

The effect of Nomad management on the plant biodiversity in rangelands of Tehran province, Iran

Rahman Sharifi^{1*}, Ali Mohebbi²

^{1*} -Research Center for Agriculture and Natural Resources, Tehran, Agricultural Research, Education and Extension Organization (AREEO), Tehran, Iran. (<https://orcid.org/0000-0002-0602-5001>) 

² Rangeland Research Division, Research Institute of Forests and Rangelands, Agricultural Research, Education and Extension Organization (AREEO), Tehran, Iran. (<https://orcid.org/0000-0002-2214-2363>) 

R.sharifi1346@gmail.com

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ABSTRACT

With the changes made in the management of nomadic rangelands, it is accompanied by the interference of the government and nomads to prepare a new migration calendar. With considering the limitations in the government system, the issue of feasibility of reassigning this responsibility to the nomads and providing the ground for their role-playing in rangeland management has been proposed as one of the ways to leave the inappropriate and inefficient situation of the current management system. Therefore, the Nomadic Affairs Organization, the Forests, Rangelands and Watershed Organization, Research Institute of Forests and Range lands of Iran; considered to interfere to this issue as a logical item based on the research findings. After several meetings, the summer rangelands of Dahaneh Sangheh, Dahaneh Chehel Bareh, Kamar dasht Vasat and Marghsar Lar in Tehran province were selected as a pilot to assess the impact of nomadic management and organization support on vegetation changes in this area. The evaluated indicators were range lands capacity, range lands condition, trend and utilization percentage in two stages before entering and after the leaving the nomads from the range lands. For this purpose, representatives of the nomad were introduced. The study began in 2016 for 4 years. The results of analysis of variance showed significant effect of the year on the percentage of vegetation after grazing and production residue. Besides, the comparison of the average data showed that most of the indicators made changes leading to improve vegetation conditions. The main reason for their success was related to the family management system and the presence of environmental and natural resources protection officers in the region. To sum up, it seems that this model can be generalized in rangeland management in other similar areas provided that the relevant organizations cooperate with the nomadic representatives.

Keywords: Vegetation, Species Richness, Transhumance, Rangeland Management, Biodiversity

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INTRODUCTION

Increasing human activity and climate change is a great threat to biodiversity, including plants and animals (He et al., 2018; Hudson et al., 2014; Sala et al., 2000). Excessive damage to biodiversity through overgrazing increases the rate of plant extinction and imbibe humanity's ability to withstand desertification, increase food security, and climate change (Cagnolo et al., 2009; Ouled Belgacem & Louhaichi, 2013; Stork, 2010). Rangelands are important areas for biodiversity conservation in terms of gene resources (Rija et al., 2013) and are sources of livelihoods to many nomad living in there; providing feed for both livestock and wildlife and medicinal plants (Abdulahi et al., 2016). Nevertheless, rangelands have

been facing contradictory pressures, i.e., increased demand for natural resources and animal products to cope with rising human populations. Conservative estimates indicate 10–20% of rangelands worldwide have been severely degraded with an additional 12 million ha of rangeland degraded each year (Reynolds et al., 2007). Pastoralists utilizing degraded rangelands generally suffer from poverty and food insecurity (Bedunah & Angerer, 2012). Thus, rangeland degradation and desertification have raised concerns globally (Abdulahi et al., 2016).

The exploitation of pastures and natural areas and genetic and natural resources in most countries is familiar and somewhat uncontrollable. Improper collection of valuable plants from

natural areas and lack of proper education of indigenous people regarding the correct harvest of medicinal plants has caused irreparable damage to nature. About 1,000 species worldwide are endangered for these reasons, and despite the great value and importance of medicinal plants, in many countries, especially developing countries, the true location of these valuable resources and reserves is still unknown. There are many weaknesses and legal bottlenecks for this sector (Omidbaigi, 2020).

From the distant past, the nomads were considered the biggest producers of livestock in Iran, which has undergone ups and downs over time. By moving their livestock in different times and places, they have sought to find suitable rangelands to feed their livestock (Bazhian, 2008). According to the results of the nomadic census of Iran, there are 1199810 nomadic people in the form of 213173 households, 104 clans and 552 independent nomad living in 31 provinces in the pastoral nomadic way of life (SCI, 2009). This population is distributed in 8 growing regions as described in North, North-West, North-East, West, South-West, South-East, Center and East. Their territory includes more than 60% of Iran's geographical space (Mohebbi & Sharifi, 2022).

Studying and correctly understanding the mutual relationships of ecosystem components is one of the most important tools for adopting correct management measures to maintain the health of rangelands. Therefore, it seems to be necessary to have efficient programs to provide a suitable condition for rangelands (Hosseinzadeh et al., 2017). Purely technical interventions in rangelands often fail when researchers and managers do not consider their impacts on economic, political, cultural, and social well-being (Wangui, 2008). The multiplicity of users and the large number of livestock in many rangelands have challenged the success rate of management programs and rangeland improvement and revitalization projects, and the increase in the number of livestock and their lack of proper management causes harm to rangelands and reduces their sustainability (Mahmoudi et al., 2018). Management and implementation of reform and revitalization projects and the application of rangeland management principles are possible if the natural value and ecology of pastures are considered in relation to social conditions, emphasizing the three elements of humans, livestock and rangeland in economic units (Hosseinzadeh et al., 2017).

