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Expanding Protection Motivation Theory: Investigating Farmers' Pro-Environmental Behavior and Their Impact on a Sustainable Alternative Livelihood under Drought

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ABSTRACT

In this study, we aimed to use the Protection Motivation Theory (PMT) to explain farmers' pro-environmental behavior, and we subsequently applied our conceptualization of the PTM to explain the effects of pro-environmental behavior as well as some alternatives to achieve a sustainable livelihood in the Borkhar Region, Isfahan Province, Iran. The population of this study comprised rural smallholder farmers who produced agricultural and horticultural crops under drought in 2017-2019. The study sample consisted of 293 smallholder farmers selected through stratified random sampling. A questionnaire was utilized for data collection, and data were analyzed using structural equation modeling. The findings suggest that self-efficacy, perceived vulnerability, and response efficacy have a positive relationship with farmers' pro-environmental behavior. In addition, the perceived severity and response costs are negatively related to farmers' pro-environmental behavior. The findings further show that alternative crops and alternative income sources are the main predictors of achieving a sustainable alternative livelihood. Moreover, saffron cultivation and rural handicrafts were found to be highly important indicators that enhance sustainable alternative livelihood under drought. Therefore, concentrating efforts and shifting the focus to these alternatives leads to increased farmers' livelihood resilience in the long run.

Keywords: Agricultural drought, On-farm and off-farm alternatives, Perceived vulnerability, Self-efficacy, Smallholder farmers.

INTRODUCTION

Drought is a complex natural catastrophe (Kim and Jehanzaib, 2020) with no universally accepted definition. Each definition reflects the differences in regions, needs, and disciplinary approaches (Tate and Gustard, 2000). Some consider the definition of drought as an agricultural drought that has become a serious threat to food security (Xu *et al*., 2021) and deeply affects production and livelihoods (Wang *et al*., 2021). Drought impact on agriculture depends on underlying social and ecosystem vulnerabilities, access to irrigation, types of crops grown, and other factors (NIDIS, 2020). At the same time, every household and farmer may be impacted differently and have different perceptions about the drought impact (Quandt, 2021). However, drought is a specific local phenomenon, and its characteristics vary significantly between regions and individuals (Sherval *et al*., 2014). Farmers in some regions have greater exposure to drought than others, and farmers in each region face their own unique set of challenges (Horion *et al*., 2012). As a result, coping behaviors and strategies used by different farmers are very different from their risk management (Quandt, 2021). For instance, agricultural drought management behaviors and strategies in arid and semiarid regions of developing

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countries, where smallholder farmers are more vulnerable to possible consequences of drought (Wiebe *et al*., 2019), tend to focus on post-disaster recovery behaviors (Carrão *et al*., 2016) and rely on more reactive short-term response approaches (Hassan, 2013).

Recent efforts have recognized the importance of applying risk reduction behaviors, both during and after the drought, to prevent environmental problems and the consequent unstable livelihood (Neisi *et al*., 2020). It would be necessary to focus on the promotion of appropriate drought management practices among farmers to achieve a more sustainable and environmentally alternative livelihood where pro-environmental behavior is set as a core factor (Bockarjova and Steg, 2014).

The first important question in this respect is divided into two parts: Why do some farmers act more pro-environmentally than others, and which factors determine whether smallholder farmers are willing to engage and promote pro-environmental behavior. Generally, pro-environmental behavior is the willingness to engage in some personal protection activities, or at a higher level, it can be the desire to conduct public environmental behavior and interactivities with other people (Zhong and Shi, 2020). It seems that pro-environmental behaviors, as an intent-oriented measure (Bamberg and Rees, 2015), can help reduce the negative environmental impacts of drought. However, such a proactive approach requires local collaboration to reduce the threat of drought on food security and the livelihoods of smallholder farmers (Reyes *et al*., 2014).

The second question is: How can we explain the effects of farmer's pro-environmental behavior on their sustainable livelihood? Overall, the Sustainable Livelihoods (SL) approach (Brocklesby and Fisher, 2003) organizes the factors that enhance livelihood opportunities and explains their relationships to achieve a more stable livelihood (Serrat, 2017). A livelihood is sustainable when it can cope with and recover from stresses and vulnerability; therefore, livelihoods can be affected by internal and external factors that reduce its vulnerability (Krantz, 2001). Furthermore, using livelihood-focused interventions and alternatives as a tool for behavior change is more appropriate than focusing on promoting existing livelihood strategies (Wright *et al*., 2016). In some cases, this intervention might mean providing an *alternative resource* (e.g. encouraging farmers to take up beekeeping), and in other cases, the focus of an intervention might be providing an *alternative occupation or source of income* (e.g. encouraging farmers to begin producing handicraft), i.e. it is encouraging *alternative methods* rather than the current methods (e.g. encouraging farmers to use drought-tolerant crop varieties) (Roe *et al*., 2015). From a holistic sustainable livelihood perspective, these alternatives might be divided into two categories: on-farm practices and off-farm activities that reduce vulnerability and attempt to change the surroundings, which can be helpful for adaption to drought in the future (Aniah *et al*., 2019).

