Routledge
Taylor & Francis Group

Journal of Environmental Planning and Management

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/cjep20

# Water/climate nexus environmental rural-urban migration and coping strategies

Ameneh Mianabadi, Kamran Davary, Mahdi Kolahi & Judith Fisher

**To cite this article:** Ameneh Mianabadi, Kamran Davary, Mahdi Kolahi & Judith Fisher (2021): Water/climate nexus environmental rural-urban migration and coping strategies, Journal of Environmental Planning and Management, DOI: 10.1080/09640568.2021.1915259

**To link to this article:** https://doi.org/10.1080/09640568.2021.1915259

Published online: 26 May 2021.

*Journal of Environmental Planning and Management*, 2021
https://doi.org/10.1080/09640568.2021.1915259

Routledge
Taylor & Francis Group



# Water/climate nexus environmental rural-urban migration and coping strategies

Ameneh Mianabadi[a,b]*, Kamran Davary[a], Mahdi Kolahi[c] and Judith Fisher[d,e]

[a]*Department of Water Science and Engineering, Ferdowsi University of Mashhad, Mashhad, Iran (the Islamic Republic of);* [b]*Department of Ecology, Institute of Science and High Technology and Environmental Sciences, Graduate University of Advanced Technology, Kerman, Iran (the Islamic Republic of);* [c]*Ferdowsi University of Mashhad Faculty of Natural Resources and Environment, Water and Environment Research Institute, Mashhad, Iran (the Islamic Republic of);* [d]*Institute of Agriculture, University of Western Australia, 35 Stirling Hwy, Crawley WA 6009, Western Australia;* [e]*Fisher Research Pty Ltd, PO Box 169 Floreat 6014, Western Australia*

(*Received 2 September 2020; revised 19 January 2021; final version received 19 March 2021*)

Rural-urban migration is a challenging issue for communities, and is influenced by interactions between numerous push and pull factors. To better understand the interacting drivers of rural-urban migration, the study investigates the factors which influence migration from rural areas in Sistan to Mashhad city in Iran. The investigation was conducted using questionnaires and deep interviews. The results show that the main reason for migration from Sistan to Mashhad is environmental degradation including drought and water scarcity, followed by economic and government operational plans for supporting rural people. However, some people stay in Sistan in spite of the current unpleasant environmental and economic conditions. The results demonstrated cultural and social factors as the main motivations for people remaining in villages. Since the factors could be more challenging under future global warming, adaptive participatory governance is needed to link civil society, authorities, scientists, and the land to develop nature-based and rural-urban migration solutions.

**Keywords:** environmental migration; land degradation; adaptive co-management; resilience

## 1. Introduction

Environmental changes have remarkable socio-economic consequences. Responses to the COVID-19 pandemic, relationship of pandemics to environmental degradation and the socio-economic consequences are a clear example (Dobson *et al*. 2020; IPBES 2020). Such changes provide greater potential for conflict, especially in developing countries (McLeman 2011), with environmental migration being a key coping strategy (Solórzano 2016). For instance, climate-related issues can affect water resources (Devkota and Gyawali 2015; Kumar *et al.* 2017; Haddeland *et al*. 2013; Delju *et al*. 2013), leading to increasing water-related conflicts and migration (Trondalen 2009). Environmental migration, in turn, can threaten regional and international security (Brown and Mcleman 2009). Degradation and socioeconomic stressors combine to

*Corresponding author. Email: amianabadi@stu.um.ac.ir; a.mianabadi@kgut.ac.ir

result in conflict and out-migration from degraded areas (IPBES 2018; Khashtabeh *et al*. 2020; Jannatichenar, Kolahi, and Mesdaghi 2020). Therefore, it is extremely important to understand the reasons for, and consequences of environmental migration and the potential and actual approaches which will build social resilience.

While Black (2001) had expressed that there is not an explicit linkage between environmental factors and migration, several researchers have revealed a clear connection (e.g. Mcleman 2013, Nicholson 2014, Burrows and Kinney 2016, Mayrhofer 2016). On the one hand, although environmental factors can lead to involuntary migration, some people voluntarily choose to migrate to regions with better environmental conditions (Mcleman 2017). On the other hand, sometimes people who are the most vulnerable to the impacts of environmental changes, are not necessarily able to migrate (Brown 2008; Stal and Warner 2009). Environmental migration may depend not only on environmental change itself, but also social, economic, cultural, and other factors, such as government policies and personal characteristics (e.g. Bardsley and Hugo 2010, Treacy *et al*. 2018). Moreover, environmental factors can also cause economic, social, and even political stresses, leading to increased migration. Accordingly, the relationship between environmental factors and migration is complex (Meze-Hausken 2000; Arenstam and Nicholls 2006; Bardsley and Hugo 2010), and it is not simply possible to isolate the role of environmental factors from other factors (Foresight: Migration and Global Environmental Change 2011; Massey, Axinn, and Ghimire 2010). This complexity makes it difficult to identify a simple cause and effect relationship (Willemen *et al*. 2020). Therefore, it reveals the importance of utilizing systematic thinking to understand the complexity of causes leading to migration, in order to establish effective coping strategies (Goodall 2004).

In developing countries, with considerable dependency on agriculture and natural resources, any increase in frequency, magnitude, and severity of extreme events can lead to an increase in rural-urban migration (Mendelsohn *et al*. 2007; McLeman and Hunter 2010). The causes can be, for example, water scarcity, drought, and desertification which can directly affect the income sources of rural people engaged in activities such as agriculture, fishing, and grazing. Poverty and significantly reduced income, arising from environmental changes, can be the key factors determining rural-urban migration (Leighton 2007), resulting in many security and socio-cultural problems at both the origin and destination (Mianabadi, Mostert, and Van de Giesen 2013). The predicted number of environmentally displaced people by 2050 is up to one billion people (Myers and Kent 1995; Biermann and Boas 2010; Sachs 2007; IOM 2009). This migration of people can cause conflict with the residents where the migrants move (IPBES 2018). Undesirable consequences arising from migration and environmental change suggest that policymakers should pay more attention to developing and implementing appropriate adaptation strategies to alleviate such consequences. However, to support policymakers and local people to develop solutions to such challenges, the linkages between environmental issues and migration needs to be better understood to provide the best information to solve these problems (Bardsley and Hugo 2010). Migration is more commonly internal, e.g. rural-urban (Boncour and Burson 2009; Stal and Warner 2009; Leighton 2007), and therefore the effect of environmental changes on internal migration needs further investigation.

This research aims to investigate rural-urban migration in a study area in Iran. Previous case studies in Iran have mostly focused on the impacts of the water/climate-related environmental migration in Khuzestan province in the southwest of the country

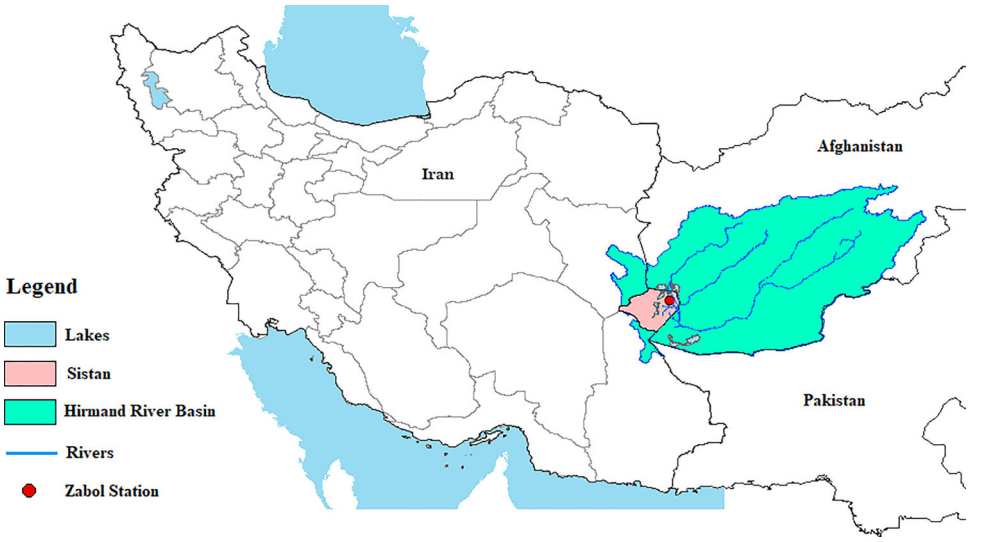


Figure 1. Location of the Sistan Area in Iran and the Hirmand River Basin.

(Khavarian-Garmsir *et al*. 2019; Pourahmad, Khavarian-Garmsir, and Hataminejad 2016; Mohammadi Dehcheshmeh and Ghaedi 2020) and Lake Urmia Watershed (Schmidt, Gonda, and Transiskus 2020) in the northwest. Khavarian-Garmsir *et al*. (2019) and Pourahmad, Khavarian-Garmsir, and Hataminejad (2016) worked on the city shrinkage/growth while Mohammadi Dehcheshmeh and Ghaedi (2020) and Schmidt, Gonda, and Transiskus (2020) focused on rural livelihoods. However, the impacts of environmental change, and other social factors, on the rate of migration on both rural and urban livelihoods have not been investigated. Accordingly, this research aims to investigate the effects of environmental changes on the rate of rural-urban migration, the consequences of migration, and finally on strategies for dealing with migration in both the sending and receiving societies. More importantly, almost all the literature related to environmental migration has focused on migrants (Wiegel, Boas, and Warner 2019), whose migration is a threat or an opportunity. The question of why and how some people stay in their current place alongside unpleasant environmental and economic conditions, has had little consideration in the academic literature (Farbotko 2018; Adams 2016; Wiegel, Boas, and Warner 2019). This question is perused in this study.

## 2. Study areas

### *2.1. Sistan area*

The Sistan Area, in the southeast of Iran, is a part of the Hirmand River Basin, a trans-boundary river basin shared between Afghanistan, Iran, and Pakistan (Figure 1). The area is classified as a semi-arid and arid region. The mean annual precipitation varies from 50 to 60 mm (Thomas, Azizi, and Behzad 2016; A. Mianabadi *et al*. 2019). The hot and dry climate of Sistan increases crop water requirements and irrigation demands from Hirmand River and/or Lake Hamoun. Moreover, the water from the river and the lake is also used for fishery, animal husbandry, and domestic consumption. The Hirmand River and Lake Hamoun are the vital water resources for the area (Kutty


Figure 2. Major migration routes from the Sistan Area (2011-2016) (Statistical Center of Iran 2016).

