Sustainable agricultural production:

Providing an alternative to opium in Afghanistan

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Front page: Farmer working a poppy field in Helmand province, in April 2008 by Dennis Dybdal

Synopsis:

Title: Sustainable agricultural production: Providing an alternative to opium in Afghanistan

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Abstract:

The aim of this project is to find a solution to the opium production in Afghanistan. The opium production is not just a problem for Afghanistan, but a global problem. This project has focused on finding a long term solution to the problem to ensure that when or if the production is stop it does not start up again. In order to determine a long term solution the project first analysed what has changed in the cultural landscape of Afghanistan since the late 1970s, which was when the opium production started.

The analysis concluded that the reason for the opium production, is a number of conditions linked to the long conflict that started with the Soviet Union invasion in 1979 and has not ended for some part of Afghanistan. First, this conflict has destroyed much of the infrastructure needed to maintain a viable agriculture in Afghanistan, such as irrigation systems, agricultural institutions and access to market. This forced the Afghan farmers to turn to opium. a drought resistant cash crop. Secondly the different event conflict has created a transnational criminal network through Afghanistan. Thirdly, the current level of insecurity and high corruption in Afghanistan has created a no-risk environment for drug traffickers.

The second part of this project is about the problem formulation "what is necessary to obtain a sustainable Afghan agricultural". This was done by researching the current and future problems of the Afghan agriculture. The climate change will constraint the production more and the growing Afghan population will increase the demand of the agricultural production system.

The research also discovered that the Afghan farmers lacks knowledge in proper resource management. The greatest constraint found in this project is the lack of available water during the crop cycle and the ineffective use of the water available. The project also found that there is not an equitable distribution in the water resource and in the maintenance of the irrigation system. The project found that there are a traditional water management institution at the local level and emerging a modern national institution, but also a possible conflict between these two.

The project has found a general problem in the national water management in Afghanistan. A lack is knowledge of what has to be managed (the resource) and how it is currently managed. In order for the Afghan agricultural to have an sustainable development, it is necessary for not just the farmers to be better educated in resource management, but also the many institutions involved there is it recommended that to ensure a long term solution to the Afghan opium production, that the international community continues to support and invest in the development of Afghanistan agriculture.

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Acronyms

AIMS	Afghanistan Information management services
AQUASTAT	FAO's Information System on Water and Agriculture
AREU	Afghanistan Research and Evaluation Unit
FAO	Food and Agriculture Organisation of the United Nations
HDI	Human Development Index
ICARDA	International Centre for Agricultural Research in the Dry Areas
ICOS	International Council on Security and Development (formerly the Sencil council)
IWRM	Integrated Water Resources Management
MAIL	Ministry of Agriculture, Irrigation and Water
MEW	Ministry of Energy and Water
RBA	River Basin Agency
UN	United Nations
UNODC	United Nations Office for Drugs and Crime
USAID	United States Agency for International Development
USGS	U.S. Geological Survey
WUA	water users association

Glossary

Mirab	Water master
Salaam	Traditional credit loan upfront with promise to deliver a specific quantity of crop next crop cycle
Shura	Traditional council of elders
Ushr	a ten percent tax currently used by the Taliban

Preface:

Afghanistan is a very interesting subject for any geographer. The countries has a rich topography creating a complex system of micro climates. the climate is affected both by weather systems in Mediterranean Sea and by the Asian south western summer monsoon Afghanistan has also a complex tapestry of ethnic groups with over 55 sub-ethnic or tribal groupings live side by side [Misra, 2004]. Its history is rich with conflicts and it has always been an important part of trade between from Asia to Persia.

I was first introduced to the current opium problems in Afghanistan during my internship in 2007 at the Office of Disarmament Affairs in New York, where my supervisor talked about the problems with combating opium production in Afghanistan. At that time the only thing I knew about Afghanistan was that there was a Danish contingency in Afghanistan as part of the International security forces. To learn that this underdeveloped country, where there was a conflict also was producing almost all the global opium. This fascinated me and when I had to find a subject for my master thesis at integrative geography, this became the subject.

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References

References in this project is done after the Harvard system of referencing. Paragraphs or sections without a references are the authors conclusions, assumption and recommendations. Figures and tables are listed by chapter and is sequentially numbered.

1. Afghanistan and opium

For more than two millennia Afghanistan has been at the crossroads of civilizations, a geopolitical centre for conflicts between various powers and a major contributor to world culture. In the past quarter century, the country has also found itself at the crossroads of invasion from Soviet Union, civil war, international terrorist violence and became a major contributor to world narcotics production [UNODC, 2002].

The Al-Qaeda attack on USA, 11th of September 2001, led to the United States responding by invading Afghanistan in October 2001, supported by a international coalition, searching for Al-Qaeda and seeking to remove the Taliban government supporting them [Misra, 2004]. This was the starting point for an international effort in Afghanistan. Under the United Nations Security Council (Resolution 1386), the international community got involved with an International Security Assistance Force (ISAF) intended to support the Afghan process of forming a new government [Tanner, 2002]. Afghanistan has since been a global political hotspot because of the constant insurgency caused by the Taliban, but international organisations involved in drug prevention, such as the United Nations Office on Drugs and Crime (UNODC), has been monitoring Afghanistan with concern since the mid 1980s where Afghanistan became a leading producer of opium [Peters, 2009]. Opium is a narcotic formed from the gum released by lacerating the immature seed pods of opium poppies, an annual plant. When refined it can be used in medicine as morphine or on the street as heroin [UNODC, 2002].

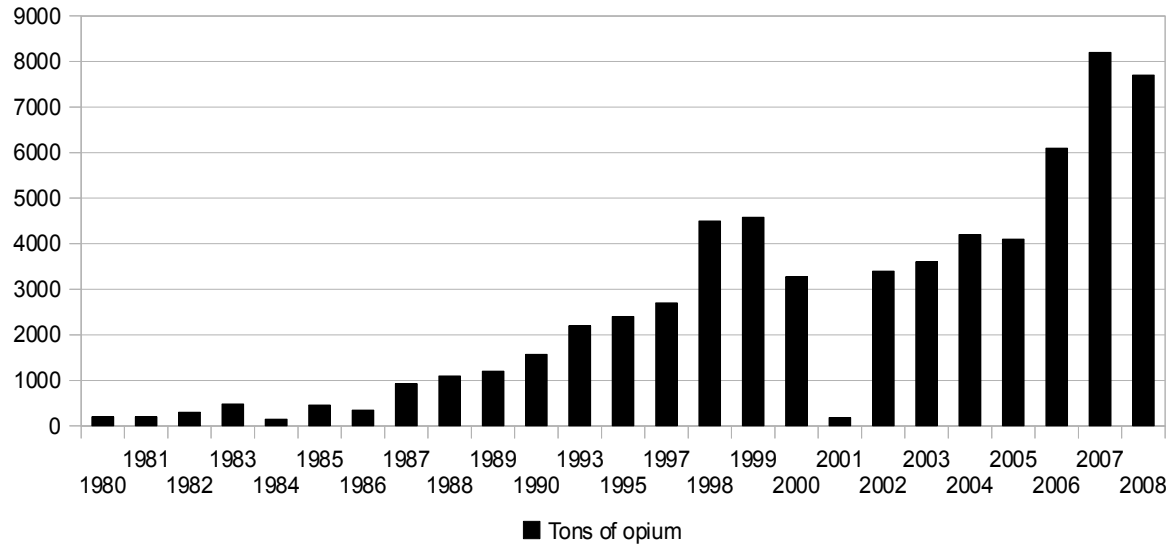

Figure 1.1: Opium production in Afghanistan from 1980 to 2008 [UNODC, 2002; UNODC, 2008, UNODC, 2009].

Figure 1.2: Political map of Afghanistan and its neighbouring countries [UN, 2009]

Before the period in international politics often referred to as the "War on terror", the international communities' focus on Afghanistan was partly concerned with the humanitarian situation and partly the increasing amount of drugs coming out of this country, opium in particular [Thoumi, 2005]. The Afghan opium production has continued to increase, even after the invasion in 2001, (figure 1.1). The opium production in Afghanistan grew at an average rate of 15% per annum over the 1980-2000 period, almost twice as fast as the global opium production growth rate of 8% [UNODC, 2002].

While Afghanistan produced about 19% of world opium in 1980, this proportion grew to 52% by 1995, the year prior to the Taliban takeover, and rose to 79% by 1999. As the production reached its current peak in 2007, 93% of the opiates on the world market originated in Afghanistan [UNODC, 2002; UNODC, 2008]. The Afghan opium production was estimated in 2007 to be worth US$ 4 billions, where the Taliban received around US$ 500 millions fuelling their

continued insurgency that causes continuous instability in Afghanistan [UNODC, 2009].

Most opiates continue to be consumed in the countries surrounding Afghanistan with an estimate of 5 million users. Afghanistan is landlocked on the north by Turkmenistan, Uzbekistan and Tajikistan, on the north east by China, on the south and east by Pakistan and on the west by Iran (figure 1.2). Increasing amounts of opium is trafficked along the East/South East European route towards Western Europe where the drug traffickers can achieve a higher selling price [UNODC, 2009].

Table: 1.1 Use of Opiates in Afghanistan and selected countries and regions [UNODC, 2009]

Country	**Population (%)**	**Year**
Afghanistan	1,4	2005
Iran	1,5 - 3,2	1999
Pakistan	0,7	2006
China	0,19 - 0,31	2005
Tajikistan	0,54	2006
Uzbekistan	0,80	2006
Turkmenistan	0,32	2007
Central Asia	0,7	2007
Near and Middle East	0,7	2007
East/South-East Europe	0,8	2007
Global	0,3	2007

Opiates remain the world's most problematic drug in terms of treatment. The highest levels of use (in terms of the proportion of the population aged 15-64 years) are found along the main drug trafficking routes, (table 1.1). UNODC [2009] estimates that the number of people who used opiates at least once in 2007 is between 15 and 21 million people worldwide. Afghan President Karzai has stated "that opium is Afghanistan's biggest problem. Either we destroy the problem or it will destroy us." [Costa, 2008]. As illustrated by the facts stated above this could be true as opium is the funding source for terrorists, insurgents, and warlords, spreading addiction in and around Afghanistan as well as causing the threat of a HIV epidemic following the injection of heroin [UNODC 2009].

The aim of this project will be to examine which methods could stop the flow of opiates from Afghanistan and prevent the continued opium production, thereby reducing the problems not just in Afghanistan, but also regionally and globally.The most common of the current counter-narcotics solutions to drug production is the eradication of the drug producing fields, but this method has been used in Afghanistan since 2002 [Barnett & Sherman, 2008] and has clearly

not helped. Research on the eradication of illicit coca fields in Colombia have proven this method ineffective in solving the similar problem with coca production in Colombia [Mejía & Restrepo, 2004] and research has also shown that eradication has the opposite effect on the incentive to produce drugs because of the increase in price [Barnett & Sherman, 2008]. Therefore before examining what methods could revert the opium production, it is necessary to know the reasons causing the opium production.

In order to answer which methods should be used to stop the opium production and ensure that it does not start up again, the initial question which must be answered is; "what are the root causes sustaining the Afghan production of opium?". This will reveal a number of factors contributing to the sustained opium production.

The Taliban did succeed in temporarily stopping the opium production in 2001, the opium production resumed the next year reaching a new record high production and researchers has suggested that even if the Taliban had stayed in power the opium production would have recommenced [Thoumi, 2005; Barnett, 2004]. Therefore it is necessary to answer which methods could be used to stop the opium production but also which methods should be used to ensure that the opium production does not start up again. Thus, the *initial question* of this project is concerned with acquiring an understanding of the problem in order to present a long term solution:

What are the root causes sustaining the Afghan production of opium?

This initial question is meant to uncover the underlying structural problems causing the opium production, in order to present a pre-emptive and durable solution concerned with curing the disease and not merely removing the symptoms. After finding a conclusion to this initial question. These findings will be used to make the research question based on both in the problem analysis and the conclusion to the initial question. The research question, will focus on the long term method or methods that could stop and prevent the opium production from starting up again.

2 Theoretical and methodological framework

This chapter will describe the theoretical framework for this project; later, the more specific parts of the theories will be explained as they are applied.

During the research for this project it became apparent how complex the causes behind the Afghan opium production are. It cannot be explained by using one sphere of science, such as the natural or social science, but it is necessary to look that this problem from many different perspectives; such as the natural, historical, social, ideological or economical causes. This makes a discipline that encourages a holistic multi-perspective approach to a problem, such as integrative geography, ideal.

The Afghan opium production dates back to ancient times and it is believed that the opium poppy was brought to the area by Alexander the Great [Misra, 2004]. But it was first during the late 1970s that the production grew and by the early 2000s Afghanistan was the dominant opium producer. It would seem that during the late 1970s and forward something changed, which triggered this drastic change in the country's agricultural production. This project will examine what caused this change in the Afghan agriculture in the 1970s and onwards in order to better determine the various causes to this change in the cultural landscape. Through analysing the causes this project would be better able to find what method(s) is necessary to stop this illegal production. ‘Cultural landscape’ is defined as a landscape influenced through time by the technology and attitudes of the human cultural groups who have inhabited it [Holt-Jensen, 1999:218].

The project is inspired by the philosophy of critical realism. This philosophy states, that yes there are a real world, however two of most significant components of reality are not directly observable [Holt-Jensen, 1999]. The first is are greater structures such as capitalism and forces of power. The second is structures, that are formed by peoples experiences and conceptions and are the basis for the individuals actions. Critical realism introduces three domain of reality, the real (mechanisms), the actual (events) and the empirical (experiences of events). While the events are an observable phenomena and the empirical is the experiences of these events. the underlying mechanisms is not observable, but triggers an event [Sayer, 2000]. Another important aspect in critical realism is the 'transitive' and the 'intransitive' dimensions of knowledge. When studying a object whether this are a social event or physical process, the scientist through his studies forms a theory concerning the object. This theory on the object is the transitive dimension, while the real object remains intransitive. Different scientist can have different transitive object, but the real object, which their theories are about is the same. An example of a transitive object, which a lot of geographers work with is the climate change. There are several different theories concerning

both the cause and what effect humanity has in causing the change. These are all different transitive objects about the same intransitive object (climate changing processes). The theories concerning the climate change has changed, but this does not mean that the intransitive object have changes. This could be cause by new knowledge are a new interpretation of data.

2.1 Explaining the changes in the cultural landscape

Michael Jones [1988] introduced a mode to explain the changes in land use and land tenure in 1880s fishing community in parts of Norway. There is a lot of difference between fishery in Norway and opium production in Afghanistan, but there also some similarities. Both cases is concerning a rural community where the primary source of income in a primary occupation (fishing and agriculture). While other studies of changes has focused on land tenure, land use, culture or settlement form, Jones points out that it is necessary to have three modes of explanation; the structural, functional and intentional. Jones also introduces phenomena that links these three different modes together: these links are; individual actors linking the intentions to functions, production linking functions and structures and ideology linking the intentions and structures, these three levels will be explained later in this project. Jones' mode will be used in the problem analysis as a method to ensure that the factors involved in the change in the Afghan cultural landscape which caused the opium production is examined. While Jones' provide the mode of explanation [Jones, 1988].

Structural mode

Structures are the factors which affect the entire landscape such a change in governmental or international politics or a market change. Structures are seen both as rules (constraints) and resources (possibilities), which affects the actor's actions [Holt-Jensen, 1999]. Even though these social structures constrain the actor, the social structures are also interpreted and transformed by the actors [Holt-Jensen, 1999]. An example on the social structure (or institution) that is interpreted and transformed is religion which is gradually transformed by the actors and other social structures. Institution will be covered in more detail later in this chapter.

While the social structures are open and can be interpreted differently, the natural structure, such as climate and physical landscape structure works in a more or less "closed" system governed by a complex interaction between the laws of nature (evaporation, erosion etc.). These difference in the two structures are important to note, when examining them. In the natural structure, an event can be explain by through one or more mechanism, such as such as gravity and the wind make an apple fall to the ground. This event can be replicated again and again with the same result. The apple falling to the ground is a good example on causation, where the

combined force of wind and gravity make some apples fall to the ground, but why not all the apples. This is caused by other mechanisms, which ensures the right conditions, which in return causes the apple to fall. So besides the structures, mechanisms, there are specific conditions that causes the event to occur [Sayer. 2000].

Changes in social structures are more complex to analyse. More that one mechanism can explain an event, and mechanisms can change during investigation [Sayer, 2000]. Therefore can the transitive dimension is some cases affect and change the intransitive. Because social structure are open, external conditions constantly affects and changes the structure. Also when analysing a social structure it is important to abstract from the many conditions of an object and focus on those it is believed to have an significant effect.

When examining the changes in a cultural landscape such as the Afghan agricultural production system, both of natural and social structures are important to examine. The social structures affect the actor's motives and set rules for production, while the natural structures either reveals possibilities or set constraints for the production [Holt-Jensen, 1999]. This ability to be applied to both natural and social structures makes the critical realism ideal for an integrative geographical approach.

Functional mode

Functions are related to the natural resources, building, property structures, market possibilities, which is related to the production [Jones, 1988]. These could be perceived as the possibilities and constraints that the social and natural structures set on the actor and thereby limits the possibility of production. When researching a change in a production system, it is necessary to examining its resources and market possibilities. One definition of resources is that something first becomes a resource, when the value or function of it is realized [Mather & Chapman, 1995]. By this definition of a resource means that no part of natural has properties that makes it a resource; it first becomes a resource, when people perceives its properties to have a use or value [Mather & Chapman, 1995]. This could be the case concerning opium, that the actors in this project, before the late 1970s, did not perceive the opium poppy as having any value. But something changes this view and the opium became a resource. Another reason could be a change in market possibilities or the markets demand would reduce or increase the intention for the farmer to cultivate a certain crop.

Intentional mode

Intention of the actors, both the individual and groups, covers the various motives, needs, preferences and actions behind changes in production [Jones, 1988]. The intentions are much

linked to the actors' knowledge of the structures possibilities and constraints. In critical realism it is assumed that individuals have free will, act rationally and must be held responsible for their actions. People are however constrained by rules and structures, even though social structures only exist when people reproduce them. Individuals are also assumed not to have a complete knowledge of the structures, which is around them [Holt-Jensen, 1999].

It is the assumption in this project that in agriculture, the intention for changing the landscape is to improve production. This is done either to cover the farms own needs for sustenance or to increase profit. The action of the actor, though rational, does not always lead to improvement in production. This is caused by the actors incomplete knowledge of the structures and mechanisms. An example of this called "tragedy of the commons" introduced by Hardin [1968] will be described later in the project, as well as the importance of institution, too prevent this from happening. As mentioned is one of the important social structures institution. The next part of this chapter will explain the various elements within institution.

Institutions

According to Scott [2001] Institutions are social structures that have attained a high degree of resilience. Institutions are composed of cultural-cognitive, normative, and regulative elements that, together with associated activities and resources, provide stability and meaning to social life. Institutions are transmitted by various types of carriers, including symbolic systems, relational systems, routines, and artefacts. Institutions operate at different levels of jurisdiction, from the world system to localized interpersonal relationships. Institutions by definition imply stability but are subject to change processes, both incremental and discontinuous.

The regulative parts of the institution are the instrumental processes involving the capacity to establish rules, monitor behaviour, as necessary, manipulate, sanctions, rewards or punishments, in an attempt to influence future behaviour [Scott, 2001]. This element is the element, which governs the actors and ensures that certain behaviours are promoted or avoided. As is the case with other social structural elements, the regulative elements in the institution are influenced by the actors involved and the other two elements of the institution.

Normative systems include both values and norms. Values are conceptions of the preferred or the desirable, together with the construction of standards. Norms specify how things 'should' be done; they define legitimate means to pursue valued ends. Some values and norms are applicable to all members of the collective; others apply only to selected types of actors or positions. Individuals in a position of power (a role), such as government officials, priests, judges and law enforcement officers, these are assumed to have a higher code of conduct than other actors, but at the same time the role has the benefit of power and prestige [Scott, 2001].

The cultural-cognitive element is concerning the symbols-worlds, signs, gestures, that have their effect by shaping the meanings we attribute to objects and activities. Meanings arise in interaction and are maintained and transformed as they are employed to make sense of the ongoing stream of events [Scott, 2001]. Cultural-cognitive is the thing that is "taken for granted" and tries to explain the meaning behind the behaviours, such as religious rituals and symbolism and their meaning for the actors or traditional tribal or ethnic values and social positions.

Almost all institutions contain parts of these three elements, but often researches focus on one element [Scott, 2001].

An example of an institution that contains all there elements is a governmental system. This is a formal regulative institution, that through written rules and enforcement of these ensures a certain behaviours in the country's citizens. The governmental also has a set of norms and standards, which must be abided, and it also contains a number of certain behaviours and symbols. With in the system could be a tradition of the bribing or 'bringing gifts' to the government official to ensure a smooth bureaucratic process.

As is the case with social structures in general, institutions only exists when people reproduce them [Holt-Jensen, 1999]. The institutional structures are very important part in the management of resources such as the ones found in an agricultural production, as for example opium. The theory on how the interaction between the various institutions and actors can facilitate management of resources will be examined later in this project.

General assumptions

Since the focus in this project is a change in the production in the Afghan agriculture. The focus in this project will be on the functions and structures as these create the possibilities and constraints for production. The intentions of the actors are also important. But without right structures and functions, the actors will not be able to change the production to another product.

It is the assumption in this project that the general intentions of the actors involved in the opium production is; first to produce enough to provide for them and their family. Secondly to increase their living standards.

Of the different structures found in relations to Afghanistan, the focus will be on the social institutions and the physical structure necessary for agriculture. The functions that are in focus are resources and market possibilities. The reason for this is that opium production as explained is an agricultural production and is the assumption of this project that these mentioned structures and functions are the important factors in facilitating an agricultural production.

3. Problem analyses – what are the causes behind the opium production?

The Afghan opium production is often linked to the Golden Crescent; the name used to describe Asia's principal area of illicit opium production, located at the crossroads of Central, South and Western Asia, which consists of Iran, Afghanistan and Pakistan [Steinberg, 1995].
While Iran, Pakistan, India and most of the other countries in the region has a long tradition of using opium in one form or another, only a few parts of Afghanistan, such as in the province of Badakhshan in the north east of the country had a tradition of opium use and that only dated back to the 18th century [UNODC, 2002]. The Afghan opium production preceding 1978 served mostly as a cash crop supplement to a limited number of Afghan farmers in case of crop failure or other economic problems, where the surplus from the opium sales could be used to cover the deficit [Asad & Harris, 2003]. Thus, opium was a part of the Afghan agriculture before the Afghan Civil War started in 1979, although on a peripheral basis.

To organise the temporal span from 1978 and up until the present and how this influenced the Afghan cultural landscape, this paper will divided the Afghan Civil War (1978 to present) into four different periods of conflict based on important events in Afghan history. The first period of conflict started with the overthrow of government during the Saur revolution in 1978, followed by the invasion of Soviet forces in 1979 and lasts until the retreat of the Soviet forces in 1989 [Misra, 2004]. In the second period starting in 1989, Mujahideen warlords fought over power and resources. This struggle continued until the Taliban gained control in 1996. The third period is the Taliban regime, which lasted until the toppling of Taliban in 2001 and was followed by the current democratic elected government in 2004. This fourth period from 2001 and until the present is defined as the 'Taliban insurgency' because of the continued instability created by their actions in Afghanistan and Pakistan. This period could have been divided into two, because of the increased momentum for Taliban since 2006 [ICOS, 2008], that has set back the development in some part of Afghanistan [Peters, 2009]. In this project the increase in insurgency is assumed to be a temporary setback in the continued trend in a positive development. Therefore the period from 2001 and until the present (2009) is seen as a period in its own, even though 2006 was a important event. The different periods are seen in table 3.1.

Table: 3.1: Periods examined in Afghan recent history

Year	**Pre 1978**	**1979-1989**	**1989-1996**	**1996-2001**	**-2001**
Period	Republic of Afghanistan	Soviet-Afghan war	Mujahideen war	Taliban regime	Taliban insurgency

3.1 Social and natural structures in Afghanistan

This section will analyses the overall social and natural structures in Afghanistan. It will also describe the state of development in general and agriculturally in Afghanistan during the late 1970s. These social and natural structures together with the state of development will explain why the events described later on in this chapter, cause a change in Afghanistan opium production.

The Afghan population composition is very complex. It can be divided into eight major ethnic groups. Listed according to numerical size starting with the largest, these are the Pashtuns, Tajiks, Hazaras, Uzbeks, Baluchis, Turkmens, Aimaqs and Kirgiz. These ethnic groups are parts of larger ethnic region across Afghanistan and its neighbouring countries, which late in this project will be revealed as important. These ethnic groups have various sub-ethnic and tribal divisions and a mid-1980s study identified 55 ethnic entities in Afghanistan. Concerning ethnolinguistic there are two major factions, Dari and Pashto, as well as several local dialects, constituting a total of 30 different languages (appendix I)[Misra, 2004]

Afghanistan was a slowly developing agricultural economy in the 1970s with a GDP growth of 78% lasting from 1970 to 1979, while Pakistan only grew 53 % and Iran with a staggering 618% [World bank, 2008]. The reason for these differences in growth could be that Pakistan was at war with India during the early 1970s and lost East Pakistan in 1971 (today known as Bangladesh) [Asad & Harris, 2003]. Iran's high level of growth is probably caused by the high increase in oil prices during the oil crisis in the 1970s. Afghanistan slow growth can partly be owing to Afghanistan's geographical position; landlocked and without an easy access to both regional and global markets, thus making it dependent on other states for access to the global market. An example on this dependency could be in the 1950s when Pakistan closed its borders for Afghan trade following a dispute over borders, which closed Afghanistan off from its Asian markets [Misra, 2004]. A National survey in 1978 revealed that the average life expectancy at birth was 39 years (which was the lowest globally surveyed at that time) and this was thought to be caused by the lack of safe water supplies and poor health-care [Balland, 2009].

Another reason for the slow economic growth and short life expectancy could be the low agricultural potential in Afghanistan. Agricultural potential can be determined by natural structures such as topography, soil and climate. Topography determines the areas which can be cultivated; a slope too steep makes it impossible to cultivate or irrigate and a steep slope also makes the soil more susceptible to soil erosion [ICARDA. 2002] and furthermore topography determines watersheds and location of orographic rain. Afghanistan is topographically defined by a central mountain range running from the north-eastern part of Afghanistan and towards the east-south-east, (figure 3.1.). Because of the range in elevation from 258 up to 7.485 meters in height, most areas of Afghanistan has some degree of slope.

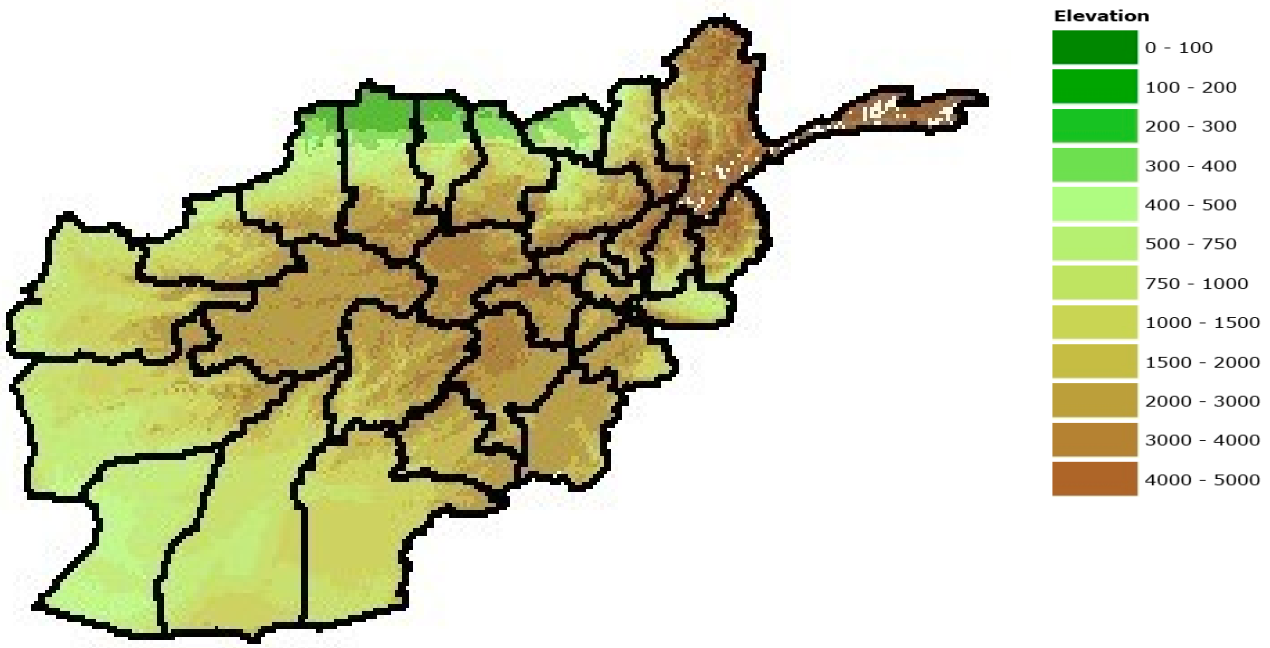

Figure 3.1: Topography of Afghanistan in meters [ProMIS, 2001]

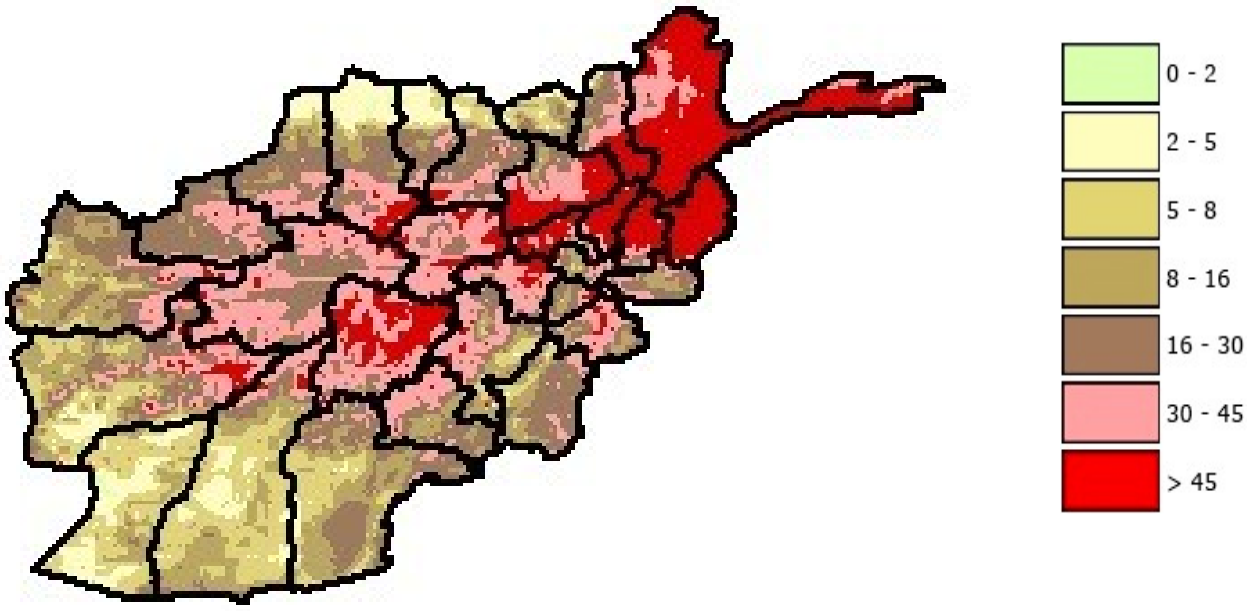

Figure 3.2.: Afghanistan's slopes. The values designate the degree of the gradient. [ProMIS, 2001]

The area with the highest average degree of slope is the central mountains, (figure 3.2). Because of this soil erosion very much in evidence in the central mountains, especially in the regions affected by precipitation from the orographic rainfall such as the north eastern part of the Afghanistan, (Figure 3.3). According to FAO [2003] 56% of Afghanistan's total area is defined as 'steeplands', which are characterized by slope inclinations of more than 12 %. Moreover, soils of steeplands are often very shallow because of a constant erosion processes.

