



Habitual food, energy, and water consumption behaviors among adults in the United States: Comparing models of values, norms, and identity

Kristin Floress^{a,*}, Rachael Shwom^b, Holly Caggiano^d, Jacob Slattery^c, Cara Cuite^b, Chelsea Schelly^c, Kathleen E. Halvorsen^{c,e}, William Lytle^c

^a USDA Forest Service Northern Research Station, 1033 University Place, Suite 360, Evanston, IL, United States

^b Department of Human Ecology, Rutgers University, 55 Dudley Road, New Brunswick, NJ, United States

^c Department of Social Sciences, 1400 Townsend Drive, Michigan Technological University, Houghton, MI, United States

^d Andlinger Center for Energy and the Environment, Princeton University, NJ, United States

^e Associate Vice President for Research Development Office, 1400 Townsend Drive, Michigan Technological University, Houghton, MI, United States

ARTICLE INFO

Keywords:

Pride
Moral obligation
Guilt
FEW nexus

ABSTRACT

Household consumption of food, energy, and water comprises a significant use of resources in the United States. National level authority-based policy tools and top-down systemic shifts have not been widely adopted, thus near-term changes in consumption are dependent upon the actions of individuals. However, typical policy tools intended to change voluntary behaviors rest on information provision, which has been shown to be largely ineffective in achieving necessary consumption shifts. Drawing from the values-beliefs-norms and values-identity-personal norms theories, we compare three models of values, norms, identities, and behaviors using data from a national survey of United States adults' habitual food, energy, and water-related household consumption behaviors. Validated scales for four values (biospheric, altruistic, egoistic, hedonic), environmental self-identity, and three types of personal norms are explored in three structural equation models to interrogate their relationships with each other and behaviors that cross environmental resource domains. We find evidence to support the values-identity-personal norms model in which biospheric values are positively related to environmental self-identity and personal norms, environmental self-identity is related to personal norms, and personal norms are positively and directly related to food, energy, and water behaviors. While norms have been explored across a number of environmental contexts, environmental self-identity may be an additional means of appealing to individuals to make voluntary shifts in consumption in the absence of larger, more systemic changes.

1. Introduction

As record-breaking heat waves, floods, droughts, and wildland fires destroy property, landscapes, and human lives [1] as a result of changing climate, the need to find solutions that effectively decrease greenhouse gas emissions has become urgent. Households in the United States (US) consume substantial food, energy, and water (FEW) resources when including both direct (e.g., energy and water for cooking food or doing laundry) and indirect (e.g., the land and water impacts from providing food or energy) resource uses [2]. These households have significant potential for increasing conservation actions that range in frequency, expense, duration, and magnitude of impact on resources and greenhouse gas emissions, with behaviors occurring more

frequently (e.g., daily) being more difficult to change [3] but also tending to co-occur they can become habitual [4,5]. There is a tendency, in the absence of laws and regulations to change behavior, to develop policy tools that decrease knowledge gaps around the impacts of individuals' behaviors. Ample evidence, however, shows that increasing environmental knowledge has not been effective enough to trigger substantial shifts in consumption behaviors (see [6] for a review). What models, then, are useful to consider when designing policy tools that can influence household consumption of FEW resources?

Recent research has applied the rich field of research on identity to environmental and conservation issues [7–9]. For everyday consumers, understanding the environmental impacts of consumption choices is immensely challenging. The environmental impacts of FEW

* Corresponding author at: USDA Forest Service Northern Research Station, 1033 University Place, Suite 360, Evanston, IL, United States.

E-mail address: kristin.m.floress@usda.gov (K. Floress).

consumption are varied and include air pollution, water pollution, land use change, biodiversity loss, and greenhouse gas emissions [2]. In addition, these multi-dimensional impacts of the production, use, and disposal of FEW resources are spread over temporal and spatial scales [10] that can be difficult for individuals to grasp and nearly impossible to account for in every day FEW consumption choices. Hence, even for behaviors where policy tools aimed at decreasing knowledge deficits might be impactful, it is not likely that they would be successful using a FEW framing. Social science research can inform effective suites of policy tools to shift consumption and conservation choices [3,6,11] and there is a need to determine the constructs that are most strongly related to habitual behaviors in the most parsimonious way.

