Environmental concern, ecological sensitivity, and ecological behavior: Research synthesis and new directions

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Abstract:
This review synthesizes research on ecological environment variables. It shows that environmental concern (EC), ecological sensitivity (ES) and ecological behavior (EB) are significantly related. It also shows that EC and ES are two different concepts but linked by two components of attitudes which are the affective component (emotions) and the conative component (action). It positions ES as a mediating variable between EC and EB such as taking actions that preserve the environment. In terms of implications, taking into account the ES of individuals makes it possible to give meaning to ecological actions, which are thus more likely to be followed by effects. There are many research perspectives, for example, on the validation of the definitions of ES suggested in this review and the definition of measures of ES.
Keywords: environmental concern, ecological sensitivity, ecological behavior, perceived effectiveness.

Préoccupation pour l'environnement, sensibilité écologique et comportement écologique : Synthèse des recherches et nouvelles directions

Résumé :
Cette revue fait la synthèse des recherches sur les variables de l'environnement écologique. Elle met en évidence que la préoccupation pour l'environnement (PPE), la sensibilité écologique (SE) et le comportement écologique (CE) sont significativement liés. Elle montre également que la préoccupation pour l'environnement et la sensibilité écologique sont deux concepts différents mais reliés par deux composantes des attitudes qui sont la composante affective (émotions) et la composante conative (action). Elle positionne la sensibilité écologique comme une variable médiatrice entre la PPE et le CE tels que la prise d'actions qui préservent l'environnement. En termes d'implications, la prise en compte de la sensibilité écologique des individus permet de donner du sens aux actions écologiques qui ont ainsi plus de chances d'être suivies d'effets. Les perspectives de recherche, nombreuses, portent, par

exemple, sur la validation des définitions de la sensibilité écologique suggérées dans cette revue et la définition des mesures de la sensibilité écologique.

Mots clés : préoccupation pour l'environnement, sensibilité écologique, comportement écologique, efficacité perçue.

1. INTRODUCTION AND RESEARCH OBJECTIVES

The concept of **environmental concern (EC)**, defined as an individual's general orientation toward the environment (Fransson & Gärling, 1999; Giannelloni, 1998; Kim & Choi, 2005) emerged over fifty years ago to explain environmentally destructive consumption behaviors and the limited impact of public interventions. Studies have linked EC to **ecological behavior (EB)**, showing a generally positive but inconsistent relationship: strong in some cases (Li, 1997; Maloney & Ward, 1973) and weak in others (Roberts, 1996b; Chan & Yam, 1995). These inconsistencies have led to the emergence of **ecological sensitivity (ES)**, viewed by some as *"a matter of affective reaction, of sensation"* (Thiery-Seror, 1996) or as an emotional construct (Zaiem, 2005), offering potential explanatory power for the variability between EC and EB. As Whiteman and Cooper (2011) note, ecological rootedness helps individuals make sense of environmental cues, while the inability to do so creates vulnerability. This research therefore seeks to **clarify the relationships between EC, ES, and EB**, establish an **integrative theoretical framework**, and identify **new research directions** to better understand ecological attitudes and guide more effective environmental strategies.

2. THEORETICAL APPROACH OF RESEARCH ON THE CONCEPTS OF THE ECOLOGICAL ENVIRONMENT

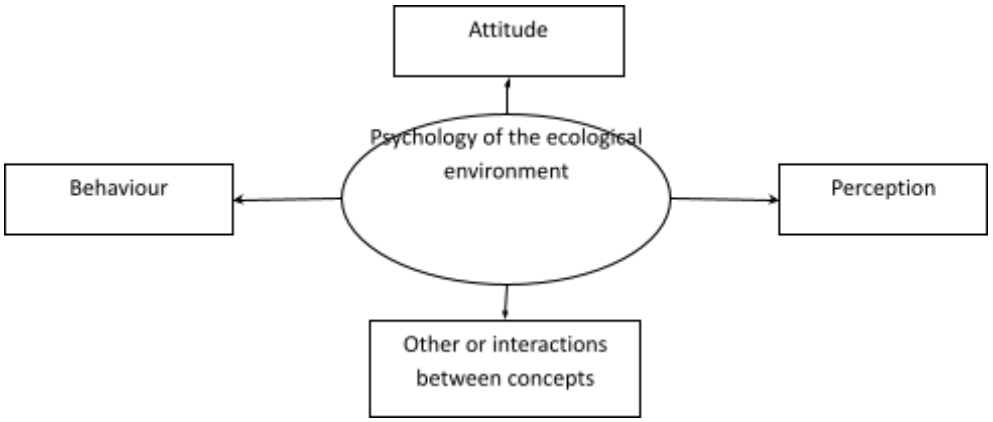
The framework is based on (1) the broad directions of research on EC, ES and EB highlighted in the definitions. This research differs in terms of levels of abstraction and theory (Smith, Bolton and Wagner, 1999), which makes it possible to observe how these concepts are dealt with across the range of situations studied, at what level (individual, institution or group), and with what other concepts. This framework is also based on (2) the man-nature relationship (in particular, man's relationship with his environment - subjugation or subjugation/mastery), one of the five value orientations proposed by Kluckhohn and Strodtbeck, (1961) and (3) the modal personality which Inkeles and Levinson, 1969, define as what is common to the adult personality. This framework combines theories supporting these three concepts. It will be further developed later.

