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The influence of farmer demographic characteristics on environmental behaviour: A review.

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Abstract

Many agricultural studies have observed a relationship between farmer demographic characteristics and environmental behaviours. These relationships are frequently employed in the construction of models, the identification of farmer types, or as part of more descriptive analyses aimed at understanding farmers' environmental behaviour. However, they have also often been found to be inconsistent or contradictory. Although a considerable body of literature has built up around the subject area, research has a tendency to focus on factors such as the direction, strength and consistency of the relationship – leaving the issue of causality largely to speculation. This review addresses this gap by reviewing literature on 4 key demographic variables: age, experience, education, and gender for hypothesised causal links. Overall the review indicates that the issue of causality is a complex one. Inconsistent relationships can be attributed to the presence of multiple causal pathways, the role of scheme factors in determining which pathway is important, inadequately specified measurements of demographic characteristics, and the treatment of non-linear causalities as linear. In addition, all demographic characteristics were perceived to be influenced (to varying extents) by cultural-historical patterns leading to cohort effects or socialised differences in the relationship with environmental behaviour. The paper concludes that more work is required on the issue of causality.

Key Words: demographic; farmer characteristics; environmental behaviour; causality

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1. Farmer demographics characteristics and environmental behaviour – the issue

Agricultural studies have long observed a relationship between farmers' environmental behaviour and a variety of demographic characteristics. For example, features such as age, education and gender can influence decision-making with respect to entry into agri-environmental schemes (e.g. Wilson & Hart, 2000; Lambert et al., 2007), environmental enhancement of the farm (Jay, 2005; Siebert et al., 2006), adoption of new technologies (Austen et al., 2002; Adrian et al., 2005), and intensity of production and land use (Ondersteijn et al., 2003; Solano et al., 2006), to name but a few. In a rural setting where the demographic profile of farming populations is changing rapidly (Cole & Donovan, 2008; Hamblin, 2009) understanding how demographic factors influence decision-making is important for designing and targeting environmental and resource management programs (Lambert et al., 2007; Bohnet et al., 2011). This is increasingly significant in light of long-term environmental issues such as climate change where the time-frame for response means that policies need to consider socio-demographic change in populations in order to promote effective action (see Below et al., 2012).

Both quantitative and qualitative investigations of farmers' environmental behaviour almost always include measures of the characteristics of the farm owner/manager (although less of other household members – Burton, 2006) including age, education, experience and gender. These personal features are measured because they influence the choices people make, and consequently provide an indication of how one group of farmers (e.g. older, female, less experienced, better educated) will behave given a particular circumstance. Understanding how they influence behaviour enables them to contribute to purposes such as constructing economic or Multi-Agent System (MAS) models (e.g. Bakker & van Doorn, 2008; Valbuena et al., 2008), identifying similar farmer types or styles (e.g. Brodt et al., 2006; Iraizoz et al., 2007), or as part of a more generic analysis to understand, for example, the past or future uptake of agri-environmental policy (e.g. Wilson, 1997; Raymond & Brown, 2011).

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Considerable attention has been paid to this issue in the literature. In particular, comment has been made on the direction of influence (i.e. choosing between behaviours that are more or that are less favourable to environmental enhancement) and the strength and reliability of the relationships. However, perhaps surprisingly, the issue of causality is often either not mentioned or justified on the basis of only one or a limited number of research papers out of a complex mass of often contradictory claims (e.g. Smithers & Furman, 2003; Raymond & Brown, 2011). This makes both the interpretation of relationships and the making of informed decisions concerning which characteristics to measure or use in analysis rather difficult. The objective of this paper is to address this gap by collecting and examining casual explanations that have emerged in the literature. To achieve this, the hypothesised connections between four commonly measured demographics (age, experience, education, and gender) are critically discussed and presented in a framework diagram indicating the connections between demographics, hypothesised causalities, and environmental behaviours. The paper concludes by raising six key issues for future research.

