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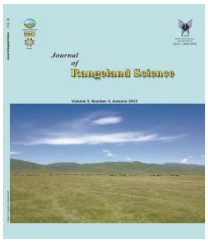

Research and Full Length Article:

Assessment of Dust Impact on Rangeland and Livestock Production According to Ranchers Opinion (Case Study: Andimeshk District, Iran)

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Abstract. Natural resources have been attracted a great deal of attentions and have been frequently exploited for many years. Dust is one of natural disasters mainly in recent years; here, in south west of Iran, it had destroyed the rangelands. The dust has detrimental effects on the rangelands, livestock and livestock production. High concentrations of dust may lead to the coughing, nasal discharge, wheezing and increased effort to breathe. Dust can weaken the immune system and expose livestock to infectious diseases and bacteria and eventually cause death. In order to assess the dust impact on rangeland and livestock production, this study was conducted according to the pastoralist opinions. The statistical population involved the pastoralists of Andimeshk with a grazing license in south west of Iran. According to Natural Resources Department, 474 pastoralists had grazing license. 110 people for the samples were selected. The reliability of questionnaire was assessed using Cronbach's alpha coefficient (α=0.82). Pastoralists believed that the greatest impact of dust is on the forage palatability in a way that livestock avoided grazing the dusty plants. Pastoralists believed that dust in winter has a greater impact on the plant than that in summer because in most tropical regions, the vegetative growth is occurred in winter. In this study, the pastoralist score given as 4.33 out of 5 implies that dust can cause the deterioration and destruction of livestock teeth due to grazing dusty plants so that the teeth get worn out over time resulting in the fact that young livestock may be removed from herds. Most of people in the desired region did not issue livestock insurance due to cost effectiveness. 67% of pastoralists believe that dust reduces the rangeland production and has some devastating impacts on it. 68% of pastoralists believe that dust reduces the livestock production and has some devastating impacts on it.

Key words: Dust impact, Andimeshk, Rangeland, Livestock

Introduction

Natural resources have been received a great deal of attention and have been frequently exploited for many years. Since the emergence of human in the world, he could strike the balance of natural ecosystems in favor of meeting demands. Rangelands are a part of natural endowed resources accounting for maximum earth surface (Rahmani, 1974). Presumably, the most important advantage of rangelands in Iran is the forage production for livestock so that many people including nomads and villagers directly live on the rangelands (Azarnivand and Chahooki, 2008).

Dust is defined as very small, solid, light, silt and clay particles transferred in very long distance by wind erosion or desertification and limits horizontal visibility about 1 to 2 km or less (Tourfi *et al.*, 2011). Recently, dust storms originated from Iran's adjacent countries including Iraq along with other degrading catastrophes such as drought and fire and the unbalanced stoking rate had imposed wide varieties of health issues to people, natural resources and rangelands. Given the lack of scientific programs to curb this phenomenon from neighboring countries and international organizations, the severity and persistence of suspended dust is unfortunately exacerbated and some concerns have emerged on healthy life and uncertain economic conditions. Dust storm is one of the world biggest environmental problems in the arid and semi-arid regions; however, fine dusts re-occur in the atmosphere leading to affect off-sites areas (Tavoussi *et al.*, 2011). The negative consequences and impacts of dust include the exacerbation of damage caused by the incidence of pests and diseases, the increased road accidents due to low visibility, huge treatment costs, and the increased cost of household per capita, the increased density and heavy rescue units and emergency medical centers among others (Nohey, 1997). Increased dust particle may be one of main outcomes of dust storms so that it interrupts air transportation while causing health issues as respiration disorders and pollution (Dehghanpour, 2005). Rangelands are among the first areas affected by dust so that it deposited on vegetation interrupting some activities such as photosynthesis (Parrish, 1910).