3. SYNOPTIC REVIEW OF THE LITERATURE AND RESEARCH PERSPECTIVES

Research on the ecological environment can be approached in two different ways: the first is to consider variables that describe the environment, independent of people or entities. This often involves analysing the ecological sensitivity of place and its components (see, for example, Mingwu et al., 2010). The second is to study how people or certain entities respond

to their environment. Ecological environmental psychology is more concerned with this second class of studies and can be conceptualized into attitude, Behaviour, perception, or interactions among these three concepts.

Figure 1. The conceptualisation of ecological environmental studies from the perspective of the individual.



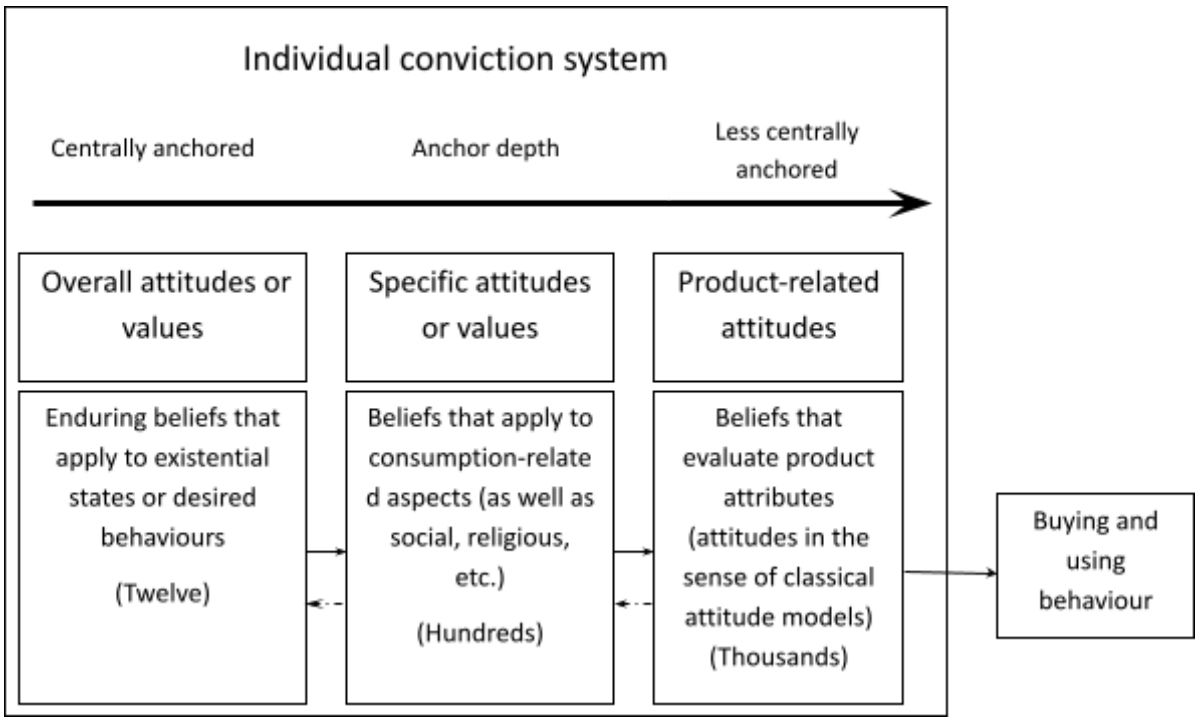
3.1. Definitions of the concepts of environmental concern (EC), ecological sensitivity (ES) and ecological behaviour (EB)

The concept of **EC** or environmental attitude differentiates individuals according to how much they care about ecological issues. A first approach defines it as *"the intensity of positive and negative affect toward concepts, people, ideas, and other 'objects' in general"* (Hunter et al., 1976, p. 3), that is, a psychological tendency to evaluate the natural environment with favor or disfavor (Milfont, 2007; Milfont & Duckitt, 2010). A second, more structural perspective views attitudes as part of a hierarchical system, where general values guide more specific attitudes and behaviors (Ajzen, 1989; Cruz & Manata, 2020; Wilson, Lindsey & Schooler, 2000). In this sense, consistent environmental behavior results from the alignment between broad value orientations and specific behavioral tendencies (Rokeach, 1968; Gierl & Stumpp, 1999).