2 Methodology

To understand the connection between demographic characteristics and environmental behaviours first requires a definition of which farming behaviours are 'environmental' and which are not. In general the literature is fairly liberal about what an 'environmental behaviour' constitutes. Entry into agri-environmental schemes, environmental outreach programs, and the adoption of more environmentally benign methods in agriculture are widely regarded as environmental behaviours (e.g. Bager & Proost, 1997; Crabtree et al., 1998; Ondersteijn et al., 2003; Kabii & Horwitz, 2006; Jackson-Smith & McEvoy, 2011). In this review 'environmental behaviour' thus refers to engagement with agri-environmental/conservation programs or farming practices that are widely accepted as more environmentally benign than intensive agriculture or that improve biodiversity on the farm. It is important to note, however, that these behaviours are not necessarily indicative of pro-environmental *attitudes* as there are many other reasons for engaging in 'environmental behaviours', for example, to improve the appearance of the farm, prevent stock losses, or

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obtain agri-environmental subsidies with limited behavioural change (Jay, 2005; Burton & Wilson, 2006). Issues of how specific 'types' of environmental behaviours are related to demographic characteristics are outlined in the text where relevant to the discussion.

Initially this research was part of a wider unpublished report that examined the influence of social and structural variables against a number of behaviours (not just environmental) to assist in the construction of farmer agents for an MAS (Burton, 2009). Information on the casual links has been drawn primarily from this source. However, the literature list has also been extensively updated, the original ideas refined, all literature re-assessed, new causal links included, a framework diagram constructed, and a discussion based around the subject added.

While many studies make mention of how demographic factors might influence environmental behaviour there is no comprehensive or simple framework for locating them. Publications for review were selected primarily by searching the commonly used academic search engines Scopus, Web of Knowledge and JSTOR using a mix of key words that included age, gender, experience, education, agri-environment, farming (farmer), and demographic. Where mention of hypothesised causal influence was made in a publication the original references were traced back where possible.

Despite the existence of a wider literature covering economically developing countries, this review focuses on agriculture in advanced economies. While similarities cannot be discounted, many developing economies have radically different farming systems, environmental problems, policy environments, education systems, and so on. The majority of studies that emerged from the literature search came from Europe where measures to decrease the environmental impact of agriculture have been the subject of many assessments. Of the 53 papers found to contain information on the relationship between the demographic variables and environmental behaviour 12 came from North America, 5 from Australasia, 1 from South Africa, and 35 from Europe (mainly the EU). This emphasis on Europe/North America needs to be considered when applying the results of this review outside of the region.

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	Tested	Relationship	No relationship	Tested but no mention	Not tested
Age	45	26	17	2	8
Experience *	15	10	5	2	37
Education	38	25	12	1	14
Gender	15	9	5	1	37

Table 1: Summary of detected relationships between demographic variables and environmental behaviour in reviewed papers. Numbers indicate the number of studies involved. ([a] One paper tested two environmental behaviours with one result significant and one not significant)

Table 1 summarises the findings of the reviewed literature. The most commonly tested characteristics were age and education – two factors believed to be strongly related to farmers' environmental behaviour. However, the review indicated that in almost 38% of cases no relationship was found between age and environmental behaviour, while for experience, education and gender around 31-33% of results showed no detectable relationship. Explanations of causality were often couched in phrases such as "provided the distinct impression" (Jay, 2005: 24), "no doubt as a result of" (Solano et al., 2006: 415), "It is also almost a cliché that" (Brodt et al., 2006: 100), "it seems reasonable that" (Ondersteijn et al., 2003: 42), "it could be expected" (Wilson, 1997: 82), "we speculate that" (Pannell et al., 2006: 1413), "with an underlying assumption that" (Riley, 2006: 341), and so on. Thus it is evident that, despite frequently testing these variables and/or employing them to model human behaviour, there is very little certainty as to how these relationships are occurring.