Dust affects plant metabolic processes such as photosynthesis, respiration, and stomata clogging in many ways (Miller *et al.*, 1973). Secondary effect of dust is the destruction of rangeland grasses that caused death of lots of livestock as goats and cattle in famine of feeds. Therefore, dust reduces livestock production and economically imposes substantial losses. On the other hand, livestock dependence on the rangelands to provide forage indirectly and losses of rangeland production can reduce the land productivity (Moradi and Alamizadeh, 2012). Baratam *et al.* (1998) pointed out that the effects of dust may trigger the leaves to grow more. On the other hand, it can reduce the amount of light that reaches to photo system leading to at least 20% reduction of leaf photosynthesis. Madigan *et al.* (2008) indicated that the effects of dust on man and livestock are the same as eye irritation, exacerbation of chronic lung disease and reduced lung function. High concentrations of dust may cause coughing, nasal discharge, wheezing and increased effort to breathe. Dust can weaken the immune system, expose livestock to infectious diseases and bacteria and eventually cause death. Zhao and Shao (2001) stated that a large number of livestock died by the inhalation of dusts; a dust storm in April 1998 and 1993 led to the death of 110,000 and about 20,000 livestock, respectively. The aim of this study was to identify the impacts of dust storms on both rangelands and livestock production based on the stakeholders' opinions.

Materials and Methods

Study area

Andimeshk with an area of 3364 Km^2 is located nestled in the northern Khuzestan province in south west of Iran. It is spanned over 32º25' northern longitude and 55º13' eastern latitude. In the present study, data collection was done using library and field reconnaissance methods so that both quantitative and qualitative techniques were used simultaneously. In the latter, in order to evaluate the pastoralist viewpoints on the effects of dust on rangelands, livestock, and livestock products, personal interview techniques were used in various meetings. Such interviews aimed to find the interested variables and how to assess them subsequently. The interviews and meetings were continued until the answers for author were repeated with not new points.

As for the quantitative part, this study was conducted in a field and survey manner in which a questionnaire was considered as a data collection tool. Questions were designed to respond without ambiguity so that a researcher achieves the main objectives in a transparent manner. The questionnaire was based on Likert scoring method so that very low, low, moderate, high and very high scores were 1, 2, 3, 4 and 5, respectively. The region has wide rangelands that are commonly used by rural farmers. The population of this study included livestock farmers with grazing license. According to statistics reported by Natural Resources Department in Andimeshk, 474 people had grazing license. To determine the sample size, a formula (Mesdaghi, 2004) was used to select 110 farmers randomly as follows (Equation 1):

$$N = \frac{T^2 S^2}{P^2 X^2}\left(1 + \frac{2}{n}\right) \qquad \text{(Equation 1)}$$

Where

N= sample size

T= T student

X= initial sample mean

P= 0.1

S^2= variance

n= number of first samples

Measuring tools involved the questionnaires and direct interviews with the selected pastoralists. To achieve the objectives of the research, questions of questionnaire were designed to be transparent and easily understandable. Validity or reliability was confirmed by Cronbach's Alpha reliability coefficient of (α=0.82) and the questions were sent to the experts and professors of Agriculture and Natural Resources department. The indices were measured using Likert scale (from very low to very high). Questionnaires completed after the initial review and verified in terms of accuracy to be analyzed. SPSS software and statistical methods were used for data processing. Descriptive statistics were used to describe personal characteristics such as age, educational status number of livestock. To assess the effects of dust on the rangelands, total scores were used. To determine the relationship between some variables including age, and the correlation between pastoralists' views, the Pearson test was used and finally to test the difference between the observed numbers and expected ones, the binomial test was utilized.

Results

Pastoralists characteristics

Pastoralist age was one of the variables dealt with in the research. Our findings showed that pastoralist ages were ranged from 19 to 80 year old on the average of 49.7 years. The percentage of pastoralist age is presented in Table 1. Results of the questionnaire show that most pastoralists were men so that out of 110 people, 104 were men and 6 people were women (Table 1). Pastoralist education status was another studied factor. The findings show that 57%, 10%, 9%, 17% and 7% of them were uneducated, elementary, intermediate, high school and academic educated, respectively (Table 1).

The pastoralist histories were asked in the questionnaire to express their herding job experiences. Of course, this includes the years that the ranchers who were involved either independently or dependently in livestock production. Results show that pastoralists with 65 and 3 years had the highest and lowest herding experiences. The mean of their job experience was 22 years. The percentage of herding job experience is presented in Table 1. For number of livestock, the results of questionnaire analysis showed that the highest and lowest numbers of livestock were 440 and 15, respectively. The mean of livestock number was 186 (Table 1).