While it is generally recognized that engaging in and sustaining an alternative livelihood based on pro-environmental behaviors under drought is a major concern and requires a set of organized efforts (Bockarjova and Steg, 2014), there has been little progress in developing theoretical accounts that identify relevant variables and describe associated factors. Therefore, developing a theoretical framework to integrate these variables and conduct causal investigations on them would be a useful framework for explaining the effects of pro-environmental behavior and other alternatives on sustainable livelihoods. Some theories have been applied to explain farmers' pro-environmental behavior under drought, and the Theory of Planned Behavior (TPB) (Ajzen, 1991), and the Protection Motivation Theory (PMT) (Rogers, 1983) are the most popular theories that examine factors influencing environmental behaviors. The PMT, a general theory of persuasive communication that incorporates individual and social factors (Rainear and Christensen, 2017), provides a set of predictors for human behavior, unlike the TPB (Shafiei and Maleksaeidi, 2020), which balances two main processes, namely, *threat appraisal* and *coping appraisal*. PMT offers a theoretical perspective for explaining and predicting behavior to enhance our understanding of motivators governing pro-environmental behavior to, subsequently, modify drought impacts (Bockarjova and Steg, 2014). In this study, we used PMT to explain smallholder farmers' pro-environmental behavior to reduce the harmful impact of drought. Subsequently, we applied our conceptualization of the PTM to explain the effects of pro-environmental behavior and offer alternatives (in this case, we focused on the on-farm and off-farm alternatives) to achieve a sustainable livelihood in the Borkhar Region.

This paper specifically focuses on a semi-arid region of the Borkhar Region in Iran, where smallholder farmers are generally among the most ecologically, socially, and politically marginalized citizens of the country. Iran is one of the most critical countries dealing with drought (Ghanian *et al*., 2020), where drought has costs for the government more than other disasters, accounting for more than 14 billion USD in the allocated budget (Seddighi and Seddighi, 2020). The Borkhar Region is under a moderate to severe drought. In this region, the impacts of drought are very impressive, and the limited local capacities and lack of access to various forms of assets make farmers' livelihoods increasingly vulnerable. Since most drought threats are direct consequences of farmers' behaviors, altering these behaviors could decrease the problems (Yaghoubi Farani *et al*., 2019). However, in this area, there is no appropriate research to understand the factors affecting farmers' pro-environmental behavior, which would be the first step in achieving a sustainable livelihood. The novelty of this study is not only the study area, but also, for the first time, providing a structural equation modeling of farmers' pro-environmental behavior based on PTM from a holistic sustainable livelihood perspective. Thus, this study considered the Borkhar-Isfahan Region to explore smallholder farmers' pro-environmental behaviors in drought and its effects on sustainable livelihood.

MATERIALS AND METHODS

Description of the Protection Motivation Theory (PMT)

Although there are various theories to explain behavior, Protection Motivation Theory (PMT) (Rogers, 1983) is the most popular. PTM indicates the role of risk perception in motivating people to reduce potential negative impacts (Ghanian, *et al*., 2020) and emphasizes the formation of protective actions against potential threats that occur through *appraisal of threats* and *coping strategies* (Wang *et al*., 2019). The *threat appraisal* process involves individual assessment of threat levels and includes two constructs: a) *perceived severity* and b) *perceived vulnerability* (Keshavarz and Karami, 2016). In this study, perceived severity is conceptualized as the degree to which smallholder farmers perceive the effects of drought. Also, perceived vulnerability to drought conditions is a situation where farmers realize that if adverse conditions are not faced, the impacts on food insecurity, occupational, social, and health insecurity increase. The *coping appraisal* process also involves individual assessment of internal and external factors and includes three constructs: a) *self-efficacy*, b) *response efficacy*, and c) *response costs* (Rainear and Christensen, 2017). Farmers' *perceived self-efficacy* has a positive and direct effect on their actual farming and non-farming practices in a drought (Yoon *et al*., 2012). *Response efficacy* refers to an individual's belief (Wang *et al*., 2019); in this case, farmers evaluate the types of adaptive behaviors and various measures to deal with the threat (Udmale *et al*., 2014). *Response cost* refers to all perceived costs (Bockarjova and Steg, 2014); farmers estimate the various structural and financial barriers affecting their coping performance (Salmoral *et al*., 2020).

Description of the Sustainable Livelihood Approach

In recent years, the “Sustainable Livelihoods (SL) approach” (Brocklesby and Fisher, 2003) has been encouraging farmers to adopt environmental strategies in rural communities (Mallick *et al*., 2020). Under this approach, the basic assumption is that the strategies in drought-prone areas must be designed in such a way that farmers develop more income generation, increase well-being, reduce vulnerability, and improve food security (Morse and McNamara, 2013). According to Van Praag and Timmerman (2019), the SL approach aims to understand how people act to maintain a socially and environmentally sustainable livelihood. Alternatives must incorporate the farmer’s needs and wants (de Haan and Zoomers, 2005) and providing spiritual satisfaction (Pollnac and Poggie, 2008). According to Roe *et al*. (2015), this intervention might be divide into three types: a) *alternative resource*, b) *alternative occupation or source of income*, and c) *alternative methods*. Alternative, in this study also means income-generating activities for farmers and replacing original ineffective methods with new resources and methods. In this case, there may be merit in dividing these alternatives into two different categories: *On-farm practices* and *off-farm activities*, which could be helpful to adapt to drought in the future (Aniah *et al*., 2019).

