

Exploring factors affecting the Pastoralists Resilience against Climate Change

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Abstract

Climate change (CC) is one of the major challenges of our time that impacts rangelands regionally and globally. The rising vulnerability among pastoralists highlights the need to prioritize resilience thinking. Pastoralists' resilience refers to the ability of rangeland businesses to endure, adapt to, and remain flexible in the face of threats or challenges. This research was conducted with the primary goal of analyzing the factors that influence resilience from the perspective of pastoralists in Tehran province under CC conditions. This research was both goal-oriented and exploratory in methodology. The study sample consisted of 317 pastoralists selected through stratified random sampling. The data collection tool was a researcher-made questionnaire. Software SmartPLS was used for data analysis. The validity of the questionnaire was assessed using the average variance extracted, while its reliability was established by calculating composite reliability and Cronbach's alpha. Data were analyzed using the structural equation modeling technique with Smart PLS software. The structural equation modeling indicated that economic, institutional, ecological, physical, social, educational and extensional and individual factors had the greatest impact on Pastoralists' Resilience under Climate Change (PRCC) conditions. These factors explained 75.5% of the PRCC conditions.

Keywords: Resilience, Pastoralists, Climate Change.

Abbreviations: Pastoralists' resilience under climate change: PRCC; Resilience Capacities under Climate Change Condition: RCCCC; Climate Change: CC.

Introduction

Pastoralism in the Zagros Mountains began approximately 9,000 years ago and is globally significant for its contributions to food production, ecosystem services, livelihoods, culture and civilization; to make a living, Pastoralists care for, maintain and use livestock in rangeland areas under unpredictable weather conditions (Dong et al., 2016). Today, rangeland degradation is a

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31 global issue that not only threatens the existing plants and animal populations, but also human
32 communities (Husein, 2021). CC is one of the factors contributing to rangeland degradation in
33 many parts of the world (Angerer et al., 2023).

34 CC causes alternations in temperature and precipitation in a region (Brêda et al., 2020). In semi-
35 arid areas, vulnerability and food security pose significant challenges (Raj and Sharma, 2023). Iran
36 is located in one of the driest regions of the world and has been affected by CC in recent years,
37 particularly by drought (Bahrami et al., 2021).

38 In Iran, rangelands cover is approximately 55 percent (Sadeghi and Hazbavi., 2022) Pastoralists
39 identified three factors of reduced forage quality, increased barren land and reduced livestock
40 production as the most important impacts of drought on rangelands (Behmanesh et al., 2021).

41 The rangelands of the province of Tehran, being in a critical state of destruction (Yousefi et al.,
42 2021) has not been spared from Meteorological station data (2001-2021), which indicates the
43 phenomena of CC and drought (Javadi et al., 2024). These issues have led to reduced forage
44 production in rangelands, making it more difficult for pastoralists. Consequently, pastoralists have
45 been compelled to overgraze beyond livestock capacity of the rangelands. This has also led to
46 degradation of these areas (Yousefi et al., 2021).

47 There is an agreement among experts that problems cannot be solved solely through technical
48 innovations, policy reforms or economic development; new researches and monitoring programs
49 need to be designed for pastoralists that might address ecological, social and economic
50 interdependencies within resilience frameworks (Dong et al., 2016).

51 There is no consensus among experts on the concept of resilience. Resilience has been defined
52 differently in various disciplines over time. Holling first introduced this term as an ecological
53 concept in 1973 (Holling., 1973). In the recent decades, this concept has emerged in the literature
54 on socio-ecological systems and rangeland management (Dong et al., 2016; Kapruwan et al.,
55 2024). The adaptive cycle illustrates how this system maintains its activities or quickly regains its
56 previous state when faced with external shocks such as drought. However, these shocks and
57 stresses may lead to new approaches or cause a socio-ecological system to be disrupted or
58 abandoned (Meuwissen et al., 2019). If the pastoral system is not resilient, it is likely to disappear
59 because it cannot guide itself through the adaptive cycle. Resilient pastoralists, when faced with
60 challenges such as drought, attempt to steer the current situation toward improvement and positive
61 outcomes by adopting logical and effective solutions.

62 Given the challenges and problems raised by CC, the most important issue is finding solutions that
63 can improve the lives of pastoralists. This is because pastoralists are major food producers who
64 are highly vulnerable and possess low recovery capacity due to their dependence on the
65 environment, particularly under conditions of CC and drought. Therefore, it is necessary to take
66 significant steps by developing effective strategies in the CC management process such as adopting
67 a resilience approach. Various dimensions, indicators and variables related to resilience can be
68 discusse, some of the most important of which have been addressed.

69 Meuwissen et al. (2019) proposed that distinguishing three resilience capacities can help evaluate
70 a wide range of resilience strategies. Adzawla et al. (2020) argued that factors such as education,
71 income, etc. are effective in promoting resilience. Ahmad and Afzal (2021) asserted that access to
72 services is one of the key factors influencing resilience. Melketo et al. (2021) found that savings,
73 livestock diversity and similar resources contribute to improved resilience. Le Goff et al. (2022)
74 also believed that farmers maintain their resilience through mutual community interactions and
75 institutional support under various conditions. Finally, Kapruwan et al. (2024) carried out a
76 research in India and found that promoting and strengthening organizational structures enhances
77 communityresilience to CC.