Attitudes serve to "*provide a summary of valences that will serve as a support for the responses that the individual will make to that environment"* (Ajzen, 1989; Wilson et al., 2000), meaning that concern for ecology or environment should translate into behaviors compatible with maintaining ecological systems (Kinnear, Taylor & Ahmed, 1974; Weigel, 1983). Yet, these definitions have been criticized for their weak operational and predictive value, as general attitudes do not always predict specific environmental behaviors (Giannelloni, 1998; Fransson & Gärling, 1999). To address this, EC is best described through

three classical components: a ***cognitive*** one (knowledge of environmental consequences), an ***affective*** one (emotional reactions to environmental issues), and a ***behavioral*** one (the intention to act pro-environmentally) (Fransson & Gärling, 1999; Dembkowski & Hammer-Lloyd, 1994). Overall, the strength of environmental attitudes significantly influences ecological behavior, especially when individuals perceive control over their own environmental impact (Gierl & Stumpp, 1999).

FIGURE 2. THE VALUE SYSTEM AND BEHAVIOUR. FROM GIERL AND STUMPP, (1999). SOURCE: VINSON, SCOTT AND LAMONT, (1977)



The concepts of ecological sensitivity (ES) and behaviour (EB):

The concept of **ES** lacks a precise definition, though it is often seen as an "*affective reaction, a sensation, and in this respect seems to be an incomplete notion* " (Thiery-Seror, 1996). It encompasses individuals' perception of the seriousness of environmental issues, their knowledge of such issues, and their support for environmental protection policies, and is generally linked to responsible behaviors that preserve the environment (Levy et al., 2014; Maresca, 2001). ES helps explain how and why consumers use ecological products (Böcker et al., 1991; Lin & Chang, 2012): environmentally conscious individuals, due to greater awareness of green products, may perceive them as less effective and thus use them in larger quantities (Lin & Chang, 2012). Defined as "*the degree to which a person is oriented towards*

caring for the environment" (Dunlap & Jones, 2002), environmental consciousness encourages consumers to prefer and even pay more for eco-friendly products (Böcker et al., 1991; Lin & Chang, 2012). Research highlights a **positive relationship between environmental knowledge, ES, and ecological behavior (EB)** (Zaiem, 2005), suggesting that **ES can act as a mediating or explanatory variable**, notably for ecological familiarity and experiences (Dekhili & Achabou, 2014). Etymologically, ES also reflects an individual's **resistance**—their tolerance and understanding of ecological pressures—and **resilience**, or capacity to recover from environmental degradation (Kinnear, Taylor & Ahmed, 1974). Thus, defining ES requires identifying key environmental factors, evaluating one's resistance and resilience to ecological stress, and modeling these dimensions to capture ecological sensitivity as a whole.

3.2. The relationship between the concepts of environmental concern, ecological sensitivity and ecological behaviour: a conceptual model

To clarify the relationship between the two concepts, the analysis draws on Suddaby (2010) and Yaniv (2011) regarding how theoretical clarity is constructed, as well as on Hempel's (1970) view of definitions as "*replacement rules*", where the definiens must be functionally equivalent in truth to the definiendum. Accordingly, good definitions should display "*inclusiveness, exclusivity, derivability, clarity, communicability, coherence and parsimony*" (Hunt, 1976; Suddaby, 2010).

Table 1. The elements of clarity in the concepts of environmental concern and ecological sensitivity

Elements of clarity in theories	Environmental Concern (EC)	Ecological sensitivity (ES)
Sparse and precise categorical distinctions (clarity) ***Derivability*** *(differentiating the concept from other terms)* ***Inclusiveness*** *(phenomena to be taken into account)* **Exclusivity** (phenomena to be excluded)	EC, also referred to as environmental attitude, is defined as a psychological tendency expressed by evaluating the natural environment with some degree of favour or disfavour (Milfont, 2007; Milfont and Duckitt, 2010). It includes both attitudinal and behavioural dimensions (Fransson and Gärling, 1999; Giannelloni, 1998) – Attitudinal dimensions: expression of a EC – Behavioural dimensions: behaviour compatible with maintaining the ecological system ⇒ EC has a triple component: cognitive, affective and behavioural of the classical attitude model. The concept of EC is thus a global attitude in the sense of Ajzen, (1989), Ajzen and Fishbein, (1980). The degree of belief in internal control[1] (perceived effectiveness of one's own actions). This is a moderating variable (Gierl and Stumpp, 1999; Pfrang and Schenk, 1986) in the relationship between an overall attitude (value) and behaviour. An individual's perceived efficacy with respect to environmental pollution has a strong effect on his or her level of ecological concern (Kinnear, Taylor & Ahmed, 1974). Socio-demographic variables - age, gender; psycho-sociological variables - personal variables, personality, etc.), are the determinants of EC.	ES is : - An affective reaction, feeling - A perception of the seriousness of environmental problems - A degree of knowledge of environmental problems - Support for government spending on environmental protection (Thiery-Seror, 1996) - An adoption of responsible practices (Özçaglar-Toulouse, 2009) - A combination of the individual's ability to tolerate external pressure from the ecological environment **(resistance)** (Kinnear, Taylor & Ahmed, 1974) and the time required to recover from a degradation of the ecological environment **(resilience)** ES is not strictly a perception. It has an evaluative dimension that links it to attitude.

