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Cultural landscapes and subjective wellbeing: exploring the strength of the relationship between landscape variables and self-reported life satisfaction

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Author's declaration

No portion of the work referred to in this thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

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ABSTRACT OF THESIS submitted by:

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Subjective accounts of wellbeing can provide insights into quality of life. Subjective wellbeing theory and measurement is increasingly popular within international development and economics. Yet, little has been written about subjective wellbeing in integrated landscape management. Cultural landscapes support vital economic, social and cultural functions. However, relationships between cultural landscapes and subjective wellbeing in developing countries have not been explored. Ten interviews and 226 surveys were conducted with residents in fifteen communities within the Toledo District of southern Belize between January and March 2015. A linear mixed effects model explored the relationship between forest and agricultural features, socio-economic characteristic and life satisfaction (a component of subjective wellbeing). Those with the greatest social support and highest self-rated health reported approximately 20% higher life satisfaction than those with the lowest (>95% CI). Those in communities with the highest extent of surrounding forest cover and agricultural pressure (between 2000 and 2014) reported approximately 40% lower life satisfaction than those with the lowest (>90% CI). Qualitative evidence suggests that subsistence and income-generating agriculture is important for wellbeing, potentially accounting for the negative relationship between forest cover and life satisfaction. Yet, extensive agricultural pressure threatens agricultural productivity, reflected in the negative relationship between agricultural intensity and life satisfaction. Therefore, landscapes may have important but complex effects on subjective wellbeing. These relationships may challenge prevalent narratives in landscape management discourse as well as offering insights into the role of cultural landscape in subjective wellbeing.

Keywords: Subjective wellbeing, life satisfaction, integrated landscape management, cultural landscapes, Cultural Values Model, ecosystem services.

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Table of acronyms

AIC	Akaike information criterion
AICc	Corrected Akaike information criterion
CI	Confidence Interval
ESI	Environmental Sustainability Index
GIS	Geographical Information Systems
HDI	Human Development Index
OSS-3	Oslo Social Support Scale - 3 Item
PCA	Principal Component Analysis
PCI	Problem Centered Interview
OWB	Objective Wellbeing
SWB	Subjective Wellbeing
SWLS	Satisfaction With Life Scale
THN	Theory of Human Needs

1. Introduction

The last four decades have seen a rapid evolution of the theoretical construction of wellbeing within psychology, permeating into economics and international development theory and practice (e.g. Sacks, Stevenson & Wolfers, 2010; Dolan, Peasgood & White, 2008; Conceição & Bandura, 2008; Tella, MacCulloch & Oswald, 1999). Subjective wellbeing is an individuals "evaluations of their lives using both cognitive judgments of life satisfaction and affective evaluations of moods and emotions" (Diener & Suh 1999). This is often contrasted against objective wellbeing - the "externally approved, and thereby normatively endorsed, non-feeling features of a person's life" (Gasper 2007). However, objective measures often offer a narrow interpretation of wellbeing, which do not account for the many cognitive processes that mediate individuals' subjective interpretation of their lives (Galinha & Pais-Ribeiro, 2011; Clark & Fischer, 2011). Subjectively and objectively measured wellbeing is often correlated (Dolan, Peasgood & White, 2008). However, there can be significant differences between individuals' experience of their lives, and how society constructs their relative quality of life (Waldron, 2011; Easterlin, 1995). Recognition of this divergence, and the wellbeing effects of elements often ignored in objective measures, is important in determining objectives, actions and evaluations in policy-making (Hoorn, 2007). Utilizing subjective wellbeing indicators can provide important insights into quality of life, which might otherwise be neglected or misrepresented by objective wellbeing measures (Dolan, 2011).

The value of measuring subjective wellbeing is increasingly recognised in national development planning (e.g. ANDI, 2015; OECD, 2013; Evans, 2011; Eurofound 2013; National Research Council, 2013). For example, the Australian Unity Wellbeing Index measures Australians satisfaction with their lives at personal, community and national scales (Australian Unity, 2015). The Australian Unity Wellbeing Index seeks to systematically measure and report on Australians personal satisfaction within eight life domains: standard of living; health; achieving in life;

personal relationships; safety; community connection; future security, and spirituality or religion. It also reports on national satisfaction with social conditions; the economic situation; the environment; business; national security; and government (Australian Unity, 2010). This tools compliments traditional economic measures, providing a more rounded picture of the quality of life of Australians (Cummins et al., 2003). Similarly, the Gallup World Poll has sought to quantify wellbeing, including subjective wellbeing, through regular surveying of "every" country in the world, since 2005 (Tortora, Srinivasan, & Esipova, 2010). Subjective wellbeing data produced by Gallup has informed a wide range of policy materials, such as the OECD's Better Life Index: (Gallup, 2015; OECD, 2011). However, there appears to be ample opportunity to employ subjective wellbeing theory within other disciplinary frameworks - for example, integrated landscape management (Vemuri & Costanza, 2006)

Multifunctional landscapes are the "physical template" that mediate the relationship between humans and nature (Willemen et al. 2010). As such, they often support important physical processes and features, and can hold deep cultural and symbolic value (Naveh, 2001; Mertz et al., 2007). Contemporary landscape management discourse is dominated by objectively measured, valued and verified aspects of wellbeing (e.g. Raudsepp-Hearne, Peterson & Bennett, 2010; Nelson et al., 2009). For example, the Millennium Ecosystem Assessment (MA 2005) synthesises substantial evidence of the importance of ecosystems in supporting livelihoods, through the supply of food and supporting important biophysical and cultural processes. However, it is unclear if these relationships are reflected in individuals' subjective experiences of their lives.

Relatively little has been written about the relationships between subjective wellbeing and landscapes (Vemuri & Costanza, 2006; Liu and Opdam 2014; Dolan, Peasgood & White, 2008). Existing literature has explored perceptions of the importance of landscapes in individuals' wellbeing (Larson et al., 2014; Bieling et al., 2014; Plieninger et al. 2013a; Plieninger et al. 2013b;

Petrosillo et al., 2013) and the role of landscapes within specific life domains such as health (Bowler et al., 2010). Studies also explore the relationship between spatial features and subjective wellbeing in a developed country (Brereton et al., 2008), and the correlation between subjective wellbeing and natural capital at national scales (Vemuri & Costanza, 2006; Engelbrecht, 2009; Bonini, 2008; Welsch, 2002; Zidanšek, 2007). However, it appears that no studies have explored the role of spatial characteristic of landscapes on SWB in developing countries.

The substantial investment in integrated landscape management in developing countries is often grounded in expectations about the relationship between landscapes and human wellbeing. Yet, these assumptions have only been tested according to objective wellbeing measures. Assuming that objective indicators of wellbeing accurately model subjective experiences can be misleading (Smith & Clay, 2010; Dolan, Peasgood & White, 2008; Royo & Velazco, 2006). Therefore, a more holistic account of people's experience of their wellbeing under different landscape conditions tests this assumed relationship. Testing this assumption may open up a more nuanced debate on human wellbeing in landscapes. This allows for a more sophisticated characterisation of wellbeing when developing objectives and activities within integrated landscape management.

Therefore, this study aims to empirically explore the relationship between landscape elements and individuals self-reported life satisfaction (a key component of subjective wellbeing), within a developing country context.

Yet, intuitively it appears that there is a strong link between individuals' experienced quality of life and environment and landscape conditions. Here the distinction between subjective wellbeing as it is understood in vernacular terms and SWB, as a psychological construct, needs to be clearly stated. Individuals naturally have their own understandings of what makes for a good life:

"I went to the woods because I wished to live deliberately, to front only the essential facts of life, and see if I could not learn what it had to teach, and not, when I came to die, discover that I had not lived."

Henry David Thoreau, Walden (1854)

Nevertheless, both stated preferences (the quote above, for example) and revealed preferences (actual market behaviour) are sometimes poor predictors of people's self-reported wellbeing (Dolan, Peasgood & White, 2008). In other words, the things individuals think are important for a good life, and the things they actually do to seek to enhance happiness, may not always be strong predictors of the self-reported quality of life.

These conclusions could be criticised as paternalistic - such a political debate is beyond my capacity to adequately discuss here, but the triangulation of 'what is good', through self-reporting measures, does not exclude the use of stated and revealed preferences. Ultimately, there are many heuristic phenomena and cognitive buffers that mediate individuals' perceptions about what makes their lives good or bad (Durayappah, 2010; Cummins, Lau & Davern, 2012). For these reasons, policy that is solely guided by perceptions of the constituents of a good life, or what is revealed through market behaviour, may fail to enhance peoples experienced wellbeing.

Additionally, individuals' definitions of what a good life means is also likely to be highly variable. In this study, I adopt Diener & Suh's (1999) definition of SWB as an individuals "evaluations of their lives using both cognitive judgments of life satisfaction and affective evaluations of moods and emotions". This definition intentionally creates space for subjective experience, but focuses on the scope and nature of SWB, not the conditions that influence it (Diener & Suh, 1999).

Within the context of landscape management, this raises the challenge that adopting a single and rigid definition of SWB imposes a significant observer bias, and precludes the many culturally relative interactions between individuals and landscapes. As will be discussed in Box 1, there is still significant controversy within psychology about what SWB is (e.g. Ryan & Deci, 2001). Therefore, any discussion of the study must be mindful of the limited scope of SWB as defined here. In this respect, the bond between SWB and landscapes discussed here does not exclude the recognition of other relationships with alternative definitions of subjective wellbeing.

In this thesis, I follow the sociological tradition of referring to the first person. Despite the predominantly post-positivist position that I employ in the study, I aim to apply mixed methods of data collection an analysis. One consequence of this attempted integration of post-positivist and constructivist paradigms is that, although aspiring towards some objectivity (particularly within the statistical component), I also recognise the inherent biases and subjectivities there are inevitable in inquiry (Moon & Blackman, 2014). Along these lines I also highlight areas beyond my capacity to interpret, or are likely to be particularly biased by my worldview. As will become more apparent when discussing the Cultural Values Model in Section 2.3.4., the position of the researcher or 'expert' is important to recognise when interpreting cultural landscapes.

1.1. Overview of thesis

The thesis consists of six main sections. Following this introduction, Section 1, is a literature review. This literature review constructs the theoretical framework, which draws on the psychological construction of SWB (Section 2.2.) and cultural landscapes (Section 2.3.). It then briefly discusses the extent of empirical research investigating the link between landscapes and SWB (Section 2.4.) and identifying conclusions and research gaps (Section 2.5.). Section 3. will discuss the methods employed in the study, including a description of the study site, epistemology and methodology, and the use of quantitative and qualitative data collection and analysis. Section 4. will present the results of the qualitative and quantitative analysis. Section 5. will discuss these results in the context of the theoretical framework. Finally, Section 6. will draw conclusion about the application of the study, its wider theoretical implications and key research gaps.

1.2. Research Aim

- To empirically explore the relationship between landscape elements and individuals self-reported life satisfaction, within Maya communities of southern Belize.

1.3. Research Questions

1. What are the primary themes that individuals in Maya communities associate with a good life?
    a. What does a good life mean?
    b. What are the things that are perceived to influence quality of life?

What is the strength of the statistical relationship between landscape variables and self reported life satisfaction, accounting for social, economic and demographic effects?

Question 1., and its sub-questions a. & b., are intended to perform four functions. Firstly, to explore if the perception of a good life is consistent with the understanding of SWB used here. Secondly, to shed light on themes that might be important to explore within the quantitative component of the study, thus informing the content of the survey. Thirdly, to inform the construction of 10 candidate models within the statistical analysis. Finally, to provide depth and context in which to situate some of the quantitative results, as well as highlight areas of contrast. Question 2., seeks to shed light on the Research Aim using statistical methods, whose results are situated in the qualitative exploration in Research Question 1. Exploring Research Questions 1 & 2 will also elucidate potential theories regarding the Research Aim.

2. Literature review and theoretical framework

2.1. Introduction and review of methods

The review seeks to do five things. Firstly, it will develop a theoretical framework for understanding wellbeing, with a specific focus on life satisfaction - an important component of SWB, alongside positive and negative affect. Secondly, it will introduce the theoretical framework for understanding cultural landscapes. Thirdly, it will seek to connect these two frameworks in a coherent model that describes how landscapes may affect SWB. Fourth, a number of empirical studies looking at the relationship between the environment and life satisfaction will be reviewed. Finally, potential research gaps will be identified.

Addressing these areas may shed light on how landscape and wellbeing discourse can further integrate a more multidimensional construction of wellbeing, particularly SWB. Such integration could enhance the capacity of decision makers to choose activities that enhance quality of life as a whole, beyond just those domains of wellbeing that have been the traditional focus. It also creates the theoretical background to which the results of the subsequent study will be analysed and interpreted.

2.1.1. Review aim

- To develop a coherent theoretical framework for understanding the relationship between landscapes and SWB.

2.1.2. Review questions

1. What is the state of the literature regarding SWB and its constituents?
2. How can multifunctional landscapes be understood in terms of their physical and cultural features?
3. What empirical evidence exists for a relationship between the environment, landscapes and SWB?

4. What are the main research gaps within the life satisfaction and environment and landscape literature?

2.1.3. Scope of the literature review

The literature review will stay largely within the scope of economic, development, psychology, and landscape theory literature. Although other disciplines, such as gender studies or political ecology, have interesting insights into the discourse, it is beyond my knowledge and the time to explore these aspects. Additionally, when creating the theoretical framework, positive and negative affect (although important component of SWB) will be largely ignored. Reasons for this omission are discussed in Section 2.2.3. Personality and genetic characteristics will also not be discussed in detail. Although these intrinsic factors explain the majority of variation in SWB (Weiss, Bates & Luciano, 2008) they are largely beyond the scope of policy intervention. Since this research is interested in applied effects of policy interventions, these factors are acknowledged but not discussed. The psychological literature cited largely remains within the realms of established and core concepts of SWB, specifically within the hedonic tradition. The review of studies described within Section 2.4.4. will largely focus on global evaluations of SWB, to the exclusion of studies that look at environmental effects on specific domains such as health and leisure. The relative importance of landscape factors on SWB as a whole may not be the equivalent to the sum of all the effects on specific life domains (Cummins, 1996). Because of the complexity of socio-ecological systems, it is beyond my capacity to dissect the relationship between landscape factors and specific life domains, and then to interpret the sum of those relationships in a meaningful and internally consistent way. Therefore, treating individuals global evaluations of life satisfaction as a 'black box' of individual own weightings for each life domain may reveal less about the relationship between landscapes and SWB, but on the other hand, does not impose a interpretive bias regarding how each domain is evaluated in relation to others. Finally, the Cultural Values Model, which identifies features according to their cultural value, will

be used as a framework for understanding landscapes. This explicitly anthropocentric approach excludes the notion of absolute intrinsic value, and therefore, environmental elements that fall outside of human 'experience' are not considered within the model.

2.1.4. Review method

The method for selecting literature for inclusion within the review was an iterative process. However, initial material was selected by inputting a combination of key words and phrases within the Google Scholar, Web of Knowledge and Science Direct journal repositories. These key words were:

- 'Subjective wellbeing'
- 'Subjective well-being'
- 'Life satisfaction'
- 'Human needs'
- 'Landscape'
- 'Cultural landscape'
- 'Multifunctional landscape'
- 'Environment'
- 'Ecosystem services'

Out of those papers retrieved from the initial search, candidate papers were selected first based on the content of the title, then by the number of citations, and finally by the content of the abstract. Twenty papers were deemed to be appropriate for the review, based on this initial search. Subsequently, additional literature was also selected from in text citations and *ad hoc* searches.

A synthesis matrix was used to identify important concepts within each of the papers, as well as highlight important themes that were consistent and in contrast across the paper. This synthesis matrix helped informally analyse the literature and provides some of results of the review.

2.2. Needs, subjective wellbeing and life satisfaction: the psychological framework

The following section seeks to describe a hieratical theory of wellbeing, ultimately focusing on one key component of SWB – life satisfaction. In doing so, a theoretical framework for understanding the relationship between landscapes and SWB will be developed.

2.2.1 The evolution of wellbeing and needs discourse

Gough & McGregor (2007), in their book *Wellbeing in Developing Countries: From Theory to Research*, describe the transition away from the pursuit of 'poverty alleviation' towards enhancing quality of life more holistically within international development. During the twentieth century, much of the development and welfare economics discourse treated wellbeing and welfare as very closely associated. Both disciplines were concerned with the fulfilment of 'basic human needs', which were externally defined and interpreted (Gough & McGregor, 2007). However, 'basic needs theory' of the 1980s and 90s came to be seen as increasingly problematic in some circles (Gasper, 2007). Stern (1989) took issue with the definitions of what a 'basic' need was (or what made a need 'basic'), and questioned what the appropriate level of fulfilment of those needs would be. Others highlighted the limited clarity on the sources of basic needs, and the lack of appropriate, systematic and politically appealing language to describe these needs (Gasper, 2007).

Some of these issues were later addressed through the development of frameworks including Doyal and Gough's (1991) 'Theory of Human Need' (THN) and Sen's capabilities approach (Robeyns, 2005; Gasper, 2007). The Capabilities approach builds on Daly's (1991) reinterpretation of the 'ends and means' of development. The 'ends' are no longer to improve indicators such as wealth or education, but to treat those factors as 'means' by which individuals achieve self-defined wellbeing goals – i.e. empowerment and enriched agency through improved life conditions, which facilitate individuals' self-actualisation (Sen, 1999; Daly, 1991).

The Theory of Human Needs distinguishes between 'needs' and 'wants' (Gough & McGregor, 2007). 'Needs' include those things required to meet basic conditions for life: physical health and autonomy. Since they meet the basic requirements for life they are held as universal across all individuals irrespective of culture. 'Universal satisfiers' are intermediate needs that are required to be fulfilled to be able to acquire health and autonomy. As a result, they are seen as having instrumental value. These universal needs are grouped into eleven categories: adequate nutrition and water; adequate protective housing; non-hazardous work and physical environments; appropriate health care; security in childhood; significant primary relationships; physical and economic security; safe birth control and child bearing; and basic and cross-cultural education. Within the THN, 'needs' are treated as hierarchical. Above the need for physical health and autonomy is what is termed critical autonomy: the capacity to be able to change ones life conditions. (Gough & McGregor, 2007).

However, one critical point within the THN is that the satisfaction of basic needs cannot be used to predict subjective quality of life. "The universal can guide but never dictate the local vision of what must be done to achieve wellbeing in specific contexts" (Gough & McGregor, 2007). This is due to a number of factors. Firstly, individuals' way of adapting and responding to life conditions significantly alters the link between life conditions and wellbeing. Secondly, 'wants' are those things that are culturally determined to be important for wellbeing, and therefore not necessarily universal. In contrast to the universal needs satisfiers, there are also non-universal needs satisfiers, which can be used to attain culturally relative 'wants'. In light of this, if one believes in the importance of enhancing quality of life beyond individuals' bare minimum for survival then the satisfaction of 'wants' and critical autonomy must also be considered. (Gough & McGregor, 2007). Although the legitimacy of hierarchically ranking 'needs' within the THN has been questioned (Kök, 2007), it spears to be a commonly used framework for understanding human wants and needs. Gough & McGregor's THN resonates, and potentially draws upon, the

work of earlier scholars including Max-Neef. Max-Neef (1992) distinguishes between existential and axiological categories of needs, as a means of understanding the relationship between needs and satisfiers (Table 1). Table 1 delineates between needs (e.g. the need for protection) and the means of satisfying that need (e.g. being cared for, having social support, being able to manage risks, all within a social environment). Similar to the THN, Max-Neef (1992) argues that basic needs are universal, but the means that these needs are satisfied can vary. Indeed, he suggests that cultures can often be delineated according to their choice of satisfiers. Changes in cultures can also be viewed in terms of changes in preferred needs satisfiers. Max-Neef (1992) also suggests that these needs can be satisfied at different levels: the individual, the social group and the wider environment. However, the role of non-universal needs (a.k.a. 'wants') is not clearly demarcated by Max-Neef (1992). In this respect, it may fall foul of some of the criticisms levelled at earlier basic needs theory.

Table 1 | Existential and axiological categories of needs, and examples of need satisfiers, adapted from Max-Neef (1992).

		Needs according to existential categories			
		Being	Having	Doing	Interacting
Needs according to axiological categories	Subsistence	e.g. physical and mental healthy	e.g. food, shelter & employment	e.g. eating, resting & working	e.g. livable environment
	Protection	e.g. being cared for	e.g. insurance & legal protection	e.g. risk management	e.g. social environment
	Affection	e.g. having self-esteem	e.g. positive social relation	e.g. physical and verbal communication	e.g. spaces for intimacy
	Understanding	e.g. critical thinking	e.g. access to education	e.g. a literature review	e.g. schools

In summary, the THN provides the first structure within the theoretical framework developed in this paper. In summary so far, there are different types of needs and wants, whose fulfilment through 'satisfiers' contribute to wellbeing in multiple ways - firstly in the fulfilment of basic needs for survival, but also the fulfilment of wants that enhance quality of life. In this respect,

'wants' are more consistently a normative concept than 'needs' (although they are linked by the relationship described above). Although the language of 'wants' and 'needs' is generally understood in materialistic terms in the THN, I choose to adopt a broad interpretation of these terms, particularly wants. The Cultural Values Model, described in Section 2.3.4., is concerned with cultural and well as physical processes, features and practices (Stephenson, 2008). As such, I interpret 'wants' as also including immaterial life conditions, including spiritual, cultural and normative elements. To this effect, cultural 'wants' can include the perpetuation of certain cultural conditions, or the attainment of normatively endorsed aspirations.

Gasper (2007) suggests that (like needs theory) wellbeing theory has had a history of being theoretically muddled. Since the 1980s a number of prominent psychologists have explored wellbeing from what has subsequently been described as the 'hedonic' tradition (Diener et al., 1999). This tradition has been contrasted with the more recent 'eudaimonic' approach, which is discussed in Box 1. However, the theoretical framework developed here is more closely allied with the hedonic narrative. Additionally, a key distinction that has been made in psychology is between OWB and SWB, which is further discussed in the following section.

2.2.2. Subjective and objective wellbeing

As above, OWB is the "externally approved, and thereby normatively endorsed, non-feeling features of a person's life" (Gasper, 2007). These features are typically the most prominent measures of quality of life within needs theory. In broad terms, the objective aspects of wellbeing are often easily measured, and based on quantitative statistics. They include a range of social and material attributes (often those simplest to enumerate) that describes a person's life circumstance (King, Renó & Novo, 2014). For example, within THN, factors such as education have been externally identified as having instrumental value in meeting needs. In this case, 'externally identified' means 'not by the individual whose quality of life is being expressed'.

Subjective wellbeing, on the other hand, is an individual's "evaluations of their lives using both cognitive judgments of life satisfaction and affective evaluations of moods and emotions" (Diener & Suh, 1999). SWB takes an individual-centred approach to assessing quality of life, where people's expression of their own wellbeing becomes the focal interest. It includes the many ways that people experience and evaluate their everyday quality of life, and is often considered in association with 'happiness' (Diener & Suh, 1999).

One group of theorise which is dominant in the psychological literature is 'hedonic wellbeing' (Ryan & Deci, 2001). Hedonic wellbeing consists of the experience of pleasure and displeasure, including those emotions felt as the result of introspective judgments about good and bad elements of ones life. Therefore, 'hedonic wellbeing' cannot be reduced to just physical hedonism, since it can be attained through the achievement of aspirations or upholding important values (especially those that are challenging to fulfil. Diener, Sapyta & Suh, 1998). These aspirations can range from the satisfaction of a basic need to the attainment highly idiosyncratic or culturally relative goals (Ryan & Deci, 2001).

Factors identified as important contributors to SWB and OWB can, and often do, overlap (Dolan, Peasgood & White, 2008). For example, society deems poor health to be a significant detractor from quality of life. Similarly, an individual with poor health may endure lowered SWB as a result. However, there are also many examples where individual's assessment of their own quality of life diverges from what is expected from their material conditions as described by objective measures. For instance, a study by Easterlin (1995) found that, across a range of studies, increases in real income did not yield overall changes in SWB. For example, between 1958 and 1987 real income in Japan increased five times. Yet, contrary to what would be expected using objective social indicators, self-reported happiness did not markedly change (Summers & Heston,

1991). The OECD's Better Life Index rates life satisfaction in Brazil and Chile as significantly higher than more economically prosperous countries such as France and Japan (OECD, 2015).

However, the use of SWB must be done with caution. For example, within the hedonic tradition (discussed in Box 1) an emphasis is placed on an individual's own criterion for valuing their wellbeing. Although this means that the measure itself is claimed to be 'value' free on the part of the observer, it provides little information about the drivers, consequences, etc. of wellbeing beyond an expression of individuals' subjective experience. This provides challenges for comparisons across individuals, because of the essentially internal (and 'hidden') nature of the cognitive process that results in the elicitation of information. (Waterman, 2008). Additionally, because many of the measures of SWB focus on the self, when individuals are asked to elicit responses regarding their wellbeing, they typically focus on things unique to their life situation (Kjell, 2011). However, many of the factors that influence SWB may be more closely tied to an individual's relationship with society and culture more broadly (Diener & Seligman, 2002). However, these social and cultural factors are often not given sufficient weight when individuals are asked to assess their quality of life, and therefore, the results may not truly reflect the individual's experienced wellbeing (Kjell, 2011).

Despite these caveats, SWB measures still offer a number of advantages when used in conjunction with objective measures. Some of these advantages include, firstly, providing a more direct way of understanding welfare in economics and related disciplines and can compliment more traditional measures. Secondly, providing alternative policy targets for those that are interesting in increasing social wellbeing, as opposed to social welfare and other traditional social indicators of quality of life (such as per capita GDP). Thirdly, it can help measure otherwise hard to quantify costs and benefits. Fourth, it can be used to provide some form of 'standard accounting unit' across various life domains, which can be used to guide trade-offs between

policy decisions. Lastly, although individual's SWB is relatively stable, it can be affected by changes in life circumstances, meaning that policy can enhance or inadvertently degrade quality of life in multiple ways. (OECD, 2012; Dolan & White, 2007). Additionally, in a report to the Office of National Statistics (ONS), Evans (2011) suggests that the use of SWB indicators is less paternalistic than traditional economic measures, which are inherently more prescriptive about what contributes towards quality of life.

SWB forms the second level of the theoretical framework being developed. Essentially, want and needs satisfiers have instrumental value in fulfilling wants and needs, and ultimately those goals and aspirations (or direct value, if they alone are the target of an individuals aspirations) that individuals deem to be important. In this respect, both the satisfaction, or progress towards satisfaction, of basic needs, wants and other personal goals can contribute to SWB, if individuals experience enhanced wellbeing as a result.

2.2.3. The primary components of subjective wellbeing

Early theory on SWB focused on the identification of top-down, external factors that influenced SWB. However, it became increasingly apparent that external, objectively verifiable ('top-down') events often have a relatively modest impact on SWB. In light of this, psychologists have turned to the "bottom-up" approach to understanding SWB. The bottom-up; approach focuses on how personal characteristics (as the result of cultural and genetic factors) influence the experience of pleasurable events and internal feelings of happiness or unhappiness. (Headey, Veenhoven & Wearing, 1991). Personality appears to be the strongest and most consistent predictor of SWB (Durayappah, 2010). Personality traits that influence SWB are thought to be largely hereditary, but also partly determined by life experiences. Additionally, individuals SWB is largely thought to exist in a state of dynamic equilibrium, where reported SWB has a tendency to revert to a baseline or 'set-point'. This process is known as habitualization or adaptation. Cummins's et al.

(2012) Homeostasis Theory proposes that SWB is maintained around a set-point through automatic, neurological devices, akin to the physiological homeostatic maintenance of body conditions such as temperature. This set-point is largely determined by an individuals "genetically-inherited tendency to experience a unique level of felt-positivity" (Tomyn, Weinberg & Cummins, 2014). These neurological devices, also referred to as cognitive biases and heuristics, include the differences between experienced and remembered wellbeing; between evaluations and expectations of one's lives; between expectations and experiences; genetically determined personality effects; elicitation context; adaption / homeostasis; cultural contexts, etc. (Durayappah, 2010).

Although psychologists are able to attribute the majority of SWB variation to intrinsic factors, and despite this tendency to adapt towards a set-point, seeking to influence external factors is still of significant political interest. For example, lasting changes to this baseline are possible (such as that result of chronic pain); a series of events may result in long-term low SWB; and even short-term acute declines in SWB (such as the loss of a spouse) are clearly important to avoid (Diener et al., 1999). Additionally, it appears that certain factors, such as income, may not be clearly correlated with SWB on an individual scale. Yet wealthier countries, *ceteris paribus*, tend to have higher SWB than low-income countries (Kahneman & Krueger, 2006). These incongruities mean that seeking to identify external factors influencing SWB is still a valid objective, alongside the political pursuit of enhancing life conditions that are conducive to higher SWB.

"Subjective wellbeing is not a single unitary entity", but is multifaceted, and includes many different and interacting elements, such as remembered experiences, satisfaction with specific life domains, mood, emotional expression and personality (Diener et al., 1999). In this respect, SWB is less of a clear theoretical model, and more of an area of complementary and contrasting theories. However, a number of aspects of SWB are often discussed: positive affect; negative

affect; the evaluations of 'global' life satisfaction and the evaluation of life satisfaction within specific domains (such as health, relationships etc. Tov & Diener, 2013).

Positive and negative affect – the experience of positive and negative emotions, respectively – were once considered two ends of a bipolar spectrum. However, more recently it has been argued that positive and negative affect are orthogonal, and it is possible to experience both at the same time. (Diener et al., 1999). It has been noted by Kahneman, and others, that there can often be a difference between experienced affect and remembered affect - the difference between how people experience a period of time and how they remember experiencing it. These differences are often twofold; a) first, additional weight is given to whatever is experienced at the end of the period, & b) the peaks and troughs of the experience have a disproportionate impact on the overall remembered experience (Kahneman & Krueger, 2006). This means that retrospective self-reported affect can be highly unreliable. Additionally, affect appears to be very strongly influenced by individual's personality traits – even the way the same event is experienced may be radically different between two individuals.

Because of these reasons, affect is less easily influenced by changes in life conditions brought about by, for example, policies and other interventions. Therefore, although still an important component of SWB, it will not form the core of the theoretical framework. Life satisfaction, on the other hand, is more significantly influenced by changes in life circumstances and will be a essential component of the framework, as discussed below.

Box 1: Hedonia and eudaimonia

One interesting development (which is not going to be discussed as a component of the theoretical framework being developed, but is nevertheless important to recognise) is the emergence of the distinct 'hedonic' and 'eudaimonic' traditions.