78 Programs and strategies for rangeland climate are more effective when they are tailored to local
79 conditions. Opinions of local rangeland advisers are crucial for the development of these resources
80 (Dinan et al., 2021). Localization was achieved through a systematic review. Research findings were
81 systematically analyzed using Sandlowski and Barroso's seven-step method. The findings of relevant
82 domestic and international researches were thorouly assessed using the seven-stage method of
83 Sandelowski and Barroso. The Waltz and Bausell method was employed to evaluate the validity of the
84 extracted data. The reliability was also assessed through the Kappa coefficient, yielding a value of 0.87,
85 indicating an excellent agreement (Darvish et al., 2023).

86 According to the various studies done, several factors influence the PRCC. Proper management of
87 these factors improves Resilience. Resilience is the capacity of pastoralists to cope with CC. It has
88 been measured through indicators of robustness, adaptability, and transformability.

89 By studying former research, the following hypotheses can be considered in the current study:

90 1. Individual factors significantly influence the resilience of pastoralists in Tehran province under
91 CC conditions.

92 The individual factor includes a sense of self that the pastoralist has, and guides itself in the right
93 direction when faced with CC. This factor is measured in terms of psychological indicators (CD-
94 RISC), health and family.

95 2. Educational and extension factors significantly influence the resilience of pastoralists in Tehran
96 province under CC conditions.

97 The educational and promotional factors encompass educational and technical support provided
98 by the extension sector, which enhances the attitude, insight, knowledge and skills of pastoralists
99 in response to CC conditions. This factor is measured by two indicators of education and extension.

100 3. Social factors play a significant role in the resilience of pastoralists in Tehran province under
101 CC conditions.

102 These social factors include the feelings that pastoralists gain from their society-such as their
103 perception of other pastoralists, their sense of responsibility toward one another, the trust they have
104 in each other, and their understanding of the social structure that guides them in effectively facing
105 CC. This factor is comprising indicators of social security, social participation, social trust and
106 social coherence.

107 4. Economic factors significantly influence the resilience of pastoralists in Tehran province under
108 CC conditions.

109 The economic factor pertains to the assets of pastoralists and their access to the resources needed
110 to engage in resilience activities in the face of CC. This factor is measured in terms of job and
111 income indicators, financial support, and economic capability.

112 5. Physical factors play a significant role in influencing the resilience of pastoralists in Tehran
113 province under CC conditions.

114 The physical factor refers to pastoralists' access to communication infrastructure necessary for
115 their activities, etc. This factor has two indicators: access to infrastructure and machinery.

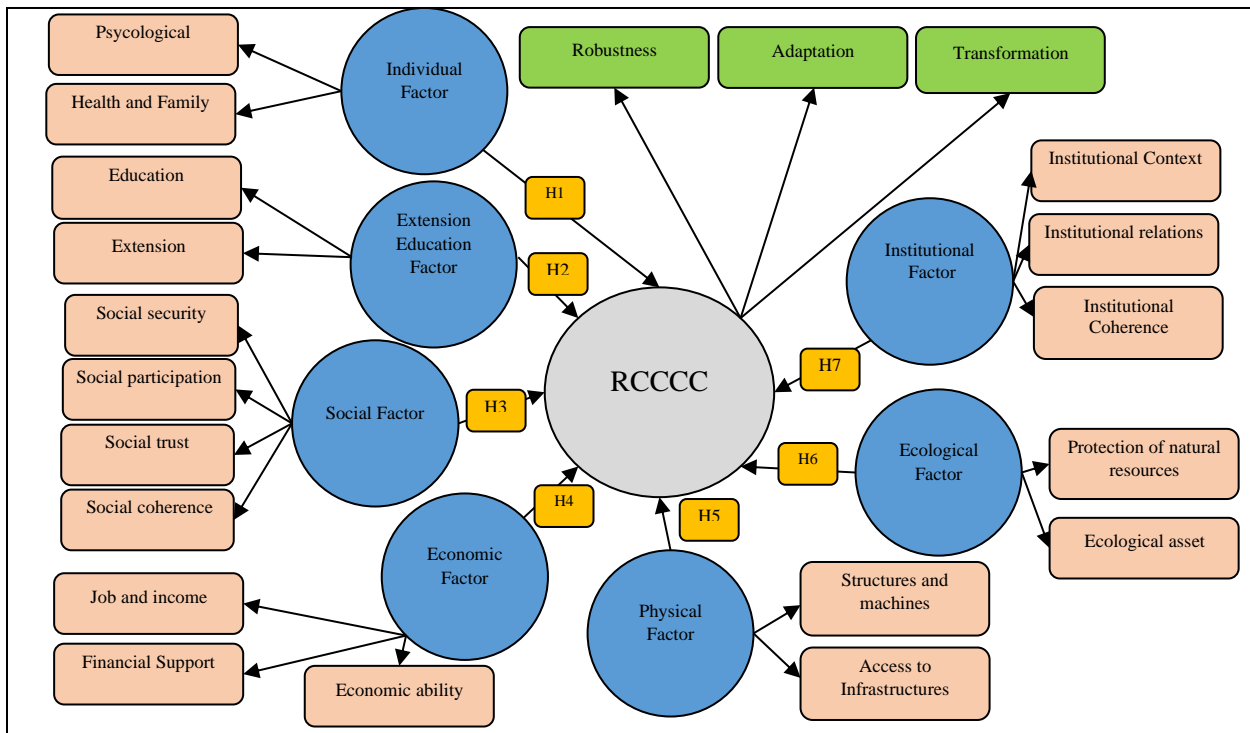
116 6. Ecological factors significantly influence the resilience of pastoralists in Tehran province under
117 CC conditions.