3 Demographic relationships and explanations from the literature

3.1 Age of the owner occupier/manager

The majority of studies examining the relationship between age and environmental behaviour suggest that younger farmers are more likely to undertake programs or environmental

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enhancements than older farmers (e.g. Filson, 1993; Bager & Proost, 1997; Bonnieux et al., 1998; Elis et al., 1999; Vanslembrouck et al., 2002; Mathijs, 2003; Brodt et al., 2006; Siebert et al., 2006; van Rensburg et al., 2009; Boon et al., 2010; Murphy et al., 2011). However, reviews of the literature observe age to be an unreliable indicator (Rougoor *et al*. 1998; Pannell et al., 2006; Knowler & Bradshaw, 2007). For example, some studies found no difference between the age of farmers who entered environmental/conservation schemes and those who did not (e.g. Wilson, 1997; Atari et al., 2009; Siebert et al., 2010; Yiridoe et al., 2010; Finger & Lehmann, 2012) while others have found younger farmers to be less willing participants (Kristensen et al., 2004; Defrancesco et al., 2008; Barreiro-Hurlé et al., 2010), possibly as a result of their greater enthusiasm for intensive agricultural practices (e.g. Short, 1997; Burton & Wilson, 2006). Within the literature four main causal explanations have been postulated.

First, the farmer's age reflects the social cohort within which he/she was raised. Cohort effects occur when attitudes and beliefs become fixed to a particular historical social context through education, socialisation, or simply the accumulation of preferences and beliefs around a set of practices or technologies related to a particular time period (Settersten & Mayer, 1997). One of the best documented cohort effects in agriculture resulted from the post-WWII 'productivist' policy era ingraining beliefs about the virtues of intensification, specialisation, expansion and technological solutions in older farmers' outlook and behaviour (Wilson, 2001; Brodt et al., 2005; Burton & Wilson, 2006). In contrast, younger farmers raised in an era of heightened environmental concern, are believed to demonstrate increased environmentally oriented thought and action (Brodt et al., 2005).

Second, age influences both physical and mental efficacy which in turn affects enterprise choice, labour decisions (and time allocation) and land use decisions (e.g. Errington, 1986; Pannell et al., 2006). In terms of the impact on environmental behaviours this physical 'slowing down' process has been suggested as one reason for older farmers adopting agri-environmental programs that involve extensification of land-use (Potter & Lobley, 1992; Barreiro-Hurlé et al., 2010). Borsotto et al. (2008) suggest another possible explanation – that

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the withdrawal from heavy work provides older farmers with the opportunity to invest in the time-consuming activity of understanding support schemes. In contrast, the authors argue that younger farmers have a greater awareness of support measures which lowers the information cost of scheme participation leading to, in their case, a middle-aged group of non-participants. Finally, in a case where older farmers were less likely to adopt organic farming, Genius et al. (2006) attribute the difference to information gathering practices decreasing with age as the farmer disengages from agriculture – almost the opposite argument to Borsotto et al. (2008).

Third, researchers often observe a high correlation between age and measures of experience to the extent that age has been suggested to be a reasonable proxy for experience (e.g. Pingali & Carlson, 1985; Genius et al., 2006) (see Section 3.2 on 'experience').

Fourth, age can represent the life-cycle stage of the farm family. This has a direct impact on environmental decision-making as "different phases are accompanied by different motivations and interests and will therefore influence management decisions" (Ondersteijn *et al*., 2003: 35 – also see Leonard et al., 2011). In particular, life-cycle stage can be indicative of periods of major business restructuring (Potter & Lobley, 1992, 1996; Ondersteijn et al., 2003; Lambert et al., 2007) as (a) the retiring manager prepares the farm for succession (Ellis et al., 1999), (b) the successor begins to make management changes, or (c) the farmer without a successor prepares for retirement (Potter & Lobley, 1992, 1996). Further, older farmers have shorter planning horizons (Pannell et al., 2006; Lambert et al., 2007) and consequently may show a preference for shorter environmental contracts (Ruto & Garrod, 2009). The "characteristic cycle of intensification and extensification" (Potter & Lobley, 1996: 185) that emerges results in an alternating emphasis on commercial and amenity (including environmental) goals over the life-time of the farmer (Kristensen et al., 2004; Burton & Wilson, 2006).