In contrast to the hedonic tradition described above, the eudaimonic tradition suggests that wellbeing is not just the experience of a continuous flow of happiness and unhappiness. Sustained period of happiness, without frequently disruption, are only attained when one lives according to their 'true self' or 'daimon'. This conception of wellbeing stresses the importance of not just the attainment of goals, but self-actualisation according to ones 'full potential', and living in a way that is consistent with deeply held values (Kjell, 2011).

According to Ryan & Deci (2001) 'hedonic' and 'eudaimonic' traditions are distinct, but nevertheless interact. Evidence suggests that wellbeing is multidimensional and includes aspects of both hedonic and eudaimonic theory. For example, studies have identified both happiness and personal growth as contributors to wellbeing. In this respect, wellbeing should be investigated through both lenses, as opposed to one at the exclusion of the other. Although this literature review, and much of the SWB discourse more broadly, ascribes more closely with the hedonic tradition, the eudaimonic aspect of wellbeing is important to recognise (Ryan & Deci, 2001).

2.2.4. Life satisfaction, wellbeing and goals attainment

Shin and Johnson's (1978) widely endorsed definition of life satisfaction is the "global assessment of a person's quality of life according to his chosen criteria". (Essentially, life satisfaction is the general feeling that an individual has during reflection over their lives, according to those things that they deem important components of their life, and their own criteria of evaluation.) As a result, the way that an individual evaluates their lives, and what aspect of their lives they focus on, is subjective. Diener et al. (1998) claim that this permits greater objectivity during measurement, since the observer does not select the criteria that the subject evaluates, and therefore, does not bias the evaluation according to preconceived judgments about what is important within an individual's life.

One important source of life satisfaction is the attainment, or progress towards the attainment, of goals and personal aspirations (which can be on-going, such as retaining a specific life domain

within a certain state, e.g. staying married. Ryan & Deci, 2001). Within this study, I adopt Oishi's (2000) definition of goals as:

"desired states internalized by individuals. ... Values, which are defined as guiding principals in life (Schartz and Savig, 1995), can be considered as higher-order goals, whereas personal strivings, which are defined as what individuals are characteristically trying to do in daily life (Emmons, 1986), can be conceptualised as lower-order goals."

However, there are a number of important elements surrounding the relationship between goals and life satisfaction. Firstly, perceived confidence and self-efficacy is a strong predictor of life satisfaction. An individual that considers himself or herself to be competent, relative to peers, is likely to report higher life satisfaction than one who feels incompetent. Goal attainment is important to life satisfaction (Emmons, 2003). However, an individual that holds goals or aspirations that are either excessively hard or easy is likely to attain lower life satisfaction than one who holds goals that are consistent with their optimal ability. High aspirations may lead to unhappiness since they take longer to achieve, or may not be achieved at all. However, aspirations that are easily attained can also be detrimental to SWB, as the result of boredom, for instance. In this respect, absolute aspiration is less important than the level of aspiration compared to the capacity of the individual to fulfil that aspiration (Diener et al., 1999). To this effect, elements of the eudemonic approach are supported, since the attainment of optimally challenging goals represents a degree of self-actualisation (Ryan & Deci 2001).

According to Diener et al. (1999) "Goals that were poorly integrated to the self, whose focus was not related to basic psychological needs, conveyed less SWB benefits, even when achieved." In other words, the attainment of goals that relate to the fulfilment of basic needs, appear to have a greater positive relationship with life satisfaction than those related to more general 'wants' (to draw on THN). Additionally, goals that are autonomously set tend to yield more positive effects on life satisfaction than those that are set by someone else (Emmons, 2003).

Social comparison theory suggests that relative life circumstances and the attainment of related goals, compared to those in a peer group, is more important than absolute circumstances. To this effect, the life satisfaction benefit derived from life conditions are modified by the social context (Diener et al., 1999).

In relation to the THN, having access to want and needs satisfiers may contribute to SWB, in at least two ways: firstly, it may have instrumental value since it facilitates the attainment of goals and secondly, it may constitute attainment of the goals themselves.

To this effect, needs satisfiers (resources, etc.) may have different impacts on life satisfaction depending on the choice of goal that is to be attained. An individual's intrinsic resources (intelligence, etc.) will also influence their capacity to transform those needs satisfiers into the attainment of goals (Cantor and Sanderson, 1999).

'Culture' also significantly influences the relationship between life satisfaction and goals attainment. Attainments of goals that are normatively endorsed yield greater life satisfaction than those that are not. Yet, basic needs are considered universal across cultures, and therefore the attainment of those needs is likely to be an important determinant of SWB everywhere (Oishi et al., 1999). Beyond these universal needs, culture is likely to have a much greater influence on the life satisfaction attained through the fulfilments of 'wants' (Diener et al., 1999).

In relation to the theoretical framework, the most salient points regarding the relationship between life satisfaction, SWB and goal attainment regard the connection between goals and individuals' characteristics. First, the degree of life satisfaction attained through the fulfilment of aspirations is dependent on how culturally relevant and socially relative the goal is. Secondly, those goals that pertain to the fulfilment of basic needs confer greater life satisfaction than those that are less essential for physiological health.

2.2.5. Some determinants of subjective wellbeing and life satisfaction

Extensive literature explores the economic, demographic and social factors that influence life satisfaction (e.g. Ryan & Deci, 2001; Diener et al., 1999). Each of the topics discussed below have a broad body of literature exploring many cultural, geographic and social facets and nuances. The following is a brief overview of the most commonly discussed factors, which provide the framework for selecting variables within the quantitative element of the study. However, the vast majority of the studies presented here have used data from developed countries, mostly in the West, and therefore this cannot be assumed to be an accurate guide for SWB determinants globally.

One of the most commonly mentioned, and consistent predictors of SWB and life satisfaction, is the quality of social relationships and support (Diener and Seligman, 2002). Those with better social relationships tend to report higher frequencies of positive emotions, and lower frequencies of negative ones, and are generally more positive about their lives. This study adopts a definition proposed by Barrera et al. (1981) as the "various forms of aid and assistance supplied by family members, friends, neighbors, and others". However, within this intuitive definition, Siedlecki et al. (2014) identifies four elements that influence positive and negative affect and life satisfaction - social embeddedness; enacted support; provided support; and perceived support. They found that enacted and perceived support were significant correlates of life satisfaction. Enacted social support is the actual support received, be it emotional, informational or material (Barrera, 1986). Contrary to some findings, Siedlecki et al. (2014) found that enacted social support was positively correlated with life satisfaction. This was understood to be the result of the generally positive relationship between material life conditions and life satisfaction. Perceived support is the anticipation that support would be provided if it were needed, and is consistently positively correlated with life satisfaction (Newsom and Schulz, 1996; Siedlecki et al., 2014). The strength of the relationship between social support and life satisfaction appears to be culturally and

economically variable; the strength of the correlation being greater in collectivist and poorer countries, and weaker in individualistic and wealthier countries (Tov & Diener, 2013; Engelbrecht, 2009). Whereas social support often refers to individuals, social capita extends to the social networks within communities and groups as a whole (Portes, 2000). As might be expected from the evidence above, Helliwell & Putnam (2004) find that those in communities with higher social capital reported higher SWB than those with lower group level social capital. Ahuvia (2002) goes as far as suggesting that the 'Easterlin paradox' (below) can be explained by changes in social capital. Ahuvia (2002) suggests that, generally, economic development is associated with declines in social capital, leading to the paradoxical observation of stable SWB despite increasing per capita wealth. More generally, Reimer (2003) identifies a range of positive household outcomes associated with higher levels of social capital, but highlights the importance of distinguishing between access and utilization of social capital.

The relationship between income, wealth and SWB is strongly contested. Diener & Biswas-Diener (n.d. Unpublished. Cited in Ryan & Deci, 2001) claim that: a) people in richer nations are generally happier than poorer ones; b) in recent decades, increased in wealth have not lead to increased in SWB; c) there is only a small positive correlation between inequitable wealth distribution and happiness; d) increases in individuals wealth does not generally increase SWB; e) people that have a strong desire for wealth are more likely to be unhappy (Ryan & Deci, 2001). One contested concept is the so-called Easterlin paradox - "high incomes do correlate with happiness, but long term, increased income doesn't correlate with increased happiness" (Easterlin, 1974). However, more recently, through the interpretation of additional data, scholars have provided evidence that no such paradox exists (Hagerty & Veenhoven, 2003; Stevenson & Wolfers, 2013; Sacks et al., 2012). Nevertheless, Easterlin et al. (2010) provide counter-evidence, incorporating more data from developing countries, reasserting the paradox. In summary, at this point there is insufficient understanding of the relationship between income and SWB to be able

to generate a holistic and consistent model. Indeed, the fact that many would intuitively claim that there is a positive relationship between income and SWB, and yet there is so much controversy, gives credence to the suggestion that similar untested assumption may exists between environments, landscapes and SWB.

However, one clear finding is that poverty is strongly correlated with wellbeing (Ryan & Deci, 2001). For example, Kingdon & Knight (2004) find that low income, unmet basic needs, limited social functioning, and low livelihood security were associated with low life satisfaction among 8,800 households in South Africa. Ryff et al. (1999) explore the relationship between eudemonic aspects of SWB and poverty. They found that socio-economic status significantly affected self-acceptance, purpose, mastery, and growth. This appears to be the result of social comparison, where individuals compare themselves un-favourable against their peers (Ryff et al., 1999).

Unemployment has also consistently been shown to have a strong negative impact on SWB (Frey, 2008; Frey and Stutzer, 2002). The effect cannot be accounted for by the loss of income – other factors like loss of sociability also have significant impacts (Diener et al., 1999). Job satisfaction appears to be correlated with life satisfaction, through the setting and attainment of goals, social interactions and a sense of identity and purpose. It appears like there is a reciprocal relationship between SWB and job satisfaction; those that have high SWB are likely to experience greater job satisfaction and those that have greater job satisfaction are likely to be happier. (Mishra et al., 2014; Diener et al., 1999).

It is widely agreed that religiosity is positively correlated with life satisfaction, although there is controversy over the mechanisms by which they interact (Lim & Putnam, 2010). Religions has been suggested as influencing SWB in at least two ways. Firstly, by providing social support from religious institutions (Krause & Bastida, 2012). Secondly, through the private support generated by religious belief (Greeley and Hout, 2006). Using panel data, Lim & Putnam (2010) find that

religious service attendance and, more importantly, the social relationships developed at church are positively correlated with life satisfaction.

Much of the early literature discussing age effects on SWB identified an interesting phenomena - the stability of SWB, despite increasing incidence of illness, loss of family and other challenges associated with aging (Ryff, 1989). Hansen & Slagsvold (2012) suggest that although set-point theory (described in Section 2.2.3.) does tend to hold as individuals age, life satisfaction and negative affect are adversely affected by old age. This has been attributed to the loss of health and family. Additionally, Swift et al. (2014) show that this general stability in SWB over an individual's age only holds in countries with higher GDP, and that individuals SWB in poorer countries are much more adversely affected by aging.

Graham & Chattopadhyay (2012) explore the effects of gender on SWB within and between countries, around the world, comparing age, income and education. They find that, with the exception of some low-income countries (in Sub-Saharan Africa), women tend to have slightly higher SWB than men. This gap between men and women's wellbeing tends to be greater in countries with higher levels of development, within older cohorts, and in urban as opposed to rural areas. The relationship between marriage and SWB is also complex. Married people overall have higher SWB than non-married people, especially in countries where their is more gender equality (Graham & Chattopadhyay, 2012). These results partially contradict earlier research by Inglehart (2002), which finds that younger women tend to have higher SWB than younger men, but later in life this trend reverses. This is attributed to the 'aspiration-adjustment model'. The model implies that despite continuing gender inequality (in both material and non-material aspects), progress made by feminist movements have addressed some of these disadvantages, meaning that women's achievements are perceived to be greater than traditional aspiration levels. This process of exceeding some aspirations yields a SWB benefit. However, this effect is offset

by the systemic devaluation of older women. In advance industrial societies, both of these antagonistic affects are particularly strong resulting in stronger differences in SWB across ages, for women (Inglehart, 2002).

Both mental and physical health has been consistently shown to be important predictors of SWB (Dolan, Peasgood & White, 2008). Recent acute health problems can have short-term impacts on SWB, and some (but not all) chronic health problems can have long-term affects, despite habitualization (Shields & Price, 2005). However, the relationship between health and SWB is bidirectional - happy people tend to be healthier, and healthier people tend to be happier (Howell, Kern & Lyubonmirsky, 2007).

Some scholars have found a roughly linear relationship between SWB and education (Blanchflower & Oswald, 2004), whereas others suggest that highest levels of SWB are associated with middle levels of education (Stutzer, 2004). Education appears to be more important in poorer countries (Ferrer-i-Carbonell, 2005), although the effect is generally lost when controlling for increased economic agency and mobility (Graham & Pettinato, 2000). Also, it appears that education may influence how individuals progress towards their goals; more educated people are more distressed when they do not attain goals than less educated people – probably as the result of different levels of expectation and aspiration (Diener, 1999). Additionally, emotional intelligence is positively correlated with SWB (Schutte & Malouff, 2011).

Although this list is a very brief summary, which only reflects a small portion of a huge body of literature, it does capture the most commonly discussed factors influencing life satisfaction. From this summary, it is clear that the relationships between contextual life factors and life satisfaction are non-linear, complex and interact with other life factors. Genetic and personality characteristics have not been discussed. As mentioned in Section 2.3.3., although intrinsic factors

explain the majority of variation in life satisfaction, they are generally less accessible to policy intervention.

2.3. Ecosystem services, cultural landscapes and life satisfaction: the landscape framework

The following section seeks to introduce the landscape theoretical framework, specifically focusing on how landscapes are interpreted and valued from an inherently anthropocentric perspective. This framework will be integrated with the psychological framework, to explore how landscape factors influence SWB. The following section will introduce, then reject, the ecosystem service framework. It will then describe some general characteristics of multifunctional landscapes, before situating those characteristics within the Cultural Values Model of landscapes, and its key components.

2.3.1. The ecosystem service framework

The ecosystem service framework has been heralded as initiating a feeling of "Renaissance in the conservation community", and is commonly used to help integrate ecological processes and human systems within environmental theory (Daily and Matson, 2008). For example, the Millennium Ecosystem Assessment (MA, 2005) provides a widely cited framework for understanding some elements of the interaction between ecosystem processes and OBW. The MA (2005) specifically focuses on the satisfaction of objectively verified needs by goods and services provided by ecosystem. These wellbeing benefits, according to the MA, include:

- "Security - personal safety, secure access to resources, security from disasters.
- Basic material for a good life-adequate livelihoods, sufficient nutritious food, shelter, access to goods.
- Health - strength, feeling well, access to clean air and water.
- Good social relations-social cohesion, mutual respect, ability to help others.

- Freedom of choice and action-opportunity to be able to achieve what an individual values doing and being" (MA 2005).

However, when seeking to understand the role of ecosystems in the supply of these services it is useful to clearly identify and delineate the causal chain between ecosystem processes, functions, services and ultimately benefits. Ecosystem processes and structures include the complex interaction of abiotic and biotic elements, often described in terms of material and energy flows (Lyons et al., 2005). Ecosystem structures and processes (such as vegetative cover) generate functions (such as slowing run-off). De Groot (1992) defines functions as "the *capacity* of natural processes and components to provide goods and services that satisfy human needs, directly or indirectly" (italics added). Ecosystem function is considered a capacity - some, but not all, ecosystem functions subsequently generate services (such as flood mitigation). Ecosystem services are the subset of the functions that are of use to humans. These services can generate benefits (such as the prevention of flooding of an inhabited basin). The value of that benefit is then the relative 'worth' according to those that benefited from the service (Hermann, Schleifer & Wrbka, 2011). Daily (1997) describes ecosystem services as

"the conditions and processes through which natural ecosystems, and the species which make them up, sustain and fulfil human life. They maintain biodiversity and the production of ecosystem goods, such as seafood, forage, timber, biomass fuels, natural fibres, and many pharmaceuticals, industrial products, and their precursors. In addition to the production of goods, ecosystem services are the actual life-support functions, such as cleansing, recycling, and renewal, and they confer many intangible aesthetic and cultural benefits as well."

Ecological processes often generate services within highly modified landscapes. For example, agro-ecosystems covered approximately 37.7% of the earth's surface in 2012 (The World Bank, 2015). Sepp (2012) describes agriculture as "humankind's largest engineered ecosystem". According to Sepp, "as a managed ecosystem, agriculture plays unique roles in both supplying and demanding other ecosystem services (Swinton et al. 2007)." As well as supporting agriculture, ecosystems are also sources of disservices, which are often partially regulated by human actions.

Conversely, the impact of agriculture on ecosystems and the services they provide is also highly significant (Swinton et al., 2007: Sepp, 2012). A number of studies argue that the value of intensifying agricultural systems is less than the value of multifunctional agro-ecosystems (Balmford et al., 2002; de Groot & Hein, 2007).

2.3.2. Challenges with the ecosystem service framework

Despite the popularity of the ecosystem service framework, it has been criticised as simplistic, often overlooking the complex interaction between human and natural dimensions within modified landscapes. Hockley (2014) argues that the focus on ecosystems as the 'providers' of services is misplaced. Instead much of the benefit of ecosystem services occurs in response to institutions, human behaviours and social systems. Hockley (2014) suggests that ecosystem services are more usefully treated as a mediator of human actions, and as such, the theoretical centrality of ecosystems is misleading. He suggest that this misplaced focus results in biases among researcher, include a tendency to underweight ecosystem disservices, the costs and opportunity-costs of maintaining ecosystems, and the services provided by 'degraded' ecosystems. This final point is reflected in the commonly held misnomer that ecosystem services are provided 'for free' by ecosystems. Attempts to integrate ecological processes within socio-ecological systems, using the ecosystem service framework, can create dubious boundaries between ecological, geo-physical and anthropological components (Hockley, 2014; Simpson, 2011).

Similarly, Robinson et al. (2013) suggests that there is "no coherent, widely agreed, and analytically useful definition of ecosystem services". Although this 'conceptual fuzziness' may be useful for mobilizing support, it can create analytical challenges. They cite a number of reasons why the ecosystem service framework is problematic when conducting ecosystem service valuation. Most pertinent to this study is that the benefits that accrue to humans result from the

interaction of services provided by ecosystems, and human and physical capital. This creates challenges for attributing 'value' to different components of the interaction (Fisher and Turner 2009). For a more detailed examination of why the ecosystem service framework, despite its intended political expedience, is analytically problematic see Simpson (2011). For these reasons an alternative framework for understanding the relationship between landscapes and human wellbeing will be adopted.

2.3.3. Characteristics of multifunctional landscapes

A diverse range of disciplines are interested in landscapes, and as such a holistic definition of landscapes is challenging. Within landscape ecology, the recognition that the study of environmental systems alone cannot accurately describe important processes within landscapes has lead some to call for a transdisciplinary interpretation of landscapes (Nassauer, 1995). However, a holistic and analytically useful definition of landscapes appears to remain elusive. Within this study, multifunctional landscapes are considered in part to be the 'physical template' that mediates the relationship between humans and nature (Liu and Opdam, 2014; Willemen, Hein, & Verburg, 2010). However, landscapes are more than just the visual result of the management and landuse of an area (Kizos and Koulouri, 2006), but also include ecological, symbolic, and political dimensions (Muir, 2003).

Land-use partly determines the socio-economic functions of landscapes. Patterns and intensities of land-use define the relationship between socio-economic and environmental functions (Mander, Helming & Wiggering, 2007). However, landscapes cannot be described as mechanistic and linear systems. Landscape systems are non-linear, chaotic and complex hierarchical systems (Parrott et al., 2012).

Applying complex adaptive systems theory offers insights into how landscapes, in all their cultural, biological, and physical diversity, are formed and evolve (E.g. Liu et al., 2007). For

example, rural communities in Kenya converted forests to intensive agriculture, causing significant soil degradation. Declining agricultural output, as the result of declining soil quality, motivated residents to clear yet more land, initiating a destructive positive feedback loop (Liu et al., 2007). Berkes (2004) suggests that indigenous / community-based management systems may be emergent phenomena, as the result of feedback learning through trial-and-error within communities.

According to Naveh et al. (2001) and others, complex systems such as landscapes are formed and evolve as the result of more general properties found in self-organising non-equilibrium dissipative structures - i.e. a system whose dynamic characteristics lead to it's replication and evolution in a semi-steady state. This evolutionary process is not necessarily stable, and can undergo bifurcations - sudden changes in the structure of the system, akin to the theory of 'punctuated equilibrium' in genetic evolution (Naveh et al., 2001). These bifurcations can occur as the result of feedback loops within complex non-equilibrium and non-linear systems, such as the rapid shift from hunter-gathering to agriculture in some parts of the world during the Neolithic Revolution (Prigogine, 2000).

Naveh (2001) discusses ten major premises, which are core to a holistic theory of multifunctional landscapes. A number of these premises are of particular interest in the context of this review. Firstly, multifunctional landscapes are more than the sum of their parts. They are a physical matrix of many biotic and abiotic features, and landscapes aspects including "cultural components of a regional landscape, its forests, grass- and shrublands, its wetlands and rivers, its agricultural fields, its residential and industrial areas, its roads, traffic- and power-lines, ... [whose] history contribute to [the] truly Gestalt character of the landscape" (Palang, Mandera & Naveh, 2000).

Secondly, and closely linked to the first point, landscapes are more than just physical spaces. As the intersection of cultural, social and cognitive processes, a holistic interpretation of landscapes must also include an appreciation of the 'landscapes of the mind' or 'noosphere'. Mapping landscapes purely according to their physical characteristics would overlook important cognitive features. (Naveh, 2001). In this respect, the same physical space is also interpreted in different ways by "both mind and body by the observer and his psychological and cultural filters and conceptual windows" (Naveh, 2000). In other words, subjective worldviews provide a unique lens through which individuals experience landscapes. For example, Aldo Leopold's 'Land Ethic' is an articulate and influential concept derived from a unique worldview, described in *A Sand Country Almanac, and Sketches Here and There* (1949). According to Leopold, "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise." He suggests that the notion of community should extend beyond just human society, but also embrace biotic and abiotic components, including "soils, waters, plants, and animals, or collectively: the land." This Land Ethic is embedded within a specific axiological, historical and philosophical context. It reflects the worldview held be Leopold, and can be contrasted against other worldviews, such as those of the Ojibwa, who view animals and plants as "persons", existing within their own societies (Peterson, 2001).

Finally, the majority of landscapes discussed in terms of management are highly modified. Conventional approaches often consider ecological systems as the highest order structures within landscapes, with human systems being treated as a sub-component of a largely 'natural' system. However, in light of the extent of human modification of landscapes, this focus is misdirected. Measurement and conceptualisation of landscapes must also include social and cultural aspects, treated in parallel with (as opposed to a sub-component of) environmental systems (Naveh, 2001).

Neveh's (2001) ten principals ascribe strongly to a systems theoretic approach. Although there is no unified complex systems theory, complex systems approaches have been criticised on a number of levels. Some scholars have raised concerns over the technocratic totality that is suggested to be implicit in the application of systems theory (Lillianfeld, 1978). More relevant here is the criticism that systems theories, as a result of their "the chameleon-like attribute" make the "systems approach all things to all people and, therefore, impervious to criticism on any specific account" (Hoos, 1983). Indeed, although complex systems concepts are often a useful description of how systems work, it appears that in some areas, such as social sciences, the insights from such approaches are limited (Ramalingam et al., 2008). Although Neveh's (2001) ten principals are descriptively useful, and provide a litmus test against simple linear narratives, its prescriptive value is less clear. The examples of the application of complex systems concepts from Kenya, etc., provided by Liu et al. (2007) do not offer particularly visionary insights. Indeed, they could have been developed through careful scholarship without the need to characterise them according to systems thinking language.

Nevertheless, the use of systems thinking concepts will be retained for two reasons. a) It can be used to accurately describe the functioning of landscape systems, and the many hierarchical interactions across elements. b) It inherently cautions against attributing definitive relationships between perceived cause and effect within landscape, as well as recognising that the measurement of atomised elements to describe the whole should be done with caution.

In light of the increased recognition of this inherently coupled nature of landscapes - as co-evolved human-natural systems - the term cultural landscapes has emerged. However, there appears to be no widely agreed definition that accurately captures the characteristics of multifunctional and cultural landscapes, as described here. A commonly cited statement, by Rowntree (1996) captures the sentiments of why this might be so:

"This etymological elusiveness is both a liability and asset; to some, the notion of cultural landscape is an appropriate bridge between space and society, culture and environment, while to others its definitional fluidity weakens the concept and disqualifies it from serious analytical usage".

Despite this, one broad description, that may substitute a proper definition, comes from the UNESCO World Heritage Centre (2012):

"Cultural landscapes are cultural properties and represent the "combined works of nature and of man" ... They are illustrative of the evolution of human society and settlement over time, under the influence of the physical constraints and/or opportunities presented by their natural environment and of successive social, economic and cultural forces, both external and internal."

With these characteristics in mind, an alternative to the ecosystem service framework will be used within this study - the Cultural Values Model.

2.3.4. The Cultural Values Model of landscapes

According to Rowntree (1996), the interpretation of landscapes and their features of interest are often determined by the disciplinary lens through which they are viewed. The worldview of those observing the landscapes can therefore have significant influence on what values and beliefs are represented when describing landscapes (Stephenson et al., 2008). This echoes Hockley's (2014) observation that the ecosystem service framework's focus on ecological processes may be more of a reflection of the worldviews of those that promote it than an accurate description of socio-ecological systems. Often the impact of these worldviews is underappreciated when seeking to describe landscapes, possibly invisibilising certain values and beliefs. Until the 1990s, landscape discourse was dominated by a focus on aesthetics and materials phenomena (Antrop, 2005a). Stephenson (2008) argues that there is still a significant bias towards these areas, citing Swaffield and Foster (2000) and Dakin, (2003). Similarly, Read (2005) argues that the views and values of inhabitants of landscapes are often obscured by those of 'experts' seeking to describe landscapes, and highlights the difference between 'insider' and 'outsider' perspectives.

Stephenson (2008) developed the Cultural Values Model to respond to these challenges through a holistic conceptual framework that incorporates the range of cultural values, and how they interrelate, within landscapes. It is a synthesis of congruencies found by Stephenson (2008) from across a wide range of landscape literature. The model expressly seeks to capture the values expressed by members of the landscape, as well as those reflected in 'expert' evaluations.

The Cultural Values Model is built on appreciation of subjective, experienced and ideological aspects of landscapes, including the conceptualisation of landscapes in space-time (Stephenson, 2008; Crang and Travlou, 2001). Ingold (2000) describes landscapes as "an enduring record of - and testimony to - the lives and works of part generations who have dwelt within it and in so doing, have left there something of themselves". Therefore, cultural aspects of the history (and supposedly the future) of the landscape are also considered within the model. According to Thrift and Whatmore (2004, cited in Stephenson, 2008) culture is 'used' in at least three ways: the life of a people, as a whole; a means of assigning group identity; and, in reference to a social process. Practices generate culture, and culture is something that people live, not live in. Value, then, is something that is both ascribed to an object and something held by an individual (Avrami, Mason & Torre, 2000). These values are considered to be social constructs, embedded in a specific time and place. Therefore, the values held by an individual, and attributed towards an object (or landscape feature) are context dependent - they only exist as human constructs within a specific social and temporal context (Brown, Reed & Harris, 2002). It is within this context that the Model describes three key components that reflect both 'expert' and locally valued aspects of cultural landscapes, and the dynamics between these elements, situated in both space and time (Stephenson, 2008).

2.3.5. Components of the Cultural Values Model

Stephenson (2008) terms the three primary components of the Cultural Values Model as '*forms*', '*relationships*' and '*practices*'. Forms are physical aspects of a landscape, which are tangible and measurable. These *forms* include features that are created by natural processes, such as mountains, and artificial or modified features, such as buildings or fields. These *forms* include those natural and anthropogenic elements that are culturally valued (either by 'experts' or inhabitants).

Human *relationships* with and within landscapes generate meaning, beliefs and interpretations of landscapes. These interpretations and beliefs are often represented through names, arts, scientific interest, 'sense of place' or spirituality. These *relationships* also include the appreciation of the intrinsic value or nature, and the interactions within human-ecological systems. *Relationships* in landscapes span the human-nature continuum. They represent the values created through interactions between people, between people and landscapes, and between elements within landscapes that of value to people. Ecological processes, in which there is no direct human interaction, are also identified within this framework when they become the subject of examination or valuation by people (e.g. existence values (Peterson, 1999)). (Stephenson, 2008).

Practices are the actual processes and actions performed within a human-natural system, inclusive of human actions and natural processes, in both the present and past. (The term *practice* is used because there is no suitable word that captures both practice and process). These include ecological processes, traditions, agriculture, etc. This category represents a continuum between human and natural processes, and does not treat them as conceptually separate (as opposed to within the ecosystem service framework, and as described by Naveh (2001)). Although *practices* are often initiated by either human or non-human forces, human actions affect natural processes and, in turn, natural processes affect human actions. (Stephenson 2008).

Although not specifically described within the Cultural Values Model, I consider these *practices* as yielding what might otherwise be identified as ecosystem goods and services. Within the model, *practices* involve the exchange of material and energy, including exchanges between human and environment systems. However, recognising that the value of 'ecosystem services' is actually the result of interplay between human and biophysical components, I would more accurately identify these as socio-ecological goods and services. However, these material and energy exchanges are bi-directional; for example, as well as extracting natural resources, we generate waste, which to varying extents is recycled within biophysical systems. The valuation of these materialistic exchanges is consistent with the notion of cultural value as defined within the Cultural Values Model, and above. It is also consistent with recognition that humans are inherently embedded within landscapes, and human systems exist on a spectrum along with ecological systems.

As described above, landscapes are complex and chaotic hierarchical systems and therefore the interplay between *forms*, *relationships*, and *practices* dynamically interact to create the gestalt of landscapes (Neveh, 2001; Stephenson 2008). *Forms* shape *practices*; alpine transhumance is the result of evolution of pastoralism in mountainous environments (Leveau & Walsh, 2005). Similarly, *practices* shape forms; the Llanberis slate quarry is a prominent feature of Llanberis Pass, in the Snowdonia Massive of north Wales (in turn creating a physical medium for another practice - rock climbing). *Forms* also engender relationships; Snowdonia has been depicted in many forms of local art, as well as being a source of pride (e.g. Gwyl Gelfyddydau Eryri - The Snowdonia Arts festival (SAF, 2005) or *Snowdonia*, by Mansel Lewis (n.d., Figure 1)). Again, relationships, manifest through practices, also influencing *forms*; dry stonewalls are also maintained to retain the traditional character of the mountain landscape (The Snowdonia Society, 2015).

Figure 1| *Snowdonia*, by Mansel Lewis (1845-1931): art as an expression of *relationships* with mountainous *forms* and sheep farming *practices* (Wikimedia Commons, 2009).