118 The ecological factor refers to pastoralists' access to natural resources and their enhancement to
119 sustain pastoral activities. Indicators of this factor include ecological assets and the protection of
120 natural resources.

121 7. Institutional factors are crucial in shaping of the resilience of pastoralists in Tehran province
122 under CC conditions.

123 The institutional factor pertains to government governance, which plays a fundamental role in
 124 improving the conditions for PRCC conditions. Government laws and regulations, government
 125 support, and the relationship between the government sector and pastoralists are effective in
 126 increasing PRCC (pastoralists’ resilience to climate change). This factor comprises indicators
 127 related to institutional context, institutional relations and institutional coherence.
 128 Based on prior research, including studies by Meuwissen et al. (2019) and Darvish et al. (2023),
 129 the conceptual model for the present study has been developed. it features seven variables and 21
 130 components, as illustrated in Figure 1. The seven factors - individual, educational-extensional,
 131 social, economic, physical, ecological and institutional – will collectively influence the resilience
 132 of pastoralists. Robustness, adaptability and transformability are outcomes of resilience that arise
 133 from the conditions related to PRCC.

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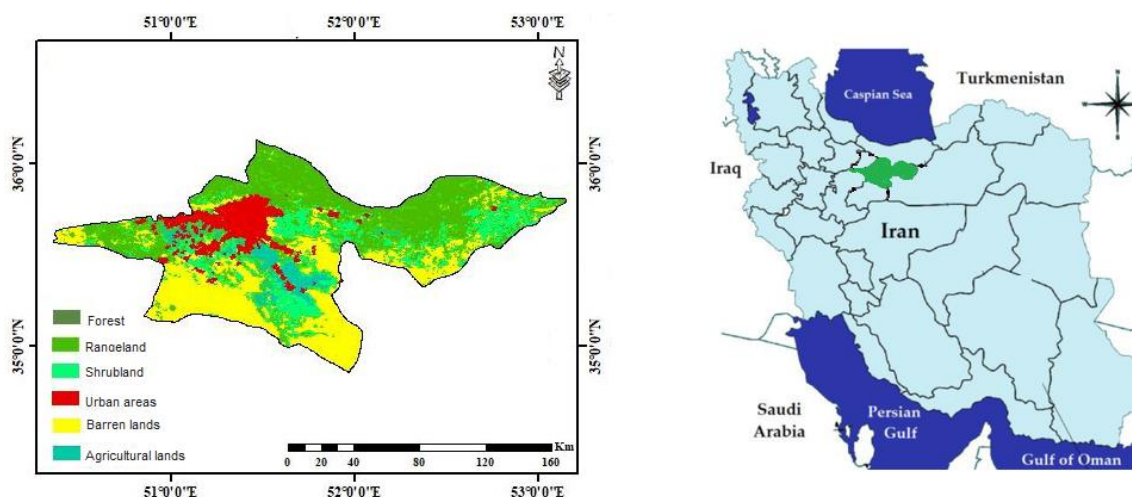
Figure 1. Conceptual model of the research (authors).

137 **Materials and Methods**

138 **Study area**

139 Tehran Province is located in the northern half of Iran (Figure 2). It has three elevation zones and
 140 an annual rainfall ranging from 230 to 500 mm. The largest area, accounting for 40.51 percent, is

141 designated for rangeland use. Additionally, the majority of the province, at 49.56 percent, is
 142 classified as having a semi-arid climate (Javadi et al., 2024).



143
 144 **Figure 2.** Study area (Javadi et al., 2024)

145 **Research methodology**

146 The present study employed a survey method to analyze the factors affecting the resilience of
 147 pastoralists in Tehran province under **CC** conditions. The statistical population of this study
 148 consists of the 5584 pastoralists in Tehran province as of 2024, according to the available statistics.
 149 To estimate the sample size from this population we utilized the Cochran formula, selecting a total
 150 of 318 individuals through stratified random sampling, taking into account the existing strata
 151 (counties). To measure the factors affecting **PRCC** conditions, we developed a researcher-made
 152 questionnaire with response options based on the Likert scale. Data analysis was conducted using
 153 SMART PLS and SPSS software. To ensure the validity of the research instrument, the
 154 questionnaire was reviewed by subject matter **experts and specialists in natural resources**. Their
 155 **feedback** was incorporated, leading to necessary revisions and confirming **the validity of the**
 156 **questionnaires**. To determine the reliability of the research tool, Cronbach's alpha coefficient was
 157 calculated for each section of the questionnaire, indicating the appropriate internal consistency of
 158 the items and the stability of the questionnaire.

159 To validate the measurement model (Table 1), we found that the composite reliability (CR) and
 160 average variance extracted (AVE) were both above 0.7, suggesting solid internal consistency
 161 among the model's variables. The AVE value exceeding 0.5 for the variables indicates acceptable
 162 convergent validity.

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Table 1. Reliability and Convergent Validity in the Measurement Model.

Constructs	Cronbach Alpha	Convergent validity	Composite Reliability (CR)	Average Variance Extracted
1. Individual Factor	0.782	0.792	0.873	0.697
2. Educational and Extensional Factor	0.777	0.888	0.840	0.534
3. Social Factor	0.860	0.909	0.897	0.527
4. Economic Factor	0.870	0.912	0.903	0.626
5. Physical Factor	0.831	0.870	0.874	0.564
6. Ecological Factor	0.737	0.774	0.787	0.525
7. Institutional Factor	0.820	0.894	0.868	0.652
8. Robustness	0.823	0.826	0.883	0.654
9. Adaptability	0.777	0.779	0.857	0.599
10. Transformability	0.812	0.815	0.877	0.642

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165 To examine the discriminant validity of the measurement model, the Fornell and Larcker criterion
 166 was employed. According to Tables 2 and 3, the square root of AVE for each construct in the
 167 present study is greater than the correlations among them; therefore, it can be concluded that the
 168 model constructs have stronger association with their own indicators than with the indicators of
 169 other constructs. In other words, the discriminant validity of the model is considered to be at an
 170 acceptable level.