3.2 Farming experience

A common observation of farming experience and environmental behaviour is that farmers with past experience with agri-environmental schemes show increased likelihood of

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engagement or greater engagement in new schemes (Crabtree et al., 1998; Smithers & Furman, 2003; Lobley et al., 2004; Defrancesco, 2008: Siebert et al., 2006, 2010; Jongeneel et al., 2008; Moon et al., 2012). Likewise, those with experience in intensive agriculture are more likely to be 'production maximisers' (Brodt et al., 2006) or 'disengaged' from environmental behaviours due to significantly stronger farming connections (McCann, 1997; Raymond & Brown, 2011). Other studies suggest that the relationship is not so simple. Atari et al. (2009), for example, divided farming experience into 3 categories and conducted a test of association with years of experience in agriculture and conservation scheme participation. The authors found that farmers with a moderate level of experience were more likely to participate in the program than farmers with both higher and lower levels of experience.

In general the influence of experience is to make past farming behaviours – whether environmentally oriented or otherwise – more likely to occur again in the future (Läpple, 2010). Higher levels of experience with a particular type of farming are believed likely to decrease the chances of changing production types or processes (e.g. Siebert et al., 2006; Atari et al., 2009). There are five hypothesised causal links that may contribute to this outcome.

First, experience is believed to increase the level of *skill and knowledge* at a particular practice (similarly to education – Section 3.3) which, in turn, increases the efficacy of the behaviour (Jongeneel et al., 2008; Läpple, 2010). In this context, experience has, in combination with education, been used as a proxy for measuring the effect of human capital on both environmental and conventional agricultural behaviours (e.g. Daberkow & McBride, 2003; Lambert et al., 2007). As farmers become more proficient at a particular type of farming, the appeal of alternatives is likely to diminish – particularly when cultural capital is being obtained as a result (see below).

Second, farmers with previous (positive) experience with environmental schemes are likely to develop positive *attitudes* towards new environmental measures (Vanslembrouck et al., 2002). This is supported by the social psychology literature which suggests that past experience is

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both (a) a key dimension of attitude strength (Krosnick et al., 1993) and (b) provides the most important source of information about behavioural control – which in turn determines the likelihood of undertaking a specific behaviour (Ajzen, 1991). Jongeneel et al. (2002, 91) describe this with respect to multifunctional activity as farmers with experience having "less of a mental barrier."

Third, in an agricultural context, Fountas et al. (2006) contend that experience increases the extent to which decision-making is intuitive rather than planned.

Fourth, experience with environmental degradation resulting from agriculture has been suggested to *normalise* environmental damage such that farmers come to regard it as part of agriculture rather than problematic (Traoré et al., 1998). On the other hand, it has also been suggested that experience with environmental degradation during the productivist era inspired increased interest in conservation amongst middle-aged farmers (Battershill & Gilg, 1997). Thus, in addition to normalising environmental damage, it can also be argued to 'normalise' a reaction *against* environmental damage.

Fifth, experience represents the extent to which farmers are structurally/culturally locked in to their current form of production. For example, when combined with existing farm structures, experience has been said to represent the past legacy of land use and increases the likelihood that historical land use will continue (Mather, 1992). Similarly, in contributing to the development of skills and knowledge (i.e. cultural capital), experience enhances farmers' social standing in their community and results in increased reciprocal exchanges. These exchanges can lead to the generation of social capital (the capital resources that can be mobilised via social connections and mutual obligations) and increase the likelihood of the farmer following socially acceptable courses of action (Sutherland & Burton, 2011; Burton, 2012). Raymond & Brown (2011) have also used experience in agriculture as a measure of the sense of belonging farmers feel towards to farming and farming communities.

