“Death and winter come suddenly. God only knows there’s time”:

Perceptions of Jordanian Bedouins in Northern Badia of precipitation and Local knowledge among their expressions

A Research project Submitted to

Larenstein University of Professional Education in

Partial Fulfilment of the Requirements for the

Degree of Master of Development,

Specialization Rural Development and communication

By

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September, 2011

Wgeningen

The Netherlands

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ACKNOWLEDGMENT

First of all, I want to thank the different institutions and members for their effort into bringing this project together.

Utmost love, pride, and appreciation to Dr. Adnan Koucher , for his remarks that lead to a clear road for me, to start through the study and for his intensive follow up of each piece of this work.

I would like to express sincere gratitude to Dr.Loes witteveen , who supported and helped me, to complete the study in VHL. I thank her also on behalf of my small family for giving us the confidence and faith of success.

I deeply appreciate my co-advisor in Jordan, Prof. Mohammaed Al-Shunnaq whose comments improved this thesis project.

I appreciate all of the lecturers who drew a spot light and guidance during management of development course.

I am deeply thankful to the Dutch government, for their financial support to complete my masters' course.

Last but not the least; I thank all my friends, who helped me through the course.

God bless all of you

Alshedeifat, Nizar

DEDICATION

To my parents Ms.Hamida and Mr.Mustafa . Who are taught me that knowledge does not come easily because it is not easy to carry.

To my daughter Reema and son Tameer ,

To my lovely wife Fatima who has always been there through the hard times.

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ACRONOMYS

DOS	Department of Statistics.
FAO	Food and Agriculture Organization.
IFAD	International Fund for Agricultural Development.
JL	Jordanian legislation.
JOD	Jordanian Dinar.
JMD	Jordan Meteorological Department.
JBRDC	Jordan Badia Research and Development center.
JHFDB	The Hashemite Fund for the Development of Jordan Badia.
MOA	Ministry of Agriculture.
MOP	Ministry of Planning and International Cooperation.
UNEP	United Nations Environment Programme.
WUR	Wageningen University .

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ABSTRACT

The research was conducted in the Northern Jordanian Badia. The research found out how the Northern Jordanian Bedouins perceptions towards precipitation ; and exploring how this local knowledge is, in perceiving precipitation, valuable, conveyed, and means of communication all over northern Jordan Badia by Bedouin. The local knowledge term concerning precipitation, has been used exchangeable with terms, which refer to the cumulative experiences in the community.

The research has been done by conducting, a checklist questions among fifteen Bedouin elders. The snow ball method has been used through asking each elderly, to name experts of local knowledge concerning precipitation. There were limitations in applying the snow ball method, found in literatures. Therefore, limitations were taken into consideration. In addition, an expert with different interdisciplinary relevant to research problem has been interviewed.

The research also draws upon reviewing a secondary data relevant to the research problem, which provides solid background, and made findings credible. It's covered the local knowledge concept; characteristics; types; the importance of local knowledge, to development and the myths as instrument save and transmit the local knowledge.

Furthermore, the secondary data had been used to reviewing the perception of precipitations. About factors shaping perception and the precipitation prediction signs, founded among previous literatures like atmospheric pattern's, celestial bodies, birds, and animals. Bedouin concept also reviewed in a different point of view.

The findings showed that knowledgeable elders have listed the local winter calendar in Northern Badia. They memorize*(ailol "gridan ", tasarin "qran 17 " , kanun awl "qiran 13",kanun tani "qirn 11" , s'bat "qiran 9", adar "sbaici ",Naisan "khamis",ayyar "Jumada ",huzzairan "klash ") . Meanwhile, in their folk calendar , they divided the year into four periods (thalath qaid , thalath sufri , ashtweyyah , and thalatha rabic*). Furthermore, winter is divided into Alskmsaniaya and Almurbaniya.

Celestial bodies, and the winds movement and origin, were used for precipitation prediction. Those knowledgeable Bedouin elders have astronomers' knowledge, transmitted through generations.

The findings also showed bio-signs. Bird of *Alrha* , red worm , and small rose flower were identified by elders as indication of precipitation time.

The findings had been transliterated, and translated into English language, due to the importance of the local linguistic. The identity of the Bedouin can be at linguistic materials. The different experts interviewed have agreed the elderly knowledge associated with precipitation.

The challenge is to continue and find out the local knowledge in perceiving precipitation, among the other members inside Northern Badia society. In addition, documentation of local knowledge related to precipitation, can be other challenges since it will be lose, if one of the Bedouin elders pass away.

CHAPTER ONE – INTRODUCTION

1.1 Background

In Jordan, drought had a privilege to pass everywhere in the lives of Jordanians. Jordan is ranked in the top ten countries in the world with the least amount of rainfall. Jordan is classified as fourth water poorest countries in water resources in the world (Denny, et al., 2008). Most development research projects conducted on national and local level have focused on intervention with the use of technology. Such as irrigation technologies for raising efficient water use. These development research project adapted new techniques and plants varieties of which are resistance to long dry seasons (Ziadat, et al., 2011). They, also, use the treatment of grey water for particular crops and they construct dams and bonds to harvest and conserve water (Al-Adamat, et al., 2010; Mcllwaine and Redwood, 2010). Instead, Jordan depends on precipitations as a source of water. And this erratic precipitation may not be solved by such technologies within regions like Badia which depends on precipitation in their cultivation and livestock production for their livelihoods (Warren and *Cahman*, 2010).

However, these development projects and research suggest solutions without taking into account the local knowledge of the Bedouins as a way of reducing the risk of climatic factors: like erratic precipitation. The little precipitation may reduce production, and lead to a lower income. As a result, there will be a lack of food (IFAD, 2011).

Exploring and understanding local knowledge regarding precipitation may lead to desirable effects through efficient use of local resources. Historical evidences provide knowledge on how Jordanian Badia was a civilized area inhabited by different nations throughout history and under the local semi-dry climate. The palaces like Qaser Amra, Qaser Al-Kharraneh, Qaser Al-Azraq, Um Aajmal, Dair Al-Kahaf and Qaser Burq can be meaningful examples of strategies of successful livelihoods.

Badia (i.e. semi-desert region) compromises 80% of the total area of Jordan, and its inhabitants are Bedouins who consist approximately 5% of 5.7 million Jordanian residents of the country (HFDJB, 2011**).** Badia's regions represent desert land in Jordan which receives (≤200 mm.) precipitation per year in different forms like rainy storms and flooding. The precipitation effects change due to temporal atmospheric phenomena and topographical factors, respectively **(**Dahamsheh and Akoys, 2007). Bedouins adapt strategies for their livelihoods according to their experiences in their fragile environment. For instance, some Bedouin clans have folk calendar for rain season. It is classified into 90 days, the first 40 days of which are called *Almirbacaniyah* (i.e. forty days) and the rest are called *AL khmsiniyah* (i.e. fifty days) which can be divided into four periods each of which is 12 ½ days .Each period has a name and represents a local climatic phase. The first is called *sa`ad dabih* (i.e. sa`ad the slaughterer) which represents the coldest and rainy period; the second period is *Sa`ad balac* which is characterized by soil saturation of rain water; The third period is *Sa`ad saoud* in which the dormancy is broken in plants; and the last one is *Sa'ad alkhabya* (i.e. the luck of hidden creatures like snakes or reptiles) which is characterized by warm climate and flowering period. The whole rainy calendar is called *Sa`ad saoud* and it has a historical story which is common among the Bedouin societies.

This knowledge has a scientific background. For instance, the *Sa`ad* phases is an astronomical phenomena.

Such local knowledge helps the Bedouins forecast opportunities as well as risks.

They decide the appropriate strategy applied in cultivation of crops like barely. Forecasting long dry seasons which force them to take decisions of mobility from east to west pastoral region for months as a resilience strategy of coping with drought based on their perception to erratic climate factors.

In Jordan, there are several institutions that focus on sustainable development in the Jordanian Badia. Some of these institutions have royal support. This royal care among these institutions stresses the importance of the Badia .In spite of these institutions, Bedouin's local knowledge is still far away from involvement in planning and sharing in development projects in Badia regions. Despite some researchers concerning water harvest start using local knowledge as guidance for their work. Furthermore, investigation of such a research may highlight the benefit of local knowledge concerning Bedouins' perception of precipitation as expressed in their local knowledge.

1.2 Research Statement of the Problem

Precipitation is a crucial factor for Nomads community. The interest of precipitation is found among the history of Nomads and linked with evidence like signs and letters found on their tales, folklores and poetry.

The Jordanian Bedouin (i.e., Nomads) manifested these interests by traditional language, behavior or artificial accumulated and storage in statements or practices transmitted from generation to another. In Badia, every individual in the society have a local knowledge, however, the quality and quantity is vary from one to another. The elders either female or male are the main source of local knowledge.

Development projects and research that working and applied in Badia suggest interventions without taking into account the local knowledge of the Bedouins as a way of reducing the risk of variable precipitation. The little precipitation may reduce production, and lead to less income and lack of food.

Nowadays, there has been growing interest and urgency to study the local knowledge related to precipitation in Badia due to lack of studies dealing with this topic. Exploring and understanding local knowledge regarding precipitation may lead to desirable effect through efficient use of local water resources since rainfall is the limitation factor for water in Jordan.

1.3 Research Objectives

- To find out Bedouin's perceptions towards precipitation; in the Northern Badia.of Jordan.
- To explore how local knowledge is valuably conveyed in perceiving precipitation and a means of communication.

1.4 Research question

This research project is an attempt to handle the following questions**.**

1. **How local knowledge shared among Bedouins communities helps in perceiving precipitations?**

   1.1 What is the main local knowledge of perceiving precipitation?

   2.1 What procedures do the Bedouin take during precipitation?

2. **What is the contribution of Bedouins local knowledge of perceiving precipitation?**

2.1 What is the Bedouins reaction to precipitation period?
2.2 How are the Bedouins conveying local knowledge of perceiving precipitation?

1.5 Limitation of the study

Since each Bedouin tribe is characterized by certain accent and pronunciation , it was difficult it was difficult for the researcher to have full understanding about the Bedouins culture and their verbal .

CHAPTER TWO -LITERATURE REVIEW

This chapter elaborates the concept of Bedouins local knowledge and its significance for the Bedouins development. It also explores the characteristics of the local knowledge. Furthermore, it introduces perception of precipitation and several indicators that can be used in perceiving of precipitation. The myths, or, folk-tales, the container for most of local knowledge are, also, explored.

2.1 Concept of Local knowledge

The concept of local knowledge can be a controversial term. Barnes (1974) as cited in Blaikie, et al. (1997) stated that there were several scholars who classified the knowledge systems into two categories; "scientific" knowledge and "local" knowledge. Other scholars used "scientific" term as professional, western, rational, or civilized. Some scholars , described the "local" knowledge as indigenous, firsthand experience , primitive or savage for classification (Blaikie, et al. ,1997 ;Agrawal ,2008 ; Courburn ,2003 ; Barnes ,1996).

Concerning local knowledge , a number of terms are determined and interchangeably used to refer to the local knowledge, including community knowledge ,traditional knowledge ,indigenous knowledge , traditional ecological knowledge ,indigenous technical knowledge , indigenous knowledge system and rural people knowledg (McGregor,2006 ; Blaikie ,et al. , 1997 ; Agrawal ,2008).

These terms express the user's methods to observe and measure their surrounding environment and how they solve their problems in harmony with their surroundings. It is noticeable, from previous perspectives, that all these interchangeable terms include a process to generate knowledge and how it is applied. It is obviously stated that the previous terms can reflect the context in which the knowledge is produced. Geertz (1983) as cited in Courburn (2003) defines local knowledge as

> *"Practical, collective and strongly rooted in a particular place "that forms an "organized body of thoughts based on immediacy of experience ".*

The primary dimension behind all these previous concepts is the locality. Locality in knowledge doesn't mean the geographical dimension, but it does mean how this interchangeable term is produced within a particular context. For instance, indigenous knowledge can be defined as local knowledge that is unique to a particular culture or society. In other words, Indigenous knowledge is the total of beliefs and institutional practices, developed over time and adapted to a local condition for particular society members. Similarly, traditional knowledge expresses a way of life, based on teaching and experiences from generation to another. Furthermore, it gives credibility to the people (UNEP, 2011; Traditional knowledge, 2011).