[1] A person is internally controlled if he or she believes that his or her own abilities and actions would have caused a given situation (Gierl and Stumpp, 1999; Krampen, 1982). A person is externally controlled if he or she explains his or her own situation by other social factors (e.g. the influence of other powerful people) or by other environmental factors, which are also not controllable by that person (e.g. luck, chance or fate) (Gierl and Stumpp, 1999; Rotter, 1990; Yuchtman- Yaar, 1987; Mielke, 1981).

Tableau 1 (continued and end). Elements of clarity in the concepts of environmental concern and ecological sensitivity

Elements of clarity in theories	Environmental Concern (EC)	Ecological sensitivity (ES)
The conditions of the scope or contextual circumstances under which the concept will or will not apply	The unit of analysis is diverse: the public authorities, the company, the individual, the association. The concept applies when one is aware of the consequences of one's actions.	The unit of analysis is the individual. The concept is applied when the seriousness of a situation is perceived.
Semantic relations to other related constructions or nomological network (Cronbach & Meehl, 1955) or meaning system (De Saussure, 2011).	The concept is related to ecological behaviour (protection of the environment; consumption of ecological products, etc.).	ES is related to the core values of a personality; Attitudes towards products or visible behaviour, and ecological awareness, being concerned about ecology (Böcker & al., 1991). ES is an antecedent of ecological behaviour. It is positioned as a mediating variable in the relationship between EC and EB, (Zaiem, 2005); and as an explanatory variable for familiarity with ecology and ecotourism experiences (Dekhili & Achabou, 2014).
*The existence of a **degree of logical consistency** of construction with regard to the theoretical argument within the theory as a whole.*	The construction of these concepts, their definitions, their conditions of scope, their lineage and their relations to other concepts all make sense. In other words, they manifest themselves in a logical way.	

Environmental concern (EC) and ecological sensitivity (ES) are therefore two different concepts but are linked by at least two components of attitudes, namely the affective component (emotions) and the conative component (action). The relationships between these concepts in the literature review can therefore be summarised as follows (Figure 3):

Figure 3. Conceptual model of the relationship between environmental concern, environmental sensitivity and consumer purchasing Behaviour