Theories that have explored constructs related to pro-environmental behaviors include the Values-Beliefs-Norms theory (VBN) [12,13] and the Values-Environmental Self-Identity-Personal Norms theory [8,14]. They each have sought to explain a range of pro-environmental behaviors in both the public and private sphere including household [14] and workplace conservation [15] and multiple behaviors among university students [16]. Values, the exogenous variable in both models, have been used to explain engagement with pro-environmental behaviors across food, energy, and water domains [17]. Values are defined as “(a) concepts or beliefs, (b) about desirable end states or behaviors, (c) that transcend specific situations, (d) guide selection or evaluation of behavior and events, and (e) are ordered by relative importance” [18] (p. 551). Four types of values have been examined in VBN models: altruistic, biospheric, egoistic, and hedonic (e.g., [14,19]). Household conservation behaviors - particularly those requiring more time, effort, or money than baseline non-conservation behaviors - reflect altruistic [20] and biospheric values, as they account for benefits that are outside one’s own self-interest like a clean environment and working toward a peaceful, just world. Biospheric and altruistic values have been linked to a wide range of sustainable behaviors, including energy use and food selection [16]. On the other hand, those with stronger egoistic and hedonic values may engage in fewer conservation behaviors, as such values reflect prioritizing economic achievements and power (egoistic values) and pleasure (hedonic values) over care for others or the environment. Hedonic values that reflect one’s desire for ease and pleasure have more recently been incorporated into environmental behavior research [14,19].

The VBN theory posits that “values influence our worldview about the environment (general beliefs), which in turn influences our beliefs about the consequences of environmental change on things we value, which in turn influence our perceptions of our ability to reduce threats to things we value. This in turn influences our norms about taking action,” [21] (p. 356). Though the VBN has been found, as stated earlier, to be related to a number of pro-environmental behaviors, the VIP has been shown to be an effective and more parsimonious behavioral model that retains biospheric values but argues that these values influence environmental self-identity [14]. Identity has been defined as “a way of organizing information about the self,” [22] (p. 45). Because values are broad indicators of what is important to people, according to the VIP they directly influence “how people want to see themselves (i.e., their ideal selves)...as well as how they actually see themselves” ([9], p. 56); how people see themselves is self-identity [9]. There are multiple identity constructs (e.g., social identity, occupational identity, personal identity) but all are based on the premise that individuals are reflexive and categorize themselves in various ways [23]. These categorizations or identities have been found to be related to general environmental behaviors [24], environmental movement participation [25,26] as well as specific conservation behaviors like protecting water quality [27] and enrolling in smart energy programs at home [14]. Pichardo et al. [28] developed a single-item measure of general environmental self-identity that asked respondents to indicate whether they considered themselves to be environmentalists, finding that the single item predicted several private-sphere environmental behaviors. Specific self-identities, like whether or not individuals view themselves as being a

certain way (e.g., a recycler or green consumer), have been found to be related to those specific behaviors [29–31], but the VIP posits that general environmental self-identity (e.g., viewing oneself as being environmentally friendly) has utility for explaining a number of conservation behaviors as others [28] found.

Previous research suggests that environmental self-identity impacts conservation actions in the absence of external rewards, and this may reflect an intrinsic motivation to do so [8]. Intrinsic motivations may be based on feelings of moral obligation (or self-expectation as described in Schwartz’s seminal work on personal norm activation, [32]) rather than “enjoyment – based intrinsic motivation” (p. 1259) and thus are functionally equivalent to personal norms. The intensity of one’s “moral (personal) obligation” (p. 227 [32]) precedes altruistic actions and thus has a key role in environmental behavior decisions. Personal norms are defined as one’s expectations for their own behavior, in contrast to subjective social norms that are one’s estimation of how others expect them to act. The VIP measures personal norms with items assessing pride, guilt, and moral obligation; this is consistent with several decades of research stemming from the norm activation model [32] examining how pride and guilt result from acting (or not) in light of one’s moral obligations. Several studies testing the VIP have found a personal norm construct comprised of moral obligation, guilt, and pride to influence smart energy system use in the home [14], reducing energy use [9], intentions to use renewable energy and preferences for environmentally friendly products [8]. As with the VBN, these personal norms are the direct antecedent of behavior in the VIP.