Research Framework and Hypotheses Development

In this study, we aimed to use the PMT to explain farmers’ pro-environmental behavior. We then applied our conceptualization of the PTM to explain the effects of pro-environmental behavior and offer alternatives to achieve a sustainable livelihood. Figure 1 shows the research

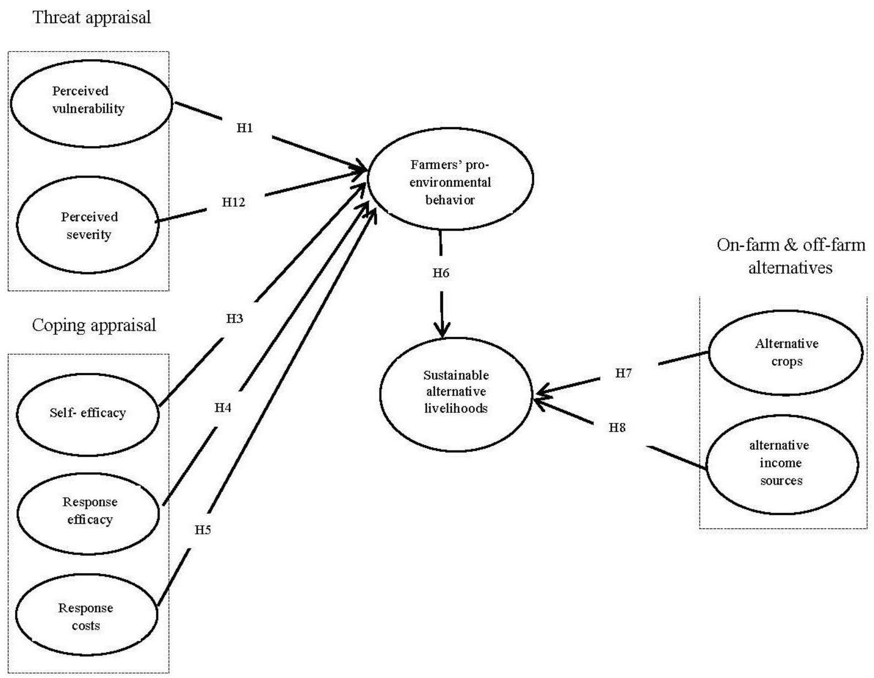

Figure 1. Research Framework: Expanding Protection Motivation Theory (PMT) for investigating farmers’ pro-environmental behavior and sustainable livelihood under drought.

framework, which was formed in five parts: (1) *Threat appraisal*, (2) *Coping appraisal*, (3) *Farmers' pro-environmental behaviors*, (4) *On-farm and off-farm alternatives*, and (5) *Sustainable alternative livelihood*. Based on the research framework, farmers' pro-environmental behaviors are influenced by two threat-appraisal factors and three coping-appraisal factors. Furthermore, sustainable alternative livelihood is directly determined by pro-environmental behavior and on-farm and off-farm alternatives. The relationships of the constructs in this research framework are presented.

Hypotheses Development

In recent researches, the PTM theory was used to explain pro-environmental behavior. Neisi *et al*. (2020) showed that PMT can be useful in explaining farmers' drought risk management behavior in Iran and response efficacy, perceived vulnerability, and self-efficacy had the greatest direct role in explaining farmers' behavior; however, other variables (response cost and perceived severity) had no significant direct effect. Shafiei and Maleksaeidi (2020) indicated that the PTM constructs along with environmental attitude are able to explain a significant portion of the variance in pro-environmental behavior; their findings showed that self-efficacy, and perceived costs were the direct determinants of pro-environmental behavior, and that self-efficacy can help increase the likelihood of pro-environmental behaviors. Rainear and Christensen (2017) indicated that perceived severity, perceived vulnerability, response efficacy, and self-efficacy positively predict pro-environmental intentions, and response costs negatively predict intentions. Also, Keshavarz and Karami (2016) reported that response efficacy, perceived severity, response costs, perceived vulnerability, and self-efficacy significantly influenced the farmers' pro-environmental behavior; while, response costs and perceived severity were negatively associated with pro-environmental behavior. Therefore, the following hypotheses are proposed:

(H1): The perceived vulnerability positively affects smallholder farmers' pro-environmental behavior.

(H2): The perceived severity negatively affects smallholder farmers' pro-environmental behavior.

(H3): The self-efficacy positively affects smallholder farmers' pro-environmental behavior.

(H4): The response efficacy positively affects smallholder farmers' pro-environmental behavior.

(H5): The response costs negatively affect smallholder farmers' pro-environmental behavior.

While it is generally recognized that engaging in and sustaining an alternative livelihood based on pro-environmental behavior under drought is a major concern and requires a set of organized efforts (Bockarjova and Steg, 2014), there has been little progress in developing theoretical accounts that identify relevant variables and describe associated factors (Wicander and Coad, 2015). Some studies have indicated that concentrating efforts and shifting the focus to sustainable activities, both farming and non-farming, leads to increased resilience for families in the long-run (Wei *et al*., 2017). For instance, Lei *et al*. (2016) indicated that farmers have gradually transformed their cropping patterns into a new diversified mode of rice, cotton, and coarse cereals (*alternative crops*); a farming practice that reduces the vulnerability of local agriculture to drought. In this regard, Ngugi and Nyariki (2005) reported that rural alternative livelihoods are discussed under regenerative and extractive themes with respect to environmental stability in Kenya; where regenerative livelihoods include activities like apiculture, poultry keeping, and drought-tolerant cropping. Examples of livelihoods that are extractive include woodcarving, and brick-making (*alternative income sources*). Therefore, the following hypotheses are proposed:

(H6): Farmers' pro-environmental behaviors positively affect a sustainable alternative livelihood.