For the purpose of this thesis, the term of local knowledge will include the way in which the informants of the study observe and measure their surroundings regarding precipitation and how they solve their problems concerning precipitation. It, also, includes the process whereby knowledge related to precipitation is generated, stored, applied and transmitted to others (FAO, 2011).

2.2 Characteristics of local knowledge

Understanding the characteristics of the local knowledge is crucial to distinguish the local knowledge as a social activity embedded in a particular society among other social activities. The characteristics of local knowledge determine identity of society that can be noticed

through skills, wisdoms and innovations of society members (Barnes, 2003).

These skills, wisdoms and innovations which are expressed and manifested in forms that adapt in that society. Barnes (1996) argued two dimensions for the local knowledge. The former includes the geographical and historical location. The geographical and historical restriction for the gained knowledge can be grasped through cultural ethnicity of a certain society like language and technical jargon. The latter includes the local conditions of local knowledge that produces the knowledge, which affects substantively the nature of the knowledge produced. The [re]production and adaptation of local knowledge are understood as a result of the needs of local conditions. This local knowledge cannot be divorced from the natural and cultural context within which it has arisen (Kumar, 2010).

However, literatures reported misunderstanding of interchangeable concepts related to local knowledge (Briggs, et al., 2006). Conducted Bedouins in "The nature of indigenous environmental knowledge production: evidence from Bedouin communities in southern Egypt" study, were clarified "indigenous knowledge" term as an implicit knowledge that is internally of their society, and evolved only within that society, and passed through the generations within family, so that this knowledge is unaffected by outside world.

The main problem in describing nature of local knowledge is how individuals recognize their knowledge and accumulated experiences. This problem can be explained by the mismatch between the context in which this knowledge is produced and the geographical borders in which the knowledge is applied. The justification of southern Egypt Bedouin may open a debate about the knowledge "unaffected by outside world "as a concept in its own characteristics like other kinds of knowledge.

The geographical and historical boundary is also justified by Courburn (2003) as the identity for a group, not society, since some groups can share with language, religion, norms, habits or interests. In addition, Courburn (2003) reported three basics can be ground to the local knowledge, the first of which is the social environment within which the knowledge processed by individuals or society over time within a local culture .The second , a physical environment that means geographical or ecological environment through which knowledge is born, colored, and adapted. Also, innovation which means ideas and materials enter into construction of knowledge as a result of an interactive process of knowledge generation. Generally, local knowledge is characterized by locality and accumulation of experiences, orally and non-written, and (re)produced knowledge.

In this research researcher will explore the social, geographical and ecological characteristics of the study area. In addition, the notions and tools used to predict precipitation will, also, be explored.

2.3 Types of local knowledge

Quality and Quantity of local knowledge vary across a certain society. The difficulty to distinguishing between different types of local knowledge based on a social activity is related to this knowledge. Several authors categorized local knowledge according to entire knowledge type. The individuals in the society can hold the same local knowledge regardless of gender, or age.

This common local knowledge is easy to be understood and transmitted through male,

female, young or elder. For instance, Alzweiri et al., (2010) found that most of Bedouins in northern Badia have a good knowledge of the wild medicinal plants spread in their area whether these plants are edible, medicinal or for grassing purposes.

There is a type of knowledge shared among many who have the same interest which is not common among society individuals. This type has its own methods to share and transmit compared with common knowledge transmission ways. For example, the knowledge on the use of plants in health care can be found within a certain group of society and this knowledge needs special methods and techniques to be shared and transmitted to others. The Last type is held by a few people who might have got training or exercises for a long time. Those few people can be considered in their society to be the most knowledgeable within their locality **(**Davis and Wagner, 2003**).**

Authors reported that elders were chosen since they are generally expected to possess decades of more extensive experience than younger generations (Ferguson and Messier, 1997).

Local knowledge domain is another way for classify knowledge , according to the entire materials in local knowledge, like ecological local knowledge, traditional agricultural knowledge, local food knowledge, local herbal knowledge or local forecasting knowledge. (Ballard , et al. ,2008 ; Kumar,2010; EM Harris, 2011; Alzweiri,2011; Orlove, et al . , 2010) .

The thesis will be conducted with elderly Bedouin in collecting the local knowledge that is classified as a local weather knowledge regarding precipitation.

2.4 Local knowledge and development

The local knowledge research can be the mediating and bridge between communities and proposed development intervention. Sillitoe (1998) has related the local knowledge research to

> "*Development issues and problems; its objective is to introduce a locally informed perspective into development, to promote an appreciation of indigenous power structures and know-how".*

In development project of rehabilitation Tell Rmah region at Jordanian Badia, project takes into account the local community knowledge in intervention. The local knowledge in Tell Rmah development project has been a crucial factor for understanding the new technologies existed in the Bedouin culture. The perception at Tell Ramah community linked to the way they predict the sustainability of the new innovations based on their experiences at local environment. The innovations cannot exist if Bedouins are not involved in this development project (Al-Tabini, et al., 2008).

Instead, in some cases of Jordan, scholars carried out drought analysis studies in Jordan under current and future climates in order to reduce its impacts at different life sectors. However, these studies depended on a scientific approach regardless of local interest of the weather forecasts even though studies goals are to reduce risks of rain variability (Al-Qinna, et al., 2010).

These findings of studies can be correspondent to the local knowledge, of the local calendar of seasonal weather, signs and the way of predictions for weather pattern.

These accumulated experiences in a community culture have the power to provide problem-solving strategies. Such as making decisions to adapt weather challenges, and creating progress at social and economic levels. Authors argued three factors that can block the sustainable development which are linked to one another .The climate variability causes a decrease in water and may lead to the soil degradation and desertification. And supposed that the most effective way to deal with increasing vulnerabilities due to climate variability is through interacting traditional knowledge in development process (Rengalakshmi ,2005). Furth

ermore, Warren and Cashman (2003) listed different scenarios illustrating how success in development can be achieved with involvement of indigenous knowledge in planning and implementation. In this case, local knowledge in combination with outsider knowledge may create livelihood development success. Otherwise, the risk increases as much as intervention is far away of including interactive participation of local knowledge.

In addition, local knowledge cannot be a communicated tool only but it is also a community innovation that had been adapted and built during decades through a local condition and improved as an optimal strategy to create livelihood progress. Some literature agreed that tribes in developing societies (re)produced an eco-friendly and sustainable local knowledge after decades of considering the tribal members as laggards in their response to the development projects (Kumar ,2010) .

The response of the informants of the study in conducting local knowledge about their perception to precipitation can give the researcher a clear image of how the Bedouins adapt and create success in their local environment.

2.5 Myths as a convey tool for local knowledge

Communities tend to use myths and include those accumulated experiences from real life, when these communities can't find a reasonable explanation for such phenomena. Strauss (1958) as cited in Lemert (2004) found that myths can be the mean for saving local knowledge. This local knowledge might be an astronomical phenomenon or phenomenon relevant to various weather patterns and thus these myths can be the best way to get out of the inability to know and explain the phenomenon. However, in case of using myths that includes local knowledge, it's important to look at the linguistic aspect of the accent used to tell the story, in addition to the local encoding within the telling of a poem, song or a story.

In this part scholars argued that these two factors, language and storytelling afford the validity of a myth for each time, it works for past as for present, and can be used in the future. The language can be sort as a social institution and a system of values. Language as a social institution is one of the specific elements for the communities' identity and a way of communication that characterizes a community. As a system of values there are elements for this language difference in their values according to their use, the value is determined by application compared to other uses in different situations (Strauss, 1958; Barthes, 1964).

The same thing on storytelling or speech, it is a language practice in part and in parcel wherein persons choose what they need to clarify what is going on in their minds and their thoughts and expresses it in language, due to the psycho-physical factor which plays an important role in the storytelling or speech.

Using the local accent in storytelling and creating the pot in which individuals restore their local knowledge, as a result of an accumulated experiences throughout the last decades cover and preserve these language elements (i.e., a social institution and a system of values) with the identity of that community, and reflect the way of expression and communication among the individuals in that community.

This makes it crucial to pay attention to transfer language the same language used in storytelling as it is in, the myth containing that knowledge, when used as a source for local knowledge.

The transmission and the spread of local knowledge among people in the community can be remedied from the environment where these thoughts are built and similar in the perceptions of individual's imaginations.

2.6 Perceptions of precipitation

2.6.1 Perception

Perception is the end product of a complicated way in which awareness and understanding of concern build and manifested (Goldstein, 2009). It is a kind of risk management in terms of designing effective intervention. When perception expects threats over time can reduce this risk, and shape a space for developed success (Renn, 2010). Perception of precipitation can be presented in several forms such as stories; songs; proverbs; rituals and dancing, shared and communicated between community members (Grenie, 1998). The local knowledge among these forms has been built up from different sources at which it was examined, weighted, tried and exercised. These conveying messages are transmitted, considered, and understood in terms of communities culture (Vansina, 1985).

The accumulated experiences received and expressed in the local knowledge provide problem-solving strategies, help communities to face different challenges and make economic and social progress (Briggs, et al., 2006). Hence, the local knowledge is recommended not to be isolated or neglected in developing programs at any culture regions and these ways of life must be protected and used (McGregor, 2006).

Taylor, et al. (1988) has specifically described four coherent elements (memory, experiences, definition, expectation) that shape perception. Instead, have stated that the formation of perception affected through which a certain culture will determine the perception. The studies focused on behavior concept at individual levels as the limitation for bringing the perception (Ajzen and M.adden ,1986; Jones ,1990).

The personal experiences interact with what is practiced in surrounding environment. The more effective interaction is at livelihood, the more memories will be stored in their brain. These memories will be recalled again and again under particular names and labels. Drawing likelihoods according to these memories will shape the behavior of the individuals at a particular community concerning what it was previously practiced. Similarly, Leeuwis and Ban (2003) indicated that perception can be described as a process by which information or motivation from surrounding environment transformed into psychological awareness. It can be said that local knowledge is a local way to understand the world through experience, giving value to things and behavior within a particular culture.

The scholars concentrated on the idea that understanding the perception and categorization of weather and climate in different cultures is very important to the process of making meteorological information more useful for local communities. Indeed, the people can accept the information regarding weather forecast to do their activities, if they find that their cultural repertoires and their experiences are used as a source for these forecasts.

Hence, in this search researcher will reveal how a Bedouin community sees and interprets their experiences regarding precipitation that lead to particular understanding in their perceptions of precipitation (Blench, 2003).

2.6.2 Perception of precipitation

The perceptions of people towards weather pattern reflect a livelihood adaptive strategies for resilience's founded on their local knowledge, stored in their memories and expressed in different forms like stories, songs, folklores and proverbs. Several scholars **(**among others have dealt with different local knowledge in perceiving precipitation within different cultures and communities

(Grenie,1998 ;Strauss and S.Orlove, 2003; *Santha and Frauunholz, 2010*;Rengalakshmi,2005 ; *Weze and Haigis., 2011* ; B.chang'a , et al.,2010;World bank,1998) .

Though, the factors that form perception are similar within different cultures and communities, environmental elements can vary in quality and quantity in which it can distinguish kinds of environments. In the study community, the physical environment in terms of geographical and ecological factors is noteworthy to be discussed further. Social environment in terms of behavior, beliefs and response must, also, be explored.

Exploration of both environments will make prediction useful to perception of precipitation and decide who has experience in the surrounding environment, how will the predictions signs be, and who has practical experience to read and interpret signs of weather conditions (Strauss and S.Orlove, 2003).

Signs can be read according to experiences and knowledge of readers to community sign. Readers will weigh the value of the signs according to their previous experiences. Moreover, signs can be classified according to knowledge that perceiver brings to a certain situation. The more the reader recognizes this knowledge, the more he will predict what can happen and lead to action that may be taken **(**Goldstein, 2009).

Religions as a living memory can shape perception of precipitation in combination with signs founded .for example in the *Shariah* law, there are more than 10,000 *ayahs (i.e.verses)* in Quran concerning waters and water uses. In the Bible it was mentioned that all living things were created on the earth from water. These Holy books mention that all things that were created by God since the creation of earth are the property of God (Kadirov, 2005).

The signs of prediction precipitation can be as: trees, stars, insects, wind or clouds or be compared with previous seasons. Generally, these signs may be found at any physical environment, though, within a particular community, different local knowledge about how things linked to precipitation can be founded. The Individuals can bring reasons for selecting a sign like stars for example to predict rain.