Both the VIP and VBN have been applied more often to energy related conservation behaviors than those in other FEW domains. Multiple studies find that VBN successfully predicts energy behaviors including household energy use [33], intention to improve household energy efficiency [34], and participation in smart energy systems [14]. The VBN may better explain low-cost behaviors, such as reducing laundry loads, than those expensive to implement like purchasing a high-efficiency washer [13]. This may also hold true for the VIP. Both models are likely to have some utility when studying low-cost food-energy-water consumption behaviors undertaken by householders, though the most parsimonious model is desirable. Research comparing the VBN to VIP found both to similarly explain participation in energy conservation programs, but the VIP requires measuring fewer constructs [14].

In this paper, we compare a VIP model that incorporates the four value constructs previously included in VBN investigations to understand the utility of including the full set of values that have been related (positively or negatively) to pro-environmental behaviors (Fig. 1). We compare this model to a standard VIP model (that is, with only biospheric values included as an exogenous variable, see Fig. 1) and a third model that estimates direct effects of biospheric values on both environmental self-identity as well as personal norms, as recent research has indicated that biospheric values are directly related to downstream variables in the VBN [35].

We expect that all three models will have adequate model fit, but that the model with the four values will have better fit and explain more variance in environmental self-identity than the second model. We hypothesize that in the first model biospheric and altruistic values will be positively related to environmental self-identity, while egoistic and hedonic values will be negatively related. In all three models, we expect environmental self-identity to be positively related to personal norms and personal norms to be positively related to FEW behaviors. We also expect the third model to support a direct effect between biospheric values and personal norms.

Data from a nationally representative survey of 1219 respondents in the US were used to compare an extended VIP model that incorporated all four type of values found in previous studies of the VBN to a model of the VIP as proposed as well as a model estimating direct effects of values on personal norms (Fig. 1.) This survey was conducted as one component of a larger project that aims to document key environmental and

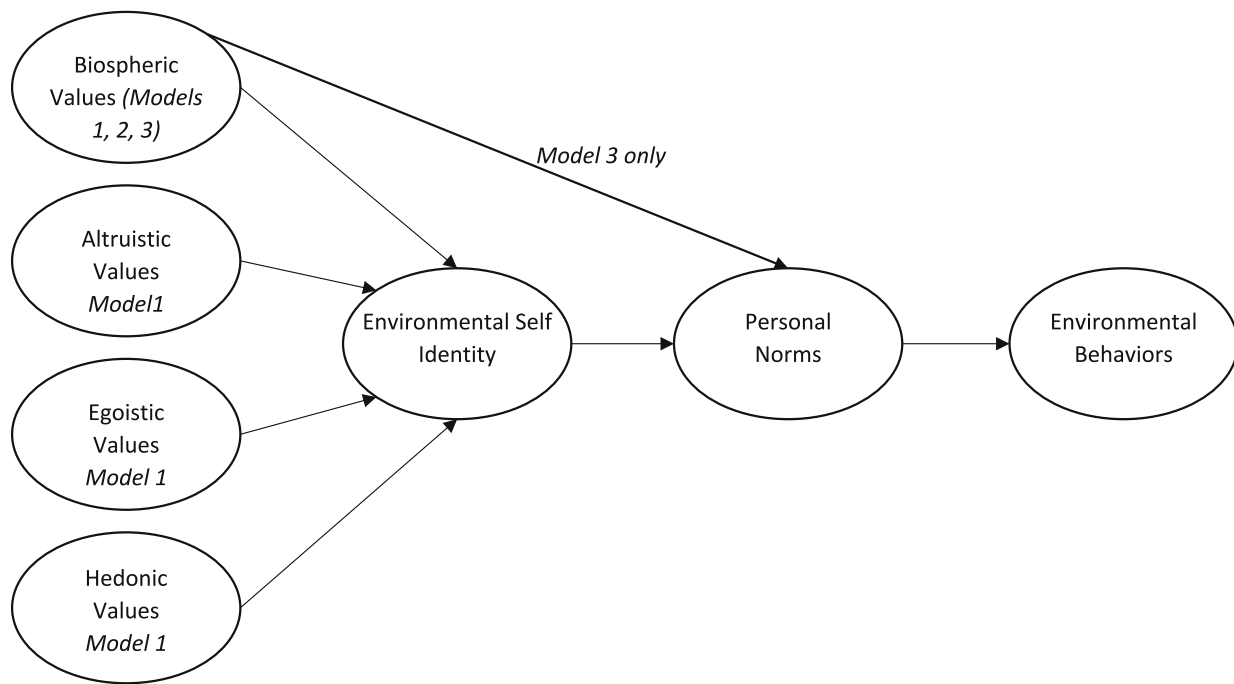


Fig. 1. Theoretical models to be tested.