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Table 2. Fornell-Larcker Criterion.

Constructs	1	2	3
1. Robustness	0.808		
2. Adaptability	0.609	0.774	
3. Transformability	0.618	0.719	0.801

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Table 3. Fornell-Larcker Criterion

Constructs	1	2	3	4	5	6	7
1. Individual Factor	0.834						
2. Educational and Extensional Factor	0.727	0.730					
3. Social Factor	0.721	0.716	0.725				
4. Economic Factor	0.765	0.705	0.670	0.791			
5. Physical Factor	0.679	0.671	0.681	0.719	0.750		
6. Ecological Factor	0.642	0.614	0.633	0.692	0.670	0.724	
7. Institutional Factor	0.686	0.658	0.692	0.768	0.685	0.680	0.807

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175 **Research findings**

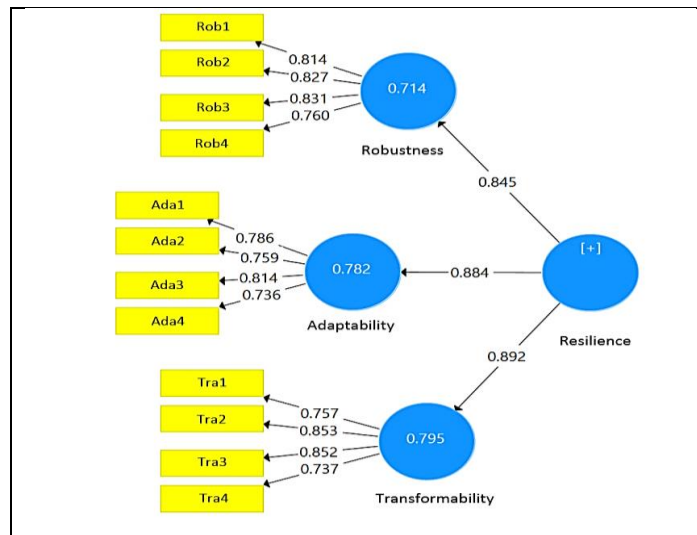
176 The age range of the sample studied was 26 to 70 years. The mean age was 23.46 years, and the
 177 standard deviation was 88.9. The median age was 47 years, and the mode was 45 years. In terms
 178 of gender, 1.3% of the respondents with a frequency of 4 were women, while 98.7% with a
 179 frequency of 314 were men. In terms of education level, the most frequently level of education

180 was a high school diploma. The median work experience among the participants was 20 years. The
 181 most common types of livestock owned by of Pastoralists were sheep, goats, cows, and camels.

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183 The measurement model

184 To examine the causal relationships between observed variables and latent variables, confirmatory
 185 factor analysis was used. Figure 3 illustrates the measurement model of PRCC conditions based
 186 on factor loadings and t-values. If t-values exceed 1.96, it indicates the significance of the
 187 corresponding variable (Vinzi et al., 2010).



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Figure 3. Measurement model.

189 As can be seen in Table 4, factor load values of indicators are more than 0.4; that is, the variance
 190 of indicators with their related construct was acceptable, indicating the suitability of indicators for
 191 measuring the latent variables of PRCC conditions. Also, the significance of all indicators is
 192 greater than 1.96, indicating a meaningful correlation between indicators and latent variables of
 193 PRCC conditions (Vinzi et al., 2010).

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Table 4. Specifications of indicators in the measurement model.

Indicator	Factor loads	t
Robustness	0.845	43.484
After something challenging has happened, it is easy for my rangeland to bounce back to its current profitability	0.814	34.865
As a Pastoralists, it is hard to manage my rangeland in such a way that it recovers quickly from shocks	0.827	34.873
Personally, I find it easy to get back to normal after a setback	0.831	34.683
A big shock will not heavily affect me, as I have enough options to deal with this shock on my rangeland	0.760	22.968
Adaptability	0.884	62.395
If needed, my rangeland can adopt new activities, varieties, or technologies in response to challenging situations	0.786	27.518
As a Pastoralists, I can easily adapt myself to challenging situations	0.759	26.949
In times of change, I am good at adapting myself and facing up to rangeland challenges	0.814	39.277
My rangeland is not flexible and cannot easily be adjusted to deal with a changing environment	0.736	22.801
Transformability	0.892	66.771
For me, it is easy to make decisions that result in a transformation	0.757	26.955
I am in trouble if external circumstances were to drastically change, as it is hard to reorganize my rangeland	0.853	46.104
After facing a challenging period on my rangeland, I still have the ability to radically reorganize my rangeland	0.852	55.130
If needed, I can easily make major changes that would transform my rangeland	0.737	25.889

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204 In this study, in the first stage, the indicators psy10, psy5, psy3, edu1, ext5, par2 and abi3 were
 205 removed from the model due to having a factor load of less than 0.4 and a t-statistic of less than
 206 1.96. Then, the measurement model was re-examined and it was found that factor load values of
 207 other indicators were more than 0.4, indicating the suitability of the indicators for measuring the
 208 latent variables of the factors affecting PRCC conditions. Also, the significance of all indicators
 209 was greater than 1.96, indicating a meaningful correlation between indicators and latent variables
 210 of factors affecting PRCC conditions (Table 5).