Table 1. Stockholder characteristics and livestock number of respondents

Age (Year)	(%)	Gender	(%)	Education	(%)	Herding Experience (year)	(%)	Livestock Number	(%)
15-30	13	Man	94.5	Uneducated	57	<20	53	<100	28
31-45	28	Woman	5.5	Elementary	10	21-40	42	101-200	31
46-60	31			Intermediate	9	41-60	8	201-300	26
61-75	26			High school	17	>60	2	301-400	14
76-90	2			Academic	7			>400	1

Impact of dust on rangeland production

The pastoralist opinions for the impact of dust on rangeland production were asked using Likert scoring method (1=very low, 2=low, 3= moderate, 4=high and 5=very high). Ranking the effects of dust on the rangelands shows that pastoralists with an average value of 4.48 believed that the greatest impact of dust on rangeland is low palatability (Table 2).

Pastoralists with an average value of 4.32 out of 5 believed that dust storm causes the productivity losses in rangeland services as beekeeping, clean air, tourism, medicinal plants and industrial plants (Table 2). On average, 4.29 and 4.27 of pastoralists believed that wind and fast livestock movement over the areas with respect to vegetation have reduced the effects of dust on plants.

On average, 4.15% of pastoralists believed that winter dust storm is more harmful than that in summer and at the same time broadleaved plants are much more affected. On average, 2.8 and 2.90 out of 5 reported the least impact of dust on plant diversity, rangeland forage production and changes of vegetation composition, respectively. Pastoralists with a mean of 4.02 believed that dust has a huge effect on seed quality. Regarding the viewpoint of pastoralists, the impact of dust on the migration phenomenon was moderate among nomadic herders (Table 2).

The impact of dust on livestock and livestock products

The pastoralist opinions for the impact of dust on livestock production like milk and yogurt were asked using Likert scoring method (1=very low, 2=low, 3= moderate, 4=high and 5=very high) (Table 3). On average, 3.78 out of 5 pastoralists reported that dust may reduce livestock products like milk and yogurt. On average, 3.90 out of 5 ones believed that the dust has a negative effect on livestock production and on the quality of sheep wool. On average, 3.64 out of 5 people said that dust is an important factor in livestock products. On average, 3.26 out of 5 people stated that dust causes the embryo abort in livestock. Similarly, 4.41 out of 5 pastoralists said that dust leads to the contamination of water sources which in turn causes diseases. 4.33 people believed that dust causes tooth decay and young livestock production losses. Pastoralists believed that dust through various ways such as eye infections, livestock, manual feed and increased gastrointestinal disease raises the cost of keeping livestock. 3.05 people stated that dust plays a trivial role in the death of livestock directly (Table 3).

Table 2. Ranking Stockholders opinions of impact of dust on rangeland production using Likert scoring method, as: 1=very low, 2=low, 3= moderate, 4=high and 5=very high score

Questioner	Mean	SD	Rank
Dust cause reduction in palatability rangelands	4.48	0.77	1
Dust reduces the productivity of rangeland ecosystems (e.g., beekeeping, medicinal plants, etc.)	4.32	1.00	2
Wind blowing after the dust is causing shake plants, pouring dust on their and reduce the effects of dust on the plants	4.29	0.88	3
The sharp decline in respiration and evapotranspiration in rangelands in the occurrence dust	4.28	0.97	4
Movement and least pasturage livestocks after the dust to dust falling on plants and the effects of dust decreases on plants	4.27	0.80	5
The impact of dust on plants in winter and spring seasons (season plant growth), is most of the summer	4.15	1.00	6
Broadleaf plants are affected by dust than most other plants	4.11	0.95	7
Occurrence of dust reduction quality forage pasture as a result livestock performance (in meat, milk, wool ...) decreases	4.08	1.03	8
Occurrence of dust can reduce production low quality seed on rangelands	4.02	1.07	9
Occurrence of dust and they sit on rangelands discounted energy stored in plant tissues and it will reduce the role of rangelands in livestock feed	4.00	1.08	10
Occurrence of dust cause reduction in growth and production plants and this causes the cover of bare soil and erosion remains elevated	3.84	1.07	11
Occurrence of dust cause reduction in vegetative growth rangelands	3.50	1.18	12
Occurrence the dust causes to early or forced migration of herders to other provinces	3.35	1.36	13
The occurrence of dust will reduce the reproductive growth of rangelands	3.20	1.22	14
Vegetation composition has changed due to the occurrence of dust	2.90	1.39	15
Dust occurrence of pasture production capacity is reduced	2.90	1.48	16
Dust reduces the diversity and density of pasture plants	2.89	1.46	17