climate impacts of household FEW consumption and explore opportunities and barriers to shifting consumption to mitigate these impacts, including testing how different forms of feedback about a variety of impacts may shift consumption. This larger project involves multiple iterative stages of data collection and analysis to examine the motivations and contexts shaping household consumption behaviors; the national survey data reported here were collected after a first stage of social science data collection via interviews [5] and before a third stage of social science data collection via an experimentally designed household consumption intervention study (see [2]). The national survey was designed with the intention to inform the in situ experimental household intervention study currently being conducted in approximately 200 US homes. Because of this, survey measures focused on factors hypothesized to significantly influence behaviors within the household experiment. The survey measured a number of different variables including those examined in the present study: values, environmental self-identity, and norms consistent with VBN and VIP theories. This investigation provides insight into these theoretical constructs in terms of what might be most useful to include in interventions tested in the household experiments as well as for policy design.

2. Methods

2.1. Participants and procedure

The target population in this study included adults 18 years or older living in the United States. Data were collected via an online questionnaire between July 12th and July 27th, 2019. Two thousand active panelists recruited by Ipsos, a market research firm, were invited to complete the survey and 1219 completed questionnaires resulting in a 61% response rate. Reminders were sent to non-respondents on survey fielding days three, seven, and eleven. The median length to complete the questionnaire was 18 min.

The survey was administered by Ipsos and participants consisted of their pre-recruited probability-based web panel. Ipsos constructs panels for a specific project both from existing panelists in their pool and by recruiting and enrolling new panelists; panelists receive incentives such as entries to win cash and prizes from sweepstakes and raffles. Ipsos

conducts ongoing recruitment to complement inactive panelist attrition [34,36,37]. Potential panelists are recruited to be representative of the US population [36]. Ipsos contacts potential panelists using known mailing addresses, telephone numbers, email addresses or face-to-face interactions. Participants complete demographic indicators and are subsequently enrolled as panelists who can be sampled for specific studies. To reduce sampling error and ensure sample representativeness, a simple random sampling approach is used to draw the sample to meet Current Population Survey (CPS) benchmarks. The demographics for this panel are based on CPS 2018 measures, and include age, race, gender, education, income, and geography designators. Panelists are selected for client surveys using the equal probability of selection method: a probability proportionate to size approach where all active panel members are assigned the same likelihood of selection [38].

1219 people responded to the survey and their characteristics can be found in Table 1. They ranged in age from 18 to 93 (mean = 51.501, standard deviation = 16.894), 648 were male and 571 were female. Of the 1153 individuals who indicated their political ideology, 400 were

Table 1
Participant Demographics.

	n	%
<i>Sex</i>		
Female	571	46.84
Male	648	53.16
<i>Political ideology</i>		
Extremely liberal	34	2.95
Liberal	157	13.62
Slightly liberal	95	8.24
Moderate	400	34.69
Slightly conservative	155	13.44
Conservative	252	21.86
Extremely conservative	60	5.20
<i>Race</i>		
White, non-Hispanic	839	68.83
Black, non-Hispanic	136	11.16
Other, non-Hispanic	61	5.00
Hispanic	147	12.06
2 + races, non-Hispanic	36	2.95

“middle of the road”, 467 were slightly conservative, conservative, or extremely conservative, and 286 were slightly liberal, liberal, or extremely liberal. The majority of respondents were white, non-Hispanic ($n = 839$, 68.83%), followed by black, non-Hispanic ($n = 136$, 11.16%), and Hispanic ($n = 146$, 12.06%). The remaining respondents were other, non-Hispanic ($n = 61$, 5.00%) or two or more races, non-Hispanic ($n = 36$, 2.95%). This distribution is close to the US population benchmarks. 1118 people responded fully to all questions included in SEMs.

