the finest bloodlines available. The Oman Equestrian Federation arranges other race meetings and equestrian events, with the aim of preserving this valuable heritage. In addition the Royal Horse Racing Club was established to oversee the planning and development of equestrian activities, as well as organising the Royal Oman Horse Show which is held every 5 years.

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The vegetation of Northern and Southern Oman

Elisabeth Hüsing

The Sultanate of Oman is a developed oil producing country in the Arabian Peninsula. Until now little has been known about the flora of Oman. In the last 30 years there have been scientific studies, such as "The Oman Flora and Fauna Surveys" in 1977 by Mandaville, and others by Cope 1988 and Ghazanfar 1992. However none of the university libraries neither in Goettingen nor in Kassel have these books in stock. But I found a flora analysis of the Oman Capital Area by Kürschner and Frey in 1986 and an overload of general background information about Vegetation of the Arabian Peninsula.

General characteristics of the Oman

Oman is located in the southeast corner of the Arabian Peninsula on the Tropic of Cancer between 16°38′ and 26°20′ North latitudes and longitudes ranging between 51°50′ and 59°35′ East. The topography of the Oman is one of the most magnificent in the Arabian Peninsula with its mountain ranges in the North and South, sand dunes and large salt flats in the Central, rugged coasts and placid beaches along the 1,800 Km coastline. The Geography of the Sultanate results in a wide variety of climatic conditions. In general three climate zones can be found. The North is characterised by a subtropical climate with hot summers and mild winters with winter rains. The annual rainfall in Muscat (see figure i) is 106mm with an average temperature of 27, 5°C. The elevated areas, like the Jebel-al-Akhdar Mountains, have a rain average ranging from 250mm to 400mm per year. The South has a tropical climate with hot and humid summer and warm winter. The monsoon season from June to September can bring rainfall from 100mm to 400mm. Salalah (see figure ii) is located on the coast and just in front of the southern mountains. The central area is an all season dry desert with an annual rainfall of less then 50mm. Thumrayt (see figure iii) has a rainfall of 35mm per year. The temperature can reach over 45°C per day in the summertime.

Zonobiome

Zonobiomes are climate zones corresponding to the largest vegetation units. They are linked with the climate zones by Walter and you could also refer to them as biogeographic zones. They are subdivided into subzonobiomes and those into individual biomes. The Oman is a transition region between the Paleotropic and Holartic Kingdoms and belongs to the subtropical, aride zonobiome. The North is situated in the Omano- Sindian regional subzone (OS), a subtropical dry zone; where else the South is located in the Eritro- southern Arabian regional subzone (EA), a tropical zone; and the Central in the Saharo– Arabian regional subzone (SA).

The following paragraphs will be listing the significant Flora of the North, South and Central Oman.

The North can be separated into four different vegetation areas (see figure iv). First there are the foothills and the mountain ranges. The foodhills are characterised by shrub and dwarf- shrub, like the Commiphora myrrha (see figure v) - Euphorbia larcica (see figure vi) community type which can be found frequently in xeromorphic, semi-desert shrub lands. The high mountain ranges of the Hajar mouintains with its colder temperature even the conifer trees, like Juniperus exelsa (see figure vii), are growing. The mountain plateau at the Jebel Akhadar (3000m) is also referred to as the green mountain and has Mediterranean-like vegetation. Because of this mild climate, pomegranate, figs, apricots, pistachios, walnuts, almonds and grapes can be planted there. Secondly, the costal plain, like the large lowland Al-Batinah, are covered by xeromorphic woodlands. These so-called pseudo savannas consisted of various acacia species (A. charenbergiana, A. tortillas) and other xeromorphic plants. They are dependant on groundwater and because of the sinking groundwater level just remnants of these thorn woodlands can be found today. The third vegetation area is an area of costal- and eolian sand dunes. These sand dunes are scarcely vegetated by psammophytic (see figure viii) vegetation. Fourthly, Depressions with salt marshes and mangroves are placed on the coast. With one species (Aviencennia mariana (see figure ix) the mangroves are represented in patches not just in

the north, but also along the whole coast of the Sultanate. The southern coastal region and the hills catch just enough of the summer monsoon to support a rich, unique tropical forest (see figure x). There are even some irrigated plantations with coconut palm (see figure xi), banana (see figure xii), Papaya (see figure xiii) and mangoes trees. The Mountains far off the sea get less rain and because of its dry tropical climate the tree Frankincense (Boswellia sacra (see figure xiv)) can be found in the Dhofar. In a wadi next to the Jebel Samham Mountains Baobab (see figures xv and xvi) trees, a typical tree species from east Africa, are growing. This wadi is the only place on the Arabian Peninsula where they are present. The Central mainly consists out of sand, rock and salt deserts. Several Grass species and some shrubs are growing there. The Ghaf-tree (Prosopis spicigeradie (see figure xvii)) and (Prosopis cineraria (see figure xviii)) with its long roots reaching the ground water and holding the sand is a typical flora of this region.