Afghanistan is located in the sub-tropical latitude with a continental climate of extreme temperature variations ranging from > -50 ° C in the tall mountains during winter and > +50 ° C in the deserts during the summer [Azizi, 2002]. Its extreme temperature range is caused by its continental climate where no large water bodies ensure a more constant temperature through heat exchange and it is amplified by the correlation between decline in temperature and incline in elevation. This correlation can be seen in the high mountain ranges of Afghanistan that are sub-arctic with only a few months a year without frost, while some of the lower lying areas almost no frost (appendix I). The high summer temperature in the lower parts of Afghanistan makes it possible for some areas to grow two crops during one season if they have sufficient water supplies [ICARDA, 2002].

Annual precipitation ranges from below 100 mm to 400 mm, with an average of 327 mm, [AQUASTAT, 2009; Bhattacharyya et al., 2004]. The country is characterised by large areas with little to no precipitation; the precipitation which does occur falls mostly as snow on tall mountains from winter storms of Mediterranean origin during winter (50% of the annual) and spring with peaks in February/March. The lack of precipitation during the hot summer is usually countered by the snow melt from the high mountain ranges that is essential for irrigation during the crop season from April to October [Bhattacharyya et al., 2004]. Much of the precipitation received in Afghanistan is caused by the wind moving over the high ranges mountains ranges such as Hindu Kush and thereby creating orographic precipitation[Savage et al., 2009]. The importance of the orographic precipitation caused by the mountains is illustrate by that over 80 % of the country's water resources have their origin as orographic in the Hindu Kush mountain ranges at altitudes above 2.000 m [Qureshi, 2002; Azizi, 2002].

When comparing the spatial distribution of precipitation with the temperatures (figure 3.3 & 3.4). It shows that the areas with the highest potential evaporation (PET) also get the least amount of precipitation, stressing the need in these areas for constant irrigation. which vary between an PET of 1.300 to 1.500 mm/year in the low lying northern plains and reach up to 1.800 mm/year in the southern and south-western plains. However, PET is locally much higher in July/August. Due to local strong winds occurring during the summer particularly in Herat where the daily PET can reach 10 mm/day [Quershi, 2002].

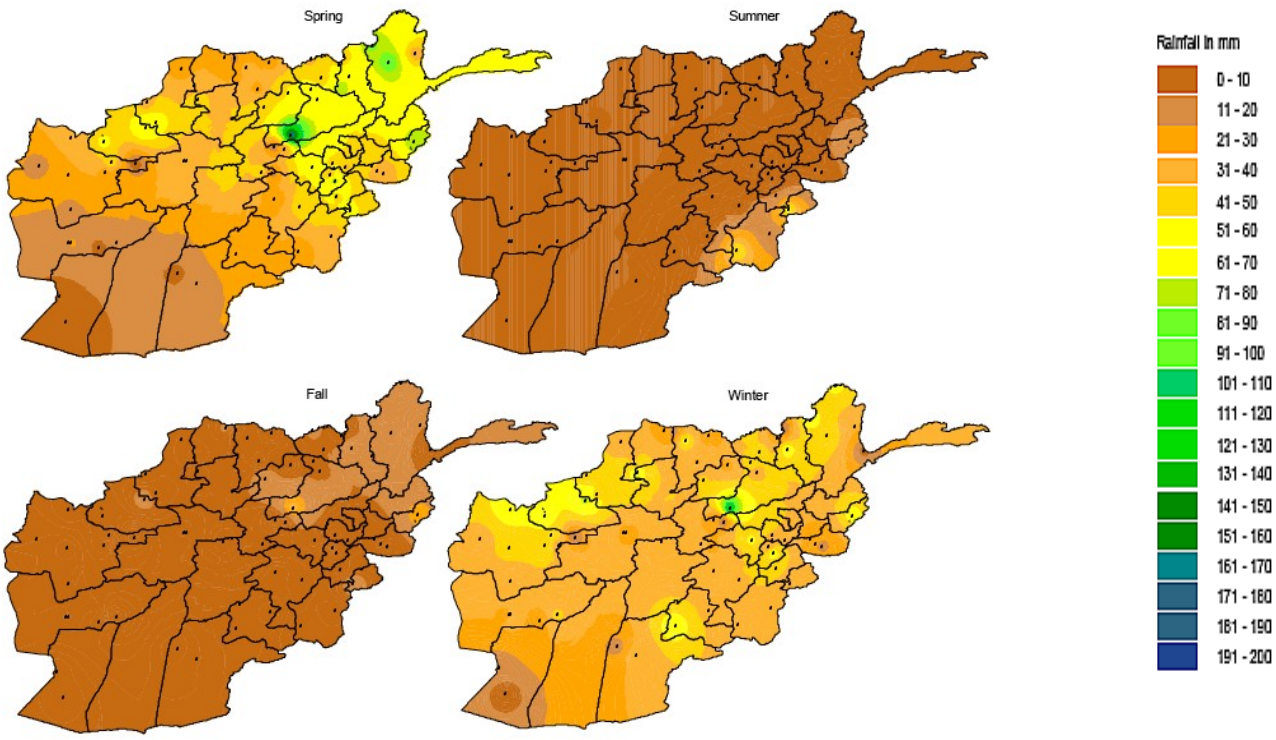

Figure 3.3 Afghanistan's seasonal average precipitation [ProMIS, 2001]

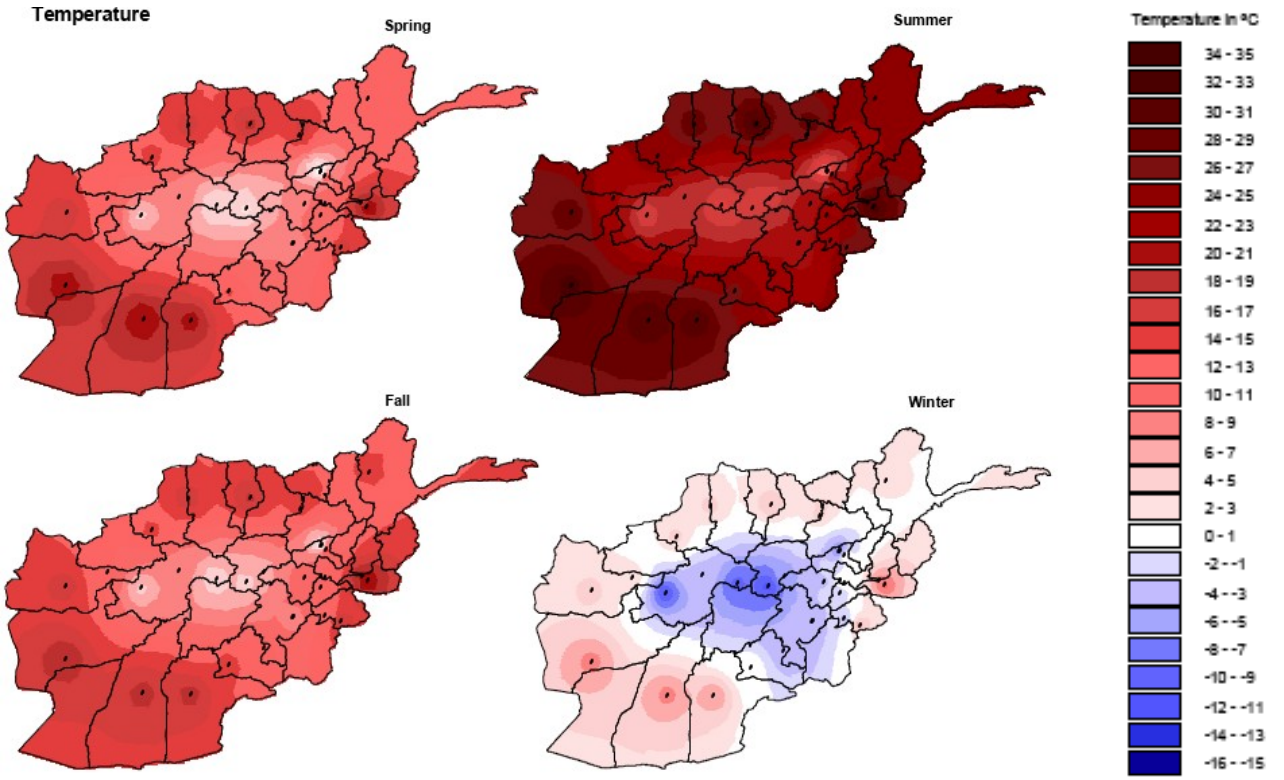

Figure 3.4 Afghanistan's seasonal average temperature [ProMIS, 2001]

The difference between the average annual precipitation (P) and PET can be used to calculate the Aridity index (AI) as used by the United Nations Environmental Programme [UNEP, 1992]. In this calculation P is divided by PET, which is the AI. The Index is numerical indicator of the degree of dryness of the climate at a given location. For example Lashkargah the province capital of Helmand in the southern part of Afghanistan has a P of 78 mm/year [ProMis, 2001] and a PET of 1.720 mm/year [Azizi, 2002]. This gives Helmand an AI of 0,045 making it hyper-arid (see appendix II). The indicator does not take into account other hydrological factors such as run-off, rivers, groundwater or other sources that could affect the areas dryness. When using AI on Afghanistan is become evident that many areas has a dependency of other water sources than precipitation (table 3.2)

Table 3.2. Afghanistan's Aridity Index [UNEP, 1992; Quershi, 2002]

Classification	**Aridity Index**	**Area (%)**
Hyper-arid	AI < 0.05	20
Arid	0.05 < AI < 0.20	25
Semi-Arid	0.20 < AI < 0.50	54
Dry subhumid	0.50 < AI < 0.65	1

The soils in Afghanistan ranges from the northern plains having extremely rich, fertile, loess like soils, while the south western part of the southern plateau has infertile desert soils with a high sand content (mean sand content 49%) except along the rivers in the south west, where alluvial deposits can be found providing the necessary nutrients for agricultural production, these deposits are linked to the constant erosion processes occurring in the steeplands [Azizi, 2002, ICARDA, 2002].

The differences in temperature, precipitation, soils and slope, creates both constraints and varied potential agricultural production (figure 3.5). These different constraints and possibilities is shown in the crop diversity during the late 1970s. The most common crop is winter wheat which is planted in the late fall and harvested in late spring [Haack et al., 1998]. During the late 1970s rice was grown in the semi-arid northern provinces. Along the Helmand river cotton was grown. This was possible because of its high average temperatures and alluvial soils which gave a high yield, but the cotton also had a high necessity for constant irrigation to obtain the required 700 - 1.300 mm of crop water during its 190 days crop cycle [Critchley & Siegert,1991; Ikisan, 2000]. The province of Kandahar, close to the Pakistan north western border, was famous for its fruit orchards [de Beurs & Henebry, 2008].

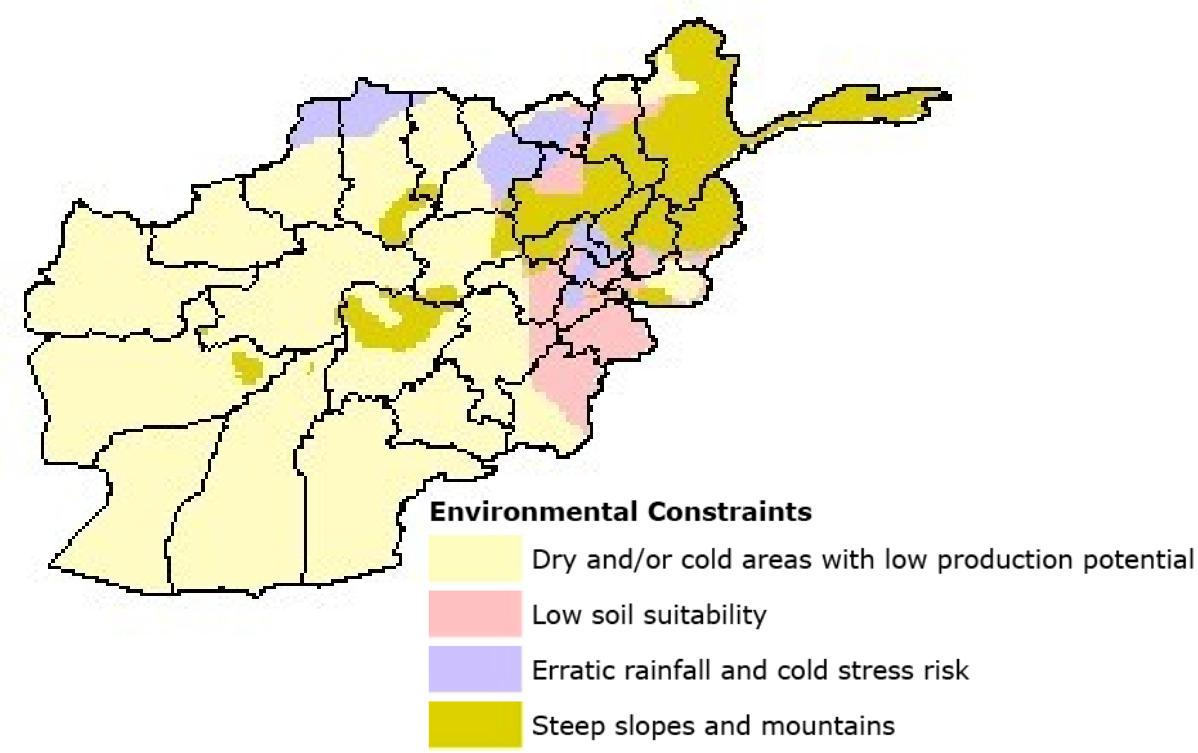

Figure 3.5: Environmental Constraints in Afghanistan [ProMis, 2001]

The environmental constraints in Afghanistan create a generally low potential for agriculture without the use of irrigation and fertiliser. The high dependency in irrigation systems are illustrated in that most agricultural areas lies along the rivers of Afghanistan (see appendix I)
The high dependency of irrigation during the crop cycle makes the crop production very susceptible to fluxes in precipitation or failure in the irrigation system, which will be examined later in this project.

Afghanistan's climate is however excellent for growing opium because of the hardiness of the opium poppy which can thrive under dry soil conditions and can be planted during the fall or early spring with a total crop cycle of 120-140 days [Griffith, 1993]. The harvesting of opium is labour intensive. The process includes lancing (making a shallow cut in the capsule to bleed sap) and gathering the opium gum hours later. This process can be done several times before the capsule runs dry, the number of times depend on the quality of the poppy seed and the expertise of the lancer [Griffith, 1993]. Traditionally the lancing is done by men, but the gathering is done by men, women and children [UNODC, 1998].

During the late 1970s Afghanistan's major agricultural export products was raisins and cotton with 31 raisin processing factories and good market opportunities in the Central Asia and India [Ward et al., 2008].

Because of the constraints towards crops production most of the Afghan agriculture was based on livestock, using the large areas for rangeland. During the 1970s Afghanistan was self-sufficient in meat and milk with an export of animal fibres and processed high value products, such as carpets and skin garments [Ward et al., 2008].

3.2 Causes for the opium production from 1979 through 2009

While the previous chapter has analysed the agricultural potential and constraint of the Afghan agriculture through its natural structures. And described Afghanistan and it the agricultural production during the late 1970s. This chapter will examine the different events during the last 30 years, which has changed the cultural landscape from a slowly developing agricultural country to a drug economy.

The Soviet-Afghan War (1979-1989)

With the Soviet invasion in December 1979, began the Soviet-Afghan war, where the fiercely independent Afghans created the Mujahedeen and fought the invading forces and their Afghan allies. The different Afghan ethnic groups have often fought each other over resources and power, but join forces to repel foreign invaders as in the case of the Soviet forces [Misra, 2004].

During their invasion, the Soviet Union used soldiers from Turkmenistan, Tajikistan and Uzbekistan, hoping that using regional troops would make the process easier, but the Afghan Pashtuns had been in conflict with these northern ethnic groups for centuries so the use of regional Soviet troops had an opposite effect and fuelled the conflict [Grau & Gress, 2002].

The Soviet-Afghan war was hard on the Afghan agriculture and economy. The commonly used tactics by Soviet troops were to scorch earth and implement minefields, thus destroying the infrastructure and making it difficult to cultivate the area without danger [Grau & Gress, 2002]. By August 2008, 4.924 hazardous areas remained, comprising an estimated 720 km^2 of land and threatening 2.229 communities [MAPA, 2009]

The Afghan economy suffered because of the usual trade route through Iran and Pakistan was closed and many of the normal traders fled, removing the market for the usual crops of the Afghan farmer and making it necessary for them to find crops which they could sell [Asad & Harris, 2003]. The orchards in Kandahar were burned down in order to flush out Mujahideen fighters [de Beurs & Henebry, 2008] and the areas were turned into minefields. Another effect of the war was the abandonment of irrigation systems. When Afghans fled to Pakistan, the irrigation

systems, which needs continuing maintenance in order for them to work deteriorated [Beurs & Henebry, 2008]. The Soviet-Afghan war ended in 1989 with the retreat of the Soviet Union forces.

Research by de Beurs and Henebry [2008] done by remote sensing found that the effects of war and civil conflict can mimic long-term effects of drought, including abandonment of agricultural areas, migration of population and reduction in crop diversity. The continued conflict destroyed much of the Afghan infrastructure, such as the much needed irrigation systems of which only 40% was working in 2001. Furthermore, the important pastoral livestock numbers fell by 50% from 1979 to the late 1990s, caused by the disruption in trekking routes, nationwide droughts and the lack of an institute to handle disease among the herds.[Ward et al., 2008]. The rise in Afghan opium production during this period could be caused by Afghan farmers changing their production to opium in order to withstand the stress put on their farming by the war between the Mujahideen and Soviet troops.

The destruction of the Afghan agriculture caused by the Soviet-Afghan war forced the farmers to take loans in order to sustain themselves. The most common form of loans in opium poppy growing areas is the system known as “salaam” which is an advance payment on a fixed amount of agricultural production. Thus, the farmer agrees to provide the lender with a set quantity of opium after the harvest in return for which the lender pays the cultivator half the value of the future crop in cash at the market price at the time of the loan. Salaam is sometimes used as advance payments on other agricultural products, such as wheat or black cumin, but opium is the desired choice of credit lenders [Ward et al., 2008].

The majority of households that cultivate the opium poppy in Afghanistan still utilise the salaam system to some extent. The resource poor farmers typically sell their entire crop prior to the harvest (some of them up to two years before) in return for an advance payment. Research on the credit system in Afghanistan portrays a consistent picture in which a significant proportion of the rural population rely on credit to meet their basic needs [Thoumi, 2008]. Research in Helmand province in 2000 reported that two thirds of the borrowed credit was used for social needs, such as food, clothing medical treatment and expenses connected to marriage whilst production needs such as fertiliser, seed, hired labour and capital investment constituted the final third [Ward et al., 2008].

During the Soviet-Afghan war opium was used as a source for income by the Mujahideen, but their largest source was the external financial and military aid (advanced military technology) which significantly raised the stakes of this war. The main external actor was USA, but Iran and UK also provided support [Misra, 2004]. Afghan factions had to compete with each other’s military competence and seek external sources of income (such as opium) to buy weapons. This

created an effective network of arms and drug trade, used both by the external actors to fund the war effort and the Mujahideen [Steinberg, 1995]. The Mujahideen had an alternative intention in producing opium. The introduction of opium to Soviet forces made some of them addicted, thereby destroying the moral [Misra, 2004]. The connection between the Mujahideen and the Soviet soldiers through the trade of opium also created a network connection between criminal elements in the Soviet army and the Afghan opium network, which continued to function after the end of the Soviet-Afghan War [Asad & Harris, 2003]. The sponsored Mujahideen factions became dependent on stable sources of high-level income provided through the external actors but with the end of the Soviet-Afghan, the external actors withdrew their financial and military aid [Misra, 2004, Peters, 2009]. The formerly sponsored factions needed to maintain the level of internal military arms race and had to find an alternative source of income. The Soviet-Afghan War created a supply chain from the Afghan farmers through the same routes as the external actors used for supplying the Mujahideen with weapons. This caused the demand for opium in Afghanistan to rise in order to supply the global market [Peters, 2009].

The Mujahideen war (1989-1996)

With the retreat of Soviet Union force the communist Afghan government had to fend for itself against the Mujahideen which ended with the republic's collapse in 1992 [Misra, 2004]. The foreign invaders repelled and the communist government overthrown, the Mujahideen started to fight among themselves. As a leader of the Mujahideen Northern Alliance stated; “Afghanistan is made up by different nationalities and when there wasn’t an outside threat these will fight to get their share of the free Afghanistan and a state of warlordism took over” [Peters, 2009].

An example of a warlord is Gulbuddin Hekmatyar; the head of Hezb-i-Islami Gulbuddin, who is one of Afghanistan's seven rival Mujahideen factions. Gulbuddin was during the Soviet-Afghan war supported by Pakistan's military intelligence agency; the Inter-Service Intelligence (ISI). After the pullout of Soviet forces in 1989, Gulbuddin attempted to take control over the opium fields in an area of the Helmand Valley controlled by another commander, Mullah Nasim Akhundzada. Hekmatyar's forces were defeated [Steinberg, 1991]. In 1991, then the deputy defence minister Nasim Akhundzada of Afghanistan was assassinated by his opium rival and fighting broke out again between the Hezb-i-Islami Gulbuddin and the Helmand Valley group. By 1995 Gulbuddin Hekmatyar controlled a string of heroin laboratories just across the north western Pakistani border, where the opium produced in his domain control be processed [Steinberg, 1995].

The internal conflict between warlords continued the drought-like conditions and Afghan farmers continued to grow opium maintain a livelihood, as normal trade was not possible,

because of roadblock made by the various Mujahideen factions in order to levy road taxes [Peters, 2009].

During the Mujahideen war there emerged a transnational trade network in Afghanistan between Central Asia and the Persian Gulf regions with connections to smuggling and drug trading groups in the neighbouring countries. This was caused by an increased enforcement against opium production and trafficking by the governments of Iran and Pakistan [Asad & Harris, 2003]. This caused these countries criminal organisations to turn to Afghanistan to continue their operations [Peters, 2009]. Most of this network is linked to the transnational region called Pashtunistan, which is the home region of the Pashtun ethnic group, (Appendix I). The increased enforcement by the Irani and Pakistani governments also caused the price on opium to rise creating a further incentive for increasing the production [Asad & Harris, 2003]. During the early 1990s there emerged a number of criminal organisation in the former Soviet republics, these organisation also traded with similar ethnic linkages in the northern part of Afghanistan [Barnett & Sherman, 2008].

During the early 1990s refugees from the Soviet-Afghan war returned home to areas such as the previously mentioned burned downed orchards in Kandahar. These returning farmers lacked the time and resources for rebuilding the burned down orchards [de Beurs & Henebry, 2008]. Other farmers returned to areas with mines and ineffective irrigation systems caused by the lack of maintenance. Most of these returned farmers who lacked alternatives turned to opium production.

The Taliban regime

In 1994 the Taliban were a former neutral participant in the infighting who became an important actor and was backed by the Pakistani government in an attempt by the Pakistani government to reopen inter-regional trading routes in Central Asia [Misra, 2004]. From Pakistan came also "the student army" consisting of young men that had grown up in refuge in Pakistan, where they were taught their belief by the Pakistani madras' promoting a radical form of Islam called "Wahhabism", an orthodox form of Sunni Islam similar to that practised in Saudi Arabia. These young Afghan men, who possessed no knowledge of the Afghan history or traditions, became the core of the Taliban [Misra, 2004]. The Taliban seized power in 1996. Taliban consisted mostly of Pashtuns and were opposed by the Northern Alliance consisting of various other ethnic groups. Both of these groups were backed by various external actors seeing Taliban either as a threat or a possibility for stabilising Afghanistan [Misra, 2004]. This led to heavy fighting in Afghanistan ending with Taliban controlling over 90% of the nation in 1998 [Peters, 2009].

From its beginning the Taliban was connected to the organised crime through the Pakistani "Quetta Alliance" which was based in the north western Pakistani city of Quetta, (figure 1.2) [Peters, 2009]. Some Mujahideen warlords outside the Taliban joined the Taliban to continue, UNODC (2002) wrote; "There are also indications that some of the Taliban commanders and mullahs were personally involved in the opium trade. Even more important, a number of warlords, who were already involved in the opium trade, surrendered to the Taliban in exchange for the promise to continue with their lucrative opium business".

As during the Mujahideen period these Taliban commanders fought each other over the control of the opium resource [Barnett, 2004]. Even though the Taliban commanders fought among each other. The Taliban reasserted control over what remained of Afghanistan's weak administration and revenue collection, including the taxation of the legal opium production and trade [Barnett & Sherman, 2008].

The Taliban regime was thus not only characterised by conflict and poor human rights record, but also by a moderate economic recovery in areas of the country that had become free of conflict [UNODC, 2002]. The country's industrial sector was largely destroyed in the previous period of the Afghan Civil War [Ward et al., 2008]. Agricultural production, notably wheat production, increased after having fallen throughout the 1980s and early 1990s. Livestock herds rose in numbers, taking advantage of widely available unutilised grazing lands, and horticultural production grew also due to the restoration and expansion of orchards and vineyards [UNODC, 2002]. The stability as it also made both the national trade and the re-establishment of trade with Pakistan, did not reduce opium production. The stability also made transnational transportation of the opium easier [Peters, 2009; UNODC, 2002]. From 1996 to 1999 the opium production doubled. Research by the World Bank and others, including UNODC, indicated that the Taliban derived more income and foreign exchange in the 1990s from taxing the transit trade in licit goods smuggled through Afghanistan from Dubai to Pakistan than from the drug trade [Barnett & Sherman, 2008].

The "Wahhabism" faction of Islam and follows a strict interpretation of the Sharia law that normally forbids all forms of involvement in narcotic production. While Taliban was very strict with enforcing harsh punishment on Afghans caught doing any kind of narcotics, their interpretation of Sharia allowed the growing of opium and other drugs[Peters, 2009]. This is an example of a conflict between the ideological belief and practical motivations behind Taliban.

In the summer of 2001 Taliban banned the production of opium. The reasons for the ban is unknown. Either it was an attempt to get some international recognition as a legitimate government, dealing with the growing addiction or perhaps to follow the Sharia law, and at the same time UNODC had promised development aid in return for a ban [Thoumi, 2005]. Another

speculation claims that the harvest for 1999 and 2000 had been so good, that the price on heroin in Europe had dropped from US$118/gram in 1996 to US$59/gram in 2001.This drastic drop in price had made the Taliban stockpiled opium from the previous years [Barnett, 2004]. If stored properly opium does not deteriorate over time [Steinberg et al., 2004] and by reducing the new production the supply of opium dropped causing the price to rise. This increased their profit when selling the stockpile [Barnett, 2008]. This theory of the Taliban trying to increase the price is supported by the fact that the ban was only on the opium production and not on trafficking [Thoumi, 2005]. If the ban had been religiously motivated, the ban would most likely also had covered the trade.