2.2. Questionnaire development

2.2.1. Values

Sixteen statements together representing biospheric, altruistic, egoistic, and hedonic values were measured following earlier research [12,19] (Table 2.). Participants were asked, “How important are each of the following to your general goals in life?” Biospheric value items were: Respecting the earth: harmony with other species; Unity with nature: fitting into nature; Protecting the environment: preserving nature; and Preventing pollution: protecting natural resources. The four items measuring altruistic values were: Equality: equal opportunity for all; A world at peace: free of war and conflict; Social justice: correcting injustice, care for the weak; Helpful: working for the welfare of others. Egoistic values were measured with five items: Social power: control over others, dominance; Wealth: material possessions, money; Authority: the right to lead or command; Influential: having an impact on people and events; Ambitious: hardworking, aspiring. Three items measured hedonic values: Pleasure: joy, gratification of desires; Enjoying life: enjoying food, sex, leisure, etc.; Self-indulgent: doing pleasant things. Responses were measured on an 8-point scale where $-1 =$ *opposed to my values*, and $0 =$ *not at all important* to $6 =$ *extremely important*. Each type of value was included as a latent variable in modeling, and its corresponding statements were included as each type's observed indicators.

2.2.2. Environmental self-identity

We replicated the environmental self-identity measures from earlier VIP research [9,14]. The three identity items were: Acting environmentally friendly is part of who I am; I am the type of person who acts environmentally friendly; and I see myself as an environmentally friendly person. These items were measured on a 7-point agreement scale from 1 = strongly disagree to 7 = strongly agree.

2.2.3. Personal norms

Nine personal norm statements were measured based on [8,9,14]. Respondents were asked “How strongly do you agree or disagree with the following statements about food, energy, and water?” For each FEW resource, and following an individual's moral obligation not to waste (food, energy, or water), guilt for not taking action to reduce impacts related to (food, energy, water), and pride for not wasting (food, energy, water) were assessed on a 7-point agreement scale from 1 = *strongly disagree* to 7 = *strongly agree*. Three scales that exhibited high internal consistency were created for analysis for each of the three types of personal norms: moral obligation ($\alpha = 0.916$); guilt ($\alpha = 0.924$); and pride ($\alpha = 0.921$).

2.2.4. Self-reported habitual FEW behaviors

Six habitual behaviors across FEW domains that range in ease of implementation were assessed: reducing or eliminating dairy, reducing or eliminating meat, reducing household food waste, monitoring and limiting household hot water use, reducing number of laundry loads, and taking shorter or fewer showers. The self-reported FEW conservation behaviors were measured by first asking respondents if they currently engaged in eight different behaviors, where 0 = *no* and 1 = *yes*. A follow-up question for each behavior for which a respondent selected “yes” assessed the frequency of the behavior. Response options ranged from 1 = *very rarely* to 7 = *all the time*. For analysis, a single, eight-point

Table 2

Descriptive statistics and standardized loadings for observed indicators of values, identity, and norms.

Latent constructs	Observed indicator items	Item mean	Item SD	Loading
Biospheric Values*	B1. Respecting the earth; harmony with other species	3.98	1.75	0.87
	B2. Unity with nature: fitting into nature	3.42	1.90	0.81
	B3. Protecting the environment: preserving nature	4.10	1.73	0.86
	B4. Preventing pollution: protecting natural resources	4.03	1.69	0.86
Altruistic Values*	A1. Equality: equal opportunity for all	4.36	1.77	0.70
	A2. A world at peace: free of war and conflict	4.42	1.74	0.72
	A3. Social justice: correcting injustice, care for the weak	3.68	1.93	0.84
	A4. Helpful: working for the welfare of others	3.65	1.81	0.70
Egoistic Values*	E1. Social power: control over others, dominance	0.81	1.80	0.63
	E2. Wealth: material possessions, money	2.61	1.80	0.49
	E3. Authority: the right to lead or command	2.12	1.94	0.79
	E4. Influential: having an impact on people and events	2.89	1.90	0.62
	E5. Ambitious: hardworking, aspiring	4.25	1.61	0.41
Hedonic values*	H1. Pleasure: joy, gratification of desires	3.63	1.73	0.82
	H2. Enjoying life: enjoying food, sex, leisure, etc.	4.35	1.58	0.73
	H3. Self-indulgent: doing pleasant things	3.28	1.84	0.72
Environmental self-identity	ESI1. Acting environmentally friendly is part of who I am	4.54	1.72	0.90
	ESI2. I am the type of person who acts environmentally friendly	4.77	1.57	0.94
	ESI3. I see myself as an environmentally friendly person	4.84	1.55	0.93
Moral obligation PN**	I feel morally obligated to not waste food	4.97	1.77	
	I feel morally obligated to not waste water	4.79	1.82	
	I feel morally obligated to not waste energy	4.82	1.79	
	PN1. Scale mean and standard deviation	4.86	1.66	0.93
Guilt PN**	I would feel guilty if I did not take actions to reduce the environmental impacts of the food I buy	4.16	1.87	
	I would feel guilty if I did not conserve water	4.53	1.87	
	I would feel guilty if I did not take actions to reduce the environmental impacts of my energy use	4.45	1.87	
	PN2. Scale mean and standard deviation	4.38	1.74	0.90
Pride PN**	I would feel proud to not waste food and reduce impacts of the food I buy	5.10	1.69	
	I would feel proud to conserve and not waste water	5.19	1.70	
	I would feel proud to not waste energy and reduce impacts of the energy I use	5.11	1.67	
	PN3. Scale mean and standard deviation	5.13	1.57	0.89