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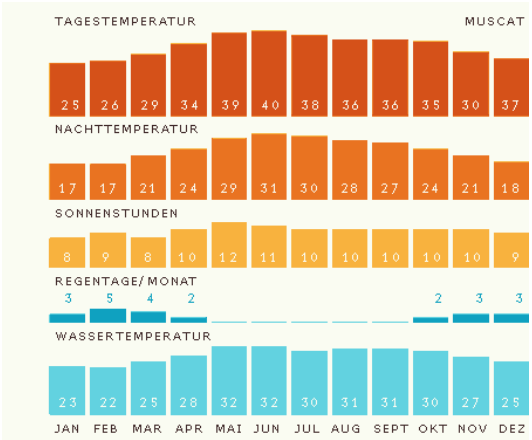
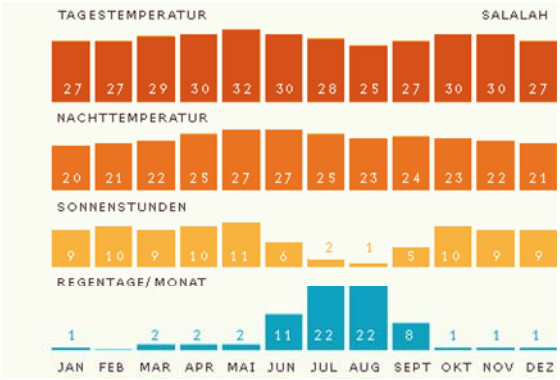
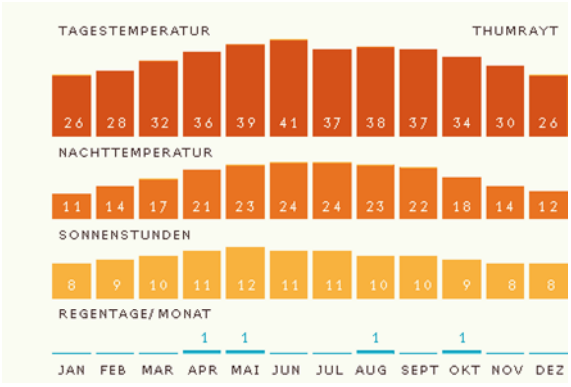
Salalah (south coast)



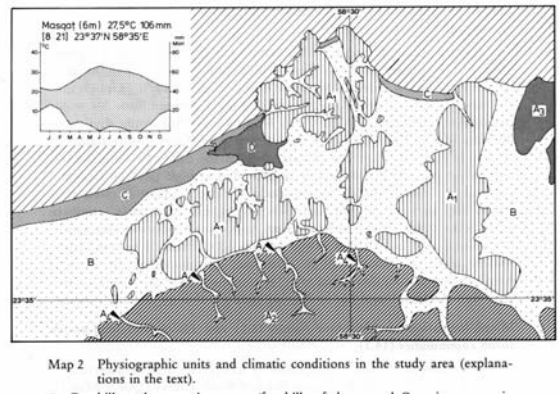
i) http://deutsch.oman.travel/index.php



ii) http://deutsch.oman.travel/index.php



iii) http://deutsch.oman.travel/index.php



Map 2 Physiographic units and climatic conditions in the study area (explanations in the text).

iv) Kürschner, H, Frey, W., 1986

v) http://www.e-ssentialoils.com/images/plantsoftheworld/commiphoramyrrha1.jpg

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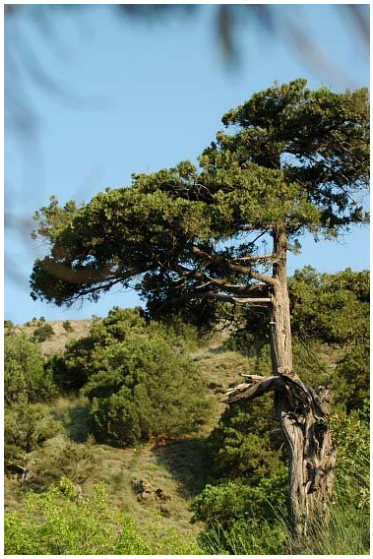

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viii) http://www.ameinfo.com/images/news/1/21941-ghaf.jpg

ix) Astaller, M.