Over many years, various solutions for optimal use and sustainable protection of natural resources, especially rangelands have been mentioned, among which participatory management has been emphasized (Rasekhi et al., 2016). Many environmental issues have been solved in the last three decades through collaborative management (Koontz & Newig, 2014). Besides, it is assumed that environmental public problems are not amenable to control satisfactory except with development of collaborative solutions (Adhami & Sadeghi, 2016). The collaborative management is a cooperation process to participate in information collecting, decision-making and accomplishment of projects (Niesche & Haase, 2012) leading to resolve complex society-environment dilemmas (Leys & Vancly, 2011). Collaborative approach has been applied in various areas such as food security (Pilling et al., 2020), natural disaster management (Begum et al., 2021), soil and

water conservation (Tanto & Laekemariam, 2019), rangeland management (Wilmer et al., 2022), and watershed management (Adhami et al., 2018).

As it was mentioned, livestock farming and migration have existed in the nomadic livestock farming system for a long time, one of the most important functions of this system is its positive effects on the condition of the rangelands due to the lack of permanent presence of livestock in the rangelands. Also, it can be seen the changes made in the way of management of migration and pasture, which is reflected in the government's role in regulating the migration calendar and its executive management instead of nomadic management (Mohebbi & Sharifi, 2022). Considering the limitations of the government system, it seems that handing over this responsibility to the nomads and providing them with the opportunity to play a role in this matter is one of the ways out of the inappropriate and inefficient state of the government system for the management of nomadic rangelands, which, despite spending a lot of money on the government, is unsuccessful. The question is:

Considering the various developments that have occurred in Iran, can returning this responsibility to the nomads be effective in improving the conditions of rangelands?

It is assumed that leaving the management to the nomads themselves can lead to the improvement of the conditions of the study rangeland.

Abedi Sarvestani and Ingram (2020) by examining the effect of joint management in the forests of Chehel-Chay in the north of Iran, showed that the training of local communities, the presence of experts in co-management and the delegation of authority within the framework of the law to local communities led to the improvement of the conditions of the region, and livestock farmers according to the training tried to controlling the presence of their livestock in the region, and over time, the biodiversity of the region's plants has increased, and the amount of livestock grazing has reached a balance with the region's ecological capacity. Furthermore Kovács et al. (2021) reported that through the engagement of local stakeholders some conflicting management issues were resolved (e.g. accepting a wider range of grazing animal species and allowing flexible time for mowing) and collaboration started on ecotourism issues (e.g. information sharing with the assistance of the national park directorate). Results also shows that adaptive co-management can be a good method for both conservation and rural development but supporting policy environment as well as financial resources assisting the participatory process and nature-friendly farming activities can be important for its long-term success.

Behzad (2012) has introduced the most appropriate way to manage pastures is to leave the affairs completely to the users themselves and to use the nomads' selected protectors. Yousefi and Behbahani (2014) in the implementation of the sustainable management of natural resources based on the participation of local communities, the role of local communities in the sustainable management of natural resources (successful experience of the international project-RFLDL South Khorasan, Sarayan) explained and stated that the management method based on the local community is a suitable tool for the sustainability of natural resources. The important point is that

participatory management has not always been successful and this issue has been proven in the research of Jones and Murphree (2013).

This research was conducted with the aim of investigating the effect of nomadic management on changes in plant biodiversity of Dahaneh-Sangheh, Dahaneh Chehel Bareh, Kamar dasht Vasat and Marghsar rangelands.

MATERIAL AND METHOD

Studied areas

These rangelands are located between 36 degrees 41 minutes to 35 degrees 48 minutes latitude and between 51 degrees 32 minutes to 52 degrees 4 minutes longitude and the height is 2600 to 3400 meters above sea level and according to Dumartin's indicators, there have a semi-dry climate. The amount of annual precipitation and the minimum and maximum temperature are shown in table one.

Table1. Weather characteristics of the region during the years 2014-2017

Year	Total precipitation (mm)	Maximum temperature (°c)	Minimum temperature (°c)
2014	595	14.1	4.8
2015	722	14.3	4.5
2016	603	14	4.5
2017	665	14.1	5.3

USER POPULATION IN THE STUDIED AREAS

Dahaneh-Sangheh

The nomads of this system speak in Lor language and from Hadavand tribe. The total area of the rangeland is 465 hectares, the number of livestock in the rangeland is 1805, the number of permitted livestock is 1020, and the number of surplus livestock is 785 livestock units. The grazing calendar specified in the license is from 15 June to 15 September for 90 days. The user population of this system includes 10 families and 55 people, and all the nomads of this system are members of the nomadic union.

Dahaneh Chehel Bareh

The nomads of this system speak in Lor language and from Hadavand tribe. The total area of the rangeland is 1915 hectares, the number of livestock in the rangeland is 2209, the number of permitted livestock is 1846, and the number of surplus livestock is 363 livestock units. The grazing calendar specified in the license is from 15 June to 15 September for 90 days. The user population of this system includes 25 families and 83 people, and all the nomads of this system are members of the nomadic union.

Kamar dasht Vasat

The nomads of this system speak in Lor language and from Hadavand tribe. The total area of the rangeland is 500 hectares, the number of livestock in the rangeland is 955, the number of permitted livestock is 550, and the number of surplus livestock is 405 livestock units. The grazing calendar specified in the license is from 15 June to 15 September for 90 days. The user population of this system includes 11 families and 53 people, and all the nomads of this system are members of the nomadic union.

Marghsar

The nomads of this system speak in Lor language and from Hadavand tribe. The total area of the rangeland is 465 hectares, the number of livestock in the rangeland is 3198, the number

of permitted livestock is 1950, and the number of surplus livestock is 1248 livestock units. The grazing calendar specified in the license is from 15 June to 15 September for 90 days. The user population of this system includes 25 families and 105 people, and all the nomads of this system are members of the nomadic union.