The Taliban's harsh enforcement of the ban worked and the opium production was reduced by 94.3% in Afghanistan and 65.3% in the world in 2001 [UNODC, 2002]. The remaining opium production in Afghanistan was mostly produced in the area still under control of the Northern Alliance [Peters, 2009]. The opium from the Northern Alliance was smuggled mostly through Tajikistan in exchange for arms [Barnett, 2004; Asad & Harris]. The Taliban ban is an example on how effective a ban on drug production can be if there are no consideration to ethics and human rights and as Farrell and Thorne (2005) writes "this may have been the most effective drug control action of modern times". But at the same time many researches doubt that the ban would have lasted longer even if the Taliban had stayed in power, because of the other conditions [Barnett & Sherman, 2008, Farrell & Thorne, 2005, Thoumi, 2005].

At the same time as Taliban enforced their ban on opium production, Afghanistan experienced a country wide drought [Thoumi, 2005] which caused major problems for the agriculture. 40% of the cereal production was lost and livestock was reduced by 60% from 1998-2001 [Barnett & Sherman, 2008]. This forced the Afghan farmers in 1999/2000 to borrow even more money through the Salaam credit system agreeing to grow opium in the following 2000/2001 season. The sudden lack of supplies made the price on opium and its derivatives to increase from US$60-100/kg to >US$600/kg, thus creating a large profit for the traffickers and a high revenue for those who taxed them. But the farmers having already been paid under the salaam credit loan did not gain any extra profit from the increased price. On the contrary in the areas where the Taliban ban was in effect they could not fulfil their contract. Instead they now owed the lender the same amount of opium but at current high price. For example a farmer lending US$300 in the autumn of 2000 for producing 10 kg of opium at the then price of US$60/kg, would in the summer of 2001 owe the lender US$6.750 at the peak average price of US$675/kg [Barnett & Sherman, 2008].

The Taliban insurgency

Even before the Taliban government was toppled in the late 2001, the Afghan farmers and traffickers were already starting up their opium production again. Richard Lloyd Parry [2001] observed farmers in the district of Surkh Rod, Nangarhar province preparing their fields for opium poppies in late November 2001. At the same time Kabul fell to the Northern Alliance and in the nearby district of Pachir Wa Agam, the Taliban and Al-Qaeda made a stand in the cave complex Tora Bora, (figure 3.6) [Parry, 2001;Tanner, 2002].

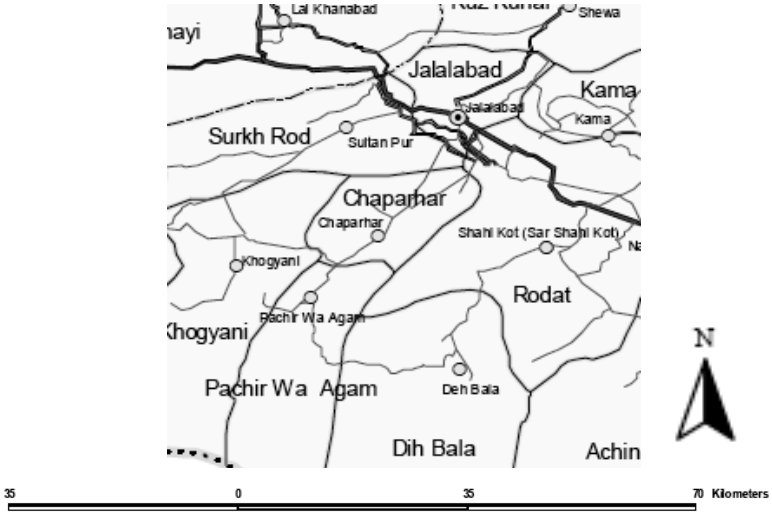

Figure 3.6: Districts of Surkh Rod and Pachir Wa Agam in Nangarhar [AIM, 2009]

Thus, the farmers started preparing the next years harvest while there was heavy fighting nearby and the Taliban were still present. This illustrates the desperation and the dependence of the Afghan farmers on the opium production after the drought of 1999-2001 and the ban on opium production. Furthermore, after two decades of growing opium it has become the traditional primary crop, rather than a supplement intended to support during stressed periods [UNODC, 2002]. It is because of these conditions that researchers found the doubtful that the Taliban's ban on opium production would have lasted longer.

In December 2001 a number of prominent Afghans met under UN auspice and planned the future of Afghanistan, this led to the Bonn Agreement[1], which was signed on 5 December 2001. This established an Afghan Interim Authority; a Council to govern Afghanistan until the first election [Wegerich, 2009]. In 2002 opium production was again made illegal, but this did not stop the opium production [UNODC, 2002]. The opium production and trade has since the illegalisation gone through an organisational change that created a new and more efficient

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structure where many of the former warlords involved in the opium production became part of the new government [Misra, 2004].

The placement of former warlords in political roles consolidated the criminal groups. Those groups not under political protection were arrested and the groups under patronage grew in size and power. From 2001 to 2004 the organisational structure of drug trafficking went from a loosely organised grouping and into a vertical hierarchy with a key trafficker controlling a region being under political protection. Based on research in Afghanistan and Pakistan, the number of key traffickers went from 100 in 2001 to 25-30 in 2005, with 15 is thought to be situated in the south where most of the opium production takes place [Shaw, 2006].

UNODC [2009b] estimates the 2008 the number of Afghans involved in opium cultivation to be 315.000-470.000 families or 2,4 million Afghan, which is 9,8% of the total population (Table 3.3). As mentioned in the introduction opium farmers are often targeted in the current counter narcotic strategy. The problem with the policy of eradication of poppy fields is that it is done without providing the farmers with an alternative to opium production. This triggers the same event as the Taliban's ban The farmers cannot provide the opium as promised and it forces the farmer to lend even more credit through the salaam credit system and thereby getting deeply involved with the opium trade. It is therefore necessary that the farmers are provided with a viable alternative to opium while the threat of eradication ensures that they do not grow opium. There are others involved in the opium trade such as refiners, who refine the opium into heroin. Cross-border smugglers, that smuggles the chemical needed along with opium and arms for the insurgency. These are often part of the criminal organisations that have had connections with the opium trade since the Soviet-Afghan Wars [Peters, 2009].

Table 3.3: A rough estimate of the number of people at each level of trafficking and their functions [Shaw, 2006; Byrd and Jonglez, 2006, UNODC, 2009b].

Role	**Numbers**	**Function**
Key-trafficker	~ 25-30	Controls refineries and international sale
Trafficker	~ 200-250	Transnational trade
Mid-level traders	~ 500-600	Wholesale of opium, connection to the criminal organisation
Small-scale and local traders	~ 10-15.000	Buy and sell at farm gates or at bazaars
Involved in opium production	~ 2.400.000	Production either as farmers or rural labours

Above the opium farmers in the opium production and trafficking network's hierarchy are the small-scale and local traders. Some are often a part of the local community, such as shop owners, and they accept the opium as currency for goods. Other traders travel from farm to farm,

buying the opium from the farmer and selling it at a profit at a bazaar or to a mid-level trader. The small-scale and local traders are dealing with the opium openly and are running the risk of their opium being confiscated by police officers that often sell to other local traders [Byrd & Jonglez, 2006]. Above the local traders are the mid-level traders who sell the opium as a wholesale, they often buy opium in provinces where it is cheap and sell it in provinces with a higher demand. In 2005 the average price in the northern provinces for dry opium was between US$70/kg to 80/kg, while prices was between US$170/kg and 220/kg in the southern provinces [Shaw, 2006]. The mid-level trader is usually where the opium trades gets connected to the criminal organisations, which is also why the level of secrecy increases. Some mid-level traders sell across the border, but this is usually arranged by traffickers. The cross-border smugglers often have connections which are either personal, family, tribal or ethnic such as the network of the Pashtunistan [Shaw, 2006; Byrd & Jonglez, 2006]. Both level of traders often interact with farmers providing credit and high quality seeds. While regular seeds can be harvested for opium gum up to six times before dried up, high quality seeds can be harvested of up to nine times[Byrd & Jonglez, 2006].

Above the traders are the traffickers, which is the part of the organisation that arranges the transnational trade of opium and its derivatives. They are thought to be highly organised and are often connected to a single key trafficker that controls 25-30 traffickers [Shaw, 2006]. The key traffickers at the top of the structure are businessmen with important political connections. These individuals are thought to be very wealthy and often play roles in the local government as well as the drug trade. The key traffickers control the opium market by controlling the heroin refinement and providing the chemicals needed in the process. They also control it through determining how much of the stocked opium to release for trafficking thereby controlling the prices [Byrd & Jonglez, 2006].

While the demand for heroin has been steady at 0,4% of the global population since 1990 [UNODC, 2008c]. Production of opium has increased almost five times in the same period, with 2008 production is twice the demand of global demand of heroin. Even though the prices has gone down since then it peaked in 2004 of US$ 222/kg to US$ 86/kg in 2008 for dry opium [UNODC, 2009], the fall in price does not match the drastic increase in supplies [UNODC, 2008c]. The demand for opiates could be greater that assumed demand, which could be caused by false information given by countries experiencing heroin problems do not want loss status by letting other countries to know the size of their problem. It could be cause by a continuous stockpiling of opium in order to keep the retail price steady. Because of their control over the opium production, the targeting of these key traffickers are important. This will be difficult because these key trafficker are seldom directly involved in the trade as well as they are protected by government officials.

The relation between politicians and the opium network created a complex mutual beneficiary relationship of pay-off and patronage where drug traffickers on all levels are protected by people in the government; from key traffickers paying off provincial chiefs of police to mid-level traders paying the local police chief and to the farmers paying so their opium will not be eradicated [Shaw, 2006]. The level of corruption is thought to go up high in the Afghan government. Ahmed Wali Karzai, the Afghan Presidents brother and the chief of the Kandahar Provincial Council has been suspected for a high level of connection to the drug trade for a long time, but there is so far no hard evidence [Peters, 2009]. The high level of corruption makes it impossible for lower level law enforcement to prosecute the traffickers without risking their own job [Byrd & Jonglez, 2006].

According to the transparency international corruption perceptions index of 2008, which rates a 180 countries from the least corrupt as 1 to the most corrupt as 180. Afghanistan is 176 of 180, dropping from 172 in 2007 so the situations has not gotten better [Transparency International, 2009]. This could be caused by the increased presence of Taliban since 2006 [ICOS, 2008] which creates the instability in places where corruption can easier go unnoticed or law enforcement is near impossible.

A government such as the Afghan, which failed in providing some of the basic conditions and responsibilities of a sovereign government can be defined as a "failed state". Afghanistan is not directly a failed state, but there is a great difference between the relative stable northern part and southern part that has a high Taliban presence. Therefore could some parts of the southern Afghanistan be defined as failed in the governmental responsibilities.

The conditions concerning a failed state and drug production is often linked. According to a study over the last 20 years, all drug producing countries in the developing world have experienced conflict in one form or another [Misra, 2004]. Drug production is the consequences of the conflict; no government to institute and enforce the law and the presence of non-state actors, such as the Taliban, needing resources to continue their agenda and the drought-like impact conflict has on agriculture. The Fund for Peace, a United States think-tank, has since 2005 created a failed state index over all sovereign states measuring the states vulnerability by 12 indicators covering four social, two economical and six political indicators with a range from 1,0 (good) to 10,0 (poor). Since 2005 the placement of Afghanistan's total score gone from 99 to 108,2 in 2009 (making it the seventh most failed state). Caused by the increased instability in Afghanistan since 2006 [Peters, 2009] index indicates that the overall situation in Afghanistan has not improved since 2005, (table 3.4).

Table 3.4: Failed State Index 2005-2009 [Fund for Peace]

Year	Social	Economic	Political/Military	Total
2005	32,4	16,3	50,3	99
2006	33,6	15,5	50,7	99,8
2007	33,5	16,3	52,5	102,3
2008	34,5	16,6	54,3	105,4
2009	35	16,7	56,5	108,2

When comparing Afghanistan to its neighbouring countries in 2005, the poor Afghan development is clear. It is so low that it is the second lowest on the 2005 (and latest) Human Development Index, situated between Sierra Leone and the Central African Republic, and as the Failed State Index indicated, the situation has not improved since 2005 thereby making Afghanistan the only non-African country below 0,35 (figure 3.7).

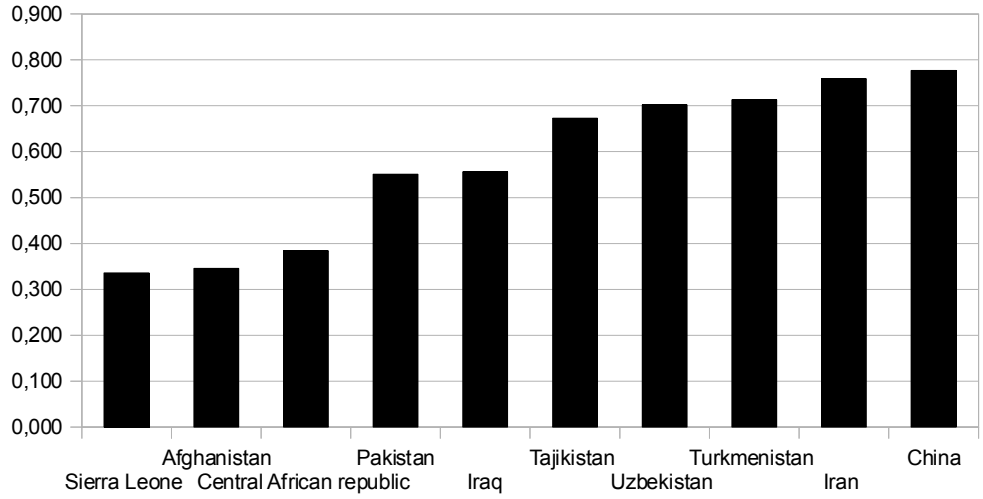

Figure 3.7: HDI Index for Afghanistan and selected countries in 2005 [HDI, 2009]

HDI uses different indices to determine the development level of the country. These are GDP per capita, life expectancy, and education. The poor development in Afghanistan and the instability causes the Afghan farmers to continue their opium production because it is a low risk and high yield cash crop, which they know there is a market for.

Since the fall of the Taliban in 2001, the development aid and counter-narcotics initiatives has increased in Afghanistan and the economy is growing. GDP growth from 1978 to 2001 was a total of 0,2 % and since 2001 the average economic growth has been over 10% per year [Ward et al., 2008]. The opium is still a large economic factor in Afghanistan; the 2008 GDP was estimated at US$10,5 billion, while the opium farm gate value was 730 millions and the total export value of opium and heroin was US$3.4 billions or almost one-third of the licit economy [UNODC,

2009b]. This high level of dependence from the Afghans on the opium emphasises that solving the opium problem in Afghanistan is not just a counter-narcotics, but also a development problem. As Barnett Rubin [2004] puts it, "Afghanistan cannot be stabilized while the most dynamic sector of its economy is illegal, nor if more than half of its economy is destroyed".

Even though the general Afghan development is lacking, because of the conflict. One of the areas with the greatest improvement of living standard is Helmand province, producing over 70% of the country total opium production, [UNODC, 2008]. This has led to a conclusion by UNODC [2008b] stating that poverty is not the biggest factor driving Afghan into the production of drug crops. A reason for the fact that living standards are going up in Helmand and the illicit production of opium continues could be caused by the debt created during the brief Taliban ban on opium production in 2001. During 2000 Helmand produced over 40% of the world's opium [Steinberg et al., 2004] and the Taliban ban on opium production would have reduced the provinces production to almost zero. This would have thrown the Afghan farmers living in Helmand deeper into debt as they could not honour their contract with the credit lender. Another reason could be that opium production requires a lot of labour; each hectare of opium poppies creates 5,6 jobs in the community during the harvest [Mellor, 2005; Ward et al., 2008]. So if Helmand has a high production it would be fair to assume that the labourers in the province would also have enough work and thereby raising the general income in the province. An example of opium's effect on the economy is when the opium economy shrank in the eastern province of Nangarhar in 2005 and the turnover in local businesses subsequently halved [Ward et al., 2008]. Therefore, the opium production could initially have been caused by poverty, overtime the production has created a higher living standard. Also the conflict and corruption has ensured that there is very risk of prosecution by the government involved, so why stop cultivating opium and change to a crops that gives a lower income.

There is still a large part of Afghanistan which is no longer directly involved in the opium production [UNODC, 2009]. According to UNODC recent survey questioning village headmen, the reasons why their village has chosen to either cultivate or not to cultivate opium. More than half answered, that the reason why, they cultivated opium was the high sale price, with the second highest reason being poverty, while only 7 % answered it was caused by the lack of government control (table 3.5) [UNODC, 2009].

Table 3.5: Reasons for cultivating opium in 2009. [UNODC, 2009]

Reasons	
High sale price on opium	53,00%
Poverty	32,00%
Other	8,00%
Lack of government control	7,00%

The dominant reasons for not growing poppies in the southern and western region, where most of the production takes place [UNODC, 2009], are the high sale price of wheat and that opium cultivation is forbidden according to Islamic law. Thus, even though the southern region remains the largest opium cultivation area, the lower prices on opium and higher price on other crops will most likely cause a reduction in opium cultivation. The dominant reason for not growing poppies in the rest of the country is the pressure from the government authorities. This reason illustrates how important that security and governance is in preventing opium production. The survey also reveals that Islam plays a role in the choice of whether or not to cultivate opium and that the traditional local institution of Elders and Shura (village councils) still have some weight in the matter, (table 3.6).

Table 3.6: Reasons for not cultivating opium in 2009 divided on southern and western region and the rest of the country [UNODC, 2009]

Reasons	Southern and western region	Rest of Country
High sale price on wheat	22,00%	0,40%
Against Islam	21,00%	15,00%
Pressure from government authorities	16,00%	52,00%
Low income from opium	15,00%	10,00%
unsuitable climate conditions	14,00%	3,00%
Drought	7,00%	7,00%
Elders and Shura decision	3,00%	6,00%
Other	2,00%	7,00%

As mentioned earlier was the north western Pakistan during the Afghan Civil War, the region where the Mujahideen based their heroin laboratories to process the opium before shipping it to their global market. There is still today a strong connection between the opium produced in the south of Afghanistan and the north-western part of Pakistan [Peters, 2009].

The current link between the Taliban and the opium production is clear. The six southern Afghan provinces of Farah, Nimroz, Helmand, Uruzgan, Kandahar, and Zabul , where the Taliban presence is strongest [ICOS, 2008] is also producing most of the Afghan opium [UNODC, 2009]. There is also the strong ethnic connection between this area of Afghanistan and north-western Pakistan as they are both part of the Pashtunistan region. The ethnic connection is as

explained an important part of the transnational trafficking of opium and heroin. The reasons for the high level of opium production in these provinces, could be caused by the previously mentioned presence of the Taliban, both in southern Afghanistan and north-western Pakistan.
These provinces has also as previously established a low production potential without irrigation, because of the high aridity found in this part of Afghanistan. After their removal from power, Taliban started with the intention of using opium as a resource for money to support their insurgency. In 2007 Taliban part of the opium profit was; a ten percent tax know as 'ushr' from farmers netting US$56 million. The Taliban also controls fifty Taliban heroin refineries which gives them another US$133 millions. The Taliban is also providing the drug traffickers with protection, which gives them another US$250 million. This brings the Taliban total resource in 2007 close to US$500 million [Peters, 2009]. So the Taliban has a good reason to pressure farmers to continue the opium production in order for the Taliban to buy arms and munitions to the insurgency. As former ISAF commander US General Dan McNeill has said: "when I see a poppy field, I see it turning into money and then into IED's and Kalashnikovs". Gretchen Peter [2009] writes in her book that a survey made on her behalf by local reporters questioned 350 people involved in the drug trade and 81% of them answered that the Taliban commanders are more interested in making money and protecting the opium production rather than recapturing territory and US military intelligence has come to the same conclusion [Peters, 2009]. It would seem that the intentions of the Taliban has changed from opium being a resource to achieve their goal of taking over Afghanistan once again. to a new goal of producing and trafficking opium for profit. The link between the Taliban and opium production also creates a problem for the local counter-narcotic units since they are up against well-protected drug smugglers. Another important reason for why the southern regions are producing this much opium is that their agricultural potential is very much dependent on irrigation because of the high average temperature and low precipitation. As mentioned did the Soviet-Afghan force a lot of Afghans to leave their home and the Soviet tactics of scorching the earth during the war destroyed permanent crops and irrigation systems. Since the refugees return in the early 1990s these Afghans has cultivated opium to survive and thus a tradition of growing opium has started.

Summary:

In the late 1970s, before the conflict. Afghanistan was a slowly developing country with a low agricultural potential, because of agricultural constraints caused by the general arid climate, poor soils and the varied topography of Afghanistan.

During the Soviet-Afghan War the motives for the Mujahadeen was to ensure enough resources to maintain their insurgency against the Soviet supported government and for the

Afghan wars. The Mujahadeen was during this time backed by external actors, who supported them through arms trade. The routes used for weapon shipment was also used for transporting opium to the global market. The conflict caused a degradation of important functions such as irrigation systems, access to pastures and market. Together with a loss of institutions need to assist the agriculture during periods of stress. These changes created a dependency, both directly on growing opium, but also through the Salaam credit system. After the withdrawing of Soviet forces the external support also disappeared and the Mujahadeen began fighting in order to gain control of the opium resources. This created a warlord ruled state with an opium based economy with connection to criminal organisations in the neighbouring countries.

The Taliban regime from 1996-2001 created a period of growth in the general economy and opium economy, which suddenly ended with the Taliban ban on the opium production, but not on the opium trade. The sudden lack of supplies created a great profit for the traffickers and Taliban warlords that had stockpiled the previous years' harvest. the dependent Afghan farmers to get deeper indebted, this was amplified by a nationwide drought in 1999-2001. After the fall of the Taliban, the Afghan farmers who were deep in debt from the previous years failure to deliver opium, were forced to grow opium again. The quick return in opium production in 2002 also showed that even a harsh enforcement on opium as done by the Taliban would be ineffective as a long term solution. The long necessity of opium production, caused by the continued lack of institutions to assist and the constant conflict. This long dependency has created a tradition among the Afghan farmers in the new millennium.

The establishment of the post-Taliban government in Afghanistan created a link between the former warlords, now politicians, and the traffickers, and this caused a consolidation of power in the organisational structure of the drug trade, thereby creating a more effective network. Once out of power, the Taliban continued to collect taxes from Afghan farmers and opium traffickers to continue the insurgency against the international forces and the new established Afghan government. Since 2001, the Taliban seem to focus more and more on protecting the opium production rather than regain territory.

3.3. Root causes sustaining the Afghan production of opium

This section will answer the initial question: "What are the root causes sustaining the Afghan production of opium?" while section 3.4 will examine what need to be done in order to change this problem.

Before 1979, the Afghan agriculture used opium as a buffer in stress situations such as the regular drought found in the semi-arid to arid climate which causes several constraints on agricultural production. The continued state of conflict from 1979 to 1996 mimicked the effects

of a long drought and it changed the Afghan agricultural use of opium from a buffer to a primary crop, because of the lack of alternatives. The high profit of opium created a trade network of opium traders and credit lenders that promoted the opium production through a traditional credit system. Interaction with different external actors, such as USA and USSR during this period from 1979 to 1996 together with ethnic and tribal connections in the neighbouring countries created a trafficking network that connected the Afghan opium production to the global market.

The Taliban regime from 1996 to 2001 stabilised Afghanistan and banned the use of opium, but promoted the continued cultivation and trade in opium until 2000 where a national ban on the production of opium increased the farmers dependence on credit lenders.

After the toppling of the Taliban regime in 2001, the opium trade network and the Taliban went through a change where key traffickers with connections to newly promoted politicians took over and consolidated the network. Consequently, the Taliban became dependent on, and participated in, the opium trade, while levying taxes. At the same time corruption increased and the instability made it possible for the opium production to continue, even though it was made illegal in 2002. This constant state of conflict, caused a destruction of the important irrigation infrastructure and lack of institutional support to the agricultural, which led the Afghan farmer on a path of dependency to opium production.

3.4 Changing the cultural landscape

The Afghan opium trade network can be divided up into two group of actors with different intentions: Firstly, the group which continues to produce or traffic opium because of the high profit and the low risk of being caught. This group consists of criminals, traders and the Taliban. The second and largest group lacks a viable alternative and consists mostly of Afghan farmers and landless rural labourers.

In order for the opium production is stopped it is necessary to address the different conditions that makes the opium production possible. These different solutions, or area of focus, must be dealt with at the same time because of their interrelated causality; If the security situation improves, the risk of trading in opium increases and deter some from this. Also an increase in security will most likely also increase the risk for government officials to get caught in assisting the opium traffickers. If the security situation continues or gets worse, while initiatives set into place to give Afghans an alternative to opium, these initiatives will more than likely be unsuccessful. Since the continued insecurity will prevent institutions from assisting the farmers and the conflict will hinder trade and construction. Also as established conflict can mimic the effect of a drought and continue to stress the agricultural production system. But the security issue and lack of alternative is just two of the areas needed to be addressed. The areas suggested

by Antonio Maria Costa, Executive Director of UNODC [2008] are;

- Reducing the insecurity and increasing law enforcement. To ensure the counter narcotics initiatives have a chance of working
- increased cooperation between counter insurgency and counter narcotics, to assist law enforcement in enforcing the Afghan laws.
- Increasing border management, to prevent the flow of drugs out of and arms into Afghanistan
- Attacking individuals higher up the hierarchy and not just the farmers, to increase the risk of the opium traders.
- Attacking the profit, to increase the risk to those actors involved for profit
- Reduce corruption, to ensure just process and increased chance of the actors involved getting caught and not protected by corrupt government officials.
- Viable alternatives to opium. To ensure that the Afghan farmers have an alternative, while the risk of eradication keeps them from continuing the opium production.
- An increased effort in reducing the demand for opium, through improving drug prevention and treatment with a focus on the countries with a high addiction.

The need to address these areas are supported by Afghanistan experts such as Rubin R. Barnett [2008]. It is the assumption of this project, that if properly implemented these initiatives will stop the opium production.

This is a change from the previous strategy, where the previous U.S. Government in 2007 supported a plan to escalate poppy eradication in order to deprive the Taliban of funding for the insurgency. This strategy is based on inaccurate assertions in the UN Office on Drugs and Crime (UNODC) *Afghanistan Opium Survey 2007* [Barnett & Sherman, 2008]. Poppy eradication that has been perceived as a “quick fix” [Costa, 2008], does not have a positive effect on the prevention of the drug production. Rather, poppy eradication works as a negative feedback, raising the price of opium, thereby making more money available for the insurgency and causing cultivation to migrate to more remote areas [Barnett & Sherman, 2008]. To implement the different areas suggested by Costa [2008] a joint strategy has been put forth, this is called 'The Rainbow Strategy'. This is a result of a number of expert and policy group meetings held under the framework of the Paris Pact Initiative, including UNODC-coordinated international partnerships of more than 50 countries an regional organisations to counter the trafficking in and consumption of Afghan opiates [UNODC, 2009c].

Of the seven different areas, one area sticks out, giving the Afghan farmers a viable alternative to opium production. The Rainbow Strategy emphasises that “No sustainable reduction in opium cultivation will be possible before farmers has a sufficient legal livelihood” [UNODC, 2008c]. Barnett and Sherman [2008] writes; “From a political point of view, the purpose of counter-narcotics is to win the support of most of those involved with the drug economy by providing them with better security and links to markets than drug traffickers, corrupt officials, and the Taliban. Where communities are confident in alternative livelihoods, they will consent to the eradication of illicit crops”. This is illustrated by the event in 2001-2002 with the Taliban's ban on production and the quick return of the opium production the following year. Because of the finding in the problem analysis and the emphasis of its importance by various expert. The focus of the project be on how to provide the Afghan farmers with a viable alternative to opium production.

4. Viable alternative to opium production

As established in section 3.4, the two main reasons for opium production are; profit and the lack of viable alternatives. The above mentioned solutions mostly focus on reducing the profit.

While all of these areas are important, the top priority must be to ensure that the Afghans have a viable alternative to opium production. When the Afghan agriculture develops to a point where none of the Afghan farmers are dependent on opium, as it was in the late 1970s, then the risk of eradication and further prosecution will most likely keep the farmers from starting the opium production up again. This emphasises the importance of the other counter-narcotic initiatives and the success of stopping the opium production by providing the farmer with a viable alternative is linked with the success of the other initiatives. Because of the current underdeveloped state of the agricultural system the timeframe for an Afghan agriculture not dependent on opium is estimated to roughly 8-20 years for the poor highly dependent farmers and the landless rural labourers [Ward et al, 2008]. This depends on an improvement of the security situation in Afghanistan.

Besides giving the Afghan farmers an alternative to opium, improving the agricultural system will also have a positive effect on the general development of Afghanistan. Afghanistan is, as established earlier, a country that has always been and still is dependent on its agriculture. In 2002/2003, the most recent year with figures available, 68% of the Afghan workforce worked in agriculture [Ward et al., 2008] and development of the agricultural system is often linked with the general development of a developing country [Roe, 2009; Potter et al. 2004]. An improvement in the agricultural system could also help Afghanistan to achieve an independent food supply. The harvest of 2009 was the greatest so far, totalling 6.333 tons of cereal, but the total domestic requirement deficit was 207 tons [FAAHM, 2009]. While the general terminology concerning the alternatives have focus on the viable development of the Afghan agriculture, the sustainable development is also very important.