(H7): Alternative crops positively affect a sustainable alternative livelihood.

(H8): Alternative income sources positively affects a sustainable alternative livelihood.

Study Area

This study was carried out in Isfahan Province, located in the center of Iran at latitude 32° 38' N and longitude 51° 39' E. The Borkhar Region north of Isfahan was selected as the study area (Figure 2). The district has a predominantly arid to semi-arid desert climate. Profitable crop production in this area is impossible without reliable irrigation.

Participants

The population of this study consisted of rural smallholder farmers. According to the Isfahan Jahad-e Agriculture Organization, there are about 3,666 smallholder farmers in the two districts of Borkhar, which consist of 12 villages (N= 3,666). The study sample consisted of 293 farmers, based on Cochran's formula, and was selected through stratified random sampling (n=293).

Data Collection

Data were collected with a questionnaire consisting of three sections: (1) *Demographic characteristics*, (2) *Pro-environmental behavior* (including three sub-scale: an appraisal of threats, coping strategies, and pro-environmental behavior), and (3) *Sustainable alternative livelihoods* (including three sub-scales: alternative crops, alternative income sources, and alternative livelihoods). The sub-scales of the pro-environmental behavior and sustainable alternative livelihoods sections were developed based on a 5-point Likert scale. The questions of these sections were derived from the research framework confirmed by the previous study of Keshavarz and Karami (2016), and modified to fit the objectives of this study. The questionnaire validity and reliability were measured through

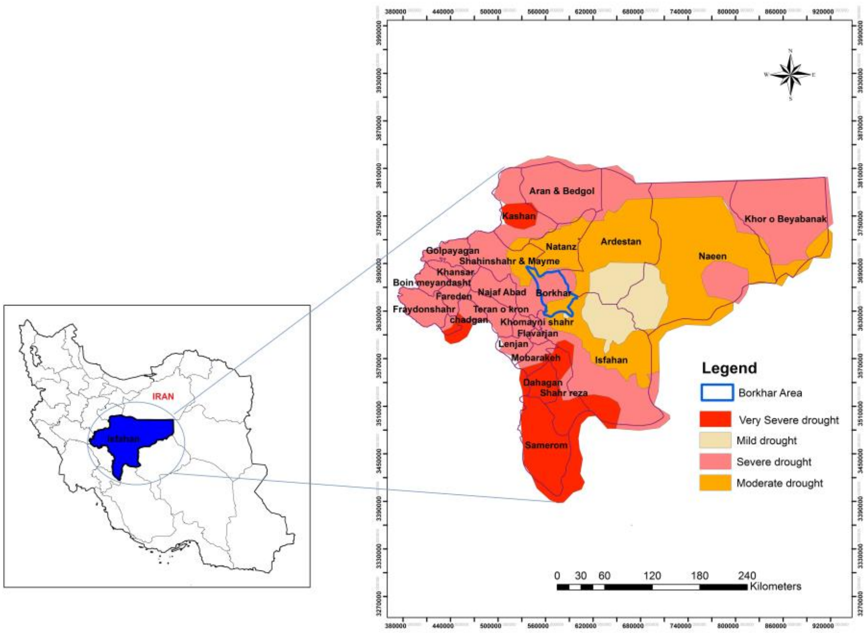

Figure 2. Location of study area in Borkhar Region, Isfahan, Iran.

a pre-test. The questionnaire was first distributed among 30 smallholder farmers who did not participate in the study. The data were analyzed using Smart PLS 3.0 to ensure the measurement items were valid and reliable. The factor loadings, Average Variance Extracted (AVE), and Composite Reliability (CR) were used to measure the convergence validity of each construct. According to Barclay *et al*. (1995), the values of AVE for each construct should be greater than 0.50. In addition to satisfying convergence validity, the CR for all constructs should be higher than 0.70. Additionally, Cronbach's Alpha coefficient was applied to assess the inter item consistency. The results suggested that the Cronbach's Alpha had acceptable reliability, more than 0.70. Then, in total, 300 questionnaires were distributed among respondents, of which 293 were fully and accurately completed.

Data Analysis

Descriptive analysis was done using $SPSS_{20}$. In addition to testing the research model, this study also used the Partial Least Squares (PLS) technique of Structural Equation Modeling (SEM) using Smart-PLS 3.0.

RESULTS

Based on the objectives and research questions, and to assess the hypothesis, both descriptive analysis of farmers' pro-environmental behavior and sustainable alternative livelihoods, as well as SEM of the research model, were conducted.

Farmers Demographic Characteristics

Among the farmers studied, 282 individuals were male (96.2%), and 11 were female (3.8%). The average age of the farmers was 33. Of the participants, 43.3% ranged between 30–40 years old (highest frequency), and 4.1% were less than 30 years old (lowest frequency). As for educational level, 35.8% had a high school degree (highest frequency), and 1.7% had an advanced degree (lowest frequency). Among these farmers, 288 (98.3%) had no current alternative income source, and only 5 (1.7%) had an alternative income source.