2014). The drying of Lake Hamoun, especially from 2000 onwards, has led to undesirable environmental conditions, such as water shortages and sand storms. The strong winds, commonly known as the "120-day wind", blow during the summer and move the fine sands from the lake bed to a hundred or more villages, covering the houses and agricultural lands (Rashki *et al*. 2012).

People in Sistan are mostly employed in agriculture, fisheries, and animal husbandry (Rashki 2012), and have been considerably affected by the drying of Lake Hamoun. According to Bilsborrow (1992), reduced income, increased income instability due to severe changes in environmental conditions, or less healthy environments may induce environmental migration. Such situations have occurred in Sistan. For example, Abbaspour and Sabetraftar (2005) reported that the drying of Lake Hamoun during 2000-2001 led to the loss of approximately 8,000-12,000 tons of fish in the area. These unfavorable conditions led to massive migration from the rural areas to other places across the country, such that this area has the second-highest rate of migration in Iran (after Khuzestan province in the southwest of Iran) (Statistical Center of Iran 2016). Accordingly, we choose this area as our case study. Figure 2 shows that, of the 394,000 people living in Sistan (including cities of Zabol, Zahak, Hirmand, Nimrooz and Hamoun as well as the villages), approximately 26,500 people emigrated to other cities in the country; mostly to Sistan and Baluchistan province

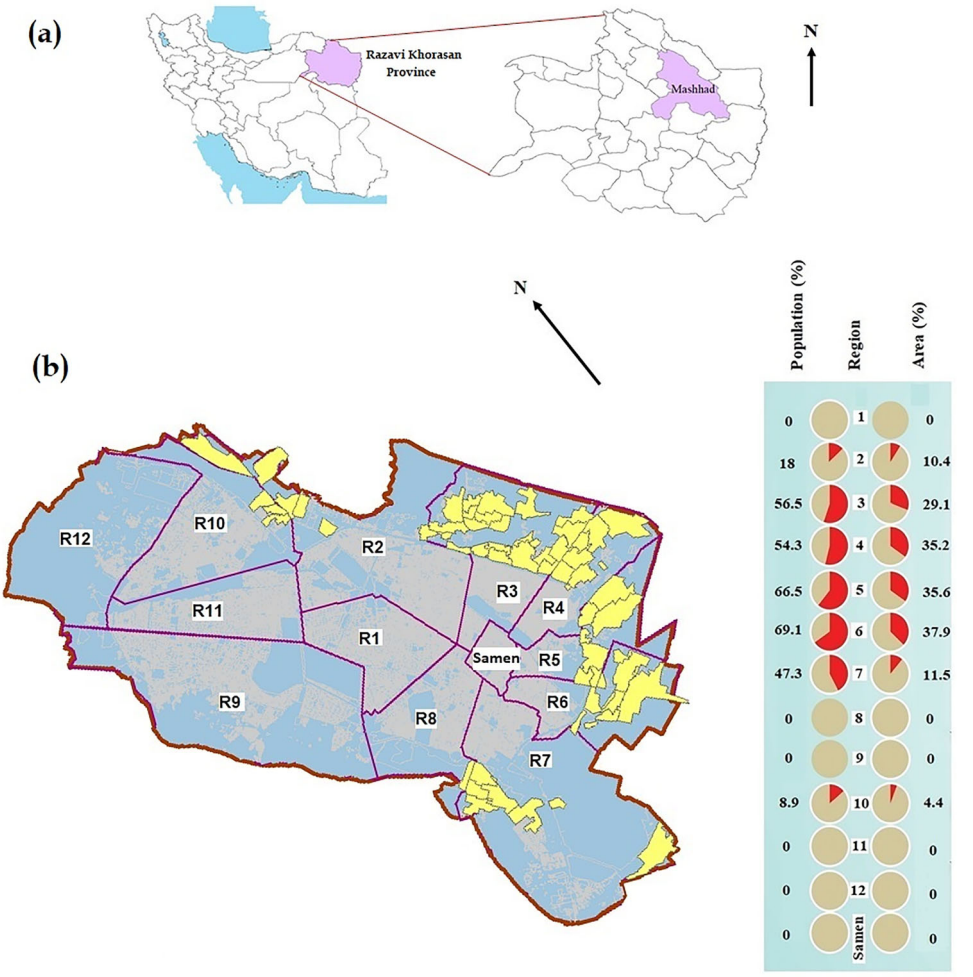


Figure 3. (a) Location of Mashhad in Iran and Razavi Khorasan Province, (b) Marginal areas (yellow areas) in Mashhad with percent of area and population in each region. Color online.

(11,484 people), Razavi Khorasan province (4,918 people) and Golestan province (2,199 people) (Statistical Center of Iran 2016).

### *2.2. Mashhad city*

Mashhad, the second most populous city of Iran (After Tehran), is located in Razavi Khorasan province, northeast of Iran (Figure 3a). The Holy Shrine of Imam Reza, is located in Mashhad which is the main religious city of Iran and so attracts individuals and migrants. Mashhad with 3,372,660 inhabitants has 3.8% of the country's population and 47.5% of the Razavi Khorasan province's population (Statistical Center of Iran 2016). Based on these statistics, the city's population has grown by 1.72% between 2011 to 2016. About 30% of the population live on the margins, mostly having emigrated from small cities or villages. Mashhad is classified as a semi-arid region with mean annual precipitation of 252 mm and a mean temperature of 15 °C

(Mianabadi *et al*. 2019). Water for agriculture, industries, and domestic consumption is provided by groundwater and surface water from the Kashaf River and Doosti Dam on the Hari River. However, due to the reduction in precipitation an overdraft of groundwater has occurred in recent years. Consequently, Mashhad has encountered a water crisis exacerbated by its many facilities and the large visitation to the holy shrine of Imam Reza, from cities and villages across Iran. The increased immigration to Mashhad has exacerbated the Citys' water problems. Furthermore, severe conflicts between immigrants and Mashhad citizens, has led to increasing concerns by the City's policymakers on the impacts of increasing rates of immigration to Mashhad. For these reasons Mashhad was chosen for this study.

## 3. Methods

### *3.1. Questionnaire in Mashhad*

There is no reliable data on the regions of origin for Mashhad migrants, making it difficult to distinguish immigrants from Sistan and other areas. Figure 3b shows marginal areas in Mashhad. Based on information from Mashhad Municipality, individuals from Sistan mostly inhabit some areas at Region 6 (R6; Figure 3b). Therefore, the data for this study has been collected through questionnaires in Region 6. The questionnaire was designed to identify the main reasons forcing them to migrate to Mashhad.

The questionnaire was classified into five main factors, including 1. environmental (e.g. shortage of accessible water, drought/flood, dust storms, and air, water and soil pollution), 2. social (e.g. ethnic strife, lack of trust, migration of family members or neighbors), 3. economic (e.g. job, incomes, savings, and unemployment), 4. operational (e.g. appropriate utilities: water, gas, electricity, suitable roads, desirable markets, and security at international borders), and finally, 5. cultural (e.g. custom, the city lifestyle, cultural and educational facilities). Six to eight questions were prepared for each factor, with a total of 34 questions, with answers given in the form of a 5-point Likert scale. Likert scales (Bernstein 2005) allow all the respondents to convey the importance of each factor on their migration as Not at all (1), Slightly, Moderately, Very, and Extremely (5). By using equally spaced integral scale values, rather than simply including 1, 2, 3, 4, and 5, it allows the scaling of response options with ordinal response categories and provides a simple sum of responses over options. Respondents' characteristics (Table 1) are noted. The survey consists of a few open-ended questions to allow the respondents to provide further explanations, e.g. their reasons for returning to their origin, and the facilities and government support they expect to be provided on their return to their villages.

### *3.2. Questionnaire in Sistan*

The rural people in Sistan were asked the main reasons which encourage them to stay in their homelands, in spite of undesirable environmental changes. The data were collected, through questionnaires, from 100 individuals at both the sending and receiving sites to ensure consistency with each other. The questionnaires were classified by five main factors: 1. environmental (e.g. access to water, the natural scene in villages, and quality of the weather), 2. social (e.g. sense of belonging to a family, relatives and their homelands, cooperation in the rural areas, and indigenous management

Table 1. Descriptive statistics of socioeconomic and demographic variables of the Sistani migrants in Mashhad.

| Variable | Explanation | Mean | Median | Mode | Standard Deviation | Min | Max |
|---|---|---|---|---|---|---|---|
| Gender | Nominal scale: 1) Male, 2) Female | 1.24 | 1 | 1 | 0.43 | 1 | 2 |
| Marital status | Nominal scale: 1) Single, 2) Married | 1.86 | 2 | 2 | 0.35 | 1 | 2 |
| Age | Ratio scale: Open-ended question | 38 | 38 | 40 | 13 | 14 | 70 |
| Household size | | 4.8 | 4.5 | 4 | 2.2 | 1 | 18 |
| Duration of residence in Mashhad | | 12 | 7 | 4 | 13.3 | 1 | 67 |
| Educational level | Ordinal scale: 1)Illiterate , 2) Literacy movement, 3) High school, 4) Diploma, 5) Associate, 6) BSc, 7) MSc and higher | 3.03 | 3 | 3 | 1.11 | 1 | 6 |
| Previous job | Ordinal scale: 1) Private sector, 2) Governmental sector, 3) Self-employed, 4) Student, 5) Farmer, 6) Ranchman, 7) Retired, 8) Housewife, 9) Unemployed, 10) Farmer-Ranchman, 11) Others | 5.73 | 5 | 3 | 2.73 | 1 | 11 |
| Current job | | 4.33 | 3 | 3 | 2.66 | 1 | 11 |
| Income level from previous job | Ordinal scale: 1) under 5 Million Rials (MR), 2) 5-10MR, 3) 10-15MR, 4) 15-20MR, 5) more than 20MR | 1.89 | 2 | 1 | 1.01 | 1 | 5 |
| Income level from current job | | 2.26 | 2 | 2 | 0.80 | 1 | 5 |

strategies), 3. economic (e.g. income, lack of enough money for migration, assets: house, land, and herd, and alternative economic activities), 4. operational (e.g. government financial support, no governmental permission for migration, and easy access to cities) and 5. cultural (e.g. custom, lifestyle in villages, cultural and educational facilities, and ethnic values) factors. The questionnaire included six to seven questions for each factor, a total of 31 questions, in the form of a 5-point Likert scale.