Sustainable development has been defined in many ways, but the most frequently quoted definition is from “Our Common Future”, also known as the Brundtland Report [WCED, 1987]:
"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:
First, the concept of needs, in particular the essential needs of the world's poor, to which overriding priority should be given; and
secondly, the idea of limitations imposed by the state of technology and social organization on the

environment's ability to meet present and future needs." [WCED, 1987].
The loose Brundtland definition of sustainable development can be used to cover very divergent ideas. Environmentalists, governments, economic and political planners, and business people can use ‘sustainability’ or ‘sustainable development’ to express sometimes very diverse visions of how economy and environment should be managed [Adams, 2006].
Therefore it is necessary with a more precise definition of what sustainable development in the Afghan agriculture should include.

Any sustainable development in the Afghan agriculture should work to cover the needs of the Afghans; food security, stable production and job security, all of these within the limitations set by the natural structures and the state of technology and organisation within the agricultural system.
Where the viable development focuses on the economical and environmental part, a sustainable development also includes the social aspect. It is in the union of these three aspects that sustainability occurs (figure 4.1).

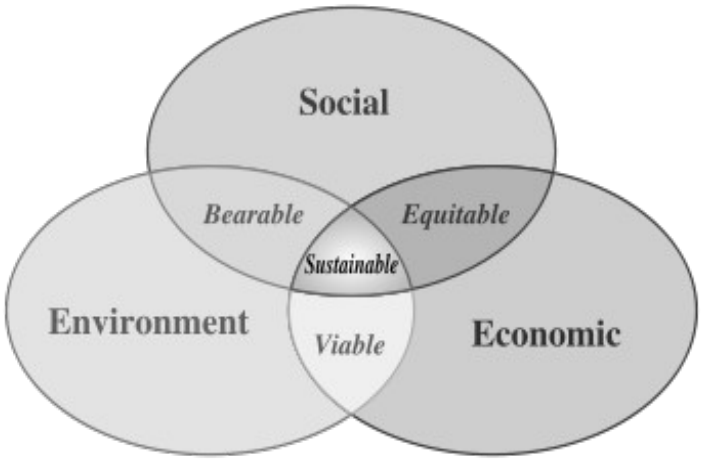

Figure 4.1: The three aspects needed for a sustainable development [Adams, 2006].

The three ‘aspects’ cannot be treated as equivalent. Trade-offs between these three aspects often happen, such as a trade-off between equitable growth and economic growth creating a larger gap between the social groups [Roe, 2009]. Trade-offs involving the environment are different. First, the society and the economy are both part of social system and are closely related: these are in many ways the same. The economy can be perceived as a mechanism or a set of rules created by society to mediate the exchange of economic goods or value and is therefore a part of

the social structure [Adams, 2006]. Secondly there is a constant exchange between the social and the environment's systems of energy, material and information, where the energy transforms the system, materials are used and information is shared. For example a farmer that cultivates his fields for crops (energy) and later irrigates the field (material), when it needs it (information) [Marten, 2001]. While industrial countries such as Denmark or USA have reached a level of development where we are no longer solely dependent on the environment to provide us with all our needs and we have the resources and knowledge to modify the environment to suit our production needs. Afghanistan is dependent on its agricultural production and its natural resources. An environmental degradation would hurt the Afghan economic growth and social structure in general.

Because of the importance of continued environmental development or at least stability for the development of both the agriculture and Afghanistan in general. The focus will be first on the environmental and secondly on the socioeconomic aspects.

On the basis of the conclusions found in the analysing the root causes behind the opium production in chapter 3. This project will analysis how to obtain a sustainable alternative to opium production as a long term solution to the opium production in Afghanistan. This will be analysed by answering the following research question:

"*What is necessary to obtain a sustainable Afghan agriculture?*"

4.1 Operational framework:

The research of the rest of the project will be based on the finding found in the problem analysis such as the natural possibilities and constraints found within the Afghan agricultural system.

The focus will mainly be on functions and structures in the natural resource management and natural structures. The reason for this focus is the difference in approaches needed for intensive research on natural or social structure. In a natural scientific approach it is possible to come to conclusion by analysing primary data from other peoples fieldwork, such as water resource, climatic data and soil types. Also as mentioned in chapter 2 natural structures are more a closed system than social structures. For an intensive research into the social structures and functions connected to the Afghan agriculture is would require interviews and surveys which is not possible within the limits of this project.

Sub-question

There are various areas which need to be researched in order to answer the research question. To ensure that these areas get researched, this project will use some sub-questions to guide the research process along, these sub-questions are:

1. *What is the current state of the Afghan agriculture and what problems currently exist*?

By researching the current sustainability of the Afghan agriculture, and its strengths and weaknesses, it will reveal the constraints and possibilities. Constraints could be the lack or misuse of certain resources, which could potentially harm the sustainability of the Afghan agriculture, while possibilities could be resources not yet discovered or structures that, if strengthened, could help to obtain sustainability.

2. *How will the predicted climate change affect Afghanistan*?

The climate is changing and this will impact the natural structures. As mentioned in chapter 2 & 3, this sets some parameters for the Afghan agriculture. Currently there are already some natural constraints which hinder a high agricultural production without resource management. Therefore, when researching what is necessary to obtain a sustainable agricultural production, the future natural parameters must be researched.

3. *What are the future demands for the Afghan agriculture*?

As the Afghan population grows, the pressure on the agricultural production for food security increases. To answer this question the size of the future Afghan population must be assessed and its possible impact on the agricultural resources will be discussed, by comparing and discussing Malthusian and Richardian theory opposed by Boserup. These three theories of the population's impact on the resources will be discussed in section 5.2

These sub-questions will reveal the overall structure of the Afghan agricultural system and the functions within it. It will also give an indication of the current state of resource management and future problems. These questions will only be used as guiding through the research and will not be answered directly in the conclusion. However because of the close link between the sub-questions and the research questions the conclusion will answer these indirectly.

Using these indicators of the future for Afghan agricultural, this project will examine the Afghan agricultural production in order to determine the reasons for its current low legal production. When the reasons for the low production are established, which is the lack of water and proper use of the water resource available. This project will focus on the water resource, which has the most significant effect on the stability of the agricultural production. Chapter 5 will also examine various alternative crops to opium and the possibility of a legal opium production.

The water resource, the agricultural use of it, and the institutions involved in water management will be described and analysed in chapter 6. To analyse the water management institutions, "Tragedy of the commons" by Hardin (1968) and "Governing the commons" by Ostrom (1990) will be used. While the research on the production system will rely on research done by organisations and scientists with expertise in improving water management in Afghanistan or other case with semi-arid and arid agricultural conditions, the analysis of water use efficiency in Afghan agriculture will be concluded with a description of practise and techniques to improve the water resource's efficiency. 'Practise' is the common day-to-day on how the farmer works such as a planned irrigation instead of irrigation based on visual dryness. 'Techniques' covers the specific techniques that can improve the systems such as drip point irrigation.

After determining which practises and techniques could improve the system, the institutions involved in water management will be analysed in chapter 7. This will lead to a conclusion in chapter 8.

4.2 On Sources:

Because of the long conflict in Afghanistan and the current instability there have been some problems in obtaining current data on the country. The level of conflict and distance between Denmark and Afghanistan has also made fieldwork and interviews with actors impossible within this project's timeframe and resources. The lack of current data is not a big issue when dealing with the natural structures as these usually change more slowly than social structures. Such events as land degradation can of course occur rapidly within months or years, but the overall natural structures such as climate and hydrology, topography do not change that rapidly. While a land degradation can be visually confirmed via remote sensing. It is more difficult to research the mechanisms and conditions which create this event.

Social structures in Afghanistan have changed a lot during the last 30 years as is described in chapter 3 and many of the involved governmental institution are just starting to emerge after 23 years of conflict (1979-2001). An example of this is the Ministry of Energy and Water, which is an important institution in water management. But during this project it has not been possible to obtain any of the documents concerning their water management, both current and planned. Therefore, in cases like this, the project relies on research papers done by other within Afghanistan. When possible this project will emphasises on the primary data found in these documents.

5. Sustainable Afghan agriculture

This chapter will examine the structure and resources of the current Afghan agricultural, in order to determine it possibilities and constraints. The first section will describe the current agriculture in various statistical data. Section 5.2 will cover the current problem found within and pertaining to the Afghan agriculture and analyse what impact climate change and population growth could have on the Afghan agriculture.

5.1 Afghan agriculture

According to a FAO survey done during the winter of 2002-2003, the average size of the 1,28 million Afghan farms is 5,11 Ha (73% under 5 Ha) [Maletta, 2007]. Other surveys has found a different average size, such as Mollet [2003] who suggest an average of nearly 3 Ha per farm. The reason for this difference in average is that some surveys have selective sampling depending on the research area. Mollet focused on beneficiaries of FAO emergency programs addressing only the most vulnerable groups, and therefore did not include larger and richer farms (those programs tended also to be concentrated on irrigated farms). Afghan rural families with less than 0,5 Ha of agricultural land have great difficulty in earning their livings solely from agricultural production in most parts of the Afghanistan. Off-farm income generating activities are an integral part for about 65 % of farming families to achieve a modest living [Qureshi, 2002]. These off-farm labourers often act as day labour on other farms. Hence, these farmers are still dependent on the sustainability of the agriculture even though it is not on their own farm. In cases of drought, the possibility of labour on other farms has been insufficient and Afghans has migrated to other places, as in the case of the drought in 2004 [Bhattacharyya et al.,2004]. Maletta [2007] also found that the small sized farmers are very susceptible to droughts and other stress on the agricultural production system.

Maletta also found that large Afghan landowners are expanding their agricultural area either by grabbing from other farmers, buying land during droughts or by expanding through irrigation [Maletta, 2007]. This problem is amplified by the lack of institutions to ensure land rights [Roe, 2009]. The land-grabbing and the increased irrigation used to expand the larger landowners agricultural area will put an increased stress on the water resource. This emphasises the importance of an improvement in regulation of the commons and protection of the smaller farmers rights. Accord to Roe [2009] there is currently no standard of land ownership, but a variation of deeds from the former Afghan government to land granted by kings centuries ago. This informal rights system and lack of information on ownership is further hindered by the complex network of institutions involved in the land management.

Roe writes [2009:13] “Afghanistan has a long history of attempting to administer land, but the lack of institutional capacity remains one of the greatest challenges to rural land registration. In theory, responsibility for rural land administration falls primarily to the Amlak (lands department) at the Ministry of Agriculture Irrigation and Livestock (MAIL). Other state institutions are also involved, including the Afghanistan Geodesy and Cartography Head Office (AGCHO), the Ministry of Justice and departments of the Ministry of Rural Rehabilitation and Development (MRRD), as well as provincial and district authorities.”.

The complexity of this problem, which would require an intensive research into the different institutions involved and an understanding of the different types of ownership. Therefore will the project abstract for this problem. because it is not possible to research with in the limits of this project. However it is a very important social aspect in the sustainability of Afghan agricultural.

As of 2002 the Afghan agriculture covers 12% of Afghanistan's land area, of which 5% is either intermittently or intensively irrigated and 7% is raid fed (table 5.1). The areal resource currently available for agricultural crop production is 12%.

Table 5.1: Land cover of Afghanistan [Bhattacharyya et al.,2004; Azizi, 2002]

Landcover	Area (Ha)	Area (%)
Urban	29.494	0,05
Orchards	94.217	0,1
Agricultural land irrigated	3.207.790	5
Intensive	1.559.654	2,4
intermittent	1.648.136	2,6
Agricultural land rain-fed	4.517.714	7
Forests	1.337.582	2,1
Rangelands	29.176.732	45,2
Barren lands	24.076.016	37,3
marshland	417.563	0,6
Water bodies	248.187	0,4
Snow-covered areas	1.463.101	2,3
Total	64.559.396	100

Agriculture is as mentioned in chapter 3, mainly located in the northern part of Afghanistan and along the rivers of Afghanistan. Rangeland, covering 45% of the total area, is used for the animal husbandry and nomadic pastoralists, which 20% of the rural population [UNEP, 2008]. Barren land and forest are also used in the winter, where the winter precipitation makes these areas vegetated [Bhattacharyya et al., 2004], giving a total area for pastoralism 70-85%. Ward et al. [2008] writes that improving the livestock would be a good initiative to improve the livelihood for the rural population in Afghanistan and especially improve the living condition for the poorest farmers and the ones living in the remotest areas of Afghanistan as a short term solution [Ward et al., 2008].

The rangelands are used for grazing during the spring, summer and autumn months and supplement with feed. During the winter months do farmers keep their livestock stalled use feed daily. The feed dependency is much greater among settled Afghans, than the nomadic tribes [Roe, 2009]

The focus in this project will be on improving the crop productivity. This is based on that the fact that the water consumption in livestock production is much greater than in crop production and therefore an agricultural development, which focuses on livestock will stress the water resource even further as well as a further use of the rangelands, barren and forest, could also lead to a further degradation [Raes et al., 2008]. Livestock has as previously mentioned been an important part of the Afghan agriculture and should still be developed, but it is the assumption in this project, that the most sustainable agricultural development would be a focus on crop production as it would cover both the population and livestocks needs.

5.2 The current and future problems

This section will analyse the current and future problems concerning Afghan agriculture. Subsequently, it will focus on the current state of the agricultural system to find the production system's strengths and weaknesses. By exposing the weaknesses it is possible to strengthen these parts, or at least ensure that they do not degrade the production system. In this project the agricultural production system covers all the subsystems that include all functions required to cultivate, produce, distribute, and service agricultural products. The agricultural production system can be divided into the on-farm production, access to necessary natural resources and the distribution of the agricultural products, which will be examined in this project.

Current problems

The degradation of natural resources is one of the most common weaknesses of agriculture in developing countries, which constrains sustainable development [FAO, 2003]. As the natural resources degrades so does the possibility for agricultural production without the constant anthropogenic supplement of resources. In Afghanistan the current environmental degradation concerns consist of soil degradation caused by overgrazing. Deforestation; forests are being cut down for fuel and building materials, which can increase the soil erosion. Desertification in the southern part and lack of water resources both for drinking and irrigation [UNEP, 2008]. As mentioned in the previous chapter, this misuse of common resources is often coined "the tragedy of the commons" and stresses the need for an institution to ensure that these resources are used correctly.

An example of a common resource being exploited is the Afghan forests, which in the 1950s-60s were estimated to cover 3,1 to 3,4 million hectare [UNEP, 2008]. Currently the largest of the remaining Afghan forests lies in the eastern part of Afghanistan (figure 5.1). Where remote analysis has shown that it has been reduced by 52% from 1977 to 2002 [UNEP, 2008]. This is a trend common for all of the remaining Afghan forests, which cover 1,3 million hectare or about 2 % of the total land area. The remaining Afghan forests is currently being cut down due to the demands for fuel wood and illegal logging for timber that is sold to Pakistan [UNEP, 2008]. It is estimated that forest cut rates are exceeding annual growth rates leaving a deficit of about 30.000 hectares of forest per year [UNEP, 2008]. The continued deforestation could increase the soil erosion and thereby damage the Afghan agriculture. Removing large vegetation, such as trees, has a significant impact on the ecological balance as trees reduce surface runoff of water which ensures less soil erosion and leach of nutrients. Furthermore, the presence of trees reduce loss of water from evapotranspiration and reduce wind erosion of soil [Bond et al., 2007].

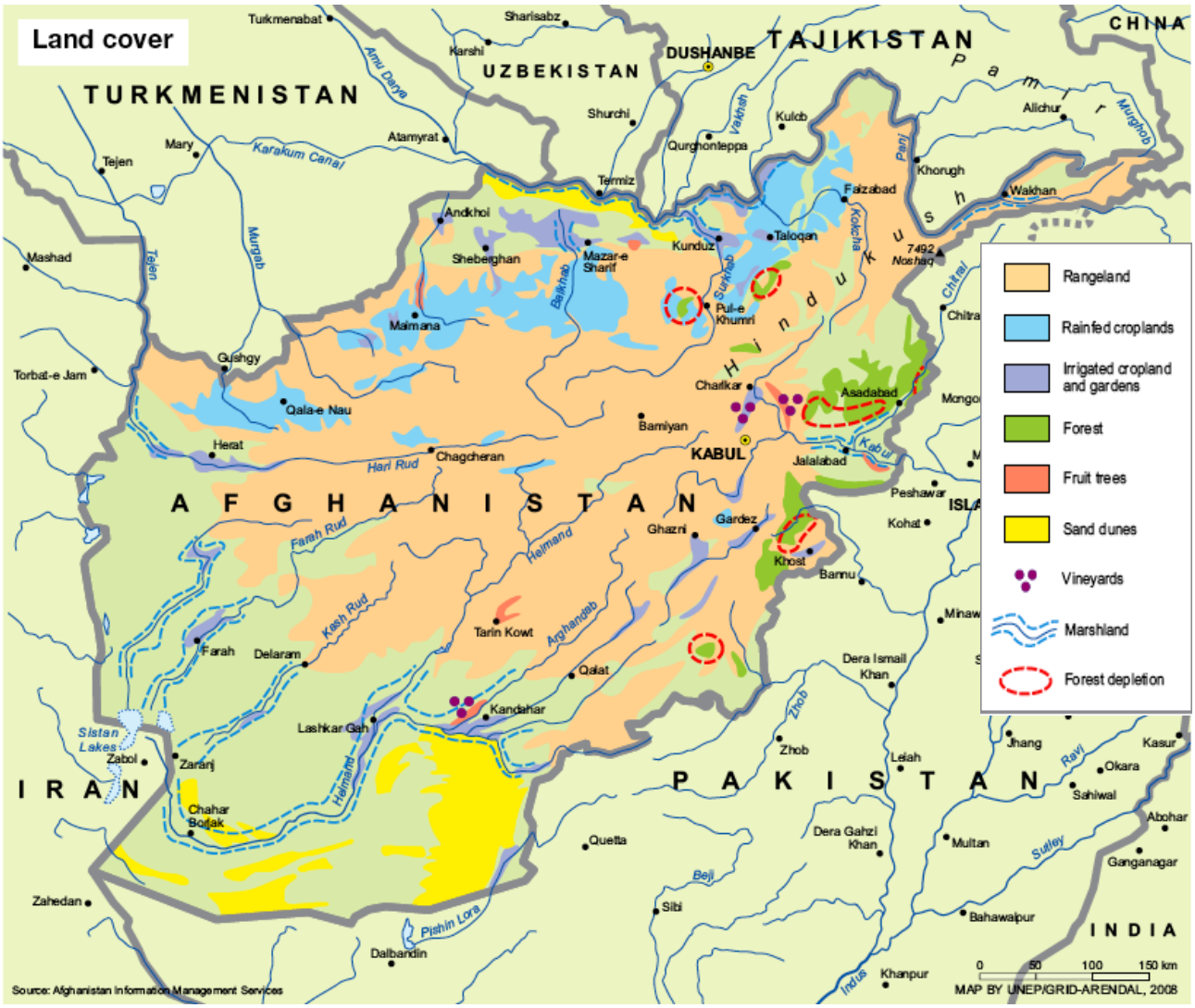

Figure 5.1: Afghanistan Land cover [UNEP, 2008].

Soil erosion is as mentioned already a problem in Afghanistan and is mostly caused by the overgrazing from livestock and since most agricultural crops are annually leaving the soil exposed during the winter, where the precipitation is heaviest, it leads to degradation by erosion and desertification in the south-south-western part of Afghanistan [ICARDA, 2002; Azizi, 2002]. The key soil characteristics that affect yield are; nutrient content, water holding capacity, organic matter content, soil reaction (acidity), top soil depth, salinity, and soil biomass. Change over time in these characteristics constitutes "degradation" or "improvement.". Degradation processes include erosion, compaction and hard setting, acidification, declining soil organic matter, soil fertility depletion, biological degradation, and soil pollution [Scherr, 1999]. According to the Global Assessment of Soil Degradation (GLASOD) about 16 % of Afghanistan's land area is severely affected by anthropogenic activities, which causes loss of soil nutrients (especially P) [ICARDA, 2002] and increasing salinity, which is a common problem in irrigated soils [Khan et al., 2005].

At the same time Afghanistan's vulnerability to desertification is one of the highest in the world (¾ of Afghanistan is vulnerable to desertification) [UNEP, 2008]. A further soil degradation in Afghanistan will put an increased pressure on the remaining 'good' agricultural areas. Stressing these areas will make them more vulnerable for degradation thereby a loop of possible continued degradation. Soil degradation is especially hard on a developing country such as Afghanistan which has a high dependency on the agricultural production system for both economical growth and food security [Scherr, 1999]. In order for Afghanistan to have viable agriculture it is necessary to protect the agricultural areas and insure that these do not degrade. It is important to secure that the other parts of the Afghanistan ecosystem are also protected at the same time, in order to avoid indirectly damaging the Afghan agriculture. As this project is concerning the sustainable agriculture and not general environmental sustainability, this project focus on natural resource management and not environmental protection and rehabilitation.

The Afghan agriculture during the drought 1999-2004

The vulnerability of current Afghan agriculture became evident during the long drought of 1999 – 2004 (excluding 2003) that pushed farmers back to illicit crops, according to a survey done by Bhattacharyya et al.[2004]. The survey focused on the Ghor, Hirat and Badghis provinces in the western part of Afghanistan, but did also survey most of the southern and western part of Afghanistan to determine the impact of the 2004 drought. Some parts of the survey area were not visited because of the instability in Afghanistan. The southern region is as previously mentioned also a region with low precipitation, shallow soils and lack of vegetative cover, constraining the agriculture without anthropogenic subsidise (fertiliser and irrigation).

The survey showed that the drought had an effect on a range of agricultural parameters (table 5.2). The lack of water cut back the crop diversity in some places from seven different crops to two, with a focus on growing food crops (cereal) instead of cash crops and fresh produce. Some of the region's fruit plantations and vineyards died out. Also the cultivated area was reduced to minimise water loss due to evaporation during irrigation. The drought caused a degradation of the range land for animal husbandry. The loss of range land for livestock reduced the rate of animal births, while the lack of water reduced the number of adult livestock.

Table 5.2: Decline in agriculture in 2004 (drought) compared to 2003 (normal year) [Bhattacharyya et al., 2004]

Province						
	Crop diversity (%)	Area cultivated (%)	Yield (%)	Area Irrigated (%)	Water Table (m)	Number of animals (%)
Badghis	30-60	15-70	20-78	50-75	3-4	20-60
Ghor	40-65	20-60	25-75	50-75	2-4	25-55
Hirat	25-70	21-67	17-88	51-86	2-4	20-50

This affected especially the tribal pastoral nomads. Livestock is used by Afghan crop farmers as a buffer to handle droughts, but the severity of the drought caused an increase in sale which lowered the price on livestock, entailing that the sale of livestock could not cover the lack of crops yield [Bhattacharyya et al., 2004].

The southern province of Nimroz lies downstream from Helmand river, Khashrod River and Farahrod River (figur 1.2). All three rivers are joining in the Kang district and are absorbed in one area, thereby creating a lake called Hamoon Saberi. This lake is part of the Sistan Basin, (figure 5.2) which will be used later as an example of the problems for agricultural areas located downstream. The forests surrounding the lake was before the drought used for grazing [RRES, 2006]. The drought has strongly affected the agriculture system in the province and the lack of sufficient surface water has resulted in desiccation of the orchards and reduction in crops by almost 80-90% and only 10% of the province's livestock survived the drought [RRES, 2006]. This was either directly caused by the drought or by movement of sand covering the vegetation [Bhattacharyya et al., 2004]. When there was water in 2005, people cultivated opium poppy and due to its high price it could help them recover from the periods of drought and no cultivation [RRERS, 2006].

The lack of cultivated areas and a reduction in the yield decreased the demand for day labour force and thereby created joblessness. This caused a migration of the younger generation to the nearby larger cities, Kabul, or to a neighbouring country. The lack of young day labourers

caused an increase in child labour and some families arranged early marriages in order to receive money. This illustrates the importance of a development that also focuses on the remote and downstream areas of Afghanistan, so these are not forced to return to opium production or putting an increased pressure on the good agricultural areas through migration.

A severe drought in Afghanistan is defined as low winter rainfall in two consecutive years. Rainfall records suggest that low winter rainfall in two successive years occurs at least once every 10 to 15 years. There is no available records of drought years during the Afghan-Soviet War or the early 1990s [Qureshi, 2002; Savage et al., 2009]. The long drought of five years from 1999 to 2004 (excluding 2003) was unusual [Bhattacharyya et al., 2004]. But one of the problems facing Afghanistan in the future is global warming and the impact it will have on the country's water resources. The following section will examine the potential future problems; the predicted climate changes in Afghanistan and population growth.

Climate change a future problem

This section will examine the climate predictions and will relate these results with the current Afghan agricultural situation in order to determine the severity of the next century's predicted changes in temperature and precipitation.

The climate in Afghanistan is, as previously mentioned, much affected by the differences in topography that divides Afghanistan into different climates. The complex topography in Afghanistan also means that local variations in response to global warming, particularly precipitation, are likely to be numerous and that many areas may vary from the regional trends. Lack of long term climatic record from Afghanistan makes it difficult to examine what climate changes there have been from 1978 to 2001, but available data and trends from neighbouring countries indicates that mean annual temperature has increased by 0,6°C since 1960, at an average rate of around 0,13°C per decade [Savage et al., 2009]. Increases have been most pronounced during the autumn, with increases at an average rate of 0,29°C per decade and a significant increase in the number of exceptionally hot days and nights. Mean precipitation over Afghanistan has decreased slightly (at an average rate of 0,5mm per month, or 2 % per decade) since 1960. This is mainly due to decreases of around 2,7mm per month (6,6 % per decade) in spring precipitation. The proportion of precipitation that occurs in heavy events has not changed with any consistent trend since 1960. The changes in climate from 1960 until now could explain some of the long drought periods that Afghanistan has experienced in the last decade, since the temperature increase happens during the autumn and the decrease in the spring, both important periods in the crop cycle from April to October.

The climate model, which shows changes in 2030, 2060, and 2090, used to determine the next decades of climate change is developed by University of Oxford/Tyndall Centre for the UK Department for International Development (DFID) and United Nations Development Programme (UNDP) and uses different Special Report on Emissions Scenarios (SRES). The climate model is built on the IPCC's A2 scenario which predicts a very heterogeneous world with a continuously increasing global population and regionally oriented economic growth that is more fragmented both socially and politically [Nakicenovic et al., 2000]. The developers of the model does not explain why they use A2, but it this projects assumption, that it is based on the most realistic scenario, which resembles the current development.

Projections show a small increase in the average rainfall by 2030, although by little more than 10-20mm. Mean annual rainfall changes in the 2090s show conditions are generally drier (by between 10-40 mm) over much of Afghanistan. Much of the drying is due to decreases in spring rainfall (March, April, and May)[Savage et al. 2009]. Winters are expected to be significantly drier in the south. It seems that the area that will experience the greatest changes in precipitation is the southern part of Afghanistan, with a 20% decrease in the west and the south west and an increase of up to 22% in the south eastern part of Kandahar. The temperature will increase ~1,5 ° C in 2030 with up to 5,4 ° C by 2090, the national differences in temperature increase is not great as in precipitation, this is caused by the previously mentioned complex topography of Afghanistan, which only affect the precipitation and not the temperature.

When comparing the projected changes in precipitation and temperature (figures 5.2. & 5.3), it becomes evident that there more than likely will be a reduction in the water resources through an increase in evapotranspiration and a decrease in annual precipitation.

Savage et al. [2009] from the Stockholm Environment Institute predict that the most likely impacts of climate change in Afghanistan are drought related, including associated dynamics of increased desertification and land degradation. Droughts are likely to be regarded as the norm by 2030, rather than as a temporary or cyclical event [Savage et al., 2009]

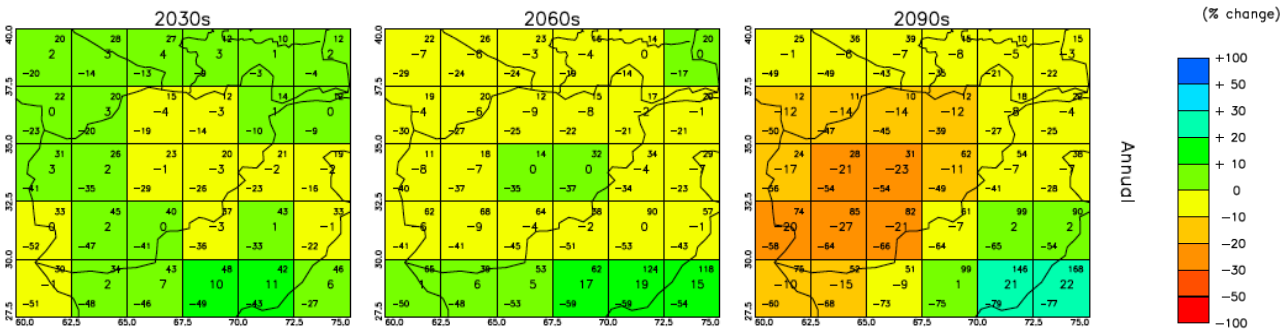

Figure: 5.2: Spatial projection for changes in precipitation (%) in Afghanistan over 10-year periods in the future under the SRES A2 scenario. All values are anomalies relative to the mean climate of 1970-1999 (2030, 2060, 2090) [UNDP, 2008]

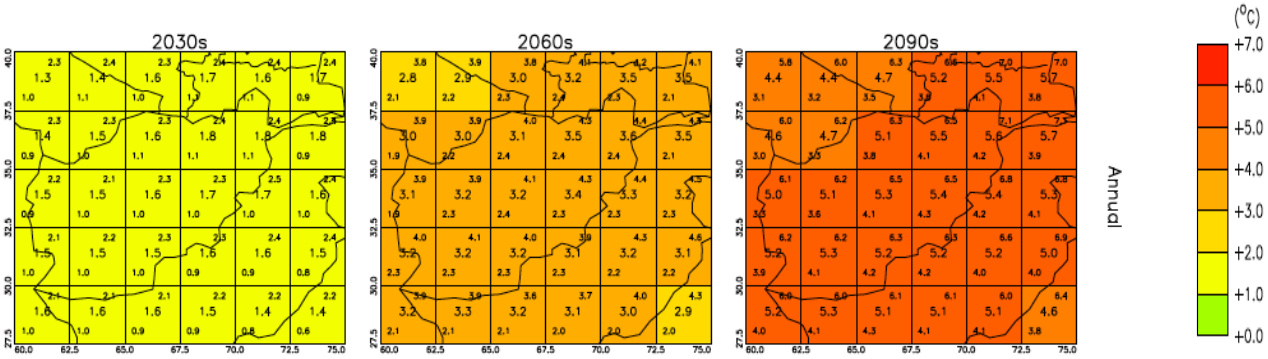

Figure: 5.3: Spatial projection for changes in temperature (%) in Afghanistan over 10-year periods in the future under the SRES A2 scenario. All values are anomalies relative to the mean climate of 1970-1999 (2030, 2060, 2090) [UNDP, 2008]

Floods due to untimely rainfall and a general increase in temperature may by amplified due to more rapid spring snow melt as a result of higher temperatures, combined with the downstream effects of land degradation, loss of vegetative cover through increased reduction in forests and land mismanagement. This could force farmers to plant more drought resilient plants such as opium again without any careful planning and improvement of the agricultural production system. Crop failure due to water shortages and the amount of potentially productive land left uncultivated will likely increase. This will most likely affect the rainfed agricultural areas more, because of their dependence on precipitation instead of surface or groundwater. This means that these areas will have to be irrigated for a continued production. Savage et al. [2009] predict that without significant investment in water management and irrigation the climate change will make large parts of the agricultural marginal in their production. The more rapid spring snow melt will also create a problem with water resource availability in the late summer and autumn, where the melting of snow and glaciers currently is supplying the rivers with water.