x) http://www.mobot.org/gradstudents/olson/dhofar.jpg

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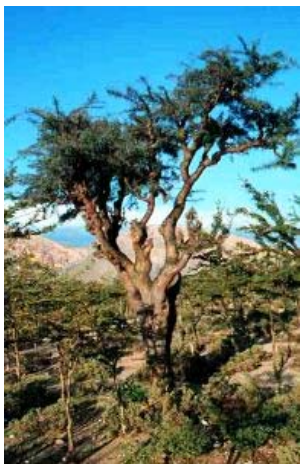

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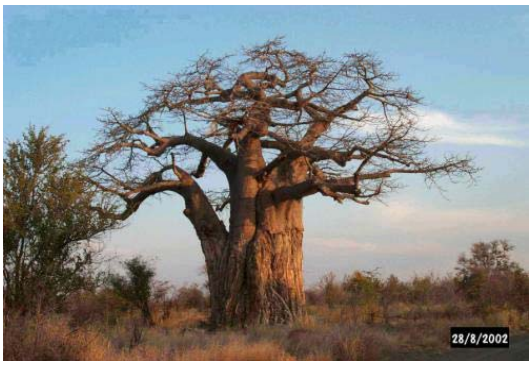
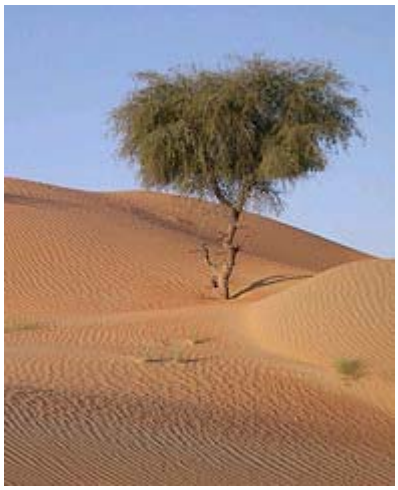


xvi) http://toursaa.com/pic.aspx?i=9167



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Islamic women in Arabian societies
Part 1: Women in Oman

Julia Frenzel

In the so called western (mostly Christian) world a lot of prejudices towards the Islam exist. Beside the aggressive fundamentalism the suppression of women is the most widespread preconception/anxiety against Islamic societies. This article will highlight some aspects of female life trying to give a more complex picture of Omani society today.

History/Religion[4]

Since the 7th century Omani society is highly influenced by Islamic teachings and traditions. When Prophet Muhammad went around on the Arabian Peninsula to spread the word of Allah current societies faced a lot of changes. In former times most people lived in matrilinear organised nomadic tribes meaning that people socially referred to their mother and her tribe. Fatherhood was unimportant and often unclear. Starting in the 4th century male Bedouins became rich through raids and started to settle. Simultaneously they began to inherit their wealth to their sons instead of to their tribe. To ensure that the heir is a consanguine son women were forced to move to their husbands home to be more easily controlled. To set off the loss of a working person and her future children the husbands tribe needed to pay compensation to the woman's tribe. Societies changed from matrilinearity to patrilinearity. In this social climate women lost a lot of their rights and respect.

During this change in society Muhammad and his teachings occurred. He himself had several very self confident wives and regarded their personalities. With his scripts he tried to improve the social status of women. In the genesis told in the Qu'ran[5] Eva and Adam (the first humans) are created simultaneously and are described as 'one unit of two members' (in contrast to the bible)[6]. Also the ejection out of paradise is caused by both, Eva and Adam. Furthermore women got a legal status meaning they could inherit, refuse a marriage, make a lawsuit and get a job. The Qu'ran permits polygamy only when the man is economically in the state to care for all his wives equally. Men and women can divorce and the men need to provide a living for all of their own children. Regarding to his life and time you can say that Muhammad did not meant to subordinate women under men. But referring to the Qu'ran many people think the Islam is man-dominated by definition. Giving an example of the discussion whether the Islamic husband is allowed to punish his wife four interpretations of the Sura 4, verse 34 are provided below:

"Men traditionally take care of women, since God has endowed each of them with certain qualities and men spend from their financial resources. The righteous women are obedient (to God) and during the absence (of their husband) they honor them according to God's commandment. As for those women whom you are experiencing a fear of disloyalty from, you shall first advice them, then (if they continue) you may desert them in bed, then you may strike them out (from your house). If they obey you then don't transgress against them. God is Most High, Supreme." (Yuksel)[7]

"Men are in charge of women, because Allah hath made the one of them to excel the other, and because they spend of their property (for the support of women). So good women are the obedient, guarding in secret that which Allah hath guarded. As for those from whom ye fear rebellion, admonish

4 This segment is content-related quoted from the book „KulturSchock - Golfemirate/Oman" by Kirstin Kabasci (Reise Know-How Rump GmbH, 2006) and translated into English by the author if not mentioned separately.