### *3.3. Interviews*

Deep informal, unstructured, and open-ended interviews were applied with 12 key administrative personnel and six university professors (in the fields of social sciences, geography, water resource management, and agricultural economics), to gather general information about migration, consequences, and also strategies for dealing with the issues. The interview contained at least three main questions: why rural-urban migration occurs, what the consequences are, and finally, how to deal with these consequences.

## 4. Results

### 4.1. Data analysis in Mashhad

Table 1 displays the descriptive statistics for migrants' socioeconomic and demographic variables. Based on the table, the average respondents' age was 38. The majority of respondents were male (76%) and married (86%) and the average household size was 4.8. Respondents had been living in Mashhad for approximately 12 years on average. Only 30% of respondents had a diploma degree or higher. Respondents were mostly farmers when they lived in Sistan and had the lowest income level. However, in Mashhad, they were mostly self-employed (50%), while their family income was still not sufficient for their life requirements (mostly (57%) between IRR 5-10 million per month).

Analysis of the questionnaire is shown in Tables 2 and 3 and Figure 4. Results indicate that the environmental factor was the most important reason (22%) pushing people to migrate (see Figure 4). Respondents had mostly indicated drought to be the most important factor causing migration, followed by dust storms and water shortages. Furthermore, Table 3 shows 60% of the respondents believed the environmental factor to be extremely important in their migration decisions; however, only 14% had mentioned it as not or very slightly important. The latter had mostly followed their families' decision for migration or had preferred a better life situation in a large city. The environmental factors were generally divided into climate change, natural disasters (e.g. drought/flood), land and resource degradation, and long-term environmental changes arising from human mal-activities such as infrastructure development (Terminski 2012; El-Hinnawi 1985; Khavarian-Garmsir *et al*. 2019). The results of Mianabadi *et al*. (2019) and Mianabadi *et al*. (2020) showed that Sistan has been getting drier between 1966–2015 and 1983-2016, respectively. Thus, climate change (reduction in precipitation and increase in temperature) has led to a decrease in available water which is mentioned by the respondents as the main reasons for rural-urban migration. The combined effects of prolonged drought and the construction of infrastructure in Afghanistan upstream of the Hirmand River Basin are also considered as the environmental factors causing the Lake Hamoun to become dry (Weier 2002), leading to water shortages in Sistan and so leading to rural-urban migration.

According to Figure 4, economic and operational factors were the second most important factors (each 21%) for migration. 49% of the respondents stated that the economic factor was an extremely important driver to leave their home places. They also indicated that economic problems had mostly arisen from environmental issues and degradation, especially water shortages. Moreover, 61% of the respondents believed that closing international borders, and the consequent reduction in their free trade, were the most important operational factors influencing their migration decisions. Once rural people lost their income due to water shortages, border trade was their only other source of income. Therefore, closing the border for the security of the region made many people decide to migrate. Additionally, the results indicate that the lack of markets, across the region or the country, for agricultural and non-agricultural products is another main concern for rural people. This is why 41% of the respondents believed the operational factor to be an extremely important pushing factor. Based on the results, social and cultural factors were less important than the other factors (both 18%). The most important social factors pulling people to migrate were achieving welfare and higher social values. A sense of higher cultural values in cities, and easy

Table 2. Descriptive statistics for effective factors on migration to Mashhad.

| Factor | Number of questions* | Mean | Median | Mode | Standard Deviation |
|---|---|---|---|---|---|
| Environmental | 6 | 4.01 | 4.33 | 4.33 | 0.70 |
| Social | 6 | 3.16 | 3.17 | 3.83 | 0.73 |
| Economic | 7 | 3.84 | 4.00 | 4.43 | 0.75 |
| Operational | 8 | 3.74 | 3.88 | 5.00 | 0.97 |
| Cultural | 7 | 3.19 | 3.36 | 3.57 | 0.79 |

*Questions were in ordinal scales and in the form of a 5-point Likert scale: 1) Not at all, 2) Slightly, 3) Moderately, 4) Very, and 5) Extremely.

Table 3. Description of effective factors on migration to Mashhad based on Likert scale.

| | 5-point Likert scale (%) | | | | |
|---|---|---|---|---|---|
| Factor | Not at all (1) | Slightly (2) | Moderately (3) | Very (4) | Extremely (5) |
| Environmental | 14 | 5 | 6 | 14 | 60 |
| Social | 19 | 16 | 22 | 17 | 27 |
| Economic | 14 | 6 | 10 | 21 | 49 |
| Operational | 12 | 8 | 16 | 23 | 41 |
| Cultural | 19 | 14 | 21 | 20 | 26 |

access to educational facilities for children were the crucial cultural aspects driving migration (48% and 46%, respectively).

Results of the open-ended questions show that 40% of the respondents would like to go back to their homelands if government support were available for their needs when they returned. Respondents also asked the government to engage young people in collaboration for the management of economic problems. However, 42% of respondents would not like to leave Mashhad.

### *4.2. Data analysis in Sistan*

According to Table 4, the average respondent's age was 34, with a minimum age of 20 and a maximum of 72. The majority were male (82%) and married (77%), with an average household size of 4.9 people. 64% of the respondents had a diploma degree or higher and 20% were studying for a diploma, and most were self-employed (43% previously and 45% currently). It shows that people who stayed in their home villages were mostly independent of agricultural activities. Although 12% were previously farmers or ranchers, currently only 3% still farm or ranch, and the other 9% were unemployed or engaged in other jobs. However, the results show that family income was mostly less than IRR 5 million.

Analysis of the data indicates that cultural (25%) and social (22%) issues were the critical factors encouraging people to stay in their homelands (Figure 5 and Table 5). Results show 35% and 27% of the respondents believed that cultural and social factors, respectively, were extremely important in their decisions to remain in rural areas (Table 6). Among the cultural and social questions, sense of belonging to the village

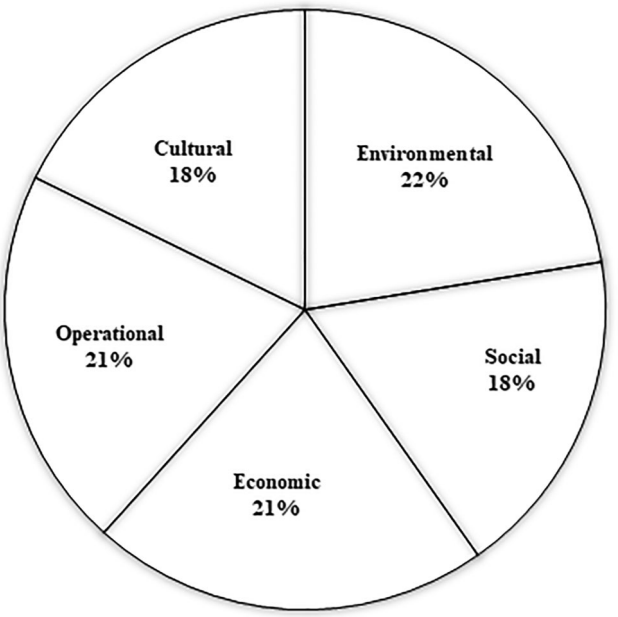


Figure 4. Contribution of each factor influencing migration to Mashhad, from the migrants' point of view.

(81%), sense of belonging to the family (65%), ethnic values (56%), not being allowed by the family to migrate (41%), the trustable social network in the rural areas (40%), and not having enough money for migration (39%) were the dominant reasons for staying in the villages.

Results of the open-ended questions show that 20% of the respondents would not like to migrate. However, most of them believed that they might be encouraged to migrate in the future due to unemployment, water shortage, unpleasant weather, and lack of access to facilities, especially for their children. They also asked if the government could provide water, jobs, investment, loans, and amenities, open the international border and allow border trade and markets, and stressed the importance of engaging local people, especially young people, in managing local challenges.

### *4.3. Deep interview with administrative personnel and university professors*

#### *4.3.1. Why does rural-urban migration happen?*

Migration generally results from push and pull factors. The interviewees believe that the push factors in Sistan are mostly related to environmental changes such as water shortage, the drying of Lake Hamoun, and dust storms. Economic problems are other push factors for individuals to leave their home places. Following migrated neighbors, family or tribe members is also a push factor for some people to migrate. Moreover, the opportunity for a better economic life and urban lifestyle are pulling rural people to cities. Inappropriate TV programs admiring the urban lifestyle and consumerism are contrary to rural vernacular culture. These programs cause rural people to feel a sense of relative deprivation, encouraging them to migrate to cities for higher earnings, a

Table 4. Descriptive statistics for the socioeconomic and demographic variables of the local residents in Sistan.

| Variable | Explanation | Mean | Median | Mode | Standard Deviation | Min | Max |
|---|---|---|---|---|---|---|---|
| Gender | Nominal scale: 1) Male, 2) Female | 1.18 | 1 | 1 | 0.39 | 1 | 2 |
| Marital status | Nominal scale: 1) Single, 2) Married | 1.77 | 2 | 2 | 0.42 | 1 | 2 |
| Age | Ratio scale: Open-ended question | 34 | 31 | 25 | 11 | 20 | 72 |
| Household size | | 4.9 | 4 | 4 | 2 | 1 | 13 |
| Duration of residence in Mashhad | | 3.88 | 4 | 4 | 1.58 | 1 | 7 |
| Educational level | Ordinal scale: 1) Illiterate, 2) Literacy movement, 3) High school, 4) Diploma, 5) Associate, 6) BSc, 7) MSc and higher | 4.12 | 3 | 3 | 2.02 | 2 | 11 |
| Previous job | Ordinal scale: 1) Private sector, 2) Governmental sector, 3) Self-employed, 4) Student, 5) Farmer, 6) Ranchman, 7) Retired, 8) Housewife, 9) Unemployed, 10) Farmer-Ranchman, 11) Others | 1.67 | 1 | 1 | 1.09 | 1 | 5 |
| Current job | | 1.64 | 1 | 1 | 1.11 | 1 | 5 |
| Income level from previous job | Ordinal scale: 1) Under 5 Million Rials (MR), 2) 5-10MR, 3) 10-15MR, 4) 15-20MR, 5) More than 20MR | 4.40 | 3 | 3 | 2.43 | 1 | 11 |
| Income level from current job | | 34 | 31 | 25 | 11 | 20 | 72 |

better lifestyle, or more amenities. Additionally, the TV programs usually underestimate the unpleasant consequences of migration on the margins of cities.

