Article

Ecological Identity: The Development and Assessment of a Measurement Scale

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Abstract

Social scientists have increasingly turned their attention to the conceptualization and measurement of different facets of the self to better understand public concern for the environment. Despite significant progress in this area, theoretical and methodological issues remain that could impede further progress. This article addresses several of these issues by providing a conceptual framework that integrates key features from two major theories used to understand self-environment relations. The framework is then utilized within a multimethod research design that emphasized theoretical and methodological correspondence and precision to develop and assess a measure of ecological identity. The results provide solid evidence of the reliability and validity of the Ecological Identity Scale and the utility of the conceptual framework designed to support it. Furthermore, the findings demonstrate that ecological identity influences a wide range of environmental behaviors both directly and indirectly via worldviews and social values. Recommendations for future research are offered.

Keywords

environmental identity, Social Identity Theory, Identity Theory, reliability and validity, values, worldviews, pro-environmental behavior

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Research on public concern for the environment and its relation to behavior has a long and rich history within the social sciences. Through the years, researchers have operationalized and tested a host of theoretical constructs such as worldviews, values, beliefs, attitudes, and norms to understand and predict individual actions and public support for efforts designed to protect the environment. Increasingly, attention has been turned to the conceptualization and measurement of different facets of the self in relation to nature and the biophysical environment. This represents an important development because people are more vested in issues and events that implicate the self (Devine-Wright & Clayton, 2010). Consequently, reliable and valid measurement of self-environment relations can provide significant insight into the social and psychological drivers of environmental problems and solutions.

A number of measures designed to tap self-environment relations have been created, some grounded in theories of the self-concept and interpersonal relationships, and others in theories of identity. For instance, Schultz (2002) drew upon research on self-schemas (Aron, Aron, Tudor, & Nelson, 1991; Markus, 1977) to conceptualize the self as a compilation of hierarchical cognitive representations (or schemas), of one's thoughts about him or herself and others. Using this view of the self, he describes "connectedness to nature" as " . . . the extent to which an individual includes nature within his/her cognitive representation of self," which is presumed to form the basis for subsequent affective and behavioral inclusion of nature in the self-concept (Schultz, 2002, p. 67). In addition to Schultz's Inclusion of Nature in Self (INS) scale, researchers have drawn upon similar theoretical and conceptual foundations to develop measures of connectedness to nature (Mayer & Frantz, 2004), connectivity with nature (Dutcher, Finley, Luloff, & Johnson, 2007), nature relatedness (Nisbett, Zelenski, & Murphy, 2009), commitment to nature (Davis, Le, & Coy, 2011), emotional affinity with nature (Kals, Schumacher, & Montada, 1999), and disposition to connect with nature (Brugger, Kaiser, & Roczen, 2011).

In contrast to the notion of connectedness, identity is often used to refer to meanings attached to the self that locate and embed individuals within webs of social relationships based on shared personal characteristics, roles, and group memberships (Burke, 2003; Stryker, 2008). Much identity research also presumes that people hold multiple identities that are more or less central to the broader self-concept (Brenner, Serpe, & Stryker, 2014; Carter, 2015; Oakes, 1987; Stets & Burke, 2000). Identities that are more central to the self have a greater propensity for being activated and have been shown to exert greater influence on behavior and cognition than identities that are more peripheral.

To be sure, however, connectedness and identity are often used in similar ways to capture related phenomena (cf. Stryker & Serpe, 1994; Tam, 2013), and what distinguishes them from each other is open to debate. For now, within the context of self-environment relations, we will conceptualize identity as relatively stable socially embedded meaning attached to the self that position individuals within a web of socioecological relationships, based on shared personal characteristics, roles, and group memberships. In contrast, we will conceptualize connectedness to nature as a cognitive, affective, and behavioral experience of nature that is less rooted in social relations and henceforth more contextually and situationally variable than identity. Both, however, may be viewed as components of the overall self-concept and appear to be important for understanding self-environment relations.

Our focus in this article, however, is on identity because " . . . one finds multiple, competing, and typically ambiguous meanings of environmental identity in the literature" (Dunlap & McCright, 2008, p. 1045), and it is unclear what counts as an environmental identity (Devine-Wright & Clayton, 2010). Furthermore, Fishbein and Ajzen (2010) have pointed out that measures of identity often lack construct validity as they " . . . do not really address a person's identification with a social group or with a social role" (p. 293), and instead measure attitudes, norms, or past behavior. Similar issues plagued the development of environmental concern measures (Dunlap & Jones, 2002), and we believe that efforts to integrate key aspects of multiple identity theories to develop a measure with increased theoretical and methodological correspondence and precision will help avoid these pitfalls in research on self-environment relations.

Toward this end, we develop and assess the Ecological Identity Scale (EIS). We ground the scale in key features of both Identity Theory (Burke & Stets, 2009; McCall & Simmons, 1978; Stryker, 1980) and Social Identity Theory (Tajfel, 1981; Tajfel & Turner, 1979), and we place strong emphasis on reliability and validity using a three-stage mixed-methods design that includes focus groups, an a priori power analysis, and a web-based survey.

Literature Review

The theoretical richness of the construct of identity has allowed researchers to investigate multiple aspects of self-environment relations, and increasingly, social scientists are working to integrate the various streams of this research into more comprehensive and coherent frameworks (see Deaux & Burke, 2010; Schwartz, Luyckx, & Vignoles, 2011). However, this same richness has led to variations in its conceptualization and measurement across a number of identity literatures (Clayton, 2012; Devine-Wright & Clayton,

2010). It is often overlooked that the existing measures of environmental identity have been grounded in theories that focus on different aspects of identity and consequently vary in their comprehensiveness and measurement specificity. Recent interest in integrating identity research has prompted some to classify research according to the assumed bases of identities (e.g., group-based, role-based, personal characteristic–based), whether the theory focuses on the content of identities (i.e., meanings associated with them), or the internal processes and structure of identities (i.e., activation, verification, and centrality of them). Drawing upon these classifications (i.e., bases, content, internal processes, and structure), we review a variety of existing environmental identity measures.

Beginning with several measures intended to cover a limited domain of identity content, Dunlap and McCright (2008) operationalized a single-item measure of identification with the environmental movement (group-based identity). They found it related to engagement in a number of pro-environmental behaviors, membership in an environmental organization, and positive evaluations of the environmental movement. The authors grounded their work in social movement theories of identity (Jasper, 1997) and, in their own words, offer a " . . . modest contribution" to overcoming the conceptual ambiguity characteristic of the use of identity in the environmental literature (Dunlap & McCright, 2008, p. 1046).

In other research, Kiesling and Manning (2010) developed a 16-item Environmental Gardening Identity Scale to assess the degree to which an individual's sense of self is associated with nature through direct experiences with gardening. The scale is focused on the content of a gardening identity, and it is grounded in theories focused on personal-, role-, and group-based identification. Although the scale was found to be reliable ($\alpha = .81$), the authors point out that it did not offer improved explanatory power over Clayton's (2003) more comprehensive measure of environmental identity (discussed below).

Researchers have also examined identification with a specific place (Korpela, Ylén, Tyrväinen, & Silvennoinen, 2009; Scanell & Gifford, 2010; Uzzell, Pol, & Badenas, 2002; Vaske & Korbin, 2001). According to Hernandez, Martin, Ruiz, and del Carmen Hidalgo (2010), place identity refers to " . . . a conception of the self that has been constructed on the basis of the place to which individuals belong" (p. 281). From this definition, it is easy to see how place and environmental identity may overlap, and researchers have found that identification with a specific place can influence a number of pro-environmental behaviors and practices such as participation in and support for conservation programs (see Devine-Wright & Clayton, 2010).

Other studies have integrated measures of environmental identity with Fishbein and Ajzen's (2010) Reasoned Action Approach to predict specific pro-environmental behaviors such as recycling and green consumption (Hinds & Sparks, 2008; Nigbur, Lyons, & Uzzell, 2010; Terry, Hogg, & White, 1999; van der Werff, Steg, & Keizer, 2013). For example, Whitmarsh and O'Neill (2010) included two identity measures (i.e., a one-item measure of Carbon Offsetting Identity and a four-item measure of General Environmental Self-Identity) with the main components of the Theory of Reasoned Action and found that they improved its ability to predict intentions to participate in carbon offsetting programs. Ostensibly, the measures used in these studies are grounded in Identity Theory (Burke & Stets, 2009; McCall & Simmons, 1978; Stryker, 1980), which typically focuses on role-based identities. However, the extent to which this and other studies of this type embed their measures in the theory is debatable. For instance, we argue that two of the items used by Whitmarsh and O'Neill (2010) to measure environmental self-identity measure something more akin to a norm (i.e., "I would not want my family and friends to think of me as someone who is concerned about environmental issues" and "I would be embarrassed to be seen as having an environmentally friendly lifestyle"). Furthermore, we find no evidence that any of the studies cited above attempted to measure the relative centrality of the identity (i.e., the propensity for the identity to be activated), which is a fundamental feature of Identity Theory.