Table 3. Ranking rancher's opinions on dust effect on livestock and livestock production using Likert scoring method, so that a 1=very low, 2=low, 3= moderate, 4=high and 5=very high score

Question	Mean	SD	Rank
With drinking dusty water, phenomenon parasitic diseases (diarrhea) increases in livestock	4.41	0.73	1
Dust cause dental erosion livestocks with eating the plants are dusty as a result; the efficiency is low in young livestocks	4.33	0.89	2
The occurrence of the dust, eyes disease livestock increases (eye infection, etc.)	4.22	0.91	3
The lack of natural forage plants due to plants pollution of soil	4.22	0.94	4
Feed rejection livestock use of plants pollution of soil	4.20	0.93	5
Dust causes a runny nose and mouth of the livestock	4.20	1.02	6
The occurrence of the dust, the respiratory diseases in increases livestock	4.08	1.06	7
The occurrence of dust coughing and wheezing becomes severe chest livestock	4.07	1.11	8
The water pollution of pathogens that are transferred by dust	4.05	0.96	9
The occurrence of dust increases cost maintenance livestock	4.05	1.21	10
Gastrointestinal disorders increase due to use of plants dusty in livestock	4.02	1.04	11
The occurrence of dust; dust sitting on livestock skin this increases the livestocks skin disease	3.90	1.02	12
The dust phenomenon reduces the amount and quality of the wool of sheep production	3.90	1.20	13
The dust reduces the efficiency of the lungs of livestocks	3.86	1.19	14
The occurrence of the dust, livestock products (milk, yogurt ...) Decreases...	3.78	1.23	15
The dust causes dystocia and retained placenta in livestocks	3.77	1.29	16
Livestock mobility and reduces dust	3.75	1.37	17
Dust causes the weakened livestock	3.73	1.32	18
Dust causes the energy loss of livestock	3.67	1.30	19
Dust causes reduction in livestock reproduction	3.64	1.29	20
Due to dust sitting on the skin of livestocks tingling livestocks increased	3.63	1.29	21
Dust causes abortion is livestock	3.26	1.32	22
The occurrence of the dust, paralysis disorder increases in livestocks	3.14	1.41	23
Livestock deaths by inhalation the dust	3.05	1.44	24

Pastoralist attitudes

To assess the effects of dust on rangeland production, 17 items were designed. So, sum of items was considered as a score for the interpretation of viewpoints and 17 items have given a score that ranged between 17 and 85; effects of dust on the rangeland were classified as too high, high, moderate and low (Table 4). According to the results, the effects of dust on pastoralists were classified as too high (Table 4). 99% of pastoralists believe that dust affected the rangelands severely and had negative effects on rangeland production (Table 4).

To investigate the effects of dust on both livestock and livestock productions, 24 items were designed (Table 4). Given that 24 items were designed, scores ranged between 24 and 120, and the effects of dust on livestock and livestock products were classified in four categories of very high, high, moderate and low (Table 4). Based on pastoralist's viewpoints, dust has huge impacts on livestock and its productions. None of them reported low or moderate impacts. This suggests that in viewpoints of pastoralists, livestock and its productions are affected by dust extremely.