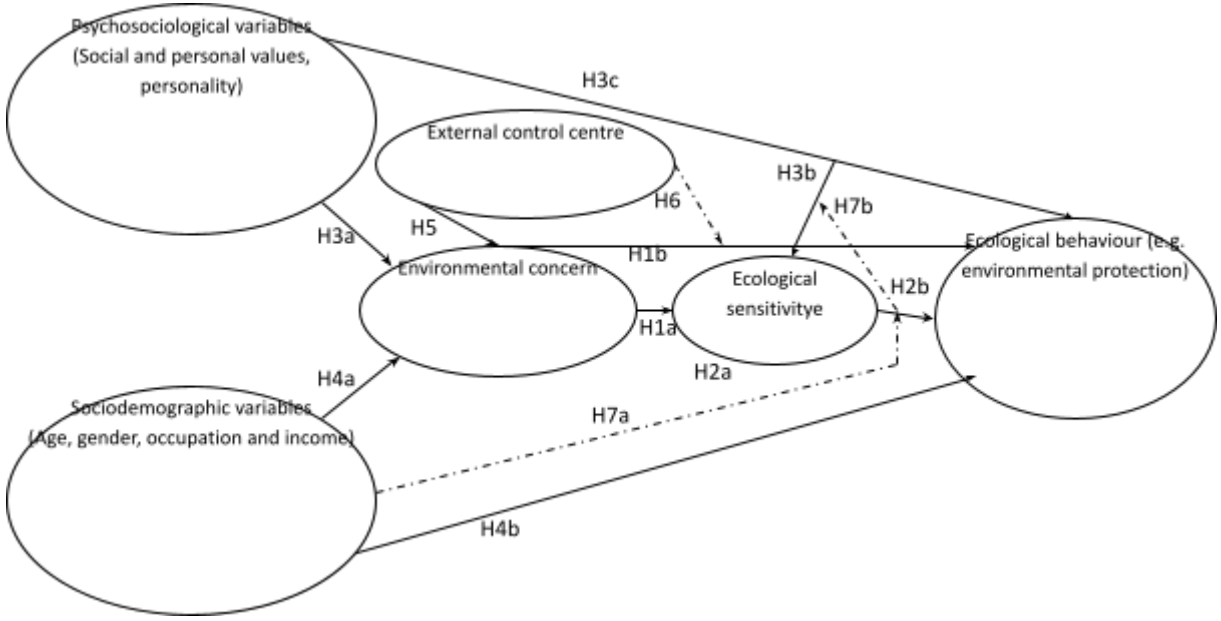


Table 2. Overview of research on ecological environmental psychology, field and main findings

Subject, area and research focus	Main findings	Significant articles
Topic or focus: Environmental attitude *Area: Environmental concern and protection.* *Research focus: Conceptual definitions, research methods, measurements*		
Environmental attitude and ecological behaviour.	● Environmental concern (EC) is often identified as a general attitude, with a threefold cognitive, affective and behavioural component of the classical attitude model. Overall, there is a lack of stability in research findings on the link between EC and ecological behavior (EB). ● A consumer's internal and external environmental attitudes are positively influenced by his or her degree of collectivism, long-term orientation, political commitment, ethics and obedience to the law, but are unrelated to liberalism. EC is the main explanatory variable for environmental protection behaviour. Environmental knowledge and environmental values explain 40% of the variance in environmental behaviour intention, which in turn predicts 75% of the variance in overall environmental behaviour. ● Perceived consumer efficacy (PCE) is distinct from environmental concerns and only contributes to the prediction of some pro-environmental behaviour. Indeed, there is a significant relationship between perceived consumer effectiveness (PCE) and consumers' willingness to make individual sacrifices. ● Important judgements on 22 aspects of the quality of life (QOL) concept summarised in seven value dimensions and general and specific environmental concerns contribute significantly to explaining political support for government regulation and market strategies to manage environmental problems as well as to explaining the acceptability of specific home energy saving and transport measures. ● The interaction of PCE and EC is insignificant, which may partly reflect the growing scepticism of many consumers towards 'green' marketing claims.	Arcury & Christianson, (1990) ; Dunlap & Van Liere, (1978) ; Fransson & Gärling, (1999) ; Giannelloni, (1998). Dembkowski, Hanmer-Lloyd, (1994) ; Dietz, Stern & Guagnano, (1998) ; Kaiser, Wölfing & Fuhrer, (1999) ; Laroche, Tomiuk, Bergeron & Barbaro-Forleo, (2002) ; Leonidou, Leonidou & Kvasova, (2010) ; Poortinga, Steg, & Vlek, (2004). Ellen, Wiener & Cobb-Walgren, (1991) ; Hartmann & Apaolaza-Ibáñez, (2012) ; Kinnear, Taylor & Ahmed, (1974) ; Takala, (1991) ; Weigel, (1983) ; Carrus, Passafaro & Bonnes, (2008) ; Fransson & Gärling, (1999) ; Garfield, 1991) ; Goldman, (1991).

Table 2 (Continued 1). Overview of research on ecological environmental psychology, areas and main findings

Subject, area and research focus	Main findings	Significant articles
Topic or focus: Environmental attitude *Area: Environmental concern and protection.* *Research focus: Conceptual definitions, research methods, measurements*		
Predictors of environmental behaviour	● When for individuals the EC plays mainly a **value-expressive role**, they are more likely to adopt environmentally friendly behaviours than those for whom the EC would have more of a **social value-expressive** function. But the use of behavioural variables only, such as values, may be too limited to explain all types of environmental behaviour. The EC is associated with high income. **Anticipated negative emotions and past behaviour** are important predictors of the desire to engage in pro-environmental actions. **Personality variables** are better predictors than socio-economic variables. **The cultural orientation "Man-Nature"** has a significant impact on ecological impact, but not on ecological knowledge. **The overall attitude towards the environment** influences the ecological behaviour of the consumer, especially when people see the origin of their life events and circumstances in their own behaviour, i.e. when they are internally controlled.	Carrus, Passafaro & Bonnes, (2008) ; Chan, & Lau, (2000) ; Eilam, & Trop, (2012) ; Giannelloni, (1998) ; Gierl & Stumpp, (1999) ; Poortinga, Steg, & Vlek, (2004) ; Smith & Haugtvedt (1995)

Table 2 (Continued 2 and end). Overview of research on ecological environmental psychology, areas and main findings