RESEARCH METHODS

According to the objectives of this research, the action research method was used to carry it out. The criterion for choosing this method was the topic and problem of the research, which required that the description of the service should be accompanied by a study with field action. In this way, the steps of doing the work were predicted in two stages. The first stage was the appointment of nomadic representatives to follow up on management matters and conclude a memorandum of cooperation between the organizations related to the said representatives. Ten families from each tribe, who had announced their cooperation for the implementation of the project, formed the statistical community of the project. The next step was to investigate the effect of this method of management on the important factors of vegetation such as the capacity, condition, tendency and exploitation percentage before the arrival and after the departure of nomads from the region as follows.

1- Appointing nomadic representatives and concluding a memorandum of understanding

These steps are carried out by holding joint meetings with the nomads, the organization of nomad affairs, the country's rangelands affairs office and the country's forest and rangeland research institute to coordinate the handover method, justify the selected nomads on how to manage the rangeland, appoint representatives by the nomads and introduce them to the relevant bodies. As well as conclude a four-way agreement numbered 278/5/246 in 2016 was made between the representatives of nomads and the aforementioned organizations regarding the cooperation and support of nomads in pasture management. The next step was to evaluate

the performance of tribal representatives and its effect on important vegetation indicators.

2- Effects of participatory management on vegetation changes
After determining the plant species, evaluating the indicators of capacity, condition, tendency and utilization percentage during the research years in two stages: May before the arrival of the nomads and October after the departure of the nomads from the study area.

In this way, in each plant species, 20 m² plots along two transects of 150 meters, in each transect, 10 plots are established randomly and systematically. rangeland capacity index using cutting and weighing method, condition trend with trend scale and utilization percentage were also calculated using the difference of production before the arrival of nomads and after their departure according to the following formula in plant species and the whole area. Utilization (%) = ((production before the arrival- production after their departure)/ production before the arrival)×100.

Statistical analysis

Analysis of variance (ANOVA) and Duncan multiple ranges mean comparison test (DMRT) were conducted using SPSS software version 25 (SPSS, Chicago, USA).

RESULTS

Dahaneh-Sangheh

The vegetation cover in Dahaneh-Sangheh rangeland was 56% which 9.8%, 4.9%, and 85.3% were I, II, and III class plants, respectively. In terms of vegetative form, 2.5, 8.75, 2.25, 10.5, 31 and 1% were annual grass, perennial grass, annual forbs, perennial forbs, shrubs, trees, respectively (Table 2).

Dominated annual grass of the Dahaneh-Sangheh rangeland with 1.5% was belong to *Bromus tectorum* which belong to III class. The highest amount of perennial grass with 5.00% was *Bromus persicus*, which belongs to the III palatability class and the lowest is *Agropyron trichophorum* by 4.9% from the I Class. Dominated annual forb of the Dahaneh-Sangheh rangeland with 1.25% was belong to *Lactuca serriola* which belong to III class. The highest amount of perennial forb with 11.00% was *Mentha longifolia*, which belongs to the III palatability class and the lowest were *Codonoccephalus peacockianum*, *Cirsium hygrophilum* and *Verbascum songaricum* by 1.00% from the III Class. Dominated shrub of the Dahaneh-Sangheh rangeland with 15% was belong to *Onobrychis cornuta* which belong to III class. After that, *Astragalus gossypinus* is the most common rangeland shrub with 9.00% and the lowest was *Scariola orientalis* by 0.75% from the II Class (Table 2).

Table 2. Composition and percentage of vegetation in the Dahaneh Sangh rangeland

Category	Species	Palatability			Cover (%)	Composition (%)
		I	II	III		
Annual grass	<i>Aegilops crassa</i>			*	1.00	9.0
	<i>Bromus tectorum</i>			*	1.50	2.7
Sum of category				4.5	2.50	4.5
Perennial grass	<i>Stipa barbata</i>		*		1.00	1.8
	<i>Festuca ovina</i>	*			2.00	3.6
	<i>Agropyron trichophorum</i>	*			0.75	1.3
	<i>Bromus persicus</i>			*	5.00	8.9
Sum of category		4.9	1.8	8.9	8.75	15.6
Annual forbs	<i>Lactuca serriola</i>			*	1.25	2.2
	<i>Achillea willhelmsii</i>			*	1.00	1.8
Sum of category				4.0	2.25	4.0
Perennial forbs	<i>Mentha longifolia</i>			*	11.00	1.8
	<i>Codonoccephalus peacockianum</i>			*	1.00	1.8
	<i>Cirsium hygrophilum</i>			*	1.00	1.8
	<i>Euphorbia aucheri</i>				1.00	1.8
	<i>Cousinia nekarmantica</i>			*	1.50	2.7
	<i>Verbascum songaricum</i>			*	1.25	2.2
	<i>Echinops sp.</i>			*	1.00	1.8
	<i>Ferula galbanifloa</i>	*			1.50	2.7
	<i>Astragalus effusus</i>	*			1.25	2.2
Sum of category		4.9		12.1	10.50	18.8
Shrubs	<i>Thymus kotschyanus</i>		*		1.00	1.8
	<i>Astragalus gossypinus</i>			*	9.00	16.1
	<i>Scariola orientalis</i>		*		0.75	1.3
	<i>Acanthlimon festuceum</i>			*	2.00	3.6
	<i>Onobrychis cornuta</i>			*	15.00	26.8
	<i>Astragalus microcephalus</i>			*	3.25	5.8
Sum of category			3.1	52.3	31.00	55.4
Trees	<i>Rosa iberica</i>			*	1.00	1.8
Sum of category				11.8	1.00	1.8
Total		9.8	4.9	85.3	56.00	100

Based on the measurements made in Dahaneh-Sangheh rangeland, its condition is average and its trend is stable. Its capacity varied from 1.12 to 1.26 livestock units per hectare during the studied years. The utilization percentage was also evaluated as more than 90% during all the years. Also, the results of indicators mean comparison during the research

years showed that the vegetation percentage before and after grazing and production increased in the last year of the plan. In the same way, the utilization percentage of dry fodder after grazing decreased by 2.1% and the rangeland capacity increased by 12.50% (Table 3).