*Responses ranged from -1 to 6 ; **Responses ranged from 1 to 7

variable for each of the eight behaviors was created where 0 = *never* and 7 = *all the time*.

2.3. Analysis

Three structural equation models were fitted to compare how well the theoretical models fit the data from this national sample, whether including all four types of values - rather than biospheric only - might be an improvement on the VIP theoretical model proposed and tested in earlier research, and whether the direct effects of biospheric values on personal norms may be important to consider.

The SEM modeling was conducted in Stata 16. For each of the three models, the measurement and structural models were simultaneously estimated and goodness-of-fit statistics obtained. Model fit was assessed using the following criteria [39]: a standardized root mean square residual (SRMR) < 0.09 in concert with either a comparative fit index (CFI) greater than 0.95 or a root mean square residual (RMSEA) < 0.06 (although 0.08 is considered a “stringent upper limit” [40]). All three goodness of fit measures are reported for each model along with the χ^2 results, which is often significant in SEMs (indicating there are differences between the implied and sample covariance matrices, [39,40]) and less informative than the other goodness-of-fit statistics.

3. Results

3.1. Description of observed indicators

We report in Table 2 the means, standard deviations, and factor loadings for the observed indicators of the values, identity, and norm latent constructs included in the models tested. The measurement model loadings for biospheric values items ranged from 0.81 to 0.87, for altruistic they ranged from 0.70 to 0.84, and for hedonic they ranged from 0.72 to 0.82. The egoistic values items had a much broader range, with two items, wealth and ambition, falling below 0.5. These two items were, however, still significant at $p < 0.01$. The environmental self-identity loadings ranged from 0.9 to 0.94, and the personal norm observed indicators ranged from 0.89 to 0.93. As explained in the methods section, the personal norms items that were nearly identical except for the FEW domain were included as index indicators of norms. For these, the index statistics as well as the items for each index are included.

The FEW behavior observed indicators for reducing/eliminating dairy and reducing/eliminating meat were less strongly related to the overall construct with loadings of 0.33 and 0.39, respectively, than the other behavior items (Table 3). Monitoring/limiting hot water use, reducing laundry loads, and taking fewer/shorter showers were more strongly related with loadings of 0.67, 0.67, and 0.62, respectively.

3.2. Model comparisons

The full model (see Fig. 1) including four types of values from VBN and earlier research as well as the VIP constructs converged after six iterations. The SRMR for the full model was 0.202, RMSEA was 0.09 and CFI was 0.85 (Table 4), indicating the theoretical model does not fit these data well. The χ^2 , while a less informative statistic, was significant

Table 3
Descriptive statistics and standardized loadings for FEW behaviors

	mean	standard deviation	Loading
FEW1. Reduce/eliminate dairy	1.251	2.366	0.33
FEW2. Reduce/eliminate meat	1.266	2.276	0.39
FEW3. Reduce food waste	3.876	2.731	0.57
FEW4. Monitor/limit hot water use	2.221	2.766	0.67
FEW5. Reduce laundry loads	2.710	2.859	0.67
FEW6. Take fewer/shorter showers	2.505	2.839	0.62

Table 4

Structural equation model comparisons

		Model 1*	Model 2	Model 3
ESI ←	Biospheric	0.77***	0.77***	0.77***
ESI ←	Altruistic	0.05		
ESI ←	Egoistic	0.02		
ESI ←	Hedonic	−0.12***		
PN ←	Biospheric	–	–	0.53***
PN ←	ESI	0.71***	0.71***	0.28***
FEW ←	PN	0.65***	0.64***	0.64***
Behaviors				
RMSEA		0.09	0.07	0.06
CFI		0.85	0.95	0.97
SRMR		0.20	0.08	0.05
χ^2		3112.18 ($p < 0.01$)	725.56 ($p < 0.01$)	540.76 ($p < 0.01$)

($\chi^2 = 2937.36$, $p < 0.01$). While individual parameter results should be cautiously interpreted due to the poor fit of the overall model, it is worth noting that the direction of the relationship between hedonic values and environmental self-identity was negative as expected.