Beyond the less comprehensive measures such as those reviewed above, there have been two efforts to draw more deeply and systematically from particular theoretical perspectives to develop a more conceptually comprehensive measure able to be used across a variety of settings and behaviors. Stets and Biga's (2003) measure of environment identity is built upon Identity Theory (Burke & Stets, 2009; McCall & Simmons, 1978; Stryker, 1980), but although Identity Theory has traditionally focused on role-based identities, the authors conceptualize their construct as a personal identity. Similar to other theorists in this tradition, however, Stets and Biga assume that identities are rooted in social relationships and social structure. They examined both the content of the personal environment identity, and the self-regulating feedback process and relative centrality of the environment identity by measuring its prominence, salience, and commitment (discussed in the "Theory and Hypotheses" section).

Drawing upon research into anthropocentric and eco-centric attitudes (Brown, 1992; Thompson & Barton, 1994), Stets and Biga (2003) created an 11-item measure designed to assess the extent to which the general personal attributes people attach to themselves (i.e., personal identity content) reflect a self that is nonexploitative/supportive of the environment or exploitive/non-supportive of it. They also use a single item to measure personal environment

identity prominence, a three-item measure of its salience, and a four-item measure of commitment to the identity. Based on survey data obtained from undergraduate students ($N = 437$), they found weak-to-strong (.17-.59) bivariate relationships between these measures of personal environment identity and ecological worldview, and moderate-to-strong (.33-.59) relationships between them and pro-environmental behavior.

Clayton (2003) also developed a conceptually comprehensive measure of environmental identity. Her 24-item scale was designed to measure " . . . the extent to which the natural environment plays an important part in a person's self-definition" (Clayton, 2003, p. 52). The scale was " . . . based in part on discussions of the factors that determine a collective social identity . . .," and the items in the scale assess perceived shared-group membership with nature and specific content related to a person's individual experiences with nature and self-knowledge gained in an environmental context (Clayton, 2003, p. 52). Specifically, the scale taps into the extent and importance of one's interactions with nature, the way in which nature contributes to the collectivities with which one identifies, one's level of support for environmental education and a sustainable lifestyle, the enjoyment one obtains in nature, and one's memories of interacting with nature.

Clayton (2003) found moderate-to-strong (.37-.79) relationships between her scale and measures of eco-centric attitudes, universalist social values, collectivist worldview, and pro-environmental behavior. Several studies have reported that the scale is internally consistent (Clayton, 2012; Davis et al., 2011; Kiesling & Manning, 2010). Using data obtained from a sample of Spanish university students, Olivos and Aragones (2011) conducted a principal components analysis (PCA) and found that the scale contained five factors (or subscales) that explained 55.6% of the total variance across the items. They labeled the first factor "environmental identity" (five items = 32.8% of variance), the second factor "enjoying nature" (six items = 7.2% of variance), the third factor "appreciation of nature" (five items = 5.6% of variance), the fourth factor was not labeled (one item = 5.4% of variance), and the fifth factor "environmentalism" (seven items = 4.6% of variance). They reported moderate-to-strong correlations (.28-.69) between each of the subscales and measures of connectedness to nature, a measure of eco-centric beliefs, and pro-environmental behavior.

The environmental identity measures developed in the last few years often focus on different theoretical aspects of identity, and vary in their conceptual comprehensiveness and measurement specificity. For instance, while a relatively large number of measures have been created to cover limited domains of identity content, only two comprehensive measures have been developed. Of the two comprehensive measures, one is focused on the *personal bases* of

environmental identity and measures socially derived general personal attributes attached to the self (i.e., Stets & Biga, 2003), whereas the other is focused on beliefs about shared-group membership with nature and the direct individual experiences one has with it (i.e., Clayton, 2003).

It is also important to note that the existing measures of environmental identity are focused exclusively on identification *with* nature and *like others*, and fail to acknowledge that identities are also a product of differentiation *from unlike others*. This is surprising because identity theorists have long acknowledged that identities are built-up, in part by efforts to draw contrasts and distinctions between self/other and in-groups/out-groups (Bourdieu, 1984; McCall, 2003; Spiers, 2011). We believe it is important to understand the role differentiation plays in defining and maintaining an environmental identity because of its link to the intergroup dynamics and expressions of power, prejudice, discrimination, and control (Weigert, 2010) that are often associated with conflicts over environmental regulation, management, and policy.

We also raise two methodological issues regarding past research in this area. First, the selection of items used to measure environmental identity has been almost exclusively based on face validity and the researchers' knowledge or intuition of the content area. Such an approach calls into question the content validity of these measures (see Raykov & Marcoulides, 2011).[1] Researchers could increase the content validity of their measures by systematically consulting with people whose everyday experiences provide insights about what it actually means to identify with nature and the environment. The views of these "insiders" could help identify the major features and conceptual boundaries of environmental identity and aid in the initial construction and selection of survey items.

The second methodological issue we raise is that researchers have typically not assessed the statistical power and precision of the inferential tests employed when attempting to validate environmental identity scales. This is an important consideration because when using null-hypothesis significance testing, the probability of committing both *Type I* and *Type II* errors is dependent upon the population effect size (unknown), significance level (conventionally $\alpha = .05$), statistical power ($1 - \beta$), and sample size (N). The relatively large sample sizes typically used (in statistical terms) raise the possibility that overly powerful tests have produced misleading p values and inaccurate conclusions about the relationships being assessed (see Cohen, 1988). This in turn may lead to misleading comparisons across studies and inhibit the accumulation of knowledge. Careful attention to statistical power seems especially important when developing new scales. Researchers could address this by conducting a priori power analyses prior to statistical testing. We believe

that development of a new comprehensive measure of identification with nature and the environment that places greater emphasis on theoretical and methodological integration, correspondence, and precision will provide an even richer and more in-depth picture of self-environment relations.

Theory and Hypotheses

Efforts to integrate the various streams of identity research into more comprehensive theoretical frameworks are especially apparent in studies that draw upon Identity Theory and Social Identity Theory. Identity Theory has traditionally focused on the role bases of identities (and more recently personal bases). Roles can be conceptualized as relatively general sets of behavioral expectations tied to webs of complimentary relationships (cf. Biddle, 1986). Individuals are believed to "take on" a role within the group and incorporate the meanings and expectations associated with it into the self-concept (Burke & Tully, 1977; Thoits & Virshup, 1997). In this way, role-based identities provide a sense of individuality that links individuals to groups (Stryker, 2008), which are seen as sets of " . . . interrelated individuals, each of whom performs unique but integrated activities, sees things from his or her own perspective, and negotiates the terms of interaction" (Stets & Burke, 2000, p. 228). Recently, some have conceptualized personal identities as general characteristics and attributes tied to the individual (rather than roles) that operate across various roles and situations (Stets & Biga, 2003).

Researchers within this tradition have also examined the relative centrality of a given identity by evaluating its prominence, commitment, and salience (Carter, 2015; Stets & Biga, 2003). *Prominence* refers to the subjective evaluation and importance of an identity relative to other identities within the self-concept and reflects the ideal self (Brenner et al., 2014). *Commitment* to an identity involves an interactional component that refers to the sheer number of relationships one has that invoke a given identity and an affective component that refers to the perceived importance of those relationships (Stets & Biga, 2003). *Salience* refers to the individual's propensity to define situations in ways that provide opportunities to perform a given identity resulting in a readiness to play it out (Stryker & Serpe, 1994).

In contrast to Identity Theory, Social Identity Theory is focused on how perceived shared-group or categorical membership define one in terms of various characteristics that distinguish in-groups from out-groups. Belief in shared membership is seen as the most basic element of a social identity (Ashmore, Deaux, & McLaughlin-Vlope, 2004), and once the self is categorized within a group, individuals begin to "act as embodiments of the relevant in-group prototype rather than as unique individuals"; analytically, this

implies "a contextual change in the level of identity (from unique individual to group member)" (Hogg, Terry, & White, 1995, p. 261). Furthermore, once the individual assesses himself or herself as being typical of the group prototype, he or she actively seeks differentiation from out-groups, which produces a sense of commonality with fellow group members and positive evaluations of their beliefs and practices (Tajfel & Turner, 1986).[2]

We propose integrating the theoretical features detailed above to develop an Ecological Identity Scale (EIS) that taps both the personal and role-based meanings attached to the self via a recognized interrelatedness with nature and the environment (i.e., Identity Theory), and the group-based attributes, commonalities, and positive evaluations attached to the self via belief in shared-group membership with environmentalists, nature, and ecological systems (i.e., Social Identity Theory). Drawing upon Social Identity Theory, we propose that ecological identification emerges and develops not only from identification with pro-ecological others but also from differentiation from perceived anti-ecological personal attributes, roles, and groups. Drawing upon Identity Theory, we propose that individuals have multiple identities that are more or less central to the overall self-concept based on their relative prominence, commitment, and salience.