The following categories expressed below can be common recognized codes through which the procedure can be taken to prediction:

I. Atmospheric patterns such as cloud, nature, color, or shape; or lightening occurrences.

II. Characteristics of celestial bodies. Such as the moon position, size and brightness; certain stars size, brightness, and location; or sun rise, sun set, or sun heating stress.

III. Characteristics of wind movement including its origin, direction and duration of wind.

IV. Bio-indicators. These include the observation of biological and behavioral modification or a change of ecological environmental elements such as the presence of higher than normal flowering intensity of certain trees during certain period. Animal's behavior and movement of birds; and appearance of different kinds of insect's species.

V. Monthly calendar and constellations. This domain focuses on different phrases used to describe and explore the local calendar provided with justification for each phrase.

VI. Festivals and rituals. Facial expressions and different statements used to describe the happy event in rainy time. Different statements and behavior that are manifested in long dry season. This can't be applied to the period of data

collection since rain season starts after August.

VII. The measure of quality and quantity of rainwater. By using local terms such as "*adhaka"* in India which equals 1.6 cm and " *rthath* " in Arabic which means a small diameter spray equals to dust .

2.7 Bedouin concept

Many descriptions can be related to the semi arid-arid areas inhabitances. In his study, Al-shunnaq (Shunnaq, et al., 2008) highlighted several points related to the Bedouin concept and clarified that these terms might have different descriptions for people handling it. The Bedouin term might be relevant to the moving community. In other words, the one looking for Pasture and food (i.e.*Rawwad*), as large groups of people are closely related to each other in blood, kinship or intermarriage.

On the other hand, we can call residents individuals who are related to each other by kinship or intermarriage Bedouin, however the difference is that this group is resident in one desert geographical area. This terminology connection to the desert might be the link between all of the researchers who studied this term as the regions where these groups move to or reside in are arid – semi arid regions. Furthermore, according to literatures it's agreed that Bedouin terms are more complicated than to be attached and linked only with the desert geographical areas (Shunnaq, et al., 2008; HFDJB, 2011; Al-homoud,et al., 1998).

About the arid and semi arid regions, studies like the research project "Integrated Wastewater management technologies and policies for marginal communities in Jordan "implied that some areas where the Bedouins settled are signified as rural regions which indicate development in the life style and the way of living of these communities and the presence of infrastructure (Assayed cited in Mcllwaine, 2010).

In addition, the spread of school and college education "for males and females" in these areas and the access to government jobs showed that the settlement and the absence of the term mobile community. Some researchers described the arid and semi arid regions that extend among four countries (Jordan, Syria, Iraq, and Saudi Arabia) as Arabian Desert and the people living there are known to be Bedouins (Bocco, 2006).

In Jordan, Badia is a local Jordanian term used to describe desert land in Jordan (Dalahmeh, et al., 2008). This semi-arid and arid area is cover nearly 80% of total area of Jordan (89,400 km²) (HFDJB, 2011). Many definitions can be related to desert as a fragile environment; however the climate factors are the combination among all the definitions. In Jordan, the description of Badia as an arid area doesn't mean that it's out of development. But it is rich in natural resources such as renewable natural range and cultivated land suitable for agriculture and livestock production. The Hashemite fund for development of Jordanian Badia(HFDJB) (2011) agreed that even Badia area classified as arid, as well as semiarid lands, but it is characterized by much more extensive plants and animals life. Geographically, Jordanian

Baida is classified according to its location into three sub-areas: North Badia , Middle Badia and South Badia . The division of Badia is composed of inhabitants living in it. Bedouin is the name of these inhabitants (HFDJB ,2011 ; Al-homoud, et al. ,1998).

The Bedouin is an Arabic term "*Badw* ", it is derived from the place where the people's life in Jordanian desert is. The term "Bedouin" can be a stereotyped to distinguish ethnicity in Jordan for those who live in non-urban area. The research will be conducted in this case in Northern Badia where particular Bedouin clans settled.

CHAPTER THREE RESEARCH METHODOLOGY

3.1 The informants

For this research, two types of informants have been interview, local Bedouins and experts

3.1.1 Local Bedouin Informants

In order to find out of Bedouins perception of precipitation, fifteen informants were selected male and female elders to answer questions. This elders have the most quantitative and qualitative local knowledge.

The snow pool was the tool used to cross check the information gathered from the informants.

They were asked to speak freely through an open-interview. Researcher received help and assistance from local development organization workers. And who had experiences in local community language in order to avoid bias toward the Bedouin culture.

The informants of the study included fifteen elderly ≥ 45 years old who had the experience and practice in forecasting weather, this were selected elders from Northern Badia tribes. The first five informants were 1st male, 2nd female, 3rd male, 4th female and 5th male. Each of the first five informants was asked to select male and female as informants for the study. The purpose of asking the first five informants to nominate other informants is because each informant has different d quality and quantity of information about the topic concerned. So the researcher was allowed to ask more about a particular topic.

Here, it should be noted clearly that the informant to be interviewed had the right to refuse answering any question, to cancel the interview at any given moment, or decline the interview altogether.

3.1.2 Experts

Researcher has chosen experts in anthropology; astronomy science; metrology and weather forecast; and local Badia development as follow:

I. An anthropologist from Jordanian Yarmouk University was chosen from faculty of Archaeology and Anthropology. This was through e-mail and formal letter from Van Hall Laernstein. The expert reviewed and explored the literature review available in Jordan regarding the topic concerned and supported the field work with methodology of data collection, analysis and findings;

II. The interview conducted with a meterology and weather forecast expert from Jordanian metrology and weather forecast department. He was asked about the data collected including *Almirbacaniyah* (i.e. forty days)**,** *khmsiniyah* (i.e. fifty days),winds and precipitation in Badia ;

III. The interview was conducted with an astronomical expert from Institute of astronomy and space science at Jordanian Al-albayt University. He was asked about the astronomical phenomena related to *Almirbacaniyah* **,** *khmsiniyah* **,** *AL Thurrya* i.e. Pleiades**.,** and *the qran* **.**

IV. The interview was conducted by two local Badia development experts; one of whom is an expert at the Research center of in water environment and arid regions.

And the other one is a specialist of rangeland management.

V. Both of them are citizens of North Badia, and have been working in JBRDC as development agent.

VI. The interview was conducted by an expert at HFDJB who conducted water management studies at Badia region. The last three experts were asked to identify development projects including local knowledge at past or present. In addition, they were asked about the elderly statements including their justification of weather differences now and then.

The selection of the experts was based on researcher experience of the local Bedouin development experts. The experts interviews were carried out by cover letters sent to their institutions.

3.2 The research Tools

The researcher used the following to collect the relevant data:

3.2.1 Secondary data sources

The WUR digital library, JBRDC Digital library, and *HFDJB* data base was used to find out relevant data for the problem statement of this research. This helped researcher to recognize and perceive the way other researchers dealt with such issue and helped him to justify findings and defense argument.

Literature review helped researcher in deciding and thinking which topic needs more investigation in this field. By reviewing literature it also helped researcher in giving form to his own work. To promote findings of studies carried out within the same field of study.

The meteorological department data was used to check the consistency of field work that has figures about rainfall and the weather pattern in periods given by informants or scholars.

3.2.2 Interviews

For this research two types of interviews were applied. Checklist questions prepared for the local Bedouin informants. An term of in-depth semi-structured interview for maximum one hour was conducted for each informant. In this type of interview when an informant mentioned something important for the research topic, the researcher was allowed to ask more questions about a particular topic to get accurate information. So, the interviews might not be similar in structure. Each informant had different quality and quantity of information about the topic concerned. New questions or changes could be done during each interview. The questions were tested first by three respondent to ensure that it's clear and understood by the informant target of the study. Listening and recording is very important since respondents were mostly illiterate and the topics concern needed a freely ended interview.

The feedback received from these interviews would make a better understanding of how their communities perceive the precipitation and the livelihood activities linked with precipitation. It may help researcher to identify issues for further research.

As regards the six experts, researcher arranged one meeting for about one hour maximum for each one after conducting his interviews in community study to crosscheck the relevant data collected among informants. For the experts who work in Badia are from Badia institutions. Researcher has been aware to ask of the involvement Bedouin local knowledge in their plan and projects.

If yes, they would be asked about the implementations, constraints and difficulties that are exercised. If No, they would be asked to justify the exclusion of the Bedouin local knowledge

in their development project.

3.2.3 Observation

It was not possible for the Bedouins to conduct their seasonal calculation in order to predict the time of rain. The Bedouins use the position of the moon, stars and bio indicators in order to predict when it will rain and when the rain will stop. The reason to why this was not done is because it is not the season for it.

The observation was in how informants used his body language as a tool to convey what they wanted to say to the researcher during the interview. Sign language helped to elaborate and understand the topic concern. This kind of observation – covert observation –was done without the consciousness of informant. Since they would change their behavior if, they were well –aware. This was not ethical. But, Douglas (1976) as cited in (Gry, 2009) considered it legitimate to conduct covert observations since people tried to obscure the truth through misinformation and evasions.

3. 3 Data analysis:

The researcher used digital voice recording to collect the data. He transcribed the field notes into a document by ordering and coding the data based on what he understood on reviewing the interview literature and being aware during reviewing of literatures. Indeed, coding data earlier made it easier for the researcher and he was familiar with most of the terms and actions that occurred during the interview. In addition, the local language terms concerning the topic were categorized, listened as it was pronounced by the interviewed, these terms were later written in Arabic, transliterations and translated to English language.

There was a contribution of Jordanian Yarmouk University for this issue. These findings were deduced and presented in form depending in which it would be applicable and serve the purpose of research.

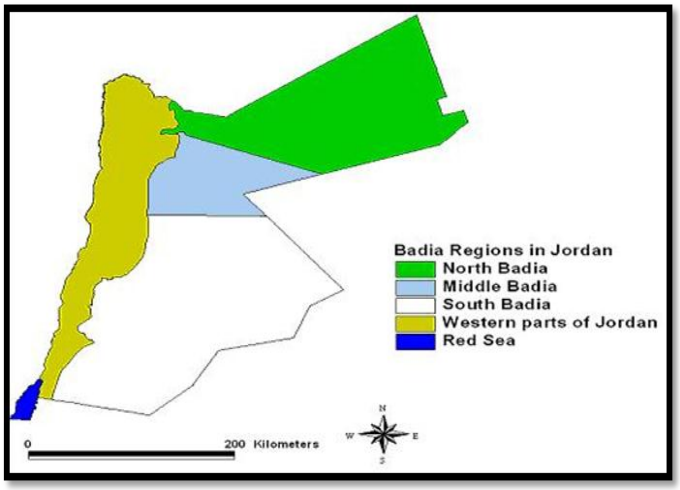
CHAPTER FOUR- NORTHERN JORDANIAN BADIA

4.1 study area

North Jordanian Badia is a part of Jordanian Badia region (figure 1) that covers 80% of the total area (89.400 km²) of Jordan. The Northern Badia comprises 35.7% (25.930 km²) of the Badia total area (Al-homoud ,et al.,1998).

The Northern Badia is located in Mafraq governorate administrates border and share country border with three Arab countries, Syria; Iraq; and Saudi Arabia.

Figure 4.1 Jordan map-Northern Jordanian Badia.



Source: HFJDB, 2011.

4.2 Characteristics of Northern Badia

4.2.1 Social characteristics

The *"ashirah* "is the Arabic term of the Bedouin community which means clan. "*Shaikh*" is the Arabic term of the Leader for each tribe. Tribal identity in Jordan is important as well as the nationality of country. According to the Act in Jordan Northern tribes are fourteen (*Bani Kahlid ; Alserhan ;Alsuradeh ;Almsaeed , Alshurrfat ;Aladmat ; Zubied ;Alnoaiem ,Enzah ,Shmr ;Alroula , Algeath ,Alfoaerah*) The total population of Northern Badia is about (160) thousands living in 110 different urban settlements (HFDJB,2011; Aloudat and Alshboul, 2010;JL , 2011).

The average density of population is relatively low (7.7 Inhabitants/km²) compared to Jordan (9.2 Inhabitants/km²). Some studies indicated 5% of the Badia populations are still nomadic; the rest are now settled (Al-homoud,et al.,1998 ;DOS[1], 2011).

