

Research Paper: Research on Livestock Management in Droughts by Nomads

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ABSTRACT

Purpose: Every nation's indigenous knowledge has enabled people to meet their needs without wasting resources, which can be applied to create a more sustainable future. This study sought to gain insights into the indigenous knowledge of some Iranian Nomadic Tribes in terms of how they manage drought conditions on nomadic pastures. Selected tribes in Ardabil, Bushehr, Chaharmahal, Bakhtiari, Mazandaran, Golestan, and Semnan provinces in Iran were selected.

Methods: A qualitative approach was adopted for this study. Specifically, a multiple case study approach will be used with reference to the theories of symbolic interaction and ethnographic methodology. The data collection method included in-depth individual and group interviews, participatory observation and focused group discussion techniques. The sampling method was purposeful and theoretical. Semi-structured in-depth interviews were conducted with nomads to explore Indigenous knowledge of drought management until theoretical saturation was reached. Data were recorded on paper, and the results were analyzed item by item by adapting the method of postmodern ethnography using a descriptive model.

Results: The results showed the nomads were implementing a range of solutions to address drought conditions, including moving livestock to areas with food sources, managing water resources (e.g., the Hanare System or livestock watering every other day, constructing traditional water storage structures, and water supply by tanker), and livestock management (removing livestock fattening and finally selling livestock).

Conclusion: During droughts, nomadic herders try to keep the herd in the same condition as before the drought or with minimal changes through different management methods. It seems that providing legal facilities in such periods can lead to the stability of nomadic livestock farming.

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1. Introduction

Different people have provided varying definitions for Indigenous knowledge. The most common definition refers to the term “Indigenous”, defined as “Groups of people whose social, cultural and economic conditions distinguish them from other sections of the national communities, and whose status is regulated wholly or partially by their customs or traditions or by special laws or regulations (The World Bank, 1998: 44). Indigenous knowledge is the sum of experience and knowledge that a community has gained over time in dealing with familiar and unfamiliar problems and has made it the basis for its decisions and challenges (Warren & Cashman, 1988: 44). There are other terms for Indigenous knowledge such as local knowledge, Indigenous technical knowledge, traditional knowledge and people’s knowledge; however, this study adopts the term Indigenous knowledge in this study (IIRR, 1996: 211).

The most important features of Indigenous knowledge are that it is based on experience, tested over centuries of application, and has practical utility. It is compatible with the environment and Indigenous culture, which is dynamic and changing (Bozarjamohri, 2003: 5-20).

The nomadic way of life is an advanced form of social life that has continued over millennia, characterised by a tribal social structure, livelihood based on animal husbandry, and a nomadic way of life. According to the results of the third socio-economic census of nomads in Iran, there are 1,186,398 nomadic people in 212,772 households, comprising 104 clans, 552 independent clans, and 19,840 smallest clans spread across 30 provinces of the country.

This population is scattered across eight regions (North, Northwest, Northeast, West, Southwest, Southeast, Center, and East), covering more than 60% of the country’s geographical area. The growth rate of the country’s nomadic population over the past few decades has decreased compared to the country’s total population. Nomads make up 1.8% of the entire country’s population.

Livestock is the main capital of nomads. In 2017, their livestock numbered 24 million units, including 28% of light livestock and 4% of heavy livestock nationwide. The majority of livestock (86.4%) are small livestock, about 70% of which are dependent on rangelands. Annually, nomads contribute about 9 million livestock units to the market, producing 162,000 tons of red meat (20%

of the country’s production). In addition, the livestock produces 400,000 tons of milk and 14000 tons of wool. (Anonymous, 2017).

The dependence of nomadic productions on rangelands requires the optimal management of these areas for sustainable production. Iranian law defines rangelands as “lands (mountains, slopes, or flatlands) with a cover of naturally growing fodder plants during the grazing season, traditionally known as rangelands due to grazing history. Lands that are fallow crops, even if covered with forage plants, are not included.”

One of the most important phenomena that affect rangelands and nomads is climate change and the occurrence of droughts. Drought is a situation caused by a lack of rainfall and an increase in temperature that may occur in any climate (Mishra & Singh, 2010: 202 - 216). Drought is often described as a creeping phenomenon, and unlike floods and rainfall, whose start, end, and range are known, it is very difficult to describe the time and place of drought. It may take weeks or months to determine whether a drought has occurred in an area, and in the same way, the effects of drought may persist long after the rain resumes (Alizadeh, 2018).