Subject, area and research focus	Main findings	Significant articles
Topic or focus: Perception of the ecological environment *Area: Ecological sensitivity (ES).* *Research focus: Conceptual definitions, research methods, measurements*		
ES and responsible behaviour of individuals	● ES is the importance one attaches to environmental problems or ecological issues. Ecological or environmental sensitivity is more of an "affective reaction, a feeling". It includes: perception of the seriousness of environmental problems, level of knowledge of environmental problems, and support for government spending on environmental protection. ES can be related to a personality's core values, attitudes towards products or visible behaviour. It can be related to one's ecological awareness or concern. It is often associated with the responsible behaviour of individuals who preserve the environment. The responsible consumer adopts responsible practices in order to: escape from unhappiness, find the authentic self, avoid isolation and take control of their life. ES explains the pattern of use of ecological products. ES is positioned as an explanatory variable for familiarity with ecology and ecotourism experiences.	Bardes, (2002) ; Böcker & al., (1991) ; Dekhili & Achabou, (2014) ; Henion, Gregory & Clee, (1981) ; Krause, (1993) ; Levy & al., (2014) ; Lin & Chang, (2012) ; Maresca, (2001) ; Thiery-Seror, (1996) ; Özçaglar-Toulouse, (2009) ; Zaiem, (2005)
Determinants of ES	Due to the lack of substantive work on the definition of ES, there is no real research on the basis of this concept and measurements are almost non-existent.	

3.3. Measures of environmental concern (EC) and ecological sensitivity (ES)

3.3.1. EC measurements

Five areas are often measured for EC:

1. **Concern for the environment itself, its index or attitude towards the environment**: Ellen, Wiener & Cobb-Walgren, (1991) ; Dunlap, Van Liere, Mertig & Jones, (2000) ; Giannelloni, (1995) ; Gifford & Nilsson, (2014) ; Milfont & Duckitt, (2010) ; Kinnear, Taylor & Ahmed, (1974) ; Schultz, (2001).
2. **Social responsibility**: Alvarado-Herrera, Bigne, Aldas-Manzano & Curras-Perez, (2017) ; Delmas, Etzion & Nairn-Birch, (2013) ; Fahlquist, (2009) ; Jagers & Matti, (2010) ; Rahman & Post, (2012) .
3. **Perception of environmental problems**: Ajayi & Banmeke, (2007) ; Choudri, Baawain, Al-Zeidi, Al-Nofli, Al-Busaidi & Al-Fazari, (2017) ; García‐Mira, Real & Romay, (2005) ; Kilian & Hennigs, (2014) ; Lee, Cin & Lee, (2016) ; Lo, (2014) ; Rocha, Pérez, Rodríguez-Sanz, Obiols & Borrell, (2012) ; Schaefer, (2004) ; Sudarmadi, Suzuki, Kawada, Netti, Soemantri & Tugaswati, (2001) ; Turaga, Howarth & Borsuk, (2010).
4. **Responsibility and/or moral obligation towards the environment**: Heberlein & Black, (1981) ; Pettus & Giles, (1987) ; Van Liere & Dunlap, (1978).
5. **Social consciousness**: Adlwarth & Wimmer, (1986) ; Webster Jr, (1975).

To assess the state of environmental attitude measurement, a review of existing scales was conducted (see Table 3), focusing on tools that evaluate *general environmental attitudes* rather than specific beliefs, intentions, or behaviors. Following Dunlap and Jones (2002), a **four-tier typology** was developed, crossing environmental issues (single vs. multiple) with expressions of concern (single vs. multiple): *(1) multiple-issue, multiple-expression; (2) multiple-issue, single-expression; (3) single-issue, multiple-expression; (4) single-issue, single-expression instruments* (Table 3). These strands align with four main conceptualizations of **expressions of concern**: (1) the **classical attitudinal model** including cognitive, affective, and conative components (Maloney, Ward & Braucht, 1975; Stone, Barnes & Montgomery, 1995); (2) the **individual's overall reaction to the environment**, encompassing control, tolerance, and satisfaction (Kinnear & Taylor, 1973; Crosby & Taylor, 1981); (3) the **New Environmental Paradigm**, centered on "*eco-crisis, anti-exemptionalism, limits to growth, and anti-anthropocentrism*" (Dunlap & Van Liere, 1978; Dunlap, Van Liere,

Mertig & Jones, 2000; Schultz, 2001); and (4) the **Environmental Attitude Inventory**, which synthesizes prior models through 12 integrated dimensions (Milfont & Duckitt, 2010).