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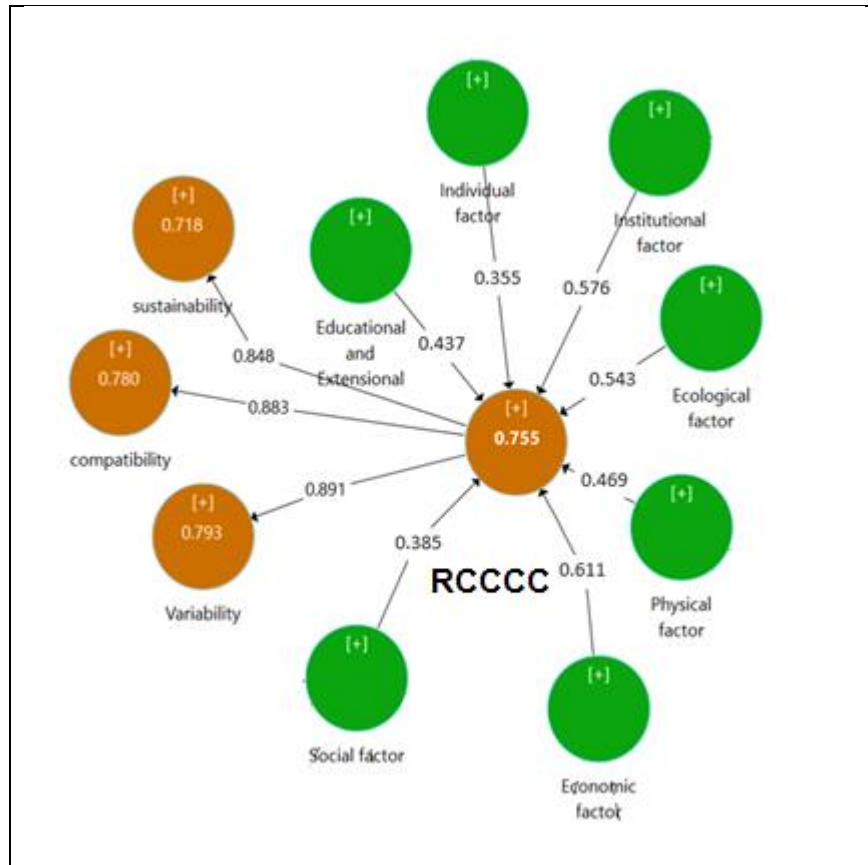
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Table 5. Specifications of indicators in the measurement model.

Indicator	Standard factor loads	t	Indicator	Standard factor loads	t
Individual factor	0.882	58.620	Abi2	0.819	42.338
psychological	0.953	107.663	Abi4	0.795	36.846
Psy1	0.559	17.353	Abi5	0.804	34.593
Psy2	0.823	39.542	Financial support	0.876	57.622
Psy4	0.751	27.812	Fin1	0.812	33.090
Psy6	0.743	23.749	Fin2	0.763	28.915
Psy7	0.789	35.944	Fin3	0.866	58.064
Psy8	0.750	27.480	Fin4	0.829	48.990
Psy9	0.648	23.924	Fin5	0.730	22.872
Health and family	0.897	48.938	Physical factor	0.875	58.114
Heal1	0.722	48.238	Structures and machines	0.878	42.696
Heal2	0.837	48.674	Str1	0.801	39.126
Heal3	0.888	61.264	Str2	0.853	40.310
Heal4	0.776	28.748	Str3	0.850	46.347
Educational and Extensional factor	0.865	46.635	Access to infrastructure	0.943	103.092
Education	0.947	110.189	Inf1	0.793	36.824
Edu2	0.787	31.155	Inf2	0.764	28.060
Edu3	0.858	51.091	Inf3	0.820	40.669
Edu4	0.813	37.027	Inf4	0.687	20.627
Edu5	0.818	39.536	Inf5	0.732	23.381
Extension	0.911	72.089	Inf6	0.693	22.846
Ext1	0.745	31.497	Ecological factor	0.831	40.794
Ext2	0.790	36.012	Ecological asset	0.929	66.954
Ext3	0.837	47.193	Eco1	0.713	20.818
Ext4	0.861	61.256	Eco2	0.766	23.128
Social factor	0.885	68.724	Eco3	0.844	48.766
Social Security	0.705	24.036	Eco4	0.709	19.434
Sec1	0.901	81.267	Eco5	0.814	38.213
Sec2	0.800	22.896	Protection of natural resources	0.833	43.141
social participation	0.868	55.075	Nat1	0.868	56.800
Par1	0.988	243.104	Nat2	0.744	21.362
Par3	0.989	288.606	Nat3	0.738	18.634
social trust	0.921	118.508	Institutional factor	0.869	49.629
Tru1	0.913	103.230	Institutional solidarity	0.915	74.681
Tru2	0.913	104.959	Sol1	0.901	82.467
social coherence	0.858	49.396	Sol2	0.745	22.894
Coh1	0.890	79.972	Sol3	0.589	12.537
Coh2	0.872	51.790	Sol4	0.907	81.336
Economic factor	0.934	114.668	Institutional relations	0.919	95.074
Job and income	0.882	54.359	Rel1	0.752	23.351
Job1	0.751	25.569	Rel2	0.858	56.401
Job2	0.811	41.156	Rel3	0.809	37.898
Job3	0.784	28.403	institutional platform	0.836	45.896
Job4	0.758	31.332	Pla1	0.868	68.685
Job5	0.765	28.676	Pla2	0.763	37.415
Economic ability	0.882	55.360	Pla3	0.724	35.138
Abi1	0.744	25.145	Pla4	0.847	43.181

220 **Structural Model Fit**

221 Figure 4 presents the research structural model based on the t-values. Since the t-values for all
 222 paths exceed 1.96, this indicates that all paths are significant, confirming the research hypotheses
 223 at the 95 percent confidence level.