There is of mid-2009 no current policy to handle future climate change, which could be because the governmental resources are already currently stretched in dealing with the current problem of food deficiency, insecurity and development [Savage et al., 2009].

The future population and Afghanistan's carrying capacity

Over the next 40 years the Afghan population is believed to go from almost 30 million in 2010 to over 65 million in 2050 (see figure 5.4). The population growth in calculated using population growth rates with a low variants provided by the United Nations Statistical Division (UNSD).

The increase in population will increase the pressure on the Afghan food production to feed the population and thereby increase the stress on Afghan agriculture and the Afghan environment. In human ecology the term often used is carrying capacity, which is the number of people that an area can feed without degrading the ecosystem [Marten, 2003]. Larger populations have in some

cases lead to a reduction in the degradation of an ecosystem instead of the normal increase in degradation [Goudie, 2000]. This can be explains by that a population growth stimulates innovation and development in agriculture, thus causing an increase in food production. This event is often referred to as 'the Boserup effect' [Lutz, 1998]. After the Danish economist Ester Boserup, who through Africa-wide case studies found empirical evidence to back up her hypothesis. This is in opposition to Malthus' theory, which considers that there are a fix amount of land and that therefore is a definite environmental limited and that therefore the population growth is dependent on the agricultural production [Mather & Chapman, 1995]

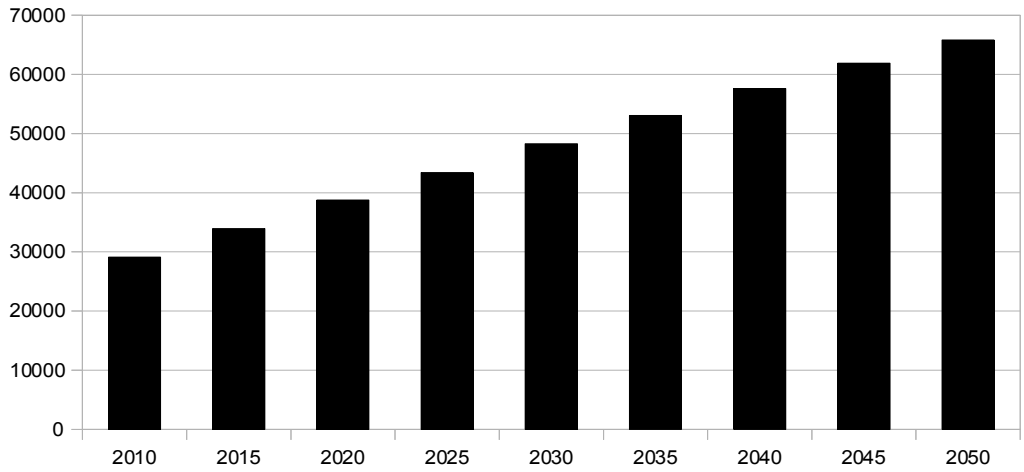

Figure 5.4: Afghanistan's predicted population in thousands from 2010 to 2050 [UNSD, 2009]

While both theories have valid points. As explained in chapter 2 some events, such as the ones described to Boserup's hypothesis can happen, but there are also several other cases, where population growth has led to resource scarcity and famine. It dependence on the structures and resources available such as a government to ensure proper resource management, also if a country is experience constant conflict, the likelihood of that country to experience a positive development in small. Neither does Boserup's hypothesis does not take into account the time span of the population growth. A rapid increase in population would put great stress on the current production system before it can catch up and produce enough. Also as the structure involved in increasing the carrying capacity improves, other structures could affect the carrying capacity negatively. For example the climate change will affect the Afghan agriculture negatively while technological input could have a positive effect on the agricultural production. In regards to the problem of opium production, an increase in population without a planned supported agricultural development could also force Afghan farmers to cultivate opium poppies in order to have a large enough output. In general is Boserup's hypothesis valid if certain conditions are present to trigger the event. A third hypothesis put forth by D. Richardo states that as the population and the

economic grows it become more likely that land of a poorer quality would be used [Mather & Chapman, 1995]. It would seem likely that this could happen in Afghanistan. As mentioned is large landowner already starting to irrigate more and more areas. If this is no regulated properly it could mean a scarcity of resources for other farmers. This could potentially become significant problem for the sustainability of the Afghan agriculture as this expansion of agricultural areas will increase the need for water resources. If the water resource is properly regulated thereby distributing the water resource to farmers after their specific need at the moment. This could ensure that the farmers does not being cultivating land without first acquiring permission from the regulating institution. Boserup's case studies shows that a population growth is not necessary a variable that affects the environment negatively, but through technological improvement is it possible to increase the country's carrying capacity without an environmental degradation.

This project will focus on how to sustainably improve the Afghan agriculture through improvement in its agricultural production through technological changes and innovative thinking. The next section will examine what are the weaknesses in the agricultural production. This will help determine which areas needs strengthening the most.

5.3 Agricultural production

The general conclusion among researchers are that the greatest weakness in the Afghan agricultural production system, and the cause for the decline in agricultural production during the drought years, are lack of water during the crop cycle and a general poor water management [FAO, 2002; ICARDA, 2002; Azizi, 2002; Bhattacharyya, et al., 2004; Roe, 2009; Savage et al., 2009]. Therefore, the focus of this project will be on how to improve the efficiency in the use of the water resources and increase the crop productivity at the same time. Before analysing the current efficiency of the Afghan agriculture's water usage and how to improve water management, the other factors that determine the output from a agricultural production system will be examined.

The lack of suitable agricultural areas without severe constraints in Afghanistan makes a stable production and the protection of the available areas even more important. There are a number of factors that contribute to determining the output of a production system and these are; stability, resources, capacity, and efficiency [Zepeda, 2001].

Stability

In agriculture, the stability is often affected by the fluctuation in weather patterns which affects the amount of available water and the temperature causing it to differ to that of the mean. Another resource which can fluctuate is the nutrients available for the crops. As the farmer harvests the

crops the nutrient in the crops are remove from the nutrition cycle [Schlesinger, 1997]. If a farmer continues this removal of nutrients, without fertilisers, the production the following year will be smaller. Other factors that affect the stability is the availability of quality seed and the presence of pests and diseases [Zepeda, 2001]. The cereal production in Afghanistan, which is the primary crop production [Ward et al., 2008], has since the forming of the new government in 2002 not been stable (table 5.3). One of the reasons has been droughts occuring in 2002, 2004, 2006 and 2008 [Bhattacharyya et al., 2004; UNEP, 2008]. The validity of the link between the droughts and the reduction in cereal production is supported by the fact that during the same period the opium production, which is as previously mentioned a crop that can withstand drought conditions, increased during the same period, as established in chapter 1. This is also caused by the introduction of high quality poppy seeds and the development of better harvesting methods thus creating a greater efficiency and capacity to the opium fields [Shaw, 2004; Ward et al., 2008]. Efficiency is defined as how effectively the production systems use the available resources.

Table 5.3: Crop production in million tons [ICARDA, 2002, FAAHM, 2009]

Crop	1978	2002	2003	2004	2005	2006	2007	2008	2009*
Wheat	2.650	2.686	4.362	2.293	4.266	3.363	4.343	2.623	5.115
Milled rice	760	260	291	310	325	361	425	410	432
Maize	400	298	310	234	315	359	360	280	300
Barley	300	345	410	220	337	364	370	333	486
Total cereals	4.150	3.589	5.373	3.057	5.243	4.447	5.498	3.646	6.333

*Estimated on previous years' production and the weather during Spring of 2009 [FAAHM, 2009].

Capacity

The maximum a production system can viably produce is defined as its capacity. Often the farmer can put more resources into the system (work, water, nutrients both natural and artificial, quality seed etc.), thereby increasing the output, until the system reaches it optimum capacity. After the optimum capacity is reach the difference between the input and output of system will decrease [Zepeda, 2001]. There is a maximum limit to how much the system can possibly produce no matter how much work is put into it [Zepeda, 2001]. Adjusting the system to yielding a maximised production requires time, knowledge and resources, which again emphasises the importance of having a agricultural institution that supports the agriculture and researches how to use the resources efficiently and maximise a fields output [Zepeda, 2001].

Comparison of input/output on different forms of productivity such as areal productivity (Tons/Ha), work productivity (Tons/man-hour) or capital productivity (Value/Ha or Value/man-hour), can be an advantage when dealing with different problems. In an area with a food production deficiency, such as Afghanistan, the nutritional value could be measured in order to

feed the population. In an industrial agricultural society, production is usually measured in capital productivity [Zepeda, 2001]. When comparing opium to alternative crops, a capital productivity could also be advantageous since one of the intentions found for growing opium is the high value of the product. Alternative crops will be discussed later in this chapter.

Resources

The availability of resources is an important factor in any production. Without the necessary resources, cultivation and growth of the crops will either not occur or give an insufficient yield. The resources in agricultural production includes available areas, work, growth days, water, quality seeds and nutrients [Zepeda, 2001]. As mentioned previously, some constraints exists in the Afghan agricultural system such as; the lack of agricultural area available per capita, the precipitation which falls mainly in November to March when the need for water is during April to October, the lack of natural nutrients in the soils found in the southern provinces and the topography which creates increased work load in order to cultivate the sloping areas.

Fertilisers are commonly used in Afghan irrigated agriculture to ensure a constant availability of nutrients for the crops. Most commonly used fertilisers in irrigated areas are urea, animal manure and DAP[2] fertilisers, fertilisers is not commonly used in rain-fed agriculture [ICARDA, 2002]. Lack of water (no economic benefit), cost of fertiliser or lack of credit were the main reasons for the farmers not to use fertiliser [ICARDA, 2002]. Fieldwork made by the International Centre for Agricultural Research in the Dry Areas (ICARDA) [2002] has shown that fertiliser usage does not always give an increase in yield. The fieldwork found that the reasons for the absence of benefits from the use of fertiliser was a lack of phosphor in DAP fertiliser, failure to supply or contain an adequate amount of a nutrient. Another likely problem with flood irrigation is leaching of nitrates. especially in light to medium textured soils, such as seen in the southern part of Afghanistan[ICARDA, 2002]. The fieldwork also found several other production problems not related to nutrients (e.g. weed, pest and disease pressure) [ICARDA, 2002]. In general there seems to lack knowledge of the correct procedures for applying fertiliser and how to handle pest and diseases.

The long conflict's impact on seed quality has been lessened by a transnational programme led by FAO since 1988, whose purpose was to ensure the quality of seed and the distribution [FAO, 2002]. In 2002 a code of conduct governing the Afghan seed production, distribution and importation in emergency situations was reached between various international actors and the Afghan government [FAO, 2002]. Whether or not all Afghan farmers benefit of the code of conduct are unknown. The high level of corruption established in chapter 3 could prevent the

2 Diammonium hydrogen phosphate; a water-soluble ammonium phosphate salt

emergency distribution of seed to poor farmers that cannot afford to bribe government officials. This emphasises the importance of not just focusing on the viable agricultural development or the security problem caused by Taliban, but also the other factors contributing to the opium problem, such as corruption. Seed quality is an important factor in improving an agricultural production system, since a better quality of seed can improve the capacity of the Agricultural area.

Because of the improvements since 2001 the wheat yield has risen from 1,0 T/Ha in 2001 to 2,0 T/Ha [Ward et al., 2008; FAAHM, 2009]. the 2009 average for yield for rain-fed wheat is 1,18 T/Ha while the yield for irrigated wheat was 3,03 T/Ha [FAAHM, 2009]. the great difference between rain-fed and irrigated yield emphasises the importance of irrigation in the Afghan agricultural system and how an effective use of resources can increase the capacity of an area. The newest initiative is that FAO is launching in 2009 several programmes to distribute high yield wheat variants to the poorest farmers and supplying them with a better quality of fertiliser. The high yield wheat variant is said to boost the current wheat production with 30% [FAO, 2009b]. This improvement of the carrying capacity disproves the Malthusian hypothesis that the resource is definite, and food production progresses linear, while the population grows exponentially. These different technological progress validates Boserup's hypothesis, that the necessity for more food will trigger the development of technologies that improves the carrying capacity. However these technologies are international external investments and not internal mechanisms. While the focus in this section has been on the important cereal production. The next section will examine some of the the crops that could be an alternative to opium.

Alternative crops

Farmers that produce enough food crop to sustain their own family and with the possibility of producing additional crops. Would most likely choose to produce another crop with a higher revenue instead of produce food crop. This intention, though rational for the individual farmer, could be problem for Afghanistan because of the food deficit. Farmers could be encouraged to grow enough cereal to cover the food deficit instead of growing a cash crop. Because of the general low prices for food crops, it could be necessary to subsidise, for example cereals, in order for building an incentive among farmers to cultivate food crops. Subsidies could also be used to ensure that the Afghan farmers do not continue to grow opium since the capital output of opium is high and this as mentioned previously is this one of the main motives behind the current opium production. So any alternative to opium should provide the same capital output or as an alternative the promoted crops could be subsidies. As the security situation improves and the risk of cultivating opium increase, the need for subsidising would decrease. Still subsidising could be a method of supporting the poorest farmers.

Ward et al. [2008] warns of the indiscriminate use of subsidies, when dealing with crops like wheat, that has a relatively low value, low labour intensity and a high usage of resources (water and area). If the price between the high value crop and the cereal differs too much, the cost/benefit will often also vary too much compared to importing cereal to cover the food deficiency [Shaw, 2006]. Subsidies should therefore only be used to given as an incentive for more expensive crops. As of 2008 subsidies is not used in Afghanistan [Ward et al., 2008].

There are some different opinions on how the Afghan farmers work on their fields, ICARDA [2002]. A survey reveals that tractors, both owned and rented, are widely used, especially in the Helmand province. The survey revealed that 17 out of 26 farms in the Helmand province owned a tractor [ICARDA, 2002]. Other surveys claims that the work preform in the Afghan agriculture is mostly be animal or manual labour [Bhattacharyya et al., 2004; Quershi, 2002; Azizi, 2002]. It is the assumption in this project that while the presence of agricultural machines is increasing, the current work that is performed in the Afghan agriculture is carried out by manual labour and animals. During the harvest season of opium it is estimated that this requires 5,6 labours pr. hectare, where at least one-third of these should be hired [Ward et al., 2008].

As Boserup [1965] writes one of the technological improvements, which happens to increase the carrying capacity is the increase of mechanical labour. Any investment in the Afghan agricultural system, that an increased mechanization would reduce the requirement for manual labour. While this will improve the work productivity, it could creating a socio-economic problem, especially for the small farmers and landless rural population. These are as mentioned often dependent on the additional income created by working during the harvest on other farmers. Therefore as the Afghan agriculture develops, then the focus should be on labour intensive crops during harvest season or jobs should be created in other sectors, such as in processing industry. This would require a further investment before this is possible [Ward et al., 2008].

Nuts and fruits are thought to be a good alternative to opium because of the high value (not necessary to subsidise) and labour absorption during harvesting [Lister and Brown, 2004]. The processing and packing of nuts and fruits creates a good profitability through the supply chain and not just during in the primary sector [Ward et al., 2008]. As mentioned in chapter 3 Afghanistan was before the conflict a major producer and exporter of raisins. In 1978 Afghanistan had 31 raisin processing plants, but of 2008 only one is operational [Ward et al., 2008]. A reopening of raisin processing plants and a marketing strategy would create both a market for the products of the Afghan farmers as well as a job opportunity for the Afghan population [Ward et al., 2008]. To rebuilt the Afghan raisin production at the 1978 level it will be necessary to re-grow or establish orchards for grape production, which is a long term investment

and not just a annual production. This would require support from outside sources or an incentive must be given to the more wealthy Afghan in order for them to invest in this. The Afghan agriculture's methods are outdated and their yield is low [Lister and Brown, 2004]. Therefore it is necessary to improve the raisin production system if grapes and raisin should be an alternative to opium. Grapes are grown in most parts of Afghanistan and Afghan farmers prefer to sell the fresh grapes because of the higher value of the grapes as fresh, than as raisins [Lister & Brown, 2004]. The poor commodity chain for fresh produce and lacking of refrigerated storage space [Ward et al., 2008] puts a restraint on the spatial distribution of grape as fresh produce, therefore increase in the raisin processing and distribution could give an extra incentive for Afghan farmers to cultivate grapes and if the commodity chain and storage possibility for fresh produce improves also sell the grapes fresh. Industrial crops such as cotton and high value crops such as saffron has a great potential [Ward et al., 2008], but there are same constraints as in the case of raisins, this being poor processing availability and low yield. The last 30 years of opium production has given Afghan agriculture a good production system for this crop and it has been suggested by The International Council on Security and Development (ICOS) that to cover the lack of sufficient morphine in developing countries, the Afghan expertise in opium production should not be discouraged but rather it should be used for growing legal opium for morphine. ICOS also suggests establishing processing plants for refining opium into morphine [ICOS, 2007]. This idea will now be analysed before further addressing the problems concerning the commodity chain.

Legalising opium production

The idea of legalising the opium production for medical purposes is gaining support from the European Union and the Canadian government [ICOS, 2007].

The basis for this idea of legalising the Afghan opium production is the global shortage of painkillers, such as morphine, in the developing countries. ICOS (formerly known as the Senlis Council) asserted that "current policy choose(s) to destroy a valuable natural resource, rather than turning it into a powerful driver for economic development" [ICOS, 2007]. ICOS called for the licensing of opium in Afghanistan for the production of medicine as an economically viable and controllable response to the extraordinary nature and scope of the illegal opium economy [ICOS, 2007]. ICOS research found the idea feasible and has put forth a plan for licensing the production, including how to build laboratories for morphine production, these laboratories would be available to add value from other agricultural products cultivated in the region the rest of the year outside the period of opium refinement [ICOS, 2007]. Initial research suggests that it may be possible to extend the project model to produce other plant-based medicines suited to the Afghan context, such as the malaria medicine, artemisinin.

Artemisia annua L., the plant from which artemisinin is extracted, grows naturally in sunny, semi-arid nutrient-poor regions, such as Afghanistan. The plant requires almost the same conditions as opium poppies, such as fertilisation and light irrigation [ICOS, 2007]. This concept of legalising opium for morphine production has been proven to work, as it was implemented with success in Turkey in1974 [ICOS, 2007]. However, it is not an initiative that this project will currently recommend for Afghanistan. The current level of corruption and lack of regulative institutions required to monitor the licensing, cultivation and processing of the opium would create problems and would more than likely indirectly become a part of the illicit opium network. As the key to stopping the illicit opium production is turning the low-risk environment into a high risk, the legalisation of some parts of the opium production will render it very difficult for counter-narcotics to work [McAllister, 2000, Grare, 2008]. Frédéric Grare [2008] also points out that the demand on painkillers found in developing countries is not based on a shortage of legal opium, where a surplus already exists. The problem lies rather in a lack of the right structures in the developing countries, such as; institutional arrangements and morphine requires legal national frameworks authorising the consumption of drugs under medical supervision, national health care delivery systems, financial capabilities and personnel training [Grare, 2008]. Therefore, a legalisation of the opium production in Afghanistan would not help on the morphine shortage, but rather create a greater surplus. The current legal production of opium has also a much lower profit than the illicit. In India in 2004-2005 the price on raw opium was US$ 26/kg [Grare, 2008], which is a very low price compared to the prices previously mentioned of US$ 86/kg in 2008 on illicit raw opium. Another problem with legalisation of opium production could be religion, since one of the main reasons for not cultivating opium is that it is against Islam, as stated in chapter 3. Hence, the promotion of a legal opium production by an Afghan government and international actors could create friction between them and the Afghan population.

Thus, taking into account the current political situation in Afghanistan, the lack of a market, the low prices on legal opium, and it being illegal according to a religious view shared by most Afghans, this initiative of legalising the opium production is not recommendable. While the legalisation of opium is not current a viable option, the feasibility study has some valid points, such as the suggestion of cultivating artemisia for producing malaria medicine. This could be a possible alternative crop for the Afghan farmers, but the distribution of this product could have the same problems as in the case with morphine for developing countries.

Commodity chain

During research by Lister and Brown [2004], of a raisin production pilot project by Central Asia Development Group (CADG) in Kandahar, several constraints in the production and commodity

chain was found. Transit and shipment procedures are one of the major constraints. During transport the shipment travelling through Pakistan was offloaded three times and spend several weeks in the baking heat between the transport links [Lister & Brown, 2004]. The transport time, procedure and lack of proper storage will reduce the value of the products [Ward et al., 2008]. Therefore improving the commodity chain by improving the transport sector would create a greater value for both the primary production and the secondary processing. One of the greatest constraints in improving the commodity chain is that Afghan trucks are not allowed to enter either Iran or Pakistan[Ward et al., 2008], which creates a need for either reloading at the border or the use of trucks from Iran or Pakistan.

Another problem in transport could be linked to the level of corruption found in the Afghan government. The tradition of bribes needed to get the proper documents also reduces the value of the commodity and reduce the incentive for investing in the Afghan agriculture or the processing sector. The cereal production, even though the value is low and it is not labour absorbing, plays an important part in the Afghan agriculture, particularly for the poor Afghan as it ensures secure food production [Ward et al., 2008].

Border management is as mentioned in section also an important part of counter-narcotics. Experiences from counter narcotics operations in Columbia has shown that targeting drug routes is one of the most effective means [Mejía & Restrepo, 2004]. Therefore border management to close of the trafficking of opium to the neighbouring countries is an priority in the counter-narcotic initiatives. Closing the border for opium trafficking will most likely have an negative effect for the Afghan agricultures access to exporting, as an increased border security tends to slow the flow of product.

As mentioned is the commodity chain of Afghan produces hindered by neighbouring countries not allowing Afghan trucks across the border. Forcing the produce to be at one point transported via a foreign shipping company creating an additional cost for either the Afghan farmer, as a cut in profit or a high retail price making the product less attractive for the buyer. This is a constraint on the economic development of Afghanistan; if its export is dependent on foreign shipping companies it will reduce the economic benefits. Therefore border management initiative should not just be about stopping the illegal trafficking. It should also be about creating a better access to the regional and global markets.

The research necessary for solving the problems concerning the transport across the borders while increasing the security is not possible. Partly because of the lack of resource and security issues, and partly because of short time period for this project. It would require intensive research into the trade agreements and border management between Afghanistan and its neighbouring countries to determine a solution to this problem. Therefore will the focus of this

project continue to be on improving the production system and resource management in Afghanistan

Contract farming, which has been used in South Asia as a development technique, could be used in Afghanistan [Ward et al., 2008]. The mechanisms in Contract farming works as the Salaam credit system and would therefore be relatively easy to implement in the Afghan agricultural structure. The farmer receives a package of input and crop advice and is assured that his crop will be bought at an agreed price. The contractor also provides the farmer with the necessary seeds. There are however problems in this; the unstable production in the Afghan agricultural production, the lack of processing and lack of a institution to facilitate the arrangement between the farmer and the buyer [Ward et al., 2008]. It is not possible with in the limits of this project to research this solution further, but an improvement in the Afghan agricultural production and thereby the quality and quantity of the agricultural product could make this approach even more viable for both the farmer and buyer.

Summary

Studies has shown the general lack of modern production methods is creating a low yield at the farm. This is generally cause by a lack of knowledge in the proper use of the available resources, lack of quality seeds and poor disease and pest control. The greatest constraint in the agricultural production system is the lack of the lack of water and poor water management. FAO is currently establishing several programmes to improve the seed and fertiliser quality to cereal production, which are improving yield for the primary cereal wheat from 1,0 T/Ha in 2001 to 2,0 T/Ha in 2009. In general the Afghan agriculture has several potential good economical alternatives to opium, such as returning to raisin and cotton production, with both a high value for the Afghan farmers and labour absorption during processing and transportation.. There is a lot of constraints in access to regional and global markets, this is caused by the hindrance of Afghan trucks at the borders. The additional transport time reduces the value of the produce. Raisin, cotton and saffron production is not a option for all of Afghanistan because of the different agricultural conditions created by the variations in climate, soils, topography and access to water, and therefore other crops must to be cultivated in those areas. This chapter also analysed the possibility of a legal opium production, but found that this would not be feasible, because of a lack of market and the current political situation in Afghanistan.

The next part chapter will examine the current Afghan water use and how to improve the Afghan agricultural productions stability through a more effective use of the water resource and the implementation of a sustainable irrigation system.

6. Efficiency and sustainability of water use in Afghan agriculture

A non-efficient use of available resources could have in great impact on both the Afghan agriculture and the environment. As it will would require a greater water supply, than the production system actually needs. Overuse of water could create a lack of water in other parts of Afghanistan, thereby stressing these ecosystems. Furthermore, the washout of nutrients such as nitrogen could, as previously mentioned, cause a degradation of groundwater quality and eutrophication in surface water [Goudie, 2000]. Therefore is an effective use of the water resource very important to obtain a sustainable agriculture.

The impact of previous years' droughts on the Afghan agricultural productions cereal yield was significant and hence a more effective use and storage of water is necessary to stabilise the future production and perhaps improve the yield through a better use of fertiliser and water availability [Raes et al., 2008].

As previously established, much of the Afghan agriculture is dependent on irrigation. Because the fall of precipitation does not coincide with the agricultural need for water the Afghan agriculture has been dependent on snow and glaciers functioning as a natural storage of water and thus supporting a perennial flow in all major rivers, thus making irrigation possible. But as mentioned earlier, the increasing temperatures will reduce the natural storage of water in the mountains by earlier snow melt and an increase in evaporation. This could create a water shortage late in the crop cycle. This project will later propose a solution to this problem.

Water resource

Estimates indicate that Afghanistan has between 75 to 77 billion m3 (BCM) of potential renewable water resources, of which 55 to 57 BCM is surface water, with an additional ~ 29 BCM shared by neighbouring countries of Tajikistan, Iran, Pakistan and Turkmenistan. The groundwater resource is estimated at 18 to 20 BCM (table 6.1.) [Qureshi, 2002; ICARDA, 2002]. These estimates are all based on studies done before 1978 and there has not been any more recent studies. A hydrological survey of the current Afghan renewable water resource should be implemented as soon as the security conditions allow it.

The latest measured annual volume of water used for irrigation is estimated to be 20 BCM, which is 99 % of the entire water use [Quershi, 2002]. Approximately 15 % of the total water volume used annually originates from alluvial groundwater aquifers called 'karez', springs and shallow wells, and almost 85 % from surface water resources [ICARDA, 2002]. Most of the Afghan groundwater resources are situated near the rivers in the river valleys where the

infiltration is high [Azizi, 2002]. Total groundwater extraction ranges from to 3 to 5 BCM. The current number of functional groundwater based irrigation system is unclear. But according to Quershi [2002] at that time 60-70% of the karezes are not in use and 85% shallow wells are dried out. The study also estimates the future use of groundwater for irrigation purposes and drinking water to at 8 BCM [Quershi, 2002].

The current annual water resource per capita water is estimated at ~ 2.500 m^3, which compares favourably with other countries of the region, for example with Iran (1.400 m^3 per capita per year) and Pakistan (1.200 m^3 per capita per year). Even during a drought period with a 50% reduction in precipitation, the water resources should be sufficient to maintain a production without the fluctuation seen in the period from 2002-2009.

Table 6.1 Afghanistan's water resources and usage in 2002 in billion m3 [ICARDA, 2002; Quershi, 2002].

Water Resources	Potential	Present use	Balance	Future use*	Balance
Surface Water	55-57	17-20	35-40	30	25-27
Groundwater	18-20	3-5	15	5	13-15
Total	75-77	20	50-55	35	37-40

*estimates made by Azizi and Quershi, both in 2002

Currently, the Afghan agricultural water use is lacking with only 25-30 % efficiency [Savage et al., 2009] and the irrigation system and the irrigation methods could be one of the causes for this inefficiency. The estimated Afghan population growth could create another problem with a reduction in water available per capita (figure 6.1). This could be further amplified by the increase in temperature and reduction in temperatures caused by climate change.