Table 4. Opinions ranchers on the effects of dust on Rangelands and livestock production

Dust Impact on	Degree of Important	Class	Frequent	Percent
Rangeland Production	Low	17-34	0	0
	Average	35-51	2	1
	High	52-68	80	73
	Very much	69-85	28	26
Livestock Production	Low	24-48	0	0
	average	49-72	0	0
	High	73-96	68	61
	Very much	97-120	42	39

The relationship between pastoralist views and individual characteristics

To determine the relationship between the pastoralists' viewpoints on the effects of dust and personal characteristics, the Pearson correlation coefficient was determined (Table 5). Results showed no significant correlation between personal characteristics and pastoralists' viewpoints about the effects of dust on both rangelands and livestock production (Table 5). This means that any changes in these variables have no influence on the rangelands and livestock.

Table 5. The relationship between vision of ranchers and Individual characteristics

Personal Characteristics	Rangeland Production	Livestock Production
Age	0.10 ns	0.03 ns
Number livestock	0.02 ns	0.02 ns
Working experience	0.10 ns	0.02 ns

Ns= no significant

Binomial test to assess between observed and expected pastoralists views

Binomial test was used to evaluate the dust impacts on rangelands and livestock production based on local pastoralists' viewpoints. The results indicated that the observed values obtained from pastoralist opinions were 0.67 and 0.68 for rangelands and livestock production, respectively. Both values had significant differences with the expected values (0.50) in 1% probability level (Table 6). Given that confidence level of binomial test is less than 0.01, the effects of dust on rangelands differ significantly from the average value. So, it can be concluded that 67% of pastoralists

believe that dust reduces the production of rangeland and has the devastating impacts on it. Similarly, it can be concluded that 68% of pastoralists believe that dust reduces the livestock and by-products and has the devastating impacts on them (Table 6).

Table 6. Binomial test for assessing the difference between observed and expected numbers

Dust Impact on	Groups	Category	N	Observed Prop.	Expected Prop.	Sig. (2-tailed)
Rangeland Production	Group 1	<= 3	628	0.33	0.50	0.000
	Group 2	> 3	1249	0.67		
	Total		1877	1.00		
Livestock Production	Group 1	<= 3	798	0.32	0.50	0.000
	Group 2	> 3	1732	0.68		
	Total		2530	1.00		

Discussion and Conclusion

Most pastoralists were characterized as non-educated or low-educated; this can be a major barrier to the implementation of new methods of livestock and range management or even the new methods.

Most pastoralists did not insured their livestock and main reason was the lack of cooperation of insurance company to pay damages, especially considering the distance of cities from villages, and husbandry would not need any compensation for each day of the long-distance travel. Perhaps by establishing offices closer to villages of pastoralists, distance would not be a constraint to the insurance. Arzani (2009) reported that livestock recognizes forage through touching, smelling and tasting. So, palatability is affected by urine or feces, tissues and leaves. In this study, ranchers believed that the greatest impact of dust is imposed on palatability and this is due to the reduced palatability of forage resulting in livestock avoidance from dusty plants.

Hosseinzadeh and Poursiahbiidi (2011) declared that dust and growing season are important so that if this phenomenon occurs at the beginning of growing season, it will cause severe damages and even destroy the plants. Pastoralists believed that dust in winter has greater impacts on plant than that in summer because in most tropical regions, the vegetative growth is occurred in winter. Pastoralists believe that the impact of dust on broadleaved plants is much more than other plants because these leaves attract more dust. Impact of dust on the migration of nomadic herders was moderate; this can be attributed to nomadic herder destination in neighboring Khuzestan province, and they were exposed to this phenomenon. Pastoralists have stated that wind and fast movement of livestock in rangeland reduce the effects of dust on rangelands because it removes the dust on plants. As a whole, total impact of dust on rangelands was at very high level so that 99% people believed that impact of dust on rangelands is much and too much. Kellogg *et al.* (2004) suggests that dust pollutes water resources resulting in the digestive diseases.

Furthermore, they argued that the highest impact of dust on livestock (mean 4.41) was the contamination of water resources so that contamination of water supply paves the way for bacteria and pathogens causing diarrhea and other gastrointestinal diseases. In this study, pastoralists (4.33) implies that dust can cause the deterioration and destruction of livestock teeth due to eating dusty plants and the teeth get worn out over time resulting in young livestock to be

removed from herds. Pastoralists believed that dust through various ways such as eye infections, livestock, manual feeding and the increased gastrointestinal disease raises the costs of keeping livestock. 3.05 out of 5 pastoralists have stated that dust plays a little role in the death of livestock directly. In dusty days, they have to manually feed livestock which in turn incurs much cost on them.