In addition to push and pull factors, intervening obstacles also affect migration. The interviewees stated that the area lacks any appropriate management plan to support Sistani people to confront problems. They highlighted other causes, such as mismanagement of water resources, lack of a plan to buy agricultural products, and inappropriate water diplomacy for negotiating with Afghanistan to release water into Iran, based on an international contract. Furthermore, inequitable and unsustainable development, and disregarding the capacity and potential of each area result in the

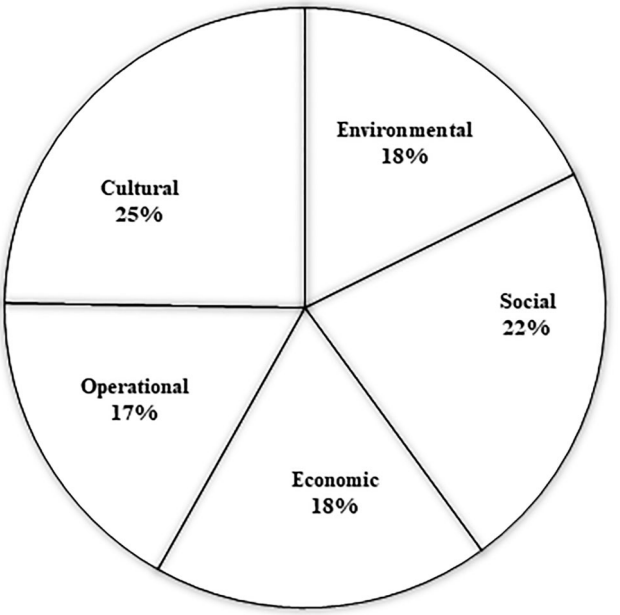


Figure 5. Contribution of each factor encouraging people to stay in Sistan.

Table 5. Descriptive statistics for effective factors for rural people to stay in Sistan.

| Factor | **Number of questions*** | Mean | Median | Mode | Standard Deviation |
|---|---|---|---|---|---|
| Environmental | 6 | 2.45 | 2.14 | 2.14 | 0.87 |
| Social | 6 | 3.04 | 3.00 | 2.83 | 0.61 |
| Economic | 7 | 2.49 | 2.33 | 2.00 | 0.67 |
| Operational | 8 | 2.37 | 2.17 | 1.83 | 0.74 |
| Cultural | 7 | 3.35 | 3.50 | 3.17 | 0.58 |

*Questions were in ordinal scales and in the form of Likert scale on five levels: 1) Not at all, 2) Slightly, 3) Moderately, 4) Very, and 5) Extremely.

deprivation of some regions in the country, including the Sistan Area. Due to structural and basic problems, providing facilities (water, electricity, gas, and roads) for villages might result in more migration if no local capacity building and empowerment takes place. Additionally, since border trade is a common business and source of income, closing the international border and consequently forbidding border trade (especially illegal fuel trade) in Sistan is a policy which interferes with the traditional structure of the area, so accelerating the migration rate.

Migration has historically accelerated, since the land reform plan (i.e. transfer of land ownership from the landlords to the peasants) in Iran in the 1960s. Simultaneously, the transition from an agricultural economy to the oil economy in the country has reduced the need for agricultural activities. Such issues gradually led to a greater tendency to migrate in order to seek employment, and better economic conditions.

Table 6. Description of effective factors for rural people to stay in Sistan based on a Likert scale.

| | 5-point Likert scale (%) | | | | |
|---|---|---|---|---|---|
| Factor | Not at all (1) | Slightly (2) | Moderately (3) | Very (4) | Extremely (5) |
| Environmental | 32 | 23 | 23 | 12 | 10 |
| Social | 25 | 15 | 17 | 17 | 27 |
| Economic | 36 | 18 | 21 | 11 | 14 |
| Operational | 33 | 23 | 25 | 12 | 7 |
| Cultural | 18 | 13 | 21 | 13 | 35 |

#### *4.3.2. What are the consequences of mass rural-urban migration?*

**In Sistan:** Due to particular ethnic and religious characteristics of the region as well as a transit route of narcotics from Afghanistan, abandoning rural areas, especially villages near the border can lead to security threats. It is a major consequence of migration for this area as well as at the national level. Moreover, villages are sources of production, and cities are dependent on rural products; thus, emptying villages has stunted production and agricultural activities and can also endanger economic security. In some cases, villages have even become more dependent on cities to provide almost all of their requirements. It can limit the development of the villages. Furthermore, since most migrants are young bachelor men seeking jobs and income, only the elderly, women, and children remain in the villages. Not only does it reduce the economic output of villages, but it also changes the demographic structure and age-gender composition of the population. This consequently leads to an increase in the assigned budget of Sistan to treat ill-old people rather than for education.

**In Mashhad:** Certainly, the most important consequence of migration at the destination is the emergence of the phenomenon of marginalization. Living in the suburbs, in turn, has implications for urban management. The interviewees pointed out that previously, about 20 percent of the population of Mashhad lived on the margins, but in recent years, it has reached about 33 percent. An increased population on the margins requires more services and amenities, to avoid potential protests which are of concern to city managers. In contrast, providing more services and amenities to the margins would attract more people to these areas. This has led to the expansion of the margins in Mashhad and the creation of a second suburb, and consequently, a horizontal expansion of Mashhad leading to a loss of agricultural land, increased land prices, and inappropriate management for the provision of basic urban infrastructure and services. These issues, in turn, result in social problems and security threats. The administrative personnel of the city municipality emphasize that, although approximately one-third of Mashhad's population lives on the city's margins, about half of the social harms are reported in these areas. Migrants often settle in places with the most cultural and religious proximity and social support, leading to the creation of a mosaic population. However, migrants usually become susceptible to identity humiliation and lose the respect and value which they once had in their homelands. Another important social consequence of marginalization is that the medical expenses of the migrants are constrained by the budget assigned to Mashhad management. It is especially true when the migrants' area is poorly financed, and they are unable to afford good-quality food. Consuming low-quality food causes and increases disease. Costs of treatment for these people are paid by Mashhad's urban management. There are many other social consequences of marginalization, such as an increased crime rate, tensions, conflicts, street

strife, ethnic and/or religious strife, incidence and spread of urban riots, unemployment, street peddling, drug addiction and dealing, murder, number of female beggars, working children and damage to public property. These consequences result from the mixture of diverse communities and different socio-economic backgrounds.

From an environmental perspective, the expansion of suburbs destroys natural capital, water resources, and agricultural lands, without providing any alternative. Water supply for this growing suburban population is also a critical issue for the municipality, as the city of Mashhad itself is facing severe water problems. It should be noted that the ecological potential of Mashhad is suitable for a 0.5-1 million population, despite the population being 3,372,660 Therefore, the expansion of suburbs threatens the environment of the city.

#### *4.3.3. How can policymakers deal with rural-urban migration?*

**In Sistan:** The strategies suggested by the interviewees for dealing with rural-urban migration are given below. While all suggested strategies are the responsibility of the policymakers, the cooperation of individuals and communities can make them more efficient.

1. To adapt to water shortages in Sistan, it is necessary to reduce the dependency of people on water and agricultural activities and to encourage them to invest in alternative activities. However, new businesses need to be identified and implemented, ensuring they are suited to the potential and capacity of the region and locals. Based on local discussions, the expansion of industries related to tourism, ecotourism, conversion industries (which convert or change the material into intermediate forms or final products), and handicrafts could be emphasized. These activities would provide situations which create more jobs and also support green entrepreneurship. Additionally, land-use planning is important and should be considered by policymakers, investors, and charity organizations which tend to invest in non-agricultural activities in Sistan. For example, Sistan's potential for wind and sunshine could be considered for the construction of wind or solar power plants in the region. In parallel, locals should be assured that the outcomes of their activities are economically efficient. Therefore, identification or establishment of a reliable market (in the country or abroad) for selling local products could be considered by policymakers.
2. Inequitable and unsustainable socio-economic development is a key factor in increasing the rate of rural-urban migration. For this purpose, the policymakers should focus on the potentials and capacities of the region. In order to maintain the security of the country, especially at the borders, it is necessary to provide appropriate facilities to the villages in accordance with their capacities and needs.
3. In addition to the low amount of rainfall in the country, the climate of each region is variable and the farmers need to be adaptable to these variabilities. Coping with these conditions needs appropriate adaptation strategies. In the agriculture sector, crop patterns should be defined according to the climate of each region. In the past, Sistan was known as the "Iranian Cereal Warehouse" due to the water of the Hirmand River and Lake Hamoun. Such conditions are no longer available due to water shortages. Rather, cereal cultivation could be replaced by low-water

requirement or greenhouse crops, which can be identified through academic research

4. Empowering people is one of the most important strategies emphasized by interviewees. People need to be engaged in planning, decision-making, and implementation of the plans. For this purpose, the creation of "local governance" in each region and village has been suggested. Moreover, endogenous rather than exogenous development should be considered in rural areas. Oil revenue has been used by the Iranian government to resolve all problems; however, the engagement of people in decision making can also reduce economic dependency on oil.
5. Turning the Sistan Area into a free zone and providing some lower-cost welfare services is also a suitable strategy. This could mediate the economic problems and keep people in the region.
6. Opening the Iran-Afghanistan border and allowing services and goods exchange across the border could play an important role in the development of the region. Creating and supporting cross-border markets and border trade, while overcoming the security issues, could lead to economic prosperity in the region, preventing migration and/or causing people to return to their villages.
7. To rural people, living in the city means luxury homes and cars, high income, and social and cultural attractions. However, they should be made aware that urban life differs from these attractions. They must be familiar with some of the undesirable consequences of migration to the cities, which may influence their migration decisions. This is the responsibility of the policymakers and experts.
8. Given that part of the water problems in Sistan, including the drying of Lake Hamoun, is due to development upstream of the Hirmand River Basin, one strategy for revitalizing Lake Hamoun is a negotiation with Afghanistan through water diplomacy and international consultation. It might encourage Afghanistan to commit to implement the 1973 water treaty between Iran and Afghanistan (The Afghan-Iranian Helmand river water treaty 1973) or to establish another treaty.