Table 3. Comparison of the Mean vegetation parameters in the Dahaneh Sangh rangeland

year	Vegetation cover before grazing (%)	Production (Kg.ha ⁻¹)	Vegetation cover after grazing (%)	Production remainder (Kg.ha ⁻¹)	Utilization (%)	Capacity (Livestock unite)
2014	54 a	151 a	6.6 b	12 b	92.1 a	1.12 a
2015	56 a	160 a	7.2 ab	13 ab	91.9 a	1.18 a
2016	52 a	155 a	8.0 ab	15 ab	90.3 a	1.15 a
2017	58 a	170 a	9.0 a	17 a	90.0 a	1.26 a
CV (%)	15.72	11.67	18.37	22.85	1.64	11.67

*The means with at least one common letter using Duncan's test at the 5% probability level are not significantly different in each column

Dahaneh Chehel Bareh

The vegetation cover in Dahaneh Chehel Bareh rangeland was 44% which 25.0%, 8.6%, and 66.3% were I, II, and III class plants, respectively. In terms of vegetative form, 2.25, 12.75, 1.25, 4.75 and 23% were annual grass, perennial grass, annual forbs, perennial forbs and shrubs, respectively (Table 4). Dominated annual grass of the Dahaneh Chehel Bareh rangeland with 1.25% was belong to *Eremopyrum* sp. which belong to III class. The highest amount of perennial grass with 6.00% was *Agropyron trichophorum*, which belongs to the I palatability class and the lowest is *Psatyrostachys fragilis* by 0.75% from the II Class. Dominated annual forb of the

Dahaneh Chehel Bareh rangeland with 1.25% was belong to *Lactuca serriola* which belong to III class. The highest amount of perennial forb with 1.50% was *Cousinia nekarmentica*, which belongs to the III palatability class and the lowest were *Cirsium hygrophilum* and *Eremurus* sp. by 1.00% from the III Class. Dominated shrub of the Dahaneh Chehel Bareh rangeland with 10.50% was belong to *Astragalus gossypinus* which belong to III class. After that, *Onobrychis cornuta* is the most common rangeland shrub with 8.00% and the lowest was *Thymus kotschyanus* by 1.00% from the II Class (Table 4).

Table 4. Composition and percentage of vegetation in the Dahaneh Chehel Bareh rangeland

Category	Species	Palatability			Cover (%)	Composition (%)
		I	II	III		
Annual grass	<i>Melica persica</i>		*		1.00	2.3
	<i>Eremopyrum</i> sp.			*	1.25	2.8
Sum of category			2.3	2.8	2.25	5.1
Perennial grass	<i>Festuca ovina</i>	*			1.00	2.3
	<i>Festuca pratensis</i>	*			1.50	3.4
	<i>Lolium</i> sp.	*			1.50	3.4
	<i>Agropyron trichophorum</i>	*			6.00	13.6
	<i>Bromus tomentellus</i>	*			1.00	2.3
	<i>Psatyrostachys fragilis</i>		*		0.75	1.7
	<i>Stipa lagascae</i>		*		1	2.3
Sum of category		25.0	4.0		12.75	29
Annual forbs	<i>Lactuca serriola</i>			*	1.25	2.8
Sum of category				2.8	1.25	2.8
Perennial forbs	<i>Cirsium hygrophilum</i>			*	1.00	2.3
	<i>Cousinia nekarmentica</i>			*	1.50	3.4
	<i>Verbascum songaricum</i>			*	1.25	2.8
	<i>Eremurus</i> sp.			*	1.00	2.3
Sum of category				10.8	4.75	10.8
Shrubs	<i>Astragalus gossypinus</i>			*	10.50	23.9
	<i>Thymus kotschyanus</i>		*		1.00	2.3
	<i>Acanthlimon festucaceum</i>			*	3.50	8.0
	<i>Onobrychis cornuta</i>			*	8.00	18.2
Sum of category			2.30	50.0	23	52.3
Total		25	8.6	66.3	44	100

Based on the measurements made in Dahaneh Chehel Barch rangeland, its condition is average and its trend is stable. Its capacity varied from 0.94 to 1.01 livestock units per hectare during the studied years. The utilization percentage was also evaluated as more than 85% during all the years. Also, the results of indicators mean comparison during the research

years showed that the vegetation percentage before and after grazing and production increased in the last year of the plan. In the same way, the utilization percentage of dry fodder after grazing decreased by 3.9% and the rangeland capacity increased by 15.96% (Table 5).