5 Talking about the Qu'ran here is meant to be talking about interpretations of the Qu'ran which can vary widely. This text refers in general to modern interpretations which are influenced by western ideology if no other source is indicated.

6 Referring to www.al-sakina.de (January 2007), translated into English by the author

7 Found April 2007 in: http://www.yuksel.org/e/religion/unorthodox.htm and http://www.quran-islam.org/228.html

them and banish them to beds apart, and scourge them. Then if they obey you, seek not a way against them. Lo! Allah is ever High, Exalted, Great." (Pickthal)[8]

"Men are superior to women on account of the qualities with which God has gifted the one above the other, and on account of the outlay they make from their substance for them. Virtuous women are obedient, careful, during the husband's absence, because God has of them been careful. But chide those for whose refractoriness you have cause to fear; remove them into beds apart, and scourge them: but if they are obedient to you, then seek not occasion against them: verily, God is High, Great!" (Rodwell)[9]

"The men are made responsible for the women [like a captain for a ship who needs to consult his officers], and GOD has endowed them with certain qualities, and made them the bread earners. The righteous women will cheerfully accept this arrangement, since it is GOD's commandment, and honor their husbands during their absence. If you experience rebellion from the women, you shall first talk to them, then (you may use negative incentives like) deserting them in bed, then you may (as a last alternative) beat them. If they obey you, you are not permitted to transgress against them. GOD is Most High, Supreme." (Khalifa)[10]

Because the original text is more than 1000 years old and some words have a variety of meanings it is difficult to find the primary meaning Muhammad wanted to spread. Only the situational interpretation can give the Qu'ran its timeless character.[11,12] This illustrates the importance of the actual society (which consists of its individual members) in the process of social rule building.

The female dress regulations in Islamic countries are often seen as a symbol for suppression. Prior to Muhammad veiling in oriental countries was reserved for nobly female citizen. As a symbol of social status it was prohibited to female dancers and slaves. In this tradition Muhammad advised women to veil that everyone can identify them as respectable religious Muslims. The covering of hair and body was also meant to be a protection against rape and mistreatment. Only 100 years after Muhammad his scripts towards body covering were more intensively discussed and formal or informal rules were established.

Society

In the past Muslim women in Arabian societies were often devaluated and shortened to their reproduction role and the household6,[13]. Strict gender segregation outside family borders is practiced. Additionally women and their public behaviour represent symbolically the cultural integrity of the family/clan in many modern nation-states in the Middle East[14]. These are the main reasons why female activities in Oman are mostly limited to household and family. Coping with the restrictions women in Oman developed certain strategies.

While men are responsible for foreign relations and maintenance of the family women take care for the household, children and all inner family affairs.4 In contrast to the western understanding of a romantic-based and equal marriage Islamic husbands and wives practice a partnership-based divided management of life. There is no emotional or economic dependence between the two partners and a contract defines the rights and duties. In case of divorce everyone keeps his property which is not mixed during the marriage. Women who can not provide a living for themselves return to their family

8 Found April 2007 in: http://www.brandeis.edu/projects/fse/muslim/mus-essays/mus-ess-diffverse-transl.html (Source: Al-Qur'an: A Contemporary Translation, Princeton University Press, 1988: 78-79)

9 Found April 2007 in: http://www.bible.ca/islam/islam-wife-beating-koran-4-34.htm (an Anti-islamic webpage)

10 Found April 2007 in: http://www.submission.org/suras/sura4.htm

11 Referring to www.zif-koeln.de (January 2007), translated into English by the author (ZIF – Zentrum für Islamische Frauenforschung und Frauenförderung = Centre for Islamic women related research and encouragement)

12 Referring to www.quantara.de (January 2007), translated into English by the author

13 Referring to "Gulf Cooperation Council (GCC) countries: Women deserve dignity and respect" (2005) found on www.amnesty.org (January 2007)

14 Referring to "Women Working in Oman: Individual Choice and Cultural Constraints" by Dawn Chatty (2000) in International Journal of Middle East Studies, Volume 32, 2000, no. 2, pages 241-254 (Cambridge University)

till they marry again. One critical point might be children who normally belong to the father after they passed a certain age. The appreciation of women rises with the number of children which ensure the continuity of the family. Sons increase the economic wealth and daughters maintain social ties within community. Especially grandmothers are highly regarded and consulted by all family members.

Female Muslims build up a strong visiting network with other women[15]. Traditionally families are huge and offer a lot of possibilities to visit relatives. With the first child women enter the intensive visiting network with non-relative women. Especially women who currently gave birth to a child provide a meeting place for all women in the surrounding who visit the mother. A high number of children ensure the functionality of this network. That is why fertility rate is still very high although the country is relatively wealthy[16]. Men are mostly excluded from those meetings.