Forms, *relationships*, and *practices*, and the dynamic interaction of these elements, shape landscapes - both in physical terms and how it is perceived (Naveh 2001; Stephenson 2008). However, another key element of the Cultural Values Model, and the literature it seeks to reflect, is temporality. Within the Model, landscapes are not just represented in the present, but are also a reflection on, and of, past *forms*, *relationships*, and *practices*. This temporality is not just manifest in historic forms in the landscape, such as geological and archaeological features, but also in stories, memories and the symbolic value embodied in *forms*, *relationships* and *practices* (Antrop, 2005b; Tress & Tress, 2001). Within the Model, the cultural values of present and immediate landscape aspects are referred to as *surface value*, whereas the value of it historical aspects are called *embedded values*. The extent to which a landscape is valued by its surface and embedded values can vary significantly between cultures and across individuals (Stephenson, 2008).

2.4. Landscapes and subjective wellbeing within the framework

In light of the challenges to the ecosystem service framework, the study will be concerned with cultural landscapes as described within the Cultural Values Model, henceforth described as cultural landscapes.

However, much of the environment and SWB and life satisfaction discourse uses the ecosystem service framework. Therefore, despite the limitation of the ecosystem service framework (which focuses primarily on the ecological practices within landscapes), these studies will be understood in the context of sub-components of cultural landscapes.

The following two sections will first describe the current state of the small body of theoretical literature that looks at the relationship between landscape, the environment, and their features, and global life satisfaction. It will then seek to integrate the psychological framework of life satisfaction and the Cultural Values Model, as a tool for understanding how cultural landscapes can influence life satisfaction. It will then review what I believe is the extent of empirical studies looking at life satisfaction and landscapes, specifically focusing on ecosystem services.

2.4.1. Conceptual links between landscapes, ecosystems and wellbeing

A number of scholars claim that the MA (2005) fails to capture the multidimensionality of wellbeing represented in social, physical, and mental wellbeing literature, instead focusing on a narrower selection of objective welfare indicators (Summers et al., 2012; Yang et al., 2013). Yang et al. (2013) attributes this to four factors: a) the concept of wellbeing is complex and evolving; b) ecosystem services are not the only contributor to wellbeing, and therefore their effects may be obscured; c) the concept of ecosystem services is also complex and rapidly changing; d) the relationship between ecosystem services and wellbeing is often reciprocal and components within ecosystems often interact in multifaceted ways.

A multitude of studies indicate that ecosystem services can essentially be characterised as want and needs satisfiers; the things required to fulfil needs and wants within the THN framework (e.g. the MA, 2005). However, only a small but growing body of environmental literature recognises the mental, emotional and cognitive factors that mediate the relationship between physical changes in material life conditions and how individuals actually experience those changes. As discussed above, the premise that quality of life can be adequately described by economic conditions is useful when seeking to explore some aspects of wellbeing (Vemuri & Costanza, 2006). However, the relationship between changes in life conditions, and how people experience those changes in wellbeing is highly complex (Ryan & Deci, 2001). Policies that prioritise objectives purely based on objective indicators may fail to enhance quality of life in its entirety. Similarly, if the goods, services and other culturally valued features of landscapes are considered purely in terms of their relationship with one aspect of wellbeing, then other aspects of wellbeing may also be overlooked.

2.4.2. Landscapes and life satisfaction

The last ten years have seen a small but gradually increasing body of literature that addresses the unbalanced focus on OWB within environmental literature. Liu and Opdam (2014) argue that a more holistic interpretation of wellbeing should be integrated into landscape management. Their paper focuses on how a wider interpretation of wellbeing could be integrated into landscape management objective setting. They argue that the link between ecosystem services and wellbeing is highly context dependent; different individuals, or even the same individual at different times, will experience different wellbeing benefits and costs from ecosystem services. Similarly, the differences in spatial distribution of ecosystem services mean these wellbeing effects will vary across a landscape, or between landscapes. In light of this, they propose a tool that supports

stakeholders in generating "a value-based vision on landscape adaptation that contributes to all wellbeing dimensions." (Liu & Opdam, 2014).

Summers et al. (2012) presents a theoretical framework for understanding wellbeing that includes basic human needs, environmental needs, economic needs, and SWB. This framework seeks to no only combine different objective and subjective elements of wellbeing, but also introduces the importance of environmental needs. Summers et al. (2012) finds that each of their categories interacts within different portions of Maslow's Hierarchy of Needs (1943), suggesting that their conception of the components of wellbeing is also hierarchical. Summers et al. (2012) use evidence from a wide range of literature to validate the relationship between ecosystems and each of their four categories. However, Summers et al. (2012) conception of the relationship between SWB and ecosystem services primarily focuses on notions of intrinsic environmental ethics such as recognised in Næss's 'Self-realisation' (1989). Although this may be one component of how individuals experience their environment, it does not reflect the many aspects by which life conditions, determined by socio-ecological context, can influence subjectively experienced wellbeing. Landscapes are likely be important for SWB, not just because of their spiritual value, but also because of the many ways that people utilise material aspects of landscapes to fulfil personal goals, such as the satisfaction of wants and needs. Additionally, Summers et al. considered that 'basic human needs', 'environment', 'economy' and 'happiness' are the four components of 'well-being'. However, Summers et al. (2012) does not clearly state what this 'well-being' is - it is something that is an embodied feeling, a cognitive judgement or a normative evaluation? To this effect, positioning objective and subjective concepts of wellbeing in parallel is theoretically confusing. They are two paradigmatically different ways of viewing the world, not two life domains that can be summed together to understand a single concept of 'wellbeing'.

King, Renó & Novo (2014) provide a somewhat clearer theory of change that links socio-ecological systems to SWB, through a similar causal mechanism to the one described below. They argue that ecosystem services act as need satisfiers that allow individuals to attain their self-prescribed aspirations, goals, etc. Meeting, or failing to meet, these aspirations subsequently influences individuals cognitive evaluations of their life satisfaction. They proceed to describe some of the current research methods for understanding multidimensional wellbeing, in the context of socioecological systems.

2.4.3. Linking the Subjective Wellbeing and Cultural Values Model

This section seeks to integrate the life satisfaction and Cultural Values Model to provide a model for understanding how cultural landscape aspects interact with the life satisfaction experienced by those in and around cultural landscapes (Figure 2). This model starts from the proposition that *forms*, *relationships*, and *practices* emerge through the complex interplay of hierarchical socio-ecological systems, over time and space (Liu et al. 2007; Neveh, 2000). These *forms*, *relationships*, and *practices* are experienced by individuals, including 'expert' and 'local', as described in the Cultural Values Model (Stephenson, 2008). These *forms*, *relationships*, and *practices* are of value because of the role that they fulfil - they can act as 'want' and 'need' satisfiers (using a broad interpretation of wants and needs from the THN). The fulfilment of wants and needs allows individuals to attain goals (including aspirations or desired life conditions. Oishi, 2000; King, Renó & Novo, 2014). The fulfilment of these aspirations influences the way individual evaluate how satisfied they are with their lives, although this process is highly modified by cognitive devices, personality traits and normative pressures (Cummins, Lau & Davern, 2012). Individuals' life satisfaction, in turn, forms a component of SWB, alongside positive and negative affect. The contribution of life satisfaction to SWB, in relation to positive and negative affect, is also partly determined by cognitive and normative processes.

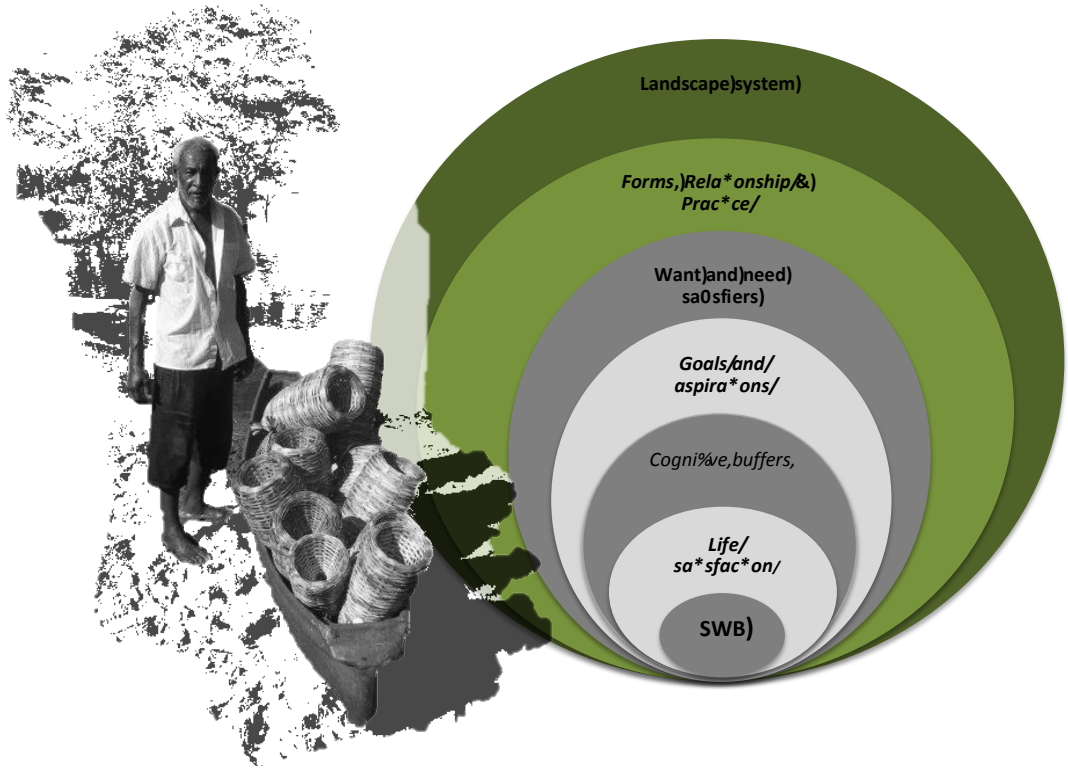

Figure 2| A conceptual diagram showing how cultural landscape systems give rise to *forms*, *practices* and *relationships*. These function as want and need satisfiers, facilitating individuals attainment of goals and aspirations. Goal attainment subsequently influences evaluations of life satisfaction, mediated by cognitive processes and buffers. Life satisfaction is one component of Subjective Wellbeing (SWB), alongside positive and negative affect. Cognitive processes and buffers also influence the relative experience of life satisfaction, and positive and negative affect. (Authors photograph from fieldwork in southwest Jamaica in 2011[1]).

As has been described, cultural landscapes can be characterised as complex hierarchical and perpetually evolving systems (Nevah, 2001). However, to reconcile the inherently post-positivist conception of landscapes as complex socio-ecological systems and the THN, and the constructivist conceptions of SWB and the Cultural Values Model, requires the use of some fuzzy logic. I argue that inherently, when people make cognitive evaluations of their lives (according to goals, wants and needs), they are conscious of the things that generate satisfaction or

[1] The image is of a shrimp fisherman and his fishing gear, in the artisanal fishery within the Black River Lower Morass Ramsar site, southwest Jamaica.

dissatisfaction (or, their intentionality is directed towards things, that influence life satisfaction). However, there are many processes that influence the conditions of people's lives that we neither consciously identify nor explain. Therefore, I suggest that when people make cognitive evaluation of their lives they are aware of the things that they perceive to influence their lives, but they may not consciously or correctly attribute it to specific changes in their life conditions. For example, a farmer recognises that his crop fails, which negatively influences his cognitive evaluation of his life, yet he may not attribute it to a specific biophysical process. This attempted reconciliation nevertheless ascribes to a dualist separation between mind and body / physical space, which is inherently post-positivist.

According to interpretations of Heidegger (1985), embodied experience (the mental and bodily 'experience' of living) is positional within space and time (cited in Wollan, 2010). Therefore, recognising that embodied experience is essentially embedded within cultural landscapes, I suggest that it is only phenomena that register within our sphere of embodied experience that influence life-satisfaction. Although the logic of the model may not stand up to rigorous scrutiny, it does offer a reasonably intuitive and analytically useful metaphor for interpreting relationships between cultural landscapes and life satisfaction.

The proposed model suggests that we may experience a relatively superficial extent of the complex bio-physical processes that exist in landscapes. This does not mean that 'hidden' layers (those processes that are not easily identifiable and interpretable) of cultural landscape systems cannot be explored; indeed, sciences, art, archaeology, etc. are concerned with the exploration of these hierarchical systems. This is consistent with the notion of *surface* and *embedded* values within the Cultural Values Model, which suggests that people experience (or create) less immediate aspects of landscapes as their exposure deepens. In a similar strain, as a result of mediating psychological factors, just because and individual or group identifies a *form*, *relationship*, or *practice*

as being of value, it does not necessarily mean that those elements have an effect on life satisfaction as it is experiences - hence why OBW is not always a suitable proxy for quality of life overall (Dolan, Peasgood & White, 2008).

At this point it is important to remember that both positive and negative affect are also key components of SWB. Experiencing positive and negative emotions does not require cognitive evaluations (Diener et al., 1999). There are clearly many positive and negative emotions that are generated through the interaction with, and within, cultural landscape, which do not require any conscious recognition. Despite the importance of these elements, these will not be discussed here since they are considered to be less amenable to policy intervention.

This model is also concerned with the marginal wellbeing effects of cultural landscape factors. This model can be used to understand how changes in cultural landscapes can influence life satisfaction in marginal, not absolute, terms. Many studies mistakenly seek to derive absolute values of ecosystem services, for example Costanza et al. (1997). However, for decision making this is often of less interest than a comparison of the marginal value of two alternative options. As the economic truism goes - "value is determined on the margin" (Simpson, 2011). This study adopts the same sentiments. We are not interested in the absolute value of cultural landscapes to individuals' life satisfaction, since this is largely an academic exercise. Instead we are interested in the effect of real world differences in cultural landscapes on life satisfaction. This marginality is not just spatial. As the result of 'set-point theory' or 'subjective wellbeing homeostasis' (Cummins, Lau & Davern, 2012), the effects of changes in life conditions on individuals' life satisfaction diminish over time. However, I suggest that historical landscape aspects can continue to serve contemporary functions, and as such they may be important for maintaining desired and valued life conditions - an on going 'aspiration'. In this respect, the age of the observer (as well as the time that the observer is exposed to the landscape) may influences the degree to which they

recognise surface and embedded values, as well as the temporal baseline by which they measures changes within landscapes.

Since *forms*, *relationships* and *practices* are often highly interwoven, interacting to create unexpected phenomena, studying any single element to the exclusion of others may miss important relationships. For example, Cocks argues that harvesting and using natural resources is often partly culturally motivated, fulfilling a cultural function (Cocks, 2006). Therefore, a certain *practice* may simultaneously provide SWB benefits through the satisfaction of basic needs, whilst also fulfilling normatively endorsed 'wants' relating to identity, etc. Whether it becomes a stretch to talk about 'wants' in the context of things like identity is highly contestable, although in this case I suggest it is more of a semantic than theoretical issue. However, other challenges to this model can also be raised. For example, individuals may pursue culturally endorsed 'wants' even when these wants actually harm SWB - e.g. when individuals damaging construct their identity based on social cues.

So far this model has largely ignored the factors that mediate the relationship between individuals and their cultural landscapes. Clearly gender, economic power, legal regimes, etc. significantly modify the way individuals and groups negotiate relationships with their environment. For example, "Powered cultural landscapes" is a term used by Spencer-Wood (2010) to express the structural and non-structural power dynamics that affect agency within cultural landscapes. Spencer-Wood (2010) uses a feminist framework to analyse how individuals and groups exercise power towards others, towards landscapes, and through landscapes. In turn, Spencer-Wood (2010) also describes how landscapes exert 'power' in relation to people, and can act as agents of social change. Similarly, Foucault (1995), although not expressly talking about landscapes, discusses how built spaces are used to regulate the behaviour of, and dominate, others. Cultural landscapes, as partially constructed spaces, also contain structures that influence how people

interact with and within cultural landscapes. There are clearly many salient areas that have not been explored within the theoretical framework. However, as an exploratory study, this research is more concerned with the testing the fundamental assumption that a relationship between cultural landscapes and life satisfaction exists.

A broader issue with employing the Cultural Values Model, within this study, is that it assumes that culturally significance landscape components can be universally delineated into the categories of *forms*, *relationships* and *practices*. The literature used to construct the Model is largely situated in Westerns scientific and philosophical cosmologies. Therefore, the extent that the Model can describe how cultural landscape components are interpreted according to other cosmologies, such as those of Maya peoples, is unclear. This will be discussed further in Section 5.4.

There are no-doubt many more challenges to the theoretical framework that could be raised. This framework is only a narrative metaphor, and to claim otherwise would be reification. Nevertheless, it provides a lens for reconciling both material and immaterial cultural landscape affects on life satisfaction. It also facilitates the further investigation of how some cultural landscape forms and processes may influence SWB. Before doing this, however, the final section of the literature review will explore the limited range of studies that investigate the links between life satisfaction and cultural landscapes, through a range of approaches and theoretical frameworks.

2.4.4. Empirical studies exploring the links between landscapes and life satisfaction

The follow section describes the existing studies that model the relationship between landscapes and quality of life, including perceptions of their importance and actual impact on measured life satisfaction. The empirical studies by Vemuri & Costanza (2006); Engelbrecht (2009), Bonini (2008), Welsch (2002) and Zidanšek (2007) explore the relationship between ecosystem services, or the environment, and SWB at the macro scale (between countries) often using both national

and subnational indicators of life satisfaction (to the exclusion of the other components of SWB - positive and negative affect). The subsequent papers in this section describe subnational studies.

Although the study is interested in SWB and life satisfaction, as a psychological construct and point of measurement, a number of papers looking at perceptions of value are also discussed. This is for two reasons. Firstly, there is only one paper that empirically compares variation in self-reported life satisfaction against landscape features, at a subnational scale. Secondly, on one hand, using perceptions of the value of landscape features cannot be treated as an accurate guide for experienced quality of life. On the other hand, it may shed some light on factors that may be important when trying to model life satisfaction effects of landscape features.

Vemuri and Costanza (2006) use measures of built, social, human and natural capital, to try and identify the extend that these national variables contribute to mean SWB, between counties. They specifically focus on life satisfaction on the grounds that national predictors of wellbeing have a stronger effect on life satisfaction than they do on positive or negative affect. Their results show that natural capital has a clear positive relationship with life satisfaction, across countries.

Engelbrecht (2009), in a similar study, asked if correlation between natural capital and SWB "is robust to the inclusion of major macro-level determinants of SWB established in the literature", as well as dummy variables that seek to represent regional effects (culture, etc.). Again, they focus on life satisfaction as the most appropriate element of SWB to study. Essentially, the relationship is robust even with these additional variables. However, they caution against attributing causation, since the relationship between natural capital and SWB may be bi-directional.

Bonini (2008) compares international data on individual life satisfaction with micro and macro level variables that predict SWB, against the Human Development Index (HDI) and Environmental Sustainability Index (ESI). However, he concludes that individual's characteristics, that vary regionally, can explain more of the variation between countries life

satisfaction than the HDI and ESI. Subsequently, he cautions against the use of universal indicators, such as the ESI, to predict life satisfaction since they poorly reflect differences in life satisfaction between countries.

Welsch (2002) explored how income, rationality, freedom and pollution effected life satisfaction between 54 countries. Pollution was founds to have negative effect on life satisfaction, when controlling for these other factors. They also estimate the monetary value of air pollution abatement and foregone income.

Zidanšek (2007) compare three measures of SWB against the ESI and Environmental Performance Index in a cross-country study. He found a general positive correlation between SWB and national positive environmental attributes. He concludes that contemporary happiness does not have to be sacrificed for future wellbeing, since holding sustainability values in of itself can elevate SWB.

Plieninger et al. (2013b) highlight the issue that cultural services, within the ecosystem service framework, are often acknowledges as important but methodological challenges mean they are rarely fully accounted for. They use participatory mapping exercises and interviews with 93 residents to identify perceived cultural ecosystem services and disservices within a landscape in Saxony, Germany. These results were analysed using Geographical Information Systems (GIS), identifying a diverse array of cultural services and landscape features that were perceived as important within individuals' wellbeing. Perceptions of the importance of these cultural services varied by socio-demographic characteristics, and were often clumped around specific landscape features.

Larson et al. (2014) surveyed 1,545 residents within the Great Barrier Reef area, to explore perceptions of what aspects of the reef ecosystem they felt were the most important contributors to their wellbeing. The study did not measure SWB or life satisfaction, instead focusing on what

individuals perceived to be important factors within their lives. However, Larson et al. (2014) argues that understanding the relative importance of different elements of wellbeing allows for more focused natural resource management, including an appreciation of the "potential ecosystem trade-offs", in a way that resonates with communities. They found that an absence of rubbish; healthy ecosystems and iconic marine species were perceived to be more important to resident's perceived quality of life than the employment and income associated with the reef.

Brown and Kasser (2005) found a positive correlation between SWB and ecologically responsible behaviour, such as voluntary lifestyle simplicity, among U.S. adolescents and adults. In both groups, this was attributed to the psychological wellbeing benefits associated with recognising intrinsic values and mindfulness.

Bieling et al. (2014) performed single-question, open-ended interviews with 262 respondents in four areas in Germany and Austria. The study aimed to explore how biophysical features of a landscape contribute towards the wellbeing of people within it. They find that immaterial values associated with physical aspects of landscapes where generally reported to be highly valuable to individuals quality of life. They suggest that the focus on these cultural aspects of landscapes are more appropriately described by the Cultural Values Model (used in this study) than the ecosystem service framework. To this effect they state that their study:

"has provided overwhelming evidence regarding nonmaterial values being attached to landscapes that challenges the perspective of the Millennium Ecosystem Assessment, which suggests that connections between cultural ecosystem services and human wellbeing tend to be relatively weak"

(Bieling et al. (2014) citing MA (2005)).

Although I contest how overwhelming their evidence is, I do agree with the sentiment that the ecosystem service framework poorly captures immaterial relationships between landscapes and perceptions of quality of life. However, yet again, because the study focused on stated

preferences, as opposed to those revealed in actual differences in SWB, it cannot be concluded that landscapes have a tangible effect on SWB.

Petrosillo et al. (2013) investigated, among other things, perceptions of quality of life, insularity, and natural and social capital with 91 permanent and seasonal residents on Vulcano Island, Italy. They conclude that both natural and social capital must be taken into account when seeking to generate indicators of quality of life. However, since the study only explored perceptions of the importance of social and natural capital it is unclear what the actual impact is on SWB.

Ferrer-i-Carbonell & Gowdy (2007) found a strong correlation between environmental attitudes (awareness about ozone depletion and loss of biodiversity), and SWB, using British Household Panel Survey data. People that were concerned about species extinction tended to have higher SWB than the mean, whereas those that were concerned about ozone depletion had lower.

Brereton, Clinch & Ferreira (2008) used spatially explicit individual and local data on socio-economic and demographic characteristics, environmental and geographic variables, and self-reported wellbeing among 1,500 adults in Ireland. They provide evidence of the importance of spatial dimensions in determining wellbeing, with spatial variable coefficients being large and highly significant. They find the effects of spatial variables are often a function of distance. They particularly highlight proximity to coasts, which have a large positive effect on life satisfaction, which diminished with increasing distance. They find that the inclusion of spatial variables substantially increased the explanatory power of their model. For these reasons, they suggest "geography and the environment have a much larger influence on well-being than previously thought". They conclude that incorporating spatial considerations is important within public policy setting, giving an example of waste processing facilities proximity to housing. As far as the author is aware, this is the only study that explicitly explores the SWB effects of landscape variables at a subnational scale.

2.5. Conclusion

The rapid increase in the number of papers published that investigate the relationship between environmental factors and SWB demonstrate increasing recognition of its potential value. However, when we compare these studies to the theoretical framework, there are a number of points that can be drawn.

Firstly, as the result of the multidimensionality of SWB, and the lack of a widely endorsed overarching framework, there are many interpretations of wellbeing in the context of landscapes. On one hand, this does reflect the diversity of theories within psychology, regarding SWB. However, there is also scope for misrepresentation of the theoretical causal narratives that link different elements of an individual's SWB and their life conditions, including those dictated by biological and biophysical systems. To this effect, the incorporation of subjective measures is an improvement on the narrow conception of wellbeing that dominates the environmental discourse at the moment. Yet, care should be taken to ensure that claims regarding the wellbeing benefits of landscapes are well grounded in psychological theory. Additionally, interpretations of terms used within the discourse appear to vary, and behind seemingly intuitively interpretable terms, such as 'happiness', lay a multitude of different definitions.

Secondly, possibly as the result of their being no universal model of wellbeing, the causal understanding of changes in landscape conditions and resultant impacts on SWB is very much in its early development. At this stage, a number of interesting relationships have been found, such as the strong link between SWB and natural capital at the national scale (Vemuri & Costanza 2006; Engelbrecht 2009). However, when we look at other variables that contribute to life satisfaction, such as wealth, it is clear that there is rarely a simple and linear relationship with SWB. Therefore, it appears to be premature to say that there is universally a positive causal relationship between environmental quality and SWB.

Third, much of the literature that explores landscape effects on SWB, focus on perceptions of the value of landscape factors for quality of life. This is a legitimate area of investigation, and does offer important and valid information for landscape management. However, it would be misleading to treat stated preferences as accurate predictors of SWB. As has been discussed by Dolan, Peasgood & White (2008), using both stated and revealed preferences offer important insights, but do not necessarily predict individuals experienced wellbeing.

Finally, the existing empirical literature exploring landscape factors influence on SWB (not perceived importance to quality of life) tend to focus on environmental and ecological features of the landscape, to the exclusion of cultural aspects. The symbolic and cultural value embodied in certain practices and forms may have important effects on SWB.

2.5.1. Research gaps

Clearly, as a relatively new domain of study, there are still many of the aspects of the relationship between landscapes, SWB and life satisfaction that are unclear. One area that has not been discussed here, but has been explored in Kjell (2011), relate to the possibilities of investigating and utilizing existing eudemonic values to promote environmental protection. Exploring this area may also add interesting new perspectives to existing debates and established ideas. For example, bring a novel outlook to the on going 'new conservation' vs. 'old conservation' debate; where 'new' instrumental values, as motivators for conservation, are posited against 'old' intrinsic values (Soulé, 2013; Doak et al., 2014).

Yet, there are still many fundamental questions that require attention. Although there are a number of studies looking at the relationship between landscape factors such as natural capital and SWB at the international scale, there appears to be far fewer at the subnational scale. It cannot be assumed that effects that exist at the national scale hold at local scales. Therefore, if

such research is to be useful for integrated landscape management then subnational and local relationships must also be explored.

Brereton et al. (2008) integrates spatially explicit data when exploring the relationship between life satisfaction and landscapes. The fact that the inclusion of explanatory variables significantly improves the predictive power of their model, and that landscape factors have large and significant affects on SWB, highlights the potential importance of appreciating spatial factors in policy development. However, Brereton et al. (2008) only explored a limited range of physical landscape elements. Investigating how differences in cultural landscape *forms*, *relationships* and *practices* influence life satisfaction is also of interest to landscape management. Similarly, the degree to which the effects found by Brereton et al. (2008) are universal across all landscapes remains unclear. Further research that investigates this relationship in different cultural, social and economic contexts is important for generating a body of theory in which to situate any policy decisions. As has been seen in Section 2.2.5., there is still substantial debate on the influence of extensively studies variables, such as income, on SWB. I believe that the relationship between landscapes and SWB is also likely to be highly complex. However, recognition and understanding of this complexity, and moving beyond simple objective measures of wellbeing, could improve the way that landscapes - as the medium of human wellbeing - are valued and managed.

3. Method

The aim of this research is to empirically explore the relationship between landscape elements and individuals self-reported life satisfaction, within Maya communities of southern Belize. To do this I seek to answerer two Research Questions:

1. What are the primary themes that individuals in Maya communities associate with a good life?
    a. What does a good life mean?
    b. What are the things that are perceived to influence quality of life?
2. What is the strength of the statistical relationship between landscape variables and self-reported life satisfaction, accounting for social, economic and demographic effects?

As mentioned Section 1.3., the purpose of the first question and its sub-questions is fourfold. Firstly, to compare and contrast SWB as a psychological construct against the quality of life as understood in Maya communities. Second, to inform the content of the surveys. Third, to assist in the development of the candidate models (in the qualitative analysis). Finally, to provide depth and context to the quantitative results.

I will answer these questions using mixed methods - systematic analysis of qualitative information and statistical analysis of quantitative information. The following methods section starts by providing a short description of the study site. It will proceed by outlining the epistemological and methodological approaches used, and how they are reconciled. Then, I describe the methods of qualitative and quantitative data collection, and some of the assumptions within the method. Following that is a description of the qualitative and statistical analysis used, again, in light of assumptions made. Then there will be a short description of the limitations of the methods employed, and the measures taken to manage those limitations.

3.1. Ethics statement

The study was conducted according to the ethical guidelines of the Central European University, Hungry. In each community the 'Alcalde' (community magistrate) or village Chairman (community leader) were consulted to request their permission before the interviews and surveys were conducted. Before each interview or survey, respondents were informed of the purpose of the study, that I was a student at the Central European University, and the confidentiality and anonymity of responses. They were also told that there would be no compensation or follow up project, that they could skip any questions or stop at any point, and the estimated time required to complete the survey or interview. Oral consent was sought before requesting if the interview or survey could proceed.

3.2. Epistemology and methodology

Differing philosophical paradigms often characterise qualitative and quantitative methods. These paradigms have explicit and inexplicit expectations about the nature of reality (ontology), knowledge of reality (epistemology) and means of understanding reality (methodology) (Sale, Lohfeld & Brazil, 2002; Moon & Blackman, 2014). Methods make inherent assumption about these aspects; it is often beneficial to recognise these assumptions when claiming subject knowledge, especially in multidisciplinary fields (Williams & Gordon, 2014). There is extensive literature on philosophical perspectives of knowledge claim positions. However, one commonly discussed distinction with the more accessible literature is between (post-)positivism and constructivism (Creswell, 2002).

Positivism is underpinned by the assumption that there is one physical reality (an ontological position), and therefore a definitive truth exists regardless of human perception (Lincoln & Guba, 2000). This means a researcher can attain an objective view of reality, devoid of the observers' values and beliefs (epistemological position) (Sale, Lohfeld & Brazil, 2002).

Methodologically, this means that by minimising bias and maximising accuracy through randomization, large sample sizes and highly structured approaches, and observer can get a representation of *the* truth. (Sale, Lohfeld & Brazil, 2002).

Post-positivism emerged in response to recognition of the unavoidable observer bias and measurement error within scientific investigation (Alvesson & Sköldberg, 2009). Post-positivists still claim that there is a reality, but humans are imperfect observers of that reality (Cupchik, 2001). Although post-positivists continue to aspire towards identifying *the* truth, it is recognised that this goal is ultimately impossible, since theory can always be revised (Phillips & Burbules, 2000). It also recognises that all theory contains cultural and normative biases, but these can be navigated through mutually held concepts and definitions.