The Bedouin community is a young community where the proportion of those less than 15 years old is 41% compared to 38% at the level of Jordan. It is noticed in Badia that families are extended ones, where the average number of each family is (6.5) persons and the proportion of the families containing 9 or more persons is about 16%.

About the education, is free of charge and compulsory for the basic stage according to the Jordanian law , and it starts from the age of six years up to the age of sixteen , then

comes two years for the secondary phase and its funded in the public schools , and almost free. Studies indicate that 91% from the male population in the northern Badia received their education in contrast to 83% of the female population. Where the proportion is 99% for the enrollment in the schools for the ages rank 8-13 (both genders). The education level is related to the place of residence (Spicer, 1999).

4.2.2 Climatic characteristics

4.2.2.1 The precipitation and temperature

Jordan is considered one of the countries that is negatively influenced by the climate change. Weather experts say that the number raining days has decreases at least by 20% (Abdulla, et al. ,,2008) and there is about (1.5-2) Celsius degree increases on average temperature (Mohammed,2008) . Therefore, rain has decreased in most of Badia areas.
Because most of the rain that is supposes to cover east of Jordan Badia region, comes from the Mediterranean and red sea. On the way much of it falls on mountain areas and by the time it reaches Badia there isn't much left. These mountain areas are already filled with green vegetation and when more rain falls on it, this causes the waters to flow toward Badia where then the water becomes flood water.
These clouds decrease as they extend to the east, so rain will decrease because the clouds will be exposed to the areas that are free of vegetation cover. The west of Jordan has also been affected with less rain as nowadays lots of trees being cut.

4.2.2.2 The winds

There are two dominant wind directions for most of Jordan, including the Badia. In the summer, North-West winds predominate, due to frequent seasonal troughs to the north of the country, which represent an extension of the Indian monsoon. In the winter, the dominant wind changes to a West-Southwest direction, due to depressions which travel along the eastern Mediterranean.

The Badia area is an extension of the low red sea. Jordan is influenced by a state of air instability because of the extension of the atmospheric depression of the red sea, and there is an air current or cold air basin in the top layers of atmosphere. This extension means that there is southeast wind. This wind is warm and hot and it rises above to the top layer so, the cold air replaces it this leads to turbulence in the air conditions. This leads to the formation of cumulus clouds and precipitation, most of this rain is heavy because of atmospheric instability. When the winds and temperature on the surface are hot, the state of instability is more effective and violent and the cumulus clouds are higher because of the great differences between temperatures on the surface and the top layers of the atmosphere.

Any depression starts with southeast wind which changes later into western winds or northwest wind. When the western wind enters, the state of stability takes over instead of instability due to the fact that the cold air is thicker and heavier at the bottom of the atmosphere layers. As a result, there will be no vertical movement above. However, the eastern wind is the beginning of the turbulence or the state of instability. Finally, the loaded clouds, which are accompanied by heavy rain, are formed especially in the northeast Badia and south of the Badia.

Generally, arid desert climate exists in the Northern Badia, dominated by low precipitation; it falls within arid climatologically zone (Al-homoud, et al., 1998) the rainfall variable in place and season. The annual average of precipitation is 100 mm in North Badia (Alzweiri, et al., 2010). There are noticeable seasonal temperature variations, with summer tending to be hot and dry and winters cool and wet. Individual's storms frequently result in *wadi* flow. Many storms are of high intensity and low duration, resulting in significant runoff (Al-Qinna, 2007).

Precipitation in Badia is an important resource of water and should be considered as one of the rarest and most valuable natural resources. More attention must be paid , also to foreknowledge of the likely pattern of precipitation could lead to substantial improvements in risk management strategies, as well as increased profits for larger –scale producers (Blench,2003).

4.2.3 Agricultural characteristics

The North Badia can be classified as a major source of cultivated crops in Jordan under irrigated fed systems. There were (715) ground well founded in North Badia to irrigate fruit trees and vegetables like stone fruits , grapes , tomato , water melon , pepper , eggplant at a land classified by agricultural law as a rangeland . The main source to feed these ground wells is precipitation (MOA, 2011).

The main livestock products in northern Badia are sheep products, chicken products and cows' products (MOA, 2010). They breed in intensive manner per unit since investment at both sectors is high due to high technologies in both the cultivated and livestock sectors**.**

Extensive tracts of land in North Badia have no current use or recognized value, or utilized on an ad hoc basis as natural pasture. The government and other development institutions has implemented several projects in order to rehabilitate the range lands by browsing Atriplex sp. And Salsola sp. shrubs and constructing dams and bonds for water conservation in the North Badia **(**MOA, 2011; HFDJB, 2011**).**

4.2.4 Economical Characteristics

Poverty in Jordan is classified as geographical "pocket" according to the Jordanian ministry of planning criterion, by which six pockets of poverty founded in Northern Badia (Table 4.1).

Table 4.1 Poverty pocket in Northern Badia

Region	Poverty rate
Ruweshid	74%
Salhia	43%
Hosha	36%
Dair Alkahf	34%
Khaldiya	36%
Northwestern Badia	28%

Source: Jordan poverty report, 2008 (DOS², 2011, p.35).

Even studies indicate pockets of poverty as a hot spot needing direct integration development intervention. The causes of poverty are blind and distributed everywhere in the Badia. *HFDJB* (2011) related the poverty in Badia to:

- The scattered settlement patterns (both villages and urbanized areas) throughout the region, which makes development plans difficult and hinders investment in some areas.
- The large family size (7 members) compared to the country average (5.7 members).
- The high rate of illiteracy among the Badia inhabitants.
- Limited source of income for Badia inhabitants .Families in Badia suffer from income deficit, which reached 12% in northern Badia .

Jordan poverty report states that Al-Mafraq governorate – which covers the northern Badia- has recorded the highest poverty ration in Jordan compared to other areas , it contains eleven Pockets of poverty , eight of which are in the Northern Badia area **(**DOS²,2008).

The main poverty indicators in Al-Mafraq are:

- First, Food poverty line. Food poverty line in Al mafraq is 227 Jordanian dinars (JOD)\ year for a person, compared to 229 JOD at the food poverty level of Jordan. and it represents the level of spending necessary for a person to meet the basic food needs which provide him with calories needed to do his usual daily actions and to keep him alive according to the community food pattern .
- Second, the absolute poverty line. in Al-Mafraq is 656 JOD\ per year compared to 680 JOD \ year at the level of Jordan. And it's the income or the spending needed to provide or meet the food needs and the basic needs concerning shelter, education, clothing, health and transportations.
- Third, Poverty gap in Al-Mfraq is 6.3% compared to 2.6% at the country level. It represents the size of the gap of cash required to for the transform the family under the poverty line into rising above the poverty line.

  On the other hand, studies indicate that in spite of food industry, Mining and milling stone, chemicals, on-ferrous organic products, and manufactured metals compromise the most important economic activities in the northern Badia region. Bedouins tend to go for governmental jobs instead of ordinary ones, as this provide them settlement and job security. Farther more the banking and financial institutions, agricultural corporations, the development and employment fund are all considered to be the leaders in providing loans to the general population of Badia (HFDJB, 2011).

4.3 Institutional development in Northern Badia

Several institutions established concerning Badia development. The Hashemite Fund for the Development of Jordan Badia, its governmental support was established in 2003, through implementing selected community-based projects in order to improve the socio-economic conditions of local communities there(HFDJB,2011) .

Jordan Badia Research and Development center is another institution .It aims toward sustainable development of Jordanian Badia. It was established in 1992 as a product of a partnership between the higher council of science and technology of Jordan, and the Royal Geographical Society and Durum University in the United Kingdom (JBRDC, 2011).

CHAPTER FIVE – FINDINGS

This chapter presents the findings of the fifteen informants from the Northern Jordanian Badia and the experts. The study showed the out of reasoning for using / not using local knowledge according to the different professional views, interpretation of the Bedouin perception of the precipitation variability and crosschecking the local knowledge gathered from Bedouins in scientific knowledge.
The research has focused on the perception of precipitation regarding the local knowledge of the Northern Bedouin. The findings were organized and typed in two languages: the Bedouins' dialects and translated into English language. Typing into Bedouin dialects is insured that the significance of the tales, and its meanings remained as accurate as possible

5.1. Informants findings

5.1.1 Bedouin calendar and Celestial bodies signs

This section covers the data that was gathered from the fifteenth elders and includes Bedouin knowledge regarding months related to precipitation; year division; and winter division. Moreover, with the assistance of a dialect expert, researcher was able to transliterate data of the Bedouin spoken language.
The fifteen Bedouin elders that were asked divided the daily movements of the moon into twenty eight location set points. The locations were spaced approximately according to where the moon stays for each night. They also, chose twenty eight sets near the course *burooj* (i.e. towers) to become a sign for the moon track in the lunar month night. Moreover, they gave the astronomical groups (houses of the moon) in which the time period for each house is equal to twenty four hours with a total of twenty eight days. The Bedouins consider that for each house of the moon there is a certain weather condition associated with it like rain, wind or hail.

5.1.1.1 Months related to precipitation

Months related to rainfall were identified by Bedouin elders as follows:

- *"Ailool"* i.e. September incorporated as :
  "*ajrad*" " أجرد" or "*gridan*" "جريدان" , and Known as *qran 19* "قران 19"or "*fardawi*" i.e. Separately according to the Arab month in which it happens as "*AL Thurrya*" "الثُريا" i.e. Pleiades is combined with the moon.
- "T*asarin*" "تَشَارِين"i.e. is two months :
  October known as *qran* 17 and ;
  November known as *qran* 15 .
  It is described as the last of *sfri "صفري"*(i.e. heat).
- *Kanun awl* "كانون أول"i.e. November known as *qran* 13.
- *Kanun thani "كانون ثاني"*i.e. December known as *qran* 11.
  It is also known as *fahl shtwiyah "فَحلْ الشَتَويه"*i.e. the strongest month of winter.
- *S`bat* "شُباط"i.e. February known as *qran 9*. Twenty five days of which are divided into
  - *sa`ad dabih "سَعدْ ذابح"*(i.e. sa`ad. The slaughterer) and;
  - *sa`ad lblac "سَعدْ أبْلع"*i.e. whatever rain comes goes down into the earth.

  Further, there are four days which forms Part (2) of *`qran a lajayiz* "قران العَجايزْ" related to old ladies.

  S'bat or February is divided into three periods:

  1. The first ten days are called "*smll*" "سم"i.e Poison.
  2. The second ten days are called *"dm*" "دم"i.e. blood.

3. The third ten days are called “*dasm*” "دَسم"i.e. fat they also mentioned that at 21st February “the brothers did not share but after February 21st.

- *Adar "آذار"* i.e. March known as *qran 7* or *sbaici*.
- *Naison* " نيسان“i.e. April is known as *qran 5* of what is called "*khamis*" " خَميس"which is a symbol of dryness.
- *Ayyar* "أيار“i.e. May is known as *qran 3* it is also called “*jumada*” "جُمادى"or “*mash*” "مآش" i.e. nothing, dryness, or hardship.
- *Huzairan* "حُزيران“i.e. June is known as “*klash*” ,"كِلاش" *hlash, "حِلاش"* and, *mash*.

5.1.1.2 Year calendar

According to the Bedouin elders’ knowledge, the year is divided into four periods:

1. *Thalath qaid "ثلاث قيض", Qran (*21, 23, 25). It divided to:
   a. *qaid I* "أول قيض"i.e., the beginning of summer heat,
   b. *qaid II* "ثاني قيض " i.e, the middle of the summer heat, and
   c. *qaid ɯ "ثالث قيض"*, the end of the summer heat.
2. *Thalathah sufri "ثلاثه صفري",Qran* (15, 17, 19).It known respectively as
   a. *awl safar "أول صَفر"*, i.e., the beginning of *safar,*
   b. *awst safar "أوسط صَفر", i.e.,* the middle of *safar ,and*
   c. *tali safar* " تالي صَفر" translated as the last period of *safar*.
3. *Ashtweiyyah "الشِتوَيه"*i.e. (winter) *qran* (9,11, 13).
4. *Thalatha rabic* "ثَلاثه ربيع"i.e. (spring) *qran* (3, 5, 7).

5.1.1.3 Winter season calendar

The Bedouin elders local knowledge, divided winter into:

First: *Almirbacaniyah " المِربَعانِيه"* (i.e. forty days) starting from December 23rd up to February, the 1st.