The literature review reveals that most environmental attitude measures are **single-issue, multiple-expression instruments**, with few available in other categories (see Table 3). Among the many scales developed, only three have shown strong **validity and reliability**: the *Ecology Scale* (Maloney & Ward, 1973; Maloney, Ward & Braucht, 1975), the *Environmental Concern Scale* (Weigel & Weigel, 1978), and the *New Environmental Paradigm (NEP) Scale* (Dunlap & Van Liere, 1978; Dunlap, Van Liere, Mertig & Jones, 2000) (Dunlap & Jones, 2003; Fransson & Gärling, 1999). The debate centers on whether environmental attitude should be treated as **unidimensional or multidimensional** (Dunlap & Jones, 2002), though consensus now supports a **multidimensional view** (Milfont & Duckitt, 2010; Schultz, 2001; Stern & Dietz, 1994). According to Milfont (2007), environmental attitude exhibits both a **horizontal structure** (its dimensions) and a **vertical structure** comprising two higher-order factors—**preservation** and **use**—where "*preservation*" reflects valuing nature's protection, and "*use*" endorses its modification for human purposes (Milfont & Duckitt, 2004, 2006; Milfont & Gouveia, 2006; Wiseman & Bogner, 2003). These correspond respectively to "*spiritual versus instrumental*" (Stokols, 1990) and "*moral/altruistic versus utilitarian*" (Kaiser & Scheuthle, 2003) worldviews. Despite satisfactory reliability (Cronbach's $\alpha > 0.7$), **the field still faces issues of validity, conceptual clarity, and comparability of items across studies** (Giannelloni, 1998; Maloney, Ward & Braucht, 1975; Dunlap et al., 2000).

3.3.2. Measures of ecological sensitivity

The absence of a true definition of ES naturally leads to a weakness in the measurement of this concept. Only Zaiem, (2005) proposes as a measure the degree of emotion than an individual attaches to ecological issues.

Table 3. Scales for measuring environmental concern (all issues and expressions of environmental concern

Expressing concerns / **Environmental issues**	**Multiple**				**Unique**
	Classic attitude structure	***Overall response to the environment***	***World view***	***Inventory of environmental attitudes***	***Overall response to the environment***
Multiple		*Environmental satisfaction scale* (Pelletier, Legault & Tuson, 1996)			Scale of environmental concern (Van Liere & Dunlap, 1981) ;
Unique	*Environmental attitude* (Kaiser, Wölfing & Fuhrer, 1999) ; *Revised ecological knowledge and attitude scale* (Maloney, Ward & Braucht, 1975)	Scale of environmental concern (Bohlen, Schlegelmilch & Diamantopoulos, 1993) ; (Schultz, 2001) ; (Van Liere & Dunlap, 1981) ; (Weigel & Weigel, 1978). Scale of environmental concern: Attitude and behaviour [Kinnear & Taylor (1973) ; Kinnear, Taylor & Ahmed, (1974) ; Crosby, Gill & Taylor, (1981)] ; *ECOSCALE : A scale for measuring environmentally friendly consumers* (Stone, Barnes & Montgomery, 1995)	*Scale of the new environmental paradigm - NEP Scale* – (Dunlap, R. E. & Van Liere, 1978) ; *New scale of the new environmental paradigm* (Dunlap, Van Liere, Mertig & Jones, 2000)	*Environmental Attitude Inventory Scale* (Milfont, & Duckitt, 2010)	

3.4. Research perspectives

The research perspectives are built by identifying gaps in the literature and proposing corresponding theories and opportunities, following three complementary approaches: those suggested by prior authors, those revealed through critical analysis of existing gaps, and those emerging from the contrast between research and market practices or trends. Overall, this review highlights numerous research avenues in the ecological field (see table below).

Table 4. Research gaps and opportunities

Research gaps	Theory development and research opportunities
− The definitions of EC are not very operational, they do not allow the qualitative or quantitative evaluation of the consumer's EC (Giannelloni, 1998) − Incomplete knowledge of the dimensions of the EC − Non-standardised EC measurement	EC is a multidimensional concept. It is an attitude that depends on the context under study and the way in which it is expressed. For example, Dunlap & Jones (2002) propose a typology of EC measures that combine environmental issues (e.g. water pollution, population growth) with expressions of concern (i.e. beliefs, attitudes, intentions and behaviours related to environmental issues. Milfont, (2007) studied the horizontal and vertical structures of environmental attitude. The horizontal structure (dimensionality) refers to the primary or first order factor(s) forming the structure of environmental attitude (EA). However, it is not yet clear how many dimensions form the horizontal structure of EA. **Research will therefore have to focus on the dimensionality of the EC.** While the vertical structure refers to the higher or second order factor(s). More research is needed in this second area. However, recent studies have suggested a vertical structure of EA with two higher order factors - preservation and use (Milfont & Duckitt, 2004, 2006 ; Milfont & Gouveia, 2006 ; Wiseman & Bogner, 2003). By combining the typology of Dunlap & Jones, (2002) and the factor structure of EC, more operational definitions of EC can be improved. The operational definitions of EC will improve the measures of EC (see Table 3 on measures).
The definition of EC has a low predictive value (Fransson & Gärling, 1999) due to discrepancies between general attitudes, value orientations and specific environmental behaviour	**Research on EC should systematically address the direct and indirect effects of EC and address how EC determines other constructs**. They should pay more attention to the different attitudes leading to ecological behaviour (global attitudes, specific attitudes, ecological behaviour). The combination of sources of variation in EC and the variables it determines can be informative. **Combining Dunlap & Jones' (2002) typology with EC factor structure research will thus improve the nomological validity of EC (the relationship between the construct and the manifest variables that operationalise it)** and thus its predictive validity (whether or not the relationships between EC measures and those of other constructs are consistent with the predictions of grounded theory from previous research).