Constructivism, on the other hand, suggests that observers constructs their own reality, and therefore there are multiple realities (ontological position) (Crotty, 1998). Subsequently there are multiple truths, which are also socially constructed, and it is impossible to claim accessible to reality outside of human experience (epistemological position. Smith, 1983). Therefore, methodologically, it is recognised that 'truths' are inherently constructed by the interaction between the object of study and the investigator. This means that depth and meaning about a particular subject is prioritised over making general claims about truth (Sale, Lohfeld & Brazil, 2002). As a result, the methods for data collection and analysis, criteria by which to evaluate work, and ultimately the questions asked, depend on the paradigm consciously or unconsciously ascribed to.

This study's Research Question would lend itself to exploration using either paradigmatic approach. Since integrated landscape management is prescriptive about management solutions, a quantitative approach allows for less nuanced but more generalizable conclusions to be drawn. However, considering the inherent subjectivity of studying cultural landscapes and subjective

wellbeing, the use of qualitative approaches can provide valuable depth and perspective when making broader generalisations. For these reasons, this study seeks to employ mixed-methods of data collection, analysis and interpretation.

One approach to reconciling competing knowledge claim positions, within mixed-methods, is pragmatism (Creswell, 2002). There are multiple interpretations of pragmatism, which engage to vary extends in epistemological discourse. On one hand, one branch of pragmatism holds that the novelty of pragmatism lies in the fact that it expressly avoids intractable epistemological debate, allowing reclamation of the 'ordinary', by taking a problem-centred approach (Frega, 2011). On the other hand, there is increased desire to integrate pragmatism within existing epistemological discourse, which some suggests detracts from its initial appeal (Frega, 2011). Creswell's (2002) description of pragmatism recognises the presence of the assumptions inherent in knowledge claim positions. It also recognises that at the moment these assumptions will remain largely untestable, and as a results seeks to move past such tricky territory by adopting a problem-centred, as opposed to method-centred, approach (Creswell, 2002). Although it is important to recognise philosophical assumptions within research, not least for constructive dialogue across disciplines, methods are adopted based on their capacity to answerer a specific question of interest. Knowledge is valued by how well it serves human purposes, and "truth claims, cultural values, and ideas are explored in terms of consequences and application" (Moon & Blackman, 2014).

I adopt this pragmatic approach, and use both qualitative and quantitative methods in the hope that the results will add value to each other and, ultimately, better investigate the focal Research Aim (Mertens & Hesse-Biber, 2013). However, I have significantly more experience in quantitative methods, and my application of qualitative approaches and understanding of their

philosophical milieu, is a weakness. For this reason the qualitative data collection and analysis will be rather superficial, with a more extensive quantitative focus.

3.3. Study site

As a Global Biodiversity Hotspot, Mesoamerica is internationally recognised for its high endemism, habitat and species diversity, supporting 7-8% of global terrestrial species (Grandia, 2013). Retaining around 62% forest cover, Belize has a critical function in maintaining the Mesoamerican Biological Corridor linking the Americas (Cherrington, 2012). The predominantly forested watersheds of Belize drain in the Belize Barrier Reef, the second largest in the world and a UNESCO World Heritage Site (UNESCO, 2015).

Toledo, the southernmost district of Belize, contains the highest intact forest cover in the country (71.2% of the district area in 2010), alongside the Cayo District (Cherrington et al., 2010). It contains the IUCN Category I Bladen Nature Reserve is widely referred to as "the crown jewel of Belize's protected areas". Yet, rapid population growth, intensification of agriculture and legal and illegal timber extraction threatens habit contiguity and a number of globally threatened species in Toledo (Young, 2008).

Toledo is also home to around 9% of Belize's population (total population est. 360,838), of which nearly 70% are Maya (Statistical Institute of Belize, 2015; Halcrow Group, 2010). Toledo has the highest levels of poverty in the country. A poverty assessment conducted in 2002 considered 79% of the population as poor (under US$5 per day), and 56% as unable to routinely meet minimum calorific requirements necessary for a healthy existence (Halcrow Group, 2010; Ministry Of National Development, 2005). Nearly half the population of Toledo are engaged in agriculture (Halcrow Group, 2010), nearly double the national average (Ministry of Agriculture & Fisheries, 2003). The majority of this agriculture is 'milpa' - shifting subsistence cultivation (Ministry of Agriculture & Fisheries, 2003). However, increasing population pressure is reducing

the fallow periods between cultivation years, leading to concerns over unsustainable land-use and soil degradation (Ruscalleda, pers. comm., 2015).

However, this description of the study site, and this unsustainability, is only one of many possible ways of characterising the area. Indeed, the common caricature of Toledo as the 'poorest' district in Belize, and the association between poverty, subsistence farming and indigenousness, appears to stem from a dominating modernisation narrative. In this respect, it is probably not a representation of how people within Toledo might construct a description of southern Belize.

3.4. Data collection

Within this section I will describe the target population, the sampling strategy and method for the qualitative and quantitative data collection, and provide justifications for choices made. I will also describe the variables of interest within the quantitative component of the study, and the reasons for selecting those variables.

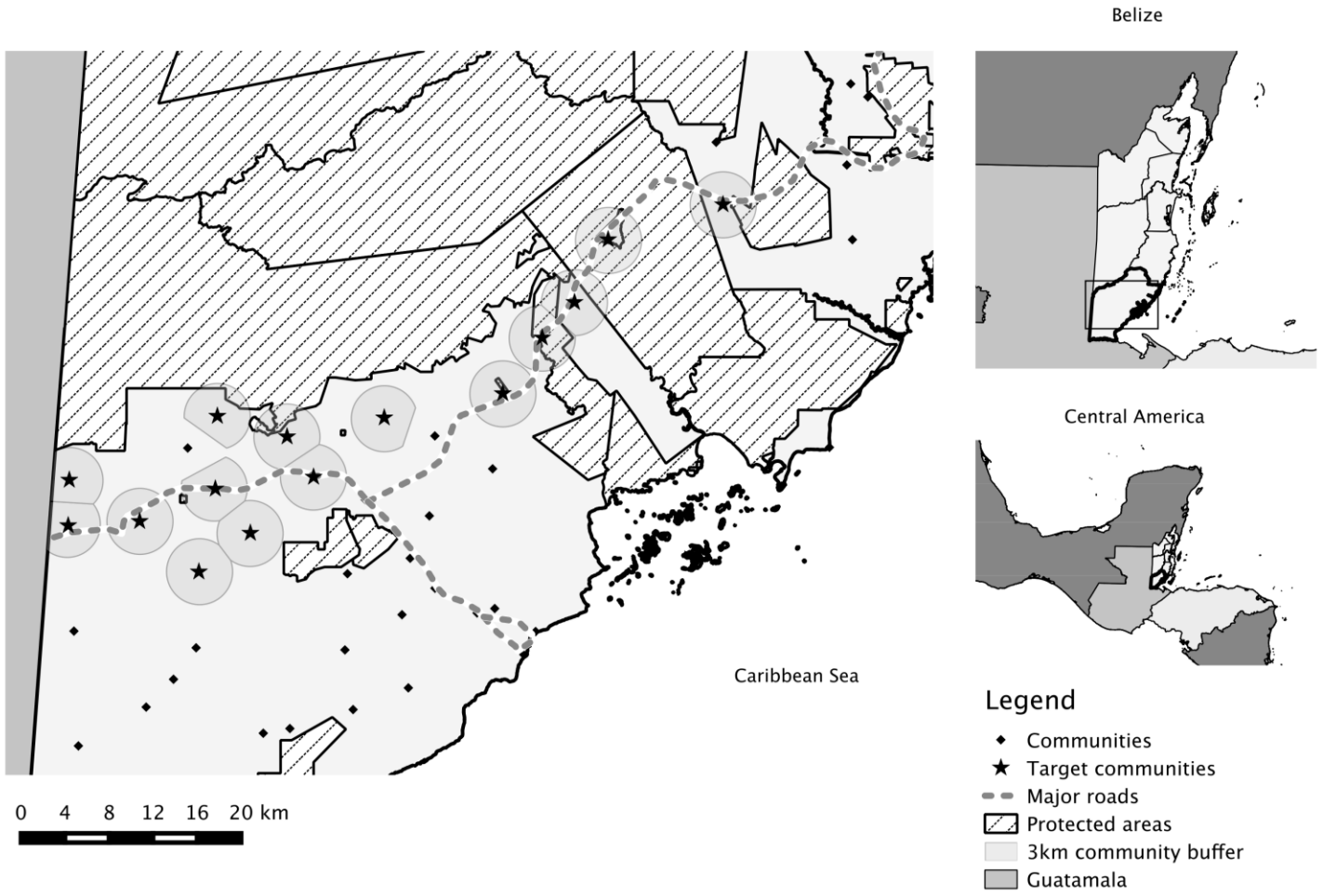

Figure 3| Map of the study site, including the location of target communities (stars), three kilometer buffer area (grey buffer), other communities (diomonds), roads (dash line), protected areas (dashed area) within the Toledo District of Belize, and surrounding countries in Central America. Data: Ya'axché Conservation Trust, 2015; DIVA-GIS, 2015).

3.4.1. Target population

The target population comprised of 15 communities within the Toledo District of southern Belize. The choice of sampling 15 communities was partly based on the desire to optimise the distribution of effort between samples in each community and number of communities in total. The communities were purposively selected according to three criteria a) representativeness of a range of landscape modification; b) spanning sufficient geographical area to minimise pseudoreplication from correlation of spatial characteristics; c) accessibility. The extent of landscape modification was determined with the aid of the Sustainable Land-use Officer (pers. comm., 2015) and the Community Outreach and Livelihoods Programme manager (pers. comm., 2015), at Ya'axché Conservation Trust. Both of these individuals were highly familiar with land-use change in Toledo, and were able to suggest communities with the most and least modified landscapes. By modification, I refer to total conversion of forest to agriculture approximately within the last 15 years. To reduce the risk of spatial correlation, and subsequently pseudoreplication, we also prioritised communities that had the greatest geographical spread. The criteria for determining if the communities were sufficient spaced was based on the qualitative interviews, and additional informal observation, with community members. Community members reported walking between 30 minuets to one hour to their farms (although it was very rare for individuals to report having to walk for an hour). We estimated, that at a moderately fast walk, this would mean individuals would travel at a maximum of about three kilometres from their community, assuming they were walking in a straight line with no stopping. This means we aimed to ensure a distance of at least six kilometres between each community. However, because of the geographical proximity of the communities, this was not always possible. However, all communities were at least three kilometres apart: and individual travelling for 30 minuets (the most commonly reported time) in a strait line would be unlikely to encounter the farms of other community members. The choice of using the individuals' farm as the reference point is based on

considerations discussed in Section 3.3.3. Lastly, the majority of communities were reached by bus, although some of the more remote communities did not have bus access, and were therefore visited by chartered vehicle or foot.

According to these criteria, the communities selected were Jalacte (households: 119); Santa Cruz (80); San Vincente (est. 80); San Miguel (105); Aguacate (64); Blue Creek (65); Bladen (110); Na Lum Ka (est. 12); Tambran (est. 10); Golden Stream (52); Medina Bank (34); Indian Creek (134); Mafredi (33); Crique Jute (50); and Pueblo Viejo (est. 105). The number of households per community were determined firstly according to the 2010 census (Statistical Institute of Belize, 2010), and secondly, if these data were unavailable (in the case of four communities), asking the village 'Alcalde' and Chairman, triangulated against a visual count of households when walking through the community. These communities are situated at varying distances from the foothills of the Maya Mountains and the Southern Highway (Figure 3).

3.4.2. Qualitative data collection: problem-centred interviews

The qualitative component of the study is principally concerned with exploring the Research Question:

1. What are the primary themes that individuals in Maya communities associate with a good life?
    a. What does a good life mean?
    b. What are the things that are perceived to influence quality of life?

Exploration of this question, and sub-questions, consisted of two elements. Firstly, informal observation during time spent in communities and in conversation with my research assistant, as well as drawing on my experience as a development officer at Ya'axché working for 14 month between 2012 and 2013. My research assistant is a young man, who has lived his entire life in Indian Creek, attended high school, and is generally well known in the surrounding communities. This informal observation was not systematically documented and therefore does not constitute a

substantial source of evidence within the study. However, it remains an important aspect of the experience, since spending time within the homes of community members facilitated a more holistic (although still very superficial) understanding of Maya life.

Secondly, ten interviews using the Witzel's Problem Centred Interview (PCI) were conducted between the 27th January and 5th February. PCI is a technique used to comprehend subjective perceptions, social constructions of reality, and behaviours (Witzel, 2000). I employed PCI for two reasons. Firstly, Baines (2012a) explored how community health and wellness is constructed within one Mopan Maya community in Toledo. The use of PCI, a theory generating approach, provides an opportunity to generate alternative theories of how wellbeing is constructed in comparison to interpretations of wellness provided by Baines (2012a). Secondly, it is a technique I am already moderately familiar with.

Following Witzel (2000), after informing participants of relevant information about the research context and acquiring consent, I told the respondent about my research interest. This aimed to avoiding respondents answering questions based on an assumption about the purpose of the research. It was also to make clear that I was primarily interested in the thoughts and opinions of the respondent (Witzel, 2000).

PCI draws on Grounded Theory: the investigator fluctuates between inductive and deductive phases within and between interviews, according to an evolving 'heuristic-analytical framework' (Strauss & Corbin, 1998). The respondent is considered to be an "experts of their orientations and actions" (Witzel, 2000). The interviewer uses the heuristic-analytical framework to ask questions, particularly relating to enacted behaviours, to generate, test and develop theories. Interview devices are used to create a 'communication situation', depending on respondent's eloquence, openness to reflection, etc. Interview approaches assist respondents in constructing and reconstructing actions and thoughts, creating a biographical narrative. This allows the

interviewer to identify 'contradictions', alternative aspects of a subject, and consistencies. The narrative focus creates a space for dialogue that might otherwise be considered inappropriate in formal interview settings. (Witzel, 2000).

Literature (e.g. Baines, 2012a), and observations were used as a guide to potential research themes. The use of an interview guide (Appendix I) aligned the interview and research themes, facilitating comparability across interviews. An open ended pre-formulated introductory question was used to initiative the dialogue. Subsequent to this, research themes were explored according to the flow of the dialogue, and in an order that was naturally determined by the respondent (Witzel, 2000). Research themes that are not voluntarily elicited by the interviewee within the initiated phase of dialogue were then presented and explored. This was done in all of the interviews, although most of the themes were typically covered before this point. Tape recording ensured an accurate record of the interviews. Short postscripts were written immediately after the interviews, describing the topics discussed, notes regarding points of interest, and initial analysis (Witzel, 2000).

This approach was demanding. As well as requiring research skills, the validity of the interviews is potentially also influenced by the extent that the interviewer is familiar with, and embedded within, the cultural context. During the process of conducting the interviews, making transcripts and initial analysis I was aware of my lack of experience using this method, and the limited exposure and integration into the lives of Maya peoples. As such, the quality of the data produced is potentially of limited quality (as will be explained in Section 3.5.1., for this reason the analysis is relatively superficial).

The key research themes that were explored within the interviews were: a) what does a good life mean, and b) what were the things that influence the quality of your life. Generating an understanding of what a good life means to people in Maya communities provides an

opportunity to explore the appropriateness of the construction of SWB as used here. However, this needs to be done with caution. People do not have an objective meta-view of their own cognitive processes (Dennett, 1991), and so the perception of what a 'good life' constitutes may not be comparable to wellbeing as described within the SWB framework. Again, to reiterate a sentiment from the introduction, the choice of using SWB as defined within the hedonic tradition is more of a practical choice than a statement about the legitimacy of different definitions of wellbeing.

Similarly, within the introduction, I state the issues with using individuals expressed preferences as the sole guide for policy decisions (Dolan, Peasgood & White, 2008). However, in light of the limited research exploring the effects of different social, cultural, demographic and economic factors on life satisfaction in Maya communities I choose to explore variables that were stated, in interviews, to be important to a good life. Although stated preferences are not always accurate guides, they may give some indication of factors influencing life satisfaction. The afore mentioned account of wellness within one Maya community, by Baines (2012a), provides an additional point of departure when identifying potential variables for quantitative study.

The choice of the term 'good life' is one that inevitable has normative and cultural connotations. Ideally, the choice of language used within the survey would have been jointly developed with participants. This would have facilitated shared ownership of the research, enhancing its legitimacy. It may also have improved the quality of the research, if the language chosen had greater resonance with participants. However, due to limited time and capacity, this was not done. Instead, the term phrase 'a good life' was employed. It was chosen because I considered it more neutral than the use of other terms such as happiness. The choice of the term 'happiness' would have implied a strongly hedonic conception of wellbeing, whereas 'a good life' leaves space for eudaimonic interpretations.

Therefore, the interview guide starts with the opening theme of 'what does a good life mean to you?' This open question is designed to elicit information about individuals' (*'to you'*) own definitions of what a 'good life' means. It then proceeds with 'what makes life good?' This theme is related to individuals overall assessments of the things they think are important for a good life, before introducing any specific life domains. This was intended to gain an impression of what the most salient, or immediate, things are that come to peoples minds when they think about a 'good life', before introducing specific life domains to the dialogue. This dialogue would be explored until respondents exhausted the list of things they thought contributed to a good life. Often something along the lines of 'you mentioned *x*, and *x*, what other things do you think are important for a good life' would be used as a further prompt. After this, the theme of 'what makes life bad' was then explored, using similar prompts. After all the voluntarily elicited themes were explored, the final stages of the guide moved on themes relating to the specific life domains of 'income and wealth'; 'social support'; 'health'; 'religion'; 'marital status'; 'occupation'; 'education'; and 'nature', if these had not already been covered.

However, the structure presented here is only an outline of the interview guide. The interviews themselves followed very different trajectories. Ten participants were purposively selected from three communities (Medina Bank, Indian Creek and Golden Stream). They were selected according to two criteria: a) representing a reasonable spread of ages and balance between men and women, b) knowledge, eloquence and being forthcoming about perceptions of contemporary Maya life, culture and beliefs. These individuals were selected with the assistance of the research assistant and the Community Outreach and Livelihoods Program manager, both of whom knew three communities inhabitants well (pers. comm., 2015). However, the criteria for selecting respondents was consequently limited to only those people that were familiar to the research assistant or Ya'axché staff, and as a result the candidate participants were not representative of the target communities. Similarly, a sample size of only ten individuals from only three of the

fifteen communities does not provide a representative cover of communities. However, in light of limited time available I deemed it acceptable to conduct only ten interviews, as long as the validity of drawing conclusions across communities is treated with scepticism. Ultimately this means that the model of landscape dynamics generated may be biased, if the views expressed in the interviews are not representative of wider opinions.

Interviews were conducted between the 27th January and 5th February. Interviews were not pre-arranged. However, it is acceptable to 'drop-in' on households. When the intended respondent was not home, we would leave a message and return at an appointed time. The interviews were recorded with a dictaphone, with the permission of the respondent. The respondent was also informed about the purpose of the study, research aims, anonymity and confidentiality, before requesting consent and permission to continue. The interviews were conducted in English when the respondent felt conformable using English (5 respondents). The remaining five were conducted in Q'eqchi' with the assistance of the Q'eqchi' speaking research assistant. Prior instruction on interview protocol was given, including the request to translate as accurately as possible. However, during the post interview translation of the first few interviews transcripts it was apparent that the in-interview translation was not exact. After this was highlighted, and both my research assistant and myself adjusted our interview styles, the issue was largely resolved. During the course of the interviews, although the life domain themes remained the same, a number of key themes became apparent. They were subsequently included in the list of life domains that were purposely asked if not openly elicited, as will be discussed in Section 4.1. The interviews lasted between c.30 and c.80 minutes, although the mean time was 43 minutes. Of the ten interviews, five were female. Ages ranged between 18 and 86, although the majority of respondents were above 30 (with no young men below 30). All individuals approached were willing to participate.

Short postscripts were written after each interview, which also included some of the reflections of the research assistant, especially when he was translating. The recordings were translated (where appropriate) and transcribed as soon after the interview as possible, either the same day or the following day (although two interviews were not transcribed until several days later). In reality, the processes of data collection and analysis are simultaneous and iterative. However, for clarity, the distinction between data collection and analysis is made here, with the analysis being described in Section 3.5.1.

3.4.3. Quantitative data collection: surveys and remote sensing

The quantitative element of the study is principally concerned with answering the Research Question:

2. What is the strength of the statistical relationship between landscape variables and self-reported life satisfaction, accounting for social, economic and demographic effects?

Unlike the inductive approach described in the qualitative methods section, the choice of variables to study was identified *a priori*, based on the results of the interviews and relevant literature. For this reason, I wills start with a description of the general approach taken to the quantitative analysis, before moving onto a description of the variables of interest, before providing a description of the methods of data collection used.

This question will be explored by modelling a range of social, economic, demographic and landscape variables regressed against individuals self-reported life satisfaction. The social, economic and demographic variables were identified in the literature as being potentially important correlates of life satisfaction. Therefore, they are included to account for the portion in the variation of self-reported life satisfaction that is associated with those factors. The question then arises, how much of the remaining variation in self-reported life satisfaction, is accounted for by the landscape variables? Multivariate regression will be employed to determine the strength

of the relationship between landscape variables and life-satisfaction, whist accounting for the effects of differences in social, economic and demographic conditions.

First, I will start with describing the sampling strategy and participation rates for the survey. Then I will provide a description and justification of the social, economic and demographic variables chosen and how they were measured in the survey (Section 3.4.3.1.). Then I will introduce the instrument used to measure life satisfaction (Section 3.4.3.2.). Finally, I will described and justify the selection of spatial variables (Section 3.4.3.3.).

The target population that was sampled in the survey were women and men, over 18 years of age, within the 15 target communities (detailed in Section 3.4.1.). The sampling strategy was selected to balance effort between attaining a representative sample size in each community, and a sufficiently large spread of communities. The desired sample size was 15% of the total number of households in the community, or 15 households, depending on which was highest.

The surveys were conducted in English, Q'eqchi' or Mopan Maya depending on which language the respondent was most comfortable using. The surveys were first translated (by my research assistant), and then back translated (by a paid translator) to insure consistency of the meaning conveyed in the questions. A pilot study was conducted with four males and four females, selected by convenience, within the community of Indian Creek. The intention of the pilot was to identify issues with the wording and interpretation of the survey. The survey was constructed with an awareness of the problems associated with response biases and heuristics, contextual cueing and priming effects, and artefacts of translation (Bradburn, Sudman and Wansink, 2004; Podsakoff et al., 2003). The OECD Guidelines on Measuring Subjective Well-being (2012), particularly the chapter on methodological considerations, was very useful in the construction of the survey structure and format. Possibly for this reason, no major changes to the survey were identified after the fourth survey, and therefore it was deemed unnecessary to continue the pilot

beyond the eight that were conducted. Because of the changes to the survey, the pilot sample was not included in the analysis.

The total sample size was 226 households (21% of 1,058 households in the 15 communities). However, in Tambram only nine households were sampled, and in Na Lum Ka, only ten (compared to the desired 15 samples). This was a consequence of the communities being very small (both less than 15 households) and some of the house owners not being available to participate.

As mentioned in Section 3.4.1., estimated of the number of households in each community were primarily derived from 2010 census data (Statistical Institute of Belize, 2010) and, when this was not available, estimates from community leaders. These estimates were used to establish the systematic sampling protocol. As described in Equation 1, the sampling protocol involved sampling every n^{th} house, counted zigzag whilst walking along all the streets in the community (N = total number of households), when

$$n = \frac{N}{s}$$

Equation 1

Where s is 15% of the total number of households in the community, unless N<150 households, in which case it denotes 15. When residents in the n^{th} house were not willing to participate or not present, the next house was visited. However, when this happened, the count continues from the original nth house. Although it was common to meet houses that were not occupied, it was rare for household residents to be unwilling to participate (this was not recorded, however). A systematic (as opposed to random) sampling strategy was chosen for convenience and to insure a spatially even spread of samples throughout the community. We intentionally sought out the most 'senior' member of the household to participate in the study. It is conventionally considered

appropriate to speak to the head of the household, or most senior member of the family if they are not present. Also, generally the head of the household is more knowledgeable on certain aspects of household conditions. The household head was almost always male. However, since the majority were farmers, they would only be at their homes in the mornings, around mid-day, and evening. For this reason, the majority of respondents were the most 'senior' females in the household.

3.4.3.1. Social, economic and demographic variables

The social, economic and demographic variables primarily selected from the literature were 'social support'; 'wealth' & 'basic needs fulfilment'; 'religiosity'; 'age'; 'gender'; 'health'; 'education'; and 'ethnic background'. These variables were all included because they were also perceived to be important determinants of wellbeing during interviews. 'Unemployment' was not included since the majority of literature related to paid employment, whereas the majority of participants lived in farming families. Additional to the variables identified in the literature, variables that were highlighted in the interviews were 'sending children to school'; 'farming household'; 'forest use'; 'land tenure' and 'dependents'. However, of these 'sending children to school', 'land tenure' and 'dependents' were dropped from further analysis, as discussed at the end of this section.

Since these variables were used in the construction of a survey, there were two key criteria when selecting the instruments and approaches for measuring the variable. First, the questions had to be easy to interpret, avoiding language that could have multiple interpretations, and excessively abstract content. Secondly, the survey had to be quick to administer, and therefore the survey and its respective instruments had to be brief (Bradburn, Sudman & Wansink, 2004). The survey was intended to take no longer than 20 minuets to administer, to maximise participation rates and minimise the imposition on respondents.

As described in Section 2.2.5., various forms of social support have been consistently identified in the literature as important for peoples self-reported life satisfaction (Diener and Seligman, 2002). Similarly, providing and receiving social support, both material and emotional, was a common feature in many of the interviews. Therefore, a measure of social support was selected for inclusion in the model. To measure social support I used the Oslo-3 Social Support Scale (OSS-3. Dalgard et al., 2006). There are a large number of tools for measuring social support. However, the majority of these are extensive and time consuming to administer. The OSS-3 is a short three item instrument, that is relatively quick to administer, and has good predictive validity with regards to (among other things) quality of life (EUPHIX, 2010; Małkowska, Mazur & Woynarowska, 2004). The Cronbach's alpha (a test of internal consistency across the items in the scale) is relatively low (0.60, compared to the recommended 0.70 threshold). However, this has been attributed to the multidimensionality of the scale (each question measures a different dimension of social support). As a result it is sometimes recommended that each of the questions is included as a separate variable as well as using the sum of responses to all the questions (EUPHIX, 2010). However, within the analysis this will not be done owing to concerns about model overfitting. The scale has been used primarily within Europe, where it has shown high predictive power (e.g. Lehtinen, Sohlman & Kovess-Masfety, 2005). However, owing to the modest number of studies conducted using the OSS-3 outside of Europe, it is unclear how reliable it is in different social and cultural contexts. Nevertheless, it has been used in Nigeria, where despite having a low Cronbach's Alpha (0.5), it proved to be highly significant predictor of depression, measures on the Hospital Anxiety Depression Scale (Abiola, Udofia & Zakari, 2013). The study contained a relatively small sample size of 70, from University students, and therefore may not be representative of the validity of the tool in Nigeria more broadly (Abiola, Udofia & Zakari, 2013). A more extensive study by Rashid, Azizah & Rohana (2014) explored how attitudes towards ageing changed among 2005 elderly Malaysians. Although they did not test the

Cronbach's Alpha, they did find a strong correlation between positive attitudes towards ageing and social supporting, measured by the OSS-3 (Rashid, Azizah & Rohana, 2014). The OSS-3 has also been used in a number of non-peer review studies (e.g. Jathanna, 2011), which also demonstrate the reliability of the OSS-3 outside of a European context. Despite the lack of conclusive evidence of its reliability across cultures, the OSS-3 was included within the survey since it is relatively quick and easy to administer.

Wealth and income, although often correlated, are not the same. As we can see from Section 2.2.5., there is still significant controversy over the relationship between wealth, income and life satisfaction (Stevenson & Wolfers, 2013; Sacks et al., 2012; Easterlin et al., 2010). Much of the economic exchanges within communities are non- or partially monetary (Baines, 2012a). Reciprocity and material support were featured in many of the interviews. Similarly, full-time farmers reported acquiring the majority of their nutritional requirements from their own farms. For these reasons, measures of income are unlikely to be representative of the economic capabilities that an individual could mobilize in the fulfilment of aspirations. It appears that wealth, on the other hand, is marginally more reflective of the material conditions of individuals' lives; there are many goods and services that are near-universally aspired towards, such as having a concrete house, a gas stove, etc. Since there appeared to be no suitable means of accurately measuring current economic capability, I decided to use an Asset Index as a proxy for wealth. One major limitation of this approach is that wealth is not likely to be responsive to recent changes in economic conditions. Yet, as the result of set-point theory, it is recent changes that are mostly likely to register in individuals self-reported life satisfaction (Tomyn, Weinberg & Cummins, 2014). Therefore, this approach may be insensitive to the effects of recent changes in economic capabilities on life satisfaction. However, very low wealth (as measured in the study) may be correlated with incapacity to meet basic needs, which is a strong predictor of low life satisfaction (Ryff et al., 1999; Sen, 1999. See section 2.2.1. for further discussion). For this reason,

to measure 'basic needs fulfilment' respondents will be asked if they either grow or earn enough to eat from their primary occupation. In this case, additional to wealth, meeting basic nutritional needs (as subjectively determined at the household level) is an additional measure of basic needs fulfilment. Depending on if the respondent is a farmer or is employed in another occupation, respondents are asked if their household has grown / earned: a) not enough to eat, b) enough to eat, or c) enough to eat and sell / save, in the last month. This is a crude measure of basic needs fulfilment and is problematic for a number of reasons. Firstly, those engaged in 'productive *bricolage*' (opportunistically combining multiple livelihood activities. Batterbury, 2001) are likely to under-report basic needs fulfilment, since they may not rely on a single primary activity to meet their nutritional needs. Secondly, the use of the term 'enough' is highly subjective and is likely to vary between individuals. However, measuring the fulfilment of basic needs in more objective terms is highly challenging, not least because of some of the theoretical issues described in Section 2.2.1. It is hoped that through triangulation between wealth and this measure of nutritional needs fulfilment, a rough approximation of basic needs fulfilment can be achieved. However, evidence from observations, interviews and discussion with my research assistant indicates that it is often only the very old and infirm, that do not have family or wider social support, that do not routinely meet their basic needs requirements. Therefore, some of the effect of 'basic needs fulfilment' may also be accounted for in age and social support variables.