The self-meanings to be measured by the EIS are thus reflective of a process that positions individuals within a structure of socioecological relations that reflect greater or lesser *sameness, difference*, and *centrality*. We assume that sameness on the personal and role-based level involves the degree to which a person has internalized personal attributes and role expectations that acknowledge an interrelatedness with nature and the environment (cf. Weigert, 1997). Group-based sameness involves the extent an individual has a sense of shared-group membership with environmentalists, nature, and ecological systems. Differentiation on the personal- and role-based level involves the degree to which internalized pro-ecological roles and personal attributes are reinforced through the stigmatization of personal attributes and roles viewed as anti-ecological. Group-based differentiation is reflected in the degree to which shared-group membership with environmentalists, nature, and ecological systems is reinforced through stigmatization of groups whose beliefs and practices are viewed as anti-ecological. Finally, we assume that the self-meanings associated with ecological identification are arranged as more or less central to the overall self-concept. Thus, a person with an ecological identity that is highly central to the self would value the self-meanings associated with it more highly than other identities (i.e., prominence), have a large number of highly valued relationships that involve it (i.e., commitment), and be compelled to define situations in ways that invoke it more frequently than other identities (i.e., salience).

In sum, the self-meanings tapped by the EIS represent an emerging set of internalized ecological sensibilities that go beyond mere concern for environmental protection and traditional views of the self, society, and environment as separate things, to a wider, deeper, and ideal type (cf. Weber, 1968) of identification. They represent many of the elements of what we term *ecological identity* or *the extent and ways by which an individual views himself or herself as being a part of an integrated social and biophysical (i.e., ecological) system characterized by mutually beneficial processes and nested webs of relationships*. In this sense, we assume that ecological identity emerges from and reflects an integral form of identity that is rooted in various streams of modern environmentalism and ecophilosophies (see Fox, 1989; Naess, 1989; Rodman, 1983; Thomashow, 1996; Wilber, 1995).

We submit the following hypotheses to test the validity of the EIS and the basic theoretical premises that undergird it:

Hypothesis 1 (H1): A person with a stronger ecological identity will more frequently engage in a variety of pro-ecological behaviors.

We assume consistently engaging in a variety of pro-ecological behaviors and practices allows a person to express, verify, and reinforce his or her ecological identity (Burke & Stets, 2009).

Hypothesis 2 (H2): The stronger a person endorses an ecological worldview, the stronger ecological identity he or she will have.

A worldview can be defined as comprehensive sets of assumptions and beliefs about the universe, causality, and nature (Myers & Russell, 2003). Drawing upon the work of Rokeach (1968) and others, Dunlap, Van Liere, Mertig, and Jones (2000) developed the New Ecological Paradigm (NEP) scale as a measure of ecological worldview that represents "'primitive beliefs' about the nature of the earth and humanity's relationship with it" (pp. 427-428). In this sense, a worldview represents a basic way of *seeing* the world while an identity represents ways of *being* in the world. We assume that "seeing the world ecologically" (cf. Dunlap et al., 2000, p. 428) often leads to taking on pro-ecological roles, and affiliating oneself with environmentalists, nature, and ecological systems (i.e., ecological identity).

Hypothesis 3 (H3): The more a person values putting the needs of others and the group above his or her own wants and desires, the more likely he or she has a strong ecological identity.

Social values represent trans-situational goals and beliefs about desired end states of existence and guiding principles for achieving these end states (Rokeach, 1968; Schwartz, 1992). According to Schwartz (2012), self-transcendence values motivate people to enhance their understanding and appreciation of others as well as to improve the welfare of all people and nature. A number of items from Schwartz's (1992) Universal Values Survey have been applied and/or adapted in research that has found significant relationships between these types of values and environmental identity and pro-environmental attitudes (Clayton, 2003; Steg & de Groot, 2012; Stern, Dietz, Kalof, & Guagnano, 1995).[3] Holding self-transcendent values should result in a greater likelihood of taking on a pro-ecological personal-, role-, and group-based identity that positions the self within an integrated social and biophysical system (i.e., an ecological identity).

Hypothesis 4 (H4): The more a person values maintaining or increasing his or her standing or control over others and resources, the less likely he or she will have a strong ecological identity.

According to Schwartz (2012), self-enhancement values motivate people to seek self-gratification, personal success, prestige, and control or dominance over resources and people. They have been found on the opposite end of Schwartz's motivational continuum from self-transcendent values. Some have suggested that at the extremes, these types of values could lead to alienation from others (Colvin, Block, & Funder, 1995) and nature. We assume that these values are indicative of egoistic and individualistic motivations, concerns, and desires that foster perceptions of independence and separation from others and ecological systems (see Steg & de Groot, 2012). In general, such a person should be less likely to identify himself or herself as being part of an integrated social and biophysical system (i.e., a lack of ecological identity).

Hypothesis 5 (H5): Having a strong ecological identity acts as an intervening influence on more general and distal drivers of pro-ecological behavior such as having an ecological worldview and holding self-transcendent values.

As they are conceptualized in the literature, values and worldviews represent general (or distal) sets of beliefs about reality and goals about the future, which lead to more specific (or proximal) beliefs and attitudes about the self, others, and behavior (Dunlap et al., 2000; Koltko-Rivera, 2004; Milfont, Duckitt, & Wagner, 2010; Routhe, Jones, & Feldman, 2005). This suggests

that the influence of values and worldviews on pro-ecological behavior is expressed through more specific and embodied aspects of perception such as identities. For instance, research by Hitlin (2003) suggested that personal commitments to particular values produce identities, which in turn influence behavior related to those values. Similarly, research by Leary, Toner, and Gan (2011) showed that identities are an important link between abstract values and beliefs, and specific attitudes toward behaviors whose pro-environmental outcomes are far in the future, uncertain, or low in direct personal relevance. We argue that internalization of an ecological identity provides a medium through which ecological worldviews and self-transcendence values can be concretely and consistently expressed via the performance of pro-ecological behaviors and related activities.

Method

Research Design and Data

Our research was part of an in-depth 2-year study composed of three stages. In the *first stage*, we conducted four focus group meetings to help us identify the conceptual boundaries of ecological identification and provide sufficient coverage of the content domain included in the theoretical framework. Participants provided valuable insight into the content and character of their perceptions and beliefs about themselves in relation to others, nature, and ecological systems. Three of the focus groups were comprised of leaders representing a variety of environmental organizations and perspectives. These types of people have been shown to hold pro-ecological worldviews, values, attitudes, and beliefs which are related to identification with nature and the environment (Kitchell, Hannan,& Kempton, 2000; Zavestoski, 2003). Moreover, they represent one of the few identifiable groups of people whose lived experiences indicate a recognition of the interrelationships and commonalities between humans and the natural environment on the personal-, role-, and group-based levels. The fourth focus group was comprised of undergraduate students drawn from a large southeastern (US) public university and was chosen to ensure our scale not only reflected the views of environmental leaders but also those of a subset of the general population. In addition, this fourth focus group helped to ensure that the language and conceptual orientation of the scale and web-based survey used in Stage 3 (see below) reflected the population of students to which it was administered.

To ensure we spoke to leaders representing a variety of groups and perspectives, we drew upon past research on the environmental movement (Brulle, 2000; Kitchell, Hannan, & Kempton, 2000) and identified environmental

organizations and groups with offices in the area that together represented nine different environmental perspectives (national/international environmental groups, student groups, civic environmentalism, conservationism, preservationism, eco-theology, environmental justice, radical, and reform environmentalism). We successfully recruited 24 leaders (10 females) from eight of the nine types of organizations. For the fourth focus group, we distributed 200 invitation emails to a random sample of undergraduate students, gauged their interest in participating, and assessed basic demographic information about them. Thirteen students were subsequently invited to attend with five ultimately doing so. Four participants identified themselves as White (1/2 female) and one identified as a Black male. The information from these focus group meetings was used to help craft a pool of potential items for the EIS and to identify commonly held beliefs about the types of behavioral practices thought to be "good" and "bad" for the environment, which we used to develop an index of pro-environmental behavior to be used in later quantitative analyses.

In the *second stage*, we used web-based survey data obtained from a small number of undergraduate students ($n = 40$) from the same university (half of whom were known members of student environmental organizations and half of whom were not) to conduct an a priori power analysis based on self-reported frequency of engagement in a range of pro-ecological behaviors. This allowed us to estimate a conceptually meaningful effect size given the domain of study. In turn, we were able to determine an optimal sample size that would minimize the probability of committing both *Type I* (false positive) and *Type II* errors (false negative), giving us greater confidence in the accuracy and meaningfulness of *p values* in the initial validity tests and improving the cross-study comparability of our findings (Cohen, 1988; Erdfelder, Faul, & Buchner, 1996).