224 **Figure 4.** Research structural model based on t values.

225 The R^2 value for the construct of PRCC was calculated as 0.755. Considering the benchmark
 226 values, this confirms the fitness of the structural model. The effect size criterion (f^2) for all
 227 constructs is greater than 0.02, indicating an average effect of the independent variables in the
 228 study. Additionally, the stone-geisser criterion or Q^2 for endogenous variables exceeds the
 229 threshold of 0.35, demonstrating strong predictive power for the model and confirming the
 230 appropriate fit of the structural model. According to the software output, the redundancy criterion
 231 for PRCC conditions is 0.568. The indicator of communalities, derived from the average factor
 232 loadings of each latent endogenous factor, is positive. This reflects the quality of the measurement
 233 model of latent variables. The overall fit of the model was evaluated using a single criterion known

234 as the Goodness of Fit (GOF). In this study, the GOF was found to be 0.559, indicating a strong
235 overall fit for the model.

236 The results of testing the research hypotheses with reference to Figure 3 are presented in Table 6.
237 The results show that individual, educational and extensional, social, economic, physical,
238 ecological and institutional factors have a significant and positive effect on PRCC, and improving
239 them will lead to enhancing PRCC conditions.

240 **Table 6.** The results of hypotheses testing.

Hypothesis	Standardized Path Coefficients	t-Value	F2	Result
H1 Individual Factor <input type="checkbox"/>	RCCCC	0.355	5.849	0.023 Confirmed
H2 Educational and Extensional Factor <input type="checkbox"/>	RCCCC	0.437	8.516	0.025 Confirmed
H3 Social Factor <input type="checkbox"/>	RCCCC	0.385	6.273	0.041 Confirmed
H4 Economic Factor <input type="checkbox"/>	RCCCC	0.611	13.643	0.039 Confirmed
H5 Physical Factor <input type="checkbox"/>	RCCCC	0.469	8.928	0.022 Confirmed
H6 Ecological Factor <input type="checkbox"/>	RCCCC	0.543	10.137	0.098 Confirmed
H7 Institutional Factor <input type="checkbox"/>	RCCCC	0.576	11.422	0.068 Confirmed

241 Discussion

242 Natural resources policymakers are concerned that, given the critical conditions arising from
243 climate changes and recent droughts, no appropriate program and actions have been taken to
244 reduce vulnerability and enhance the resilience of pastoralists. this is the gap that has always been
245 existed. Furthermore, the actions taken to improve resilience have often resulted in the
246 misallocation of significant resources. Therefore, analysing the factors the influence resilience was
247 one of the primary objectives of this study, which aimed to enhance the resilience of pastoralists.
248 Based on this, the present study aimed to analyze the factors affecting resilience from the
249 perspective of Tehran province pastoralists under climate change conditions. Consequently, seven
250 individual, educational and extensional, social, economic, physical, ecological and institutional
251 factors were investigated. According to the literature review, the individual factor included
252 psychological indicators, health and family dynamics. The educational and extension factor
253 encompassed indicators related to education and extension services. The social factor was defined
254 by indicators of social security, participation, trust and coherence. The economic factor involved
255 measures of employment and income, financial support and economic capacity. The physical
256 factor included indicators related to access to infrastructure, structures and machinery. The
257 ecological factor focused on ecological assets and the protection of natural resources. Lastly, the
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259 institutional factor comprised indicators of institutional context, institutional relations and
260 institutional coherence. Robustness, adaptation and transformability were identified as outcomes
261 of resilience and were investigated.

262 In this study, seven hypotheses were formulated and tested using structural equation modeling
263 with Smart PLS software. The impact analysis revealed path coefficients and significance values
264 for the individual (0.355, 5.849), educational and extension (0.437, 8.516), social (0.385, 6.273),
265 economic (0.611, 13.643), physical (0.469, 8.928), ecological (0.543, 10.137) and institutional
266 (0.576, 11.422) factors. This indicates that the seven aforementioned factors have a positive and
267 significant effect on PRCC conditions with 95 percent confidence. This finding is consistent with
268 some studies (Adzawla et al., 2020; Melketo et al., 2021; Ahmad and Afzal et al., 2021; Le Goff
269 et al., 2022; Kapruwan et al., 2024).

270 The R^2 value for the construct of PRCC was calculated as 0.755, considering the benchmark
271 values, confirming the fitness of the structural model. The GoF (0.559) criterion value indicated
272 that the overall quality of the model is strong and the overall model of the study is an appropriate
273 model. Therefore, the need to pay more attention to the model is felt.

274 The second part of the model was dedicated to ranking the factors affecting PRCC conditions. The
275 findings showed that the economic factor with a value of 0.611, the institutional factor with a value
276 of 0.576, the ecological factor with a value of 0.543, the physical factor with a value of 0.469, the
277 educational and extension factor with a value of 0.437, the social factor with a value of 0.385, and
278 the individual factor with a value of 0.355 have significant and positive effects on PRCC conditions
279 respectively. they directly explain 75.5 percent of the changes related to the variable of PRCC
280 conditions.