Second: *AL khmsiniyah "الخِمسانِيه "* (i.e. fifty days) can be divided into four periods each of which is 12 ½ days which run as follows:

- *Sa`ad El dabih* "سَعد الذابِح"(i-e. sa`ad the slaughterer) begins on February 1st and ends up on the 13 day of February.
- *Sa`ad bala "سَعد بلَع"* starts on February the 13th and ends up on February 25th .
- *Sa`ad saoud "سَعد أسعُود"* which starts on the 26th of February and ends up in the middle of march. The Bedouins feel optimistic of seeing *sa`ad soud* apart from *almistqridat " المِستَقرِضات"* i.e., the period of the end of February and the beginning of March.

Regarding *Sa`ad saoud* period, the informants told the story of *Qiran AL. jayiz* i.e. the story of revenge of February from the old lady who said:

رَاح شباط وَ دسِينا بِحلِقْتُه مِخبَاط

“*rah shbat wa dsaina bhalqatuh almiktbat*”

This could be translated as

“February has gone and we inserted a stick into its arse” .

Q*iran Al jayiz* begins, definitely, in the first seven days of *sa`ad saod*. Three days of which are in February and other four ones are from March (if there is an eclipse, there must be four days of February and 3 days of March).

Qiran Al jayiz is, also, known as *Almistiqri dat* as February borrowed 4 days from March. It is, also, called " *alhusmat*" " الحسُومات" fatal or grulling days. *Alhusum* " الحُسُوم "are, also, stated in surat "*Alhaqqah*" in holly Quran :

> "*He made it rage against them seven nights and eight days in succession: so that thou couldst see the (whole) people lying prostrate in its (path), as if they had been roots of hollow palm-trees tumbled down!" Ayyah (7),*

This is referring to seven nights and eight days. These days are a sign of bad omen according to Bedouins. Man cannot make love to his wife. Marriage or any social activity does not take place in these days.

- *Sa'ad alkhabya " سَعدْ الخَبايا"* (i.e. the luck of hidden creatures like snakes or reptiles). It begins with the end of ***saa'd soud*** and ends up with ***khamsiniyat ashita's*** *" خمْسِنية الشِتا"* .*Sa'ad alkhabya* is the time when heat begins to rise.

Regarding the timing of precipitation, Bedouins divided the Arabic months' days into fruitful days and empty days as follow:

One fruitful then one empty, two fruitful then two empty, three fruitful and three empty, four fruitful then four empty, last five fruitful and five empty.

Moreover, the earliest and first precipitation was named "*Hareif* " " هَرِيف"which comes by the end of *safar*.

5.1.2 Bedouin winds Signs of precipitation

According to the Bedouins' knowledge, the wind is divided into:

- *Ashamali(*i.e. Northern) " ألشِمَالي "

There were two sayings among the informants regarding this wind ,

First,

اذا كان الهوا شِمالي ، يا حسرِتكُن يا عيال

" ida kan elhawa shamali ya hsritkon ya ciyali"

This could be translated into English as

"if there is a Northern wind, it is too bad for my fellow men".

Second,

اذا انطلْقت شِمـالي ، يا هِلـچت أعيالي ، يعني أنهلكوا وما طِلِع عُشُب ولا زرِع

" ida intlqt shmali ya haljet ciyali" yceni inhalaku wa m tilic cob wala zaric"

This could be translated into English as

”If it is northern wind, what a pity for you, my fellow men”

This means they die and there would be no grass or plant. In addition, the Bedouin believes that the dead person suffers from the Northern wind.

- “ *Aljibl”Alqibli”* " الچبلي ″(i.e. Southern)

There were two sayings among the informants regarding this wind ,

First,

چبلي يا ميات عدلي ، أذا كان الهوا چبلي يا كَلاَتك يا عدلي

“ *jibli ya maiyat cdl: idakan elhwa qibl: ya kalatak yu Cdli*”

This could be translated into English as

“Robin hood water comes from the South. If the air/ wind comes from the South, It is your misfortune oh Robin Hood.”

Second,

“ *aljibli qibli Kaman arhm min ashameli”*

This could be translated into English as

“Southern wind is tender than the Northern one”.

- *Asrqi walgrbi* ألشرقي والغربي ″(i.e. Eastern and Western)

There were four sayings a among the informants regarding this wind,

First,

ألشرقي مِحراك لشْتا

“ *asrqi mihrak lashta*”

This means:

“Eastern wind causes precipitation”.

The Eastern winds always moves and rotates, and then it is followed by Western winds as an indicator of rain.

Second;

“Alghribi abrd watfil “

This means:

"Western wind is more gentle and tender."

Third; ,

"Algrpi arhm min asrqi liana afrqi yucniff. Algrbilbi rutubah wa Smali mahu ba'd btal"

This could be translated into English as

"The Western wind is more tender than the Eastern as the Eastern wind brings forth draught and dryness; the Western wind is humid similarly, the Northern wind is not bad "

The Western wind is called Cyprus winter.

Fourth;

"ألشرقي بَس بِحَرك أشتــا "

" *Alshrqi bas bi harik a Shita*"

This could be translated into English as

"Eastern wind moves rain, Western wind is more beneficiary".

The winds according to interviews could be a source of rainy storms

النَوْ يجي برْيَاح والموتْ يجي بصْياح

" *anau'yidji bryah walmaut yidji bsyah*"

This could be translated into English as

"Storm comes as a result of winds and death begets cries". Furthermore,

"ما يصير كون مِن غير صياح وما يصير نو بِدون رياح "

" *maysir kaun min gair siyah" wma yiji nau bdoun riyah*"

This could be translated as

"There is no existence without cries and there is no storm without wind".

5.1.3 Denotation of animal, insect and grass

The following bird, insect and grass related to precipitation were identified by elders Bedouins:

- *Ta'ir arha* . (i.e. Bird of *Al Raha*). The informants had a saying which was

"طِيرْ الرها يقعِد يكرِك ويغنِج" وِكاد الدنيا ودها تِمطر "

"Ta'ir arha yugcd yikrik ow yaghnuj" wakad dunia wdha tmtr "

This could be translated as

"The bird of Al Raha starts singing it is certain that rain would fall".

- *Adudih alhmar. "الدويده الحمرا"* (red worm).

The informants had a saying which is

"أبو حِلس .أبوقطيفه حطَاط الزُبده بالرغيِف "

"Abuhls, *Abu qatifih" htat azubdeh braghif" adudih alhmar a claiha wabar"*

This could be translated as " Abu hli puts butter on bread. The red worm has hair". This is an indication of the end of the rain season.

- *Alcsib i.e.,(small grass) "العْشِيبْ"*

"العْشِيبْ نوارتُه وردْ صغِير لُونهْ زهري "حليو "

Alcsib" nuwartuh" wrd sager lunoh zhri " hliu"

This could be translated as "the grass blossoms small rosy flowers". This is an indication of rain time.

5.1.4 The denotation of lightning and thunder

There is a saying among elders Bedouin that is

"بَرق أبو نياسي يا يصَابِح يا بِيماسي"

"*Barg Abu niasi ya bisabih yabimasi*"

Which could be translated "*Abu nissis* lightening either happens in the morning or in the evening". They have also a saying about the times of predicted lightning and thunder that is

"يجنَا رعود بصفِري وترعِدْ الدنَيا وتسيِل الصحرا وتِمتِلي الغُدُر واماكِن الميْه"

" yina rucud bisfari wa tircid adunia wa ts:l ashra wa temtali algudr wa a makin almaiyah"

This means:

"Thunder comes in *safar* and the desert becomes flooded and ponds become full of water".

The action taken when the Bedouin seeing lightning is described by elders as follows:

"يجنَ رعود عامَه طامَه واتسيِل الْبلاد . نِطرِف او تِعسْ الناس مِطب الرعود والبرق وتتأكد مِن المِيه انها سالتْ والعَربْ تشِيل

وتشرِق عالبرية محلْ ما أكَد الطارش او العسَاس . أحيانا البدوي اذا بَرق البَرق بالليِل ، الصُبحْ يرجِي مِن دون ما يطَرِش وينزلون عالميه عِند مِطب البرق"

" Yjin ruud camih tamah watsil albilad. Ntrif aw" tcs" anas cla mtb arcud walbarg wa tatakad min almaiyah inha salat wal carab tsil watsriq al baryah mhl. Ma akd- ataris aw alsas. ahyanan albadawi ida baraq albrq bilail, asubh yarhi min dun ma yatris wa yenzilun cal maiyah cind ma tb albrq."

This could be translated as

"The thunder storm comes all over and rain causes floods. Someone is sent to search for a better place wherein thunder and lightning took place as a sign of wealth and prosperity. Then, we make sure that water fell and then the Arabs moves east. Nevertheless, sometimes when there is lightening at night the Bedouins move or depart without sending someone to roam and they settle close to water areas where the lightening took place".

5.1.5 Bedouin action against drought seasons

When rain stops or interrupted or delayed the Bedouins resort to what is known as "altghith" "التغِييث" . "*Altghith"* consists of ten to fifteen homes close to each other called " *fariq*""فِريچ" i.e. team ", where three to five women bring pieces of clothes to make out of it a head on a piece of wood similar to the cross. They insert a mirror in it, and then they walk among the people praying, and singing in loud voices. The Bedouins lullaby or song

" um Aligith" ya um algith ya ragda ya maitna ya ba'duh	يا ام الغيث يا رِعْده يا ميِتنا يا بِعده
youm algith githina bali zari'na annayim	يام الغيث غِيثينا بلِي زرِعِنا النايم
ya um algith halah halah	يام الغِيث هالله هالله
Wa yarb tbul asrsuh	ويا رب تبِل الشَرشوح
whna th tak wein enruh."	واحنا تحَتكْ وين أنْروُح

They move between the houses and the owners of these houses offer them *Hummus*, lentil, flour, wheat, and fat. Then, they " i.e. the women" take it to a well - known person's home as "boon and bounty house" .When rain comes by Allah willingness, women make food for Allah`s sake at this home and they invite the people to "*Um Alghith"* festival.
One of the old ladies said, that she was very young and heard that song from her mother, and the other elderly women while moving around the houses, gathering and picking up food, wheat, they cooked and eat it.

5.1.6 Bedouins Perception of Precipitation variability

During interviewing the elder informants, the researcher found out that there are different interpretations of their perception of precipitation variability in Badia region .These interpretations can be categorized into four categories.

The first was the religious believes expressions (Box 5.1). For instance, According to their expressions, Bedouins were linked the precipitation to "Allah" forgiveness. They also linked in their sayings the charity and offering of sheep or camels for poor people for god's sake to thank "Allah" for his blessing i.e., rainfall.

Box 5.1 A semantic expression of Bedouin elders related to religious believes.

- *"…People pray nowadays, but they have no faith deep inside... (i.e. hypocrites)."*
- *"…If you pray rain does not come to your mind..."*
- *"…The Bedouin slaughter a sheep for God's sake when lambs are born..."*
- *"..The Bedouin never tastes the ripe yoghurt for two weeks when he starts collecting yoghurt and butter. Slaughter sheep for God's sake and invite the neighbors in the beginning of spring as a sign of gratitude to Allah for wealth and prosperity. "He bestowed on him fir. It is called ftooh (i.e. the beginning) then you can taste yoghurt, milk and butter…."*
- *"…Death and winter come suddenly. God only knows their times..."*
- *"…Time changed and the rain fall became weaker; praise is to Allah, time has changed…"*
- *"…Prosperity has gone with the elderly. Rain comes from Allah, he can cancel or send it anytime..."*
- *"…This is a test whether it is good or bad. The Bedouin must understand the misfortunes..."*
- *"… Many Bedouins depend on themselves. They say "Oh, my son! I have money. I don't worry about hunger and thirst. You depend on Allah. Allah is mightier than anyone else. Allah is greater than anyone else…"*
- *" …. The Bedouins have pride nowadays. I remember people used to pick up grapes from the floor because it is a bounty and a blessing…"*
- *" … We have a lack of boon and blessings today… ".*
- *" … Astronomical movements have changed. Rain shower elapses; praise be to Allah. He treats people fairly... ".*
- *" … We seek refuge to Allah, weather has changed… " .*
- *" … People in the past were simple depending on Allah and they were optimistic regarding rain and well fare… ".*
- *" … Nowadays, people start praying at the mosque. Allah responded in the past, but nowadays does not… " .*
- *" …. Women, nowadays, sing happily when rainfalls. Today millions of people pray for Allah but there is no response… " .*

The second category was the human behaviors. The Bedouins sayings (Box 5.2) shown that mistaken of human activities nowadays can be the reason for the variability of climate .For instance, safety was prevalent among society members and honesty was commonly but not more nowadays.