3.3 Formal education

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Education's ability to change attitudes and increase understanding of complex issues provides a clear rationale for its role in promoting environmental behaviour. Consequently, it is widely believed that the higher the level of formal education the more likely the farmer will be to engage with environmental programs and approaches to agriculture. There are numerous studies suggesting that education enhances, for example, the adoption of or attitudes to organic farming (e.g. Stock, 2007; Best 2009), participation in agri-environmental schemes (e.g. Wilson & Hart, 2000; Mathijs, 2003; Smithers & Furman, 2003; Lambert et al., 2007; Barreiro-Hurlé et al., 2010), farmers' environmental attitudes (Filson, 1993) and investment in sustainability measures (Jay, 2005). However, many studies have also found no relationship (e.g. Vanslembrouck et al., 2002; Best, 2010; Siebert et al., 2010; Yiridoe et al., 2010; Finger & Lehmann, 2012) or even an inverse relationship (Bonnieux et al., 1998; Ondersteijn, 2003; Riley, 2006; Defrancesco et al., 2008). Thus despite Siebert et al.'s (2006, 329) observation from a review of literature that "the significance of education for participation is confirmed throughout" the results are by no means conclusive.

One explanation for the inconsistency in results is the way education is measured. Studies commonly use the number of years in education or the highest qualification achieved (e.g. McCann et al., 1997; Wilson, 1997; Wilson & Hart, 2000; Ondersteijn et al., 2003; Toma & Mathijus, 2004; Atari et al., 2009; Best, 2009; van Rensburg et al., 2009; Moon et al., 2012), whereas other studies suggest that the content of the education is of more importance. Researchers have observed both with respect to the adoption of conventional agricultural technologies and environmentally friendly management techniques that farmers with a conventional agricultural education behave differently to those with a general education (Pannell et al., 2006; Riley, 2006; Murphy et al., 2011). For example, in Riley's (2006) case a conventional agricultural education lead to a positive relationship between education and the intensity of hay-meadow management, while Murphy et al. (2011) found that, with respect to biodiversity undertakings, having a 'general' or 'agricultural' education led to different option choices in a menu scheme. There are three main causal influences associated with education.

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First, it has been suggested that education creates or enhances environmental behaviour through initiating attitude change. According to Jackson-Smith & McEvoy (2011) this belief stems from the Theory of Planned Behaviour. At its most basic level, this postulates "that behaviour is a function of *salient information*, or beliefs, relevant to the behaviour" (Ajzen, 1991: 189 – emphasis added). Education can change attitudes by, for example, dispelling myths about the outcomes of environmental behaviours (Kreutzwiser et al., 2011) or introducing new knowledge that enables farmers to recognise environmental problems (Jackson-Smith & McEvoy, 2011). This in turn may lead farmers to become 'environmentally conscious' (Traoré et al., 1998; Ellis et al., 1999). However, even if education does enhance environmental attitudes, attitudes to the environment and agri-environmental schemes are not always correlated with environmental behaviour (Brotherton, 1991; Knowler & Bradshaw, 2007: Jackson-Smith & McEvoy, 2011) – thus the connection is not a simple one.

Second, as with experience, education has been associated with the level of cultural capital held by an individual via status generated by improved efficacy of management (Burton & Paragahawewa, 2011). As with cultural capital derived from experience, education can thus tie people into socially accepted courses of action. However, researchers have also observed that in farming communities educational qualifications tend to be less valued than the skills and knowledge generated by experience in the practice of agriculture (Burton, 2006; Sutherland et al., 2013).

Third, education is believed to increase the efficacy of farm management through either the enhancement of technical skills and familiarity required to operate new technological innovations (e.g. seasonal climate forecasts - Adrian et al., 2005; computerised management - Austen et al., 2002) or enhancement of understanding of complex farming systems (e.g. use of pasture maintenance strategies - Austen et al., 2002, Solano et al., 2006; efficacy of implementation of nutrient accounting systems - Ondersteijn et al., 2003), i.e. it enhances the farmer's human capital (Genius et al., 2006). A similarly improved understanding of ecological systems has been suggested as a reason for better educated farmers being more likely to follow environmentally sustainable agricultural practices. This includes explaining

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differences in eco-efficiency (depending on whether the education is general or agricultural – Picazo-Tadeo et al., 2011), identifying and effectively addressing complex environmental problems such as soil conservation issues (Traoré et al., 1998) and farm beautification (Vanslembrouck et al., 2002[1]). In addition, the argument that education familiarises farmers with new technologies also emerges as education is thought to enhance the ability to cope with the administration required for agri-environmental programs (Siebert et al., 2006; Pfeifer et al., 2009; Ruto & Garrod, 2009).