Table 5. Comparison of the Mean vegetation parameters in the Dahaneh Chehel Barch rangeland

year	Vegetation cover before grazing (%)	Production (Kg.ha ⁻¹)	Vegetation cover after grazing (%)	Production remainder (Kg.ha ⁻¹)	Utilization (%)	Capacity (Livestock unite)
2014	41 a	127 b	6.6 b	10 b	92.2 b	0.94 b
2015	44 a	137 ab	4.2 c	7 b	94.9 a	1.01 ab
2016	39 a	123 ab	4.8 c	9 b	92.8 b	0.91 b
2017	47 a	147 a	9.0 a	17 a	88.3 c	1.09 a
CV (%)	14.84	10.20	19.41	21.31	1.56	10.19

*The means with at least one common letter using Duncan's test at the 5% probability level are not significantly different in each column

KAMAR DASHT VASAT

The vegetation cover in Kamar dasht Vasat rangeland was 48.25% which 21.3, 10.4, and 66.4% were I, II, and III class plants, respectively. In terms of vegetative form, 3.00, 11.00, 2.00, 6.00 and 26.25% were annual grass, perennial grass, annual forbs, perennial forbs and shrubs, respectively (Table 6).

Dominated annual grass of the Kamar dasht Vasat rangeland with 1.25% was belong to *Hordeum bolbosum* which belong to II class. The highest amount of perennial grass with 4.00% was *Agropyron trichophorum*, which belongs to the I palatability class and the lowest is *Bromus tomentellus* by 1.00% from the I Class. Dominated annual forbs of the Kamar dasht Vasat rangeland with 1.00% were belong to *Lactuca serriola* and *Achillea willhelmsii* which belong to III class. The highest amount of perennial forb with 1.50% was *Ferula*

galbanifloa, which belongs to the I palatability class. Dominated shrub of the Kamar dasht Vasat rangeland with 12.00% was belong to *Onobrychis cornuta* which belong to III class. After that, *Acanthlimon festucaceum* is the most common rangeland shrub with 7.00% and the lowest was *Thymus kotschyanus* by 1.00% from the II Class (Table 6).

Based on the measurements made in Kamar dasht Vasat rangeland, its condition is average and its trend is stable. Its capacity varied from 0.91 to 1.01 livestock units per hectare during the studied years. The utilization percentage was also evaluated as more than 90% during all the years. Also, the results of indicators mean comparison during the research years showed that the vegetation percentage before and after grazing and production increased in the last year of the plan. In the same way, the utilization percentage of dry fodder after grazing increased by 0.7% and the rangeland capacity increased by 10.99% (Table 7).

Table 6. Composition and percentage of vegetation in the Kamar Dasht Vasat rangeland

Category	Species	Palatability			Cover (%)	Composition (%)
		I	II	III		
Annual grass	<i>Aegilops crassa</i>			*	1.00	2.1
	<i>Hordeum bolbosum</i>		*		1.25	2.6
	<i>Hordeum fragile</i>	*			0.75	1.6
Sum of category		1.6	2.6	2.1	3.00	6.2
Perennial grass	<i>Stipa lagascae</i>		*		1.50	3.1
	<i>Festuca pratensis</i>	*			2.00	4.1
	<i>Bromus tomentellus</i>	*			1.00	2.1
	<i>Agropyron trichophorum</i>	*			4.00	8.3
	<i>Bromus persicus</i>			*	2.50	5.2
Sum of category		14.5	3.1	5.2	11.00	22.8
Annual forbs	<i>Lactuca serriola</i>			*	1.00	2.1
	<i>Achillea willhelmsii</i>			*	1.00	2.1
Sum of category				4.1	2.00	4.1
Perennial forbs	<i>Cirsium hygrophilum</i>			*	0.50	1.0
	<i>Euphorbia aucheri</i>				1.00	2.1
	<i>Cousinia nekarmantica</i>			*	1.00	2.1
	<i>Verbascum songaricum</i>			*	1.00	2.1
	<i>Ferula galbanifloa</i>	*			1.50	3.1
	<i>Astragalus effusus</i>	*			1.00	2.1

Sum of category	5.2	5.2	6.00	12.4	
Shrubs	<i>Astragalus gossypinus</i>	*	5.00	10.4	
	<i>Thymus kotschyanus</i>	*	1.00	2.1	
	<i>Scariola orientalis</i>	*	1.25	2.6	
	<i>Acanthlimon festucaceum</i>	*	7.00	14.5	
	<i>Onobrychis cornuta</i>	*	12.00	24.9	
Sum of category	4.7	49.8	26.25	54.4	
Total	21.3	10.4	66.4	48.25	100

Table 7. Comparison of the Mean vegetation parameters in the Kamar Dasht Vasat rangeland

year	Vegetation cover before grazing (%)	Production (Kg.ha ⁻¹)	Vegetation cover after grazing (%)	Production remainder (Kg.ha ⁻¹)	Utilization (%)	Capacity (Livestock unite)
2014	48 a	136 a	5.0 a	9.4 a	92.9 b	0.91 a
2015	51 a	140 a	1.8 b	3.0 b	97.8 a	0.93 a
2016	37 a	107 b	2.0 b	4.0 b	96.3 a	0.72 b
2017	53 a	151 a	5.0 a	9.6 a	93.6 b	1.01 a
CV (%)	16.98	13.24	18.37	37.76	1.80	13.24

*The means with at least one common letter using Duncan's test at the 5% probability level are not significantly different in each column

MARGHSAR

The vegetation cover in Marghsar rangeland was 40.50% which 22.2, 17.9, and 59.9% were I, II, and III class plants, respectively. In terms of vegetative form, 4.50, 12.50, 1.25, 4.75 and 17.50% were annual grass, perennial grass, annual forbs, perennial forbs and shrubs, respectively (Table 8). Dominated annual grasses of the Marghsar rangeland with 1.25% were belong to *Eremopyrum* sp. and *Hordeum bolbosum* which belong to III and II class, respectively. The highest amount of perennial grass with 4.00% was *Agropyron trichophorum*, which belongs to the I palatability class and the

lowest is *Bromus tomentellus* by 1.00% from the I Class. Dominated annual forb of the Marghsar rangeland with 1.25% was belong to *Lactuca serriola* which belong to III class. The highest amount of perennial forb with 1.50% was *Cousinia nekarmantica*, which belongs to the III palatability class and the lowest were *Cirsium hygrophilum* and *Eremurus* sp. by 1.00% from the III Class. Dominated shrub of the Marghsar rangeland with 9.00% was belong to *Astragalus gossypinus* which belong to III class. After that, *Onobrychis cornuta* is the most common rangeland shrub with 4.00% and the lowest was *Thymus kotschyanus* by 1.50% from the II Class (Table 8).