The third category is a social solidarity expression .

Box 5.3 contains the sayings of Bedouins regarding their reasoning of precipitation variability based on social solidarity. It is showing how was the closed relationships among individuals in Bedouin society can be a way for brings rainfall.

Table 5.2 A semantic expression of Bedouin elders related to human behaviors.

- *"… In the past, people were better and honest. Nowadays people hate and envy one another. Man squeezes out your sheep and sells it for fifty pounds..."*
- *" … Days are the same our lord is Allah, but people changed and they are not alike " .*
- *" …. People live in corruption and chaos. Allah Almighty is generous and He will judge us…. " .*
- *" … The Bedouins in the past were kind- hearted. They had no envy, and they were honest… " .*
- *" …. Women in the past traveled with us up to Rutba (i.e Rome). Their dignity and blessedness are kept until they get to their parent's home. Today you cannot trust your sister to go to Mafraq … "*
- *" … When a person talked to you. He talked frankly .now-a days it is all playful and crookedness… " .*
- *" … In the past, people were kind hearted and alike…"*

Box5.3 A semantic expression of Bedouin elders related to social solidarity

- *" … During the days of churning yoghurt (i.e. laban)people pave stones and put piles on stones, while you pass by you can take a piece nobody would say anything. Now it has changed… "*
- *"…There is plenty of rainfall, but there is no bless today. we have personal interests. Men in the past were knights and brave "appear in dark nights…."*
- *"… In the past, when a person died the Bedouins shared their sorrows to the extent of not washing clothes until death rituals are over. Nowadays, a person died and there could be singing and dancing nearby…"*
- *"…People in the past helped the poor and they offered a sheep to milk and eat yoghurt, butter… etc. Nowadays no one gives you a kilo of yoghurt for free. .. ".*
- *"…. people in the past were better and honest. The whole society was better. The climate was better and there was no draught and poverty. Rain falls continuously and it rarely becomes dry…. " .*
- *" … People`s good intentions in the past were better. Neighbors were united and kept one another for the seventh houses. A dignified woman would accompany you at night till you get her to her family. People, men and women, gathered and spent the night telling folk tales. They have nothing but legal things… ".*
- *" … The Arabs (i.e. Bedouins) leave and settle in tents of animal's hair. If someone loses his cattle another finds it and brings it back to its owners. One under takes all Arabs… ".*
- *" … People in the past did not think of a drink or food. People were together whether during day or at night. People gave birth to one another. That is, newborn babies belong to the whole tribe not to a particular family. They had respect for the elderly people. Today, months pass by and your kids do not visit you ….. ".*

And the fourth category (Box 5.4) is the expressions of Bedouin elders related to using the updated technology.

The findings below are showing how the Bedouins were justified the rainfall variability related to using the modern technology like television and medical care.

B 5.4ox A semantic expression of Bedouin elders related to modern technology

- *"….The country "balad" was not polluted. There was no sickness. People did not know doctors / physicians. If someone had a stomachache, they would offer him an herbal drink. If a woman delivered a baby while working and picking up wood they offered her ginger with jam…. " .*
- *" … We do not trust in God, we trust in television... " .*
- *" … Today people watch Television, but there was no television in the past... ".*

5.1.7 Bedouins tales

The Bedouins informants accounted folk Bedouins tales in the interviews to manifest their local knowledge .They told the tales using the local Bedouins dialect. Hence, the dialect has been taken into account, and transliterations of these tales have been conducted since different dialects and vocabulary may be used to tell the tales. This insured that the significance of the tales, and its meanings remained as accurate as possible.

5.7.1.1 Qran aljayiz "*almistigridat"*

"في عجوز عندها ناقه ، يوم ظل من شباط ثلاثة ايام قالت الحمدلله يا ربي ، قمحاتي فرا وناقتي عشرا وچلبتي وبرا. ومضى شباط وندس بحلقته مخباط . زعل شباط وقال :ايدار يا خوي يا ابن عمي أقرضني مني ثلاثه ومنك اربع ، خلي العجوز تسع وترعد . وهي تركب الدنيا عليهن ثلج وتصير العجوز تاخذ من القمحات وتطعم الناقه ، وتظل تكرك عليهن لما خلصن ، والكلبة اخر ما اخر من البرد ژتت حالَ پنار واحرقت حالها.والعجوز نارها بالبيت طفت من كثر الثلج ودست حالها بفراش ووقع عليها بيت الشعر وماتت".

" fi cjuz cndha nagah, yum dl min sbat thalathat ayyam galat alhmdlilah ya rabi gmhati fra wa nagti csra wa jalbati wabra. Wa mada sbat winds bhlgotuh mihbat zicil sbat wa gal adar yahui aw yabin cmi aqrdni mini thathah waminak arbacah hal juz tsc watrid, wahi trkib adunia cleihun thalj watsir alcjuz tahd min alqmhat we ttcm annaqh watdl tkrik cleihun lmakhlsn walkalbah ahr ma ahr min albrad ztat hala binar wa ahrqet halha wal lcjnuz narha bil beit min tft khuthr athlj wadst halha bifiras wa wiqic celiha beit a scr wa matat".

The whole anecdote could be translated into English as "there was an old lady who had a camel. There were 3 days left of February. She said "God, my wheat is abundant and my Camel is pregnant and my clothes are worm".

She said "February elapsed and a stick is inserted into its arse". February got angry and wanted to revenge and said, "March oh' my uncle's son three days from me and four days from you so that the old lady starts yawning, going and coming " .

Then snow fell and the old lady start feeding her camel from the wheat till there was no more. Then the she - dog threw itself in fire and burned. The old lady's fire blew off because of the snow, and put her in bed and then the tent fell off, and the old lady died".

The old woman myth identifies seven days where the weather could be risky for Bedouin.

They are three days left of February and four days of coming march. Thus, Bedouin carry out actions during these seven days to ensure safety, for his life and wealth of livestock.

5.7.1.2 Denotation of animals and insects – Mouse and the servant tale

The Bedouins who lived in the deep valley had a smart servant. He spent a lot of time observing a mouse that was carrying its children for 500m. And put them on the head of the leather. The servant said “oh God it will rain tonight”. Then he moved and settled on the top of the mountain, and told the *sheikh* “the eldest people in the tribe” that tonight it would rain. The *sheik* said you are crazy. Daighm told the servant that if it is a lie I will cut off your head, but if it is true you will save yourself .Later, at night there were floods and all of the people died. *Daighm,* was the only survivor along with the mouse and the servant.

5.7.1.3 *Bedouin* tales of token of esteem that took place by Gods willingness due to good intentions and good deeds.

1. *“cuwaiyed adcas” "عويد الدعَاس"*(i.e. a name of Bedouin person) from “*aljabal” "الجبِلْ"* clan (i.e *jabal al crab* "جِبلْ العَرب" clan in the eastern part of Jordan.) was walking in the desert and felt thirsty. He had no water around and he prayed for God and God responded to his prayers. The sky became cloudy and rain fell and he quenched his thirsty.
2. *“ Hamdan Abu Jnaib” "حمدان أبو جنيب"*(i.e. a name of Bedouin person) was in a place and wanted to move to another place in “ *Jabal adruz” "جبِل أدروز"* . The distance was a two day walk and there was no water there. The old man prayed seeking help from Allah. So, Allah responded and the clouds poured out rain which is similar in size to “*Cab’ah*” "عَباه"(i.e. garment) poured out water.
3. A man had some camels and a shepherd who intended to go for pilgrimage (i.e. Mecca). He saw a thirsty female dog and its puppies. He stepped down the camel, milked it, put the milk in “ *jud” "جُودْ"* i.e. a leather container , then fixed it between two stones and tore it in half. Then, the dog drank the milk.
   The Bedouin turned to the dogs puppies, and carried them with him. When he arrived to his destination, as narrated, he saw an owner of a tent told the shepherd, that he saw him (i.e. the shepherd) in the Holy shrine in Mecca. As a pilgrim accompanied by the dog; although he (i.e. the shepherd) did not go to Mecca for hajj as a pilgrim, due to the favor he did to the dog.“One good turn deserves another. ”

5.7.1.4 Sa`d Anecdote

In the past, people lived in “*jabal al crab”* and there was a “*sheik*” called *Sa`ad*, and his father was an old man. His fellow men came in the beginning of February, and said "Oh *Sa`ad* we want to invade".

The old man said "Oh son, it is not a time to invade and “*alhamad*” "الحَمَاد" "came in suddenly". They told him "No, you must come with us". They obliged him and they were coming from “*Alshauf” Mountain*. They told him "You are our *sheikh*". The young man did not invade but his father did. "You would be our leader you must come". The young man’s father said “It is an inevitable “.

The young man said to the *shiek* "the fellow men are determined; I would not disappoint and let them down". The young man’s father said "Ok, I advise you, if you see a change in the weather, and the wind is Eastern chilly turning South and West and it starts roaring; back your men off. And slaughter the camel, and cut its belly and take it out, and hide inside".

When they went for a three night invasion and arrived in “*alhamad”,* the weather suddenly changed .The old man had guests in *Horan* and the guests said that was snowing. The old man awakens his women and asked them to remove the snow from the top of the tent. That

night, the old man couldn't sleep and he kept walking from the middle of the tent to the yard calling out "Oh, my son! Sa`ad, Sa`ad slaughter your she - Camel Sa`ad to be rescued".

When Sa`ad saw that it was about to snow, he asked his fellow men to pick up wood and each one's dough and bake his bread. They thought that the sheik got crazy.

Some obeyed the sheik's order and the others did not. The snow began falling down and they rode their camels looking for a shelter from snow. She-camels could not see very well because of snow and the sheikh called to slaughter the camels and hide inside its belly. Then, they said "the sheik got crazy" and the sheik slaughtered his she-camel and took out its belly, and lit fire inside and close its skin and went inside for twelve and half days of snow. The other fellow men didn't listen to the old man's advice and they kept riding the she-camels and they knelt down their camels and hid beside it. Finally, they all died from the snow and the cold weather.

After twelve and half days the temperature increased and the weather became warm, and then Sa`ad came out and he threw the saddle bag and arrived home safely. When he met his father, he asked him "Did you do what I asked you to do?" He replied "As you advised me, my father. My fellow men didn't listen and they all died".

Generally, the fifteenth informants were described the local winter calendar in details; their own year division, the myths and songs that have save and convey by the local knowledge, and their expressions regarding precipitation.

5.8 Experts perspectives

5.8.1 Badia development projects and sharing of local knowledge

Experts listed projects that have been already done and that are being preceded. The use of geographic information system (GIS), Remote sensing and indigenous knowledge, to select the optimum sites for water harvesting schemes in the Jordan Badia which are implemented by the Water, Environment and Arid Regions Research Center "WEARRC",Al Al-Bayt University . This project is a research project aiming to use GIS, Remote sensing and indigenous knowledge to select the optimum sites for water harvesting schemes in the Jordanian Badia .

The knowledgeable Bedouins provide experiences as guidance for researchers in the desert about water runoffs and water catchments' areas. This local knowledge helps researchers to determine the sites available on the ground based on local citizens' experiences, and then researchers can select some of these sites for water harvesting.

The use of local knowledge is based on different past experiences of implemented development projects in the Badia regions. One of these experiences is about a Bedouin called *Duhilan* . He advised the BRDC team who has selected a certain area in *Alhshad* region based on hydraulically studies and decided to construct water harvesting techniques there.

This Bedouin told them that this area will not harvest water if the excavation was constructed there .But his knowledge in the Badia region was not taken, so the result was , as he told them, the water did not come to it at all .Hence, they considered Duhilan experience at the end.

There are many proposed projects that might be implemented. Documentation of traditional knowledge on soil and water conservation is a proposed project that has been presented in the National Strategy of Desertification Control in Jordan. This proposed project has not been implemented yet.

There is also a project of Environmental Compensations of the Third Gulf War[1] Damage to the Jordanian Ecosystem during and after the war. This project has a community action plan in which there is no separation between the local society in Badia region and the project in all over its stages and levels.