Building upon the first and second stages, in the *third stage*, we used data gathered via a longer web-based survey distributed to a larger sample of undergraduate students at the same university to select items for the final EIS, test our hypotheses, and assess the scale's reliability and validity. As our interest was in development and assessment of the EIS, and not inference about a population, we used simple random sampling and oversampled students who were members of an environmental organization to ensure a sufficient number of these students were included in the analysis.[4] In total, 497 surveys were completed (70 members and 427 nonmembers). Our statistical approach in the third stage involved first conducting item-analyses, Cronbach's alpha reliability testing, and PCA to explore whether the pool of potential EIS items could be sufficiently reduced to a smaller number of internally consistent items that both reflected the underlying theory used to ground the scale and exhibited a basic level of unidimensionality. Similar procedures were used to construct

the other scales in the analysis. Next, using standardized component scores, we conducted the initial phase of validity tests on the EIS using randomly drawn subsamples (with replacement) of the optimal size ($n = 28$), determined by the power analysis. We computed bivariate correlations between the EIS and the other scales in the analysis to test H1 to H4 and assessed the convergent and discriminant validity of our scale (at an appropriate level of statistical power). We then used the full sample of eligible respondents ($N = 497$) to test the construct and predictive validity of the EIS using structural equation modeling in a multimodel comparative approach (see Anderson, Burnham, & Thompson, 2000; Burnham & Anderson, 1998).

Measures

Ecological identity. Analysis of information from the focus group meetings yielded a pool of 12 potential items for assessing the sameness feature of ecological identity and 13 for differentiation. To this, we added six items adapted from the literature (Brenner et al., 2014; Merolla, Serpe, Stryker, & Schultz, 2012; Stryker & Serpe, 1994), to assess the centrality of the identity by measuring its prominence, commitment, and salience. All of the items were scored on a 5-point Likert-type scale ranging from 1 to 5 (Table 1), with higher scores reflecting a stronger ecological identity (reverse coded when applicable).

General ecological behavior. Analysis of the focus group exit questionnaires yielded a pool of 14 items to measure general ecological behavior. Survey respondents indicated the frequency (1 = *rarely* to 5 = *almost always*) they engaged in a number of general pro-ecological practices.[5] They included things such as the following:

> learning more about myself and my connection with wildlife, nature and the environment; reducing my overall purchases and use of products and materials; reusing products and materials as long as I can; repairing or properly maintaining the things I use or own; buying or using products that take less energy and resources to produce and distribute.

Ecological worldview. The 15-item NEP scale (Dunlap et al., 2000) was used to assess ecological worldview. The NEP is one of the most utilized and reliable measures within the environmental social sciences. For instance, Hawcroft and Milfont (2010) reported its use in over 69 studies spanning 30 years. It has been consistently shown to be related to other pro-environmental measures including measures of environmental identity. Consequently, the NEP

Table 1. Ecological Identity: Scale Items, Features, and Principal Component Loadings.

Ecological Identity Scale items (Cronbach's α = .91)	Feature of ecological identity	First PC loading
I am someone who . . .		
1. Is aware of and cares about my impact on the environment	Sameness	.729
2. Is strongly connected to nature and the environment	Sameness	.692
3. Is a protector/nurturer of wildlife and their habitats	Sameness	.659
4. Others view as being an environmentalist	Sameness	.746
5. Views myself as an environmentalist	Sameness	.757
6. Is trying to be a better environmentalist	Sameness	.755
I identify with people who . . .		
7. Make significant changes in their lifestyle for environmental reasons	Sameness	.721
8. Feel they have the right to consume as much as they want (*reverse coded*)	Differentiation	.505
9. Don't care about their environmental impacts (*reverse coded*)	Differentiation	.562
10. Doubt global warming is happening (*reverse coded*)	Differentiation	.530
11. Doubt global warming is mostly caused by humans (*reverse coded*)	Differentiation	.520
I identify with . . .		
12. Big business and corporations (*reverse coded*)	Differentiation	.480
How likely are you to discuss wildlife, nature, or environmental issues with each of the following people?		
13. Classmates or coworkers	Centrality	.563
14. My friends	Centrality	.623
15. My family	Centrality	.523
16. How close are you to people who want to protect and preserve the environment?	Centrality	.677
17. How much of a role does protecting and preserving the environment play in your life?	Centrality	.728
18. How large of a role do these activities or actions play in the ideal person you strive to be?	Centrality	.670

Note. Unrotated principal component solution. N = 497.

provides an important benchmark for testing the convergent and discriminant validity of a new scale such as the EIS. On the NEP, respondents are asked to indicate their level of agreement with statements designed to tap primitive beliefs about the relationship between humans and nature. Responses are scored on a 5-point Likert-type scale ranging from 1 to 5 with higher scores reflecting a stronger endorsement of ecological worldview (reverse coded when applicable).

Social values. Thirteen items from Schwartz's (1992) Universal Values Survey were used to assess social values. Eight assessed self-transcendence values, and five assessed self-enhancement values. These items have been tested using hundreds of samples in over 82 countries around the world (see Schwartz, 2012), and items in the self-transcendence and self-enhancement value clusters have been consistently found to be related to a variety of pro-environmental measures. Consequently, this scale represents another important benchmark for testing the validity of a new scale such as the EIS. Respondents were asked to rate the importance of these 13 value statements as guiding principles in their lives. Responses were arranged into five categories ranging from 1 = *opposed to my values* to 5 = *extremely important.*

Results

Scale Construction and Descriptive Findings

Using item analysis and PCA, we determined that 13 of the 31 potential EIS items should not be included, yielding a final 18-item scale.[6] As can be seen in Table 1, the remaining 18 items demonstrate a high level of internal consistency ($\alpha = .91$) and sufficient unidimensionality with all of the items loading strongly on the first principal component extracted, which explained 41% of the variance across the items (Dunteman, 1989). Thus, it is feasible to conclude that the first component reflects a general identification with nature and the biophysical environment that is built up from identification with pro-ecological personal attributes, roles, and groups; differentiation from personal attributes, roles, and groups perceived as anti-ecological; and highly ranking these self-meanings within the broader self-concept. As indicated by the consistently larger loadings for the sameness items, this feature of the EIS appears to be of primary importance in regard to ecological identification. The slightly smaller loadings for the differentiation and several of the centrality items suggest that these features are of secondary importance, a finding that is supported by identity research on group self-esteem (Brewer, 2007) and the causal relationship between identity prominence and salience (Brenner et al., 2014).[7]

EIS numbers 1 to 7 tap the sameness feature of the scale and reflect content related to the personal, role, and social bases of identity. Indeed, Items 1 and 2 appear to reflect ecological identification on the personal level by tapping general personal attributes attached to the self that reflect a recognition of interrelatedness with nature and the environment. It is likely that these general qualities operate across multiple roles and group memberships (cf. Stets & Biga, 2003). Interestingly, the strong loading for Item 2 suggests that connectedness to nature and the environment may be an important aspect of personal

ecological identity, a finding that supports recent research on sustainable consumption (van Dam & Fischer, 2015). Items 3 and 7 reflect role-based ecological identification by tapping into moderately general behavioral expectations that link the individual to nature and the environment through presumed complementary role relationships. Items 4, 5, and 6 reflect group-based ecological identification by assessing one's beliefs about shared-group membership and commonality with environmentalists. EIS numbers 8 to 12 tap into the differentiation feature of the scale and reflect the types of general personal attributes (Item 9), roles (Item 8), and specific social groups (Items 10, 11, and 12) that focus group participants viewed as being anti-ecological.

EIS numbers 13 to 18 (adapted from the literature on Identity Theory) provide an assessment of the extent to which an ecological identity is central to someone's overall self-concept and has a propensity for being activated. For instance, by assessing the respondent's likelihood to discuss environmental issues with classmates, friends, and family (Items 13-15), we can get some sense of the tendency for situations in their lives to be defined in environmental terms (i.e., salience). Items 16 and 17 assess affective and interactional commitment by measuring the number and perceived importance of the relationships a respondent has that invoke an ecological identity, and Item 18 assesses the prominence of the ecological identity by tapping the subjective evaluation it has in relation to the respondent's ideal sense of self. These initial results provide enough empirical evidence to suggest that the EIS represents a fairly consistent and coherent picture of the theoretical features that ground the scale.

Information provided in Table 2 indicates that the other scales in our analysis also meet an acceptable level of reliability and unidimensionality with Cronbach's alpha coefficients ranging from a low of $\alpha = .72$ for the self-enhancement values scale to a high of $\alpha = .91$ for general ecological behavior scale, and first components explaining substantial variance in the scale items ranging from a low of 30% for the NEP to a high of 48% for the self-transcendence values and general ecological behavior scales. Table 2 also indicates the range of possible scores for each scale, overall sample mean, and mean scores for members of environmental organizations and nonmembers. As expected, the mean EIS score for members of student environmental organizations was substantially higher than for nonmembers ($\Delta = 14.9$). Mean differences on the other scales were also in the expected direction.