Droughts may have different causes; first meteorological droughts involve a decrease in rainfall in one place for some time (Chang, 1991: 935-943; El-Tahir, 1992: 185-199; Pinki, 1966; Santos, 1983: 183-211) second, hydrological droughts marked by periods with a shortage of surface and underground water resources due to the excessive use of available water. Third, agricultural droughts are associated with a decrease in soil moisture and, as a result, a decrease in crop yield (Mishra & Singh, 2010: 202-216) Fourth, a socioeconomic drought reflects the failure of water resources systems to meet societal water needs (Alizadeh, 2009).

However, this phenomenon (drought) can be managed. In Iran, due to low precipitation (average annual rainfall is about 250 mm), which is one-third of the world average and the inappropriate spatial distribution, the country is among the driest semi-arid regions globally. It is also one of the most water-scarce nations worldwide (Mas-soudian & Kaviani, 2016). However, due to the increase in population and the consequent expansion of industry, agriculture, urbanization and the development of economic sectors, the demand for water is escalating daily (Farajzadeh, 2014: 5).

As discussed, nomadic communities are globally one of the most vulnerable populations in terms of climate

change and drought, yet their Indigenous knowledge plays an important role in pasture and livestock management (Calvosa et al., 2009: 20; Sabohi et al., 2017: 438-453). Senos et al. (2006) pointed out that the effects of ecosystem destruction impact nomads more rapidly than urban populations. Farmers, including nomads who live a pastoral life, are often faced with unpredictable climates and dynamic conditions in arid regions. In recent decades, the presence of farmers has ensured sustainable management and ecological health of arid regions (Hartman & Sugulle, 2009: 62).

With this background, the current research was conducted between 2018 and 2020. The key research question was: What are the Indigenous management techniques used by Iranian nomads to address drought conditions? The study aimed to collect, preserve, and maintain this knowledge as a cultural and ethnic asset for the country, ensuring its use in future development projects and climate change management. The nomadic tribes of Ardabil, Bushehr, Chaharmahal Bakhtiari, Mazandaran, Golestan and Semnan provinces possess extensive experience in drought management in Iranian rangelands and were therefore selected for this study.

2. Literature Review

The importance of Indigenous knowledge

In the 1950s and 1960s, all aspects of indigenous knowledge were considered ineffective and an obstacle to progress and development. Nevertheless, currently, indigenous knowledge is recognized as a valuable resource for future land management. In 1993, the United Nations declared the “International Year of the World’s Indigenous Peoples” through Resolution No. 164. The purpose of declaring this year was to develop international cooperation in order to plan and examine the issues and problems of the Indigenous peoples of the world. The problems identified in 1993 included, the unfavorable situation of human rights and the development of education, health and environment (Kolawopole, 2001: 1-9). Indigenous knowledge is now acknowledged as important, and as such, the United Nations provides financial assistance in different countries to collect such knowledge. A number of authors, such as Asgari (2005), Ashraghi (1998), Heydari et al. (2006: 741-757), Moshiri (2001), Shah Hosseini (2005) stated that Indigenous knowledge and culture are useful, dynamic, cost-effective and holistic and is complementary to official knowledge. Indigenous knowledge has usually been passed down orally from one generation to another and is the result of experiences through trial and

error. In fact, one of the most important topics of anthropology is the knowledge of the culture of rural and nomadic communities and the investigation of Indigenous knowledge and its adaptation to the environment and meeting nomads’ needs from the environment. This type of knowledge often forms the basis of the animal husbandry system of different communities (Momeni et al., 2009). Arabiun (2006: 81-136) states that paying attention to Indigenous knowledge should challenge the current one-way, top-down approach to management and result in a two-way and bottom-up process in land planning and management. The system should be more focused on facilitation and be farmer-oriented. This alternative approach affects the intra-organizational and extra-organizational communication of the current system to fill the deep gap between the user and the information sources. In the term Indigenous knowledge, the word Indigenous indicates the locality and traditional knowledge and separates it from academic and official government information. Currently, most Indigenous knowledge is held by elders, and it is only after their death that, in some cases, the loss of the knowledge is recognised (Naseri, 2002: 48-62). In a study by Popzen and Afsharzadeh (2010: 476-488) of Indigenous knowledge of Kalhor (Iranian Clan) pastoralists, they state that almost all the country’s natural resources experts agree that Indigenous knowledge, especially of rangelands, is vital to save these areas, yet to date this knowledge is not being recognized.