The model testing only the VIP theory better fit the data than the full VBN-VIP model, and fit was acceptable (SRMR = 0.08, CFI = 0.95, RMSEA = 0.07; $\chi^2 = 725.56$, $p < 0.01$; see Table 4). To explore the relationships between biospheric values, environmental self-identity, and norms we tested a final model estimating the direct effect of biospheric values on norms as well as indirectly through environmental self-identity (Fig. 2). Overall fit for this model including direct effects of values on norms was superior (SRMR = 0.05, CFI = 0.97, RMSEA = 0.06; $\chi^2 = 540.75$, $p < 0.01$; see Fig. 2) to both the VBN-VIP and the VIP models with only direct effects from environmental self-identity on personal norms estimated. Exploring the parameter results in the third model, biospheric values are positively associated with environmental self-identity ($\beta = 50.63$, $p < 0.01$) and personal norms ($\beta = 14.96$, $p < 0.01$), and the magnitude of the relationship is rather strong ($\beta = 0.76$ and 0.53, respectively). Further, environmental self-identity has a moderate, positive relationship with personal norms ($\beta = 7.66$, $p < 0.01$; $\beta = 0.28$) and personal norms have a strong, positive relationship with FEW behaviors ($\beta = 26.66$, $p < 0.01$; $\beta = 0.64$). The variance in FEW behaviors explained by this model is 41%.

4. Discussion

We were interested in understanding the utility of simple models that could impact habitual behaviors that cross FEW domains in US households. Recent theoretical and measurement developments around environmental self-identity (e.g., [14,26]) have provided a useful avenue to explore new models of environmental behavior, especially for those behaviors that are altruistic in nature and accrue benefits to entities other than the individual engaging in the actions. In this research, we confirmed that the VIP is a useful model for investigating habitual FEW behaviors that take place in households in the US. The three identity items included in our survey were excellent indicators of environmental self-identity as proposed and tested in earlier studies of energy behaviors. Likewise, moral obligation, pride, and guilt were strong indicators of latent personal norms. With regard to the habitual FEW behaviors latent variable, the food consumption related items (reducing/eliminating dairy, reducing/eliminating meat) were sufficient indicators but not as strong as the four energy/water indicators. Recent research finds engaging in other pro-environmental behaviors and being motivated to protect animals predicted short-term adherence to plant-based diets, but intentions to continue this pattern of eating was lower in those who did not have close others (friends/family) who also ate plant-based [41]. Although the study reported in [41] did not directly ask if individuals adopted plant-based diets because of environmental reasons (only social, taste, animal welfare, and health motivations, expecting environmental reasons to be captured by other

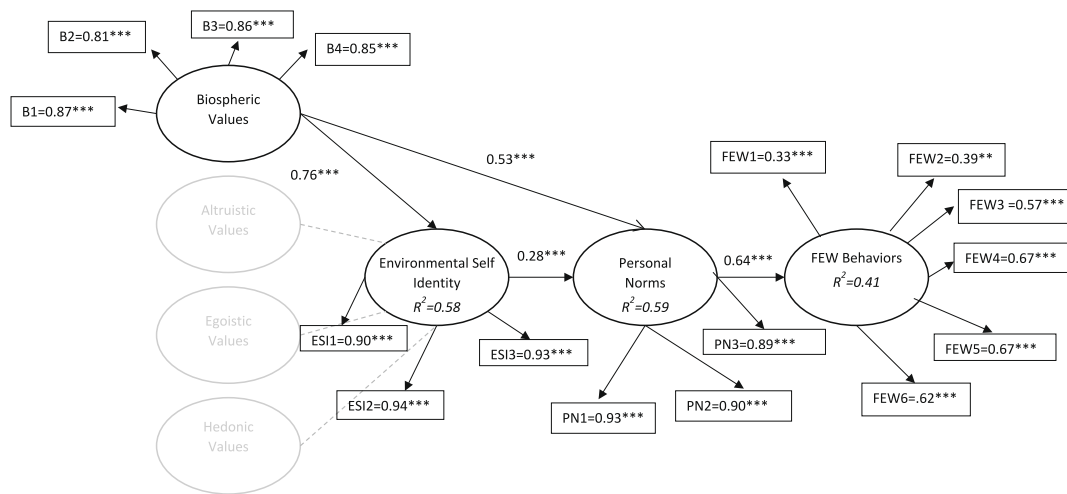


Fig. 2. Final model, coefficients, and loadings.