Initial Validity Tests

PCA is a methodology for scale development that is more inductive and less restrictive than factor analysis (FA). In PCA, the first component extracted is

Table 2. Summary Statistics for Scales Used in the Analysis of Ecological Identity.

Scale	Sample *M*	*SD*	Environmental organization member (*M*)	Nonmember (*M*)	Range	Items	α	PCs extracted (total variance explained)	Variance explained by first PC
EIS	63	11.9	76.1	61.2	18-90	18	.91	3 (63%)	41%
GEB	39	11.4	50.3	37.2	14-70	14	.91	3 (66%)	48%
NEP	54	8.9	59.5	52.6	15-75	15	.83	3 (48%)	30%
STV	32	5.1	35.1	31.2	8-40	8	.85	1 (48%)	48%
SEV	14	3.2	13.8	14.5	5-20	5	.72	1 (48%)	48%

Note. EIS = Ecological Identity Scale; GEB = General Ecological Behavior; NEP = New Ecological Paradigm; STV = Self-Transcendence Values; SEV = Self-Enhancement Values; PC = Principal Component.

the linear combination of scale items that best accounts for the maximal amount of variance in the items, and it reflects the primary conceptual dimension being measured. Any secondary components produced represent additional variability within the scale items, but do not necessarily reflect (mathematically or conceptually) dimensions within the underlying latent factor structure as is the case with FA. This difference has important implications for scale development and the assessment of validity, with PCA being appropriate for initial item selection and early validity tests and FA being appropriate for exploring (and confirming) any dimensionality within the underlying construct(s) being measured by the scale items.[8] Using PCA, convergent validity (the extent to which a scale is related to reliable measures of other constructs in theoretically predictable ways, see Raykov & Marcoulides, 2011) can be assessed by testing for correlations between the first components of scales that should be theoretically related.

To assess convergent validity and test our first four hypotheses, we calculated bivariate correlations between the first principal component of the EIS and the other scales across eight randomly drawn subsamples of the optimal size determined by our power analysis ($n = 28$). H1 proposed that people who have a stronger ecological identity will engage more frequently in a variety of pro-ecological behaviors. As the figures presented in Table 3 indicate, strong and statistically significant positive relationships were found between the EIS and the measure of general ecological behavior across all eight subsamples (median $r = .71$). These findings offer solid support for H1. H2 suggests that the stronger someone endorses an ecological worldview, the stronger their ecological identity will be. This hypothesis is also supported as statistically significant and strong positive relationships were found between the EIS and the NEP across seven of the eight subsamples (median $r = .64$). H3 asserts that the greater someone values putting the needs of others above his or her own wants and desires (i.e., self-transcendence values), the more

Table 3. Convergent Validity: Bivariate Correlations Between First Principal Component Scores of EIS and Other Scales Used in the Analyses of Ecological Identity.

Scale	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8
GEB	.79***	.75***	.54***	.82***	.71***	.68***	.84***	.54**
NEP	.53**	.65***	.18	.76***	.59**	.61***	.67***	.66***
STV	.54**	.66***	.21	.81***	.66***	.63***	.77***	.59***
SEV	−.04	−.03	−.42**	−.37**	−.21	−.45**	.25	.07

Note. A total of eight randomly selected subsamples (n = 28; with replacement) were drawn from the larger data set (N = 497). EIS = Ecological Identity Scale; GEB = General Ecological Behavior; NEP = New Ecological Paradigm; STV = Self-Transcendence Values; SEV = Self-Enhancement Values.
*$p < .05$. **$p < .01$. ***$p < .001$, one-tailed tests.

likely this person will have a stronger ecological identity. This is also supported as statistically significant and strong positive relationships were found between the EIS and the Self-Transcendence Values scale across seven of the eight subsamples (median $r = .67$). Finally, H4 posited that those who want to maintain or increase their standing or control over others and resources (i.e., self-enhancement values) will be less likely to have a strong ecological identity. This hypothesis was weakly supported as significant negative relationships were found between the EIS and the Self-Enhancement Values scale in only three of the eight subsamples. Still, these relationships were in the expected direction and moderately strong (median $r = -.41$). Overall, these results provide support for H1 to H4 and demonstrate the convergent validity of the EIS.

Recall that PCA takes a more inductive and less restrictive approach by modeling the items in a scale as independent variables from which components are extracted (Jolliffe, 2002). Because of this, assessment of discriminant validity can be accomplished with less emphasis on showing that scale items are exclusively related to the hypothesized dimensions of the construct (as with FA and confirmatory factor analysis [CFA]) and greater emphasis on confirming that the first principal component of the scale of interest (e.g., the EIS) is unrelated to the variance explained further out in the component structure of other scales (i.e., second, third, and so on . . . components). If a scale is discriminant from another, its first principal component should be unrelated or only weakly related to the secondary components of the other scales.

We assessed the EIS for discriminant validity (i.e., the extent to which a construct is unique from well-established measures of other closely related constructs and not replicating them, see Raykov & Marcoulides, 2011), by calculating bivariate correlations between its first principal component and

Table 4. Discriminant Validity: Bivariate Correlations Between First Principal Component Scores of EIS and Second and Third Principal Component Scores of Other Scales Used in the Analysis of Ecological Identity.

Scale	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8
GEB-2	−.14	−.38	.13	−.22	−.06	−.05	−.19	.20
NEP-2	−.11	.32	.11	.16	−.03	−.09	−.31	−.12
NEP-3	.14	−.17	−.19	−.32	−.11	−.30	−.15	−.06

Note. A total of eight randomly selected subsamples (n = 28; with replacement) were drawn from the larger data set (N = 497). PCA on the STV and SEV scales did not produce secondary components. One-tailed tests. EIS = Ecological Identity Scale; GEB-2 = Second PC scores on the General Ecological Behavior scale; NEP-2 = Second PC score on the New Ecological Paradigm scale; NEP-3 = Third PC scores on the New Ecological Paradigm scale. PCA = Principal Components Analysis; STV = Self-Transcendence Values; SEV = Self-Enhancement Values.

the secondary components of the general ecological behavior and NEP scales across eight subsamples (n = 28). Figures presented in Table 4 indicate that no significant relationships were found in any of the eight subsamples, offering support for the discriminant validity of the EIS.[9] Together, the results of these validity tests provide strong support for H1 to H4 and demonstrate the convergent and discriminant validity of the EIS, by showing that the primary conceptual dimension being measured by the EIS is strongly related to those of the other scales, but unrelated to the more peripheral aspects being measured by them.

Construct and Predictive Validity Tests

Given the evidence garnered from our initial tests of reliability and validity, next we used survey data obtained from the full sample of student respondents (N = 497) to assess H5 and the construct validity of the EIS. Specifically, H5 proposed that ecological identity is more psychologically proximal to behavior and acts as an intervening influence on more general and distal drivers of pro-ecological behavior such as having an ecological worldview and holding self-transcendence values. To test this, we compared three structural equation models (SEM) of pro-ecological behavior, each of which arranged ecological identity, ecological worldview and self-transcendence values in a different causal order. Model 1 (the hypothesized model) situates ecological identity as an intervening influence (endogenous variable) between two exogenous variables (ecological worldview and self-transcendence values) and the dependent variable (general ecological behavior). Models 2 and 3 shift the causal ordering so that ecological worldview is treated as the (endogenous) intervening influence in Model 2, and self-transcendence values is treated as the (endogenous) intervening influence in Model 3. By comparing the models based on

Table 5. Multimodel Comparison of Fit of Candidate Models.

Model	χ^2	*df*	AIC	BIC	CFI	SRMR	NNFI
Model 1 (Ecological identity intervening)	15.3	2	25.3	46.4	.98	.03	.95
Model 2 (Ecological worldview intervening)	216.4	2	226.4	247.5	.73	.16	.19
Model 3 (Self-transcendence values intervening)	165	2	175.2	196.3	.80	.13	.38

Note. Standardized principal component scores were used to represent each construct in the SEM. $N = 497$. AIC = Akaike Information Criterion (lower = better/more parsimonious fit); BIC = Bayesian Information Criterion (lower = better/more parsimonious fit); CFI = Bentler's comparative fit index (Closer to 1.0 = better fit with CFI ≥ .90, good fit); SRMR = standardized root means square residual (SRMR ≤ .05, good fit); NNFI = nonnormed fit index (NNFI ≥ .95, good fit); SEM = structural equation model.

a number of carefully selected fit indices, we can test H5 by determining which of the three candidate models best approximates the data and, consequently, which of the three causal orderings is more plausible.