Asset indices' are commonly used tools for determining the relative wealth of individuals across a population (Sharker et al., 2014). This involves asking respondents about their possession of a list of specific durable assets (car, radio, etc.) and household characteristics (access to electricity, dwelling place materials, etc.). This list is then used to create an index, weighted by the relative 'importance' of each item, which can then be summed to get a single relative value of wealth (Filmer & Pritchett, 1999). Principal Component Analysis (PCA) can be used to reduce the dimensionality of the data and give an estimation of the 'importance' of each question, according

to the extent that underlying dimensions (unmeasured, but revealed in the data) influence the overall responses across the index. It is assumed that the underlying dimension, or factor, with the largest effect on the variation in the index is wealth. Therefore it is standard practice to extract the first component from the PCA, supposedly representing the effect of wealth on the variation in the responses (we ignore the other components since it is unclear how to interpret them). From this first component, the factor scores are extracted. These factors scores represent the weightings that are applied to each item, assuming each item is binary (e.g. the weight reflecting the importance of ownership of a radio). (Vyas & Kumaranayake, 2006; Filmer & Pritchett, 1999; Sahn & Stifel, 2000). An alternative approach to generating the weightings is to use factor analysis. However, the decision to use one over the other is mostly a matter of convenience in this case (Vyas & Kumaranayake, 2006). Equation 2 describes how an estimation of relative wealth (W) is the sum of each response to each question (X_1- X_n) multiplied by their weighting (a_n).

$$W = \sum a_1 X_1 + a_2 X_2 + \ldots + a_n X_n$$

Equation 2

Within this study a number of questions were used to develop the Asset Index, weighted according to the factor scores, extracted through PCA. The assets were selected based on observations, interviews, commonly used assets in the literature, and discussions with my research assistant and Ya'axché staff. The assets and household conditions were selected because they were anecdotally associated with a range wealth levels. When developing Asset Indexes in developing countries it is common to include types of lighting, toilet facilities, electronics, household electrification, and access to municipal drinking water. However, household electrification was highly dependent on if the community was connected to the municipal grid.

As a consequence, variables such as electrification, lighting, and ownership of electrical appliances were not accurate predictors of wealth (asides from 'radio', which were largely battery powered). Similarly, although a question relating to the source of drinking water was included in the survey, it was removed from the analysis for the same reason. Toilet facilities were not included because there was little variation between households.

These durable assets included in the study were ownership of a vehicle (including motorbikes, etc.), bicycle (1≥='yes'), radio, chainsaw and lawnmower. These responses were binary ('no'=0, 'yes'=1). Respondents were also asked about household conditions, including the type of floor (concrete / wood / bare / other), walls (concrete or block / wood / other') and roof (cement / zinc or tin / thatch / other) they had in their houses. They were also asked about their use of cooking methods (just gas / mostly gas but sometimes wood / mostly wood but sometimes gas / just wood / other), and their sourcing of water (although this was excluded in the analysis). They were asked about the number of rooms for sleeping they had in their house. However, it is more challenging to use numeric or ordinal as opposed to binary data within PCA. The common solution to this is to sub-divide the responses into separate items (Vyas & Kumaranayake, 2006). For example, within cooking, the response 'just wood' scores 0 and all other responses = 1. Additionally, in a second item the response 'just gas / mostly gas but sometimes' scores 1 and all others score 0. This separates between those people that use just wood (0) and those that use wood and butane gas (1), and those that use mostly or all gas (1) and those that use some wood and some gas (0). However, since the two new items become separate variables they are also incorporated within the PCA, and are given their own weightings within the index. As a consequence, although only 11 questions were asked, 13 variables were included in the Asset Index (excluding water sourcing).

However, despite the common application of PCA, it has been criticised for inaccuracy. Sharker et al. (2014) compared a simulation of socioeconomic status against the results obtained from performing PCA. They found that there was a c.50% probability that any simulated individual would be misclassified into the wrong quintile (five categories each representing 20% of the data). However, Sharker et al. (2014) only used a simulated sample size of 100 subjects, and only modelled five items within the Asset Index. Therefore, with a larger sample size and more items it is likely that the predictive power would be substantially greater. Similarly, even if 50% of the subjects fall into one higher or one lower quintile there is still significant variance between the top and bottom quintile. This means that PCA may give an accurate spectrum of wealth distributions across a population but is less suitable for predicting the wealth of an individual. However, its predictive power is also largely determined by how well the index is constructed, and how well each question reflects wealth status. Within this study, the Asset Index was constructed using 'R' version 3.1.2 (R Development Core Team, 2005). The PCA was conducted using the 'stats' package, version 2.15.3 (R Core Team, 2014) and 'plyr' package, version 1.8.1 (Wickham, 2015).

Religiosity, as we have seen in Section 2.2.5. has been clearly shown to have a positive relationship with life satisfaction, although the exact reasons for this are still debated (Lim & Putnam, 2010). Nevertheless, it appears that religion plays two key functions, first as a source of social support, and second as a source of emotional support from adherence to the religion itself (Krause & Bastida, 2012; Greeley and Hout, 2006). Within this study I make the assumption that frequency of church attendance has a positive relationship with both the emotional support derived from belief and the social support from others in the congregation. This assumption is supported by the interviews (and later in the surveys), where people saw their religion as a source of eudemonic guidance in living a good life, and a pool of individuals that would rally to support them. Similarly, it appeared that those who adhered most strongly to their religious faith would

attend on a more regular basis than those who did not. However, this effect did not necessarily hold into old age, with infirmed individuals attending church on a less regular basis despite strong avowed religiosity.

There is controversy over the effects of age and gender of life satisfaction, as described in 2.2.5. However, as well as the effects of age and gender themselves, there may be co-correlated effects that could be accounted for through the inclusion of these variables. Therefore, age (measured in years) and gender (binomial - there were no individuals that self-identified themselves as anything apart from male or female) was included. However, gender appears to be important for determining some aspects of how individuals interact with landscapes (for example, almost all farmers are men).

Both mental and physical health are important predictors of self-reported life satisfaction (Section 2.2.5). Single item scales of self reported general health, such as "In general, would you say your health today is: Excellent? Very good? Neither good nor poor? Poor? Very poor?" are commonly used when longer instruments cannot be used (McDowell, 2006). Generally these self-reported general health scales show high correlation with mortality and other objective measures of physical and mental health status (McDowell, 2006; DeSalvo et al., 2010). Although the majority of studies testing the validity of such measures have been conducted in the USA and Europe, it is generally considered to be a valid tool internationally (Bowling, 2005). Therefore, within this study I use the generic self-reported measure of general health, as quoted above. This measure does not distinguish between mental and physical health, and owing to its inherent subjectivity, respondents evaluate their health according to their own criteria. Subjective evaluations of health are generally positively correlated with life satisfaction (e.g. Siahpush, Spittal & Singh, 2008; Gwozdz & Sousa-Poza, 2009). However, as will be discussed in Section 5., care should be taken in attributing causation between subjective health and life satisfaction.

Additionally, it appears that the response scale is typically non-linear (Ware et al., 1993) - the difference between 'very good' and 'good' is unequal to the difference between 'good' and 'neither good nor poor', for example. This means that the response is ordinal, which has consequences for the analysis as described in Section 3.5.2.

The relationship between education and life satisfaction is contested (Section 2.2.5.). However, according to Ferrer-i-Carbonell (2005) education appears to be more important in poorer countries. However, this effect is generally lost when controlling for increased economic agency (Graham & Pettinato, 2001). Since educated is often co-correlated with economic capacity, and owing to the concerns about the validity of using the Asset Index as a measure of contemporary economic capacity, education will be included a) to account for the effect of education itself, and b) because it may also be a proxy for economic agency. However, because of this, care must be taken with attributing any relationship between life satisfaction and education. For the survey, education in years will be used as a measure of education level. This is an imperfect proxy, since many younger individuals have benefited from free access to education till secondary school levels, but have had to pay tuition fees for education thereafter. This means that access to education over a certain level is also related to families' economic status.

'Culture' and social norms has been shown to interact with many elements of SWB and life satisfaction, from the extent that people interpret life events (Tov & Diener, 2013) to the relationship between goal attainment and life satisfaction (Oishi et al., 1999). Yet, the portrayal of 'culture' in the SWB literature described above is relatively unsophisticated. Seeking to model cultural affects on life satisfaction within this study is problematic for a number of reasons. Firstly, it is theoretically questionable if culture, as something multifaceted and lived, not lived in, can be modelled. Secondly, to attempt to do so in the context of Toledo would be an extensive study in its own right. Lastly, I lack the skills and experience to make a legitimate attempt at it.

However, it appears from the interviews, observations and a discussion with the research assistant, that Q'eqchi' and Mopan Maya are distinct constructs that individuals self-identify with, as well as being distinct from other minorities (Creol, Garifuna and Mestizo). Although some people have Q'eqchi' Maya, Mopan Maya, or 'other' parents, they typically associate themselves with one ethnical background. Similarly, different cultural characteristics are attributed to Q'eqchi' and Mopan Maya communities (where ethnic minorities also resided). Some of the variation in life satisfaction may be accounted for by those characteristics that individuals consider as distinct between Q'eqchi' and Mopan Maya culture. Therefore, although the use of individuals' self-identified status as either Q'eqchi' Maya, Mopan Maya or other ethnic groups, does not capture the multidimensionality of culture and culturally embedded worldviews, it may capture some important differences. For this reason, individuals' self-identification as Q'eqchi' Maya, Mopan Maya or 'other' is used as a crude proxy for some of the presumed, but 'unmeasured' cultural differences found with the study sample.

Farming was a key feature in all of the interviews, and it was apparent how integral farming was in the lives of communities during informal observations. For both men and women, farming and the lifestyle of a farming household appeared to be important for self-identification. This is supported by Baines (2012a) study, which highlighted the deep cultural link between the practice of farming (often by men), or corn processes and related practices (often by women), and living well, in one Mopan Maya community. However, despite the perceived importance of the 'farming livelihood' for alignment with 'traditional' Maya culture, many individuals sought paid employment - to 'job-out'. It is less clear how non-farming livelihoods are experienced in Maya communities. However, as discussed in Section 2.2.4., those goals that are socially endorsed, self-determined and are directly associated with the satisfaction of 'basic needs' typically have a larger influence on life satisfaction than the converse. Therefore, the survey asked respondents if they,

or the head of the household, considers themselves primarily as a farmer - i.e. are they a farming household.

This does exclude households that also engage in other activities, since many farmers sought additional income from other activities. However, it does delineate between those households that consider themselves to be farming or non-farming households (often being employed in the public sector, construction, industrial agriculture and aquaculture, tourism, etc.). The binary response (farming=1, non-farming=0) is intended to capture not just the material effects of farming or non-farming, but also some of the ideological and symbolic values associated with it. However, the importance of landscape variables such as agricultural cover on life satisfaction is also potentially modified by individuals' engagement in farming. Within the interview, respondents were asked how many acres of land they were currently working. However, owing to differences in planting cycles, types of crops grown (such as the inclusion or exclusion of agroforestry plots) there appeared to be different ways that this question could be interpreted. For this reason, it was dropped from the analysis. Additionally factors such as soil quality, farming practices, etc. modify the relationship between agricultural land-use and its role in people's lives. Despite this, the vast majority of farmers practice traditional slash-and-burn 'milpa' farming (which was the focal type of farming in interviews).

The inclusion of some measure of forest use behaviour was decided upon *a priori*, since the extent that landscape variables influence life satisfaction may partly be a function of use. However, dependence is difficult to quantify, since it requires knowledge about hypothetical alternatives (the degree of dependence is partly determined by the ease of substitution. Pienkowski et al., 2015). However, the interviews, observations and discussions with the research assistant highlighted the importance of forest resources. The forest resources that were most commonly reported were 'firewood'; 'wild game'; 'bush medicine'; 'wild fruits' and 'other wild foods'; 'wood

for construction'; 'thatch' (the palm *Opuntia cochenillifera*); 'craft materials' and various forms of 'enjoyment'. This list of forest resources is subsequently used to create a Forest-use Index, similar to the Asset Index. Others 'forest products' also included the extraction of jade, archaeological artefacts and clay for pot building. However, these were not commonly mentioned and therefore excluded from the Forest-use Index.

The Forest use Index applies roughly the same logic as the Asset Index. One major difference is that the first principal component is assumed to be described by the extent of forest use (in the same way wealth is deemed the most important factor within the Asset Index). Subsequently, using the same approach as in the Asset Index, respondents were asked if they had used the listed forest products in the last month. The emphasis was placed on use, not extraction, since often one individual in the household would extract a product (such as men and hunting) that the whole household would benefit from. One shortcoming of this list is that it only included extractable forest products (apart form 'enjoyment'). This meant that the other vital biophysical *practices*, such as the use of river water for drinking, washing and bathing, local climate regulation, etc. were not represented. These were not included either because they were used so frequently (such as bathing in the river) that they would show no variation, or because they were challenging to identify and attribute (such as climate regulation). Two questions asked about game meat consumption. The first asked about the frequency of game and wild fish consumption in the last two weeks. The second asked if the respondent had consumed game in the last two weeks. These two questions were included to triangulate game meat consumption behaviour, since people were sometimes hesitant to talk about consumption activities. However, since both variables were highly correlated (unsurprisingly), the second question was removed from the index. According to the same processes described above, each question was given a weighting based on their factor scores extracted from the first principal component from PCA. For each respondent, his or her weighted scores were summed to give a single abstract measure of forest resource use. Again, the

Forest-use Index was constructed using 'R' version 3.1.2 (R Development Core Team, 2005). The PCA was conducted using the 'stats' package, version 2.15.3 (R Core Team, 2014) and 'plyr' package, version 1.8.1 (Wickham, 2015).

As mentioned above, the number of family 'dependents' was dropped from the analysis for two reasons. Firstly, because of varying interpretation of dependence across respondents. Secondly, the most senior members of the household (e.g. household head) were not always in attendance and were subsequently not always the participant. As a consequence, there was no consistent and clear theoretical link between the life satisfaction of some of the less senior members of the household surveyed, and the number of dependents. Similarly, the capacity for individuals to attend school was frequently mentioned as being important for a good life. This eudemonic aspiration appears to be based less on the perceived value of school for the respondent themselves, and more because it provides a means by which their children can engage in alternative livelihoods to theirs, often suggesting a move away from farming. The main barriers to being able to do this appeared to be cost. These costs included the cost of uniforms and school supplies up till the age of 12 years, and the additional substantial cost of high school and tertiary tuition after that. However, there appears to be substantial opportunity costs associated with forgone labour, especially during adolescence. This included teenage men not being able to work on farms, and teenage women not being able to assist with domestic activities. Therefore, the survey included a measure of the number of children of school age, and the number of children attending school. This allowed for the calculation of the proportion of children that were sent to school. However, this measure is a poor proxy for the eudaimonic effect of being able to send a child to school for a number of reasons. Firstly, the cost and opportunity cost significantly vary with age and therefore a parent of two young children face vary different choices in choosing to send their child to school or not. Secondly, many respondents did not have children of school age, which raised conceptual challenges within the model. For this reason, 'sending children to

school' was dropped from the analysis. Multiple land-use and tenure regimes operate across the communities. Therefore, the concept of access and ownership was not consistent across the communities. For this reason, the accessible acreage was removed from the analysis.

3.4.3.2. Measuring life satisfaction

Within this study I adopt Shin and Johnson's (1978) definition of life satisfaction: the "global assessment of a person's quality of life according to his chosen criteria". There are many instruments used for measuring life satisfaction (to the exclusion of positive and negative affect, or life satisfaction to specific domains). However, one of the most widely used is the Satisfaction With Life Scale (SWLS). Since its introduction by Diener et al. in 1985, the tool has been translated into at least 30 languages and cited in over 10,000 articles (Diener, 2015; Google, 2015). The scale consistent of five statements, all of which relate to a single underlying dimension. These statements are designed to stimulate individuals to consider how satisfied they are with their lives according to their own criteria of evaluation (Beuningen, 2012). Respondents then indicate their level of agreement or disagreement along a scale of one to seven.

The validity of the tool has been extensively tested. The instrument has generally been found to be strongly correlated with other measures of life satisfaction (Lucas, Diener, & Suh, 1996; Pavot, et al. 1991). The stability of SWLS responses has also been found to be stable in repeated measures over time (Pavot & Diener, 2009; Lucas, Diener, & Suh, 1996).

For example, Beuningen (2012) used Statistics Netherlands' 2010 Perceptions Survey to test various aspects of the SWLS's validity. Beuningen finds that the Cronbach's alpha is 0.85 (higher than the 0.70 threshold that is often considered when evaluating internal consistency across items). Beuningen also finds highly significant correlations with other measures of life satisfaction, although the strength of the correlation is moderate. However, the consistency of SWLS against other measures of life satisfaction is lower for two groups; those that have lower

levels of education and those from non-Dutch backgrounds (attributed to being non-native Dutch speakers). (Beuningen, 2012).

Oishi (2006) found a slight difference in the way that Chinese students, relative to American students, compared two of the five items with the SWLS, which indicated a potential bias in the instrument. Nevertheless, the SWLS has generally been found to be valid in a wide range of ethnic and cultural context (Pavot & Diener, 2009. e.g. Westaway, Maritz & Golele, 2003; Swami & Chamorro-Premuzic, 2008; Ponizovsky et al., 2013).

However, there were two modifications made to the scale. Firstly, respondents were asked to elicit their agreement according to a scale of one to five, instead of one to seven. A number of studies have concluded that higher item levels (between seven and eleven) are preferable to lower item levels (between three and five), since they can detect finer variation between respondents. However, the majority of these studies appear to have been conducted in countries with higher education levels (OECD, 2012). Depending on individuals 'information-processing capabilities', higher numbers of response levels escalate the burden on respondents, potentially leading to less motivation, higher likelihood of satisficing answers (using heuristics to estimate a satisfactory answer based on interview cues, etc.) and ultimately greater response bias and error (OECD, 2012). Therefore, owing to the limited formal education of many respondents (some have never attended school) it was deemed to be easier for individuals to respond according to five response levels. The reduced resolution of the scale was deemed an acceptable trade off compared to the increased ease of interpretation (and, assumedly reduced measurement error). The second change was the use of a visual aid - a ladder with rungs representing the five potential responses, from 'strongly disagree' on the lowest rung of the ladder, to 'strongly agree' on the highest (Appendix IV). The concept of using a ladder is adopted from the Cantril "Ladder of Life" scale (Bjørnskov, 2010). The use of a visual ladder was intended to aid comprehension, since the surveys were

conducted orally. Although we did not compare comprehension between the original and modified SWLS scale, it appeared like the use of the ladder did assist respondents in understanding and respond.

However, it is unclear how these changes influence the validity and internal consistency of the measure. Ideally, the modified SWLS scale would be tested for validity and reliability before hand. This would involve comparing the modified scale to the original, and alternative measures, within a dedicated study. However, due to various constraints this was not possible. However, as discussed in Section 3.5.2., the Cronbach's alpha was calculated to give an indicator of the internal consistency of the measure.

The normal procedure within the SWLS is to perform a linear summation of the five items to create a single measure of life satisfaction (Diener et al., 1985). However, because of the potentially culturally relative interpretation of some of the questions, the results of the SWLS were weighted according to their factor scores, extracted from PCA. This means that the effects of slight differences in interpretation of each of the items has a relatively smaller effect on the total score than if the scores were linearly summed. (However, it also means that scores cannot be directly compared to other studies.) Again, it is assumed that the first principal component from the PCA represents an underlying dimension of life satisfaction. Subsequently, each of the five items was weighted according to their factor scores, according to the same procedure described in the creation of the Asset Index (constructed using 'R' version 3.1.2 (R Development Core Team, 2005), the 'stats' package, version 2.15.3 (R Core Team, 2014) and the 'plyr' package, version 1.8.1 (Wickham, 2015)). Table 2 provides a description of the variables collected within the survey.

Table 2| Social, economic and demographic variables included within the surveys, identified through interviews, literature and observations.

Variable name	Description	Data type / unit of measurement

'Social support'	The amount of perceived social support available, measured using the OSS-3.	Numeric (3-14)
'Wealth'	The relative wealth of a household, according to the possession of durable assets and household conditions. The Asset Index is weighted according to factor scores extracted from the first component within PCA.	Numeric (1-n)
'Basic needs fulfillment'	A binary indicator of if the respondent sources enough food / income from their main occupation to meet basic nutritional needs, as defined by the individual.	Binary (0 / 1)
'Religiosity'	The number of times an individual attends church in a two weeks (standardized over 4 weeks to capture those that went once a month or less).	Numeric (0 - 20)
'Age'	The age of the individual.	Numeric (years)
'Gender'	Genetic gender.	Binary (0 / 1)
'Health'	Individuals' self-rated health, following a generic self-rated general health format.	Ordinal (1-5)
'Education'	Number of years of education.	Numeric
'Ethnic background'	Individual self-identification as Q'eqchi' (1), Mopan (2) or other (3).	Categorical
'Farming'	Individuals, or household heads, identification as being a farming or non-farming household.	Binary (0 / 1)
'Farm'	The extent of land currently being farmed, in acres.	Numeric
'Forest use'	The relative level of use of selected forest resources. The forest use index is weighted according to factor scores extracted from the first component within PCA.	Numeric (1-n)
Community	The community in which the respondent resides.	Categorical

3.4.3.3. Spatial variables

The Cultural Values Model recognises a wide range of *forms*, *practices*, and *relationships* that are identified in landscapes according to their cultural significance. Culture is 'used' in at least three ways: the life of a people, as a whole; a means of assigning group identity; and, in reference to a social process (Stephenson, 2008). Therefore, aspects of a landscape can be identified and interpreted according to any number of worldviews, including 'scientific' and 'indigenous' cultures (Rowntree, 1996). These *forms*, *practices*, and *relationships* arise out of complex hierarchical

interactions between biophysical and human systems, generating emergent phenomena that cannot be understood through the atomisation of components (Naveh, 2000).

However, measuring and interpreting these *forms*, *practices*, and *relationships* let alone understanding the complex systemic dynamic that give rise to them, would be a massive endeavour. Attempting to model this complexity, or gain a comprehensive assessment of all the *forms*, *practices*, and *relationships* within a landscape is probably impossible owing to the amorphous, multifaceted and constantly changing nature of cultures, as lived, not lived in (Ingold, 1994).

Nevertheless, integrated landscape management is prescriptive, and therefore requires some amount of generalisation. Starting from the proposition that prescriptive landscape management is a valid pursuit, and yet it can benefit from the Cultural Values Model approach, it follows that some degree of generalisation and reductionism is necessary. This reductionism somewhat contradicts what has been said about the importance of using holistic and multi-perspective approaches towards understanding cultural landscapes, as complex and dynamic spaces (Naveh, 2001). However, this study is largely exploratory and, as such, any conclusion drawn must be conscious of the limited aspects by which the cultural landscapes of Toledo have been measured and interpreted.

With this in mind, I highlight some of most salient landscape features identified in the interviews, through my own position as an 'expert' participant (my position is informed by academic literature and professional experience working in Belize), observations, and the views of Ya'axché staff. These landscape aspects, although identified as spatial *forms*, can also be considered as the manifestation of *practices* and embodied *relationships*. These *forms* are 'agriculture' and 'forest'. However, a number of *practices* have also been identified as important. These are 'the generation of forest resources', 'the supply of agricultural resources', 'changes in the flow of forest resources' and 'changes in soil fertility & agricultural productivity' (Table 3).

In the pursuit of being able to make prescriptive generalisations, attempting to map some aspects of these *forms*, *practices* and their embodied *relationships* inherently involves simplifying them, in this case, according to their spatial characteristics. Therefore, the landscape variables used within the analysis are extent of 'forest cover' and 'subsistence agricultural cover', 'percentage in forest cover change between 2012 and 2014', and 'intensity of agricultural use'. Although it would be preferable to measure individuals' landscape interactions, and the spatial location of behaviour, this was not possible. Therefore, to create some degree of consistency, a functional buffer region was designated around each community. This functional buffer region represents the typical distance that individuals travel into the forest to reach their farms; an estimated three kilometres. It is assumed that the majority of the 'relationship' that exist between landscapes and people are dependent on changes within this buffer region. This three kilometre buffer represents the furthest extent that people would typically travel to reach their farms, according to the interviews, observations, and discussions with the research assistant. Typically, the majority of interactions between landscapes and people occur on the way towards, on, and in the immediate proximity of farms. Although exceptions apply, such as when individuals go hunting, this buffer region still appears to be the most critical area determining people's interactions with landscapes. Not all of these interactions involve the material exchange of resources. Indeed, the importance of individuals' self-identification as farmers, or 'farmers' wives', are related to the symbolic value of agricultural landscapes, for example (Baines, 2012a). The exact mechanisms by which cultural landscape aspects may influence life satisfaction will not be explored here, and will remain a 'black-box' for further investigation.

A number of assumptions are made within this approach. Firstly, that there is a perceptible effect of differences in landscape variables on the relationship between landscapes and people (e.g. limited forest cover subsequently reduces the availability of forest resources, cultural values associated with forest, etc.). Secondly, that a sufficient (i.e. could generate a distinct statistical

effect) amount of variation in forest use behaviour can be accounted for by landscape factors within a standard functional buffer region around each of the communities. Although many social, economic, technological and cultural factors are likely to influence forest use behaviour, it is assumed that these factors are not strongly co-correlated across landscape gradients (however, the validity of this assumption challenged within Section 5.4).

Table 3 introduces and describes each of the four spatial variables included within the analysis: 'Forest cover'; 'Agricultural cover'; 'Forest loss' and 'Agricultural intensity'. A further description and justification of each of these variables is presented in the remainder of this section, followed by a short description of the methods used for extracting and processing the spatial data.

Table 3 | Spatial variables included within the linear mixed effects mode, identified in interviews, observations and literature.[2]

Variable name	**Description**	**Justification**	**Unit of measurement**
'Forest cover'	The extent of forest cover within the 3km buffer. Results are scaled from 0-1 to allow for easier interpretation.	There are many important *processes* (such as 'ecosystem service' provisioning) and *relationships* that occur within forest *forms*. Therefore, it is assumed that there is a relationship between the extent of forest cover and the degree that these *processes* and *relationships* are supported.	0-1 (lowest to highest level of observed forest cover)
'Agricultural cover'	The extent of subsistence agricultural cover within the 3km buffer. Results are scaled from 0-1 to allow for easier interpretation.	There are also many important *processes* (such as food production) and *relationships* that occur within agricultural *forms*. Therefore, it is assumed that there is a relationship between the extent of agricultural cover and the degree that these *processes* and *relationships* are supported.	0-1 (lowest to highest level of observed agricultural cover)
'Forest loss'	Forest loss between 2012 - 14 as a % of forest cover within the 3km buffer. Results are scaled from 0-1 to allow for easier interpretation.	Changes the extent of forest *forms* may also have an effect on the *relationships* that are derived from forest *processes*. In other words, the loss of good and services, for example, may have cultural significance.	0-1 (lowest to highest level observed of forest change)

[2]As described within Section 4.2.1., although there is a relationship between the extent of types of land-cover, especially forest and agricultural land-cover, none of these are statistically significantly (p>0.1). Therefore, although there is a negative correlation between, for example, forest and agricultural cover, this is not strong enough to warrant the exclusions of any of the spatial variables.

'Agricultural intensity'	The frequency of use of 30m x 30m cells across the years of 2000, 2004, 2007, 2011 and 2014, summed across all the agricultural cells in the 3km buffer region, divided by the total buffer region. Results are scaled from 0-1 to allow for easier interpretation.	The historic impacts of agricultural *processes* can have multiple effects on contemporary agricultural *processes*. For each of the years (out of 2000, 2004, 2007, 2011 and 2014) that a cell is used, it is given a value of one. The mean intensity of use within the buffer region is a sum of the number of instances of use per cell (over the five sampling years), summed across all the agricultural cells, then divided by the total number of cells in the 3km buffer.	0-1 (lowest to highest level of observed agricultural intensity)

Forest cover is one of the seven spatial variables included in the study. The interviews, observations, and surveys highlight many important *practices* (such as 'ecosystem service' provisioning and agriculture) and *relationships* that occur with and within forest *forms*. Both the 'quality' and 'quantity' of these ecological *practices* is dependent on a wide range of ecological factors (Benayas et al., 2009; Hooper et al, 2005). One of these factors is spatial extent - it is assumed that there is an at least linear relationship between forest extent and ecosystem functioning (Kremen, 2005). Within the Cultural Values Model, those *practices* that involve the combination of human and natural capital (flows of resources from ecosystem functioning) are also expected to vary in response to forest extent (although the value is not a linear function of area. Mullan, 2014). The assumption that increasing forest extent (*form*) would be associated with increased associated *relationships* is more tenuous. Yet, it is reasonable to suggest that certain *relationships* associated with (historic) forest *forms* might also be lost with the loss of the forest itself. Therefore, it is assumed that there is a relationship between the extent of forest *form* and the degree that forest *practices* and *relationships* are supported. However, the exact mechanisms and structure of this relationship will not be explored. The extent of forest cover as a percentage of the total area of the three-kilometre buffer will be used as a proxy for these *relationships* and *practices*, as well as the cultural value associated with the forest *form*. This will be the first spatial variable within the model.

Changes in forest cover are also expected to exert an effect on *practices* and *relationships*. Indeed, it may only be those recent changes that have a impact on peoples life satisfaction, as a consequence of individuals adaptation toward life circumstances, as would be anticipated by subjective wellbeing homeostasis theory and shifting baseline syndrome (Cummins, Lau & Davern, 2012; Papworth et al., 2009). For this reason, an extension of the absolute forest cover variable is to look at recent changes in forest cover. Hence, net forest loss between 2012 and 2014 as a percentage of the total areas of the three-kilometre buffer will be the second spatial variable in the model. However, since forest is almost exclusively cleared for agriculture, this variable is likely to be closely correlated with increases in agricultural extent. Therefore, the recent forest cover loss variable is also a proxy for recent agricultural expansion. As a result, there might be antagonistic effects between, on one hand, the loss of *practices* and *relationships* associated with declining forest *forms* and a subsequent gain in *practices* and *relationships* associated with increased agricultural *forms*. This would suggest that there would be a net increase in life satisfaction associated with changing agricultural land-uses, since individuals choose to convert land in order to achieve certain goals and aspirations. However, since this study is looking at the net effect on individuals' life satisfaction within the community, and not the individual that chooses to convert the land, this is not a foregone conclusion. In this case, forest resources are often common-pool resources (Wiersum, 1997). Yet, when the land is converted to agriculture, many of the benefits of land-use accrue to the individual (Balmford et al., 2002). The public cost of loss of forested land may outweigh the private benefits of agricultural land, and therefore it is possible to see a decline in mean life satisfaction as the result of land-use change (Balmford et al., 2002). Additionally, assuming that forest and agricultural 'services' are not directly substitutable, the absolute change in forests and agriculture *practices* and *relationships* may be less important than the relative composition of different *forms* within the landscape matrix. In this respect, it is likely that the effect of forest conversion to agriculture on life satisfaction is non-linear. For example,

certain game species cannot be easily domesticated. The purely nutritional function of these species may be substituted by domestic species. Yet, in many parts of the world there is a preference for game species (e.g. Fa et al., 2002; Ndibalema & Songorwa, 2008), whose cultural function cannot be directly substituted by domestic species. Additionally, changes in forest quality, as well as forest cover, are likely to have an important effect on the benefits derived from forest cover. However, forest quality is not measured within the study. This is ultimately a limitation in the study (Section 5.1.).