Table 8. Composition and percentage of vegetation in the Marghsar rangeland

Category	Species	Palatability			Cover (%)	Composition (%)
		I	II	III		
Annual grass	<i>Melica persica</i>		*		1.00	2.5
	<i>Aegilops crassa</i>			*	1.00	2.5
	<i>Hordeum bolbosum</i>		*		1.25	3.1
	<i>Eremopyrum</i> sp.			*	1.25	3.1
Sum of category			5.6	5.6	4.5	11.1
Perennial grass	<i>Festuca ovina</i>	*			2.00	4.9
	<i>Festuca pratensis</i>	*			2.00	4.9
	<i>Agropyron trichophorum</i>	*			4.00	9.9
	<i>Bromus tomentellus</i>	*			1.00	2.5
	<i>Psatyrostachys fragilis</i>		*		1.50	3.7
	<i>Stipa lagascae</i>		*		2.00	4.9
Sum of category		22.2	8.6		12.50	30.9
Annual forbs	<i>Lactuca serriola</i>			*	1.25	3.1
Sum of category				3.1	1.25	3.1
Perennial forbs	<i>Cirsium hygrophilum</i>			*	1.00	2.5
	<i>Cousinia nekarmantica</i>			*	1.50	3.7
	<i>Verbascum songaricum</i>			*	1.25	3.1
	<i>Eremurus</i> sp.			*	1.00	2.5
Sum of category				7.0	4.75	11.7
Shrubs	<i>Astragalus gossypinus</i>			*	9.00	22.2
	<i>Thymus kotschyanus</i>		*		1.50	3.7
	<i>Acanthlimon festucaceum</i>			*	3.00	7.4
	<i>Onobrychis cornuta</i>			*	4.00	9.9
Sum of category			3.7	39.5	17.50	43.2
Total		22.2	17.9	59.9	40.50	100

Based on the measurements made Marghsar rangeland, its condition is average and its trend is stable. Its capacity varied from 0.85 to 1.03 livestock units per hectare during the studied years. The utilization percentage was also evaluated as more than 90% during all the years. Also, the results of indicators mean comparison during the research years showed that the

vegetation percentage before and after grazing and production increased in the last year of the plan. In the same way, the utilization percentage of dry fodder after grazing decreased by 2.0% and the rangeland capacity increased by 21.18% (Table 9).

Table 9. Comparison of the Mean vegetation parameters in the Marghsar rangeland

year	Vegetation cover before grazing (%)	Production (Kg.ha ⁻¹)	Vegetation cover after grazing (%)	Production remainder (Kg.ha ⁻¹)	Utilization (%)	Capacity (Livestock unite)
2014	36 b	115 a	3.0 bc	6.2 bc	94.2 b	0.85 a
2015	39 ab	120 a	1.4 c	3.0 c	97.4 a	0.89 a
2016	41 ab	124 a	4.0 b	7.0 b	94.3 b	0.92 a
2017	47 a	139 a	6.2 a	11.0 a	92.2 b	1.03 a
CV (%)	17.18	16.53	34.92	35.79	2.26	16.53

*The means with at least one common letter using Duncan's test at the 5% probability level are not significantly different in each column

DISCUSSION

Rangelands as the bed of life and the main pillar of ecosystems play a significant role in human life. In this regard, various strategies have been proposed for the optimal use and sustainable protection of natural resources, especially Rangelands, among which the participation of the people has already been emphasized (Ghorbani et al., 2015). According to the problems created in the management of rangelands after the nationalization of forests and rangelands in Iran, as well as the limitations of government management, from the point of view of some experts, assigning this responsibility to the nomads and give them the opportunity to play a role in this matter, can be considered as one of the solutions to way out of the inappropriate and inefficient state of the public administration system. It has been shown that the privatization of grasslands or the banning of access to it cannot solve the current challenges of China's rangelands because it has led to ecosystem fragmentation and unequal land use (Yan & Wu, 2005). An alternative promising approach, suggested from research results and practical experience, is co-management of rangeland resources to achieve sustainable pastoral development. Rangeland co-management engages multiple stakeholders for different uses and conservation purposes. It is a continuous and dynamic process that involves all concerned parties-especially government agencies and heterogeneous communities-to negotiate, define and guarantee amongst themselves a fair sharing of rights and benefits with clear responsibilities and entitlements of each group (Yan et al., 2021).

Therefore, entering this subject from the path based on the results of the research was recognized as a logical subject and the leading project was implemented. The evaluation of the effect of this method of co-management on the important indicators of rangeland vegetation such as capacity, condition, tendency and utilization percentage in two stages before the arrival of nomads and after the departure of the nomads from the rangeland was done. Based on the measurements carried out in the Dahaneh-Sangheh, Dahaneh Chehel Bareh, Kamar dasht Vasat and Marghsar rangeland showed the improvement

on vegetation conditions after applying co-management compared to the previous stage.