281 Considering the results of the second dimension, there is an increasing need to pay more attention
282 to economic, ecological, and institutional factors. Attention to economic factor has been noted in
283 some studies (Adzawla et al., 2020; Melketo et al., 2021; Ahmad and Afzal et al., 2021; Le Goff
284 et al., 2022; Kapruwan et al., 2024). However, Le Goff et al. (2022) and Kapruwan et al. (2024)
285 have stated other priorities for strengthening the resilience of communities to CC.

286 287 **Conclusion**

288 This research was carried out in one of the key regions of Iran to explore the factors influencing
289 pastoralists' resilience to CC. Identifying appropriate measures to enhance pastoralists' resilience

290 to CC can improve their adaptability to crises, thereby preventing rangeland degradation and
291 migration of pastoralists. Obviously, it is necessary to focus on increasing the resilience levels of
292 Pastoralists in the region within the context of CC. Accordingly, this study has attempted to
293 identify resilience measures and analyze them in the form of seven hypotheses and models. Former
294 findings have pointed out some of the factors affecting resilience. In this study, a new and
295 comprehensive interpretation of the factors has been considered via combination of the previous
296 findings. They've been added to the existing body of knowledge in this field. The findings of this
297 study indicated the significant effect of these factors on improving the resilience of the studied
298 pastoralists. Economic, Institutional and Ecological factors are the most important ones affecting
299 them. Drought affects vegetation and makes it difficult for pastoralists to meet basic needs.
300 Government financial and technical support can protect livelihoods during times of crisis and
301 increase resilience. Given these results, the following suggestions are made to enhance the
302 resilience of pastoralists in the face of CC:

303 - Government managers and planners must pay special attention to the economic factor in order to
304 enhance resilience and support pastoralists. At a lower level, it was determined that increasing
305 resilience necessitates strengthening the economic capacity, which includes the ability to purchase
306 food for households during times of need. This group operates within a dependent and vulnerable
307 economy, and the distribution of water and food by government agencies can help meet basic needs
308 and mitigate the impact of crises.

309 -Managers of government departments should provide the necessary infrastructure to strengthen
310 institutional relationships through the interaction of pastoralists with experts and specialists. This
311 approach will lead to greater familiarity, recognition, and improved decision-making regarding the
312 cultivation of suitable plants, optimal range management, and transitioning livelihoods from
313 livestock to other oportunities, including beekeeping, ecotourism, etc. furthermore, Strengthening
314 trade associations and cooperative unions with economic, institutional, and legal support can
315 enhance coordination and cooperation between departments and institutions, thereby bolstering
316 Institutional solidarity.

317 - It is essential to raise the awareness, knowledge, and attitudes of pastoralists to improve
318 ecological assets. Capacity building in livestock management and rehabilitation efforts in
319 rangelands can enhance plant cover, preserve soil quality and quantity, and prevent soil erosion,
320 all of which are crucial for supporting pastoralists during drought years.

321 In this study, variations in rangeland cover, climate, and livestock types were observed. This
322 indicates that pastoralists in this region do not form a homogeneous group. This variability may
323 have affected the responses of pastoralists and represents a limitation of the research. Future
324 studies should take these factors into account.
325 Since the factors affecting resilience vary across countries, the results of this study should be
326 generalized with caution to other regions that are less similar to this area.

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328 References

- 329 1. Adzawla, W., Azumah, S.B., Anani, P.Y. and Donkoh, S.A., 2020. Analysis of farm
330 households' perceived climate change impacts, vulnerability and resilience in Ghana. *Sci*
331 *Afr*, 8: e00397.
- 332 2. Ahmad, D. and Afzal, M., 2021. Impact of climate change on pastoralists' resilience and
333 sustainable mitigation in Punjab, Pakistan. *Environ Dev Sustain*, 23(8): 11406-11426.
- 334 3. Angerer, J. P., Fox, W. E., Wolfe, J. E., Tolleson, D. R., and Owen, T., 2023. Land
335 degradation in rangeland ecosystems. In *Biological and environmental hazards, risks, and*
336 *disasters* (pp. 395-434). *Elsevier*.
- 337 4. Bahrami, M., Bazrkar, S., and Zarei, A.R., 2021. Spatiotemporal investigation of drought
338 pattern in Iran via statistical analysis and GIS technique. *Theor Appl Climatol*, 143(3):
339 1113-1128.
- 340 5. Behmanesh, B., Shahraki, M., Sherafatmandrad, M. and Mahdavi, S., 2021. Nomadic
341 Pastoralists and Drought in the Rangelands of Gonbad-e Kavous, Iran. *ECOPERSIA*; 9 (3)
342 :207-214
343 URL: <http://ecopersia.modares.ac.ir/article-24-42326-en.html>
- 344 6. Brêda, J. P. L. F., de Paiva, R. C. D., Collischon, W., Bravo, J. M., Siqueira, V. A., and
345 Steinke, E.B., 2020. Climate change impacts on South American water balance from a
346 continental-scale hydrological model driven by CMIP5 projections. *Clim Change*, 159(4),
347 503–522.
- 348 7. Darvish, A. K., Omidi Najafabadi, M., Mirdamadi, S. M., and Farajollah Hosseini, S. J.,
349 2023. Model for Pastoral Housholds Resilience under Drought Condition. *Iranian Journal*
350 *of Forest and Range Protection Research*
- 351 8. Dinan, M., Adler, P. B., Bradford, J., Brunson, M., Elias, E., Felton, A., ... and Thacker, E.