Drought – its meaning and management

A drought is a period of drier-than-normal conditions and can last for days, months or years (Douville et al., 2021: 1055–1210). A number of studies of rainfall and drought have been undertaken in various provinces in Iran. Khodagoli and Soltani (2009) evaluated the drought situation in Isfahan province during three, five, and eight-month periods from 1970 to 2008, with emphasis on the water year 2007-2008. The results of their research showed that the spring drought (a period of 3 months) was more intense and extensive than in the other two periods. In a further study in Isfahan province, Modares and Khodagoli (2008) undertook a regional analysis of the rainfall trends during the period from 1970-2005. The results showed that in a large part of Isfahan province, especially in the east of the province, the rainfall had a negative trend, and only in a small part of the centre and in the south and west of the province, it showed a positive trend. Khodagoli, Sabohi and Eskandari (2013: 367-379), in their analysis of the drought in Isfahan province, concluded that most parts of Isfahan province faced severe drought in 2000 and 2008.

Finally, Ayuzi, Masaadi and Misbah (2013) studied the data from 20 rain gauge stations in 30 years in Golestan province and found that except for two stations, in all the stations studied, the occurrence of very severe drought was parallel with the occurrence of minimum rainfall.

Further, more recent studies have been carried out exploring drought in Iranian provinces. Esmailnejad and Pudineh (2016: 85-100), in the assessment of adaptation to climate change in the rural areas of South Khorasan, found the most important consequences of climate change in that area are drought, dust and floods, respectively. Ninety per cent of the study respondents believe that the local climate is changing, referring to an increase in hot days, the frequency of droughts, and decreased rainfall. Most respondents believed that climate change was directly affecting their livelihoods and agriculture in the region, and 87% of the study respondents indicated they had adapted to these conditions. The most important economic response was selling livestock, taking loans from relatives, reducing planting and using agricultural inputs, choosing new businesses and migrating from the area. Creating new businesses that are less dependent on nature has been proposed as a new approach to adapting to climate change, reducing vulnerability, and improving livelihoods in the region (Yegangi et al., 2018: 1352-1362).

The effects of drought on rangelands

In a study by Ehsani et al. (2006: 249-260) the effect of climatic conditions on the production of rangeland fodder of four dominant species (*Artemisia sieberi*, *Salsola rigida*, *Noaea mucronata*, *Stipa barbata*) in the steppe region of Markazi Province, Iran during 1998 - 2005 showed there is a linear relationship between the rainfall of the growing season plus the previous rainfall with production. Esmaili Sharif et al. (2018) stated that, in drought conditions, the use of more adapted species and populations can be considered as one of the important strategies for managing such conditions. Badripour (2008) reported that the preparation for facing drought has the following components: an early warning system, a drought plan, and a plan to return to normal conditions, policies and support programs. In the section on actions during the occurrence, the components of reducing the effects, providing relief, and reviving and rebuilding are also listed. Khayam Nekui et al. (2008) have recommended the use of entophytic fungi as an important biological factor in increasing the tolerance of grass against drought stress. Alavi et al. (2008) reported that, with the decrease in rainfall, the condition of the Kaboud cheshmeh Polsefi (In the North of Iran) has

changed from good to average. Misbah and Fakharizadeh (2009) positively evaluated the impact of watershed management projects on water storage and aquifer nutrition in the Perziton basin of Firozabad, Fars province, especially in drought conditions. Zare Kia and Zare (2013) have stated, "The effect of rainfall fluctuation on plant species is different, and the species have different behaviours against drought stress. Khosravi et al. (2010) showed that the lowest yield corresponds to the driest year in Iranshahr city, Sistan va Balouchestan Province. Rashid Nasab et al. (2016) reported that the Nomads of the "Derila" area of Gachsaran City do not have a positive view of the consequences of drought. They have evaluated it as destructive and, at the same time, controllable. The investigation of managerial behavior towards this phenomenon can be identified in two dimensions: technical and non-technical modifiers. The priority of the studied nomads in dealing with drought is to use non-technical modifiers such as prayer, performing rain-reading ceremonies, selling rangelands and all female lambs, and migrating to cities and villages. They expect support from the government in this condition. Abdul-lahzadeh et al. (2016: 85-106), in the study of villagers' perception of climate change and adaptation strategies in "Zabul" city, stated that the variables of perception of climate change, gender, literacy level, agricultural experience, type of job, livestock ownership, having drought insurance and income using strategies to deal with climate change are more effective. The results showed that the physical, social and economic limitations of dealing with climate change are the creation of large dams in Afghanistan, inefficiency of storage systems at the regional level, lack of suitable reservoirs for storage, financial inability, inability to receive bank facilities, lack of capital to use modern irrigation systems, lack of strategies to deal with climate change and non-participation of some in reducing water consumption are the most important limitations factors in adapting to climate change. Sabohi et al. (2017: 438-453) evaluated that 90% of the Qashqai nomads in the "Semiroum" region consider the change in temperature, precipitation and wind parameters as the main signs of climate change. Adaptation methods such as delaying migration time, building block houses, building swimming pools, reducing livestock, feeding livestock with other fodder sources, etc., were solutions to deal with drought. Zare Kia and Mir Jalili (2018), in their study in the steppe areas of Tang Chenar pastures in Yazd province, concluded that the drought caused a severe decrease in fodder and livestock, so the herders were forced to sell their livestock. In order to continue herding and get out of the drought crisis in these areas, the researchers suggested some management solutions,