Besides showing their faith veiling is used to keep the distance to men, to get respect and to move freely in public. Women who cover themselves are expected to live after the Qu'ran and are not questioned. It is also meant to exclude the sexual dimension out of communication between men and women meaning men are protected from unchaste behaviour and women from being seen as a sexual object. Today the veil and the abaya[17] are also a medium to set fashionable, social and ethnic accents.

Modern Life

When Sultan Qaboos came into power in 1970 he tried to open Oman for western economy and life style. The Article 17 of the Oman Constitution said that all "citizens are equal before the Law" no matter of "gender, origin, colour, language, religion, sect, domicile or social status"[18]. During this push of modernisation women were encouraged to participate in the construction of their country14. Educated women (often out of returning families from abroad) started working in public institutions. The education system was improved and opened for both sexes.

In the 1980s skilled labour got scarce in Oman and society put pressure on working women. Additionally strong conservative groups claimed the Muslim identity and postulated the traditional gender segregation. In the mid 90s government even prohibited certain women public activity like studying engineering. The number of female employees decreased.

In the last years the situation for women relaxed again. Female students can study what they want and are actually higher in number than male students. You find female ministers, lawyers, doctors, dentists, police members, engineers, economists, bankers, teachers and university professors. 80 % of the employed women in Oman are highly educated and work in Muscat. In the context of the "Omanisation" even elderly, illiterate or unskilled rural-based women start to work in elementary jobs that in the past were done by low-paid male foreigners. Today women make 8.6 % of the economically active Omanis. But more then 90% of the working women are not registered as economically active. Female work in household, agriculture and animal husbandry is ignored and seen as normal wife activities. Still women can not start their own business. Women in senior managerial or professional positions are only widespread accepted as long as they are wives and mothers first and make symbolic gestures regarding gender segregation.

Final remark

The life of Muslim women in Oman is different than the life of women in Germany. Even though the religious roots are similar to a certain extend the women have different expectations towards their life. The first segment showed that the Qu'ran (as the basis of the Islam) is not discriminatory itself,

15 Referring to "Fertility and Social Change in Oman: Women's Perspectives" by Christine Eickelmann in The Middle East Journal, Volume 47, 1993, no. 4, pages 652-666 (Washington, DC.)

16 A common principle in development is that increasing wealth/education causes a decreasing number of children per women.

17 Arabic word for a black, long sleeve coat for women to cover (and protect) their clothes.

18 Found January 2007 in: www.omanet.com

especially if you take into account that appropriate interpretations (hermeneutics) are desired by Muhammad. It is rather society and history who define the proper behavior of its members. Oman society is characterised by strict gender segregation. Women activities are dedicated to the family and caring tasks whereas men are responsible for the economic and administrative parts of life. To my mind the Division of work is not the problem but the men made and widespread belief that women are subordinate to men. The exclusion out of decision making processes and the social dependency on male relatives facilitate a climate of repression. The actual disadvantages for women depend on the involved individuals. But Amnesty International is reasonably concerned about women rights in Oman.

For the last three centuries especially the wealthy parts of Oman society were trying to converge to the western way of fairness. The Oman constitution states that men and women are equal before the law and legal restrictions decreased. Women are trying to find an accepted place in public life and the number of female employees is growing. It is still a long way till the appearance of men and women in public will be equal but I think that this is not the point anyway. To stop discriminatory behavior a climate of mutual respect is the first requirement. The acceptance of personal integrity of all humans is not self-evident among Omanis as well as among Germans.

Islamic women in Arabian societies
Part 2: Women in neighbouring countries - Saudi Arabia and Yemen

Rico Ihle

The topic of the role of women in the Arab world is a very comprehensive one because the situation of women differs strongly from country to country. The impression that most of Westerners are sure of and that is essentially presented by the western media does not reflect the actual social situation of women in its complexity and diversity. I consider in this context the neighbouring countries of Oman that are located on the Arabian Peninsula, which are the United Arab Emirates (UAE), Qatar, Bahrain, Kuwait, Saudi Arabia and Yemen. They are scattered along the Arabian Sea and the southern coast of the Persian Gulf.

Saudi Arabia and Yemen represent the largest of these neighbouring countries with respect to the total area as well as with respect to the population. Therefore, I would like to pay particular attention in this article to these two countries. Additionally, they represent pronounced contrasting societies regarding to most socio-economic characteristics such as economic development, education and living standard of the inhabitants. However, both countries are also very different regarding the religious tradition and the prevailing religious school of Islam. Thus, they are suitable for giving an impression of the role of women in large and different societies around Oman.