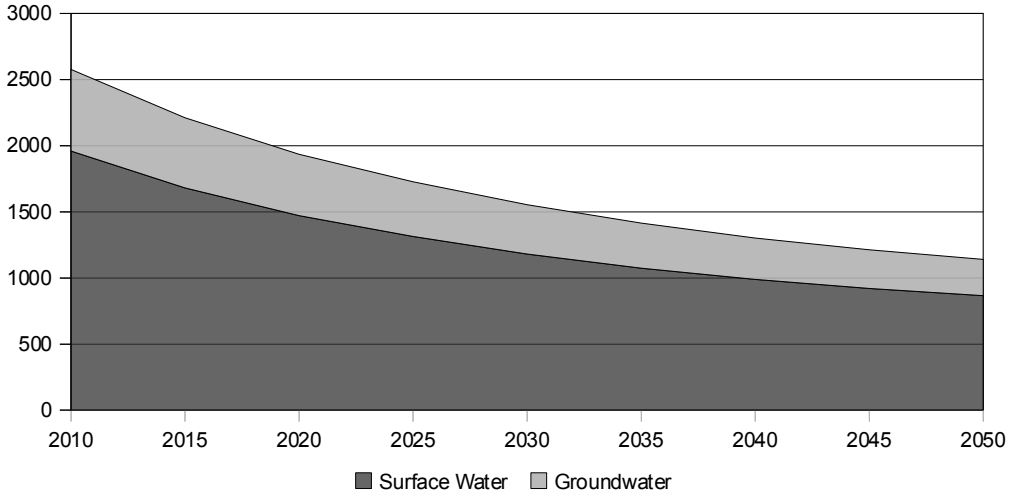

Figure 6.1: Afghanistan's water resources from 2005-2050. This figure does not take into account a the effect of climate change on the water resource.

This will amply the stress on the water resource both for common purposes (drinking, cleaning etc.) and by the agriculture to increase its carrying capacity. If there is not an increase in the efficiency of the irrigation systems the future demand for water could lead to water scarcity in parts of Afghanistan, especially those downstream. The problems concerning downstream will be described in section 6.1.

Khan et al. [2005] have examined different modern irrigated agricultures in other semi-arid areas, and conclude that the challenges for sustainability is the same as it was for the irrigation systems used in Mesopotamia. These challenges are; creating a more effective use of resources, minimising environmental impact on both the production system and the surrounding ecosystems, selecting the right crops in order to ensure that the water resources are not overused thereby causing a failure of both production system and ecosystem, and finally the presence of a robust regulative institution, that ensure the constant maintenance and fair distribution of the water resource [Khan et al., 2005]. One of the basic problems in dealing with a primary production, such as agriculture, is the "tragedy of the common" which is a term introduced by Garret Hardin [1968]. Hardin argues that with a common resource such as a meadow, any rational farmer would try to maximise his production by adding one more piece of livestock to his flock. the farmer would receive the direct benefit from the additional livestock, while the negative impact, such as the extra loss of vegetation, is shared by the entire community. The combined negative impact from all farmers adding livestock would lead to a stress point for the common resource and a degradation of the common would result in loss of livelihood for the entire community [Hardin, 1968]. If the agricultural development in Afghanistan is not monitored, regulated and planned properly this could also happen here. Thus, it is important when examining the institutions surrounding the Afghan agriculture to ensure that "a tragedy of the common" does not happen here.

In order to analyse the efficiency of the Afghan irrigation system and the institution's robustness, the various parts of the system must first be described in order to locate its strengths and weaknesses.

6.1 The Afghan Irrigation system

The annual amount of water used for irrigation accounts for about 99% of the entire water usage. The Afghan irrigation system can be divided into traditional and modern systems. Traditional systems constitute nearly 90 % of all irrigation systems in Afghanistan, covering about 2,3 million Ha and are therefore the most important part of the irrigation system [Bhattacharyya et al., 2004].

Traditional irrigation systems

The traditional irrigation systems are developed and built by farmers that operated and maintained by them according to traditional communal customs and practices [Bhattacharyya et al., 2004]. The traditional irrigation systems can be grouped into two categories: surface systems and groundwater systems.

The surface systems range from a few hectares to thousands and have been built and improved over centuries. Small-scale traditional river systems are often located in remote valleys along a stream or river and vary in size (up to 100 Ha) [Bhattacharyya et al., 2004]. Large-scale traditional diversion structures can cover an area of up to 200.000 Ha. Although they are called traditional or informal, their operation and maintenance are highly structured, involving different communities of different ethnic origin [Bhattacharyya et al., 2004].

In river diversion system the water is often diverted into an primary canal and thereafter shared between the secondary canals [Roe, 2009]. River diversion systems can be problematic during drought periods, especially for the downstream irrigation systems, because of the upstream usage, as well as evaporation and infiltration during flow [Bhattacharyya et al., 2004].

An example of the environmental impact of downstream ecosystems occurred during the drought in 2001, where the Hamoun wetlands which lies in a large depression called Sistan basin encompassing large parts of south-western Afghanistan (see appendix III) and south-eastern Iran [Partow, 2003]. This wetland normally gets its water from the Helmand river. But the drought caused the Helmand rivers' water flow fell by 98 %, from its annual average (figure 6.2). Remote sensing showed that by 2003, 99% of the Hamoun wetlands were dried up [Partow, 2003].

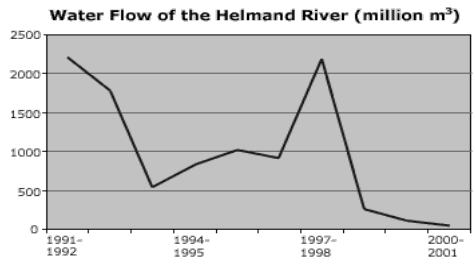

Figure 6.2: Water flow of the lower part of the Helmand rivers [Partrow, 2003]

As a result, much of the Sistan basin's natural vegetation died, an increase in soil erosion occurred, and sand spread onto roads, fields and settlements. The Hamoun wetlands were otherwise known for their resiliency, having bounced back from previous drought, but the continued increase in upstream irrigation and the severity of the 2001 drought had a major impact on the Hamoun wetlands' ecosystem [Partow, 2003]. This same problem has emerged for the downstream irrigation systems [Bhattacharyya et al., 2004] and since an agricultural system is

dependent on certain stability in its production it hasn't got the resiliency of a natural ecosystem [Marten, 2003].

As mentioned previously are there three different methods for the ground water to be extracted. The karez system is an ancient regional method of exploiting groundwater using gravity. Karez systems are very delicate irrigation systems made up of vertical wells, underground canals, above-ground canals and small reservoirs [ICARDA, 2002]. The vertical wells are for ventilation, digging and maintenance of the karez. The bottoms of all the vertical wells are connected so that water can pass through. The underground canal is about 2 m high and covered with dirt in order to resist the heat. The surface canals, connected to the underground ones, are not more than 1 m wide with trees planted on both sides to prevent evaporation. There are 6.741 karezes in Afghanistan. These karezes irrigate about 163.000 Ha of land. Karez irrigation is common in the south and southwest of the country and less common in the north of the country. One of the disadvantages of the karezes is that there are no mechanism to stop water from flowing during winter or when there is no need for irrigation. In each karez about 25% of the total annual volume of water is wasted [Qureshi, 2002; ICARDA, 2002].This is a problem in the karezes because of the natural difference between when the water is available and when the water is needed. If possible these systems should be expanded with a reservoir, so that the farmers could have water available when needed.

When a groundwater table reaches above the ground surface, either because of depression in topography or the build-up of arterial pressure, it starts flowing on the surface and form springs. There are about 5.558 springs in the country, which irrigate about 188.000 Ha of land [ICARDA, 2002]. Spring irrigation is common in the east and in the south and is directly dependent upon the groundwater level [ICARDA, 2002]. When the groundwater level goes down during drought years, it results in a reduction of outflow from springs. That is why some of the worst drought-stricken areas of the country are located in regions where they depend heavily on spring water for irrigation [ICARDA, 2002].

The final method is ground water is lifted from shallow wells with the help of Persian wheels (arhad) supplying irrigation water to the fields of an individual farmer. The size of the land irrigated by shallow wells does not exceed 3 Ha. The total number of shallow wells in Afghanistan is 8.595 which irrigate around 12.060 Ha of land [ICARDA, 2002]. these shallow wells are also dependent on a high groundwater table or that the farmers have enough resources to dig deeper.

Formal irrigation systems

Formal, large-scale and state-owned irrigation systems were engineered in the 1950s and 1970s, mostly with the assistance of the USSR and the United States. By the late 1970s five large-scale modern irrigation systems with storage capacity had been built and were in operation [Azizi, 2002]. These systems require a trained maintenance staff and often, if the system is broken, mechanical parts need to be ordered from outside the local community [Azizi, 2002]. The systems are controlled by the government [Quershi, 2002], and for these systems to work efficiently there needs to be an interaction between the local community (user) and the government authorities (manager) to ensure that the community gets the water needed, when needed. The indirect impact of the 30 years of conflict on modern irrigation systems is much more serious than on the traditional schemes [Azizi, 2002]. Without a governmental institution, the systems where not maintained. The intake structures of modern irrigation schemes are not functioning due to the missing mechanical parts looted during the war and lack of professional staff to repair and operate the systems.

Other formal systems are ground water systems, but very little is known about the irrigation schemes supplied by ground water from deep and shallow wells[AQUASTAT, 2009]. In the 1970s about 100.000 Ha are said to have been under sprinkler irrigation (private and government owned) and plans existed to introduce drip irrigation [Quershi, 2002]. While the Afghan farmers have the knowledge and resource to maintain the traditional irrigation systems, these formal systems requires a presences of expert labours. Because of the current low level of development in Afghanistan, could make the continued maintenance of formal systems difficult. Then an approach with more 'low tech' solutions, such as those found in other arid and semi-arid countries traditional water management could be easier and quicker to implement. In section 6.3 different 'low tech' option will be examined.

6.2 Efficiency of the Afghan agricultures water use

As mentioned previously the irrigation systems in Afghanistan have been damaged during the long conflict and currently the efficiency of the irrigation systems is estimated to be 25-30% for both traditional and modern systems [Savage et al., 2009].

The primary purpose for improving water management in agriculture is to achieve a greater yield [Critchley & Siegert, 1991]. The heart of this crop growth process is the plant environment, particularly the plant root zone. Here, most of the agricultural inputs such as seeds, cropping cultural practices, and water come together, along with climatic conditions, to determine crop yields. Improved water management is to provide the proper quantities of water to the root zone at the appropriate time to maximise crop production. This is dependent on the type of crop,

evaporation and soil conditions and texture, which determine the infiltration and water capacity of the soils [Critchley & Siegert, 1991]. Also the farmer should have knowledge of the irrigation requirements for the different growth periods of the crops [Brouwer & Heibloem, 1986; Critchley & Siegert, 1991].

According to the survey made by ICARDA [2002], the levelling of Afghan farmer fields and the knowledge of proper irrigation requirements for different crops are generally poor. The Afghan farmers do not plan their irrigation or have any knowledge on the crop requirements, but irrigate from previous experience and sight of dryness [ICARDA, 2002]. Fields with low and high spots present many problems to farmers as well as to the system as a whole. By the time many farmers have applied the amount of water to completely fill their fields to cover all the high spots, soil moisture requirements have been exceeded leading to an over-use of the water resource. Some areas of the field receive excess water (shallow parts) while the others receive too little (high spots) [ICARDA, 2002]. This un-even distribution of water in the field produces patches of low and high infiltration rates, which in turn produces patches of low and high salinity within the same field [Critchley & Siegert, 1991]. In the fields where fertilizer has been applied, it is expected that much of the nutrients is leached and lost before giving any benefit to the crop [Critchley & Siegert, 1991, ICARDA, 2002]. Actually over-irrigation of fields can be viewed as a triple menace because it creates water-logging and salinity problems, leaches expensive nutrients, resulting in a reduction in the crop yields, and reduces the quality of groundwater.

Through studies conducted elsewhere under similar environmental conditions a direct relationship between field levelness and water saving and crop yields has been shown [ICARDA, 2002]. Evaluation of several fields after precision land levelling in various parts of Pakistani Punjab have shown that there is a saving of from 33% to 50% water on precision levelled fields as compared to traditional un-level fields. These studies have also related land levelling to improved crop yields [ICARDA, 2002].

Since the survey in 2002 there have been initiatives to increase the production yield of Afghan farmers, through increasing their knowledge of better nutrient use and on seed quality, as previously explained in section 5.3. The effects of droughts in the years 2002, 2004, and 2008, where the production was significantly reduced shows that there are still some areas to improve if the Afghan agriculture is going to be sustainable. The next section will examine how to improve the Afghan irrigation system and water use.

6.3 Improving the Afghan irrigation system and water resource

There are various practises and techniques, which can improve the Afghan agricultural water resource and use. Techniques such as improvement of the irrigation system's canal will improve the flow, and closed pipes that minimize loss from evaporation will improve the current irrigation system [Raes et al., 2008]. The traditional practise of irrigation by filling the field with water, until completely covered, should be replaced by either sprinklers or drip systems, which could be used in fields with a steep slope, where levelling of the area would be too costly [ICARDA, 2002]. As previously established one of the main problems for the Afghan agriculture is the difference between when precipitation falls during the winter and the crop cycle during the summer.

Improvement in water catchment through rainwater harvesting and storage of water could reduce the effects of this problem. Rainwater harvesting may be defined as any human activity involving collection and storage of rainwater in some natural or artificial container either for immediate use or use before the onset of the next season. Runoff farming, micro-catchment farming and contour catchment farming are some examples of rainwater harvesting used in irrigation. The underlying principle of rainwater harvesting is to ensure direct use of most of the rainfall, and this is achieved in certain natural catchments or modified existing catchments to produce maximum surface runoff and minimum evaporation, transpiration and infiltration [Swamy, 2005].

Water harvesting systems consist of three different parts: Catchment area, storage and target. The catchments area can range from a couple of m^2 (micro-catchment) to several km^2 (macro-catchment), the area can be agricultural land, barren rocks or even urban areas, such as rooftops and paved roads. Storage facility; where the run-off can be stored until it is needed, the storage can either be; a surface storage such as a pod or surface reservoir, in a soil profile as soil moisture, or underground in a cistern or as groundwater in an aquifer. Use or target; either for irrigation or drinking water [Wani et al., 2009]. There is often also a conveyance system from the storage facility to target, but in smaller scale system this is often not necessary or is seen as part of the irrigation system [Wani et al. 2009]. Without careful planning water harvesting systems can lead to increased soil erosion when slopes are clear for high run-off [Wani et al., 2009]. Critchley and Siegert [1991] describes the three basic technical factors necessary for sustainable run-off catchments; slope, soil and costs. The ground slope is a key limiting factor to water harvesting. Water harvesting is not recommended for areas where slopes are greater than 5% due to uneven distribution of run-off and large quantities of earthwork required which is not economical [Critchley & Siegert, 1991]. The topography of Afghanistan, with lots of slopes could make unsustainable water catchment in some places. Another hindrance for water catchment in the

southern part of Afghanistan is the region's soils that have a high content of sand which means a high infiltration rate. When the soil's infiltration rate is higher than the rainfall intensity, no runoff will occur making water catchment difficult. This is a problem as the need for improved water catchment is greatest in the southern part because of the region's dependence on irrigation. As is the case with most construction projects, the quantities of earth/stonework involved in construction directly affects the cost of a scheme or, if it is implemented on a self help basis, indicates how labour intensive its construction will be [Critchley & Siegert, 1991].

In water resource management there is a tendency to focus on formal water catchment such as large dams [Bhattacharyya et al., 2004] and on the centralization of water supplies [Swamy, 2005]. Due to the distance between settlements and the topography of Afghanistan, creating a central water supply would be costly due to the transportation of water from storage facility to target. Instead community based water harvesting and management built on the current traditional water institutions could be more beneficial. In India the renewed traditional water harvesting techniques have worked with great success in semi-arid and arid regions [Rae et al., 2008]. Using traditional water harvesting system which can be build and maintain by the local communities, rather than more formal and larger modern systems [SIWI, 2001].

Need for a more stable and efficient use of the water resource in Afghanistan could make the establishment of water catchment sustainable even though the soils and slope factors are not optimal. A Pakistani hill run-off system "sylaba" could also be implemented in areas with a high slope, where the other traditional system would not be viable, such as the central and western part of Afghanistan. The system uses ditches with bunds which are used to direct the run off towards fields which are surrounded with levees to ensure storage of water in the fields' soil [Wani et al. 2009]. There is empirical evidence from fieldwork done in the Negev desert in Israel (annual precipitation of 105 mm) by Michael Evenari, that small-scale water catchments are more cost-efficient and more effective than larger projects [Corwan, 2007; Bhattacharyya et al., 2004]. Evenari reconstructed irrigation systems used by an ancient Israeli civilization and concluded that their use of small watersheds was significantly better that a larger watershed of the same total capacity. A network system of 345 watersheds of 1 hectare produced up to 95 m^3/Ha/year while a single 345 hectare watershed produced 24 m^3/Ha/year [Bhattacharyya et al., 2004].

Table 6.2. Effect of catchment size on runoff water harvesting with a total area of 300 hectare [Agarwal, 2001]

Size of Catchments (Ha)	**Water harvested (m^3/Ha)**	**% of annual rainfall collected**
0,1 -1	160	15,2
20	100	9,52
300	50	3,33

The difference is most likely caused by the increased evaporation and infiltration during the additional transport time. Another advantage in the smaller watersheds is that during drought periods (< 50 mm for Negev desert) catchments larger than 50 hectares would not produce any appreciable water yield, while the smaller natural would yield 20-40 m^3/Ha and micro-catchments (smaller than 0.1 hectare) as much as 80-100 cubic metres per hectare [Bhattacharyya et al., 2004, Agarwal, 2001]. 3000 micro-catchments of 0.1 hectare each will give five times more water together than one catchment of 300 hectares even though the total land area from which the rain is harvested remains the same (Table 6.2). In a drought prone area such as the southern Afghanistan, 10 dams with a one hectare catchment each will give substantially more water than one large dam with a 10 hectare catchment. These catchments are focused on precipitation. The catchment and storage of water from rivers and ground is also very important in Afghanistan, because of the high dependence on water from the mountains. A problem could be an increased water catchment in the areas with high precipitation causing a smaller amount of surface runoff to enter the rivers and transported to the downstream settlements. Another problem with reducing the surface runoff from the mountains is that it could reduce the amount of nutrient rich alluvial sediments transported to the downstream fields. One of the basic laws of ecology is that you cannot just change one thing in nature [Goudie, 2000]. Therefore further research into the consequence of water catchments and the need to protect the downstream areas from overuse of resources upstream.

The improvement of storage facilities in order to reduce loss of the water yield through infiltration and evaporation is also needed in order to minimise water loss from evaporation during the storage period from catchment to use. Bhattacharyya et al [2004] suggest that using the indigenous storage used in other arid parts of Asia could be implemented in Afghanistan. These are used with good results in the Thar desert (annual precipitation 100 to 500 mm) in India and other dryland areas [Oweis et al., 2001]. Because of the difference in season between the precipitation from November to March where the water is harvested and the need for water for agricultural production during April to October, correct storage of the water yield for the crop cycle is very important. The field targeted can as previously mentioned also be structured to reduce water loss, such as Contour ridge. Semi-circular and trapezoidal bunds are especially effective in orchards, small pits in the field, run-off strips and basins [Owies et al. 2001]. The use of the different structures are dependent on what kind of crop is cultivated on the field, soil and slope. These techniques are not promoted in Afghanistan by either government or NGOs [Bhattacharyya et al, 2004]. These techniques should be fairly easy to promote through the use of the agricultural and water institutions. The implementation of micro-water catchment, other traditional storage facilities, and specific field structures to specific crops and fields could

increase the water available and efficiency of the Afghan agriculture.

Deficit irrigation

The great challenge for the future agriculture will be the task of increasing food production with less water per capita, particularly in countries such as Afghanistan, with limited water and land resources. In the context of improving water productivity, there is a growing interest in "deficit irrigation" - an irrigation practice whereby water supply is reduced below maximum levels and mild stress is allowed with minimal effects on yield [Raes et al., 2008]. Basically the technique find the optimum capacity in terms of water input and yield output. Deficit irrigation can result in substantial water savings with little impact on the quality and quantity of the harvested yield [FAO, 2002b]. However, to be successful, an intimate knowledge of crop behaviour is required, as crop response to water stress varies considerably. Positive results have been described for both cotton and wheat, which as previously mentioned are already grown in Afghanistan. Experiments in Turkey and India indicate that the irrigation water use for cotton could be reduced to up to 60 % of the total crop water requirement with limited yield losses. In this way, high water productivity and a better nutrient-water balance was obtained [FAO, 2002b; Raes et al., 2008].

Deficit irrigation maximizes the productivity of water, generally with adequate harvest quality. It stabilizes the production through minimizing the water dependency allowing for economic planning in comparison with rain-fed cultivation [Raes et al., 2008]. This approach also decreases the risk of certain diseases linked to high humidity (e.g. fungi) in comparison with full irrigation. It also reduces nutrient loss by leaching of the root zone, which results in better groundwater quality and lower fertilizer needs compared to cultivation under full irrigation [FAO, 2002b]. It also improves control over when to start sowing and makes the length of the growing period independent from availability of the water resource and it thereby improves agricultural planning [FAO, 2002b].

There are a number of constraints that apply to deficit irrigation. It requires exact knowledge of the crop response to water stress which could be a problem in Afghanistan with lots of remote settlements. This could be lessened by the use of the shura to share knowledge and the distribution of irrigation charts together with seeds, which explain the water required by the specific crop under the local conditions [FAO, 2002b, Raes et al., 2008]. There are other constraints in deficit irrigation which could create problems in implementing the technique in Afghanistan. The precise application of water on specific periods during the crop cycle requires sufficient flexibility in access to water during periods of high demand (drought sensitive stages of a crop). Also the minimum quantity of water should be guaranteed for the crop, below which the technique has no significant beneficial effect [FAO, 2002b]. This again emphasises the

importance of improvement of Afghan water storage facilities and distribution if this irrigation technique should be implemented and it underlines the need for proper education in this technique. Because irrigation is applied more efficiently, the washout of saline from the soil is also minimized with the risk for soil salinisation under deficit irrigation as compared to full irrigation [Geerts et al., 2008], which could lead to soil degradation if not monitored. An individual farmer could consider that extra land can be irrigated with the saved water instead of consider the benefit for the total water users' community. This again emphasises the importance of the local water institution to promote and regulated the individual farmer's water use.

Summary:

This chapter has found that currently Afghanistan water resource should be sufficient to ensure a sustainable agricultural production. Regarding the population growth then if the water resource is not significantly reduced by the climate change, then it total water resource would be approximately the same as their neighbouring country Pakistan has available at the present. The problem for the Afghan agricultural is a lack of good irrigation practise and techniques. This is cause by the lack of knowledge how to improve this. This chapter has analysed several methods of improving the efficiency in irrigation water use such as levelling the field, shaping the structure of the field to guide and contain the water and teaching the farmers how to reduce their water use through knowledge of the crops actual water requirements. Because of the spatial distribution of settlements along the rivers and the low level of development. This project recommends that the improvement in the Afghan water management should be based on more local 'low tech' solutions rather than more modern centralised solutions. The possibility of water harvesting either as precipitation or surface water has been described, these techniques could improve the water resource available to the Afghan farmers, but this should be used with caution as the improvement of water resource in one area will reduce the water resource in another, which could lead to a degradation of the environment and the natural resources. This chapter has also discussed the possibility of that the single farmer will use the "surplus" water from the improvements to his fields to cultivate more land instead of sharing the surplus with the rest of the farmers. In order for this not to happen there needs to be a institution to manage the common resources such as land and water. The water management institution in Afghanistan will be analysed in the next chapter.

7. Water management institutions

This chapter will examine the institutions involved in water management, both on a local level and national level. This project will not examine the transnational institution concerning the shared water resources with Afghanistan's neighbouring countries. If droughts as predicted become common phenomenon, then there could become some conflicts between Afghanistan and its neighbours. Because of the limited time of this project will abstract from these transnational institution, but recognizes that these could have an future effect on the Afghan agriculture.
The other institutions involved in the agriculture and resource management such a land management and rural development play an important role in the sustainable development, but as the focus of this project is on water management, these will not be examined in this project.

Before examining these institutions, it is necessary to determine, what the requirements are for an institution to manage an resource. Dr. Kai Wegerich writes in *Water Strategy Meets Local Reality*, "A prerequisite to management, however, is knowledge of what has to be managed (the resource) and how it is currently managed" [Wegerich, 2009: 55]. Without knowledge of the resource and what the current situation is, an institution could easily make mistakes and mismanage the resource. For example if a manager was set in charge of managing a countries energy network, without understanding at least the fundamental this would most likely end in a 'black out'. Therefore one of the benchmarks this examination of the institutions will use are their knowledge of the resource and its current condition. Other requirements of an institution in order for it to properly manage an institution listed by Ostrom [1990]. The institution needs rules, which determines what a actor can and cannot do within the system. In order to secure the enforcement of the rules the institutions requires the ability to monitor and sanction actors that does not follow these rules. Without these three factors the institution cannot ensure that the resource and negative impact get distributed fairly and that no actors misuse the resource or gets a "free ride". This section will start by examining the institutions found on a local level and expand out to the national water management institutions.

Local water management

The Afghan Civil war created a lack of central governance to solve problems concerning problems and disputes. There were, and still is, working traditional institutions on village level, called the "Mirab", and "Shura". These informal water institutions are not always presence (except the Shura), in some areas of Afghanistan with little or no experience in water scarcity, there is not always Mirab [Wegerich, 2009]. Therefore is the Mirabs more present in downstream

settlements, than upstream [Roe, 2009]. The different parts of the traditional informal water institution is not transparent and are described differently by different researchers. Quershi [2002] and Bhattacharyya et al. [2002] describe the role of a Water Waqil (Water judge) as a separate actor from the Mirab, while Thomas and Ahmad [2009], Roe [2009] and Wegerich [2009] explain that the Water Waqil and Mirab plays the same role and are just different names for the same position (it dependent on if it is a primary and secondary canals Mirab). Since the majority of researchers does not distinguish between these two will in this project the Mirab and Water Waqil be seen as the same position within the informal water institution.

Shura

Shura is a religious and administrative institution whereby members of the community select their leader(s) to represent them as a village council [Quershi, 2002; Bhattacharyya et al., 2004]. It is not directly a water institution, such as the Mirab, but because of its power in the local community it has an influence on both water use and agriculture. A typical Shura would include a Head, an Assistant, a Secretary and a few other members solving a variety of economical, cultural and civil problems, including rehabilitation of roads and canals, construction of bridges and schools, etc. [Quershi, 2002]. The number of Shuras in a village may be proportional to the village population [Bhattacharyya et al., 2009]. If an outsider will work in the village, permission must be obtained by the Shura head [Bhattacharyya et al. 2004].

The Shura is not directly a water management, but more an traditional administrative institution. The Shura could be utilised for a dialogue between the local community, the Afghan government (provincial or state) and international organisations, when trying to promote a sustainable agricultural development. The decisions of the Shura is a factor in deciding which crops the community grows, as seen in the survey concerning reasons for not to cultivate opium in chapter 3. Using the Shura to promote less water consuming crops as well as better practices and knowledge of the proper use of nutrients and how to handle pests and diseases, it would be possible to reduce the community's dependence on a large water resource.

Mirab

The Mirab (water master) plays another important role in traditional institution. The Mirab is a service provider, he does the inspection, decision making, operation, and maintenance of the irrigation system in an area [Thomas & Ahmad, 2009]. The term Mirab can both be used for a single individual or as a part of a network of Mirabs working together. For example In the large river systems, which can cover several settlements there is often a leading Mirab and number of underlings [Roe, 2009] Mirabs are, in general, respected persons in the area and farmers listen to

them and abide by their decisions. Some communities have the head of the Shura as Mirab [Thomas & Ahmad, 2009]. Operation of the irrigation system and supervising the water distribution is, according to the agreed arrangement, his responsibility. The Mirab is elected by the farmers and he also serves as a link between the government water authority personnel and the farmers. Before the Soviet-Afghan Civil war the link between the Mirab and the government was clear. According to Thomas and Ahmad [2009] was the Mirab a part of the governmental water management up to the late 1970s. However the long period of time without a governmental institution was changed the Mirab into a community based.

The Mirabs generally receive some compensation in the form of farm products such as wheat for the performing of their services [ICARDA, 2002, Bhattacharyya et al., 2004]. It could be a problem within the institution, that the Mirab is dependent on that there being enough water, as this could work as an incentive for the Mirab because of his pay is dependent on that the system works. Long periods of drought, which causes a low income could also make the Mirab lose interest in his occupation [Thomas & Ahmad, 2009]. Bhattacharyya et al. [2004] surveyed the drought-stricken parts of southern and western Afghanistan in 2001 and showed that Mirabs had lost interest in their position, because of the lack of a steady pay. The study also showed that the communities lost some of the confidence in the Mirab institution, but still thought they performed a good service [Bhattacharyya et al., 2004]. But in general the Mirab system works [Lee, 2006; Thomas & Ahmad, 2009]. Another problem occurs in areas where the water is heavily contested, in these areas the Mirab lacks the power to enforce his rulings [Roe, 2009]. The lack could be solved with a re-establishment of cooperation between the governmental water management institution and and the Mirab.