- 352 2021. Making research relevant: Sharing climate change research with rangeland advisors
353 to transform results into drought resilience. *Rangelands*, 43(5), 185-193.
- 354 9. Dong, S., Kassam, K.A.S., Tourrand, J.F. and Boone, R.B., 2016. Building resilience of
355 human-natural systems of pastoralism in the developing world. *Springer, Switzerland*, 298
356 p.
- 357 10. Husein, A., 2021. Courses of Rangeland Degradation and Rehabilitation Techniques in the
358 Rangelands of Ethiopia. *J Earth Sci Clim Change*, 12(10), 1-6
- 359 11. Javadi, S., Ranjbar Fordoie, A., Khosravi, H., and Eskandari Damaneh, H., 2024.
360 Investigating the effects of drought on the water use efficiency in different climates and
361 land uses (Case study: Tehran province. *Journal of Arid Biome*
- 362 12. Holling, C.S., 1973. Resilience and stability of ecological systems. *Annu Rev Ecol Syst.* 4,
363 1-23.
- 364 13. Le Goff, U., Sander, A., Lagana, M.H., Barjolle, D., Phillips, S. and Six, J., 2022. Raising
365 up to the climate challenge-understanding and assessing farmers' strategies to build their
366 resilience. A comparative analysis between Ugandan and Swiss farmers. *J Rural Stud*, 89:
367 1-12.
- 368 14. Melketo, T., Schmidt, M., Bonatti, M., Sieber, S., Müller, K. and Lana, M., 2021.
369 Determinants of pastoral household resilience to food insecurity in Afar region, northeast
370 Ethiopia. *J Arid Environ*, 188: 104454.
- 371 15. Meuwissen, M.P.M., Feindt, P.H., Spiegel, A., Termeer, C.J.A.M., Mathijs, T.E., de Mey,
372 Y., ... and Reidsma, P., 2019. A framework to assess the resilience of farming systems.
373 *Agric Syst*, 176: 102656.
- 374 16. Kapruwan, R., Saksham, A. K., Bhadoriya, V. S., Kumar, C., Goyal, Y., and Pandey, R.,
375 2024. Household livelihood resilience of pastoralists and smallholders to climate change
376 in Western Himalaya, India. *Heliyon*, 10(2).
377 <https://doi.org/10.1016/j.heliyon.2024.e24133>
- 378 17. Raj, A., and Sharma, L. K., 2023. Spatial E-PSR modelling for ecological sensitivity
379 assessment for arid rangeland resilience and management. *Ecol Modell*, 478, 110283.
- 380 18. Sadeghi, S. H., and Hazbavi, Z. 2022. Land degradation in Iran. In *Global Degradation of*
381 *Soil and Water Resources: Regional Assessment and Strategies* (pp. 287-314). Singapore:
382 Springer Nature Singapore.

- 383 19. Vinzi, V.E., Trinchera, L. and Amato, S., 2010. PLS path modeling: from foundations to
384 recent developments and open issues for model assessment and improvement. *Handbook*
385 *of Partial Least Squares*, Springer Berlin Heidelberg.
- 386 20. Yousefi, S., Pourghasemi, H. R., Avand, M., Janizadeh, S., Tavangar, S., and Santosh, M.,
387 2021. Assessment of land degradation using machine-learning techniques: A case of
388 declining rangelands. *Land Degrad Dev*, 32(3), 1452-1466.

389

تحلیل عوامل موثر بر تاب‌آوری مرتعداران در شرایط تغییر اقلیم

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392 امیرکیوان درویش، مریم امیدی نجف آبادی، سیدمهدی میردامادی، و سیدجمال فرج‌اله حسینی

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چکیده

395 پدیده تغییر اقلیم یکی از بزرگترین چالش‌های عصر حاضر است که مراتع را در مقیاس جهانی و منطقه‌ای تحت تاثیر قرار
396 داده است. افزایش آسیب‌پذیری در میان مرتعداران، اهمیت تمرکز بر تفکر تاب‌آوری را نشان می‌دهد. تاب‌آوری مرتعداران
397 به ظرفیت کسب و کارهای مرتعداری در مواجهه با تهدیدها یا چالش‌ها، بصورت مقاومت، سازگاری و تغییرپذیری است.
398 این پژوهش با هدف کلی تحلیل عوامل موثر بر تاب‌آوری از دیدگاه مرتعداران استان تهران در شرایط تغییر اقلیم انجام شد.
399 این پژوهش از نظر هدف کاربردی و روش شناسی اکتشافی بود. نمونه مورد مطالعه شامل 317 مرتعدار بود که به روش
400 نمونه‌گیری تصادفی طبقه‌ای انتخاب شدند. برای گردآوری داده‌ها، از پرسشنامه محقق ساخته استفاده شد. روایی پرسشنامه با
401 استفاده از میانگین واریانس استخراج شده و پایایی آن از طریق محاسبه پایایی ترکیبی و آلفای کرونباخ تعیین شد. داده‌ها با
402 استفاده از تکنیک مدل سازی معادلات ساختاری با نرم افزار Smart PLS مورد تجزیه و تحلیل قرار گرفت. نتایج نشان داد
403 که عوامل فردی، آموزشی و ترویجی، اجتماعی، اقتصادی، فیزیکی، اکولوژیکی و نهادی بر تاب‌آوری مرتعداران تحت
404 شرایط تغییر اقلیم رابطه معنادار دارند. این عوامل 75.5 درصد تاب‌آوری مرتعداران را در شرایط تغییر اقلیم تبیین کردند.