I will sketch the complexity of the topic first. Afterwards I will introduce the principle of muhtaram that is fundamental for female conduct in Muslim societies. This is followed by a comparison of a number of characteristics between Saudi Arabia and Yemen. Finally I will briefly present a number of headlines from the English-language newspaper Yemen Observer that gives an impression of the public discussion of the role of women in Yemen.

The role of women is mainly determined by three factors which are the prevailing religious school and other (historical) particularities of Islam, the recent political history and the recent (socio-) economic history of the respective country. The most important determinant of the situation of women is religion. In Saudi Arabia, for example, the Hanbali School is the predominant school of Islam. It formed the basis for the extremely conservative and orthodox Wahabi sect (Wahhabiyya) that is connected with the secular ruling dynasty of Al-Saud for almost 200 years now. In Kuwait and Bahrain, the religious schools of Shafi'i and Hanafi respectively are prevailing which are much more liberal in their interpretations of Islam. In Yemen, around half of the population is of Sunni belief (mainly of Shafi'i school) and the other half is of Shi'a belief. The respective religious school shapes the framework for the role of women in society. One can get an impression of the heterogeneity of the topic by comparing the clothing of women in different countries. Women of former Bedouin societies such as in the centre of the Arabian Peninsula or also in the area of the UAE or the interior of present-day Oman wear traditionally the burqa which differs strongly in shape and colour from region to region. The burqa does not cover the whole face but only the nose, the mouth and parts of the forehead. In the north of Yemen, where people used to be sedentary highland farmers, women wear traditionally the so called setarh which is a combination of a colourful piece of cloth covering the head and the body and a black veil that is covering the face except the eyes. The modern clothing in Yemen is the niqab which is a long black veil covering the female face except the eyes. The niqab is often also worn with a very thin black tissue that covers the eyes. It still permits the women to see everything but prevents that her eyes are seen so that she can (mostly) not be recognized by men.

The Fundamental Concept of 'muhtaram'

The central and most fundamental concept that guides the conduct of women in Muslim societies is the principle of muhtaram. The word has the meaning respectable or esteemed in Arabic. It is a participle of the verb ihtarama which means to respect and is derived from the root h-r-m. This verb is closely related to the verbs harama (to deprive) and haruma (to be prohibited). Furthermore, it is, among others, etymologically closely related to the Arabic words for respect/ esteem/ obeisance,

harem/ women (‘s area), wife, holy place/ sanctuary/ a sacrosanct object/ taboo, (religiously) forbidden/ unlawful and sin. The words and terms mentioned indicate that there exists a sharp and apparently important distinction between the behaviour of women which is considered respectable and which is not. The concept of respectable female behaviour is derived from the Qu’ran and the Sunna. It can roughly be described by a modest, reserved, not expressive at all behaviour. A central characteristic is the separation of women, because it is not considered respectable for a woman, at least according to the conservative interpretation of Islam, to have any relations with men who are not her husband or of her kin. Along with these general characteristics there is a whole bunch of rules how it is respectable for a woman to behave and how it is not. Important aspects represent how to speak, with whom to speak and with whom not, how to dress and above all how to behave in public or which kind of relations beyond the own house are considered respectable for a women and which are not.

This concept has a wide range of important and all-embracing consequences not only for women, but also for the second half of society, i.e. for men. A fundamental consequence is the social value or even the sanctity a woman possesses. This social category is not only relevant for the women herself, but to an even much higher extent for her family or even the whole clan. Roughly speaking, the honour of a family is mainly determined by the behaviour of the women belonging to her. The film Rashida gives an authentic impression of this particular concept of honour which does not exist in Western societies and its social consequences. It portrays the fate of a woman in the Algerian civil war. Of course, the interpretation of the concept of muhtaram, as sketched above, depends on the society, the form of Islam and also time. For example, the attitude towards the veil can be mentioned here. This attitude changed immensely even during such a relatively short period as the last century.

Differences between Saudi-Arabia and Yemen

Table 1 gives some details confirming the above statement that Saudi Arabia and Yemen “represent extreme contrasts regarding to most socio-economic characteristics”. The Gross Domestic Product (GDP) in Purchasing Power Parity (PPP) per capita amounts in Saudi Arabia to the seventeen fold of the GDP in Yemen, consequently Saudi Arabia ranks among the 50 wealthiest countries of the members if the International Monetary Fund (IMF) in 2005. In contrast, Yemen ranks on position 175 among the 181 member states of the IMF. A similar picture gives the comparison of the UN’s Human Development Index (HDI), the illiteracy rate, fertility rate or the population growth. Whereas Saudi Arabia is considered as belonging to the countries of medium human development, Yemen belongs to the 50 least developed countries. Such diversity in social-economic indicators suggests that also the situation and the role of women might be much more different than one would expect at first glance. In order to give some evidence for this diverseness, I will compare selected social and political issues between both countries.