Table 4 (continued and end). Research gaps and opportunities

Research gaps	Theory development and research opportunities
Lack of definition of ecological sensitivity (ES)	There is no real definition of ES. However, etymologically it seems to have two main dimensions: resistance (tolerance: understanding and/or openness to new ideas) and resilience (which is the time needed to recover from a degradation of its ecological environment). This definition needs to be characterised and refined.
Measurement of ES	The measurement of ES can be done using Churchill's (1979) scale construction procedure, taking into account the new definition (tolerance and resilience)
How ES gives meaning to ecological events	Whiteman, G., & Cooper, W. H. (2011) analyse the data used in Weick's (1993) classic sense-making study of the Mann Gulch disaster in Montana and show how firefighters' varied ability to make ecological sense contributed to their survival or demise. These authors propose sense-making behaviours (2011, p. 904) which are: Ecological integration; Expert advice; Fragmentation; Dismemberment. These behaviours involve: ecological awareness (how actors notice and bracket material ecological cues from a stream of experiences and make connections and causal networks between various cues and with past environments); *the evaluation of different approaches to awareness* among group or team members, namely retention or conservation, enactment and selection. The research should therefore link ES to these behaviours and show which mechanism of awareness is fundamental in ecology.
How ES can complement the explanation of the relationship between environmental concern (EC) and ecological behaviour (EB)	The implementation of the ES mechanism should be studied in relation to EC in order to increase the explanatory potential of EC and ES on EB. The role of mobilisation in the ES and EB relationship could be explored. For example, could the same approach to donations (blood donations, charitable donations...) be used to mobilise ecologically aware people to adopt ecological behaviour? However, it turns out that the two concepts have many differences. The concept of ES is focused directly on the individual, whereas in donation we are pushed to adopt a behaviour. Donation therefore seems to be external to the individual, whereas ES is inherent to the individual. Is mobilisation for donation also external? Further research can look at this from this perspective.
Segmentation of the population according to the level of ES	Research should focus on how to better segment messages to the public based on ES to improve their impact.

DISCUSSIONS AND CONCLUSION

The discussions

This research aimed to synthesize the key variables of the ecological environment, revealing that **environmental concern (EC)** and **ecological sensitivity (ES)** differ conceptually and analytically. EC encompasses the three attitudinal dimensions—**cognitive, affective, and conative**—and can apply to individuals, organizations, or institutions, whereas ES relates to individuals' **perception, knowledge, and control** of ecological problems. Both share an interest in environmental knowledge and perceived control, though the latter remains underexplored for ES. The relationship between EC and ecological behavior (EB) appears unstable, with ES emerging as a **mediating variable** (Ekwa, 2020). Measurement of EC is well developed through **multidimensional, single-issue, multiple-expression instruments**, while **ES lacks robust measurement tools**, highlighting a significant gap and opportunity for future research.

In summary, research on these three concepts (especially for ES) still reveals a strong need for conceptual work that provides clarity. This is important to enable their application to environmental protection.

The contributions and limitations of the research: The first contribution of this research is theoretical and conceptual. It concerns the parsimonious definition of the concepts of the EC and ES through the systematic use of the criteria for the construction of clarity in the theories proposed by Suddaby (2010) and Yaniv (2011). This research thus highlights that these two concepts are different at several levels (on the definition and on the units of analysis). This contribution will eventually lead to more appropriate measures of these concepts. The second contribution is to have highlighted that ES is a mediating variable between the EC and the EB. This conceptualization of the role of sensitivity in this chain of relationships makes it possible to give more meaning to ecological indices. The third contribution concerns in-depth research on the measurement of EC and ES. In the case of ES, much work remains to be done to arrive at a valid measure of the concept.

The limitation of the paper is that this work is a synthetic literature review. In order to validate the various avenues of research highlighted here, it will also be necessary to go through an empirical phase and integrate the various concepts into a general theory of the environment.

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