The relationships between agriculture extent and subsistence *practices* are evidently easier to argue for. Agriculture is an intentionally initiative *practice* for generating food, etc. We can expect a roughly linear relationship between the extent of agricultural cover and intended food production. In the words of one interviewee - "if you plant more you reap more, but if you plant less you reap less." Much of the multifunctional landscape literature highlights the important cultural and symbolic values associated with agricultural practices, and therefore it is reasonable to suggest that there is also a relationship between agricultural *practices* and *relationships* (Kizos & Koulouri, 2006). Consequently, it is assumed that there is a relationship between the extent of agricultural cover (*form*) and the degree that these *practices* and *relationships* are supported. However, within this study I am only considering subsistence agriculture, which plays a very different function to commercial plantations (the dominant alternative agricultural land-use). The extent of subsistence agricultural cover as a percentage of the total area of the three-kilometre buffer will be the third variable within the model.

The historic impacts of agricultural can have multiple effects on contemporary agricultural *practices* (Filho, Adams & Murrieta, 2013). A general rule of thumb, applied Ya'axché staff, is that the use of agricultural land more than once in a fifteen-year cycle degrades soil quality, and leads to declines in productivity (Ruscalleda, pers. comm., 2015). Levasseur & Olivier (2004) claim that

the majority (c.75%) of the 20 participants in a study conducted in San Jose, Toledo, reported fallow periods of between five and seven years. However, they also report declines in soil quality within the surrounding area, attributed in part to agricultural pressure. Similarly Baines (2012a) reports that within Santa Cruze, Toledo, best farming practice (which is not always adhered to) requires fallow periods of at least seven years between cropping cycles. However, neither Levasseur & Olivier (2004) nor Baines (2012a) conducted dedicated research on this topic (and indeed, Baines (2012a) may be drawing on Levasseur & Olivier (2004)). However, Ya'axché's agricultural extension staff have experience working with many farmers across Toledo, and are all from farming backgrounds. Therefore, I consider their estimate that fallow periods need to be at least 15 years to be considered sustainable to be the most reliable approximation. Yet, to model the impact of historical agriculture on contemporary soil quality and productivity is highly complicated. It requires information about agricultural practices, the intensity of use, the management of soil quality, the initial soil conditions, topography, etc. (Rosa & Sobral, 2008). Although measuring the frequency of agricultural activity within a specific area does not give an accurate representation of agricultural impact, it may provide a rough approximation of potential agricultural pressure. Within the study, for each of the years (out of 2000, 2004, 2007, 2011 and 2014) that a 30m x 30m cell is used for agriculture, it is given a value of one. The mean intensity of use within the buffer region is a sum of the number of instances of use per cell (over the five sampling years), summed across all the agricultural cells, then divided by the total number of cells in the three kilometre buffer. Again, this is a measure of relative frequency of use, and not actual impact on the landscape (which is vastly more complex). However, assuming that frequency of land-use is an acceptable proxy for impact (assuming that soil conditions, agricultural practices, etc., are not radically different) then a frequency of land-use greater than once every 15 years is anticipated to reduce soil quality. This is expected to negatively impact the functional value of

practices (such as food production) that are generated by agriculture. This is partially supported by the interviews, where people report declining soil quality as fallow periods decline.

Clearly in reality factors such as access, land tenure, socially defined roles, etc. are likely to significantly influence the relationship between these landscape *forms* and how they interact with *relationships* and *processes*. For example, a community might be right next to extensive forest, yet cannot access this forest because it is within a protected area.

Mr. Ruscalleda, the Sustainable Land-use Officer and GIS technician at Ya'axché Conservation Trust, performed the extraction and processing of the spatial information from remote sensing data. Although it was arranged that a detailed description of the methods would be supplied, this was not received in time for submission of the document. However, I provide a brief summary of the processing that I understand was performed by Mr. Ruscalleda.[3] Landsat images, purchased by Ya'axché, with a spectral resolution of 0.45-52.35μm and a spatial resolution of 30m were used. Processing was conducted using the ENVI 4.7. spectral image processing software (2009). For each year (2000, 2004, 2007, 2011, 2012 and 2014), the spatial layers were sub-set into image bands, according to infrared visualisation following Ruscalleda (2012), Cherrington (2010) and Meerman (2010). Where required, changes in infrared band were classified as the appropriate change in land-use following Ruscalleda (2012). The validity of the classifications was tested following Ruscalleda (2012), although they were not ground-truthed. Following further processing, thematic rasters were vectorised and layer stacked to extract data on the spatial extent of each land use. These data were extracted according to their attributes, and provided to me in an Excel database.

[3] I am unfamiliar with the method Mr. Ruscalleda employed. This description is based on what I believe the process involved, based on discussion notes, emails and methods employed in Ruscalleda (2012).

3.5. Data Analysis

The following section will provide an overview and justification of the qualitative and quantitative data analysis methods employed. The following Section (3.5.1.) will describe that qualitative analysis, using the Problem Centred Interview approach (Witzel, 2000). The subsequent section will describe the quantitative analysis, including the use of descriptive statistics and a linear mixed effects model.

3.5.1. Qualitative data analysis

Although field observations, and discussions with the research assistant and Ya'axché staff were important sources of knowledge, they were not systematically conducted nor will they be methodically analysed. The interviews were analysed using an abbreviated form of the PCI approach. This was for three reasons. Firstly, as the result of the moderate quality of the data and small sample size, seeking to draw conclusions about all but the most salient aspects of the interviews may be misleading. Secondly, I did not have the experience to be able to interpret deeper levels of meaning within the data. Finally, time constraints prevented these issues from being addressed.

Consequently, below I describe an abridged interpretation of the PCI analysis, following Witzel (2000). This analysis occurred in two phases. First, a rapid review of all the interviews, extracting the most salient themes for consideration within the development of the survey. Secondly, a more systematic and deeper analysis of the interviews, which constitutes the bulk of the qualitative results.

The first review involved a rapid sentence-by-sentence analysis of each transcript, identifying key themes. These key themes developed into the coding matrix. This coding matrix was then reviewed to identify the most common and salient themes that occurred within each of the

interviews, and across the interviews. These key themes were then used to stimulate consideration of potentially important aspects for inclusion within the survey.

The second, more focused review, continued from this initial sentence-by-sentence identification of themes. The transcripts were re-reviewed, with the coding matrix in mind. As well as highlighting themes using the coding matrix, useful quotes were extracted, as well as writing notes and memos. The next stage is the development of *case descriptions*. This should involve brining statements and themes together to develop a general description of the interview. This case description includes comments regarding the general themes, specific features, uncertainties and methodological errors within each of the interviews (Witzel, 2000). However, this stage was relatively superficial within my analysis, only containing a short case description of each of the interviews, highlighting general themes, uncertainties, important quotes, and other comments.

The third stage involved the development of *case-specific main topics* - these were anchored to places within the text, and were the first stage of theory development, accompanied by analytical statements. These main topics should be interpreted in relation to actual behaviours, and the perceived motivation for those behaviours, that the respondent describes within the interview. Again, my analysis course scale, only generating very broad theories of individuals' behaviour and motivation.

The final stage involves systematic contrasting of themes and topics, identifying the main themes, but also relating these commonalties and differences to characteristics of the respondent. Key commonalities, contrasts, etc. were then extracted (Witzel, 2000). Again, with this study, this case comparison focused on the most salient aspects.

This process, combined with field observations, discussions and literature, was critical in the development of the candidate models within the linear mixed effects model. It also helped interpret the results of the quantitative output, adding depth to some of the conclusions.

3.5.2. Quantitative data analysis

All data analyses were conducted using the statistics programme 'R' version 3.1.2 (R Development Core Team, 2005). First, descriptive statistics were used to explore the structure and distribution of the data. These included studying the variance, standard deviation, means etc. of each of the variables. The data was visually explored using box-and-whisker plots, to see the spread of data across communities, data distributions using histograms, and the rough relationship between variables using scatter plots, box-and-whisker plots, etc.

Next, the validity of the modified SWLS was tested according to its Cronbach's coefficient alpha. The Cronbach's alpha is a test of the internal consistency of a specific tool (Cronbach, 1951). Within this application, it tests the extent to which the modified SWLS is answered consistently across all the items (since they are measuring a single underlying dimension - life satisfaction). Although the Cronbach's alpha test has been criticised, for among other things, underestimating the reliability of a test or instrument, it remains the most commonly used measure of internal reliability (Sijtsma, 2009). Consequently, the Cronbach's alpha was used to allow for easy comparison against its commonly reported validity. The Cronbach's coefficient alpha was tested using the 'psych' package version 1.4.5 (Revelle, 2014). The internal consistency of the OSS-3 was also explored according to its Cronbach's alpha. However, this was less critical since the OSS-3 is often found to have a low score, which is attributed to the multiple underlying dimensions of social support that are measured in the instrument (EUPHIX, 2010).

Once the Asset and Forest-use Indexes were constructed, and the SWLS scores were weighted according to the factor scores (as described in Sections 3.4.3.1 & 3.4.3.2.) a linear mixed effects model was created. There are many approaches to model generation. A linear mixed effects model was chosen because; a) it is a multivariate regression, b) it allows one to model fixed and

random effects within a nested design, and c) since the assumptions of the model were upheld, there was no need for more complex models such as generalised linear mixed effects models.

Null-hypostasis testing has been a central component of scientific analysis for much of the last century. Yet, although the "Fisherian or 'frequentist'" paradigm has been long recognised as problematic, it is only until recently that these criticisms have gathered widespread recognition (Stephens et al, 2005). Some common criticisms of null-hypotheses approaches are the arbitrary nature of *p*-values and the pervasive focus on statistical significance to the omission of subject matter significance (Johnson, 1999). (For example, a biological relationship may be statistically significant, and form the focus of results, but be ecologically inconsequential). Null-hypothesis testing is particularly problematic for model selection (as will be described and performed within this study). Model selection involves generation a model that 'best' describes a subject of interest. Often the variables that contribute to this model are not known in advance. Yet, selecting a combination of variables that best describes the data can lead to woefully misleading conclusions (hence the problems with data mining / dredging). Yet, within commonly used step-wise methods, this is essentially what is done. Variables are either added or removed from the model until the model best fits the data. This can lead to models that fit the data very well (i.e. the most variation in the dependent variable is accounted for by the independent variables), yet offer completely spurious conclusions (Anderson et al., 2001).

One alternative is the information-theoretic approach, which offers many advantages over traditional null-hypothesis testing (Stephens et al., 2005). The information theoretic approach argues that the configuration of variables within a candidate set of models (alongside the 'global model') should be selected *a priori*. In other words, a range of alternative models should be developed, in advance of fitting the models, each of which is justified by a strong a theoretical grounding (Burnham & Anderson, 2002). It is these candidate models, all of which offer

plausible explanations grounded in literature, past experience and extensive exploratory analysis, which are then compared according to how well they fit the data. None of these candidate models claim to represent the 'truth', but can provide useful approximations - this usefulness is core to the pragmatic paradigm adopted in the study. Candidate model creation is "partially a subjective art" (Burnham & Anderson, 2002). The number of candidate models is a balance between underfitting (omitting variables that have important effects) and overfitting (including to many variables, relative to the sample size, reducing the models predictive power). (Additionally, for this reason, interaction effects were not modelled). Burnham & Anderson (2002) encourage "investigators to give very serious consideration to a well-founded set of candidate models and predictor variables (as a reduced set of possible prediction) as a means of minimizing the inclusion of spurious variables and relationships". Out of these carefully considered candidate models, the 'optimal' model that best describes the data can be selected.

Akaike Information Criterion (AIC) is a commonly used means by which to rank candidate models, with goodness of fit determined by maximum likelihood (ML). Simplistically, it selects models that have a optimal balance between fit and parameter parsimony (the most variation accounted for with the fewest parameters. Bozdogan, 1987). Corrected Akaike Information Criterion (AICc) is often used for smaller sample sizes since it increases the penalization given to parameters, thereby giving preference to models with fewer parameters (Burnham & Anderson, 2002).

Because of the advantages it can convey, I employed information theoretic approaches in constructing the linear mixed effects model. First, a global model was constructed including all the variables described above. The dependent variable was life satisfaction. The independent fixed-effects variables are listed in Table 2 and 3. The model was nested by community - the random effect - to minimise pseudoreplication (i.e. the samples in each community were not

treated as independent replicates of each other, since share landscape, and probably other, characteristics). The linear mixed effects model was constructed with a Gaussian distribution and identity link function. Although the life satisfaction data showed a moderate negative skew (common in life satisfaction data), a visual inspection of the residuals showed that the assumptions of the model were upheld (although there was a slight, but acceptable, fat positive tail and thin negative tail within the quantile-quantile plot). If the residuals were not normally distributed then I would have either used a generalised linear mixed effects model (GLMM) with an alternative data family and link function, or reflected and transformed the data to normalise it (the forming being the preferred, since it means that the results do not have to be back-transformed, among other reasons).

Then, a series of 10 candidate models were developed through careful consideration of a range of plausible scenarios (*a priori*). Examples of these scenarios include where landscapes have no effect on life satisfaction or where only economic factors influenced quality of life. These candidate models are presented in Table 5. These candidate models were then ranked according to their AIC. The model with the lowest AIC was considered 'optimal' since it had delta (Δ) AIC > 2 from the nearest model. The absolute number of AIC is irrelevant. The model with the lowest AIC fits the data, with the fewest parameters, most optimally. However, for it to be considered the 'best' then it must be sufficiently different to other models, hence why it must be ΔAIC > 2 from the model with the next lowest AIC. If there were no model with ΔAIC > 2, I would have averaged across the candidate set of models, following Burnham & Anderson (2002). Model averaging entails integrating the output of all the candidate models weighted according their relative AIC (the model with the lowest AIC generates the largest contribution to the integrated model).

4. Results

4.1. Qualitative results: interviews, field observations and informal discussions

The ten interviews, combined with field observations and informal discussions, were intended to explore Research Question 1., and its sub-questions:

1. What are the primary themes that individuals in Maya communities associate with a good life?
    a. What does a good life mean?
    b. What are the things that are perceived to influence quality of life?

This Research Question served four purposes. Firstly, to explore if the perception of a good life is consistent with the understanding of SWB used here and as understood in the hedonic tradition of wellbeing psychology. Secondly, to shed light on themes that might be important to explore within the quantitative component of the study, thus informing the content of the survey. Thirdly, to inform the construction of 10 candidate models within the statistical analysis. Finally, to provide depth and context in which to situate some of the quantitative results as well as highlight areas of contrast.

Alone, the qualitative results might be considered trivial. However, this information is valuable for building a rounded interpretation of landscape *forms*, *relationships* and *processes*, including the many ways that peoples social, economic and natural environment relate to their wellbeing.

The qualitative results primarily focus on the content of the interviews. However, some basic heuristic models were generated linking key themes and individuals' descriptions of their own quality of life. These basic mental models were triangulated and substantiated across and within the interviews. The following two sections explore the two sub-questions of Research Question

1; what does a good life mean (4.1.1.1), and what are the things that are perceived to influence quality of life (4.1.1.2.).

4.1.1. What does a good life mean?

This question sought to gain an impression of how individuals constructed the concept of wellbeing - or a good life. Almost all respondents answered the question with a description of desirable life conditions or engagement in practices, as opposed to a description of emotional states, feelings of fulfilment, etc. However, one respondent cited happiness as a description of a good life. The focus on engagement in practices and upholding certain beliefs, especially religious, suggests that conceptualisations of a good life tend to focus on the fulfilment of aspirations, maintaining life conditions, and upholding eudaimonic values. These life conditions principally focused on needs fulfilment and the engagement in agricultural practices.

"the rules and principles, and being happy - that's all about it - and if not there would be nothing good."

Respondent 8 (farming 'housewife')

4.1.2. What are the things that are perceived to influence quality of life?

The themes described below include information that was voluntarily elicited during the initial open phase of the interviews, as well as research themes introduced if they had not been covered. These themes were co-generated during the interviews, informed principally by what respondents considered important, but also by prompting questions I asked, and the topics that I later introduced. In this respect, these themes relate to *practices*, *forms* and *relationships* that hold cultural value not only to respondents, but also myself (as a result of my own interpretations during and after the interviews, and the topics I presented).

The key themes that were discussed during the interviews were farming, nature, gender, health and mortality, culture, religion, social-support, income, non-farm income and employment, as well as other less frequently mentioned themes. These themes will be discussed in turn, and in

relation to each other, to give an impression of the things considered important in influencing quality of life.

4.1.2.1. Farming

In response to the question 'what does a good life mean?', seven respondents (all the male and two of the female) described the importance of subsistence farming. Farming was valued for a number of reasons. Firstly, as a primary source of nutrition to meet basic needs, especially corn and beans.

"when we don't have money it doesn't bother us and when we say that we are poor, we are not poor ... Only if I am a lazy person and don't want to work [on the farm] *then we don't have food, that's what we suggesting, as long as we have food that makes us happy."*

Respondent 2 (farmer)

"Well that is where I am, working in the farm, everything that I have I get it from the farm."

Respondent 6 (farmer)

"I don't have much to say about having a good life; it is only by how we get our food. We need to have somebody to bring our food home to maintain our lives, as food is the only source of life. They need to work to clear the land and from that we get our food. There is nothing else but only food."

Respondent 9 (farming 'housewife')

Farming was equally often mentioned as a source of income generation. Crops that exceeded the volumes required for subsistence were sold either within the community, to local corn mills, or outside of the communities. This income also plays a vital function in relation to other aspects including health, education, farm investment and insurance, as will be discussed more below. One respondent discussed the importance of selling crops to generate income that would then be used to buy food during non-harvesting seasons, as a means of smoothing consumption between seasons. This sale of crops would also be used as insurance against future crop failure.

"I just only got mind to farm. From before we used to plant rice - rice, corn and beans. Those are the money we tried to find with those crops."

Respondent 4 (farmer)

As might be anticipated in light of the primacy of farming, crop failure was also a prominent feature of the interviews (mentioned by four of the respondents). Crop failure appeared to rarely affect a farmer's whole crop, since farmers diversified across a range of crops. Suggested reasons for this crop failure are discussed in the context of the nature theme, below. As well as outright crop failure, two respondents also mentioned declines in soil quality associated with increased agricultural pressure. Declines in productivity were attributed to declines in soil quality, as well as other factors discussed below.

"It affected us with the corn, that time we had un-harvested corn, it was hit by a hurricane and it rotted by the rain, and that is where we lost a lot."

Respondent 8 (farming 'housewife')

"it is sometimes difficult like I said when you don't reap a good crop it brings you down from that time."

Respondent 2 (farmer)

"Well they say like near here the crops are not as good as before but I don't know ... I am hearing that here the land is not good anymore."

Respondent 10 (female shop keeper)

Another common feature, alluded to by at least four respondents, was the importance of farming for individuals' identity. Informal observations and discussions with my research assistant also strengthen the assertion that people socially situate themselves, and construct their identity, depending on their engagement or non-engagement in farming practices (including those often performed by women). Farming appears to be seen as the norm within communities, with non-farming being seen as the exception. Farming livelihoods were often juxtaposed against non-farming livelihoods. It appears that the former is more normatively endorsed, and more related to 'traditional Maya culture', than the latter, which was linked with change. (It is interesting that there appears to be a perceived dichotomy between 'modernity' and 'tradition' - potentially linked to the political expediency associated with cultural heritage narratives used by some Maya leaders.) Some respondents discussed young peoples' exit from farming and the resultant loss of

community cohesion and decline of practices such as reciprocity, which were associated with 'Maya culture'.

Differences between male and female respondents will be discussed below. However, although women rarely engaged in farming (according to the surveys), females would still identify themselves in relation to associated farming activities' within the household. For example, women in farming households would often elicit information about farming when asked about their lives, as well as discussing produce-processing activities.

"I never change, I cannot not be a farmer, I have to continue. That's where we make our livelihoods."

Respondent 2 (farmer)

"in a fu we culture, in a fu we life, we all do farming."

Respondent 4 (farmer)

"You see we have farms and we find our foods there, that's the only way we live you see."

Respondent 10 (female shop keeper)

Some men mentioned their experiences of going to 'job-out', where individuals leave farming to seek paid employment. This will be discussed more below, however, one of the reasons why individuals returned to farming was because of the independence that farming offered - one could "*work when you want to*" (Respondent 3 (farmer)).

Three respondents mentioned diversification of farming activities and entrepreneurialism as being important for a good life. Diversification was often discussed in the context of generating insurance against crop failure, and entrepreneurial activities (such as using novel farming practices or cash crops) were discussed in terms of generating additional farm income.

One respondent also linked farming practices to health in at least two ways. Firstly, the practice of farming itself was linked to good health. Secondly, there was a common belief that eating "*can*[ed] *food*" was associated with illness, especially diabetes (anecdotal evidence indicates the

high prevalent of diabetes in the study area). Two respondents reported that eating fresh farm produce was important for good health.

Farming was also discussed in association with sharing within the community. Corn, in particular, was the most commonly discussed means of providing material support for those that were unable to meet their nutritional needs. This support will be discussed more extensively below, but it was either in the form of gifts or selling excess corn at a lower than market price.

4.1.2.2. Nature

When exploring the role of 'nature' (intentionally unspecific) in people's lives, the distinction between forests and farms was not always clear. Owing to the rotational nature of farming practices, active farmland was often surrounded by secondary regrowth from historical farming activity, which in turn may also be proximate to primary forest. Individuals would often collect forest resources from afforested portions of their farms, as well as forested areas on the way, and in proximity, to their farms, which are not physically demarcated. Four individuals discussed farming in the context of the 'surrounding nature', with one specifically identify the forest as a resource to be converted to farming, when needed.

"[the forest] *helps us. Like sometimes my husband go hunting, going to get the firewood, you know making farms - planting, that's where we do our crops."*

Respondent 8 (farming 'housewife')

Additionally, when discussing 'nature', three individuals mentioned changes in weather being associated with increased crop failure. Although no one mentioned the term 'climate change' I am aware that a number NGO's have implemented climate change awareness campaigns in the area. Therefore these observed agricultural changes may be attributed to changing weather patterns as a consequence of the awareness raising campaigns.

"Well, today I am seeing that the crops are not the way they used to be, I'm not sure if it is the sun that is causing this. Before it wasn't like this, and there is another problem with the soil too where it is infertile - the crops are not

good, but in fertile lands we get good crops. We used to get some but now the sun is the problem. The rain comes and the sun comes and it is burning down the plants."

Respondent 9 (farming 'housewife'):

Changes in weather conditions were also associated with increased incidence of illness. It is not clear if this is because of the direct effects of weather on people's health, or as a consequence of increased crop failure, and subsequently not meeting nutritional needs.

"Sickness is common now, and we are blaming the rain. It's the day that is changing now; there are more sickness today."

Respondent 9 (farming 'housewife')

However, there were multiple other explanations for perceived declines in productivity. These included birds eating the seedlings (later discussions with the research assistant indicated that protected areas were perceived to increases the number of bird), a plague brought about by God, pests and increased agricultural pressure.

"I don't know what is causing it because when you plant rice now the little birds root them out. But I don't know how true, I think maybe the end has come [implying 'Judgement Day']. ... *Because now farmers are saying they are planting two times then I think about it, why are they doing that, because when my dad plants his crop are always good by truck-full."*

Respondent 10 (farming 'housewife' & shopkeeper)

However, asides from the connection between 'nature' and farming, six of the respondents associated the surrounding environment with forest resources. These forest resources included bushmeat and wild fish, wild fruit and other foods, 'thatch' (the palm *Opuntia cochenillifera*), bush medicine, wood for building, and firewood.

"All of these things that are for we culture, if we need like game meat we go hunt and get it, yeah"

Respondent 4 (male farmer)

This importance was highlighted by two respondents, who associated Hurricane Iris, 2001, with damages to both farms and forest, and the resultant impact on peoples lives. Hurricane Iris was

often mentioned during the surveys as a distinct historical event that caused a period of hardship in people's lives.

"Nine years now, it was difficult because Hurricane [Iris] *hit it* [the forest] *to the ground, no more animals, we suffered a little."*

Respondent 6 (farmer)

During the interviews, and supported by observations, two respondents attributed declines in game meat availability to increased agricultural activity. However, respondents did not indicate a decline in other forest products in the interviews. Informal discussions with survey participants did indicate that people had to travel further to find larger trees for firewood. Additionally, some individuals also suggested that the availability 'thatch' was also declining around the communities for two reasons. Firstly, because of increased house construction, requiring the use of palm fronds. Secondly, because of less controlled harvesting of 'cahoon cabbage', an edible portion of the palm that could only be harvested through the destruction of the palm.

"because of the farming. We lose a lot of the jungle, many farmers, and by cutting down all these jungle there are many animals that goes far away from us now."

Respondent 8 (farming 'housewife')

4.1.2.3. Gender

Although the sentiment was never expressed, one critical mental model that emerged when discussing male and female roles and relationships was the asymmetrical dependency between men and women. This asymmetry appeared to curtail women's agency in a range of ways; the things they had access to, their involvement in decision-making and their interaction with others (including the research team). This asymmetry extended to marriage, parent-child relationships, families, and social networks more broadly. All of the women interviewed elicited information about their husbands' activities and behaviour when discussing the things that influenced their life. Often their own activities' would be discussed as secondary to their husbands.

"Well yes, he has to be the one to go get what we need, or what we eat"

Respondent 9 (farming 'housewife')

"Like for me I raise my children after their father died. It was hard, we didn't have money, they need money to go to school and for food; it was hard for me up to now."

Respondent 7 (unemployed widow):

Two men indicated that decision-making also included discussions with their partner. However, the fact that this was not considered the norm highlights that women appear to be marginalised in household decision-making.

"I married my wife, so we come together after our marriage, so we sit down together, we collaborate we ask each other 'what can we do together?'"

Respondent 2 (farmer)

This limited agency also manifests itself in sentiments regarding alcoholism and domestic abuse. For example, one respondent indicated that she considers her life to be good because her husband is *only* an alcoholic but does not physically assault her.

"He's a drunkard but he doesn't beat me - he just come home, freshen up, and go sleep."

Respondent 5 (female 'housewife')

Another respondent told us about how her husband used to be an alcoholic and physically assaulted her. The prevalence of domestic abuse was also highlighted during informal discussion and observations, whose sensitivity means that they cannot be treated as data here. Nevertheless, it appears that domestic abuse is tolerated and even considered as normal within some of the communities visited.

"he is not drinking nowadays because before it was only problems, there was nothing good even eating and drinking, just [physical] *fighting. But now ever since he began going to church he helped in leading the service so that is where I am, seeing that everything is good"*

Respondent 10 (female shop keeper)

Both of these respondents, as well as Respondent 8 (farming 'housewife'), had independent sources of income. Respondent 8 particularly highlighted the importance of this source of income for her children's education.

A good life means for me, just doing a little business as a mother of six children. Getting into a business like that so we can make a little income, so we can help the children ... I just need them to do better and encourage them [at school] *more so that they can be better for the future and change the way the life that they are living."*

Respondent 8 (farming 'housewife')

Although it appeared the female and male participants were relatively open to talking about their lives in general the topic of domestic abuse was less openly discussed (apart from the two respondents). Similarly, from informal conversations it appears that paedophilia and other forms of child abuse were also tolerated, although these topics were not raised during the interviews.

4.1.2.4. Health

Almost all respondents, male and female, cited health as a significant factor in their quality of life. Three of the respondents highlighted the physical and emotional challenges associated with health.

"I went through a sickness so long and I suffered"

Respondent 9 (farming 'housewife')

"I am just getting up from my sick bed because I was sick for a long time I was lying down. ... with my customers I tend to them and I am happy seeing them and seeing each day go by [now she has recovered]*."*

Respondent 10 (female shop keeper)

However, often a major focus was on the lost capacity to work. In this respect, sickness is not just problematic because of the suffering it causes directly, but because of the lost labour associated with it.

"Once you are healthy you can able to ... to do some work for yourself. ... maybe I think I will be unhappy if I am sick an unable to farm."

Respondent 1 (widower & farmer)

"Like I'm healthy now but just like sickness hit me, you know like a fever you don't feel, like you are finished, you can't walk or you're weak."

Respondent 2 (farmer)

"Well its sad that I can't work but when I healthy like this then I keep moving so I can keep my family moving."

Respondent 8 (farming 'housewife')

"I feel that I got better, I don't feel anything else, I cook. When I couldn't get up I was tired of lying down but now I gladly get up and wash clothes and I do everything"

Respondent 10 (female shop keeper)

Mortality was clearly linked to grief, as would be expected. However, that grief was also partly associated with the loss of labour within a family.

"After my wife passed away it is a tremendous stress emotionally that you go through, because you feel that, OK you have lived a life, a happy life, and um now you gone into this situation is that you feel like you don't have a plan. ... I just feel like no more, I lost strength doing things I want to do, so you lose that strength you lose that, you lose that courage of doing things."

Respondent 1 (widower & farmer):

"Yes because he [late father] *was hard working and he loves to plant, whatever he find he shares it with us."*

Respondent 9 (farming 'housewife'):

4.1.2.5. 'Culture'

This category of themes is only loosely compiled, and since people live culturally (as opposed to living in a culture) it permeates into every aspect of the interviews. The themes discussed here are either explicitly (individuals refer to culture) or implicitly related to cultural. Two of the respondents who mentioned culture explicitly, did so in the context of changing traditional culture. This changing culture included the loss of traditional farming lifestyles, and concepts such as reciprocal labour between farmers (as opposed to cash exchanges which are becoming more dominant), and increased 'consumerism'.

"our culture, the Mayan people live happy once they have their basic needs at home ... But its a changing situation because of what we call the Western... things that are happening. People want, sometimes people want a car.

Sometimes people don't want to work on the farm, they want to have a nice office job, so you have all these things, so its a continual changing, so I would not be able to say okay I have my land I can sit back"

Respondent 1 (widower & farmer)

However, in this case there is a difference between the way that culture is conceptualised as something constantly evolving and culture as presented here, which is more static. This conceptualisation of culture is one that focuses on traditions and historical beliefs and practices. In this way, contemporary Maya culture does not appear to be seen as 'culture'. Within the interviews, this notion of a historic culture (as a relatively static object that can be adhered to) is interwoven with rural lifestyles. These rural lifestyles are closely associated with farming (as mentioned above), 'communal living' and religion. It is also associated with low crime although crime is perceived to be increasing.