**In Mashhad:** To deal with marginalization, it is emphasized that strategies should first be focused on the rural areas to prevent migration. But, at present, migration to Mashhad is inevitable. Hence, some strategies for managing marginalization should be considered by policymakers, in cooperation with individuals and communities.

1. Urban managers need to have a systematic and planned approach for the development of the city and its direction, quantity, and quality. In the present situation, without proper management of the marginal areas, the city lacks sustainability and a high coefficient of viability. It causes less human development and value indicators such as social justice. Moreover, the dense population on the margins causes many security and social problems which are outside the control of planners. In the margins, urban landscape, passages, the resistance of buildings, social and cultural conditions, and a decent living environment should be managed through long-term planning (e.g. for 10 to 15 years). The management systems should be committed to implementing these plans.
2. Part of the problem of marginalization at the destination could be solved through the engagement of migrants in managing the challenges. The most important thing for migrants at the destination is finding a job that gives people identity and helps them to deal better with the various consequences of their migration. Thus, for

example, migrants can be engaged in building houses on the outskirts of the city. Furthermore, the culture of migrants, who often come from villages, is different from the culture of urban citizens. Thus, policymakers need to focus on empowering and educating migrants to get closer to urban culture and provide a decent cultural environment in the city.

3. The horizontal growth of Mashhad restricts the ability to provide services for all citizens and migrants. It will further expand the margins. The city should be grown vertically in order to deliver better services. However, vertical growth can also lead to increased social harms, particularly for people coming from rural areas.
4. Encouraging investors to construct houses with affordable and standardized conditions for marginalized people, taking into account people's desires, needs, and financial capabilities, is a key strategy that can be considered by managers and policymakers.

## 5. Discussion

Migrants mostly believed that environmental factors, including water shortages and dust storms, are the most important factors for migration. Other factors such as policy and governance, rapid increase in development of the region, family income, unemployment, and cultural and social conditions have a relatively important influence on migration. The results of Henry, Boyle, and Lambin (2003) in Burkina Faso also showed that migration is influenced by environmental changes as well as distance, demographic, and socio-economic variables. Some previous studies have also shown that migration does not occur solely due to environmental factors, but is rather a set of interacting economic, social and environmental factors (e.g. Neumann *et al*. 2015; Lei *et al*. 2013; Khavarian-Garmsir *et al*. 2019; McLeman and Smit 2006). Moreover, the environmental factors can also cause economic, social, and even political problems, leading to increased migration. Therefore, it is often difficult to differentiate between the effect of the environmental factors and the other factors (Bardsley and Hugo 2010). Furthermore, any kind of migration can lead to political instability and military conflicts, which in turn, have harmful impacts on the environment and reinforce environmental migration (Döös 1997). It should also be noted that, in spite of many push and pull factors forcing people to migrate, migrants need the money and also family networks at the destination to support their migration (Brown 2008). Some previous studies used the term “trapped population” for people who have needs or desires to migrate, but lack the ability to migrate, especially due to poverty (Carling 2002; Lubkemann 2008; Black and Collyer 2014) or religious beliefs (Mortreux and Barnett 2009; Charan, Manpreet, and Priyatma 2017) (see more details in Zickgraf [2019]). In this case staying is involuntary; however, some people voluntarily chose to stay in their home places. As with our findings, Adams (2016), Farbotko (2018), and Khanian, Serpoush, and Gheitarani (2019) found that sense of belonging, or current place attachment, is a key factor which encourages people to stay in their homelands. However, water shortage makes rural livelihoods increasingly risky and threatens the communities and households that are more dependent on natural resources (Keshavarz, Maleksaeidi, and Karami 2017). Such conditions force people, especially poor and vulnerable families, to abandon agricultural activities and change their jobs (Keshavarz and Karami 2014).

Mechanized farms lead to increased agricultural productivity and a significant decline in agricultural employment. However, large-scale urbanization and expanding and growing industries pull unemployed people to cities and motivate rural-urban migration (Boone and Wilse-Samson 2019). This migration has especially increased since the land reform in the 1960s. Previously, rural areas in Iran were almost self-sufficient socio-economic units (Mosleh 1983). Land reform "neglected the socio-economic aspects and the value systems of the rural areas" (Balali 2009, 167). Interference of central government via eliminating feudal systems (lord and vassal [peasant]) without embedding appropriate alternative structures led to the abandonment of agricultural lands, stopped the dredging of Qanats, and disintegrated traditional cooperative units, mostly named "*Boneh*" (Katouzian 1974). Moreover, the lands assigned to peasants were small and inferior, and people were ill-equipped to maintain their lands (Mosleh 1983). They were also unfamiliar with the markets to sell their products. Some of them could not afford to buy lands or if they did so, could not afford the expenses related to agricultural activities. Thus, agricultural output considerably declined, and peasants were unable to sustain their households.

Seeking better economic life in the cities mostly comes from the uneven geographic distribution of welfare, social and spatial injustice, and perceived better living conditions in cities, which pull people to the big cities (Madani 2014; Kolahi, Entegham-Kesh and Kermani Mahmoudmolaei 2019; Kolahi and Payeste 2020). It is mentioned in the literature that the movies and television programs mostly glamorize consumerism, with the stars having strong social values and achievements (Piotrowski 2010). Many rural people compare their conditions with these lifestyles of urban people, and as they cannot attain such lifestyles in their village, they decide to migrate to the cities. It is suggested that inequality demonstrates greater encouragement for people to migrate than the absolute level of poverty and deprivation (Black, Natali, and Skinner 2005; Pourahmad, Khavarian-Garmsir, and Hataminejad 2016). Additionally, severe environmental degradation in rural areas, which accelerates the rate of rural-urban migration, has also become a problem, due to mismanagement of the issues in the rural areas, lack of appropriate preparedness plans, and bad governance (Kolahi 2020; Kolahi *et al*. 2012; Kolahi *et al*. 2013). For example, Shahraki (2020) mentioned that unqualified water management and failed policies for water supply in Iran, have played a crucial role in the water resource elimination which has led to increased rates of migration. Therefore, migration is under the influence of not only the push and pull factors, but also intervening obstacles (Lee 1966).

The security threat which is indicated by the respondents and interviewees is also mentioned by Abbaspour and Sabetraftar (2005) who stated that rural-urban migration increases drug trafficking in villages near borders. Furthermore, the excessive drain of young men from the rural areas, leads to the reduction of rural labor forces, stunting agricultural activities and products and consequently endangering food security of the communities (Amrevurayire and Ojeh 2016). Such situations have also been indicated for Khuzestan province in Iran. Mohammadi Dehcheshmeh and Ghaedi (2020) mentioned that due to the strategic location of Khuzestan, the phenomena of "rural escape" and "rural evacuation" is a considerable threat to territorial, food and environmental security.

At the destination, migrants, especially those who settle on the fringes, usually do not feel a sense of belonging to cities and their neighbors. This creates unpleasant cultural situations leading to increases in crime. While rural people lose some of their positive rural characteristics in cities, they are unable to act similarly to urbanites and

consequently they become more vulnerable to social harms. Accordingly, a new way of life on the margins is established that is 'neither urban nor rural' (Habibi 1993). In these conditions, the harmony and uniformity of the city are degraded. Moreover, the migrants have few opportunities for legitimate life conditions, which can lead to more crime and violence on the fringes (Young *et al*. 2006). Despite the low level of wealth, comfort, material, goods, and necessities at the destination, migrants would not have been persuaded to return to their home place, especially when push factors still remain a challenging issue. They try for a better economic situation in order to leave marginal lifestyles to live in the center of cities, but usually, such situations do not happen.

Migration has significant environmental implications at the destination, through increased pressure on urban infrastructure and services, diminishing economic growth, increasing risks of conflict, and worsening health, educational and social indicators (Mauck and Warburton 2014; Ikutegbe, Gill, and Klepeis 2015; Brown 2008). In other words, marginalization is a social issue in which human behavior is a key component which affects people and their surroundings. Therefore, impacts cannot only be assessed from a physical point of view. There is a need to provide amenities and services for people in the suburbs, along with capacity building and training in empowerment. Without these economic, cultural and social support systems security problems eventuate and development is hindered. Nonetheless, the severity and weakness of these implications depend on the policies of authorities managing the issues. To address the resulting issue of marginalization, it is important for decision makers to pay attention to all aspects, including social and economic, in the past, present, and future.

Migration is a complex problem and requires a complex mixture of solutions, as one single solution cannot deal with this issue on its own. However, the administrative personnel proposed some strategies for better management of rural-urban migration in this related case study. Due to the low amount of precipitation in most parts of the country, agricultural activities, which are mostly dependent on surface or ground waters, are becoming less viable. Drying water resources is a key issue for many farmers and hence there is a need to develop alternative livelihoods and income sources which require less water (Schmidt, Gonda, and Transiskus 2020). Therefore, the main focus and purpose of the policymakers should be to create alternative jobs or cultivating plants with low water requirements. For example, due to the vicinity of Afghanistan, the processing of poppies cultivated in Afghanistan and the production of morphine for medical purposes can reduce agricultural dependency in the region, employing people and providing considerable income. Establishing cross-border markets and turning the Sistan Area into a free zone, while considering regional security, is one of the most important and highlighted strategies, based on our findings.