Table 5 provides information of model fit for the three models. Given our interest in model comparison, primary importance was given to the two absolute comparative measures of fit (Akaike information criterion [AIC] and Bayesian information criterion [BIC]). The data suggest that Model 1 (AIC = 25.3; BIC = 46.4) fits the data better and in a more parsimonious way than Model 2 (AIC = 226.4; BIC = 247.5) and Model 3 (AIC = 175.2; BIC = 196.3). Similarly, the Bentler's comparative fit index (CFI) suggests that Model 1 (CFI = .98) fits the data well and better than Model 2 (CFI = .73) and Model 3 (CFI = .80). The standardized root mean square residual (SRMR), a residual-based absolute index, suggests Model 1 (SRMR = .03) fits the data well while neither Model 2 (SRMR = .16) nor Model 3 (SRMR = .13) meets the typical threshold of SRMR < .05 (Schumacker& Lomax, 2004). Finally, the nonnormed fit index (NNFI), an incremental index, suggests Model 1 (NNFI = .95) fits the data well while neither Model 2 (NNFI = .19) or Model 3 (NNFI = .38) meets the typical threshold of NNFI near .95 (Schumacker & Lomax, 2004). Results from this multimodel comparison support H5 and demonstrate the construct validity of the EIS by providing evidence that ecological identity is more proximal to behavior than ecological worldview and self-transcendence values, and that it may be an important link between distal aspects of perception and pro-ecological behaviors.

Given these results, we retain Model 1 as the best of the three candidate models and now turn to a brief discussion of the model effects and the predictive validity of the EIS (see Figure 1). We found moderately large direct effects leading from ecological worldview ($\beta = .44$) and self-transcendent values ($\beta = .37$) to ecological identity, which together explained a good deal of the common variance in ecological identity ($R^2 = .49$). Furthermore, the model

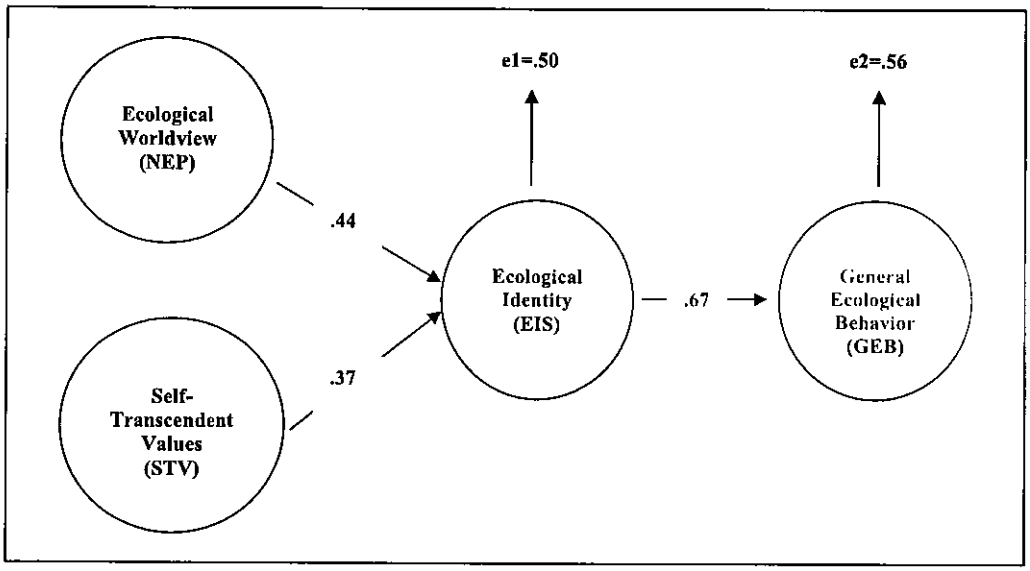

Figure 1. Path Model 1: Ecological identity intervening.
Note. All path coefficients are standardized and significant at the $p \leq .001$ level. Overall R^2 = .44. NEP = New Ecological Paradigm.

estimated a very large direct effect leading from ecological identity to general ecological behavior ($\beta = .67$). In total, the model explained 44% of the variance in self-reported general ecological behavior. These results support H5 and provide solid evidence of the predictive and construct validity of the EIS by suggesting that having a strong ecological identity significantly influences the likelihood of engaging in a wide range of pro-ecological behaviors, both directly and by providing a medium through which ecological worldviews and self-transcendent values can be concretely and consistently expressed.

Discussion

Identity is a rich explanatory construct that is experiencing increased use within and outside of environmental research, and we are " . . . in need of an integrative perspective that brings together the strengths of these seemingly contrasting theoretical and methodological approaches" (Schwartz et al., 2011, p. 12). Dunlap and McCright (2008) echoed this concern and point out that existing efforts to create comprehensive measures of the broad and ambiguous concept of environmental identity are "complex and in some cases difficult to use in surveys" (p. 1049). Toward these ends, we developed a framework that integrates key features of two major theories of identity and then used a multimethod research design that emphasized theoretical and methodological correspondence and precision to develop and assess an

18-item comprehensive measure of ecological identity. Our results provide preliminary but solid evidence of the scale's reliability and validity, as well as initial support for the integral framework that grounds it and methodological design used to develop it.

The EIS integrates theoretical aspects of identity that have yet to be operationalized in a single measure. Whereas past measures have tended to focus exclusively on a single basis of identification, the EIS assesses a form of identity that acts in correspondence across the personal-, role-, and group-bases of identification. Indeed, someone who ranks highly on the EIS is simultaneously aware of and cares about his or her impact on the environment (EIS 1, personal-based identification), makes significant changes in his or her lifestyle for environmental reasons (EIS 7, role-based identification), and is trying to be a better environmentalist (EIS 6, group-based identification). In addition to assessing the substantive content of identity across multiple bases, the EIS includes six items that assess the relative centrality of ecological identity within the broader self-concept. And although the measures developed by Stets and Biga (2003) assesses centrality, their analysis stopped short of integrating their centrality indicators with those designed to measure personal environmental identity content.

The EIS also covers theoretical territory not yet operationalized in other measures. Whereas past measures have neglected the role differentiation plays in defining and maintaining an identity, the EIS contains several items that assess personal-, role-, and group-based beliefs about anti-environmental others. Indeed, we found evidence that ecological identification involves differentiating oneself from people who do not care about their environmental impacts (EIS 9, personal-based differentiation), those who consume as much as they want (EIS 8, role-based differentiation), and those who doubt global warming is mostly caused by humans (EIS 11, group-based differentiation). By operationalizing differentiation, our work connects to recent research on intergroup bias, social comparison, and identity-protective cognition (Clayton, 2012; Gifford, 2011; McCright & Dunlap, 2011). In this way, the EIS may be uniquely suited for applied research in the often politically charged contexts of natural resource management, development, and environmental conflict.

The EIS also differs from past scales in two particular ways related to measurement. First, it combines several very general items that assess personal-based identity with moderately general items designed to assess role-based identity and highly specific items designed to assess group-based identity. Existing environmental identity measures typically cover a much more limited range of measurement specificity. Second, because of the strong stereotypes associated with the term "environmentalist" (Pearson, Schuldt, & Romero-Canyas, 2016), we

designed the EIS to assess beliefs about shared-group membership differently than past measures. Indeed, in our focus group discussions with leaders representing a variety of environmental groups and perspectives, we found that a majority of them did not label themselves as an "environmentalist," despite recognizing their membership in this social category. Consequently, the scale contains one item that taps *self*-identification as an environmentalist (EIS 5) and a second item (EIS 4) that assesses beliefs about being an environmentalist based on one's perceptions of the beliefs of *others* (cf. Cooley, 1902).

From the above, we conclude that the EIS offers a substantially different picture of self-environment relations than existing measures. Indeed, it taps into socially embedded meanings attached to the self that position individuals within a web of socioecological relationships, based on shared personal characteristics, roles, and group memberships. This integral form of identification operates in correspondence across these different bases of identity, and it incorporates important aspects related to power and the intergroup dynamics characteristic of complex societies. Given our current lack of an integrated framework for understanding the individual, intra-group, and intergroup social and psychological processes involved in environmental issues (cf. Devine-Wright & Clayton, 2010; Pearson et al., 2016), the EIS, and the theoretical framework that underlies it, may be a small step in this direction.

That being said, identity is a rich construct, and our measure by no means exhausts all forms of identification with nature and the environment. Future research should continue to investigate the different content, bases, structure, and process of identification with nature and the environment. For instance, the relevance of the different bases of identity may vary depending on social and situational context as well as individual trait characteristics. Similarly, it will be important to determine what types of research objectives are better served by more comprehensive measures of identity versus those that are focused on a single content domain. We must also continue expanding our knowledge of the relationships between identity and other constructs used to study self-environment relations (e.g., connectedness, inclusion). For instance, our results suggest that connectedness to nature and the environment may be an important aspect of ecological identification on the personal level. Interestingly, Schultz (2002) drew a very close comparison between connectedness to nature and beliefs about interdependence, suggesting that increasing our understanding of the relationship between identity, connectedness, and interdependence may provide opportunities for promoting the moral inclusion of nonhuman species (cf. Chang & Opotow, 2009; Clayton, 2008).