This project aims at rehabilitation of the devastating environmental system in the Badia region which was affected by the third Gulf war. As a result, a socio-economic survey has been conducted in this project's region and there were interviews with the local community. The locality appears during gathering information as a baseline for designing the coming development projects targeted.

5.8.2 Rationale for using-no using local knowledge

This section has examined the experience of disciplinarians in development of north Badia relevant to local knowledge.

The experts agreed that during their experience in the Bedouin communities, they can analysis the environmental system through local knowledge. For example, in the Badia, people in the grazing season move to the east part of Badia during December and January. Several studies have illustrated the highest vegetation growth in *Al-Hmad* is in areas located east of Jordan during January.

This period is called *althsreeq (* i.e. movement to the Eastern Badia).This is because these areas are full of floods. Consequently, valleys become green and Bedouin livestock graze there during that time. The experts revealed that Bedouin had a cycle of movement inside and outside the Badia controlled by the rainfall seasons. This cycle of movement can be described as accumulated experience among past years.

When experts in the development projects concerned with constructing over the valleys face challenges at the flat areas and the direction of the surface flow is not obvious, they ask for the local people's to help to define that. Nevertheless, the local knowledge is always unreliable as there are people from the Bedouin community who give you biased information when they know that you are coming from development agency.

For instance, for one of the valley's projects, there was a proposal to build a water harvesting technique on this valley; the area has been hydraulically studied.

In addition, the amount of surface flow and the capacity of the valley are known, but the local citizen was biased through his answers about the annual amount of water flowing through the valley. The local knowledge about valley is inflated by the local citizen to stimulate the development project within his region.

However, researchers use the local knowledge because the measures expense is high. For example, it is expensive to put a tool to observe the amount of surface flow of all the Badia valleys. So, in this case, researchers go to the local knowledge for help. Instead, the challenges will be in determining the knowledgeable individuals as the experts revealed.

The experts were mentioned about a survey in the Badia .The survey was about the length of barely in a certain area. Some informants said that its length reached a meter, however, the area was dry, and this information is not acceptable and biased.

5.8.3 Interpretation of Bedouin vision for change

According to their experiences, the Bedouin understand the climate variability indirectly. They know that there are a rainy years and drought years. But nowadays, they know that there are many dry years repeated a lot. However, the Bedouin do not have any scientific reason, but they feel that the past was better and more blessed.

This vision was justified by the experts regarding that the Bedouins who live in the desert are aware of Allah's mercy. Moreover, they linked the climate variability to the mistaken human activities. The Islamic religion has urged people to maintain resources, but when people burn

[1] The Iraq war, 2003.

and cut trees; they destroy the earth. This leads to devastation while dealing with natural resources. The holy Quran says

"*And when he turneth away (from thee) his effort in the land is to make mischief therein and to destroy the crops and the cattle; and Allah loveth not mischief." Sura AL-Baqara from verse 206.*

Moreover, the charity and blessing attitude, are also linked to the religious believes. For instance, rain water and irrigation water the charity of rainwater is more than irrigation water because rainwater is for all people, as a result, it is more charitable.
The holly Quran says
"*And the likeness of those that spend their wealth in search of Allah's pleasure, and for the strengthening of their souls, are as the likeness of a garden on a height, the rainstorm smiteth it and it bringeth forth its fruit twofold. And if the rainstorm smite it not, then the shower. Allah is seer of what ye do" Sura Al-Baqara from verse 265.*
And this may be linked to the offerings of sheep or camels for poor people.
On the other hand, if the social solidarity decreases, there will be a problem in the distributing wealth. There are twenty two poverty pockets out of thirty in the Badia e; this is a warning and indicator that there will be a big problem as these areas is full of natural resources.
In general, experts clarified that the climate conditions did not change, but the interference of other factors among Bedouin society like land uses, or mobility are changed. The lands in Badia regions shift from ranges to horticultural and vegetables farms.
The repetition of drought in the last years and its interpretation in Jordan, is affected by the precipitation has almost a cycle each six or seven years. Sometimes, some years are higher the average, but others are lower than the average. The years of 1990 and 2003 are examples of the years in which average was high. Nonetheless; the cycle is not irregular sometimes. Snow was fallen three time during winter in 2003(at December ,2002 ; Jan. and feb.,2003) .

5.8.4 Scientific knowledge of the climate at Badia region

5.8.4.1 Almirbacaniyah and *AL khmsiniyah* phenomena

"Almirbacaniyah" is an astronomical phenomenon; consequently the appointment of the beginning of *"Almirbacaniyah "* is stable because it is linked with movement of the earth around the sun. This marks the beginning of astronomical winter. When the sun is on the farthest point in the south, the winter of the northern hemisphere will begin. The earth is vertical on the equator, on the corn of Capricorn or on the corn of cancer, each one of these has a fixed date. The change may happen just between the leap year and the light year.
The twenty –first or twenty–second of Januarys is the beginning of *"Almirbacaniyah"*. But it is not connected with rainy season. *"Almirbacaniyah"* is the coldest period of the year for two reasons. First, distance of sun to the south away from the equator. Then, the distance of sun away from northern part of the earth and it will be far away from Jordan. So, the amount of the sun lights, which reach to the earth surface in the northern hemisphere, is less than the amount during "*Almirbacaniyah* ". Secondly, sun slope. Here, the energy that touches to the earth surface is less than it is during the year in this period, and temperature, in this time, is the coldest.

For "*AL khmsiniyah" ,* it's also astronomical phenomena as follow:

I. *S`ad dabih* represents two fading North and south stars. Closer to the Northern star, there is a small star attached to it which is roughly the slaughtered Sheep / Camel. The star symbol is alpha, beta from a Capricorn.

II. *Sa`ad balac* is a symbol of two stars one of which is fading (dim) from Aquarius. While, the other star is swallowed up. Their symbols are (meo, ebsellion) from Aquarius.
III. *Sa`ad saoud* is composed of three stars, two of which belong to Aquarius and the third belongs to Capricorn. Their symbols are beta, zeita from Aquarius and delta from Capricorn.

5.8.4.2 Alhareef (i.e. fruitful rain)
When the rain is combined with coldness it means that earth is inoculated. This means that the earth is pregnant and it will yield, and as they said there will be fruitful days and empty days. So, the fall of 10 or 20 mm of rain in January or February is better than 100 mm during April or May. The benefits of the rain during January or February for the soil and crops will be too high because the earth is very cold and the amount of evaporation is very little. Thus, the earth is ready to receive these quantities of rain and absorb it deep in the soil.

***5.8.4.3 Qran aljayiz*:**

They are outputs of accumulated experiences, statistics and incidents that happened with the Bedouins, so they have no scientific base. It is within the last two *saoud*; in this period, there will be a probability of rainfall, snowfall and low temperatures. It is scientifically included in the winter season.

CHAPTER SIX - DISCUSSION

This chapter will discuss the findings of the study, in three parts. First, the Bedouin perception of precipitation factors , the second validity and reliability of the local knowledge that has been collected based on the experts point of view; and third the integration between Local knowledge and scientific knowledge for Badia development.

6.1 Bedouin perception of precipitation elements

6.1.1 Fragile environment and formation of local weather knowledge

The findings of the study, show that the local knowledge of rainfall , as a traditional practice is deep rooted and widespread amongst the people in the North Badia in Jordan, in terms of methods and techniques adopted in forecasting rainfall. Further, the research study highlights the significant role of ecological environment, as regards Bedouins' knowledge of rainfall as well as in framing the local climatic, or weather knowledge.

The tough and dry surrounding environment, in Northern Badia in Jordan drives its inhabitants to move in search of pastures, and water supply for their cattle. As a consequence of repeated movements and wandering about, within the Badia region accompanied with lots of observation related to movement decision, such as signs of climatic and living creatures are found in the region.

Moreover, the Bedouins' movement within the Badia region is closely connected, to frequent astronomical phenomena amongst the regions they come and go, in certain periods of time. This provides the Bedouin society of accumulated experience, throughout the route of time of predicting rainfall. This can be seen clearly in Courburon (2003) and Barnes (1996) and Barnes (2003). So, rough and dry environment represent local conditions that bring about the climatic local knowledge related, to geographical dimension for the concept of Badia.

These climatic environmental and climatic conditions forced the Bedouins' community to practice using Bedouin lexicons to express and explain these observations and practices so that the Bedouin community members understand, and communicate smoothly and clearly with one another.

6.1.2 The effect of Bedouin lifestyle

It might be to say that the change of lifestyle for the people of North Badia community, wherein they keep moving and living in tent homes made of cattle wool and depend on cattle as a source of income, and turned into a settled community provided with infrastructure, did not affect the validity and efficiency of local calendar in Jordan North Badia, as regards rainfall months, (HFDJB, 2011).

This new lifestyle characterized as neglecting being attached to nearby, environment reflects peoples' perception of rainfall, as well as the variability of climatic factors. They express their vision using lexicon and expressions differently, some of which relate to religious belief. Others related to peoples' behavior and those related to lose social values as well as using expressions related to technology widespread. Despite this, the change is not attributing to the climate. Climatic fluctuations are not genuine changes as the findings show as radical change takes a long time to happen. For instance, the moon and other star groups have fixed and clear routes that cannot be changed suddenly, or in a short time.

It is worthy to note that it is obvious from the findings of the study, that local knowledge would not necessitate that people can read and write. Studying and tracing stars in relation

to the Moon is based on a need of a fragile and dry environment in which livelihood strategy depends on. This is similar to what Courburn (2003) ; Taylor , et al. , 1988 ; Ajazen M.adden (1986) refer to as one feature of peoples' local knowledge who stress what might be kept or stored as memories could be described and identified so that people can refer to once needed, within the context of social culture for that memory.

6.1.3 The local dialect of informants and linguistic expressions

The findings of the study were reported using the Bedouins' local dialect, which probably is one of the obstacles to get along with the Bedouins, as regards using the local knowledge amongst the urban community members (i.e. outside the Bedouin community).

In contrast, linguistic expressions adopted in local knowledge in addition, the human beings characters derived from the Bedouin community, play a significant role in Bedouins' perception of rainfall.

The linguistic expressions and lexicons people use to narrate incidents or events related to rain have its own entity which distinguish it from other Jordanian dialects used in Jordan even if it is used in Mafraq, which lies within the borders of Northern Badia.

It is possible to identify the Northern Bedouin community identity, from everyday language use among each individual. And this is in line to what Barthes (1964) refers to about the linguistic topics, as the language is part of the social institutional and value system.

The findings of the study, show numerous lexicons and vocabulary use stemming from the local knowledge and culture of the Bedouin community. For instance, the word 'rain' in English has so many counterparts in Arabic wherein each word signifies the word 'rain' in a certain case.

This can be seen clearly in '*Alharif* 'relates to rainfall in the beginning, of the rainy season. Similarly, the word '*Algaith*' refers to rainfall after long absence. More, the word '*Jraidan'* refers to' naked', it can be used to describe 'autumn 'or; fall season.

Not only these linguistic signs are confusing, or can be understood and familiar amongst the Bedouin people in North Badia, but this can, also, be knowing by others who know more about the Bedouin community.

6.1.4 The human beings characters

Proper Nouns are significant and have a decisive role, most of the time, in the local knowledge of the Bedouin community. It is possible to understand local knowledge, because of understanding those folk and mythical characters. Researcher have traced and recorded characters, representing individuals of the same tribe in the Bedouin community , in narrative context throughout conducting personal interviews , such as ,*saad, alcjuz (i. e .old lady), "cuwied aldcs ", " hamdan abu jnaib"* in attempt to keep its interesting , persuasive and fluent record .

The rational beyond adopting folk characters is to highlight the nature of the local community knowledge, inherited from one generation to another. So, *Saads'* character was presented in form of' *alshkeih* ', the young – tribe *sheikh* son-. It is a common folk figure. Further, saads' figure was framed within '*ahl aljabal* 'clan (i. e. mountain owners). It is a well-known tribes, in Jordanian Badia which goes back in origin to "*jabal alarab "* in *Sham* Badia. Similarly, "*cuweid adcas"* figure represents the Bedouins' reliance and deep faith in Gods' response to him.

6.1.5 The incidents

It is obvious from the findings of the study, that much of the Bedouins' local knowledge was founded the incidents of which they demand or people making it up .That is it reveals the specific incident to be pronounced for the first time. These expressions can be comprehended most of the time as expressing or fake environmental moments or not true. In other words, these linguistic expressions do not assign a certain date for the birth of this knowledge, but also, they can tell the beginning of the certain mythical incident. Narrative of elderly about frequent mythical traditions is the most important because there is not ready–made recipe to make sure the story is true, or is not. Researcher has to use comparison and approximation to confirm truth.