*Table 1: Socio-economic characteristics (Source: www.wikipedia.org , http://gender.pogar.org (UNDP) *The numbers are cited from wikipedia.org if not stated otherwise. Numbers in brackets indicate the respective rank of the country among all countries acc. to www.wikipedia.org)*

	Saudi Arabia	Yemen
GDP (PPP) 2005 per capita	$15,338 (46th)*	900 US$ (175th)
HDI 2004	0.777 (76th)	0.492 (150th)
Illiteracy rate 2000	Adult, female vs. male: 33.1% vs. 17%(UNDP)	Adult, female vs. male: 75 % vs. 33 % (UNDP) Youth, female vs. male: 54% vs. 17% (UNDP)
Fertility rate 2005 (births/ woman)	4.1	6.7
Population 2005	27,019,7311 (46th)	20,975,000 (51st)
Pop. growth rate 2005 p.a.	2.31%	3.45%

In restaurants, there are special dining areas for women in both countries which are also sometime called family sections. Regarding the driving of cars the picture is the complete opposite in Yemen to that in Saudi Arabia. Whereas women are not allowed to drive cars or to ride bicycles in the latter country, there are no legal restrictions at least for driving cars in the former one. Also in Yemen, women wouldn't probably ride bicycle, but not because it is legally not permitted but rather because it is not custom. Since the last couple of years, even a small revolution is taking place in the streets of the Yemeni capital Sana'a because more and more female car drivers can be seen there. This can be seen as an expression of increasing liberty. It is furthermore a safe means in order to avoid sexual harassment by men in streets and public transport which does occur with a relative high frequency in Yemen.

The picture is more similar among both countries concerning education. In Saudi Arabia more than half of all students are female, but they are restricted in the choice of the subject. According to UNDP, they are, for example, not allowed to study engineering, journalism or architecture. There were not any numbers available for Yemen, but the percentage of female students is also very high there and, to my knowledge, they do not underlie any restrictions. Although a high share of high school students is female, the percentage of women among the total workforce amounts only to 16% in Saudi Arabia. Most of women work as teachers, but the trend is increasing according to UNDP. In Yemen, more than one quarter of the labour force is female. Due to the history of the country, the percentage of working women is considerably higher in the former socialistic Southern Yemen than in the north. UNDP identified a decreasing trend since the reunification of the country in 1990.

Lastly I would like to compare political rights of women. Saudi Arabia is a kingdom. Consequently only municipal elections exist. Women possess neither the right to vote nor the right to stand for election. The situation in Yemen is completely different. There exist municipal, parliamentary and presidential elections. Women possess the right to vote as well as the right to stand for election on each level. There are female judges in the capital of the former Southern Yemen. The first female ambassador was appointed in 1999. To give some numbers, it is here only mentioned that 38 women were elected into local councils in the municipal elections in 2001. 40% of the electorate were female. In 2006, 33 women were elected. Two women were elected into the parliament in 1997, one woman in 2003. The Minister of State for Human Rights is female since April 2001, her successor is also female. There was even a female candidate in the presidential election in 2006.

Women in the Yemeni News

To finish this article, I would like to cite a couple of headlines form the Yemen Observer without commenting them. They do not reflect the social reality for women in Yemen completely, but they give at least an impression of topics that are discussed in the media and in the public in Yemen.

The headlines are summarized by main topics. The first four topics focus on rather negative aspects of the situation of women in the Yemeni society. The second half of topics gives an impression of positive aspects, of pride of women and social emancipation.

A number of these articles are written by women because a number of female journalists are working for the newspaper in contrast to Saudi Arabia where the profession of journalism is not allowed for women.

Marriage:

- 'High dowries put marriage at risk'
- 'The arbitrary divorce - a desperate situation'
- ' Tourism Marriage – Again'

Politics:

- 'Women candidates exposed to violations'

Social pressure:

- 'Suicide among women raises questions'
- 'Religion used to thwart women, says forum'

Violence/ harassment:

- 'Crimes against women on the rise'
- 'Honor crime in Yemen - Unjust against women'
- 'Women complain of the rise of street harassment'

Pride of own traditions:

- 'New fashions threaten the ancient art of nagsh'
- 'Setarh - An endangered species?'

Activities:

- 'Sport summer for women'
- 'Unobserved, women journalists discuss their future in Yemen'

Virtues:

- 'Unveiling of workplace - Modernization or discrimination?'
- 'Yemeni women shaking men's hands - Right or wrong?'