Despite these encouraging results, our study has a number of limitations that need to be addressed in the future. First, the scale will need to be assessed in more general and diverse samples. We developed the EIS using qualitative data

gathered from undergraduate students and leaders of locally based environmental organizations (most of whom were White) in one region of the United States. And although this appears to be an improvement over the conventional approach of simply using our own intuition to develop scale items, people from other populations within and outside of the United States should be called upon to provide additional insight into the content of self-meanings that constitute ecological identification. This is especially important to address in regard to racial and ethnic minorities in the United States and non-Westerners globally. For instance, it has been well documented that despite high levels of concern (Jones & Rainey, 2006) and a greater likelihood of being negatively impacted by environmental problems (Bullard, 2000), racial and ethnic minorities in the United States are typically underrepresented in mainstream environmental organizations and professions (Taylor, 2014). Indeed, it is likely that the personal, role, and group affiliations through which individuals express ecological identity vary across different racial and ethnic groups, and across different cultural, political, and economic contexts (Pearson et al., 2016). It will be important to expand our understanding of ecological identity and adapt the EIS to incorporate these diverse perspectives. Similarly, our quantitative tests of the EIS used a relatively controlled sample of undergraduate college students, and statistical tests using more general and diverse samples will be vital.

Second, because we prioritized inductive methods to develop the scale (i.e., focus groups, PCA), we have not yet rigorously investigated dimensionality within it. Future research using deductive techniques such as CFA should be used to identify any underlying factor structure. Such an analysis will have important implications for the theoretical framework that grounds the EIS. Third, we did not directly compare the EIS with other comprehensive measures of environmental identity, and important questions remain regarding how ecological identification, as measured by the EIS, relates to what previous researchers were measuring. We also did not investigate potential relationships between ecological identity and other identities one may hold (e.g., political, gender, racial, and place identities). These relationships may be powerful and even overlapping at times. We believe that a research agenda addressing these and other questions can continue to bring greater focus to research on self-environment relations, and greatly increase our understanding of the bridges and barriers to more sustainable lifestyles and the promotion of more adaptive socioecological systems and management practices.

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Notes

1. Content validity is the extent to which the items in a scale cover a sufficient range of meanings associated with the underlying construct the scale is intended to measure.
2. Theorists within this tradition have also examined the relative centrality of a given identity, but have done so by focusing on social contextual factors that are highly situationally dependent and largely beyond the control of the individual (see Spiers, 2011). This largely precludes an ability to incorporate this feature of Social Identity Theory into a survey scale.
3. A number of studies have modified Schwartz's (1992) original values scale and expanded the number of items in the self-transcendence value cluster to include additional items aimed at measuring biospheric values as distinct from self-transcendent values. However, the results have been mixed (see de Groot & Steg, 2008).
4. Because of this oversampling, prior to validity testing, we conducted a series of random-effect linear regressions to test for the presence of any design effects, and none were found.
5. As the Ecological Identity Scale (EIS) represents a comprehensive measure, we constructed the General Ecological Behavior (GEB) to represent an equally broad domain of environmental behaviors (see Fishbein & Ajzen, 2010).
6. Eleven items were removed because of low inter-item correlations (<.11), first component loadings (<.40), individual Kaiser–Meyer–Olkin scores, and adverse impact on Cronbach's alpha coefficient. Two additional items were removed because reviewers pointed out that the items appeared to measure behavior not identity.
7. In total, three components with eigenvalues greater than one were extracted, together explaining 63% of the total variance in the items. Predictably, the loadings suggest the second component was primarily driven by the differentiation items, and the third component was primarily driven by three of the centrality items (see online appendix).
8. At this early stage in the development of the EIS, we are not interested in exploring dimensionality and are instead interested in item selection and initial validity tests. However, the online appendix contains the full results from the principal components analysis (PCA) which suggest the scale may contain dimensions that fall along the expected lines of sameness, differentiation, and centrality.
9. As the self-transcendence values (STV) and self-enhancement values (SEV) scales only produced a single component, we conducted additional tests of discriminant validity on the item level using an approach similar to the adaptation of Nunnally's (1978) Multiple Group Method (MGM) used by de Groot and Steg (2008) and van der Werff, Steg, and Keizer (2013). In this procedure, we used

item-corrected correlations and confirmed that the EIS items were consistently more strongly correlated with the first component of the EIS than with the first component of the STV and SEV scales (results not presented).

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Appendix

As discussed in the text, statistical and theoretical considerations were used to reduce the original pool of 31 items derived from the focus groups to 18 (see endnote 6 in text). All of the items loaded strongly and positively on the first principal component, which explained 41% of the total variance within the scale (see Table A1 & A2). Indeed, 11 items loaded above $r = .6$, and the remaining 7 items loaded around $r = .5$. These results constitute what Dunteman (1989) refers to as a "size factor" (p. 38), or a situation when all items in a scale load strongly and in the same direction on the 1st PC. This suggests that the EIS has an acceptable level of unidimensionality and represents a comprehensive form of ecological identity that incorporates each of the theoretical features used to ground the scale.

Given this confirmation of unidimesnionality, we decided to rotate the component matrix in order to minimize cross loadings and render the 2nd and 3rd PCs more easily interpretable. As can be seen in Table A3, the pattern of component loadings fairly closely aligns with the theorized features of ecological identity (i.e., sameness, differentiation, and centrality). Indeed, the overwhelming majority of strong loadings on the 1st PC, are items assessing the sameness feature of ecological identity. Substantively then we can conclude that the 1st PC represents a comprehensive form of ecological identity that is primarily driven by a perceived sameness with nature and the environment, but also incorporates elements of differentiation and centrality.

The overwhelming majority of strong loadings on the 2nd PC (13% of total variance), are items assessing the differentiation feature of ecological identity, suggesting that it is the second best way to explain variance within the scale. Substantively then we can conclude that the 2nd PC represents ecological identification as it occurs through differentiation of the self from personal attributes, roles, and groups perceived to be anti-ecological. As noted in the text (p. 18), this finding is supported by research on group-based identities and self-esteem, which finds that identification is primarily driven by positive evaluations of the in-group, and only secondarily by derogation of outgroup identities (Brewer, 2007).

Lastly, the majority of strong loadings on the 3rd PC (which explains 8% of total variance within the scale), are three of the six items that assess the centrality feature of ecological identity. We were

somewhat surprised that the centrality items were split between the 1st and 3rd PCs, however as noted in the text (p. 18), this pattern is supported by research on identity activation (Brenner et al., 2014). Recall from the text (p. 9 – 10), that we have conceptualized the centrality feature of ecological identity as a combination of the identity's relative prominence (the subjective evaluation and importance of an identity relative to other identities within the self-concept), commitment (the sheer number of relationships one has that invoke a given identity, and the perceived importance of those relationships), and salience (the individual's propensity to define situations in ways that provide opportunities to perform a given identity, resulting in a readiness to play it out). Interestingly, the three centrality items driving the 3rd PC (EIS items 13, 14, 15), are those items designed to measure salience, while the three centrality items designed to measure commitment and prominence (EIS items 16, 17, 18), load more strongly the 1st PC. From this we can conclude that commitment and prominence are more basic elements of an ecological identity, while salience is more ancillary.

As noted above, this pattern of PC loadings is supported by research on the causal relationship between identity prominence and salience. Specifically, Brenner et al. (2014) found strong evidence that prominence precedes salience in the process of identity activation. Substantively this suggests that for an identity to be activated, an individual must first subjectively value the identity, which will in turn result in a tendency to define situations in one's life in relation to the identity. This would seem to corroborate our conclusions from above that prominence is a more basic element of an ecological identity, while salience is more ancillary.

Overall, the pattern of PC loadings across each of the three principal components extracted is closely aligned with the theorized features of ecological identity (i.e., sameness, differentiation, and centrality), further demonstrating the construct validity of the scale and the theoretical framework that undergirds it. That being said, future research using more rigorous deductive techniques such as confirmatory factor analysis will be necessary to more adequately assess the underlying factor structure of the scale and its relationship to the theoretical framework that grounds it.