variables), it is worth considering that more restrictive (e.g., vegan) food consumption choices may be further down a behavior change pathway. Others have found environmental reasons to be primary (e.g., [42]) and secondary (e.g., [43]) motivations for plant-based diets. Research often examines only one domain of behaviors (food, energy, or water rather than behaviors that affect more than one domain or environmental behaviors across a number of domains other than FEW), but there is evidence that people engage in sets of behaviors that are habitual [4,5] and our results suggest that biospheric values, environmental self-identity, and personal norms are related to the set of routinized behaviors we studied even though dietary changes as they relate to environmental protection may be a positive spillover from other environmental behaviors. It may also be that individuals experience behavioral permitting in the form of moral licensing, where those who have engaged in some environmental behaviors may feel as though they deserve to engage in other, potentially damaging, behaviors [44]. There may also be patterns future research can identify by exploring how specific motivations for different behaviors are related to VIP variables, which would help determine if further modifications to the theory are needed, or if the theory adequately explains some but not all environmentally friendly behaviors.

Our expectation that the model including all four types of values from previous VBN research would fit as well or better than the other models tested did not hold true with these data. The fit of our first model was poor and the second model (of the most simple and parsimonious VIP) fit quite a bit better than the first. However, the third model estimating direct effects between biospheric values and personal norms based upon recent research [35] improved somewhat upon the second model that did not estimate this relationship. This third model was the best fitting of the three and explains 41% of the variance in FEW behaviors and an additional 9% of the variance in personal norms compared to the second model, suggesting these direct effects may be important to consider in future investigations of the VIP. We also believe that hedonic values, which were not included in our final model (nor in the original VIP investigations) may have more potential for understanding environmental behaviors and is deserving of further investigation. The VIP has primarily been applied in the Netherlands, thus examining it in other cultural contexts is needed to understand how well it represents other populations.

Some widely studied models of behavior stress the importance of behavior-specific measurement of attitudes and norms in order to predict specific behaviors. The VIP model was developed specifically to understand general constructs that could predict a broad swath of environmental behaviors, and our research also found that biospheric values, environmental self-identity, and personal norms are positively

related to habitual FEW behaviors. Voluntary policy tools, which are primarily relied upon without top-down mandates, in the form of social marketing and other symbolic campaigns, may be motivating for individuals who view themselves as environmentally friendly by activating personal norms related to feeling obligated to act. A comparison between actual and self-reported habitual behaviors will be useful, both in the ongoing experimental research of which this study is a part and in that conducted by others, especially if testing interventions like the suggested policy tools.

Policy tools for those who may not view themselves as environmentally friendly have often relied upon financial incentives to support behavior changes but these may have the opposite effect on those not already engaged [45]. Incentives also assume a rational actor is carefully considering all choices; other options requiring no decision like automatic opt-ins requiring consumers to opt out can also be used [46] for intermittent behaviors like summer energy conservation program enrollment. Further, those designing all types of FEW policy tools can consider incorporating commitments into policy delivery [47] and can potentially serve to increase one's environmental self-identity. However, it may be that the VIP is a useful theory to use when communicating with those who are already, in their own estimation, environmentally friendly.

The FEW nexus involves complex interactions across multiple scales with embedded and indirect impacts. Our study of US adults reveals that the VIP constructs are important for understanding habitual household behaviors that affect these domains.

Funding

This material is based upon work supported by the National Science Foundation under Grant No. 1639342 and the USDA Forest Service Northern Research Station. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation or the United States Department of Agriculture.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The authors would like to thank the FEWCON research team for their

input on survey items and Sonya Sachdeva and Robert Haight for their reviews of an earlier draft of this paper. We also wish to thank four anonymous reviewers for their invaluable feedback on earlier drafts of this manuscript.

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