3.4 Gender

Studies of the impact of gender on environmental behaviour generally suggest that women in agriculture are more environmentally oriented than men. For example, research has shown that women are more likely to support government regulations to protect the environment (Filson, 1996), women are more likely to be organic farmers (Egri, 1999), farms are more likely to encourage wildlife when women are involved in decision-making (Hall & Mogyorody, 2007) and women are more likely to participate in agri-environmental programs or undertake private conservation activities (Curtis & DeLacy, 1996; Boon et al., 2010). However, other studies have also observed no significant relationship between gender and environmental behaviour (Borsotto et al., 2008; Best, 2009; Conradie et al., 2013).

Feminist studies have long theorised on the issue of causality between gender and environmental behaviour. Theories to explain these differences include the role of biological or evolutionary influences (essentialist), the influence of social factors on the construction of women's self concepts (social constructivist), and the role of selective access to resources, training, technologies and so on in culturally defining the role of women (historical-materialist) (Alston, 2006; Nightingale, 2006). In an agricultural context Trauger et al. (2008) suggest another possibility, that a combination of physiology (less physical strength) and

[1] Note that Vanslembrouck et al. (2002) looked at both farm beautification and extensification of field margins as environmental behaviours. They found a significant relationship with education in the first case but no relationship in the second.

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culture (less technical competence due to lack of education) leads women to select strategies that require less strength and limited use of large equipment – consequently favouring agricultural approaches that are less energy intensive. However, in contrast, Brandth (2006) observes that the failure of women to operate large machinery is attributable to its cultural construction as a male domain (a social constructivist perspective) rather than a matter of ability.

With the exception of a pure essentialist argument (which has been rejected by post-modern feminist approaches – Pederson and Kjaergard, 2004) it is apparent, looking across the theories, that the differences between men and women are at least in some way socially/culturally constructed. Consequently, the nature of the relationship between gender and the environmental behaviour should be expected to change in accordance with changing social/cultural structures and beliefs with regards to the role of women. One of the key changes in European women's roles over the last century resulted from the introduction of new 'masculine' technologies (e.g. mechanical milking – Brandth, 2002) and the intensification/specialisation/mechanisation of agriculture which led to the loss of many of the traditional farming roles of women (Symes, 1991; Brandth, 2002; Prugl, 2004). This relegated many into support tasks and handed the decision-making power to men on the basis of greater experience in farming (Hall & Mogyorody, 2007). However, recent emphasis on the non-productive role of farms in Europe (what Prugl, 2004, terms the "liberal-environmentalist" era) has increased the importance of environmental management and tourism and provided women with a greater say in farm management. In addition, the growing importance of paperwork (particularly in agri-environmental scheme management) and its position as a female role has resulted in an increase in the influence of women on farm decision-making in some cases (Riley, 2009).

4. Discussion – causality issues

Figure 1 summarises the above sections into demographic characteristics of farmers, causal links, and the impact of the causal link on environmental behaviour and serves as a point for a

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discussion on the key findings of the review. There are six main issues that can be identified as warranting the attention of researchers.