Table A1. Unrotated Principal Components Loadings for the EIS, and Features of Ecological Identity

	Feature of Ecological Identity	Component Loading		
		1	2	3
I am someone who...				
1) Is aware of and cares about my impact on the environment	(Sameness)	.729	-.135	-.142
2) Is strongly connected to nature and the environment	(Sameness)	.692	-.350	-.104
3) Is a protector/nurturer of wildlife and their habitats	(Sameness)	.659	-.410	-.151
4) Others view as being an environmentalist	(Sameness)	.746	-.422	-.166
5) Views myself as an environmentalist	(Sameness)	.757	-.400	-.183
6) Is trying to be a better environmentalist	(Sameness)	.755	-.155	-.140
I identify with people who...				
7) Make significant changes in their lifestyle for environmental reasons	(Sameness)	.721	-.190	-.129
8) Feel they have the right to consume as much as they want *(reverse coded)*	(Differentiation)	.505	.623	-.092
9) Don't care about their environmental impacts *(reverse coded)*	(Differentiation)	.562	.589	-.100
10) Doubt global warming is happening *(reverse coded)*	(Differentiation)	.530	.600	-.218
11) Doubt global warming is mostly caused by humans *(reverse coded)*	(Differentiation)	.520	.604	-.240
I identify with...				
12) Big business and corporations *(reverse coded)*	(Differentiation)	.480	.433	-.064
How likely are you to discuss wildlife, nature or environmental issues with each of the following people?				
13) Classmates or co-workers	(Centrality)	.563	.074	.569
14) My friends	(Centrality)	.623	.083	.635
15) My family	(Centrality)	.523	.027	.639
16) How close are you to people who want to protect and preserve the environment?	(Centrality)	.677	-.009	.135
17) How much of a role does protecting and preserving the environment play in your life?	(Centrality)	.728	-.125	-.007
18) How large of a role do these activities or actions play in the ideal person you strive to be?	(Centrality)	.670	-.021	-.039

Note. Unrotated Principal Component Solution. *N*=497.

Table A2. Total Variance Explained within the EIS

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	7.433	41.294	41.294
2	2.384	13.244	54.537
3	1.434	7.966	62.503

Note. Only components with eigenvalues greater than one were retained.

Table A3. Rotated Principal Components Loadings for the EIS, and Features of Ecological Identity

	Feature of Ecological Identity	Component Loading		
		1	2	3
I am someone who...				
1) Is aware of and cares about my impact on the environment	(Sameness)	.724	.208	.043
2) Is strongly connected to nature and the environment	(Sameness)	.781	-.005	.046
3) Is a protector/nurturer of wildlife and their habitats	(Sameness)	.788	-.062	-.015
4) Others view as being an environmentalist	(Sameness)	.872	-.034	-.008
5) Views myself as an environmentalist	(Sameness)	.875	-.007	-.019
6) Is trying to be a better environmentalist	(Sameness)	.756	.201	.050
I identify with people who...				
7) Make significant changes in their lifestyle for environmental reasons	(Sameness)	.740	.153	.047
8) Feel they have the right to consume as much as they want *(reverse coded)*	(Differentiation)	.180	.778	.118
9) Don't care about their environmental impacts *(reverse coded)*	(Differentiation)	.246	.773	.121
10) Doubt global warming is happening *(reverse coded)*	(Differentiation)	.236	.796	.001
11) Doubt global warming is mostly caused by humans *(reverse coded)*	(Differentiation)	.230	.800	-.022
I identify with...				
12) Big business and corporations *(reverse coded)*	(Differentiation)	.237	.593	.116
How likely are you to discuss wildlife, nature or environmental issues with each of the following people?				
13) Classmates or co-workers	(Centrality-salience)	.351	.170	.703
14) My friends	(Centrality-salience)	.387	.188	.783
15) My family	(Centrality-salience)	.323	.098	.754
16) How close are you to people who want to protect and preserve the environment?	(Centrality-commitment)	.570	.238	.309
17) How much of a role does protecting and preserving the environment play in your life?	(Centrality-commitment)	.693	.187	.173
18) How large of a role do these activities or actions play in the ideal person you strive to be?	(Centrality-prominence)	.603	.262	.139

Note. Rotation Method: Quartimax with Kaiser Normalization. Rotation converged in 4 iterations. *N*=497.

Recall from the text that we initially assessed convergent validity by testing correlations between the 1st PC scores of each scale in the analysis using a sample size ($n = 28$) that an *a prior* power analysis determined would optimally minimize the probability of committing both *Type I* and *Type II* errors. The results of this *precise testing* supported the convergent validity of the EIS by demonstrating that it was significantly and strongly related to reliable measures of other constructs in theoretically predictable ways. Given these results we decided to also report correlations between the scales using a more *conventional testing* approach. In this conventional approach, each of the scales was constructed as a composite measure (i.e., respondents' scores on each scale item are summed) instead of using PC scores, and we used the full sample of respondents ($N = 497$), to calculate correlations. Doing so may help make our results more interpretable for some readers not familiar power analysis, and it will also offer an interesting opportunity to identify discrepancies between the two approaches. Using a larger sample size and constructing the scales in our analysis as composite measures when calculating correlations should produce evidence of inflated significance levels (due to increased power $1 - \beta$, and greater likelihood of *Type I* errors), and could change the estimated strength of the correlations (i.e., effect size), between the scales because of the introduction of increased measurement and random error.

Table A4 below replicates the findings of our initial assessment of convergent validity using the precise testing (i.e., optimal sample size n=28 and 1st PC scores), and Table A5 contains the results of the more conventional testing (using the full sample N=497 and composite scales). As expected, a comparison of the two sets of results indicates the presence of inflated significance levels and minor differences in the strength of the correlations. This can be seen in three noticeable ways. First, the conventional testing (Table A5) produced very highly significant correlations ($p \leq .001$), between the EIS and all other scales in the analysis. However, the probability that these significance levels are inaccurate has increased due to the larger sample size (Cohen, 1988). The more precise testing using the information from the power analysis however produced a mix of significance levels which overall confirm the presence of the expected relationships, but more accurately reflect the probability that the relationships exist in reality.

Second, there is some evidence that the estimated strength of the relationship between the EIS and the general ecological behavior scale (GEB) differs between the two approaches. Indeed, while the significance level of the relationships reported in each are largely equivalent, the conventional testing produced an estimated correlation of (r = .66), and the more precise testing produced a median estimated correlation across eight subsamples that is noticeably stronger (r = .71). Since the power analysis helped us ensure that statistically significant results were also substantively meaningful, we conclude that the results of the precise test (r=.71), more accurately reflect the actual magnitude of the relationship between the EIS and the general ecological behavior scale (GEB). Importantly however, additional analyses using some form of bootstrapping methodology would be necessary to confirm this conclusion (see Hall, 1988).

Lastly, the difference between the two approaches is most apparent in the estimates of the relationship between the EIS and the self-enhancement values scale (SEV). Indeed, the conventional testing (Table A5), produced a very highly significant yet weak negative relationship between the EIS and the self-enhancement values scale (r = -.15, $p \leq .001$). Had we only viewed this result, we would be led to conclude with a very high level of confidence that there is a weak yet largely consistent negative relationship between ecological identification and self-enhancement values. In contrast, the interpretation and conclusions drawn from the precise testing (Table A4), are more nuanced. In this case, we found highly significant and moderately strong negative relationships (i.e., r = -.45, r = -.42, r = -.37; $p \leq .01$) between the EIS and the self-enhancement values scale in three of the eight subsamples. The remaining five subsamples did not produce significant relationship between the two. From these results we can conclude with a relatively high level of confidence that the relationship between ecological identification and self-enhancement values, although not always present, is moderately strong when it is.

In conclusion, although the differences in significance and estimated effect size produced by these two different approaches were not extreme, they were noticeable. Furthermore, it is possible that there could have been substantial differences in both the probability estimates (i.e., p-values), and the estimated effect sizes of the relationships. If so, had we not conducted the precise testing using information from the *a priori* power analysis, we would be unaware of the inaccuracies of our results.

Lastly, by making the power of our tests explicit we can improve the cross-study comparability of our results for those willing to attend to this important issue because statistical tests at similar levels of power are directly comparable.

Table A4. Convergent Validity: Precise Testing using the Optimal Sample Size n=28 and 1st PC Scores

Scale	Sample #1	Sample #2	Sample #3	Sample #4	Sample #5	Sample #6	Sample #7	Sample #8
GEB	.79***	.75***	.54***	.82***	.71***	.68***	.84***	.54**
NEP	.53**	.65***	.18	.76***	.59**	.61***	.67***	.66***
STV	.54**	.66***	.21	.81***	.66***	.63***	.77***	.59***
SEV	-.04	-.03	-.42**	-.37**	-.21	-.45**	.25	.07

Note. A total of eight randomly selected subsamples (n = 28; with replacement) were drawn from the larger data set (N = 497).
GEB = 1st PC scores on General Ecological Behavior scale: NEP = 1st PC scores on New Ecological Paradigm scale: STV = 1st PC scores on Self-Transcendence Values scale: SEV = 1st PC scores on Self-Enhancement Values scale
*p < .05. **p < .01. ***p<.001, one-tailed tests.

Table A5. Convergent Validity: Conventional Testing using the full Sample Size N=497 and Composite Scales

	EIS	GEB	NEP	STV	SEV
GEB	.664***	-			
NEP	.635***	.392***	-		
STV	.620***	.512***	.506***	-	
SEV	-.150***	-.104*	-.231***	.033	-

Note. GEB = General Ecological Behavior composite scale: NEP = New Ecological Paradigm composite scale: STV = Self-Transcendence Values composite scale: SEV = Self-Enhancement Values composite scale.
*p<.05, **p<.01, ***p<.001, one-tailed tests. N = 497.

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