such as preventing premature grazing in summer rangelands, investigating the possibility of reducing the pressure on rangelands through the application of grazing systems, using all the potentials of the field (cultivation of medicinal and industrial plants, beekeeping, etc.) and insurance of pastures and livestock. Behzad (2021), in his interview with IRNA news, reported that according to estimates, with the continuation of the drought, the rangeland yield will decrease from 10.7 million tons to 6.45 million tons in 2021, which indicates that the reduction is four million tons. Rezaei (2021), CEO of the National Union of Natural Resources and Watershed Cooperatives of the country, in her conversation with “Agha”, announced a 43% decrease in rangeland fodder due to drought.

Theoretical foundations of research

The qualitative research process begins with philosophical assumptions which influence the selection of the qualitative method (Creswell, 2019: 29). Every science needs philosophy to establish its prior principles. (Zanganeh, 2020: 565-584). In addition, the researcher introduces worldviews or paradigms (a set of researcher’s beliefs) and interpretative or theoretical frameworks that serve as a guide for shaping the study. Regarding the necessity of paying attention to the issue of worldview, it is mentioned that the facts (facts of nature) are universal. However, each ideology shapes knowledge and science according to its perspective. Interpretive frameworks are also chosen based on the research topic. In a research activity, it is essential first to determine the appropriate paradigm for the research topic to establish compatibility between the philosophical foundations, research methodology and tools. Otherwise, the research will suffer from inconsistency.

Philosophical framework

The four main concepts underpinning the approaches of different methods of social science studies are the concepts of “Ontology” (what is reality?), “Epistemology” (ways of knowing reality), “Method” (research methods, techniques and methods of data collection and analysis) and “Methodology” (study of methods and their critical analysis) (Mohebbi & Hosseini Tavassol, 2022). From Creswell’s point of view (2011), in addition to the assumptions of ontology, epistemology and methodology, the assumptions of “Valuation” (reviewing the value of research) and “Expression” (choosing a writing style) should also be used in guiding the researcher’s decision to choose effective qualitative research.

The paradigmatic framework (worldview) of research

The paradigmatic frameworks are fundamental beliefs that guide actions (Guba & Lincoln, 1988). Considering that the purpose of the present research was to record the knowledge of the local communities about different methods for managing drought conditions, the paradigmatic framework of the present research integrates three theoretical positions: subjective views, the construction of social realities, and the cultural formatting of social realities, respectively, with “Symbolic interaction” (it is based on an immediate two-way relationship. It focuses on the subjective meanings of the phenomena in the eyes of the people during the interaction), “ethnographic methodology” (paying attention to daily activities, how they are implemented, etc.) and structuralism and psychoanalysis (which examine underlying structures beyond the scope of everyday interactions) (Flick, 2010: 492).

Theoretical Frameworks (Interpretive)

Knowing the theoretical literature and being familiar with the existing views and approaches around the subject helps us to make informed choices regarding theoretical positions, data collection methods, interpretation methods, and areas of application. Therefore, the viewpoints and theoretical references of the subject under study (the analysis of Indigenous knowledge among nomads in coping with drought conditions) were included: the post-development approach (Postmodernism), the Theory of symbolic interaction (Social interaction), the Phenomenology theory (Life experience), the Social constructivism approach, and the Ethnography Methodology.

3. Methodology

The research was carried out in three steps as follows:

selection of nomadic rangelands to be studied:

Selection of cases was made based on a purposeful judgment method with consultation with experts and local informants, Such as Elderly and experienced herders and professional shepherds. Finally, the nomads of Ardabil, Bushehr, Chaharmahal, Bakhtiari, Mazandaran, Golestan, and Semnan provinces who have strong local knowledge and valuable experiences in the field of local knowledge of rangeland management under drought conditions were selected (Table 1).