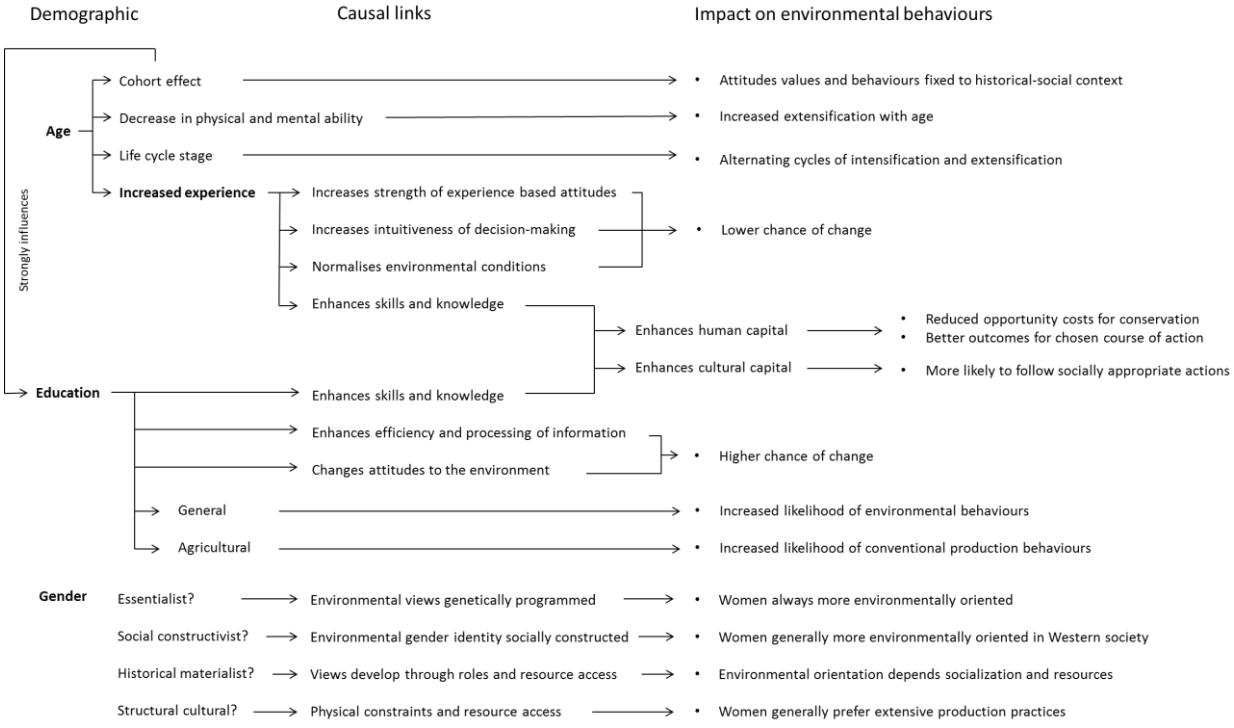

Figure 1: Summary diagram of the causal links between demographic characteristics of farmers and environmental behaviours.

First, the figure illustrates the complexity of the connections between demographic characteristics and environmental behaviours. Effectively it can be contended that age links to education via a cohort effect, experience is a direct effect of age, and experience and education are connected via the tendency of both to enhance cultural capital and thus socially appropriate courses of action. This inter-relationship has been observed (but not explained) in other studies through a tendency to report good or even very good correlations between age, education, and/or experience (e.g. Wilson, 1997; Ellis et al., 1999; Goodwin & Mishra, 2004; Borsotto et al., 2008). Such a correlation in their demographic data led Ellis et al. (1999) to urge caution in interpreting the influence of any individual variable on environmental behaviour. The relationship between age and experience is particularly strong for family

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farmers where successors are socialised into agriculture from early childhood (Fischer, 2007). Yet, as is apparent from Figure 1, age is not only an indicator of experience, but also of cohort effects, physical and mental abilities, and stage of life-cycle – while experience influences *only* efficacy, attitude strength, intuitiveness and cultural lock-in to modes of production.

Second, if one considers the number of different potential causal pathways then the reason for the unreliability of demographic characteristics as noted in the literature is clearly evident. In particular, as the age demographic is connected to both education and experience in addition to having three other possible causal connections of its own, observations that it is unreliable when predicting environmental behaviours are completely understandable (Pannell et al., 2006; Knowler & Bradshaw, 2007; Rougoor *et al*. 1998; Yiridoe et al., 2010).