"I think it's in our culture - the Mayan people live happy once they have their basic needs [from farming] *at home."*

Respondent 1 (widower & farmer)

"Sure, like yes like when I am going to plant or I have lots of things to harvest [I receive communal help]*, so as a Maya culture that why we say the word communal life. ... we use that word communal, because if I have like, lets say six acres, so I will call the attention of my friends. I need them, can you guys help me today to plant and everybody comes. ... When he's ready, he call my attention and we go back help him, and that's where we rotate from those ideas. From those cultures."*

Respondent 2 (farmer)

"Um, in a fu we culture, in a fu we life, we all do farming. When I was a young guy with my old parents, they raised me and show me how to raise pig, raise chicken."

Respondent 4 (farmer)

4.1.2.6. Religion

All the respondents mentioned religion in some form. Together with farming it was the most pervasive themes across, and within, interviews. It was a crosscutting theme that interacted with farming, health, domestic life, social networks, 'nature', 'culture' and respect. Religion, and the

attendance of church, was reported to play multiple functions in peoples lives. It was often references as a guide to living well, a source of guidance and ultimately eudemonic wellbeing.

"But in the Bible it says, okay, you go to church, you serve god, you do everything, you have a good life, you go to heaven".

Respondent 1 (widower & farmer)

"Because of the Bible teach me that I have to teach people how to work, who like to thief, make them stop thief. ... when I used to live like a drunken man before, you see. I no have to do good, as I said, 25 years I started to become a Christian. But, after all when I change, I sad to see, I had to I have to tell my people".

Respondent 4 (male farmer)

"Like how we go to church you see, we get some advice about how to live you see. We must change because we are believers so we must grasp some advice what is our main commandments."

Respondent 10 (female shop keeper)

Praying to God was also seen as a critical means by which an individual could change their life circumstances. This was especially apparent in the case of adverse life conditions, such as poor health.

"how can I say, because they were continually praying for me here I think that was where I got help a little. ... Well, how can I tell you, I did not feel sick now ever since I got into this faith."

Respondent 9 (farming 'housewife'):

"Only God can help you if you believe, or if not well you can't then problem come like those, they are troubles."

Respondent 3 (farmer)

"Its very important to trust God rather to trust man, as I said I tried to do all kind of works myself [but was unsuccessful]*."*

Respondent 4 (farmer)

"Then they start to pretend that everything grows its own way, they plant it and leave it there, they don't care about it. Maybe they don't even pray"

Respondent 10 (female shop keeper)

Another associated sentiment was that everything happens for a reason, according to the "*Will of God*". This indicates that individuals consider themselves to have limited agency in their lives - a reaction that was reflected in observation and informal discussions. It appeared that the belief

that negative life events "happen for a reason" also provided a degree of consolation, a sentiment that was reported by two interviewees. However, it is unclear how this is aligned with perception that individuals can change their lives through prayer, and cannot be successful without following religious belief.

Two respondents also discussed how their lives improved for the better when they converted from one denomination to another. Again, this indicates that people's life conditions are perceived to be determined by their choice of religious belief.

"we were Catholics but with this sickness now, when it won't leave me alone, I wasn't getting any better. Some told my husband that what else can you do ... when we were up and down they told us to turn into Christian. ... That was how I got into this religion. Maybe it was there that I lost the sickness."

Respondent 9 (farming 'housewife')

"before it was only problems, there was nothing good even eating and drinking, just [physical] *fighting but now ever since he began going to church he helped in leading the service so that is where I am seeing that everything is good"*

Respondent 10 (female shop keeper)

Religion also had an important function in social networks. Four interviewees reported that church congregations provided emotional, informational (advice) and materials support. Similarly, two respondents reported feeling happy as the result of adhering to religious principals of sharing with those requiring assistance. One respondent also highlighted the importance of religion in allowing him to forgive people that he perceived to have caused him emotional and material harm.

"Church coming together, not to argue to each other. You have to love each other, you see, come as one."

Respondent 4 (farmer)

"like for the poor, we need to help them because that is where our Christian life will show if we are really believers, when we are helping the poor"

Respondent 10 (female shop keeper)

4.1.2.7. Social networks and support

Social networks and support was also a very common theme across the interviews. The most commonly references social network was family, which was often cited as a source of labour (support in household tasks), material, financial, emotional and information support, as well as being important for general happiness.

(Author: "what are the things that make life good for you?") *"My kids and dad, always listen to radios and stay home with my kids while I am sowing, like those and making baskets. ... whatever like sometimes a problem comes my family help me."*

Respondent 5 ('housewife')

Wider social networks were also seen as a source of emotional, informational and material support. This was closely linked to the notion of reciprocity, which was twice cited as a component of Maya culture. This reciprocity involved helping each other in times of need, in the expectation of reciprocated support. Sometimes this support came in the form of advice or sharing of information. Other times it would be material support, such as the gift of grain, or financial support in the form of cheaper sales of agricultural products (often cited in relation to crops failure). The benefits of social support sometimes appeared to be bi-directional, with some individuals claiming that they gained enjoyment from sharing (potentially because it is aligned with religious concepts of sharing).

"The cooperation, you know they say that they were learning, how they should work together and and from there now you can hear from them that, wow, like its working for them. So now those person should pass again to other family and that is how we can grow up and build relationships more with others."

Respondent 2 (farmer)

"I am glad to share because I feel also when I am in need."

Respondent 9 (female farming 'housewife'):

However, social networks were also a source of problems reported by three respondents. Jealously was mentioned twice as being a source of tension between families. Particularly during informal discussions, '*obeath* ' or witchcraft was sometimes mentioned as s source of strife within

communities. One respondent made an oblique reference to *obeath* (later highlighted by my research assistant during translation) during the interview.

"Well like how they do bad things one to another [relating to the use of spirits and witchcraft]*, well they do those to create trouble so as to bring unhappiness. When you are happy you feel happy, well to live peaceful, in other words, but when they hurt each other they bring sadness."*

Respondent 9 (farming 'housewife')

Informal discussion suggested that fears over witchcraft were more ubiquitous than the interviews indicated. I believe this was for two reasons. Firstly, it is unclear if belief in witchcraft is aligned with religious beliefs, and therefore may not be endorsed by religious elements. Secondly, there appeared to be a hesitance to talk about certain topics including 'spirituality' and bush medicine, and therefore these aspects are likely to be under represented.

Two respondents highlighted the lack of social support being major negative aspects of their lives. In the case of Respondent 7 (unemployed widow), the social support received was limited to advice. However, the as a single mother she was entitled to nominal financial support from the government (around €4 per child per week).

"like anybody who want to help me they can like giving me advice on how to live, they do it so."

Respondent 7 (unemployed widow)

4.1.2.8. Education

Eight of the respondents discussed the importance of education for their child's future livelihood prospects. Interestingly (and potentially contradictorily) despite people identifying farming as a highly important aspect of their lives (food, income and identity) all of the eight respondents saw education as a means of enhancing their children's capacity to gain paid employment. Within two interviews, respondents bemoaned the loss in farming lifestyles whilst also describing the importance of education in allowing children to pursue non-farming careers. Education was

mentioned as being of importance in the life of one of the respondents, although she stressed that her education had been largely informal.

"Their lives should be better, different jobs from mine, mine is just farming but theirs could be they could find better jobs. Different and with that you can uplift yourself."

Respondent 6 (male farmer):

"like how I have always been telling them, for them to live better or to be able to find a job they can work with because I know that education is important for them to find a job so that their life can be better than mine."

Respondent 9 (farming 'housewife')

4.1.2.9. Employment and non-farming lifestyles

Despite the near ubiquity of farming the respondents livelihoods, many individuals either spent time in paid employment or had family and friends who were currently employed. Employment was often contrasted against farming, with a number of key benefits from employment being highlighted. The first was steady income, mentioned by five of the respondents as being a major advantage of employment. Similarly, two respondents also mentioned their desire to start their own businesses as a means of earning additional income, alongside farming, and another two mentioned the advantages of combining farming and non-farming activities as a means of diversifying income streams. However, the primary reason why individuals reverted back to farming was because they struggled to meet their nutritional needs (as well as the loss of independence). As mentioned above, farming provides essentially the majority of nutritional needs, as well as generating a small additional source of income. However, individuals who were engaged in paid employment claimed that it was insufficient to cover the cost of purchasing food and other necessities provided by farms (such as regular access to forest resources.

"I have tried that when I went to drive with the ministry of works as a truck, they pay me, but now I to buy everything. Everything is money, you want corn you want grounds food you want this and you need your food on the table. By the time I go pay my bill I couldn't pay everything; its growing - its growing and I can't give everything because like I said as I have children going to school."

Respondent 2 (farmer)

"But the thing with job is your food because you don't have corn. But if you had farm you have food and with your little money you are finding and gathering. ... farming is a little better because you eat it and still get a little income".

Respondent 3 (farmer)

4.1.2.10. Income

Income and liquidity was often discussed in relation to basic need fulfilment, health, education and investment. Three respondents mentioned the importance of having monetary savings as a form of insurance, especially for healthcare in times of sickness. Having some form of income was essential for sending children to school. Although tuition is free until the age of twelve, four interviewees mentioned the cost of school supplies as a barrier to education. Liquidity was generally seen as important for investment in farming and enhancing economic mobility. One respondent described how he earned income through selling of corn, which was used in turn to buy pigs, which in turn generated income for investment in other farming enterprises. This ultimately allowed him to support his family and build a house. In contrast, one of the respondents highlighted the lack of money as prevent her from meeting basic needs and educational requirements.

"Like for me I raise my children after their father died. It was hard, we didn't have money, they need money to go to school and for food; it was hard for me up to now.... like how my children get sick, whatever [money] I find I give them like medicine."

Respondent 7 (unemployed widow)

"Like how the children sometimes drop sick or when they need books or donations for school then that's where the money goes or like now we don't have any corn you never find corn anywhere so we must buy corn."

Respondent 10 (female shop keeper)

"I started to shell those corn, and I sold them. With all that I made with it I bought myself pigs."

Respondent 3 (farmer)

4.1.2.11. Age

Although age was not explicitly mentioned during the interviews, it was clear that aspects of individuals' lives changed as they aged. For example, informal discussions indicated that the very old and infirmed (or otherwise lacking capabilities) sometimes struggled to meet basic needs. However, other informal discussions suggested that the highest rates of suicide in communities are among young farming men. Similarly, those that were older tended to report higher dependence on their family and friends, especially in terms of labour.

Despite their limited quality, the interviews were a rich source of information and could have been examined in greater detail given the available time. The above themes and sub-themes, as well as their interactions, appeared to be the most salient elements that people perceive to influenced their qualities of life. As well as highlighting common themes, the results also indicate at least four important contrasts. Firstly, between farming and non-farming livelihoods and the associate features of each lifestyle. Secondly, between men and women, and the perceived agency they have in determining their own quality of life. Thirdly, between those that receive greater and lesser degrees of social support, and the extent that they are integrated into their communities. Finally, between that those could and could not routinely meet basic needs, including nutritional needs. 'Culture' remained relatively opaque - indeed, a much more focused study would be needed to explore the different ways that people live culturally (although all of these results discusses people 'living culturally').

Nevertheless, it should be reiterated that the elements that are perceived to influence quality of life might not manifest themselves in differences in individuals' self-reported experiences. Again, this is owing to the many cognitive buffers that mediate the relationship between people's life conditions and how they experience those conditions.

Ultimately, what a good life means was less clear. In this respect I not believe there is enough evidence to adequately address the research sub-question 'what does a good life mean?' Despite this, the limited evidence that was generated can still be employed when conducting and interpreting the analysis.

The discussion, in Section 5., will be the focal integration point between the qualitative and quantitative components. However, these results also inform the development of the candidate models, introduced in Section 4.2.

4.2. Quantitative results: surveys, spatial landscapes and models

The quantitative element of the study was primarily focused on exploring Research Question 2.

2. What is the strength of the statistical relationship between landscape variables and self reported life satisfaction, accounting for social, economic and demographic effects?

The following questions first describe the results of the survey (4.2.1.), before focusing on the Cronbach's alpha (4.2.1.1.) and PCA (4.2.1.1.) results. The selection of the 'best' candidate model and the results of the linear mixed effects model will then be discussed (4.2.2.).

4.2.1. Survey and spatial results

The following section presents the results of the 226 surveys conducted within the 15 communities, between 8th February and 29th March 2015. This represents approximate 21% of 1,058 households in the 15 communities. Table 4 describes the spatial and survey results using summary statistics (mean or count, range and standard deviation) of each variable described in Table 2 and 3, and the SWLS results.

Results across each community appeared to be relatively homogenous, with no clear distinction between communities (through visual inspection of box-and-whisker and other plots). One

exception to this is ethnicity, with some communities clearly containing majorities of either Mopan Maya or Q'eqchi' Maya, although other communities were mixed.

Social support and wealth are relative and abstract scales and therefore their absolute values are not of interest. However, social support was strongly negatively skewed, indicating that a minority of individuals report substantially lower social support than the mean (±2.65 s.d.). Similarly, wealth was strongly positively skewed, suggesting that a minority of individuals reported being substantially wealthier (according to the index items) than the mean (±1.03 s.d.). 71.7% of respondents reported that they had either grown, or been able to purchase, enough food to feed themselves in the previous month (compared to the remaining 28.3% that reported the opposite). The mean church attendance per week was reported to be twice a week (mean 8.01 per 4 weeks), although there was high variance in attendance (±7.52 s.d. per 4 weeks). The majority of respondents were female (58.4%), since the majority of men were working on farms during the day. Over half the respondents considered themselves to be in good health (50.5%, with 19% reporting very good health, but 5.8% considering themselves to be in very poor health). The mean number of years of education reported was just over six, although there was large variation in attendance (±4.02 s.d.). The majority of respondents identified themselves as Q'eqchi' Maya (58%), with only a small minority of respondents identifying themselves as non-Q'eqchi' or non-Mopan Maya (5.3%). The majority of respondents reported themselves to be living within predominantly farming households (77%). The forest use index is relative, but is positively skewed, indicating that a minority of individuals use the listed forest products substantially more than the mean level of usage (±0.77 s.d.).

Owing to overlap between the buffer areas (and the bisection of that over lapping area), the actual mean area of each three-kilometre buffer is 8.2% smaller than the intended buffer area (±9.7% s.d.). However, the spatial data was scaled according to the size of the actual buffer

region, and therefore should not significantly bias the results. The mean extent of forest cover within the buffer was 77.6%, although this ranged from as little as 15.6% to as much as 97.5% (±25% s.d.). Since the major alternative land-use is subsistence agriculture, it is unsurprising that the mean agricultural cover was 19%, ranging from 0.7% to as much as 84.2% of the buffer area (±26% s.d.). The mean rate of forest loss between 2012 and 2014 was 4.2% (an annual loss of 2.1%), ranging from 0.8% to 7.5% forest loss (±2% s.d.). The agricultural intensity index is of limited value in absolute terms. However, it is interesting to note that intensity of land-use was over a magnitude of order different between the least intensively used (0.9) and the most (19.4. ±5.3 s.d.). Finally, self-reported life satisfaction, according to the pre-PCA Satisfaction With Life Scale (SWLS), was strongly negatively skewed indicating that a minority of individual report substantially lower life satisfaction than the mean. The mean score was 20.74 out of a maximum of 25, with only 17.3% of respondents scoring below the neutral point of 17.5, with 15.5% of respondents attaining the maximum score of 25 (±5.3 s.d.). However, since the response levels in the SWLS were between 1 and 5, instead of 1 and 7 (in the unmodified scale), it was not possible to make a meaningful rescale of the satisfaction categories described by Diener et al. (1985). Weighting the SWLS according to their first principal component factors scores makes the mean largely meaningless in absolute terms, although the scores still retained its strong negative skew (±1.72 s.d.) and similar structure of distribution.

4.2.1.1. Cronbach's alpha

The Cronbach's alpha of the SWLS (life satisfaction) was 0.75, which is higher than the 0.70 threshold that is often referenced. The Cronbach's alpha of the OSS-3 (social-support) was low, at only 0.53 (below the 0.70 threshold). However, this score is within the expected and acceptable range for the OSS-3, since it supposedly measures a number of underlying dimensions. Therefore both the modified SWLS and OSS-3 data were included in the analysis.

4.2.1.2. Principal component analysis

In the construction of the Asset Index, the first principal component explains around 27% of the variation across the index. This is comparable to other Asset Index's created using PCA (e.g. Filmer & Pritchett, 2001). The Asset Index assumes the first principal component is a proxy for an underlying wealth dimension. The factor scores for each of the 13 items in the index, extracted from the first principal component, ranged between 0.42 and 0.06. Again, these scores are generally in the range found in other Asset Indexes (e.g. Filmer & Pritchett, 2001). Unlike the majority of applications of Asset Indexes, I did not categorise individuals into wealth quintiles. Classifying individuals into wealth quintiles is useful when seeking to describe the wealth of particular groups in society (e.g. when trying to identify the 'poorest' % of a population). However, doing so in this application would have needlessly lost information that is of value within the following analysis.

Within the forest use index, the first principal component explains 27% of the variation across the index. It is assumed that the first principal component measures an underlying dimension of forest use (or, in loose terms, 'dependency'). Factor scores ranged between 0.51 and 0.09, although the remaining were in the order of magnitude of the former. Since I could not find other examples of where PCA has been used to determine a single value of forest use, it is unclear to what extent this variable is valid.

The first principal component in the PCA of the SWLS explains over 51% of the variation in the data, significantly greater than the second principal component. It is assumed that the first principal component measures an underlying dimension of life satisfaction. This first factor scores of each of the questions in the SWLS, explained by the first principal component, were 0.44, 0.47, 0.46, 0.46 0.40 respectively. These are subsequently the weightings applied to each of

the question. The weighted responses to each of the questions are then summed across all the questions, generating a single score of SWLS.

Table 4| Summary statistics of survey and spatial data (no intended order)

Variable name	Type	Summary	Range	s.d.*
'Social support'	Numeric	Mean: 8.64	3-14	2.65
'Wealth'	Numeric	Mean: 1.40	0-4.53	1.03
'Basic needs fulfillment'	Binomial	Count: (No: 28.3% / Yes: 71.7%)	0-1	NA
'Religiosity'	Numeric	Mean: 8.01	0-20	7.52
'Gender'	Binomial	Count: (Male: 41.6% / Female: 58.4%)	0-1	NA
'Health'	Ordinal	Count: (VP: 5.8% / P: 12.8% / GP: 11.9% / G: 50.5%/ VG: 19%)**	VP-VG	NA
'Education'	Numeric	Mean: 6.34	0-18	4.02
'Ethnic background'	Categorical	Count: (Maya: 58% / Mopan: 36.7% / Other: 5.3%)	NA	NA
'Farming'	Binomial	Count: (Farmer: 77% / Non-farmer: 23%)	0-1	NA
'Forest use'	Numeric	0.90	0-3.26	0.77
'Community'	Categorical	15 target communities	NA	NA
'Forest cover'	Numeric	Mean: 77.6% (of buffer area)	15.6 -97.5%	25%
'Agricultural cover'	Numeric	Mean: 19% (of buffer area)	0.7% - 84.2%	26%
'Forest loss'	Numeric	Mean: 4.2% (of buffer area)	0.8 - 7.5%	2%
'Agricultural intensity'	Numeric	Mean: 7.4	0.9 - 19.4	5.3
Pre-PCA SWLS	Numeric	Mean: 20.74	8.0-25.0	5.3
'SWLS'	Numeric	Mean: 9.25	3.6-11.7	1.72

* s.d. = Standard deviation

** VP = very poor, P = poor, GP = neither good nor poor, G = good, VG = very good.

4.2.2. Linear mixed effects model results

Since many of the numeric data's absolute range are uninteresting (the interest is in their relative range), all of the numeric survey data were normalised to a range between 0 and 1. This means that the lowest in the range is assigned '0' and the highest is assigned '1' (with intermediate data in between). This does not modify the relative ranking of each datum, and therefore does not change the results. However, it does make it easier to interpret the relative importance of each

variable (especially within Figure 4). Similarly, the SWLS was also normalised and converted to a percentage. This means that the effect of each variable on SWLS can be understood as a percentage of the total variance (again, much more meaningful than an abstract score). Since the model assumptions were upheld (as described in Section 3.5.2.) the linear mixed effects model is considered to be an appropriate means of analysis.

Table 5 describes the candidate models, ranked according to their AIC. The coefficient estimates (β), standard errors (s.e.), AIC, and ΔAIC are presented for each of the ten candidate models. Initially a 'best' model (the original of model 3) was selected based on having the lowest AIC, and ΔAIC>2 from other models. However, after an inspection of the correlation between fixed effect variables, significant collinearity was found between agricultural intensity and forest cover (r=0.98: this collinearity did not exist in the global model). Therefore, agricultural intensity was dropped from the model. However, after dropping the variable, the models AIC increased and was subsequently no longer the 'best' model. Consequently, model 1 had the lowest AIC, and ΔAIC >2 compared to the nearest alternative model, and was therefore considered the 'best' model. Model 1 did not suffer from collinearity between parameters.

Table 5| Candidate models, ranked according to their AIC. The 'best' model is Model 1, which has the lowest AIC and a ΔAIC > 2 from any other model. *Coefficient estimate in percentage terms. ** Standard error. *** Delta AIC. ⭘ Global model.

Model	Intercept β* (s.e.)**	Social support	Wealth	Basic needs	Religiosity	Age	Gender	Health - poor	Health - good /poor	Health - good	Health - very good	Ethnicity - Mopan	Ethnicity - Other	Education	Farming	Forest use	Forest cover	Forest loss	Agricultural cover	Agricultural intensity	AIC	ΔAIC***
1	93.5 (29.2)	22.1 (5.7)			2.2 (3.7)	9.4 (7.4)	0.3 (2.8)	14.8 (6.7)	9.4 (6.7)	16.5 (6.0)	22.6 (6.7)	-6.0 (3.2)	-10.4 (6.5)	-11.0 (7.1)		1.0 (5.7)	-47.7 (27.6)	6.5 (5.1)	-4.4 (15.6)	-41.8 (25.2)	1919.3	0.0
2	93.8 (29.1)	22.2 (5.6)			2.2 (3.7)	9.5 (7.4)	0.3 (2.8)	14.8 (6.6)	9.4 (6.7)	16.5 (6.0)	22.6 (6.7)	-5.9 (3.2)	-10.4 (6.5)	-11.1 (7.1)			-47.8 (27.6)	6.4 (5.0)	-4.5 (15.6)	-41.9 (25.2)	1922.6	3.3
3	43.6 (9.0)	22.4 (5.9)	4.4 (6.4)	-1.6 (3.2)	2.3 (3.8)	7.1 (7.6)	1.0 (3.6)	14.6 (6.7)	8.4 (6.8)	16.5 (6.1)	22.2 (6.8)	-7.8 (3.0)	-14.3 (6.4)	-12.2 (7.0)	1.2 (4.3)	0.8 (5.8)	-45.4 (24.0)	2.9 (4.7)		3.7 (5.1)	1925.2	5.9
4	96.1 (29.2)	22.3 (5.6)			2.5 (3.7)	14.2 (6.8)	1.3 (2.8)	13.6 (6.6)	9.2 (6.7)	15.7 (5.9)	21.5 (6.7)	-6.7 (3.1)	-12.1 (6.4)				-54.9 (27.3)	5.3 (5.0)	-9.8 (15.2)	-42.5 (25.2)	1928.8	9.5
5	87.7 (26.0)	22.2 (5.6)			2.7 (3.7)	14.6 (6.8)	1.4 (2.8)	13.5 (6.6)	9.3 (6.7)	15.7 (5.9)	21.7 (6.6)	-7.0 (3.1)	-12.3 (6.4)				-46.4 (23.8)	5.5 (5.0)		-43.6 (25.1)	1934.5	15.2
6	116.0 (29.1)	24.4 (5.6)			1.9 (3.7)	5.6 (6.0)	0.8 (2.8)					-7.2 (3.2)	-12.0 (6.5)				-56.9 (27.7)	4.1 (5.1)	-11.7 (15.4)	-42.5 (25.6)	1952.4	33.1
7	46.4 (8.2)	22.9 (5.8)	1.6 (6.1)	-2.0 (3.2)	1.9 (3.7)	4.8 (7.4)	0.9 (2.9)	15.2 (6.7)	9.6 (6.8)	17.4 (6.0)	24.4 (6.8)			-19.1 (6.6)							1953.6	34.3
8	162.2 (27.4)		7.0 (6.6)	0.6 (3.2)											3.5 (3.5)	2.6 (6.0)	-93.6 (26.1)	7.6 (5.3)	-19.4 (16.0)	-71.8 (24.7)	1982.2	62.9
9	163.0 (27.3)														2.8 (3.4)	2.5 (6.0)	-91.4 (26.0)	7.8 (5.3)	-19.4 (15.9)	-71.0 (24.6)	1989.3	70.0
10	69.2 (4.8)		6.4 (6.6)	1.7 (3.3)										-15.4 (6.3)	3.1 (3.4)	1.6 (6.0)				5.0 (5.7)	1999.2	79.9
⭘	93.1 (29.4)	22.4 (5.9)	5.0 (6.4)	-1.7 (3.2)	1.9 (3.8)	8.6 (7.6)	1.1 (3.6)	14.9 6.7	9.4 6.8	16.7 6.0	22.3 6.8	-5.9 3.2	-10.3 6.7	-10.9 7.2	1.7 4.3	0.7 5.8	-48.5 27.8	6.9 5.1	-3.5 15.7	-42.8 25.4		

Model 1 is considered to be the 'best' or most 'optimal' model within the candidate set since it explains the most amount of variation with the fewest parameters. However, within information theoretic approaches this model is not considered to be the 'truth', only a useful approximation. However, the usefulness and accuracy of this approximation is largely dependent on how carefully and thoughtfully the candidate set was developed (the 'best' of a poor set of models is still a bad approximation of reality).

Model 1, the 'best' or 'optimal model', has 14 variables. Since health is ordinal and ethnicity is categorical, each of the categories is modelled in relation to the 'first' category (e.g. coefficient estimates of health are in relations to 'very poor health' & all the ethnic categories are in relation to Q'eqchi' Maya). Since the analysis is employing information theoretic approaches, I am using confidence intervals, not *p* values, to determine the confidence that a variable has a significant effect on self-reported life satisfaction. The intercept is not included within Figure 4, since it obscures the scale (but see Table 5 for the intercept coefficient estimate). In Figure 4, the central axis is the mean of the range of SWLS scores. The scale is presented in percentage differences in life satisfaction away from the mean score, for easier interpretation. Within Figure 4, the points are the coefficient estimates (β), the thick lines are 90% confidence intervals and the thin lines are 95% confidence intervals. These confidence intervals were chosen because they offered a reasonable conservative indicator of confidence and are commonly used within the literature. With the 95% confidence interval we can say that we are 95% confident that the unknown population parameter (the real effect of the parameter in the population, based on our sample of that population) lies within that range. The same goes for the 90% confidence interval, except we are less confident that the population parameter falls within the range. Since all variables were normalised to a comparable scale, the points indicate the highest end of the range of each variable (and the lowest being 0).

Within the 'best' model, there was high confidence (since the 95% interval does not overlap with the central axis) that 'health' and 'social support' were positively correlated with life satisfaction, as measured by the SWLS. There was a low degree of confidence (since the 95% confidence interval overlaps with the central axis) that those that report being Mopan Maya, 'agricultural pressure' and 'forest cover' are negatively correlated with life satisfaction, measured using the SWLS. None of the other variables could confidently (≤90%) be said to correlate with life satisfaction - a point of interest in its own right.

Figure 4| Coefficient estimates and confidence intervals of variables influence on life satisfaction, according to the 'best' model. The points are the coefficient estimates (β), the thick lines are 90% confidence intervals and the thin lines are 95% confidence intervals.

There was <95% confidence that those that report very good health were estimated to report a mean of 22.6% higher life satisfaction than those that had very poor health (±6.7% s.e.). Those that reported the highest levels of social support could confidently (95% CI) be said to also report an average of 22.1% higher life satisfaction than those that reported the lowest (±5.7% s.e.). Those that reported good health were estimated to report 16.5% higher life satisfaction than those that reported very poor health (95% CI, ±6.0 s.e.). Those that reported poor health were

estimated to report 14.8% higher life satisfaction than those with very low health 95% CI, ±6.6 s.e.). Interestingly, those that reported neither good nor poor health were estimated to report only 9.4% higher life satisfaction than those that reported very poor health (5.4% lower than those that reported poor health. ±6.7 s.e.). However, since the 90% confidence interval overlapped with the central axis this could not be said with confidence.

Similarly, 'age' (β=9.4%, ±7.4% s.e.), 'forest loss' (β=6.5%, ±5.1% s.e.), 'religiosity' (β=2.2%, ±3.7% s.e.), 'forest use' (β=1.0%, ±5.7% s.e.) and 'gender' (β=0.3%, ±2.8% s.e.) all had positive coefficient estimates. However, there was very low confidence about these effects (<90% CI). Similarly, 'agricultural cover' (β=-4.4%, ±15.6% s.e.), 'other' minority ethnicity (β=-10.4%, ±6.5% s.e.), and 'education' (β=-11.0%, ±7.1% s.e.) were all negatively correlated with life satisfaction. However, there was very little confidence about these estimates (<90% CI).

However, there was marginally more confidence (>90% CI) about the estimated negative correlation between those that self-identified as Mopan Maya and life satisfaction. Those that self-identified as Mopan Maya were estimated to report 6.0% lower life satisfaction than those that identified as Q'eqchi' Maya (>90% CI, ±3.2% s.e.). This could equally be attributed to high levels of life satisfaction among Q'eqchi' Maya as it could be lower levels of life satisfaction by Mopan Maya, depending on how you choose to frame it. There was also moderate to low confidence about the effects of 'agricultural intensity and 'forest cover' on self-reported life satisfaction. There was greater confidence (>90% CI, which was still a relatively low level of confidence) that 'agricultural pressure' was negatively correlate with life satisfaction, with the highest areas of agriculture reporting 41.8% lower life satisfaction than those areas with the least agricultural pressure (>90% CI, ±25.2% s.e.). Interestingly, those with the highest levels of forest cover were estimated to report 47.7% lower life satisfaction than those that had the lowest forest

cover (>90% CI, ±27.6% s.e.). Although this appears contradictory, it is not, as will be discussed in Section 5.

However, it is important to reiterate two things. Firstly, these coefficient estimates are estimating the effect on the *variance* in life satisfaction. This means that an x percentage effect size for a certain group does not mean that those groups have x percentage higher life satisfaction on the satisfaction with life scale (a big effect). Instead it means that they have x percentage higher life satisfaction within the range of self-reported life satisfaction (a relatively smaller amount, considering that the standard deviation in life satisfaction is 18.6% of the mean). Secondly, and associated with the first point, although the standard deviation of life satisfaction was 1.72 around the mean of 9.25 (±18.6% s.d.), the absolute mean score was relatively high. Therefore, the variables effects manifest in varying degrees of high life satisfaction.