Social emancipation (in accordance with Islam):

- 'She has the right to work just like him'
- 'Hey men, women are learning to drive'
- 'Women learn to speak up'

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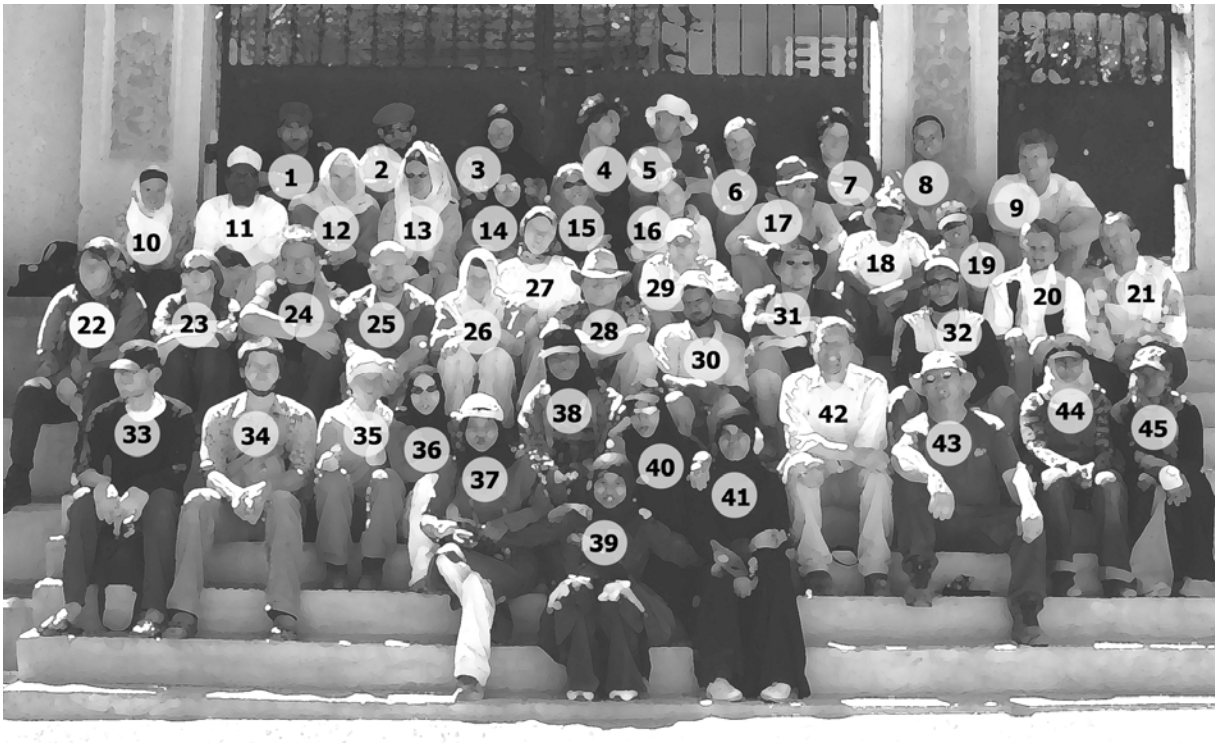
http://en.wikipedia.org/wiki/Demographics_of_Yemen , Jan 2007.

http://en.wikipedia.org/wiki/Niqab , Jan 2007.

http://en.wikipedia.org/wiki/Women_in_Muslim_societies , Jan 2007.

The participants

Figure 1: The excursion group at Balad Seet primary school



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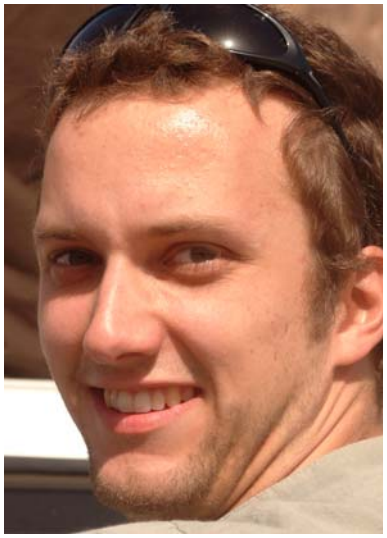

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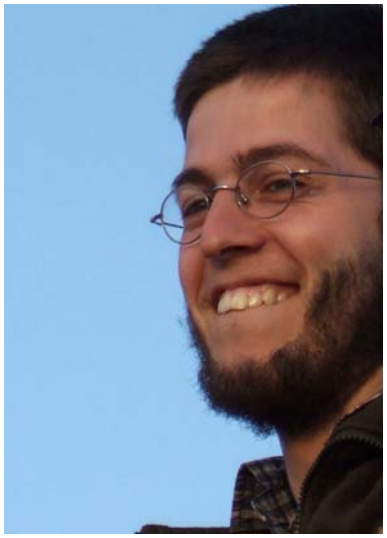

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