Shahrokhi et al., Studying the biodiversity of plant species in Kuh-e-Klar region located in Chaharmahal and Bakhtiari province, observed that out of 67 exclusive species of Iran in this region, 61 species are in the low-risk category in terms of extinction and 12 species are vulnerable (Shahrokhi et al., 2011). Nasab and Khosravi (2014) showed that despite the semidesert climate and lack of rich vegetation, many medicinal and economic plants can be found in Sirjan region. Improper harvesting of medicinal plants such as *Carum carvi*, *Cuminum cyminum*, *Zataria multiflora* and *Satureja bachtiarica* in this area has increased by local people, their risk of extinction has increased. By observing the dangers of not properly managing rangelands, it can be analyzed that cooperative management can not only lead to the economic security of nomads, but also can improve biodiversity and prevent the extinction of endemic species in Iran.

Considering the almost same climate and weather conditions during the research, it seems that the main reason for the success in pasture management is related to the family exploitation system and the presence of environmental and natural resources protection agents.

CONCLUSION

According to the results, it can be concluded that the defined cooperative management, i.e. cooperation between nomad, protection agents and government support, led to the improvement of rangeland conditions. Therefore, it seems that this model can be generalized in the management of rangelands in other similar areas on the condition of the cooperation of organizations related to nomadic representatives.

Conflict of Interest Declaration

The authors declare no conflict of interest. The funders had no role in the design of the study, in the collection, analysis, or interpretation of data, in the writing of the manuscript, or in the decision to publish the results.

REFERENCES

- Abdulahi, M. M., Hashim, H., & Teha, M. (2016). Rangeland degradation: Extent, impacts, and alternative restoration techniques in the rangelands of Ethiopia. *Tropical and Subtropical Agroecosystems*, 19(3), 305–318.
- Abedi Sarvestani, A., & Ingram, V. (2020). Perceptions and practices of rural council participatory forest governance: Closed co-management in Chehel-Chay, Iran. *Forest Policy and Economics*, 117, 102202. <https://doi.org/10.1016/j.forpol.2020.102202>
- Adhami, M., & Sadeghi, S. H. (2016). Sub-watershed prioritization based on sediment yield using game theory. *Journal of Hydrology*, 541, 977–987. <https://doi.org/10.1016/j.jhydrol.2016.08.008>
- Adhami, M., Sadeghi, S. H., & Sheikhmohammady, M. (2018). Making competent land use policy using a co-management framework. *Land Use Policy*, 72, 171–180. <https://doi.org/10.1016/j.landusepol.2017.12.035>
- Bazhian, G. R. (2008). Nomadic Rangeland Management in past and present in a review: Changes, Challenges and Solutions. *Iranian Journal of Range and Desert Research*, 14(4), 524–538.
- Bedunah, D. J., & Angerer, J. P. (2012). Rangeland degradation, poverty, and conflict: how can rangeland scientists contribute to effective responses and solutions? *Rangeland Ecology & Management*, 65(6), 606–612.
- Begum, F., Lobry de Bruyn, L., Kristiansen, P., & Islam, M. A. (2021). Institutionalising co-management activities for conservation of forest resources: Evidence from the Sundarban mangrove forest management of Bangladesh. *Journal of Environmental Management*, 298, 113504. <https://doi.org/10.1016/j.jenvman.2021.113504>
- Behzad, T. (2012). *Grazing management*. Forests, Rangelands and Watershed Management Organization.
- Cagnolo, L., Valladares, G., Salvo, A., Cabido, M., & Zak, M. (2009). Habitat fragmentation and species loss across three interacting trophic levels: Effects of life-history and food-web traits. *Conservation Biology*, 23(5), 1167–1175. <https://doi.org/10.1111/j.1523-1739.2009.01214.x>
- Ghorbani, M., Salari, F., Saeidigarghani, H., & Sanaei, A. (2015). Analysis of trust and participatory management by users network in toward rangelands co-management (case study: Gorgoo region-Kohgiluyeh and Boyer-Ahmad province). *Rangeland*, 9(2), 182–194.
- He, J., Yan, C., Holyoak, M., Wan, X., Ren, G., Hou, Y., Xie, Y., & Zhang, Z. (2018). Quantifying the effects of climate and anthropogenic change on regional species loss in China. *PLOS ONE*, 13(7), e0199735. <https://doi.org/10.1371/journal.pone.0199735>
- Hosseinzadeh, A., Heidari, G., Barani, H., & Zali, H. (2017). Effects of livestock number on range condition (case study: Shahsavani nomads of Meshginshahr city). *Iranian Journal of Range and Desert Research*, 24(3), 513–523.
- Hudson, L. N., Newbold, T., Contu, S., Hill, S. L. L., Lysenko, I., De Palma, A., Phillips, H. R. P., Senior, R. A., Bennett, D. J., Booth, H., Choimes, A., Correia, D. L. P., Day, J., Echeverría-Londoño, S., Garon, M., Harrison, M. L. K., Ingram, D. J., Jung, M., Kemp, V., ... Purvis, A. (2014). The PREDICTS database: a global database of how local terrestrial biodiversity responds to human impacts. *Ecology and Evolution*, 4(24), 4701–4735. <https://doi.org/10.1002/ece3.1303>
- Jones, B., & Murphree, M. (2013). Community-based natural resource management as a conservation mechanism: Lessons and directions. In *Parks in Transition* (pp. 80–121). Routledge.
- Koontz, T. M., & Newig, J. (2014). From Planning to Implementation: Top-Down and Bottom-Up Approaches for Collaborative Watershed Management. *Policy Studies Journal*, 42(3), 416–442. <https://doi.org/10.1111/psj.12067>
- Kovács, E., Mile, O., Fabók, V., Margóczy, K., Kalóczkai, Á., Kasza, V., Nagyné Grecs, A., Bankovics, A., & Mihók, B. (2021). Fostering adaptive co-management with stakeholder participation in the surroundings of soda pans in Kiskunság, Hungary – An assessment. *Land Use Policy*, 100, 104894. <https://doi.org/10.1016/j.landusepol.2020.104894>
- Leys, A. J., & Vanclay, J. K. (2011). Social learning: A knowledge and capacity building approach for adaptive co-management of contested landscapes. *Land Use Policy*, 28(3), 574–584. <https://doi.org/10.1016/j.landusepol.2010.11.006>
- Mahmoudi, J., Roudgar, A., & Mahdavi, S. K. (2018). Evaluation of the factors affecting on beneficiaries' participation in Range Management Plans Case study: Rural restrict of Nemarestagh of dependencies of part of Larijan Amol. *Natural Ecosystems of Iran*, 9(1), 103–118.