Other important points which should be considered by the policymakers are the engagement of the people and the creation of local governance and unified thinking in the region so that people can contribute and play an active role in decision making to solve the regions' problems. Since the dependence on oil revenues in Iran has had negative effects on the functioning of the traditional sectors of the rural economy (Hajipour, Hassan, and Azizpour 2016), the engagement of people in decision making can also reduce the economic dependency of rural areas on oil. This is emphasized in some literature especially in the case of water resource management in rural areas (e.g. Bouarfa and Kuper 2012; Mitchell *et al*. 2012). When people are involved in decision making, they feel more responsible for the implementation of the decisions and policies (Oxley 2013; Scolobig *et al*. 2015). In contrast, if marginalized people are

excluded from participation in local management systems, they may engage in activities that accelerate environmental degradation in the fringes (Black and Sessay 1998).

The report of the International Organization for Migration in 2009 mentioned that the extent to which climate change may exacerbate the existing situation in the future is still unknown (IOM 2009). This means it is unclear how the destination and the form of migration (e.g. temporary/permanent, internal/international, voluntary/involuntary) would be changed due to future climate change. However, recent studies have shown that climate change would mostly lead to long-distance internal migration rather than short-distance and international migration and the climate-induced slow-onset events, such as drought are more responsible for migration than the sudden-onset ones, such as flood (Kaczan and Orgill-Meyer 2020; Podesta 2019). While early studies indicate that migration would dramatically increase in response to climate change for people who are unable to adapt to these changes, the recent studies have shown that there is no linear linkage between climate change and migration (Kaczan and Orgill-Meyer 2020). There is a definite need for policymakers and scientists to investigate, not assume, the dynamic causes and consequences of migration (Black 2001), to understand the problem and develop effective solutions. McLeman and Smit (2006) found that the effect of anthropogenic climate change on future migration can be moderated through policymaking, especially by improving the adaptive capacity of the vulnerable regions. Stal and Warner (2009) suggested that investigations of the connection between environmental change and migration need qualitative and quantitative data. However, such adequate and reliable information is not widely available (IOM 2018). Thus, providing sufficient data should be an important concern of scientists and policymakers. The data can be collected and analyzed through questionnaires as conducted in our study, which has provided much-needed qualitative and quantitative data.

The International Organization for Migration (IOM 2009) believed that the complexity of the migration-environment nexus causes policymakers to be slow in identifying and providing appropriate strategies. It has been suggested that dealing with environmental migration needs close cooperation between researchers and policymakers. Because, for example, in the case of water issues, lack of agreement between policymakers and academics on the causes of water challenges, has resulted in a lack of appropriate comprehensive water management plans (Jafary and Bradley 2018). However, the researchers and scientists (especially locals who are more familiar with the challenges of the region) have a crucial role in identifying and managing the issue. Additionally, researchers from different disciplines need to work in cooperation, because migration is a complex issue with social, economic, religious, environmental, and political aspects. To manage the issue of migration, there is a need for a holistic approach rather than the singular-focused approaches or the one-size-fits-all agendas, which have not been effective (Willett and Sears 2018; McAdam 2012). Avoiding land and water degradation is economically sound, with consequent improvements in food and water security, while avoiding conflict and migration and contributing to the Sustainable Development Goals (IPBES 2018). Appropriate governance for climate/environmental-related migration can effectively reduce humanitarian crises and social conflicts, and provide opportunities to benefit from environmental changes (Bardsley and Hugo 2010).

## 6. Conclusion

This study utilized a case study to focus on the factors forcing people to migrate from the rural area in Sistan to urban Mashhad, as well as the consequences and the proposed strategies for dealing with this issue.

According to the results, environmental factors contributed most strongly to migration, followed by economic problems and operational factors. In contrast, people in Sistan pointed out that cultural and social factors were the key factors encouraging them to stay in their homelands. They believed that the sense of belonging to the village and family, ethnic values, family's opposition to migration, a trustable social network in the rural areas, and lack of money for migration, were significant deterrents to migration.

Generally, modernization, the transition from agriculture to industry, oil-based economy, urbanization, inequality, and social and spatial injustice have been the primary factors, increasing the rate of rural-urban migration in Iran. However, it is exacerbated due to environmental degradation and inappropriate policies. This forced migration has consequences at both the origins and destinations. Rural-urban migration, on the one hand, limits the development in villages and on the other hand, creates and exacerbates various challenges in cities. For example, mass migration would lead to a decrease in labor in the origin and socio-economic problems in the destination.

In some cases, management strategies are focused on the destination and do not consider improving the conditions at the origin, resulting in a higher rate of migration. However, it is emphasized that the strategies should be more focused on improving living conditions in rural areas, the origin. Policymakers should focus on promoting sustainable development with equitable distribution of population, income, national wealth and access to resources for all people within the country. They need to identify the adaptation/coping strategies, engage people in their plans and strategies for development and consider human security in this process. Otherwise, there will be no homogeneity in the provision of services and facilities, and this will endanger national security. Dealing with the complex issue of migration needs wise and adaptive management. A deep understanding of the issue, using a holistic point of view may help the policymakers to provide appropriate plans for managing migration and its consequences. For this purpose, they need to have strong cooperation with scientists and experts and engage local people in their plans. The strategies provided in this study can be considered by policymakers, not only for the case study of the current paper but also for other rural and urban areas which experience such challenges.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

## ORCID

Ameneh Mianabadi http://orcid.org/0000-0002-8948-6881

## References

Abbaspour, M., and A. Sabetraftar. 2005. "Review of Cycles and Indices of Drought and Their Effect on Water Resources, Ecological, Biological, Agricultural, Social and Economical Issues in Iran." *International Journal of Environmental Studies* 62 (6): 709–724. doi:10.1080/00207230500288968.

Adams, Helen. 2016. "Why Populations Persist: Mobility, Place Attachment and Climate Change." *Population and Environment* 37 (4): 429–448. doi:10.1007/s11111-015-0246-3.

Amrevurayire, Edith Ochuko, and Vincent Nduka Ojeh. 2016. "Consequences of Rural-Urban Migration on the Source Region of Ughievwen Clan Delta State Nigeria." *European Journal of Geography* 7 (3): 41–56.

Arenstam, Sheila J., and Robert J. Nicholls. 2006. "Island Abandonment and Sea-Level Rise: An Historical Analog from the Chesapeake Bay, USA." *Global Environmental Change* 16: 40–47. doi:10.1016/j.gloenvcha.2005.10.002.

Balali, M. R. 2009. "Towards Reflexive Land and Water Management in Iran: Linking Technology, Governance and Culture." PhD diss., Wageningen University.

Bardsley, Douglas K., and Graeme J. Hugo. 2010. "Migration and Climate Change : Examining Thresholds of Change to Guide Effective Adaptation Decision-Making." *Population and Environment* 32: 238–262. doi:10.1007/s11111-010-0126-9.

Bernstein, Ira H. 2005. "Likert Scale Analysis." In *Encyclopedia of Social Measurement*, 497–504. Amsterdam, The Netherlands: Elsevier. doi:10.1016/B0-12-369398-5/00104-3.

Biermann, Frank, and Ingrid Boas. 2010. "Preparing for a Warmer World: Towards a Global Governance System to Protect Climate Refugees." *Global Environmental Politics* 10 (1): 60–88. doi:10.1162/glep.2010.10.1.60.

Bilsborrow, Richard E. 1992. *Rural Poverty, Migration, and the Environment in Developing Countries: Three Case Studies*. Washington, DC: World Bank.

Black, Richard. 2001. "Environmental Refugees: Myth or Reality?" In *UNHCR Working Paper*, Vol. 34: Geneva: UNHCR.

Black, Richard, and Michael Collyer. 2014. "Trapped Populations: Limits on Mobility at Times of Crisis." In *Humanitarian Crises and Migration*, edited by Susan F. Martin, Sanjula Weerasinghe, and Abbie Taylor, 287–305. London: Routledge. doi:10.4324/9780203797860-14.

Black, R., C. Natali, and J. Skinner. 2005. *Migration and Inequality*. Washington, DC: World Bank. https://openknowledge.worldbank.org/handle/10986/9172 License: CC BY 3.0 IGO

Black, Richard, and Mohamed F. Sessay. 1998. "Refugees and Environmental Change in West Africa: The Role of Institutions." *Journal of International Development* 10 (6): 699–713. doi:10.1002/(SICI)1099-1328(1998090)10:6 < 699::AID-JID511 > 3.0.CO;2-Z.

Boncour, Philippe, and Bruce Burson. 2009. "Climate Change and Migration in the South Pacifc Region: Policy Perspectives." *Policy Quarterly* 5 (4): 13–20.

Boone, Christopher D., and Laurence Wilse-Samson. 2019. "Farm Mechanization and Rural Migration in the Great Depression." https://scholarship.sha.cornell.edu/workingpapers/8.

Bouarfa, Sami, and Marcel Kuper. 2012. "Groundwater in Irrigation Systems: From Menace to Mainstay." *Irrigation and Drainage* 61 (SUPPL.1): 1–13. doi:10.1002/ird.1651.

Brown, Oli. 2008. *Climate Change and Forced Migration : Observations, Projections and Implications*. International Organization for Migration (IOM) Research Series No 31. Geneva: IOM.

Brown, O., and R. Mcleman. 2009. "A Recurring Anarchy? The Emergence of Climate Change as a Threat to International Peace and Security." *Conflict, Security & Development* 9 (3): 289–305. doi:10.1080/14678800903142680.

Burrows, Kate, and Patrick L. Kinney. 2016. "Exploring the Climate Change, Migration and Conflict Nexus." *International Journal of Environmental Research and Public Health* 13 (443): 1–17. doi:10.3390/ijerph13040443.

Carling, J⊘rgen. 2002. "Migration in the Age of Involuntary Immobility: Theoretical Reflections and Cape Verdean Experiences." *Journal of Ethnic and Migration Studies* 28 (1): 5–42. doi:10.1080/13691830120103912.

Charan, Dhrishna, Kaur Manpreet, and Singh Priyatma. 2017. "Customary Land and Climate Change Induced Relocation: A Case Study of Vunidogoloa Village, Vanua Levu, Fiji." In *Climate Change Adaptation in Pacific Countries: Fostering Resilience and Improving the Quality of Life*, edited by Walter Leal Filho, 19–33. Cham: Springer International Publishing. doi:10.1007/978-3-319-50094-2_2.