In future, it may use indicators to test the structure, of these incidents. So that it makes it easy to know that it is true or false. This local knowledge can distribute over many stories or incidents. In other words, when it comes to local knowledge, we do not refuse this or accept that**.** We have to gather together bits and pieces related to it.

The divergence of incidents of local knowledge may sometime allude to different inventions of linguists. It may sometime allude to different forms and types of local knowledge of such incidents in terms of variation, its elements, in addition to the peoples' knowledge of the narrators, or interpreters are significant.

By the same token, staying far away from the myth settings may lead to change the intended meaning totally. Care and attention should be taken into consideration as regards addition and interpretation attached to folk-tale knowledge.

For instance, February's according to local calendar is known as "*qran 9"*. Elsewhere 25 days of February are distributed into "*saad dabah "* and "*saad balac" .*

Also, in different story, February days are distributed into three period's .Each is given certain name. Finally, the tale of "*alcjuz wal mikhbatt "* (i.e. the old lady and the stick).

These different levels of the local Bedouins' knowledge of February needs collection and build up. This local knowledge is distributed over so many folk –tale.

As a result, we cannot refuse the tale of the old lady and accept "*saad dabih "* and "*saad balac"*. As for reasoning for the local knowledge in every tale, incidents found in each tale were gathered and studied in order to make up the detail knowledge related to February.

6.1.6 The social solidarity

It could be stated that the social solidarity factor is not mentioned in the literature reviewed that dealt with the society perception of rainfall. However, there are literature indicate that culture might be in harmony with the social solidarity factor.Therefore; individuals have common interests and enhanced values such as donation and kinship ties.

The value of social solidarity amongst the Bedouins' community, members has an effective role in perceptions of precipitation. The majority of the people interviewed are the elderly and experts, who have their own expressions, related the change in rainfall to dramatic changes in community behavior. That expression was in a form of strong bond of intimate social relations amongst individuals of the Bedouin community. Such instances of change are the recurrence of the expressions' donation. Those expressions imply wealthy people granting the poor or the needy person, a sheep for a certain period of time to benefit from it and then to return it back. This personal practice or behavior expresses the solidarity and integration within the Bedouin society members.

Similarly, this social behavior or practice is of great social value.

Moreover, it is a kind of peoples' gratitude towards God's blessings, when it rain, or fertility. One more of social solidarity missing image among the society is not to eat or drink from animal's productions but to sacrifice by the owner of the cattle, slaughter a sheep for the God's sake, and distributes it amongst the poor and the needy ones. This change in integrated behavior is faced with gods' punishment according to changes shown in the findings of the study, whose consequences would entail a change in rainfall.

6.1.7 The religious believes

A change has been occurred in peoples' doctrine according to interviews with the elderly as regards faith in fate and destiny, and rain connection to supernatural force which is God from the Bedouins' viewpoint. Kadirov (2005) mentioned that Islamic doctrine refers the creation of Earth to one God – Allah-.So; creatures on Earth must abide and stick to good conduct and behavior. They must thank Allah for water as a source of life in order not to be punished and deprived of it.

The Bedouins' belief as the elderly report, in begging "*um alghaith"* to bring down rain after a long absence indicates the lack of effect of the religious factor as narrators mention. This is a great challenge to determine the influential factor in the local knowledge of the people. As a result, the researcher claim that the religious doctrine does not only intend to God's reward and punishment, but it also goes beyond this into mythical dominant, and present figures in folk stories and engraved in people's minds as "*um alghaith "* who is seen as a source of rain.

The findings show that the local knowledge is distributed among individuals who do not belong to the same tribe. In other words, they are not kinship and they belong to different Bedouins' tribes or, families living in the Northern Badia and share the same language, and traditions. The findings are in line with what Courburn (2003) mention about the local knowledge as an identity for a group, who has no blood or kinship ties.

6.2. Validity and reliability of local knowledge: Experts perspectives

Despite using the mythical folk-tales like "*saad, alcjuz"* (i.e. the old lady) among others to narrate and clarify the local knowledge, this does not prevent to mention that the findings of the study are correct .Strauss (1958) stated that using the myth as a container to record and store expertise the society relies on its measures and procedures as a reason for the incapability of the individuals reason, the effectiveness and accurateness of these experiences throughout the years.

With reference to the findings derived from the local elderly people interviewed, who usually do not read or write it is obvious that they mention indicators of rainfall. In addition, they report from the beginning and the ending of rainy season, such as wind, lightening, and insects. They, also, mentioned different names of rainfall which is reflect the type and time of rainfall. Also, the local people could describe the four seasons of the year, giving it names and relate it to astronomical phenomena.

In comparing this accumulated local knowledge related to rainfall according to the Bedouin in Northern Badia and the conclusions derived from interviews with experts, whose expertise and skills rely heavily on academic and scientific knowledge, in certain field of concern. Moreover, the comparison relies heavily on the direct interviews with the experts due to the lack of related studies regarding the Bedouins' local knowledge related to rainfall.

It is obvious that the expertise of metrological observations, are correct in matters related to the Bedouins in Northern Badia concerning the signs of wind, and the phenomena of

"*Alkhmsiniayeh"* (i.e.50 days) and "*Almirbacanyeh"* (i. e .40 days).The total of which comprises winter season. Also those meteorological experts are accurate and précis in connecting the connotation and denotation of rain labels which take place, in the beginning of winter to distinguish it from other rain markers in terms of benefit and date.

These experts are, also, very keen and careful to draw a comparison, between weather in terms of severe coldness and the soil readiness to receive , a greater quantity of rainwater. This scientific analysis for these signs draws a clear cut line to the credibility and validity of the findings of the informants of the people of Northern Badia. In contrast, literature stated that the astronomical phenomena related to rainfall, are widespread amongst other communities. This could be supported and elaborated in Slegers (2008) citing Tanzania as an example as the appearance of a star, in the sky in a certain period of time, as a sign to predict rainfall. It is worthy to mention that the shared factor amongst these pieces of knowledge in different communities is to connect these astronomical phenomena, proved scientifically, with the local knowledge belief in each community in an attempt to clarify and reason its occurrence on the one hand, and to confirm the scientific precision and usefulness, on the other.

The Astronomer attempted to prove the validity and credibility of the findings concerned with star groups, and the movement of the moon. These local calendars are fixed and stable as regards the stability of the tracks of these star groups, and the stability of the movement of the moon, in the sky. This local knowledge of the Bedouins' in Northern Badia is deep rooted and it is based on historical grounds amongst ancient Arabs, regardless the different labels connected to months names or seasons in the local calendar. The findings of the comparison between the local and scientific knowledge leaves the door open, to challenge before the scholars as regards the manner of how this local knowledge of The Bedouins in Northern Badia is transferred into present times. Findings as stated by the astronomer refer to mention "*Althuraia"* group *star* belong to the same entities in different regions far away from Jordan.

As the experts of natural resources confirmed that the regions that witness movement, in its prosperous time in January and February, must be visited repeatedly according of satellite images taken from the sky. This movement is closely related to either; astronomical signs such as the moon, and other star groups. Or, it could be attributed to climate signs such as lightening, thunder and wind. It should be noted that is the decrease of the number of the Bedouin people, who do still practice this movement in an attempt to look for water supply, and pastures for their cattle. This movement is based on a unanimous decision that must be made according to local expert for weather signs once appear.

Although there is no enough studies of the local knowledge of the Bedouin people ,in Northern Badia of rainfall, the researcher have to mention that this study , does not include every single detail about the research topic in the afore mentioned region, in particular, signs and tools used need further investigation. Similarly, factors related to the Bedouins' recognition to the variability of climate needs more investigation and further studies.

It might be possible to consider these pieces of local knowledge transmitted, or inherited from one generation to another as valuable as the validity and credibility of scientific knowledge throughout the passage of time. This validity and credibility might be in need of aid and support within the Bedouins' community, so as to restore it and keep a speech record of the Bedouins' dialect.

6.3 Local and scientific knowledge integration for development

Experts included in the research study, confirmed the using of some of the local knowledge of the Bedouins. Others confirmed that they have just started this local knowledge as

regards research only. Besides the fear of used this local knowledge, which can be reasoned by the individuals of local community bias for the interest of their region. It is noteworthy to mention that Rengalakshmi's (2005) study which focused that the local knowledge is a driving factor for development. As cited in Warren and Cahman (2003) they concluded that the combination of the scientific and local knowledge would create and enhance development projects that help in raising the standard of living for the individuals. So, the folk-story of "*Dhailan"* and constructing water harvesting technique as experts mentioned is an indicator that the local knowledge plays an important role side by side, to scientific knowledge in development, in general.

This local knowledge provides the community individuals with solutions to issues related to climate and weather that should not be ignored and we have to protect it as McGregor (2006) mentioned. Similarly, Davis and Wagner (2003) reiterated this as saying that these studies indicate, in general, that this local knowledge is confined to the elderly. It is a great risk that this knowledge is disappeared, or, lost. That is it goes with the people who have a record for it. Once an old man dies, this knowledge dies with him if it were not kept or stored.

Despite the change accompanied the lifestyle in northern Badia, the findings of the study have so much data categorized as a specialized scientific knowledge in predicting rainfall.

CHAPTER SEVEN: CONCLUSION AND RECOMMENDATIONS

7.1 CONCLUSION

The Bedouins have their own methods when it comes to predicting weather conditions. They depend on the knowledge of elderly people to determine when and where It's going to rain as they move from place to place. Without the technology of today and despite the drastic weather changes, their methods still make correct predictions.

The elderly use certain indicators in their prediction of weather such as:

- The Bedouins local calendar. It has the names of months and periods of rain, linked with moon movement.
- Denotations of bio-indicators like insect, bird and grass related to the precipitation.
- Denotations of weather pattern like lightning and winds origin.

It is of importance to note that this knowledge is limited to certain group of well known elders within the Bedouin community. The elders who tell the weather are not aware of the present technology which the outside world uses in order to tell weather conditions, some have seen the weather men on television telling the weather and they do not trust it. The nomadic Bedouins do not record their calculation methods on paper they simply pass it on to the next generation by telling a story. When analyzed this Bedouin methods are losing their ground as elders die and Bedouins move to rural areas.

The ecological environment is the most important factor affected Bedouins awareness. Also, four categories of perception founded among Bedouins. These came due to the change of life style at Badia, from the mobility and searching for pasture and water, to the urban life.

Since there is no enough studies of the local knowledge of the Bedouin people ,in Northern Badia of rainfall, it must be mention that this study , does not include every single detail about the research topic in the afore mentioned region, in particular, signs and tools used need further investigation. Similarly, factors related to the Bedouins' recognition to the variability of climate needs more investigation and further studies.

7.2 RECOMMENDATIONS

- **Inclusion of local knowledge**

It is recommended that national development institutions should consider the local knowledge before they arrange their development activities in Northern Badia. And develop strategy includes the local in their planning and implementation. So this strategy can be implemented for at least five years as a pilot strategy.

This strategy can be shared between the JBRDC and JHFDB which have experience in Badia regions, and ministry of planning and International Corporation which can provide funding for implementing the strategy.

Concerning period of strategy this could depend on the skills of the staff who work in the field and their experiences at regions of implementations.

- **Documentation of local knowledge**

Since there is lack information related to local Bedouin knowledge when it comes to precipitation, I highly recommended developing a national plan, between ministry of culture, ministry of planning and international incorporation. It would be better is the anthropologies in the Jordanian universities take part of this national plan.

The ministries can provide the financial and technical support of the documentation project. While the anthropologist will draws the road map of the project to achieve the goal.

The limitation will be the lack of skills from the field staff, which will collect the local knowledge. It is better that the anthropologists arrange a training course for the ones who will make direct contact with Bedouins.

- **Local knowledgeable Bedouins**

To further develop and save local knowledge used by elders related to precipitation, the development institutions could establish a Bedouin network ,with the names and residence of the elders , and this elders could serve as trainees to the rest of the Bedouin members or to the outsiders .

- **Further study**

It is recommended that a further deep and detailed study exploring with different Bedouin society members, from residents inside and outside Badia. This would provide explanation to the expressions found during the field study.

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