Table 1. Specifications of project implementation locations

Row	Province	City	Clone/ Tribal people	Summer rangelands	Winter range-lands	Mean rainfall (mm)	Mean temperature (degrees C)	Above Sea Level (m)
1	Ardabil,	Parsabad	Moghanlou / Shahsavan	Sablan	Fath Ali	270	10.6	22 to 574
2	Bushehr	cities of Dashtestan-Dashti-Tangestan-Dir-Jam-Dilam	Shesh Blouki /Ghashghaei	variable	variable	variable	variable	variable
3	Fars	Euclid	Shesh Blouki /Ghashghaei	variable	Miandasht (Midast) Dejjah and Del Garde Dahram	357	22.4	720
4	Chaharmahal and Bakhtiari	Kohrang	Hamuleh/Bakhtiari	Dasht Laleh-Vajghon	Sergacheh Bessim Masjed Soliman	1359.1	9.5	2480
5	Semnan	Mehdi Shahr	Parsa and Ali Akbari, Dost Mohammadi, Pelangi (Firouzian), Murad Alian, Masumian	Lar	rangelands around Damghan	253.2	12.4	1630
6	Golestan	Gonbad, Kalleh, Aqqola, Gamishan	Turkman	Rangelands of Gonbad, Kalleh, Aqqola, Gamishan	Rangelands of Gonbad, Kalleh, Aqqola, Gamishan	280	18	1100
7	Mazandaran	different cities of Mazandaran	Galesh	variable	variable	977	17.6	0 to 3000



The second step is to carry out base studies (social and ecological) of the selected rangelands:

This step involved conducting library studies and checking internal and external sources to compile the theoretical foundations and background of the research, as well as obtaining statistics, information, and maps of the studied areas from the relevant bodies.

determining the Indigenous knowledge of nomads in facing drought conditions using a qualitative research approach:

This stage was carried out using a qualitative approach as follows:

The type of research design was multiple case studies. This approach makes it possible to compare the study items and find the similarities and differences between them (Yin, 2009). The research relies on subjective approaches and social constructivism, respectively, with reference to “Symbolic Interaction” theories and “Ethnographic” methodology (Flick, 2010: 492). The method of data collection, according to the topic, included in-depth individual and group interviews, participatory observation, and focused group discussion techniques. The sampling method was “Theoretical and Purpose-

ful”. Contrary to the quantitative method, the number of samples was not determined in advance, but their number was determined after the completion of data collection. In this way, first in the study area, we referred to the first utilizer or experienced group (suitable to the topic and purpose). We conducted an in-depth semi-structured interview regarding the Indigenous knowledge of the nomads who were facing the drought conditions. The interview continued until the “Theoretical Saturation” was reached. This stage was when no new data was produced with the continuation of the interviews. The data was recorded by 3 people, using tools such as audio recorders and video cameras, as well as taking notes. For this purpose, in addition to the facilitator, two colleagues also took notes and recorded the information. The good thing about taking notes is that if the recording device breaks down, you can refer to the relevant notes. Considering the conditions of conducting individual and group interviews, each interview lasted about 1.5 hours. Finally, the data from the audio recording was recorded on the paper.

4. Findings

In general, the various solutions that the nomads of the studied areas adopt to deal with the drought phenomenon are summarized in Table 2 and Figure 1. As evident from the table and figure, the research results are divided into

three parts: Moving livestock to places with food sources, water resources management, and livestock management. Each of the relevant categories is explained below:

Moving livestock to places with food sources

Moving livestock to places with food resources includes moving on foot rather than by car to utilize fodder available along the route, using farm pastures, early migration to summer and delayed migration to winter rangelands, moving livestock to fodder-rich pastures, using resources for new food, use of non-palatable plants such as camel’s thorn (*Alhaji camelorum*), livestock grazing on the side of drainage canals, moving to rain-fed areas, use of pastures on the northern and eastern slopes, use of pastures on the valley floor as well as pastures near the pens, collecting some species Pastures and

their use during migration, grazing in cool weather, use of night grazing system, food rationing, change of food composition towards cheap composition, non-migration and feeding with hand fodder are done.

Water resources management

The management of water resources also includes the use of the “Henareh system”(livestock watering every other day), the construction of traditional water storage structures and water supply by tankers.

Livestock management

Livestock management is done by removing fattening and finally selling livestock (in critical conditions, even productive livestock) (Table 2).

Table 2. The various solutions of the nomads of the studied areas in order to deal with the drought phenomenon