Studies done by Lee [2006, 2007] have shown that the Mirab system appears to be equitable in terms of water distribution and maintenance work. These studies also show, however, that water allocation among communities along main canals is inequitable. As the upstream farmers has access and uses a larger quantity of the water resource. The Mirab system is not isolated; instead, it is linked to administrative units at the district or province levels. In the past, the government used taxes to partially decrease inequities in water distribution by paying for the Mirabs service [Wegerich, 2009]. This connection between the Mirab system and administrative units have also been used to resolve conflicts at the canal level and between canals [Lee, 2006]. This connection could be established again to ensure that problems between upstream and downstream farming communities would be solved. This creates an important link between the traditional water institution and the modern water institution. Upper parts of the irrigation system receive more water than mid- and downstream but are required to contribute less maintenance work (primarily at the canal intake)[Thomas & Ahmad, 2009]. Downstream settlements often end

up cleaning the whole canal but receiving the least amount of water. Consequently, the Mirab still often comes from the downstream-end, because upstream-enders do not need him and in some cases even refuse to contribute to his wages [Lee, 2006]. This is a problem which should be solved, so that all users of the irrigation system contributes equally to its maintenance.

Studies has also shown that the Mirab and Shura often works together. In the northern part of Afghanistan, the Shura in consultation with the Mirab makes decisions that affects the irrigation system and water resource. These decisions could be initiatives to improve the physical infrastructure or an ban on cultivating specific water-intensive crops (for example rice) or enforce an reduction in the areas used for cultivation [Roe, 2009]. The Mirabs of and the Shuras should be part of any initiative to improve the Afghan irrigation system locally and ensure maintenance of the traditional irrigation systems [Wegerich, 2009]. On a regional and national level there is still need for a modern formal institution to provide support and handle issues beyond the local institution control such a events of regional or nation wide scarcity. It is also necessary to have an institution that are able to monitor and regulate the water resource from a national perspective to ensure that both regional and national issues also are addressed.

National water management

In 2001, at the time of the international community toppled Taliban, state institutions were weak or non-existent after more than two decades of war and instability, and the country lagged severely behind in terms of water management policies, laws and regulations [Wegerich, 2009].

The current institution involved in water management, The Ministry of Water and Power (MEW), formed in 1988 as the merger of the former separate Ministry of Irrigation and Water Resources and the Ministry of Power and Ministry of Agriculture, Irrigation and Livestock(MAIL). This institution is in charge of production and, therefore, of on-farm infrastructure and water management, MAIL will be analysed later in this chapter.

A water law was passed in 1981, but is under revision and the law draft will be examined below [AQUASTAT, 2009]. The analysis of effectiveness of MEW is hindered by a lack of available information on both the current strategy and the future water management. Therefore is this analysis based on information from Wegerich [2009] *Water Strategy Meets Local Reality.*

Water Sector Strategy

There is currently no formal water management, but a formal water management strategy is planned, this is called Water Sector Strategy (WSS). These policies are based the ideology of integrated water resources management (IWRM), which has become popular in water management since the 20th century [Saravana et al., 2008]. The IWRM approach promotes giving

some or all decision-making power to the actors involved (the users and service providers). New forms of institutions (councils, committees, boards) are established at river-basin level to gather different involved actors around one table to implement IWRM [Varzi & Wegerich, 2008]. It is basically a decentralised water management institution. In Afghanistan the approach divides the Afghanistan water resource into five river basin management structures. The basis for the WSS is a pilot project on the Kunduz river-basin. The decision to place a pilot project in the Kunduz river basin, which drains a part of north-eastern Afghanistan and covers a portion of Bamyan province, most of Baghlan and Kunduz provinces and the southern half of Takhar province [Milner et al., 2005]. Looking back at the climatic data presented in chapter 3 and appendix II it shows that the semi-arid climate in this area it mild compared to the rest of Afghanistan. This area is also known for a one of Afghanistan breadbasket [Milner et al., 2005]. This project would assume that in order to conduct a proper pilot project, it would have been better to use an river basin with more problems concerning water management and environment problems in general. While it has not been possible to find to reasons for the choosing this area, the relative stable security situation in this area has probably played a factor in the decision.

There have been several drafts of the WSS, the latest of February 2008. The five river basins are to be managed by River Basin Authorities (RBA) representing the service agencies and River Basin Councils based on the users of the water resource with sub-basin councils [Wegerich, 2009]. While these councils are described in both the WSS draft of February 2008 and the draft water law of June 2008, there are nothing concerning who should be in the council and what areas the respective councils should cover. WSS promotes the establishment of Water Users Association (WUA) instead of the Mirab, which is seen in the current WSS draft as as ineffective water management institution [Wegerich, 2009]. The WSS draft of February 2008 writes that it has not researched the Mirab system nor does it suggest further research [Wegerich, 2009; Thomas & Ahmad, 2009]. The critique of the Mirab seems strange since studies done by Afghanistan Research and Evaluation Unit (AREU) has shown that the Mirabs along the Kunduz river has been effective even during drought periods [Roe, 2009]. It would seem that the critique of the Mirab is more based on assumption, than any real knowledge concerning their effectiveness. The WUA should incorporate the Mirab, but these should be changed into a more modern regulative institution [Thomas & Ahmad, 2009]. The WUA should cover all types of water users and not just the irrigation users. This is of cause necessary for the MEW, because even though 99% of the water is used on irrigation, there are several other purposes for water. There are also the non-consumption uses of the water ,such as use of the potential energy stored in the water as it flows to a lower level, as for example hydroelectric plants which currently provides 65% of the total generation in the country, with future plans of hydroelectric plants

supplying 95% of the Afghanistan demand [Milner et al., 2005].

The current draft of the Water Sector Strategy also contains several initiatives to develop new irrigation projects and dams. There has been a lot of critique of these projects, because there is a lack in transparency of whether they are an improvement of old traditional irrigation systems or a development of new modern systems [Wegerich, 2009], Also, some of the projects are based on old projects from 1980s. A problem by implementing the old project is that both some of the natural and social structures has changed since the project ideas was made. For example is the area planned as the reservoir for a dam project now is settled by 45.000 Afghans. These Afghan would have to be moved if the project is to start [Wegerich, 2009]. The draft also wants to establish permanent intake structures at the river irrigation systems [Wegerich, 2009], which would lessen the need for upstream maintenance and remove the upstream farmers' incentives to contribute to the Mirab's wages.

Revision of the water law

The current water law of 1981 is because of the many changes since the 1980s, not up to the current governmental structure and needs for water management. Therefore has the development of a new water law been an ongoing process since 2002 [Wegerich, 2009].

The draft for the Water law focuses on three areas; permit (water use), license (for infrastructure) and water rights. The implementation of regulative elements is often used with success in resource management, but is requires precise rules and strong terminology to ensure understanding. The term "water rights" is not defined and is used in the water law to refer to individual as well as collective (canal-level) rights. It is foreseen in the Draft Water Law that currently existing water rights will be transformed into permits and that only established WUAs will obtain permits [Wegerich, 2009]. Thereby ensuring the Afghans involvement in the establishment of these associations. The Water law does not mention licensing for the traditional irrigation systems nor does it specify what the permits should entail, but states that it would be the Basin councils that can give or take away these permits [Wegerich, 2009]. This would force the communities to participate in this modern institution at the cost of the traditional irrigation systems [Wegerich, 2009]. Another problem is that as state is most of the irrigation systems currently in use traditional irrigation systems and not to include these seems as a flaw in the draft of the water law. A common problem for the recent drafts of both the WSS and the Water Law; they seem to be vague with weak terminology and lack of transparency [Wegerich, 2009]. Another problem concerning the increasing amount of permits, licences and rights in water use is the high level of corruption in the Afghan Government, which could create a problem for the poorer communities lacking the sufficient funds for obtaining the permits. The distance between

settlements and level of development, the reduced ability to monitor because of lack of qualified human resources would make it difficult to enforce the water law [Wegerich, 2009].

Studies have shown that the traditional water institution is still functioning well and has shown to be robust during the Afghan Civil War, while there are some problems concerning the responsibility of maintaining the irrigation system, where the downstream-ender bear the burden. The formal water institution is currently focusing on creating a modern system, based on a general integrated water resources management. This does not take into account the current problems or how the resource is managed on a local level currently. Instead the modern institution focuses on an ideology of decentralised water management with enforcement of rules and regulation through permits, licences and rights. The implementation of these is questionable because of lack of clear terminology and how to practically implement and monitor these. Also it would seem that the suggested strategy lack an understanding of the current situation in Afghanistan. In any regulative institution, the clear rules, ability to monitor and possibility to sanction, is imperative for success. Otherwise the rules can be circumvented and actors will lose confidence in the institution.

Because of the current situation in Afghanistan with a high level of corruption and insecurity, this modernization of the water management could easily be exploited by wealthy landowners bribing government officials creating a more inequitable distribution of the water resource. This conflict between the traditional informal water institution and the formal modern institution could hinder a sustainable development of the Afghan agriculture. Ostrom [1990] writes in “Governing the commons” to be cautious concerning the nationalisation or privatisation in management of the common resources, because these will often destroy working local institutions and make the situation worse. Instead she suggests that in some cases a “self-organizing and self-governing form of collective action” would work as management of common resources [Ostrom, 1990]. On the other hand, there is a need for a government institution to assist the traditional local institution during droughts and to have a large scale view of the resource management. An adoption of the Mirabs into the WSS as service providers and Shuras as representative of the irrigation user could strengthen both the traditional institution and the national institution.

On-farm water management

While the national water management falls under MEW, the on-farm water management falls under MAIL. Where the national water management is involved in the distribution of the water resources, the on-farm management is more concerned with the efficient use of the resources available. The term 'On-farm water management' covers from single farms and up to small scale

irrigations systems (secondary canals) as a part of a larger irrigation system [MAIL, 2009]

In April 2009, MAIL launched a national agricultural development framework which focuses on natural resource management. This framework is a further development of the other national plans that has been in action since 2002 [MAIL, 2009b]. MAIL states, in the new framework, that the economic growth through increased agricultural production must not happen on the cost of environmental and natural resource degradation. The framework involves several sub-programmes to improve the agriculture and also sub-programmes intended to protect and monitor both natural resources and the Afghan environment [MAIL, 2009b].

A concept paper for on-farm water management was release as part of this framework. The concept paper concerning on-farm management recognises the same areas to improve as was determined in the previous chapters, such as the lack of levelled fields, the potential of structural improvement of the field, the need for better irrigation techniques and for water storage facilities [MAIL, 2009]. The concept paper is suggesting a pilot project which should consist of up to ten test sites to cover the different conditions and crop types used in the Afghan irrigated agriculture [MAIL, 2009]. The concept paper recognises that there will be some constraints in the pilot project, such as the need of security and that it has to be in the proximity of an agricultural extension centre for monitoring the progress [MAIL, 2009]. The concept paper seems to focus on how to reduce water loss during irrigation and to promote better water use through training farmers in crop requirements and how to structure the fields. There is however no plans and suggestion for water storage facilities, even though these are recognises as important [MAIL, 2009].

This project has focused on water management issues, but as mentioned there are several other on-farm management problems which needs to be addressed. The Afghan farmers also need education in proper use of fertilisers, together with assistance in combating pests and diseases. The reduction of pest and diseases and the proper application of fertiliser will increase the yield of the farmer area. Another important aspect to reduce the water use and improve the yield is the introduction of new crops variants or new crop species. Introduction of a more drought resistant variant or species will help stabilize the production. Alternatively an introduction of a variant or species, that gives a higher yield, would increase production, if there were sufficient water to meet this variants requirement. These issues are also falling under MAIL and these will partially covered by the pilot project and partially covered by other sub-programmes [MAIL, 2009;2009b].

MAIL seems to be well aware of the current problems are in the Afghan agriculture and if the national agricultural development framework get implemented, then this could be a good step toward increasing the efficiency in the Afghan agricultures water use. The framework contains

several sub-programmes for monitoring the environment, natural resources and different parts of the Afghan agriculture. MAIL seem to have a close cooperation with to the various external actors working to improve the Afghan agriculture, such USAID, FAO, WFP and the EU. This cooperation could be the reason why MAIL has knowledge of what the current problems in Afghan agriculture are, since these external actors are involved in numerous development projects in Afghanistan.

Summary:

Because of the short time (from 2001 to 2009) that the new governmental institutions have been developing, and the fact that the national water institution is still in its draft state, it is difficult to conclude how effective these will be. However it seems that the Ministry of Agriculture, Irrigation and Livestock has a better understanding of the current state of the agriculture and what needs to be improved in order to obtain sustainable development, and has already begun implementing initiatives to improve the situation.

The Ministry of Energy and Water seems to be more involved in planning rather than implementation. The use of standard Integrated Water Resource Management approach instead of a more case-based resource management strategy could become a problem as there seems to be a lack of cooperation and understanding between the forming national water management institution and the current local management institution. The local institution that is based around the Shura council and the Mirab represents the local users and the service provider. While this local institution has some weaknesses when it comes to solving disputes during water scarcity, it generally works and tries to ensure an equitable distribution of the water resource and that the planned production does not overreach the capacity. Whether or not the final WSS and revised water law will take into account the current management is unknown, but this project would recommend an integration of the traditional local institution into the modern national institution in order to strengthen both.

8. Conclusion

The motivation for this project has been to analysis the reasons behind the current high level of opium production in Afghanistan as well as its affect on both Afghanistan and the rest of the world and finally to propose a long term solution to the problem. The problem analysis revealed that the opium production is a symptom of the problems in Afghanistan, and not the problem in itself.

Before the opium production started, Afghanistan was a slow developing country highly dependent on its agriculture. The Afghan agricultural system was and is, because of natural constraints, highly dependent on irrigation systems. The problem analysis revealed a number of causes that amplified each other and created the perfect conditions for opium production.
The high level of production started during the Soviet-Afghan War where the conflict destroyed much of the infrastructure and irrigation systems, thereby forcing the Afghan farmers to cultivate opium in order to maintain a livelihood. In the aftermath of the Soviet-Afghan War, the Afghan government collapsed. The failed state of Afghanistan was the perfect place for criminals and non-state actors to operate without any risk of prosecution. This presence of criminals combined with connections established during the Soviet-Afghan War created access to the global opium market.

During the Taliban regime (1996 – 2001), the opium production increased because of the relatively stable conditions. For unclear reasons the Taliban suppressed the production of opium in 2001, possibly to bargain for international assistance and recognition, but not the opium trade. The economic effect of the ban was a significant rise in the price of raw opium gum and its derivatives. While this assured a profit for the traffickers and revenues for the regime that taxed them, it put peasants in deep debt. Most poor peasants who cultivated opium agreed to the traditional credit in form of 'salaam' contracts with wholesalers or money lenders before planting. As the Taliban was forced from Kabul in late 2001, the farmers had already started planting opium poppies to reduce their debt. If the Taliban had stayed in power their ban on opium production would probably not have lasted much longer than it did, because of the Afghan farmers' dependency on opium production.
While The new government in Afghanistan in 2002 quickly banned opium production and trafficking, the establishment of a new government also created another problem. Influential actors with connections to the opium trade came into position of power. These actors started protecting the opium trade in exchange for bribes. The level of corruption in Afghanistan grew and has since made prosecution more difficult. The difficulties in enforcing the ban on the opium production and trafficking was amplified by a dependency on the opium profit by the Taliban.

This made the Taliban fiercely protective over the opium trade.
The poor state of the Afghan agricultural structure after the conflict together with mechanisms such as insecurity, market access and corruption is the root cause of the current high opium production. Therefore is the long term solution to the opium production to provide the Afghan farmers with a viable alternative to opium. Because of the different conditions and mechanisms which together create the foundation for the opium production in Afghanistan, any given solution to this problem must address the problems as a whole and not only the individual causes. Therefore are any conclusions limited to the success of the other counter-narcotic initiatives listed in section 3.4. these are linked to the viable alternative as the insecurity, corruption and poor border management hinders and constraints the possibility of developing of the Afghan agriculture. In order to find a viable alternative to opium, this project tried to answer the following research question:

"*What course of action is necessary in order to obtain a sustainable Afghan agriculture?*"

This project can conclude that in order for the Afghan agriculture to become sustainable there are two areas in the agriculture which needs to be improved; its capacity and its institutions.

Capacity
The Afghan agriculture is as mentioned constrained by natural structures such as the arid climate, poor soils and high variation in topography, with over 56% of Afghanistan being defined as steep land. The main constraint is the spatial and temporal difference between the needs and availability of the water resource. Over 80% of the total water resources falls as orographic precipitation in the mountains at altitudes above 2.000 meters. Furthermore, the precipitation falls mainly during November through March while the agricultural need for water resources are greatest in April through October. The lack of precipitation in the populated areas together with the high temperatures makes Afghan agriculture highly dependent on irrigation for crop production, with 99% of the annual water consumption used for this purpose.

This project has found that the Afghan farmers lack proper techniques and practises in irrigation, which is shown in the correlation between droughts and significant drops in Afghan cereal production. Some of the problems found are unlevelled fields which causes an uneven distribution of the irrigated water, the practise of irrigation by flooding the field based on visual dryness causes an overuse of water and in turn a washout of nutrients. These poor practises and techniques create a low efficiency in use of the water sources and a low capacity in the Afghan agriculture.

As the Afghan population grows, Afghanistan's carrying capacity must increase proportionally. This will stress the Afghan agricultural system to increase its production, while the other uses for the Afghan water resource also will increase such as the growing population need drinking water, sanitation purposes and hydroelectricity. The future stress on the water resource will be amplified by future climate changes. Climate models predict that drought is likely to be regarded as the norm by 2030. Without significant improvement in irrigation, the Afghan agricultural areas will be severely reduced through associated dynamics of increased land degradation and desertification. A further degradation of the remaining forests would amplify the risk of flood caused by untimely precipitation and the more rapid snow melt caused by the increase in temperatures. To improve the on-farm water management and possibly the water resource this project has suggested various techniques and practises, which could be implemented into the Afghan agriculture to ensure a more efficiency use of the resource. This project has also examined the possibility of water harvesting that could improve the water resource available, Since all the mechanisms involved in water harvesting in Afghanistan is not known, this project has found that this possible solution would require further research to ensure that this technique would not cause an environmental degradation elsewhere. In order to ensure that the Afghan natural resource are not degraded further it is important for Afghanistan to have institutions that governs both the natural resources and protects the environment.

Institutions

The key actors in sustainable agriculture are the institutions involved in the natural resource management. These areas needed to increase the carrying capacity of Afghanistan through promoting better irrigation practise and techniques. The institutions are also necessary in order to regulate and ensure an equitable distribution of the resources and to protect the natural resources and environment from degradation. Currently in Afghanistan there are already problems concerning soil degradation, deforestation and overgrazing, which needs to be addressed by resource management institutions.

This project finds that a strong resource management institution requires clear rules, the ability to monitor and sanction, and an understanding of how the resources are currently managed. This project found that concerning the on-farm management, a pilot project is planned with the purpose of implementing good practises and new techniques into the Afghan agriculture. This falls under the Ministry of Agriculture, Irrigation and Livestock that seems to have a good concept of what the problems are within the Afghan agriculture, as they in their current framework emphasises the need for environmental protection and rehabilitation.

This project has found that in Afghanistan there is both a local traditional water management institution and an emerging formal national water institution through the Ministry of Energy and Water. The local institution is the local community council (Shura) working together with a water manager (Mirab). The Mirab use to be part of the governmental institution, but the lack of a national institution has changed it into a community based institution. This local institution has shown to be robust, but with some weaknesses during events of water scarcity. This relates to the local institutions' lack of sanctioning actors, when they do not uphold the institution's rulings in water disputes. There is also an inequitable distribution of water within the irrigation system, where the burden of maintenance falls on the downstream settlements, who also receive the least amount of water. These weaknesses need to be solved for a sustainable agriculture.

The national water institutions are a Water Sector Strategy, with current draft from February 2008 and a draft revision of the Water Law from June 2008. Neither are implemented as of September 2009. These are based on the principles of the 'Integrated water resources management' (IWRM), which promotes a decentralised management with participation of all actors involved in water resource management, such as users, service providers and governmental departments. The emerging national water institution aims to modernise the management structure and have the conception that the Mirab is ineffective and the WSS wants to establish another community-based participation through Water User Association (WUA).

The draft for the national water management institution also builds three regulative elements in the revised water law; permits, licenses and water rights. However, this lack of clear definitions and the draft to the water law has weak terminology on what the different terms pertain. Also there are no clear plans for the implementation of either the WWS or the regulative elements. This could weaken the resource management, especially under the current high level of corruption within parts of the Afghan government. In general, this project concludes that the planned national water management lacks an understanding of how the resources are currently managed and how to successfully implement its own regulative elements.

This project recommends that the local traditional water management is implemented into the national strategy in order to strengthen their ability to solve disputes and sanction when necessary. However, the WUA is necessary since there are other uses for water than irrigation, such as drinking water, sanitation and energy production and these needs also be addressed for a sustainable development. Furthermore, to ensure that the Afghan farmers has an viable alternative to opium production. This project recommends that the international community continues to support and strengthen the Afghan agriculture and the institutions involved in the resource management of Afghanistan should be assisted in building a strong water resource management.

9 . Perspectives

This project has focused on how to make the current crop production in Afghanistan more stable by increasing its efficiency in water use and by strengthening the water management institutions. As is stated during this project there are several limits to this conclusion. The research has been limited to the crop production in Afghanistan as it is the most importance part in food security and the focus has been on improving the management of the water resource as this is the greatest constraint in the arid Afghan climate. This chapter will discuss some of the other aspects, which will also affect the sustainability of the Afghan agriculture.

Resource management

If there had been more time and opportunity then a more intensive research on IWRM would have improved the understanding of the structures involved.

For example is selection of regions based on the river basin a good idea. The river basins may be a physical landscape, but actors involved come different perspectives depending on the knowledge, familiarity, awareness and comprehension in place and needs. These different transitive object will affect how each actor perceives what the best way to manage the resource and how to implement IWRM. Especially in a country such as Afghanistan with a complex ethnic diversity. These diverse perspectives will shape the councils' policies, programmes, visions and values that actors negotiate to manage water resources. In this ‘ebb and flow’ regime, actor would ‘scramble for responsibilities and control’ thereby ‘ensuing conflict and power struggles’ making development of critical water resources management more complex [Saravanan et al., 2008]. A better understanding on law making concerning resource could together with a better understanding of the structures and mechanisms in Afghan water management could give some idea on how to improve the water law giving the water management institution a better regulative instrument to work from. As mentioned in chapter 5 is there also a problem concerning the land management, cause by a weak institution, lack of information and many different informal form of ownership. As in water management it would be necessary to research how the resource is currently being managed. As mentioned are three major problems in the land management; weak institution and to many different involved, lack of information and many different kinds of ownership, where many of these are informal. Therefore could research into best practises in how register the land rights in other developing countries could give some general insight into how the Afghan land management should proceed. The approach used in this project with could work as a general framework to investigate the other natural resource management aspects in Afghanistan.

Agricultural research

In section 6.3 the project suggests a lot of different techniques and practises which could improve the on-farm water management. If there had been time and resource it could have been interesting to research how these techniques and practises could best be promoted. In this project the implementation is left up to MAIL and through their pilot project. A further analysis of what this pilot project should entail and how it should later teach the Afghan farmers its result. By examining case studies on other similar project and put this into the cultural context of Afghanistan it could give a best practise on how to teach the farmers these techniques.

As mentioned in section 5.1, livestock is another important aspect of the Afghan agriculture. This sector has some different requirements than the crop production even though they are linked. The livestock sector provides natural fertiliser to the crops and in some cases labour, while the livestock sector is dependent on the crop sector for feed during the winter. In order to analyse the livestock sector some of the same factors must be investigated such as the production of the livestock and capacity of the rangelands and barren lands for livestock. The life cycle of livestock is very different than crops, while the crops are usually an annual production cycle, livestock can varies depending on the livestock. There will it be necessary to distinguish between the different kinds of livestock and the livestock on the farmers and the pastoralistic nomads. The environmental impact and needs of stationary and migrating are very different. Where the stationary has a greater need for feed during winter and can has a larger local effect on the environment. The migrating livestocks need for feed are as mentioned less. The environmental impact would likely be less in a single place is over a great area. To analyse the environmental impact of the livestock the migration patterns of the nomads would have to be examined.

As in the case with crop production, the resource management institutions would have to be analysed. This investigation would be concerning MAIL, on how this institution manages the rangeland resources, assists the pastoralists and regulate the livestock numbers to ensure that the environmental impact does not exceed the environments resiliency. The general environmental and land management could also be necessary because of the nomadic pastoralists range.

The focus in this project has been on the physical and natural structures in the Afghan agriculture another approach that could be advantageous is a focus on the problem in the trade off between a economic growth and rural stability. If the development happens with a focus of economic growth there is a chance that the free market would make the large landowners richer while the poorer rural population stays or becomes poorer as Afghanistan develops [Roe, 2009]. Therefore could a socioeconomic study on how to ensure that the poorest part of Afghanistan is not left behind and what effect this 'pro poor' policy would have on the general development in

Afghanistan. This would require both a general study in how to focus on the 'pro poor' and perhaps case studies on other areas that have used this policy with or without success. It could involved community based projects, where all parts of a rural community has a share in a common investment such as a dairy or a textile plant. This could help the local community to increase their profit by processing their own products and thereby get a higher price.
These are some of the aspect that with further research could help improve the sustainable development of the Afghan agriculture

Counter narcotics, Counter Insurgency and development
This project has focused on the root cause of opium production, which is the lack of alternative for Afghan farmers. But as established through out this project some of the other conditions that facilitate the opium production and trafficking also hinders the development of a sustainable agriculture. These being the lack of security, the high corruption and the border management. Where the insecurity prevents the establishment of development project and assistance to the farmers in the southern areas. If there had been more time and resources for the researching these aspects could have been analysing in order to better the chances of a sustainable agriculture.

A project with a focus on the military geographical perspectives. Such as how to improve the cooperation between the counter-insurgency, counter-narcotics and development efforts. As mentioned in chapter 3 the counter-narcotics lack the firepower to handle the Taliban protected facilities and caravans. Cooperation between counter-narcotics and counter-insurgency could give the drug enforcement the firepower it needs. This could also bring the fight to the Taliban instead of fight them on their hit and run premise.
A cooperation between counter-insurgency and development could help the farmers that lives in areas with a high Taliban presence. US forces in Afghanistan has the winter 2008 started a strategy called Agribusiness Development Team (ADT). It is a strategy that have been used in Central America for 20 years. The ADT consists of regular soldiers and soldier with agribusiness degrees or experience in dryland farming[US Army, 2008]. While the regular soldiers provide security, the specialists assist the Afghan farmers. The ADT also suggest other crops to the farmers and provide them with seeds. The high corruption is as mention as hindrance for the development process as the need for bribes increases the cost of investments and can discourage development projects. Since this approach has been done before in Central America [US army, 2008].

A research into how to stop governmental corruption would require knowledge on how this practise is done and on how deep this corruption goes. An investigation on how corruption is combated in other developing countries would give some indications of best practises and what

not to do Border management is both important to stop the flow of illegal products in and out of Afghanistan, but also to ensure that the Afghan agriculture has access to the regional and global markets. A case study of the current border management at main border check points and comparing this with best practise would reveal the strengths and weaknesses of the Afghan border management. By studying how the agricultural products are handled at the border and how the further shipping is arranged it could be possible to improve the commodity chain.

These are some of the different aspects concerning the opium production and the Afghan agriculture, that if there was time and resources it would be interesting to research further.