Third, the review highlights a need to understand how 'scheme factors' influence 'farmer factors' (see Brotherton, 1991). While these are generally treated as independent (with some exceptions – e.g. Ruto & Garrod, 2009; Leonard et al., 2011) the review of causal influences suggests that 'scheme factors' can have a major impact on the way in which 'farmer factors' influence or indicate likely behaviour. For example, Wilson (1997) found no significant relationship between age and entry into the Environmentally Sensitive Area (ESA) scheme in general. However, within the scheme, older farmers were more likely to enter into Semi-Natural Rough Grazing (SNRG – grazing at low stocking densities), while younger farmers were more likely to enter into long-term Broadleaved Woodland planting (BLW). One explanation for this difference is that extensification via SNRG appeals to older farmers because of declining physical ability (Potter & Lobley, 1992; Barreiro-Hurlé et al., 2010) whereas BLW participation is more appealing to younger farmers with a longer planning horizon (Lambert et al., 2007). Overall scheme participation is likely to have been non-significant because some options of the scheme were attractive to younger farmers while other options were more attractive to older farmers – and these effects cancelled each other out.

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Fourth, it suggests that attempts at explaining the causality of relationships may require more in-depth investigation than is normally the case. For example, the finding (contrary to expected) that older farmers are more willing to engage in conservation projects than younger farmers have variously been attributed to; a preference for traditional practices akin to those offered by the scheme (a cohort effect – Defrancesco et al., 2008), the prioritisation of commercial production by younger farmers establishing themselves in agriculture (a life-cycle effect – Kristensen et al., 2004), and to older farmers preferring to engage with less physically demanding environmental measures (a physical efficacy effect – Barreiro-Hurlé et al., 2010). In none of these cases was any investigation actually conducted into causality but rather was based on explanations selected from the literature. While the causality may not be important in some cases, it becomes more relevant when results are translated into policy recommendations as different casual pathways are likely to demand different approaches to agri-environmental scheme design.

Fifth, the practice of using number of years in education or highest educational qualification should be avoided where possible. While education uniformly increases the efficacy of decision-making, enhances cultural capital, and potentially changes attitudes to the environment, the influence of this process on environmental behaviour can depend strongly on the content of the education and in particular whether it is a general education or a conventional education. A differentiation between agricultural and non-agricultural education (e.g. Riley, 2006; Murphy et al., 2011; Picazo-Tado et al., 2011) should be a minimum requirement if the influence of education on environmental behaviour is to be assessed.

Sixth, while demographic characteristics are often treated as having linear effects, this is not necessarily the case (e.g. Jay, 2005; Borsotto et al., 2008; Atari et al., 2009). There are two reasons for this. First, the multiple causal pathways may not always act in the same direction so that while increasing age (for example) decreases physical efficacy, it may simultaneously push the farm into a growth period through life-cycle change. Second, some of the causal influences are not intrinsically linear. In particular, any influence of cultural-historical patterns on the outcome (e.g. in gender, education or other cohort-based influences) will alter

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as a result of changes to the content of education, changing roles of women, changes in the dominant worldview, and so on. Even relationships dominated by physical constraints may change as a result of societal developments. For example, the influence of mechanisation on the necessity for physical strength in agriculture could change the relationship between both age and gender and environmental behaviour. Thus, even when we think we understand the causal influence of demographic variables, it should be acknowledged that these may be constantly changing and thus should never be taken entirely for granted.

5. Conclusion

Studies looking at the environmental behaviour of farmers often examine the influence of demographic characteristics in order to explore the social bases of the behaviour – but the results are frequently inconsistent. It has been suggested here that the key reason for these perceived inconsistencies lies in our failure to understand issues of causality and, in particular, to grasp the complex and sometimes contradictory nature of the casual influences associated with demographic variables. In many cases, a correlative relationship simply should not be expected. In others the outcome will be entirely dependent on features of the environmental behaviour/scheme in question – whether it be the need for understanding complex ecosystems, the physical strength required, the association with traditional farming behaviours, or whatever. Consequently, it is important that as researchers we move away from concerns for directionality and strength of these relationships to tackle the issue of causality. In particular, if we are to design and target long-term environmental and resource management programs at a farming population that is likely to be subject to significant demographic change over the next decades, we must know more about the causal connections that underlie the influence of demographic characteristics.

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