- Mohebbi, A., & Sharifi, R. (2022). The effect of Co-management system on the vegetation in summer rangelands of Dahaneh-SAnghe Lar. *Iranian Journal of Forest and Range Protection Research*, 20(1), 84–95.
- Nasab, F. K., & Khosravi, A. R. (2014). Ethnobotanical study of medicinal plants of Sirjan in Kerman Province, Iran. *Journal of Ethnopharmacology*, 154(1), 190–197.
- Niesche, R., & Haase, M. (2012). Emotions and Ethics: A Foucauldian framework for becoming an ethical educator. *Educational Philosophy and Theory*, 44(3), 276–288. <https://doi.org/10.1111/j.1469-5812.2010.00655.x>
- Omidbaigi, R. (2020). *Production and processing of medicinal plants*. Astan ghods razavi.
- Ouled Belgacem, A., & Louhaichi, M. (2013). The vulnerability of native rangeland plant species to global climate change in the West Asia and North African regions. *Climatic Change*, 119(2), 451–463. <https://doi.org/10.1007/s10584-013-0701-z>
- Pilling, D., Bélanger, J., & Hoffmann, I. (2020). Declining biodiversity for food and agriculture needs urgent global action. *Nature Food*, 1(3), 144–147. <https://doi.org/10.1038/s43016-020-0040-y>
- Rasekhi, S., Mehrabi, A., Javadi, S. A., & Ghorbani, M. (2016). Analysis of the Integrated Institution–User Network in Co-Management Action Plan of Rangeland (Case Study: Ghasr-e-Yaghouh, Khorram Bid, Fars Province). *Journal of Range and Watershed Managment*, 69(2), 367–382.
- Reynolds, J. F., Smith, D. M. S., Lambin, E. F., Turner, B. L., Mortimore, M., Batterbury, S. P., & Walker, B. (2007). Global desertification: building a science for dryland development. *Science*, 316(5826), 847–851.
- Rija, A. A., Kideghesho, J. R., Mwamende, K. A., & Selemani, I. (2013). Emerging issues and challenges in conservation of biodiversity in the rangelands of Tanzania. *Nat Conserv*, 6, 1–29.
- Sala, O. E., Stuart Chapin, F., III, Armesto, J. J., Berlow, E., Bloomfield, J., Dirzo, R., Huber-Sanwald, E., Huenneke, L. F., Jackson, R. B., Kinzig, A., Leemans, R., Lodge, D. M., Mooney, H. A., Oesterheld, M., Poff, N. L., Sykes, M. T., Walker, B. H., Walker, M., & Wall, D. H. (2000). Global Biodiversity Scenarios for the Year 2100. *Science*, 287(5459), 1770–1774. <https://doi.org/10.1126/science.287.5459.1770>
- SCI. (2009). *The nomadic population of Iran*.
- Shahrokhi, A., Shirmardi, H. A., & Ghaedamini, M. (2011). Identifying some medicinal kinds at risk of extinction in Kallar Mountain in Chaharmahal va Bakhtiari province. *Journal of Medicinal Herbs*, 2(2), 95–100.
- Stork, N. E. (2010). Re-assessing current extinction rates. *Biodiversity and Conservation*, 19(2), 357–371. <https://doi.org/10.1007/s10531-009-9761-9>
- Tanto, T., & Laekemariam, F. (2019). Impacts of soil and water conservation practices on soil property and wheat productivity in Southern Ethiopia. *Environmental Systems Research*, 8(1), 13. <https://doi.org/10.1186/s40068-019-0142-4>
- Wangui, E. E. (2008). Development interventions, changing livelihoods, and the making of female Maasai pastoralists. *Agriculture and Human Values*, 25(3), 365–378.
- Wilmer, H., Schulz, T., Fernández-Giménez, M. E., Derner, J. D., Porensky, L. M., Augustine, D. J., Ritten, J., Dwyer, A., & Meade, R. (2022). Social learning lessons from Collaborative Adaptive Rangeland Management. *Rangelands*, 44(5), 316–326. <https://doi.org/10.1016/j.rala.2021.02.002>
- Yan, Z., Richard, C., & Waters-Bayer, A. (2021). Co-Management of Rangelands to Avoid the Tragedy of the Commons: Experiences from Highland Asia. *XXI International Grassland Congress*, 957–961.
- Yan, Z., & Wu, N. (2005). Rangeland privatization and its impacts on the Zoige wetlands on the Eastern Tibetan Plateau. *Journal of Mountain Science*, 2(2), 105–115.
- Yousefi, M., & Behbahani, N. (2014). *Sustainable management of natural resources based on participation of local communities (successful experience of international project- RFLDL South Khorasan, Sarayan)*.