Farmers' Pro-Environmental Behavior

The farmers' pro-environmental behaviors are discussed in four sub-sections: (i) Conservation of natural habitats and biodiversity, (ii) Protection of soil and water resources, (iii) Reduction of environmental pollution, and (iv) Reduction of pressure on land and energy resources. We asked the respondents whether they intended to apply any of these items during the past three months; eight items were derived from their responses and analyzed. Table 1 indicates the mean and Standard Deviation (SD) of the eight items used to measure the farmers' pro-environmental behavior. The mean value of all items was higher than average, with the scores ranging from 1: "I intended to apply, very low" to 5: "I intended to apply, very high". Among the items, "pests and disease management appropriate to drought condition and using organic inputs" had the highest mean score ($\bar{X}$= 4.06, SD= 0.73), while the item "grazing management to enhance sustained pasture" had the lowest mean value ($\bar{X}$= 2.96, SD= 1.23).

Sustainable Alternative Livelihoods

Table 2 indicates the mean and standard deviation of seven items used to measure sustainable alternative livelihoods. The mean value of all items is higher than average, with the scores ranging from 1-5. Among the items, "*Planting drought-resistant crops and varieties*" had the highest mean score ($\bar{X}$= 4.48, SD= 0.56), while the item "*Migration from rural areas to cities to find a new job*" had the lowest mean value ($\bar{X}$= 2.65, SD= 0.88).

Table 1. The mean value of farmers' pro-environmental behaviors.[a]

Items	Mean	SD
Pests and disease management appropriate to drought and using organic inputs	4.06	0.73
Conservation tillage	3.70	0.74
Increasing crop row spacing and reducing the grain density	3.63	0.98
Conservation agriculture	3.34	0.92
Utilizing low pressure water pipes	3.31	0.95
Providing agricultural equipment with less environmental pollution	3.10	0.87
Development of new irrigation systems, and salinity management	3.10	1.11
Grazing management to enhance sustained pasture	2.96	1.23

[a] Scale: I intended to apply; Very low= 1, Low=2, Medium=3, High= 4, Very high=5.

Table 2. The mean value of sustainable alternative livelihoods.[a]

Items	Mean	SD
Planting drought-resistant crops and varieties	4.48	0.56
Covering small home-based businesses	3.93	0.96
Supporting important regional handicrafts	3.86	0.96
Multiple-cropping and sequential cropping	3.63	0.91
Changing the status of on-farming activities to non-farming	3.43	1.14
Providing subsidies and loans to enhance entrepreneurship	3.23	1.11
Migration from rural areas to cities to find new job	2.65	0.88

[a] Scale: Very low= 1, Low=2, Medium=3, High= 4, Very high=5.

PLS-SEM Analysis

After evaluating the measurement model and structural model for each of the latent constructs of the research model separately, a model was developed in Smart-PLS 3.0 using the aggregation of all constructs, including the endogenous, exogenous, and indicators. The model was then assessed through a two-step process: (a) The measurement model was evaluated to assess the reliability and validity of the constructs, and (b) The structural model was evaluated to examine the significance of the path coefficients.

Measurement Model

First, confirmatory factor analysis was executed to examine the reliability, convergent validity, and discriminant validity of the constructs for achieving the optimum values of parameters. Smart-PLS estimated the construct loading, Average Variance Extracted (AVE), and Composite Reliability (CR). As revealed in Table 3, all construct factor loadings were higher than the benchmark value of 0.5. Table 3 shows the AVE values of all the constructs were higher than the required value of 0.5. CR values were higher than the cut-off value of 0.7 for all constructs.

Structural Model

The structural model was evaluated to assess the quality of the model and examine the research hypotheses through the process of bootstrapping using a two-tailed t-test with a 5% significance. The path coefficient was considered significant if the t-value was larger than 1.96 (Ringle *et al*., 2015). The results of the structural model are shown in Figure 3, along with the coefficients (β) of all the paths and their significance. All of the

Table 3. Results of measurement model based on confirmatory factor analysis.

Variables	Items	Loadings	t-Value	Sig	AVE[a]	CR[a]
Perceived vulnerability	Possible threat to food security	0.875	25.867	0.000	0.511	0.803
	Possible reduction in water quality and quantity	0.765	4.922	0.000		
	Possible changes in land usage	0.593	4.887	0.000		
	Possibility of livelihood vulnerability	0.585	5.529	0.000		
Perceived severity	Serious threat to food security	0.901	19.012	0.000	0.629	0.894
	Significant decrease in rainfall	0.810	7.843	0.000		
	Reduce access to surface and groundwater	0.782	6.001	0.000		
	Agricultural land use change	0.766	14.927	0.000		
	Damage to agricultural products	0.691	9.882	0.000		
Self- efficacy	Ability to implement best farm management	0.952	73.614	0.000	0.730	0.942
	Ability to store rainwater	0.863	14.438	0.000		
	Ability to use indigenous methods	0.858	25.133	0.000		
	Ability to replant	0.848	32.976	0.000		
	Financial ability	0.828	20.313	0.000		
	Social and local participation skills	0.765	17.584	0.000		
Response efficacy	Participating in extension training courses	0.879	40.066	0.000	0.631	0.895
	Planting drought-resistant alternative crops	0.826	26.000	0.000		
	Using indigenous methods	0.765	13.616	0.000		
	Improving the pattern of water consumption and other resources	0.755	12.890	0.000		
	Modification or sharing of damages	0.740	17.889	0.000		
Response costs	Limited access to credits and facilities	0.832	3.483	0.001	0.584	0.848
	Lack of access to early warning information system	0.812	3.294	0.001		
	Unfair distribution of water	0.756	4.104	0.000		
	Lack of access to equipment	0.642	3.666	0.000		
Pro-environmental behavior	Conservation of environmental habitats and biodiversity	0.803	7.621	0.000	0.536	0.821
	Protection of water and soil resources	0.797	18.704	0.000		
	Reduction of pressure on resources	0.659	6.118	0.000		
	Reduction of environment pollution	0.656	8.091	0.000		
Alternative crops	Saffron cultivation	0.899	38.644	0.000	0.690	0.869
	Cultivation of crops resistant to dehydration	0.867	31.659	0.000		
	Cultivation of greenhouse crops	0.715	7.095	0.000		
Alternative income sources	Rural handicraft development	0.853	25.288	0.000	0.619	0.828
	Rural tourism development	0.821	25.985	0.000		
	Expansion of conversion industries	0.676	9.486	0.000		