Delju, A H., A. Ceylan, E. Piguet, and M. Rebetez. 2013. "Observed Climate Variability and Change in Urmia Lake Basin, Iran." *Theoretical and Applied Climatology* 111 (1–2): 285–296. doi:10.1007/s00704-012-0651-9.

Devkota, Laxmi Prasad, and Dhiraj Raj Gyawali. 2015. "Impacts of Climate Change on Hydrological Regime and Water Resources Management of the Koshi River Basin." *Nepal. Journal of Hydrology: Regional Studies* 4: 502–515. doi:10.1016/j.ejrh.2015.06.023.

Dobson, Andrew P., Stuart L. Pimm, Lee Hannah, Les Kaufman, Jorge A. Ahumada, Amy W. Ando, Aaron Bernstein, et al. 2020. "Ecology and Economics for Pandemic Prevention." *Science (New York, NY)* 369 (6502): 379–381. doi:10.1126/science.abc3189.

Döös, B. R. 1997. "Can Large-Scale Environmental Migrations Be Predicted?" *Global Environmental Change* 7 (1): 41–61. doi:10.1016/S0959-3780(96)00037-4.

El-Hinnawi, E. 1985. *Environmental Refugees*. Nairobi: United Nations Environment Programme, Nairobi.

Farbotko, Carol. 2018. "Voluntary Immobility: Indigenous Voices in the Pacific." *Forced Migration Review* 57: 81–83.

Foresight: Migration and Global Environmental Change. 2011. *Final Project Report*. London: The Government Office Science.

Goodall, Sarah K. 2004. "Rural-to-Urban Migration and Urbanization in Leh, Ladakh." *Mountain Research and Development* 24 (3): 220–227. doi:10.1659/0276-4741(2004)024.

Habibi, S. M. 1993. "Eslamshahr: A Perfect Human Settlement or a Mixed Human Settlement." *Goftegoo* 1: 62–85. (In Persian).

Haddeland, Ingjerd, Jens Heinke, Hester Biemans, Stephanie Eisner, Martina Flörke, and Naota Hanasaki. 2013. "Global Water Resources Affected by Human Interventions and Climate Change." *Proceedings of the National Academy of Sciences of the United States of America* 111 (9): 3251–3256. doi:10.1073/pnas.1222475110.

Hajipour, Mortaza, Afrakhteh Hassan, and Farhad Azizpour. 2016. "Effects of Distribution Model of Oil Wealth on the Economic and Migration of Villages in Iran: Case Study Birjand County." *IIOAB* 7 (1): 107–121.

Henry, Sabine, Paul Boyle, and Eric F. Lambin. 2003. "Modelling Inter-Provincial Migration in Burkina Faso, West Africa: The Role of Socio-Demographic and Environmental Factors." *Applied Geography* 23: 115–136. doi:10.1016/j.apgeog.2002.08.001.

Ikutegbe, Vicki, Nicholas Gill, and Peter Klepeis. 2015. "Same but Different: Sources of Natural Resource Management Advice for Lifestyle Oriented Rural Landholders." *Journal of Environmental Planning and Management* 58 (9): 1530–1543. doi:10.1080/09640568.2014.936551.

IOM. 2009. *Migration, Environment and Climate Change: Assessing the Evidence*, edited by Frank Laczko and Christine Aghazarm. Geneva, Switzerland: International Organization for Migration.

IOM. 2018. *World Migration Report 2018*. Geneva, Switzerland. https://www.iom.int/wmr/world-migration-report-2018.

IPBES. 2018. *Summary for Policymakers of the Assessment Report on Land Degradation and Restoration of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*. Bonn, Germany: IPBES.

IPBES. 2020. *Workshop Report on Biodiversity and Pandemics of the Intergovernmental Platform on Biodiversity and Ecosystem Services*, edited by P. Daszak, J. Amuasi, C. G. Das Neves, D. Hayman, T. Kuiken, B. Roche, C. Zambrana-Torrelio, P. Buss, H. Dundarova, Y. Feferholtz. Bonn, Germany: IPBES Secretariat. doi:10.5281/zenodo.4147317.

Jafary, F., and Ch Bradley. 2018. "Groundwater Irrigation Management and the Existing Challenges from the Farmers' Perspective in Central Iran." *Land* 7 (15): 1–21. doi:10.3390/land7010015.

Jannatichenar, M A., M. Kolahi, and M. Mesdaghi. 2020. "Social Conflicts and Rangeland Management: A Case Study at Rangelands of Kalatnader County, Iran." *Iranian Journal of Applied Ecology* 9 (3): 77–97.

Kaczan, David J., and Jennifer Orgill-Meyer. 2020. "The Impact of Climate Change on Migration: A Synthesis of Recent Empirical Insights." *Climatic Change* 158 (3–4): 281–300. doi:10.1007/s10584-019-02560-0.

Katouzian, M. A. 1974. "Land Reform in Iran a Case Study in the Political Economy of Social Engineering." *The Journal of Peasant Studies* 1 (2): 220–239. doi:10.1080/03066157408437885.

Keshavarz, Marzieh, and Ezatollah Karami. 2014. "Farmers' Decision-Making Process under Drought." *Journal of Arid Environments* 108: 43–56. doi:10.1016/j.jaridenv.2014.03.006.

Keshavarz, Marzieh, Hamideh Maleksaeidi, and Ezatollah Karami. 2017. "Livelihood Vulnerability to Drought: A Case of Rural Iran." *International Journal of Disaster Risk Reduction* 21: 223–230. doi:10.1016/j.ijdrr.2016.12.012.

Khanian, Mojtaba, Behrad Serpoush, and Nima Gheitarani. 2019. "Balance between Place Attachment and Migration Based on Subjective Adaptive Capacity in Response to Climate Change: The Case of Famenin County in Western Iran." *Climate and Development* 11 (1): 69–82. doi:10.1080/17565529.2017.1374238.

Khashtabeh, Rokhsareh, Akbari Morteza, Kolahi Mahdi, and Talebanfard Ali. 2020. "Assessing the Effects of Desertification Control Projects Using Socio-Economic Indicators in the Arid Regions of Eastern Iran." *Environment, Development and Sustainability*, 1–15. https://doi.org/10.1007/s10668-020-01065-6

Khavarian-Garmsir, Amir Reza, Ahmad Pourahmad, Hossein Hataminejad, and Rahmatollah Farhoodi. 2019. "Climate Change and Environmental Degradation and the Drivers of Migration in the Context of Shrinking Cities: A Case Study of Khuzestan Province, Iran." *Sustainable Cities and Society* 47: 101480. doi:10.1016/j.scs.2019.101480.

Kolahi, Mahdi. 2020. "Administrative Organizational Structures towards General Environmental Policies." *Quarterly Journal of the Macro and Strategic Policies* 8 (31): 280–301.

Kolahi, Mahdi, Entegham-Kesh Narges, and Kermani Mahmoudmolaei Batoul. 2019. "The Role of Socio-Cultural Components on Citizens' Environmental Behavior, Case Study: Shirvan." *Journal of Urban Ecology Researches* 10 (20): 41–56.

Kolahi, Mahdi, and M. Payeste. 2020. "Impacts of Natural Resource Projects on Socioeconomic Issues of Villagers at ChahNouroz Watershed." *Journal of Watershed Management Research* 11 (21): 154–164.

Kolahi, Mahdi, Tetsuro Sakai, Kazuyuki Moriya, and Majid F. Makhdoum. 2012. "Challenges to the Future Development of Iran's Protected Areas System." *Environmental Management* 50 (4): 750–765. doi:10.1007/s00267-012-9895-5.

Kolahi, Mahdi, Tetsuro Sakai, Kazuyuki Moriya, Majid F. Makhdoum, and Lina Koyama. 2013. "Assessment of the Effectiveness of Protected Areas Management in Iran: Case Study in Khojir National Park." *Environmental Management* 52 (2): 514–530.

Kumar, Navneet Tischbein, Jürgen Kusche Bernhard, Patrick Laux, Mirza K. Beg, and Janos J. Bogard. 2017. "Impact of Climate Change on Water Resources of Upper Kharun Catchment in Chhattisgarh, India." *Journal of Hydrology: Regional Studies* 13: 189–207. doi:10.1016/j.ejrh.2017.07.008.

Kutty, Sumitha Narayanan. 2014. "Iran's Continuing Interests in Afghanistan." *The Washington Quarterly* 37 (2): 139–156. doi:10.1080/0163660X.2014.926214.

Lee, Everett S. 1966. "A Theory of Migration." *Demography* 3 (1): 47–57. doi:10.2307/2060063.

Lei, Yinru, Max Finlayson, Rik Thwaites, and Guoqing Shi. 2013. "Migration Drivers in Mountain Regions in the Context of Climate Change: A Case Study in Shangnan County of China." *Chinese Journal of Population Resources and Environment* 11 (3): 200–209. doi:10.1080/10042857.2013.818438.

Leighton, Michelle. 2007. "Desertification + Migration = Security?" In *Desertification and Security*, 1–13. Berlin: Europasaal, Federal Foreign Office.

Lubkemann, S. C. 2008. "Involuntary Immobility: On a Theoretical Invisibility in Forced Migration Studies." *Journal of Refugee Studies* 21 (4): 454–475. doi:10.1093/jrs/fen043.

Madani, Kaveh. 2014. "Water Management in Iran: What is Causing the Looming Crisis?" *Journal of Environmental Studies Science* 4: 315–328. doi:10.1007/s13412-014-0182-z.

Massey, Douglas S., William G. Axinn, and Dirgha J. Ghimire. 2010. "Environmental Change and Out-Migration: Evidence from Nepal." *Population and Environment* 32: 109–136. doi:10.1007/s11111-010-0119-8.

Mauck, Benjamin Alan, and Michele Warburton. 2014. "Mapping Areas of Future Urban Growth in the Mgeni Catchment." *Journal of Environmental Planning and Management* 57 (6): 920–936. doi:10.1080/09640568.2013.775062.

Mayrhofer, Monika. 2016. "Climate Change and Migration: Dimensions, Concepts and Policy Responses from a Human Rights Perspective." In *Refugees and Migration in Asia and Europe*, edited by Beatrice Gorawantschy, 158. Singapore: Konrad-Adenauer-Stiftung Ltd.