Row	Province	Tribal People	Solutions to deal with drought
1	Semnan	Sanghsari (Parsa and Ali Akbari, Dost Mohammadi, Pelangi (Firouzian), Murad Alian and Masumian Clones)	a) Feeding cattle by hand b) Food rationing c) Lease of barley, wheat and beet fields d) Changing the food composition towards a cheap combination (such as mixing oats with straw and hay instead of feeding with pure oats e) Not moving to winter rangelands instead of, renting a place in the outskirts of the region and spending the winter there f) Implementation of “Henareh” system g) Water supply by tanker h) Grazing management (for example, grazing the south aspect of mountains (pastures facing the sun, warm up earlier, then the grass grows earlier). i) Selling livestock
2	Fars	Shesh Blouki /Ghashghaei (in summer rangelands)	a) Early move to the summer rangelands b) Later, moved to winter rangelands c) Use of manure from their farms d) Construction of water ponds with different methods e) Using agricultural water in winter rangelands to provide drinking water for animals and humans and to fill 20 thousand liter water tankers f) Changing the composition of food to a cheaper composition (increasing the percentage of white straw in the composition of manual fodder g) Selling and removing old and weak livestock h) leasing the agricultural land i) Collecting species such as koma, artichoke and jashir (<i>Ferula sp.</i> , <i>Prangus ferulacea</i> , <i>Gundellia tournefortii</i>) in the pasture and using them during migration. j) Buy fodder
3	Ardabil	Moghanlou / Shahsavan	Immediate sale of surplus male lambs and old and eliminated sheep Elimination of fattening of salable male and female lambs or adult sheep in winter Changing the food composition towards a cheap combination (80% straw and 20% alfalfa or spruce) Using corn silage instead of hay Providing minerals and salt needed by sheep and lambs from mineral bricks and rock salt (adding 100 grams of salt and 150-200 grams of mineral and vitamin supplements to 100 kg of ration to prevent abortion of sheep pregnant) The use of unusual and unpalatable plants such as camel thistle (<i>Alhaji camelorum</i>) Renting lawns, orchards (garden fodder under the trees), or farm waste Early spring migration from winter rangelands and renting agricultural land from villagers to summer rangelands Early autumn migration in case of drought in summer and renting agricultural land Livestock grazing on the edge of Moghan drainage canals k) Pedestrian travel instead of car travel to use the fodder between the fences l) Late departure from the summer rangelands m) Finally, the sale of productive ewes

Table 2. The various solutions of the nomads of the studied areas in order to deal with the drought phenomenon

Row	Province	Tribal People	Solutions to deal with drought
4	Bushehr	Shesh Blouki /Ghash-ghaei (in winter rangelands)	Water supply by tanker Construction of traditional structures for extracting rainwater and underground water such as; Reservoir, dam, well, terrace, cistern, cistern and aqueduct Change the migration calendar
5	Chaharmahal and Bakhtiari	Hamuleh/Bakhtiari	Shelter in the northern slopes (Nassar) moving to rainy areas Selling a number of livestock Manual feeding of animals Applying "Henareh system" (in the cold seasons and months of the year) Performing the traditions and rituals of asking for rainwater from god
6	Golestan	Turkman	Renting the remaining agricultural products for livestock grazing Manual feeding Use of the pastures of the northern and eastern slopes Using pastures on the valley floor as well as pastures near the pens on hot days Grazing in cool weather f) Using "night grazing" system Selling livestock (even productive livestock)
7	Mazandaran	Ghalesh	Transferring livestock to " Partas" pastures (ecotone) at lower altitudes Selling a number of livestock

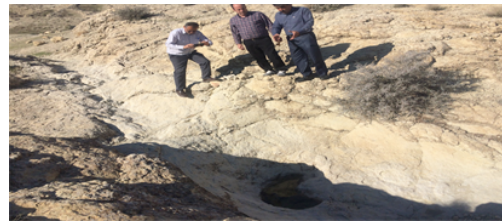
**Summary of findings:**

The results are summarized as follows:

- a) Feeding with fodder
- b) Food rationing
- c) Changing food composition towards cheap composition
- d) No migration
- e) Applying "Henareh system"
- f) Water supply by tanker
- g) Changing the way of why
- h) Early move to the summer rangelands (Summer Quarter)
- i) Late moving to winter rangelands (Winter Quarter)
- j) Use of agricultural residues
- k) Construction of traditional water storage structures
- l) Selling livestock
- m) Remove fattening
- n) Use of new food sources
- o) Supplying minerals and salt needed by livestock from mineral bricks and rock salt
- p) The use of non-palatable plants such as camel thistle (Alhaji camelorum)
- q) Collecting some types of pasture and using them during migration
- r) Cattle grazing on the edge of drainage canals
- s) Emigration on foot instead of car and mechanized migration
- t) Moving to rainy areas
- u) Use of the pastures of the northern and eastern slopes
- v) Using pastures on the valley floor as well as pastures near the pens
- w) Grazing in cool weather
- x) Using "Night Grazing" system
- y) Moving livestock to pastures with fodder
- z) Implementation of rituals for seeking water



Remains of old buildings (Seng Dam and Saroj) on the river for flood control and water storage



“Qaqlu” or water stone (rainwater gathering in the cracks and natural pits of rocks)



Livestock watering place (Guru or Gurab) resulting from the storage of rainwater in Qeshlaq (winter rangelands)