[a] AVE> 0.5, CR> 0.7.

path coefficients were statistically significant (Figure 3), and all of the hypotheses are supported (Table 4).

Considering farmers' pro-environmental behaviors, the highest positive relationship between self-efficacy and farmer's pro-environmental behavior was confirmed (β= 0.419; t= 4.397; P= 0.000); thus, H3 is supported. The positive relationships between perceived vulnerability and farmers pro-environmental behavior (β= 0.368; t=2.835; P= 0.005), and response efficacy and farmers pro-environmental behavior (β= 0.209; t=2.426; P= 0.015), were also confirmed; thus, H1 and H4, respectively, were supported. In addition, the negative relationships between

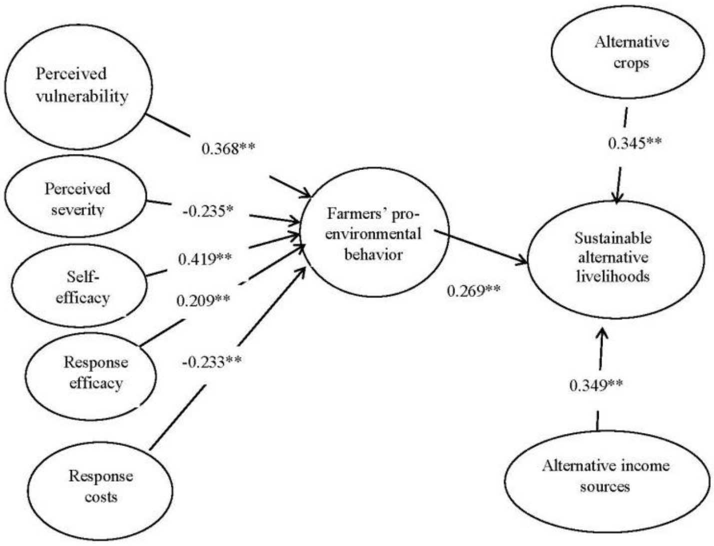

Figure 3. Structural model results for research framework (*** P< 0.001; ** P<0.01, * P< 0.05).

perceived severity and farmers pro-environmental behavior (β= -0.235; t= 2.404; P= 0.016), and response costs and farmers pro-environmental behavior (β= -0.233; t= 2.971; P= 0.003) were confirmed; thus, H2, and H5, respectively, were supported (Table 4). Moreover, R2 values were higher than 0.63, which indicates the models were good (Hair *et al*., 2011). Considering sustainable alternative livelihoods, Figure 3 also shows that the highest positive relationship between alternative crops and sustainable alternative livelihoods was confirmed (β= 0.349; t= 2.624; P= 0.009); thus, H7 was supported. Furthermore, the positive relationships between alternative income sources and sustainable alternative livelihoods (β= 0.345; t= 3.111; P= 0.002), and farmers pro-environmental behavior and sustainable alternative livelihoods (β= 0.218; t= 2.648; P= 0.008), were confirmed; thus, H8 and H6, respectively, were supported (Table 4). In addition, R^2 values were higher than 0.59, which indicates the models were good (Hair *et al*., 2011).

DISCUSSION

In this study, the PMT was first used to explain the farmer's pro-environmental behavior. Then, we applied our conceptualization of the PTM to explain the effects of pro-environmental behavior and, finally, we offered alternatives to achieve sustainable livelihood.

Discussion of Key Findings

First, the findings show that, in the farmers' opinion, *pests and disease management appropriate to drought conditions and using organic inputs*, and *conservation tillage* can lead to improved farmers' behavior under drought. They also thought *planting drought-resistant crops and varieties* and *using small home-based businesses as an income source* could improve a sustainable alternative livelihood in the Borkhar Region.

Secondly, the findings show that all five hypotheses were supported, with PMT variables accounting for 60% of the variance in farmers' pro-environmental behavior, and it is, therefore, suitable for investigating the underlying factors influencing pro-environmental behavior. Our results show that *self-efficacy*, *perceived vulnerability*, and *response efficacy* had significant positive effects on the farmers' pro-environmental behavior under drought.

Table 4. Hypothesis testing, relationships between constructs.