McAdam, Jane. 2012. *Climate Change, Forced Migration, and International Law*. Oxford: Oxford University Press.

McLeman, R. 2011. *Climate Change, Migration and Critical International Security Considerations*. Geneva: International Organization for Migration (IOM).

Mcleman, R. 2013. "Developments in Modelling of Climate Change-Related Migration." *Climatic Change* 117: 599–611. doi:10.1007/s10584-012-0578-2.
Mcleman, R. 2017. "On the Origins of Environmental Migration." *Fordham Environmental Law Review* 20 (2): 403–425.
McLeman, R., and Lori M. Hunter. 2010. "Migration in the Context of Vulnerability and Adaptation to Climate Change: Insights from Analogues." *Wiley Interdisciplinary Reviews. Climate Change* 1 (3): 450–461. doi:10.1002/wcc.51.Migration.
McLeman, R., and B. Smit. 2006. "Migration as an Adaptation to Climate Change." *Climate Change* 76: 31–53. doi:10.1007/s10584-005-9000-7.
Mendelsohn, R., A. Basist, P. Kurukulasuriya, and A. Dinar. 2007. "Climate and Rural Income." *Climate Change* 81: 101–118. doi:10.1007/s10584-005-9010-5.
Meze-Hausken, Elisabeth. 2000. "Migration Caused by Climate Change: How Vulnerable Are People in Dryland Areas? A Case-Study in Northern Ethiopia." *Mitigation and Adaptation Strategies for Global Change* 5: 379–406.
Mianabadi, Ameneh, Kamran Davary, Hojjat Mianabadi, and Poolad Karimi. 2020. "International Environmental Conflict Management in Transboundary River Basins." *Water Resources Management* 34 (11): 3445–3464. doi:10.1007/s11269-020-02576-7.
Mianabadi, H., E. Mostert, and N. Van de Giesen. 2013. "Glocal Transboundary River Basins Management." *NCR-DAYS 2013 Conference*, UNESCO IHE-Delft, The Netherlands, 3-4 October.
Mianabadi, Ameneh, Pooya Shirazi, Bijan Ghahraman, A. M. J. Coenders-Gerrits, Amin Alizadeh, and Kamran Davary. 2019. "Assessment of Short- and Long-Term Memory in Trends of Major Climatic Variables over Iran: 1966–2015." *Theoretical and Applied Climatology* 135 (1–2): 677–691. doi:10.1007/s00704-018-2410-z.
Mitchell, Michael, Allan Curtis, Emily Sharp, and Emily Mendham. 2012. "Directions for Social Research to Underpin Improved Groundwater Management." *Journal of Hydrology* 448–449: 223–231. doi:10.1016/j.jhydrol.2012.04.056.
Mohammadi Dehcheshmeh, Mostafa, and Sohrab Ghaedi. 2020. "Climate Change and Ecological Migration: A Study of Villages in the Province of Khuzestan, Iran." *Environmental Research, Engineering and Management* 76 (1): 6–19. doi:10.5755/j01.erem.76.1.24513.
Mortreux, Colette, and Jon Barnett. 2009. "Climate Change, Migration and Adaptation in Funafuti, Tuvalu." *Global Environmental Change* 19 (1): 105–112. doi:10.1016/j.gloenvcha.2008.09.006.
Mosleh, Zahra Homa. 1983. *Rural-Urban Migration and Urban Poverty: The Case of Tehran, 1962-1978*. Northridge: California State University.
Myers, Norman, and J. Kent. 1995. *Environmental Exodus: An Emergent Crisis in the Global Arena*. Washington, DC: Climate Institute.
Neumann, Kathleen, Diana Sietz, Henk Hilderink, Peter Janssen, Marcel Kok, and Han van Dijk. 2015. "Environmental Drivers of Human Migration in Drylands: A Spatial Picture." *Applied Geography* 56: 116–126. doi:10.1016/j.apgeog.2014.11.021.
Nicholson, Calum T. M. 2014. "Climate Change and the Politics of Causal Reasoning: The Case of Climate Change and Migration." *The Geographical Journal* 180 (2): 1–10. doi:10.1111/geoj.12062.
Oxley, M. C. 2013. "A 'People-Centred Principles-Based' Post-Hyogo Framework to Strengthen the Resilience of Nations and Communities." *International Journal of Disaster Risk Reduction* 4 (2013): 1–9. doi:10.1016/j.ijdrr.2013.03.004.
Piotrowski, Martin. 2010. "Mass Media and Rural Out-Migration in the Context of Social Change : Evidence from Nepal." *International Migration* 51 (3): 169–193. doi:10.1111/j.1468-2435.2010.00627.x.
Podesta, John. 2019. "The Climate Crisis, Migration, and Refugees." Brookings Blum Roundtable. https://www.brookings.edu/research/the-climate-crisis-migration-and-refugees/.
Pourahmad, Ahmad, Amir Reza Khavarian-Garmsir, and Hossein Hataminejad. 2016. "Social Inequality, City Shrinkage and City Growth in Khuzestan Province, Iran." *Area Development and Policy* 1 (2): 266–277. doi:10.1080/23792949.2016.1170581.
Rashki, A. 2012. "Seasonality and Mineral, Chemical and Optical Properties of Dust Storms in the Sistan Region of Iran, and Their Influence on Human Health." PhD diss, University of Pretoria, South Africa.

Rashki, A., D G. Kaskaoutis, C J. Rautenbach, P G. Eriksson, M. Qiang, and P. Gupta. 2012. "Dust Storms and Their Horizontal Dust Loading in the Sistan Region, Iran." *Aeolian Research* 5: 51–62. doi:10.1016/j.aeolia.2011.12.001.

Sachs, Jeffrey D. 2007. "Climate Change Refugees (Extended Version)." *Scientific American* 296 (6): 43.

Schmidt, Matthias, Robert Gonda, and Sebastian Transiskus. 2020. "Environmental Degradation at Lake Urmia (Iran): Exploring the Causes and Their Impacts on Rural Livelihoods." *GeoJournal* 0123456789. doi:10.1007/s10708-020-10180-w.

Scolobig, Anna, Tim Prior, Dagmar Schröter, Jonas Jörin, and Anthony Patt. 2015. "Towards People-Centred Approaches for Effective Disaster Risk Management: Balancing Rhetoric with Reality." *International Journal of Disaster Risk Reduction* 12: 202–212. doi:10.1016/j.ijdrr.2015.01.006.

Shahraki, Abdol Aziz. 2020. "Ending the Water Migrations Thru the Sustainable Improvement of Origins' Water Resources, a Reflection of Case Studies." *Sustainable Water Resources Management* 6 (6): 109. doi:10.1007/s40899-020-00468-7.

Solórzano, ClaudiaRodríguez. 2016. "Connecting Climate Social Adaptation and Land Use Change in Internationally Adjoining Protected Areas." *Conservation and Society* 14 (2): 125. doi:10.4103/0972-4923.186334.

Stal, Marc, and Koko Warner. 2009. *The Way Forward: Researching the Environment and Migration Nexus*. Bonn, Germany: UNU-EHS - United Nations University, Institute for Environment and Human Security.

Statistical Center of Iran. 2016. "Statistical Center of Iran." https://www.amar.org.ir/english?portalid=1.

Terminski, Bogumil. 2012. *Towards Recognition and Protection of Forced Environmental Migrants in the Public International Law: Refugee or IDPs Umbrella?* 21. https://nbn-resolving.org/urn:nbn:de:0168-ssoar-329056.

The Afghan-Iranian Helmand River Water Treaty. 1973. *The Afghan-Iranian Helmand River Water Treaty*. Center for Documents and Diplomatic History of the Ministry of Foreign Affairs. http://internationalwaterlaw.org/documents/regionaldocs/1973_Helmand_River_Water_Treaty-Afghanistan-Iran.pdf.

Thomas, Vincent, Mujib Ahmad Azizi, and Khalid Behzad. 2016. *Developing Transboundary Water Resources: What Perspectives for Cooperation between Afghanistan, Iran and Pakistan?*, edited by Richard Dennis, 111. Kabul, Afghanistan: AREU.

Treacy, Paul, Pamela Jagger, Conghe Song, Qi Zhang, and Richard E. Bilsborrow. 2018. "Impacts of China's Grain for Green Program on Migration and Household Income." *Environmental Management* 62 (3): 489–499. doi:10.1007/s00267-018-1047-0.

Trondalen, J.M. 2009. Climate Changes, Water Security and Possible Remedies for the Middle East. http://unesdoc.unesco.org/images/0018/001818/181886e.pdf.

Weier, John. 2002. *From Wetland to Wateland*. NASA. https://earthobservatory.nasa.gov/Features/hamoun.

Wiegel, Hanne, Ingrid Boas, and Jeroen Warner. 2019. "A Mobilities Perspective on Migration in the Context of Environmental Change." *Wiley Interdisciplinary Reviews: Climate Change* 10 (6): 1–9. doi:10.1002/wcc.610.

Willemen, Louise, Nichole N. Barger, Ben ten Brink, Matthew Cantele, Barend F. N. Erasmus, Judith L. Fisher, Toby Gardner., *et al*. 2020. "How to Halt the Global Decline of Lands." *Nature Sustainability* 3 (3): 164–166. doi:10.1038/s41893-020-0477-x.

Willett, Jennifer, and Jeanelle Sears. 2018. "Complicating Our Understanding of Environmental Migration and Displacement: The Case of Drought-Related Human Movement in Kenya." *International Social Work* 00 (0): 1–7. doi:10.1177/0020872818799431.

Young, Oran R., Frans Berkhout, Gilberto C. Gallopin, Marco A. Janssen, Elinor Ostrom, and Sander van der Leeuw. 2006. "The Globalization of Socio-Ecological Systems: An Agenda for Scientific Research." *Global Environmental Change* 16 (3): 304–316. doi:10.1016/j.gloenvcha.2006.03.004.

Zickgraf, Caroline. 2019. "Keeping People in Place: Political Factors of (Im)Mobility and Climate Change." *Social Sciences* 8 (8): 228. doi:10.3390/socsci8080228.