Schlesinger *et al.* (2006) pointed out that diseases that are caused by fine dust and can affect livestock and humans are as follows: low lung function, eye irritation, nose, mouth and throat, coughing, wheezing, respiratory diseases such as bronchitis, low body energy, headaches, dizziness, impaired immune system, reproduction and death of fetus. They have mentioned that dust reduces the energy leading to poor performance and chest tightness of livestock. Also, it can lead to such side effects as the reduced fertility in livestock reproduction. They stated that livestock fetus deaths occur less frequently.

This may be due to the fact that dust occurs in July and August when livestock is exposed to high risk. Given that lamb is one of rangeland productions and the reproduction decreases due to the reduced fertility, it can be concluded that dust imposes negative effects on rangeland production. 3.78% stockholders stated that dust storms lower the livestock productions. Nearly all the stockholders confirmed huge effects of dust on livestock and livestock products to large extent and believed that they result in huge costs every year. Most of them did not issue insurance for their livestock because of both cost effectiveness and no dust insurance.

67% of pastoralists believe that dust reduces the rangeland production and has the devastating impacts on it. 68% of pastoralists believe that dust reduces the livestock production and has the devastating impacts on it.

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ارزیابی اثرات ریزگردها بر اکوسیستم‌های مرتعی و تولید فرآورده‌های دامی از دیدگاه دامداران (مطالعه موردی: مراتع اندیمشک، ایران)

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چکیده. منابع طبیعی از هزاران سال قبل مورد توجه قرار گرفته و استفاده شده است. گرد و غبار یکی از بلایایی طبیعی است که در چند سال باعث تخریب مراتع شده است. این گرد و غبار باعث اثرات زیان‌آوری بر مراتع، دام و تولیدات دامی دارد. غلظت بالایی این گرد و غبار باعث سرفه، ترشحات بینی، خس‌خس و سختی نفس کشیدن می‌شود. ریزگردها می‌توانند سیستم ایمنی بدن را تضعیف کنند و باعث بیماری‌ها و در نهایت مرگ شود. به منظور ارزیابی اثرات ریزگردها بر اکوسیستم‌های مرتعی و تولیدات دامی از دیدگاه دامداران این تحقیق در جامعه آماری دامداران شهرستان اندیمشک که دارای پروانه چرا بودند به اجرا درآمد. باتوجه به اطلاعات گرفته شده از اداره منابع طبیعی اندیمشک ۴۷۴ دامدار پروانه چرا داشتند. برای تعیین حجم نمونه از فرمول تعیین حجم نمونه استفاده شد و براساس این فرمول ۱۱۰ نفر از دامداران به صورت تصادفی انتخاب شدند. پایایی پرسش نامه با استفاده از آزمون آلفای کرونباخ (α=۰/۸۲) مورد سنجش قرار گرفت. دامداران معتقد بودند که ریزگردها باعث کاهش خوشخوراکی گیاهان مرتعی می‌شود و کاهش تعلیف آنها توسط دام‌ها می‌شود. دامداران باور داشتند که ریزگردهایی که در زمستان اتفاق می‌افتد تاثیر بیشتری نسبت به ریزگردهای تابستان دارد. دامدران با میانگین نمره ۴/۳۳ از ۵ عقیده داشتند که وقوع ریزگردها باعث سایش و خرابی دندان دام‌ها می‌شود. بسیاری از دامداران دام‌های خود را بیمه نکرده بودند و دلیل کار خود را هزینه زیاد حق بیمه می‌دانستند. حدود ۶۷ درصد دامداران اعتقاد داشتند که تاثیر ریزگردها بر مرتع زیاد و خیلی زیاد است. و به همین ترتیب ۶۸ درصد دامداران اعتقاد دارند که تاثیر ریزگردها بر تولیدات دامی زیاد و خیلی زیاد است.

کلمات کلیدی: اثرات ریزگرد، اندیمشک، مرتع، دام