Terrace using stone (blocks and dams) and runoff control (blocks or “Bast” are called plains or flat land in the local dialect, and dams or stone slabs are built in the direction of rainwater control)



water supply by tanker by nomadic affairs in low rain years



Herd grazing at the beginning of the spring migration in the rented fields on the way to destination

Figure 1. Different forms of drought management by Iranian nomads in the study areas



It seems that the nomads are trying to keep the conditions at the same level as before the drought by moving the animals to places with fodder available along the way to their destination, initiating early migration to summer rangelands and delaying departure from there. At this time, they sometimes move on foot instead of using a vehicle to allow them to use the fodder on the way to their destination. Even in the critical drought conditions and its continuation in the winter Quarter” and “Summer Quarter” if they do not have cash to buy food, they are forced to use unusual and unpalatable plants such as *Alhaji camelorum* (soaking in water for 24 hours) and *Cersium* sp. They may also graze their herds in areas where unusual plants grow, which often grow more in valleys or northern slopes. Due to extreme hunger, the sheep are forced to graze on these plants.

With the continuation of the drought, manual feeding becomes necessary, especially for productive ewes (mostly pregnant in autumn and winter) at levels sufficient for maintenance and pregnancy. This feeding is

achieved by purchasing cheaper food resources, such as cereal straw (wheat and barley), and slightly more expensive fodder such as *Medicago* sp. and *Onobrychis sativa*.

As drought continues and food resources remain scarce, the next step is to immediately sell surplus male lambs and old and eliminated sheep before losing weight at a cheap price. Eliminating the fattening of salable male and female lambs or adult sheep in winter due to the high cost of fattening rations (fodder and concentrate) is considered another nomadic measure.

Finally, if the herders are not able to feed their flock, they decide to sell their productive ewes and go to the cities in search of their educated children. These steps are shown in [Figure 2](#) as coloured lines from green to red.

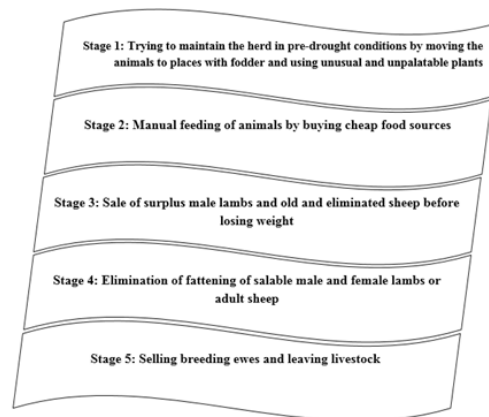


Figure 2. Stages of nomad decision making when facing drought conditions



What is certain is that livestock is the main capital of nomads, so when faced with droughts, they first try to move their livestock to places where fodder is available, such as the ways to destination, use of crop residues, summer rangelands and use of unusual and unpalatable plants. They try to feed the animals manually by purchasing cheap food sources. Selling surplus male lambs and old and eliminated sheep before losing their weight. If the drought conditions continue, they will remove the fattening of salable male and female lambs or adult sheep. The decision to sell productive ewes and leave livestock farming is the final blow that the drought phenomenon inflicts on the nomadic livestock farming system.

However, if the government does not think of a solution, we should gradually wait for the elimination of nomadic livestock farming. The decrease in production of meat, dairy and livestock products is one of the most obvious disadvantages of eliminating nomads; with the decrease in production and increase in consumerism and re-inflation will be inevitable, which the security, social, political and economic consequences should be added. Also, the disproportion of livestock distribution (which is one of the problems of natural areas) will also be added to the environmental issues.

Rain is the most important change factor in the nature and living place of these people in (Winter Quarter). It is also necessary to pay attention to this point that (Winter Quarter) has always been known for water scarcity, and people used to store rainwater and use that water to provide for themselves and their livestock. What has been achieved during the past years and due to the uniform management of water resources by the governments is the forgetting or losing the colour of the Indigenous

knowledge and traditional methods of water management.

The drying up of permanent and seasonal rivers and springs, which in the past caused people to gather around a natural source of water, has brought about many changes in the life forms of nomads. Setting up tents at a close distance to each other and around water sources has led to the formation of a culture of cooperation and help in doing tasks such as guarding and taking care of livestock and women and children spending time next to water sources. Now that the surface water sources are almost dry, families carry the water in water tankers by vehicle. Each family freely sets up its tent in a place in its pastures, which is usually located near a village for easy access to water. For the first time, the life of nomadic families has taken an individualistic form, and the possibility of permanent movement has been denied to them. Living in one or more specific places has limited access to fodder and natural pastures, and families have to pay a lot of money to provide fodder for animals and to buy water. The lack of movement of nomads in a long way has a great impact on the quality of pastures, and indiscriminate grazing of livestock in one place has caused damage to pastures and reduced quality in the long term. Currently, in the absence of non-governmental organizations and representatives of various water stakeholders, the government is considered the main ruler of water. The type of management of water resources by the government in the long term has brought about many changes in the attitude of the nomadic community toward water. The phenomenon of water supply by the "Organization of Nomadic Affairs" mainly in mobile form, buying water with tankers since at least 10 years ago, has turned water into an economic and non-free commodity. It seems that in addition to the adoption of drought management solutions by nomads in different regions,