	Hypothesis	Coef (β)	SD	t-Value	P-Value	Decision	R^2
H1	Perceived vulnerability→Pro-environmental behavior	0.368	0.130	2.835	0.005	Supported	0.602
H2	Perceived severity→Pro-environmental behavior	-0.235	0.098	2.404	0.016	Supported	
H3	Self- efficacy→Pro-environmental behavior	0.419	0.095	4.397	0.000	Supported	
H4	Response efficacy→Pro-environmental behavior	0.209	0.086	2.426	0.015	Supported	
H5	Response costs→Pro-environmental behavior	-0.233	0.078	2.971	0.003	Supported	
H6	Pro-environmental behavior→Sustainable alternative livelihoods	0.218	0.082	2.648	0.008	Supported	0.758
H7	Alternative crops→Sustainable alternative livelihoods	0.345	0.111	3.111	0.002	Supported	
H8	Alternative income sources→Sustainable alternative livelihoods	0.349	0.133	2.624	0.009	Supported	

These findings are consonant with Neisi *et al*. (2020), Shafiei and Maleksaeidi (2020), Rainear and Christensen (2017), and Keshavarz and Karami (2016). Moreover, *self-efficacy* has the greatest direct role in explaining farmers' pro-environmental behavior. Based on the results, environmental *self-efficacy* is beliefs about the farmer's ability to successfully organize and perform an action. Also, based on confirmatory factor analysis, "ability to implement best practices to improve farm management" and "ability to collect and store rainwater" accrued the highest loadings and are the main indicators for explaining self-efficacy. Huang (2016) believed that environmental self-efficacy affects all types of environmental behavior; however, a higher level of self-efficacy, as a major determinant of intention, in environmental tasks indicates greater capabilities and confidence in performing tasks. Furthermore, the results revealed that *perceived vulnerability* significantly influenced farmers' pro-environmental behavior. Based on confirmatory factor analysis, "possible threat to food security" and "possible reduction in water quality and quantity" are the main indicators for explaining perceived vulnerability. Thus, understanding vulnerability to environmental issues raises farmers' awareness and attitudes toward prevention effects; therefore, when farmers' perceptions of vulnerability are very high, the likelihood of an adaptive response increases (Alam *et al*., 2016). Also, the study showed that *response efficacy* had a positive effect on the farmers' pro-environmental behavior and, based on confirmatory factor analysis, "participating in extension training courses to enhance knowledge and skills" and "planting drought-resistant and high-yielding alternative crops" are the main indicators for explaining response efficacy. It seems that when farmers evaluate the type of adaptive behavior and practices to deal with the threat, they can resist it without suffering damage (Bryan *et al*., 2019). Therefore, higher response efficacies increase the farmers' desire to adapt to drought. Our results also show that *perceived severity* and *response costs* have a significant negative influence on the farmers' pro-environmental behavior. This finding corresponds with Keshavarz and Karami (2016). However, it is not consonant with the findings by Neisi *et al*. (2020) who perceived severity and response costs had no significant direct effect in explaining farmers' behavior. Further, this finding is fairly consistent with the results of Rainear and Christensen (2017) who reported that only response cost was negatively associated with pro-environmental intentions. Following the negative effect of *perceived severity* on the farmers' pro-environmental behavior, confirmatory factor analysis showed that "limited access to credits and facilities" and "lack of access to early warning information system" are the main indicators for explaining perceived severity. Threat appraisal is based on weighing the benefits of not engaging in pro-environmental behavior under drought (Keshavarz and Karami, 2016). Thus, the greater the severity of the risk perceived by individuals, the more it reduces the likelihood of drought-coping behaviors. Also, the study showed that *response costs* have a negative effect on pro-environmental behavior. Based on confirmatory factor analysis, "serious threat to food security" and "significant decrease in rainfall" are the main indicators for explaining response costs. As indicated by Bryan *et al*. (2019), whenever response costs decreased, the higher perceived costs of pro-environmental practices reduce the probability of protective behavior. Therefore, when a farmer evaluates the implementation of an environmental behavior as laborious, expensive, unpleasant, and time-consuming, he will be reluctant to implement it.

The findings further show that *alternative crops* (Wei *et al*., 2017; Lei *et al*., 2016), *alternative income sources* (Roe *et al*., 2015; Ngugi and Nyariki, 2005), and *farmers pro-environmental behavior* have significant positive effects on sustainable alternative livelihoods. In this regard, the *alternative crops* and *alternative income sources* both play a greater direct role in explaining sustainable alternative livelihoods. Based on confirmatory factor analysis, "saffron cultivation" is the main indicator for explaining the alternative crops. Besides, "rural handicraft development" is the main indicator to explain alternative income sources. Modification of cultivation patterns and strategies are alternative adaptive measures that will reduce vulnerability in drought conditions.

Implications for Research

This study has several implications for the existing literature. Firstly, for the first time, we used PTM to investigate farmers' pro-environmental behaviors under drought in Borkhar Region. The results revealed that environmental self-efficacy, in particular, improving the farmer's abilities to implement best practices to promote farm management, and his abilities to collect and store rainwater are the best way to enhance environmental friendly behaviors to drought management among smallholder farmers. *Secondly*, we expanded the PTM with a holistic sustainable livelihood perspective to explain sustainable alternative livelihood under drought. Our results showed that "alternative crops" and "alternative income sources" both play an important role in achieving sustainable alternative livelihoods, with saffron cultivation and rural handicraft development being the two major indicators, respectively. In recent years, significant advances have been made in reforming the cultivation patterns of alternative crops (such as saffron) and supporting strategies to expand handicrafts (like woodcarving) in the Borkhar Region; but there is still a huge gap to achieve the ideal sustainable livelihoods.