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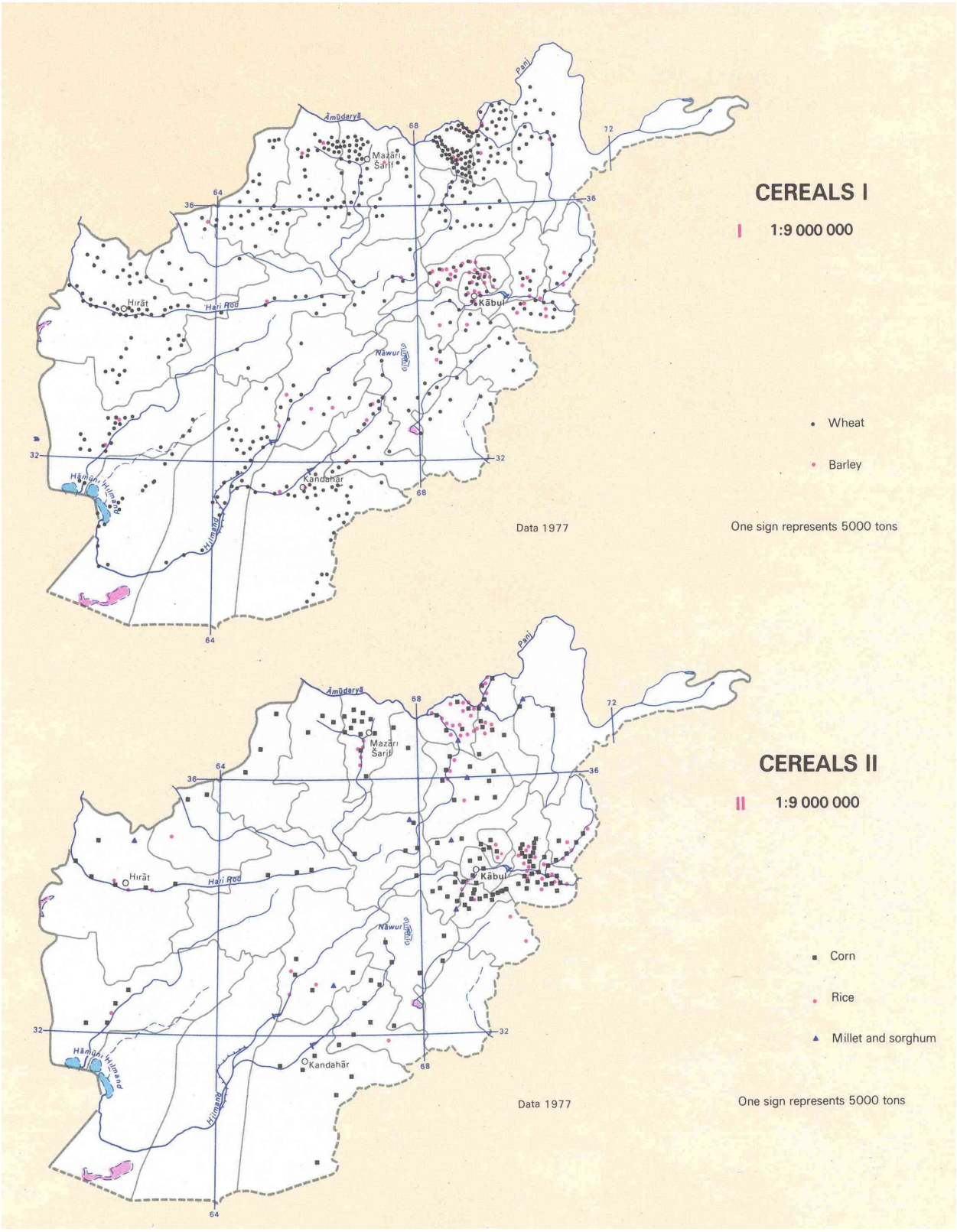
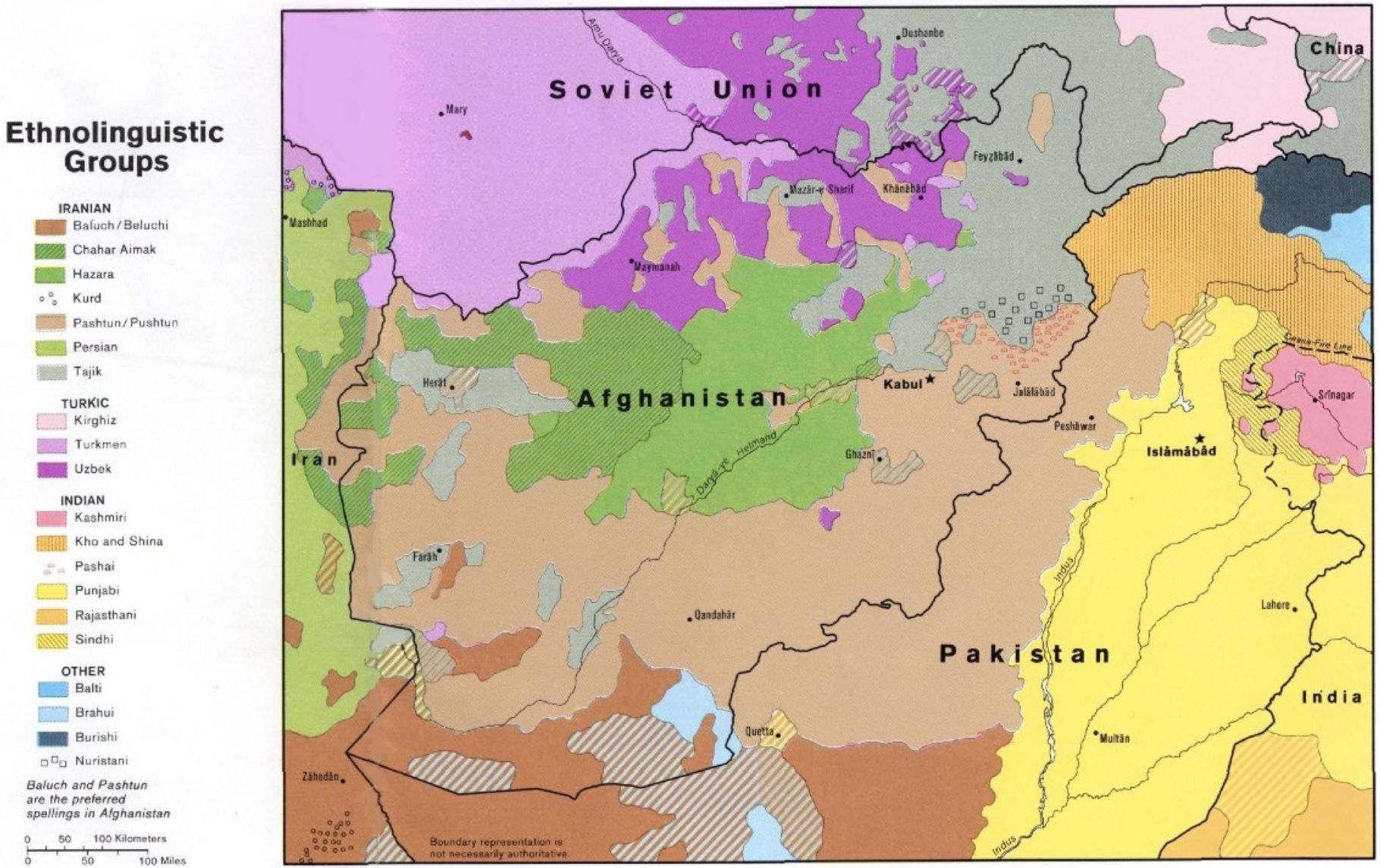
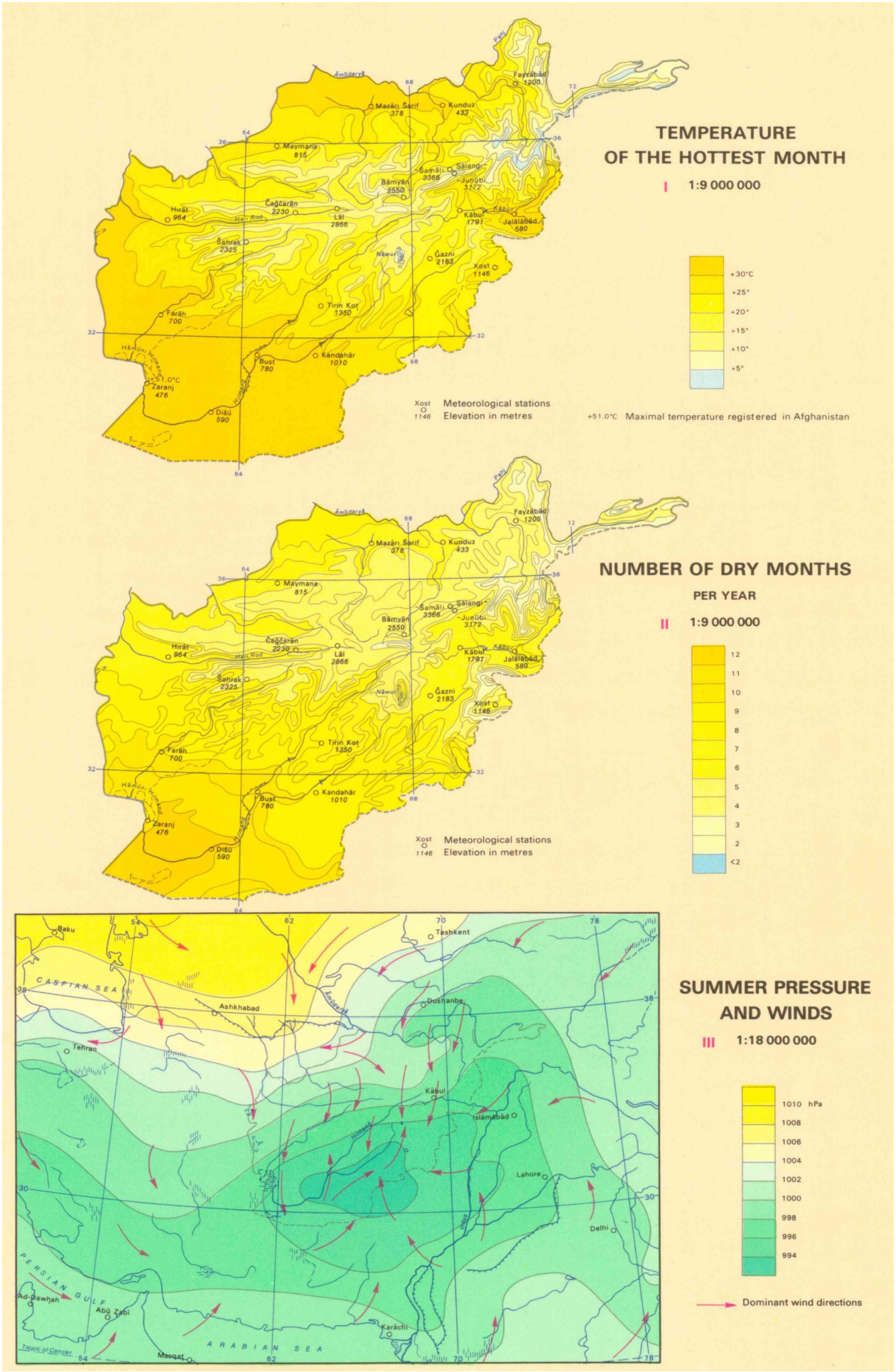
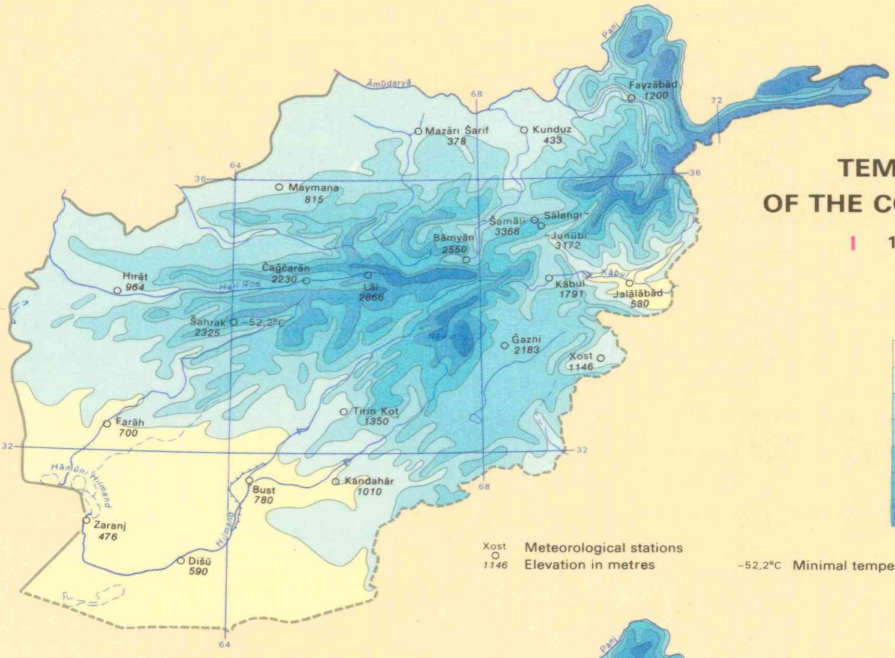
Appendix I: Selected maps from National Afghanistan Atlas

The National Atlas of the Democratic Republic of Afghanistan is the only comprehensive collection of thematic maps prepared by Afghan specialists. The project was a joint venture between the Afghan and the Polish Geodesy and Cartography Head Offices, with the assistance of UNDP. The work on the atlas was started in 1977 and it was completed in 1984 [AIM, 2009]. This appendix contains selected maps from this. These are agricultural production, ethnolingustic groups, and various map concerning climatic conditions such as hottest month, number of months with < 0° C, seasonal winds and pressures.




Ethnolinguistic Groups
IRANIAN
Baluch / Beluchi
Chahar Aimak
Hazara
Kurd
Pashtun / Pushtun
Persian
Tajik
TURKIC
Kirghiz
Turkmen
Uzbek
INDIAN
Kashmiri
Kho and Shina
Pashai
Punjabi
Rajasthani
Sindhi
OTHER
Balti
Brahui
Burishi
Nuristani
Baluch and Pashtun are the preferred spellings in Afghanistan
0 50 100 Kilometers
0 50 100 Miles
Soviet Union
China
Afghanistan
Iran
Pakistan
India
Amu Darya
Dushanbe
Mary
Feyzābād
Mazār-e Sharif
Khānābād
Mashhad
Maymanah
Herāt
Kabul
Jalālābād
Peshāwar
Islāmābād
Srīnagar
Cease-Fire Line
Ghaznī
Darya-ye Helmand
Farāh
Qandahār
Indus
Lahore
Multān
Quetta
Zāhedān
Boundary representation is not necessarily authoritative.


TEMPERATURE
OF THE HOTTEST MONTH
I 1:9 000 000
+30°C
+25°
+20°
+15°
+10°
+5°
Xost 1146 Meteorological stations
Elevation in metres
+51.0°C Maximal temperature registered in Afghanistan
NUMBER OF DRY MONTHS
PER YEAR
II 1:9 000 000
12
11
10
9
8
7
6
5
4
3
2
<2
Xost 1146 Meteorological stations
Elevation in metres
SUMMER PRESSURE
AND WINDS
III 1:18 000 000
1010 hPa
1008
1006
1004
1002
1000
998
996
994
Dominant wind directions
Fayzābād 1200
Mazār Sharīf 378
Kunduz 433
Maymana 815
Bāmyān 2550
Šamāli 3366
Sālangi
Junūbi 3172
Hirāt 964
Čağčarān 2230
Lāl 2866
Kābul 1791
Jalālābād 580
Šahrak 2325
Ġazni 2183
Xost 1146
Farāh 700
Tirin Kot 1350
Kandahār 1010
Bust 780
Zaranj 476
Dišū 590
Baku
Tashkent
Dushanbe
Ashkhabad
Tehran
Kabul
Islamabad
Lahore
Delhi
Karāchi
Masqat
Ad-Dawhah
Abū Zabi
CASPIAN SEA
PERSIAN GULF
ARABIAN SEA
Tropic of Cancer



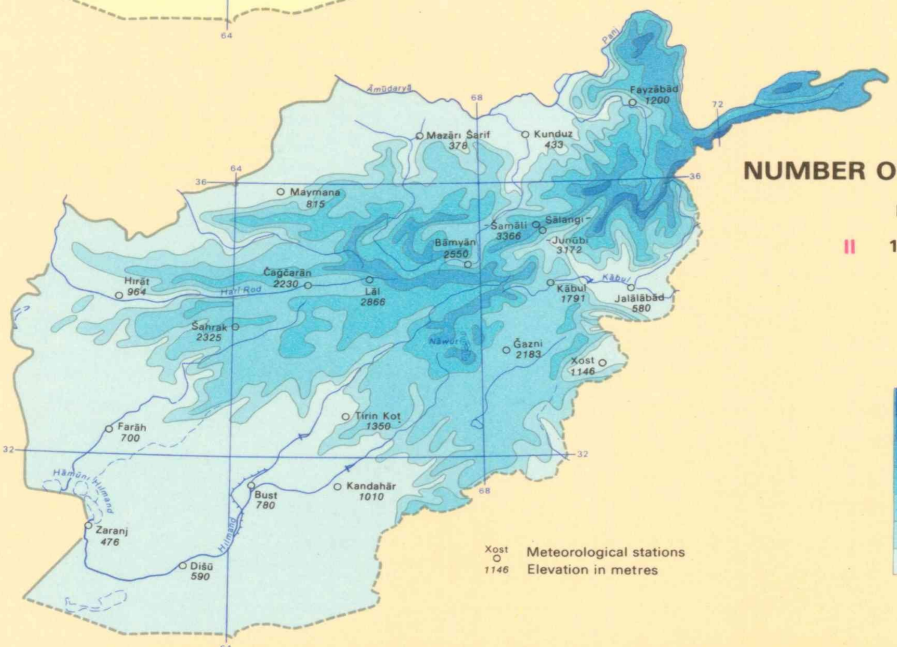
TEMPERATURE OF THE COLDEST MONTH

I 1:9 000 000

+5°C
0°
−5°
−10°
−15°
−20°

Xost 1146 Meteorological stations
Elevation in metres

−52,2°C Minimal temperature registered in Afghanistan

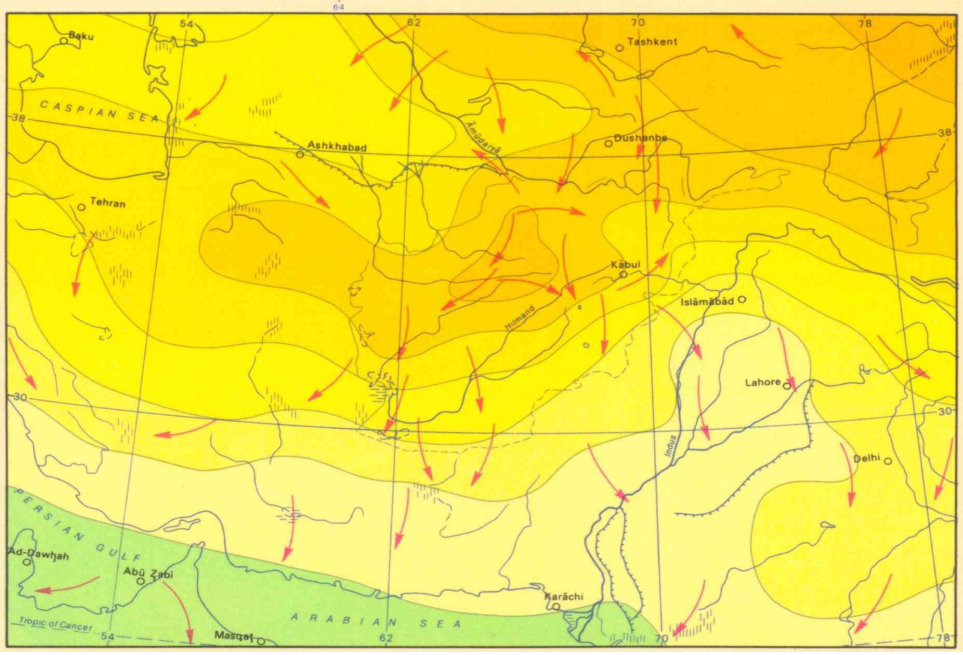


NUMBER OF MONTHS T≤0°C PER YEAR

II 1:9 000 000

11–12
9–10
7–8
5–6
3–4
1–2
0

Xost 1146 Meteorological stations
Elevation in metres

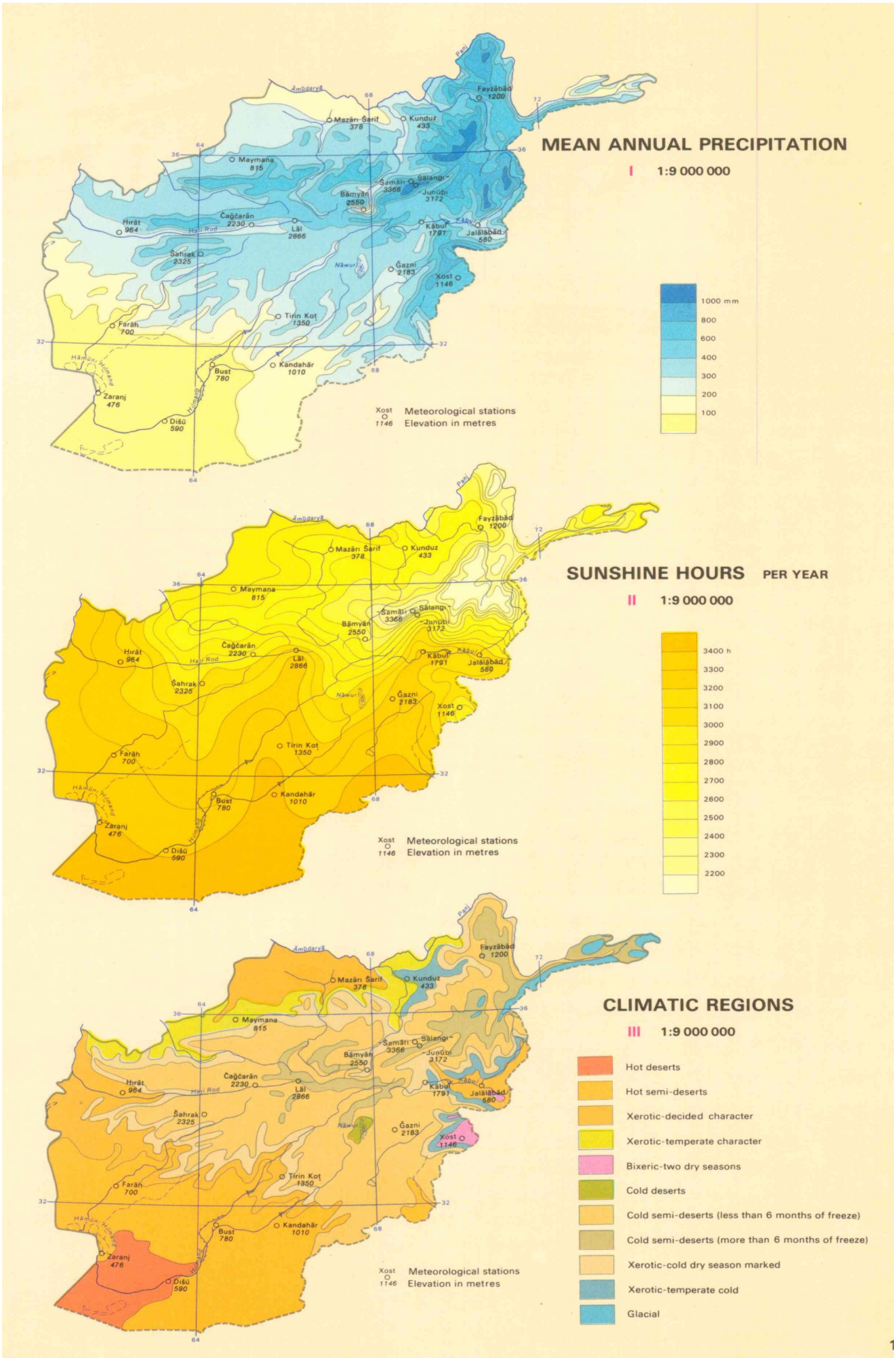


WINTER PRESSURE AND WINDS

III 1:18 000 000

1028 hPa
1026
1024
1022
1020
1018
1016

Dominant wind directions


MEAN ANNUAL PRECIPITATION
I 1:9 000 000
1000 mm
800
600
400
300
200
100
Xost 1146 Meteorological stations
Elevation in metres
SUNSHINE HOURS PER YEAR
II 1:9 000 000
3400 h
3300
3200
3100
3000
2900
2800
2700
2600
2500
2400
2300
2200
Xost 1146 Meteorological stations
Elevation in metres
CLIMATIC REGIONS
III 1:9 000 000
Hot deserts
Hot semi-deserts
Xerotic-decided character
Xerotic-temperate character
Bixeric-two dry seasons
Cold deserts
Cold semi-deserts (less than 6 months of freeze)
Cold semi-deserts (more than 6 months of freeze)
Xerotic-cold dry season marked
Xerotic-temperate cold
Glacial
Xost 1146 Meteorological stations
Elevation in metres
Panj
Amūdaryā
Fayzābād 1200
Mazārī Šarīf 378
Kunduz 433
Maymana 815
Šamāli 3366
Sālangī
Junūbī 3172
Bāmyān 2550
Hirāt 964
Čağčarān 2230
Hari Rod
Lāl 2866
Kābul 1791
Kābul
Jalālābād 580
Šahrak 2325
Nāwurī
Ğazni 2183
Xost 1146
Tirin Kot 1350
Farāh 700
Hāmūn-i Hilmand
Bust 780
Kandahār 1010
Zaranj 476
Hilmand
Dišū 590

Appendix II: Aridity index for locations in Afghanistan.

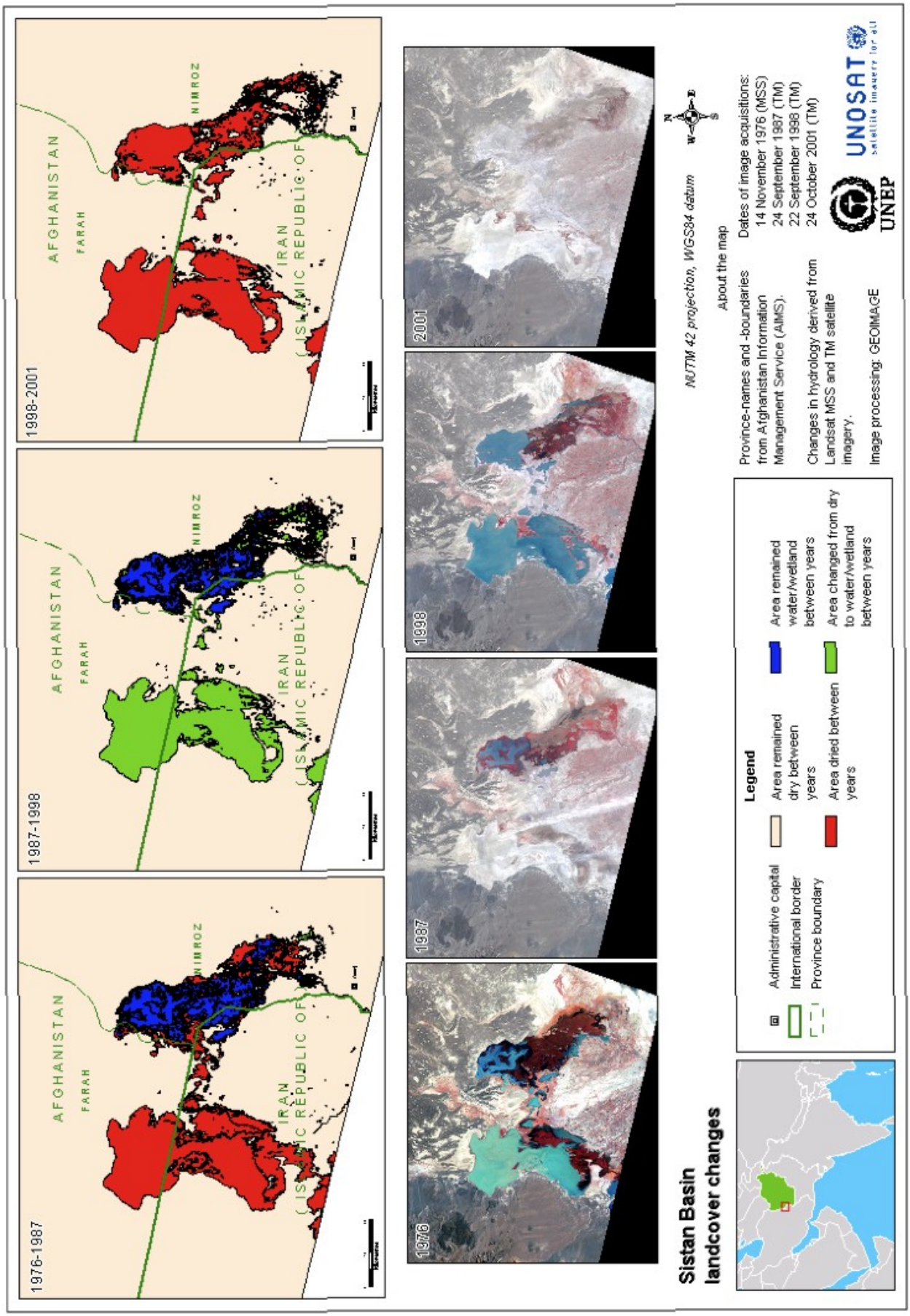
Shows the Climatic data for different locations in Afghanistan, data is from Aziz [2002]. Aridity index is calculated after P_{annual}/ETP_{annual} as described in UNEP [1992].

The drylands are areas with a AI < 0,65. The areas can be further divided into;

Dry Sub-Humid 0,65>0,5, Semi-Arid 0,5 > 0,2, Arid 0,2>0,05 and Hyper-Arid 0,05>

Location	**Province**	**Position**	**Elevation (m)**	**Precipitation (mm)**	**Temperature (Cº)**		**Annual ETP (mm)**	**Aridity Index (AI)**
					Min	**Max**		
Shiberghan	Jowzjan	Northern	360	214	-2	+38	1.420	0,15
Mazar-I-Sharif	Balkh	Northern	378	190	-2	+39	1.530	0,12
Kunduz	Kunduz	Northern	433	349	-2	+39	1.390	0,25
Baghlan	Baghlan	Northern	510	271	-2	+37	1.100	0,25
Faizabad	Badakhshan	Northern	1.200	521	-5	+35	1.020	0,51
Maimana	Faryab	Northern	815	372	-2	+35	1.310	0,28
Lashkargah	Helmand	Southern	780	89	0	+42	1.720	0,05
Kandahar	Kandahar	Southern	1.010	158	0	+40	1.790	0,09
Herat	Herat	Western	964	241	-3	+36	1.720	0,14
Qadis	Badghis	Western	1.280	323	-3	+30	1.240	0,26
Farah	Farah	Western	660	77	0	+42	1.610	0,05
Jalalabad	Nangarhar	Eastern	580	171	+3	+41	1.350	0,13
Khost	Khost	Eastern	1.146	448	-1	+35	1.390	0,32
Jabul Saraj	Parvan	Eastern	1.630	499	0	+31	1.610	0,31
Kabul	Kabul	Eastern	1.791	303	-7	+32	1.280	0,24
Ghazni	Ghazni	Central	2183	292	-11	+31	1.420	0,21
Lal Wa Sarjangal	Ghor	Central	2.800	282	-21	+25	950	0,3

Appendix III: Change in the Sistan Basin 1976-2001



Appendix IV: Kunduz river basin profile [Varzi & Wgerich, 2008]