the implementation of laws supporting nomads in times of drought (laws on compensation for losses and prevention of complications caused by drought approved by the Islamic Council on 2000/5/9 including financial facilities in the form of grants, loans and product insurance and the Law on Prevention of Complications Caused by Drought and Compensation of Damages approved on 2002/7/25) can be a solution to the damage caused and the continuation of traditional livestock farming. Management of herd composition can also be proposed as one of the solutions to solve the problem of excess livestock over rangeland capacity. In this way, by removing the surplus lambs and introducing them to the fattening system, the supply of barren livestock, as well as rams, goats and non-productive goats, to the market for slaughter, and the pressure on the pastures can be mostly reduced. In addition, under the current drought conditions, animal husbandry costs are reduced due to the provision of supplementary food. The results of [Mohebbi's calculations \(2022\)](#) on Iran's light livestock statistics in 2018 showed that at least 15% of the country's light livestock have the conditions to be removed from pastures or transferred to the fattening system. Therefore, on the one hand, it is necessary to prevent excess livestock from entering the pastures by strictly applying the laws and, on the other hand, to provide the ground for lamb fattening and the sale of non-productive and surplus livestock.

The presence of goats and camels in the composition of the herd can be considered as a solution that needs to be researched. However, the rapid movement of the goat leads to the thinning of the sheep behind it and the difficulty of control by the shepherds, so the nomads of the regions do not show much desire to have a large number of goats. The goat drags the sheep to the place of thorny plants and causes them to get injured. The reason for keeping goats is the high quality of their dairy products. In terms of quality, goat dairy products are lower than sheep and higher than cows ([Mohebbi, 2023](#)). It can be said that there is a direct relationship between the number of goats and the poverty of herders. Due to the low cost of goats, poor herders have more of these animals. It seems that with the occurrence of climate changes and droughts, goats will receive more attention. Also, goat dairy products can enter the industry more with media advertising. Also, camels, due to special physical conditions, can live in harsh conditions. A camel is an animal that needs very little fodder, little water, and a vast desert area. It is also very resistant to diseases and temperature differences. Due to its adaptation to the conditions of dry and desert areas, the breeding of this animal does not have the problems of other animals, so it is easier to maintain it. Also, the high ability to tolerate dehydra-

tion, feed on dry fodder and pasture and desert plants, low treatment costs compared to other livestock, low metabolism, appropriate daily weight gain and short fattening period make raising this animal economical. Many products will also be available. Camel meat has a warm character and is recommended in Islamic and traditional medicine. Camel milk is also used for many diseases, including blood sugar control, camel oil is used for medical purposes, and camel wool is used for clothing and handicrafts.

Among the other solutions, it is possible to mention increasing the diversity of the nomads' income and establishing their employment in matters other than animal husbandry. In this case, it is expected that the pressure on Rangelands will be reduced in times of drought. [Martin et al. \(2014: 1-20\)](#) also introduced the most important solution to deal with climate change conditions in arid regions by increasing mobility and diversifying income. In order to complete the current research, it is suggested to research the compatibility of various pasture and livestock species with drought conditions in different areas.

5. Discussion

Every nation's indigenous knowledge has enabled people to meet their needs without wasting resources, which can be applied to create a more sustainable future. This study sought to gain insights into the indigenous knowledge of some Iranian Nomadic Tribes in terms of how they manage drought conditions on nomadic pastures. Selected tribes in Ardabil, Bushehr, Chaharmahal, Bakhtiari, Mazandaran, Golestan, and Semnan provinces in Iran were selected.

The results showed the nomads were implementing a range of solutions to address drought conditions, including moving livestock to areas with food sources, managing water resources (e.g., the Hanare System or livestock watering every other day, constructing traditional water storage structures, and water supply by tanker), and livestock management (removing livestock fattening and finally selling livestock).

And finally In general, during droughts, nomadic herders try to keep the condition of the herd at the same level as before the drought or with minimal changes through different management methods. It seems that providing legal facilities in such periods can lead to the stability of nomadic livestock farming.

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Conflict of Interest

The authors declared no conflicts of interest.

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