Implication for Practice

From a practical perspective, this study might help local policymakers as well as extension and advisory service providers to target their planning and training strategies toward smallholder farmers. According to the results, environmental self-efficacy, in particular, improving farmer's "abilities to implement best practices to promote farm management" and "abilities to collect and store rainwater" are the best way to enhance environmentally friendly behaviors in drought management. In this regard, educational programs for farmers could be offered at the proper time and in an appropriate manner by local media, such as radio, TV, and newspaper. Also, by expanding use of mobile applications and ICT, training and educational programs about the best farming practices during preparation, planting, protecting, and harvesting drought-resistance crops such as saffron can be presented through popular social networks. This also applies to the introduction and implementation of appropriate ways to collect and store rainwater. Also, our results showed that "alternative crops" and "alternative income sources" both play an important role in achieving sustainable alternative livelihoods, with saffron cultivation and rural handicraft development being the two major indicators. In this regard, local officials can provide and allocate the needed equipment and facilities to exchange the current practices and crops with new effective ones. These supportive services could include various kinds of financial, equipment, marketing, legal services, and other incentives.

Limitation and Future Research

There were several limitations in this study. First, indicators were chosen or selected through a thorough review of literature and some indicators were omitted to reduce the complexity of the data collection and analyses, while it might be better to choose very broad concepts and indicators. Second, the size of the sample in this study was relatively small, which may affect the generalizability of the findings. Finally, we suggest future studies to investigate in more detail the role of saffron cultivation and rural handicraft as highly important indicators in sustainable alternative livelihoods under drought.

CONCLUSIONS

In this study, an expanded framework of Protection Motivation Theory (PMT), with a holistic sustainable livelihood perspective, was used to explain the farmers' pro-environmental behavior and subsequent sustainable alternative livelihood. This study showed that improving farmers' ability to implement best practices to promote farm management and to collect and store rainwater could be two effective concepts for educational programs that providers of training courses could implement to enhance farmers' self-efficacy. The findings further show that paying more attention to alternative crops and alternative income sources, especially saffron cultivation and rural handicraft, could be important to enhance a sustainable alternative livelihood under drought. Therefore, concentrating efforts and shifting the focus to these alternatives could lead to increased livelihood resilience for farmers in the long run. Also, this study suggested that the harmful consequences of droughts could be reduced significantly and farmers' environmental friendly behaviors could be improved by offering appropriate educational programs through local media and social networks. In addition, the study suggests that local officials provide and allocate needed equipment, facilities, and services in the form of financial, equipment, marketing, and legal services to make it possible to alternate the older practices and crops with more effective ones. Future research should investigate the effects of saffron cultivation and rural handicraft development on a sustainable alternative livelihood under drought in the Borkhar Region.

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گسترش نظریه انگیزش حفاظت :(PMT) بررسی رفتار طرفدار محیط زیست کشاورزان و تأثیر آنها در معیشت جایگزین پایدار در شرایط خشکسالی

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چکیده

هنگام بررسی معیشت جایگزین پایدار که رفتار حامی محیط زیست به عنوان یک عامل اصلی تعیین می شود، لازم است که بر ارتقای شیوه های مدیریت خشکسالی در میان کشاورزان خرده مالک تمرکز کنیم. بعلاوه، استفاده از جایگزین های معیشت محور به عنوان ابزاری برای تغییر رفتار بسیار مناسب است. از دیدگاه معیشتی پایدار جامع ، این گزینه ها ممکن است به دو دسته تقسیم شوند: اقدامات در مزرعه و فعالیت های خارج از مزرعه که آسیب پذیری را کاهش می دهد و سعی در تغییر محیط تحت خشکسالی دارد. بنابراین، در این مطالعه، هدف ما استفاده از نظریه انگیزش حفاظت (PMT) برای توضیح رفتار طرفدار محیط زیست کشاورزان است و متعاقباً ما از مفهوم PTM برای توضیح اثرات رفتار حامی محیط زیست و همچنین برخی جایگزین های دیگر جهت دستیابی به معیشت پایدار در منطقه برخوار–اصفهان در ایران، استفاده کردیم. جمعیت این مطالعه را کشاورزان خرده مالک روستایی تشکیل داده اند که بین سال های 2017–2019 و تحت خشکسالی محصولات زراعی و باغی تولید می کنند. نمونه مورد مطالعه شامل 293 کشاورز خرده مالک بود که از طریق نمونه گیری تصادفی طبقه ای انتخاب شده اند. برای جمع آوری داده ها از پرسشنامه استفاده شد و داده ها با استفاده از مدل معادلات ساختاری (SEM) مورد تجزیه و تحلیل قرار گرفت. یافته ها نشان می دهد که خودکارآمدی ، آسیب پذیری درک شده و اثربخشی پاسخ با رفتار طرفدار محیط زیست کشاورزان رابطه مثبت دارد. علاوه بر این، شدت درک شده و هزینه های پاسخ با رفتار طرفدار محیط زیست کشاورزان ارتباط منفی دارد. یافته ها بیشتر نشان می دهد که محصولات جایگزین و منابع درآمد جایگزین، پیش بینی کننده های اصلی دستیابی به معیشت جایگزین پایدار هستند. علاوه بر این، مشخص شد که کشت زعفران و صنایع دستی روستایی از شاخص های بسیار مهمی هستند که معیشت جایگزین پایدار را در شرایط خشکسالی تقویت می کنند. بنابراین، تمرکز تلاش ها و جلب توجه به این گزینه ها منجر به افزایش انعطاف پذیری معیشت کشاورزان در طولانی مدت می شود.