5. Discussion

The discussion is divided into seven components - the first will explore some of the studies limitations (Section 5.1.). The following three sections explore Research Questions 1. (5.2.) and its sub-questions, a. & b. (5.2.1. & 5.2.2 (also sub-sectioned)). Section 5.3. precedes the exploration of Research Question 2., focusing on the social, economic and demographic factors influencing life satisfaction in the context of the qualitative evidence developed in Section 5.2. However, Research Question 2. and the Research Aim will be more fully explored in Section 5.4., which explicitly discusses the qualitative and quantitative evidence for the effects of landscape factors in life satisfaction.

5.1. Study limitations

Before proceeding into the discussion, a number of key limitations in the study will be suggested.

- Within the study, only a small number of cultural *forms* and *practices* were explored in the quantitative model. There were no variables that attempted to account for *relationships*. This means that only a narrow selection (albeit those that were most salient in the interviews) of the wide range of potentially important landscape elements were modelled.
- The quantitative approach attempts to reduce a highly complex system down to linear and mechanical elements within the quantitative model, although the qualitative component sought to provide balance and depth.
- The study did not use participatory methods to explicitly identify important landscape elements, instead relying on my 'expert', outsider perspective. As a result, the range of landscape features identified may not reflect the potential range of features that would have been elicited in more participatory approaches.
- This 'expert' perspective (as adopted from where researcher are situated within the Cultural Values Model) is reflective of my research experience and formal training - predominantly conservation science - and limited exposure to other disciplines such as political ecology, gender studies, etc. My perspective is also that of a young white male,

from outside of Belize. Although this is not a limitation as such, it is important to recognise that this background orientates understanding and interpretation.

- The interviews represented a relatively small sample, which was not representative of all communities. It did not include any young men, or any non-farmers.
- I have had no formal training in qualitative methods. As a result, the quality of the qualitative data was potentially of limited quality.
- A sample size of 226 households might be considered small, when considering that a large portion of the variation in life satisfaction is attributed to unmeasured personality traits and characteristics. This small sample size also limited the complexity of the model, due to concerns of overfitting (Johnson & Omand, 2004).
- Some statisticians have argued that the information theoretic approaches are only appropriate when the system of study is well understood, since candidate model development is dependent on a sufficient understanding of the system of interest (Mundry, 2011). However, since this is exploratory research, the understanding of the system may not be adequate to develop a valid set of candidate models.
- Some of the quantitative instruments used, such as the OSS-3, are of unclear validity (EUPHIX, 2010). Therefore, the accuracy and precision of the instruments may have unknown effects on the data.
- The study largely ignores the role of institutional, politics, meso- and macro-economics in determining the relationship between people and landscapes. Overlooking these factors may have biased the results of the study, in unknown ways.
- Other aspects such as gender were only superficially explored. Again, this could have created biases of unknown magnitude.
- Research Question 1.a. could not be as adequately answered as initially expected, with the method employed. This means that the validity of using the SWB framework within this context is unclear.
- Toledo remains relatively ecologically 'intact'. Therefore, conclusions about the role of forested ecosystems may not extend to more degraded landscapes.
- The SWB framework appears to ascribe to a 'cognitivist' account of the mind, as being situated 'outside' of the world (making judgements whilst looking upon the body and world). The Cultural Values Model adopts a 'phenomenological' accounts of the mind as 'inside' the world (being in the world & rejecting mind / body duality. Ingold, 1993).

However, these potentially conflicting accounts of how human beings perceive the world are not reconciled within the study. Although this could be considered problematic, I avoid this issue in the same way as I do other ontological, epistemological and methodological incongruities, by judging the appropriateness of the frameworks according to how well they explore the focal research problem.

- The Cultural Values Model is developed largely according to Western scientific cosmologies (although it is employed in analysing cultural landscapes of value to New Zealand residents, including Maori peoples) (Stephenson, 2008). Therefore, the extent that it aligned with interpretations of landscapes by Maya peoples is unclear. As a result, the categories of *forms*, *practices* and *relationships* may not reflect the way that landscapes were structured in Maya culture, and as such may overlook elements that were important for SWB.
- Although changes in forest cover were modelled, changes in forest quality were not. This could be a significant limitation of the study, since it did not account for forest degradation associated with extractive practices and disruption of forest ecosystems. This change in forest quality may have had a significant, and unaccounted, effect on life satisfaction, through the Cultural Landscape - SWB mechanism described.

5.2. The primary themes that individuals in Maya communities associate with a good life

This section seeks to explore Research Question 1., and its two sub-questions a. & b.

1. What are the primary themes that individuals in Maya communities associate with a good life?
    a. What does a good life mean?
    b. What are the things that are perceived to influence quality of life?

Research Question 1., will be explored in two parts; firstly, reviewing interpretations of what a good life means among the interviewees and second, by discussing some of the major themes in the context of the Cultural Landscapes Model and wider literature.

5.2.1. What a good life means: sub-question a.

The primary purpose of this Research Questions was to compare the local interpretations of wellbeing with the concept of SWB, specifically life satisfaction, as presented in the wellbeing psychology literature. SWB is defined as individual's "evaluations of their lives using both cognitive judgments of life satisfaction and affective evaluations of moods and emotions" (Diener & Suh 1999). Within this, I adopted Shin and Johnson's (1978) definition of life satisfaction: the "global assessment of a person's quality of life according to his chosen criteria".

I sought to contrast this framework of wellbeing, compromising both emotions and cognitive reflections on ones life, against respondents' construction of wellbeing. However, I believe there is insufficient evidence to adequately explore this question. The methods employed placed insufficient attention on exploring the meaning of a 'good life'. The only question that sought to explore this topic, within the interviews, was often responded to with a list of desired life conditions. However, little attempt was made to explore this topic through alternative interview devices. As a consequence, it is unclear how valid and prominent life satisfaction, as understood within the SWB framework, is within individuals overall SWB. As a result, the usefulness of SWB framework for describing subjective experiences of wellbeing within the target communities is ambiguous. This ambiguity derives from the lack of clarity regarding how life satisfaction is situated in relation to positive and negative affect. Similarly, this uncertainty is also the result of lack of evidence indicating that positive and negative affect and life satisfaction are accurate constructs for describing subjective experiences of wellbeing within Maya cosmologies.

In response to the question 'what does a good life mean', almost all respondents described archetypal life conditions that contributed to what they considered a good life. For example, the engagement in farming practices and following religious beliefs. From this we can draw one aspect of how a good life, or subjective wellbeing (they are not necessarily the same), is

constructed: a good life involves fulfilling goals (as defined by Oishi (2000), and living according to certain principles and beliefs. However, only one respondent mentioned the attainment of happiness (the experience of positive affect) as a condition for a good life. The avoidance of negative emotions was not mentioned at all.

In this respect, it appears that goal attainment and eudemonia, associated with the life satisfaction component of SWB, was more dominant than affective components. The construction of wellbeing presented by respondents appears to resonate with constructs of SWB, specifically life satisfaction and eudemonia. Respondents' focus on practices (such as farming) and attaining outcomes (such sufficient food) also appears to be consistent with literature regarding the importance of attainment and progress towards goals for life satisfaction (Ryan & Deci, 2001). Within the life satisfaction literature, factors such as the extent that goals are endogenously or exogenously determined, normatively endorsed, etc., are commonly mentioned (Emmons, 2003; Diener et al., 1999; Oishi et al., 1999). The interviews only focused on *perceptions* of what influenced people's lives (not actual differences in self-reported life satisfaction). However, it appeared that features such as ways of living culturally, and factors association with basic needs fulfilment, modified the way individuals ranked the importance of activities related to goal attainment. This is typified in the example of farming - something socially endorsed, embedded in cultural heritage, and directly associated with the fulfilment of basic needs.

Although I am not aware of any studies that specifically explore SWB in Maya communities, through a psychological lens, at least one study has explored wellness, using anthropological approaches. Baines (2012a) used an ethnographic approach to explore wellness, community health and ecological knowledge and practice in the Mopan Maya community of Santa Cruz. She explores the many ways that ecological heritage and practice interface with community health and wellness. She suggests that participation in practices (those that could be defined as 'traditional')

was fundamental to a holistic conception of wellness in the community. Wellness, as described by Baines, is very different to the construction of SWB used in this study. However, Baines's research points towards the importance of both progress towards specific goals (e.g. the engagement in farming practices) and the attainment of goals (e.g. the importance of consuming farming produce). However, her research also highlights the importance of engagement in the practices themselves: not just for their instrumental value, but also because of the importance of living according the beliefs, meanings and values coupled with practices. This is where the construction of SWB used in this study appears to falter. Although 'culture' is recognised as an importance factor in SWB, it is often presented as a 'modifier' of more easily conceptualised and measured elements (such as modifying the way that wealth changes affect life satisfaction). In this respect, by adopting the SWB framework I also admit a relatively narrow construction of culture. The SWB framework appears to treat an individual's satisfaction with their lives as the degree to which they progress from one goal to the next. In this respect, I believe it deals poorly with the attainment of desired life conditions that cannot be treated as discrete goals. For example, Fink (1987) describes the importance of foods as a means of maintaining healthy bodily and mental conditions, in the community of San Jose (southern Belize). It is unclear how the dynamic maintenance of a desired state (such as being a practiser of 'traditional' culture) fits within a framework that is principally concerned with discrete goals. This focus on goals may be reflective of a wider goal-orientation narrative, which may be prevalent in postmodern modernising paradigms. For example, Fukuda-Parr (2012) describes how the Millennium Development Goals, although mobilising support, oversimplify complex challenges and risk generating unintended consequences. Similarly, the emphasis on progression between discrete goals may also reflect a

wider tendency in psychology (during the 20th century) to mistake abstract and simplified psychological models for 'reality' (Flynn, 1997).[4]

One means of addressing this challenge might be to embrace the eudemonic tradition more extensively with the life satisfaction framework. Eudemonic conceptions of wellbeing suggest that life satisfaction is not just gained through the attainment of goals (Ryan & Deci, 2001). Instead, it stresses the importance of self-actualisation according to ones 'full potential', and living in a way that is consistent with deeply held values (Kjell, 2011). Colquhoun & Dockery (2012) summarise Dockery's preceding work with Australian Aboriginal peoples, where he found that 'cultural participation', cultural identity and use of Indigenous language was positive associated with SWB (Dockery, 2010; Dockery, 2008). In these studies, the eudemonic benefit of living aligned with certain cultural constructs and identities appears to correlate with higher SWB.

Although to an extent the interviews can be interpreted as resonating with SWB concepts with the psychology literature I believe there is insufficient evidence to draw decisive conclusion with confidence. I believe that understanding what a good life means in Maya communities would require a specific approach in its own right. The brevity and lack of exploration of what a good life means, within this study, ultimately means this Research Question (1.a.) cannot be answered confidently. Therefore, it is unclear how appropriate the use of the SWB framework is for understanding subjective wellbeing in the study communities. Yet, Tay & Diener (2011) argue that SWB is largely a universal framework for human wellbeing, although the dominance of life satisfaction, positive affect and negative affect vary. However, the importance of hedonic and

[4] As mentioned in Section 2.4.3., this "fallacy of misplaced concreteness" (Whitehead, [1925] 2008), or reification, is also worth considering more generally within this study. It is worth reiterating that the theoretical framework presented in the study is a simplified metaphor for more complex processes. As such, care should be taken when extrapolating these results temporally or spatially, since they may represent emergent artefacts and not general governing principals of the system of interest.

eudaimonic components of SWB remains an on-going debate within psychology (Henderson & Knight, 2012).

5.2.2. Themes perceived to influence quality of life in landscapes: sub-question b.

The most salient themes that were perceived as influencing peoples quality of life were farming, nature, gender, health and mortality, culture, religion, social-support, income, non-farm income and employment. The following section describes how salient each theme appeared to be in people's lives, how they can be understood in the Cultural Values Model, and wider literature regarding perceptions of the importance of life domains. All of the themes are intimately linked within the cultural landscape system of Toledo. However, for brevity, the discussion will focus most on farming (Section 5.1.2.1.) and nature (Section 5.1.2.3.) as the most apparent features of people-environment interactions within a cultural landscape. Although the other themes are also important, they will be discussed less (Section 5.1.2.3.). This is partly because they are more closely characterised as people-people interactions (although such categorisation does not reflect the way all of the themes interact within the socio-ecological landscape). Therefore, omitting a detailed discussion of these topics allows for a more focused approach towards the ultimate Research Aim, discussed in Section 5.3.

5.2.2.1. The perceived importance of farming and associated activities

Farming was perceived to be one of the most (if not the most) prominent factors influencing the quality of life of the interviewees. It was a substantial focus in all of the interviews, with men and women alike. Farming appeared to relate to all of the other themes. Its ubiquity and prevalence within the interviews (and field observations and informal discussions) indicates that farming can be considered one axis by which life in Maya communities revolve. Additionally, non-farming lifestyles appear to be framed in relation to farming.

The reported importance of farming stemmed from its role in satisfying nutritional needs and wants - not just in terms of calorific intake but also proving certain foods considered important in Maya life. This is reflected by Baines (2012a) who found that 'traditional' farm and forest foods were strongly associated with living healthily, and knowledge about certain practices associated with farming and food was important for wellness.

Baines (2011) also highlights the essential interconnected nature of farming and health, as perceived in Mopan Maya communities of southern Belize. Figure 5 (adapted from Baines, 2011) describes a feedback loop between health and ecological heritage in Mopan Maya communities. The feedback loop highlights how illness can precipitate inability to engage in farming practice (with all the mental and physical connotations associated with this), creating conditions of further illness. This illness is not just physical, but also relates to wellness, as understood in Mopan Maya communities, that includes the capacity to engage in practices that are deeply linked to ecological heritage. Baines's (2011) model is consistent with the findings of this study. Poor health was often discussed in relation to inability to work. Although not mentioned during the interviews, informal observations support the proposition that social relationships and inclusion are partly dependent on individuals' engagement and success in farming. In turn, the strength of social networks influences how easily individuals mobilise support in times of need, providing a further feedback loop with health and capacity to engage in farming.

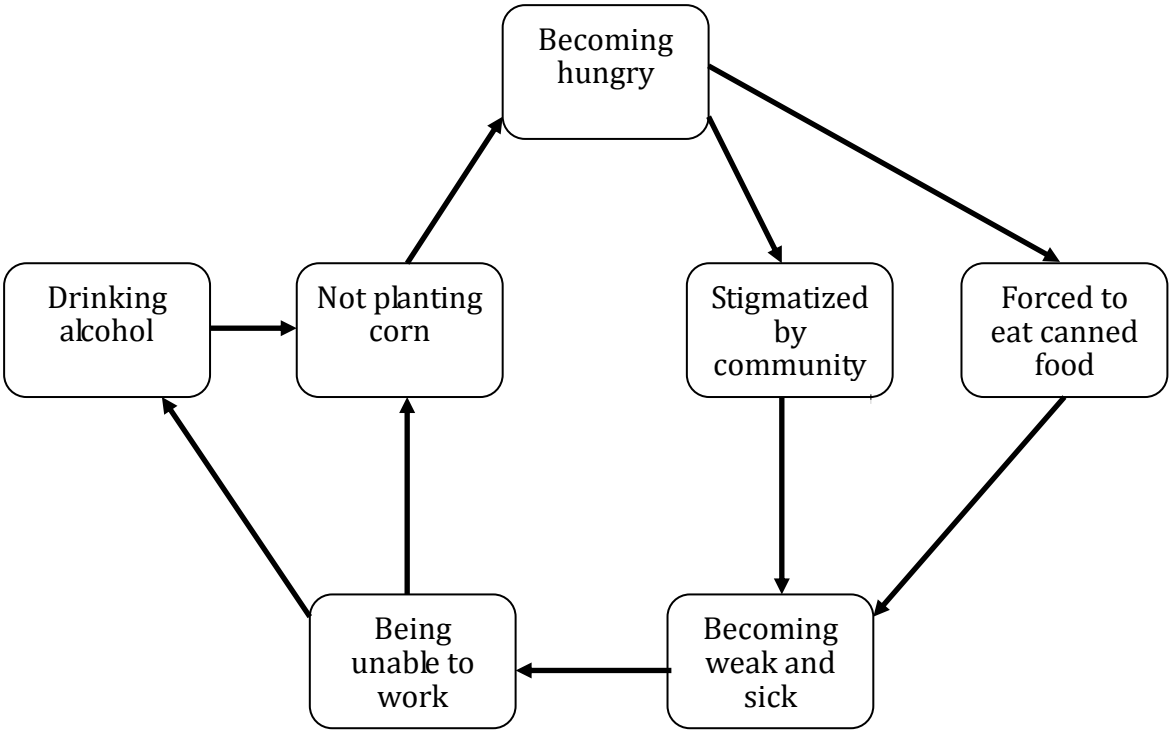

Figure 5 | Phenomenological feedback loop between health and ecological heritage, adapted from Baines (2011).

However, this can be contrasted against Wilk's (1984) interpretation of the role of agriculture within Maya communities during the early 1980s. Approaching the topic from a political economy and cultural ecology perspective, Wilk's explores subsistence life according histories of capitalist development, colonialism and political power. The majority of nutritional needs were met through subsistence farming (primarily corn), raising livestock, and, in areas with more intact forests, hunting and gathering forests products. He found that many crops, practices and beliefs were treated in accordance with 'traditional' heritage. This could be treated as akin to Baine's (2012) description of traditional ecological heritage - the perpetuation of knowledge and culture through embodied ecological practice. However, Wilk's (1984) also describes a parallel tradition, which emerged in the 18th Century, defined by varying degrees of engagement in cash based markets and commerce. This was reflected in a long tradition of growing cash crops alongside subsistence produce (approximately ⅓ of labour being devoted to cash crops). The income generated was not only used to meet nutritional needs, but to purchase a wide range of

commodities, especially among younger men and women. He argued that one of the main motivators for expanding agricultural frontiers, and increased agricultural pressure, was the desire for higher incomes and the capacity to consume. He argues that the commodity economy he observed was no new phenomenon and has a history of comingling with 'traditional' practices - indeed, living Maya culture was not polarised into the 'traditional' and the modern. Baines's (2012a) "Embodied Ecological Heritage" model recognises some of this history, and expressly does not present contemporary Maya culture as a static relic of the past. However, it appears to engage less with the role of farming as a means of acquiring commodities, and the symbolic values associated with consumption. Interestingly, Wilk's (1984), who was conducting his research in the early 80s', noted how older community members bemoaned the rise of consumerism and the decline of reciprocal 'communal life' among younger farmers. Thirty-five years later and older respondents were also expressing the same sentiments. (This raises the question of if such change is really something novel within the last generation, or if a certain degree of romanticisation of 'traditional' communal life has entered into the lexicon of cultural attitudes.)

Field observations also echo some of these sentiments - although farming is deeply embedded in individuals' identity, and was seen as vital for life, it was equally valued as a source of income. Farming income was used for health, education but also the purchase of a wide range of commodities. The primary motivation for farmers to send their children to school was to allow them to engage in livelihoods that, in some respects, took them away from the landscapes and practices of their parents. Levasseur & Olivier (2004) also highlighted the importance of farm saving, sale of crops, working for paid labour on others farms, or sale of farming capital to generate income for a wide range of needs, among farming families in San Jose (southern Belize). He suggested that limited liquidity was exacerbated by restricted access to credit and inadequate land tenure, which discouraged long-term agricultural investment (Levasseur & Olivier, 2004).

Although engagement or non-engagement in farming activities appears to be one critical axis by which lifestyles and identities were structured, this may reflect the sampling focus within the interviews. All men interviewed were farmers, and the majority of women were from farming families. This sample is reflective of the prevalence of farming but nevertheless it does omit the perspective of those engaged in non-farming livelihoods. Steinberg (1999) describes how improved access and increased contact between Toldo's rural Maya and greater Belizean society precipitated what Gregory (1987) called the "young man's revolution". This revolution was characterised by increasing rejection of traditional civil-religious hierarchy in favour of alternative lifestyles and non-farming livelihoods among the younger male generation. Cash and material wealth increasingly replaced age and experience as the hallmarks of prestige in Maya communities. Steinberg (1999) also described a more recent "young women's revolt" - young women are receiving greater access to high school education, and as a result marriage is postponed until later in life. According to Steinberg (1999), this has upset the traditional economic dependency on men, enabling greater economic agency for women. He also argues that the influx of tourism, and the establishment of women's groups gave women more time, money and ultimately agency. This resonates with Heywood & Drake (2004) who discuss, among other things, the role of globalisation and the opportunities for independent paid employment in disrupting patriarchal systems of domination (although of course creating other systems of control). For these reasons, the primacy and superiority of farming lifestyles that was presented in the interviews may be a reflection of the sample used. If the sample had included more young men who were going to 'job-out' then the benefits of paid employment, and its associated cultures, might have been more apparent. Taking the discussion further, and into the realm of speculation, 'traditional' farming culture may be associated with systems of power and male supremacy derived from age and farming ability, that younger generations are seeking to reject. In this respect, older male farmers, the traditional power holders, may regret the transition towards

other social systems because it disrupts their position of primacy. Similarly, these new lifestyles may also present untested and potentially risky modes of living that may worry certain groups.

In a global context, subsistence agriculture is often characterised according to its importance for meeting economic, nutritional and social needs - to 'lift people out of poverty'. Small-scale farming produces the majority of food in developing countries (IFAD & UNEP (2013) citing Koohafkan, 2011), and are estimated to constitute around 85% of all farms (IFPRI, 2005). However, these farmers are expected to consist of around half of the world's undernourished peoples, and the majority of those living in absolute poverty (IFPRI, 2007). For these reasons, the international community also places multiple values on substances farming - as a source of food security but also an avenue for economic development.

In terms of framing agriculture in Toledo within the wider theoretical framework in this study, farming and its associated activities can be clearly situated within the Cultural Values Model (Stephenson, 2008). Farming can be identified as a *practice* - the practice of farming itself, but also the human-ecological *practice* of converting material, energy and informational resources into products such as corn and cash-crops. Farming *practice* also gives rise to forms, such as 'milpa' and forest regrowth. *Forms* are identified at varying extents of temporal and spatial delineation. These *forms* and *practices* also give rise to many *relationships* - such as individuals' self-identification as farmers. The temporal nature Toledo's cultural landscapes can also be inferred from interviews and observations. Steinberg, (1999) suggests that the thread of symbolic value associated with corn as a source of life and health can be traced back to classical Maya periods. Although the accuracy of catastrophist theories typified by Diamond (2005) and others are still disputed, there is evidence that historical land-use has altered contemporary landscapes (Dunning, 1999).

5.2.2.2. The perceived role of 'nature'

This leads onto the next theme of discussion - the perceived role of 'nature' in peoples lives. 'Nature' was almost as commonly mentioned a theme as farming, which influenced peoples lives through a wide range of mechanisms. However, exactly what constituted 'nature' is unclear. During the interviews, respondents were asked about their 'surrounding nature', a term that I used because of its intended vagary. This vagary was also partially reflected in respondents opinions - I had the impression that the delineation between farms, secondary regrowth / fallow, and forest was not clear. Indeed, owing to the history of agriculture, it is possible that forested areas proximate to communities are mostly secondary regrowth following historic clearance (Wainright, Jiang & Liu, 2013). The clear delineation between forest and farm that I might identify, as an environmental conservationist, may be a temporally superficial perspective that does not reflect how farmers view their landscape, as a shifting mosaic of farms and forest regrowth. However, differing to my interpretations, Baines (2012a) described clearer classifications of land-use. In Mopan, *k'ux* or "high-bush" (old growth forest) is cleared using slash-and-burn to create fields for planting. *Matahambre* (secondary regrowth) is cleared using a machete (but not often burned), and also used for planting. She finds that informal community rules govern the distribution of communal land, although from my field observations such rules vary significantly between communities. Similarly, she finds that although there is 'best farming practice', such as the length of time between planting cycles, this is not always followed. In this study, the apparently blurred-lines between forests and farms may also be an artefact of the limited exploration of how land types are categorised in Maya communities. Nevertheless, many 'forest' products are gathered from fallow areas, and when asked how often people visited the forest, respondent would sometimes mention going every day, in reference to their farms (hence why the question was excluded from the analysis). This has wider implications for the study. The *relationships*, *practices* and *forms* associated with forests and farms may also be more amorphous than

a static classification of land-uses. Similarly, the management practices used to meets goals and aspirations within different land-uses may be a spectrum of approaches as opposed to clearly distinct practices.

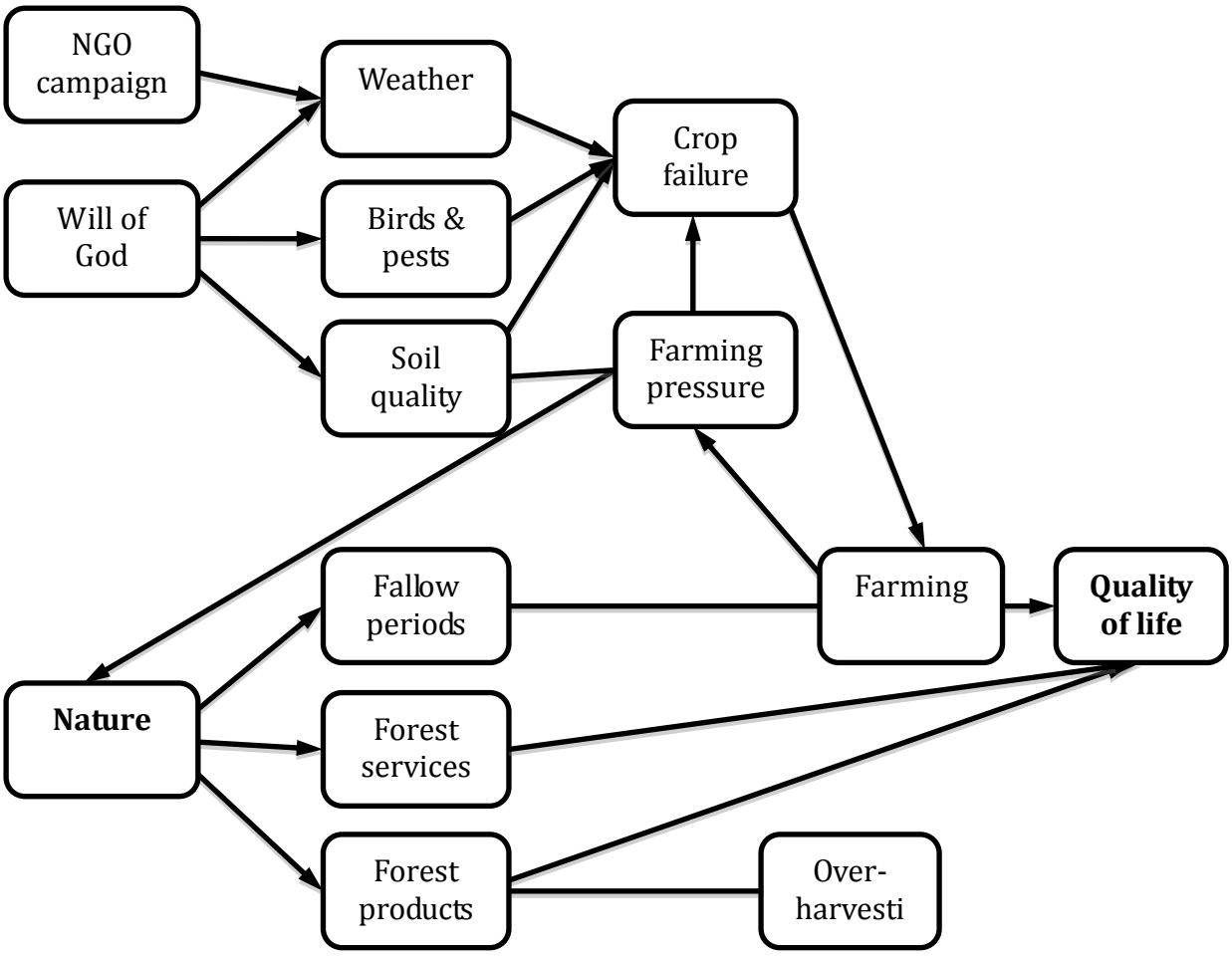

Figure 6 | Conceptual model describing some relationships between 'nature' and quality of life.

Nevertheless, 'nature' was perceived to influence people's quality of life through a number of mechanisms described in Figure 6. Firstly, crop failure was associated with a range of perceived environmental factors. These included changing weather patterns, increased bird populations (that fed on crops) and other crop pests. The divine judgement of God was also cited as a cause of crop failure. In this respect, 'nature' has derived importance through its effects on farming, and ultimately the capacity to meet subsistence and income needs. There appears to be no studies that look at the *contemporary* effects of climate change on southern Belize, and to conclude that

these reported changes in weather patterns are as the result of anthropogenic green house gas emissions would be unsubstantiated at this stage. However, Ramírez et al. (2013) modelled the anticipated effect of climate change on agriculture in southern Belize, estimating declines of between 6% and 20% of maize, beans, and other important crops (2007 baseline, measured in terms of GDP) by 2100. Yet, a number of local NGO's have conducted climate change awareness raising programs, and therefore, farmers may have become more sensitised to perceived changes in weather patterns as a cause of typical levels of crop failure. Nevertheless, crop failure is an important theme within people's lives, as well as the antecedents attributed to it (regardless of if such opinions are shared by agronomists and other 'experts') that are often associated with 'natural' phenomena.

Yet, the relationships between agricultural and natural vegetative cover is bi-directional. Respondents highlighted how increased agricultural pressure was leading to declines in soil quality and ultimately reduced yields. Within rotational systems, fallow periods are critical for restoring soil nutrients and maintaining agricultural productivity (Filho, Adams & Murrieta, 2013). During these fallow periods vegetative regrowth and ecological function enhances soil organic matter, water retention and nutrient content (Tilman et al., 2002). Levasseur & Olivier (2004) identify a wide range of social, institutional, political and economic drivers that encourage shorter fallow periods and expansion of farming into forested areas, in southern Belize. They also highlight the subsequent impact on agricultural yields. Similarly, Baines (2012a) describes farmers' perceptions of changes in agricultural practices, and subsequent impact on productivity. She also discusses farmers' negative sentiments regarding agrochemical inputs, and its perceived impacts of human and ecosystem health.

Forests and fallow areas within shifting rotations were cited as the source of a number of important forest products. These included firewood, bushmeat, materials for constructing

houses, wild fruits, vegetables and other foods, bush medicine and other products. The importance of forest products were also reflected in the surveys, where 83% of respondents reported using mostly or exclusively firewood in cooking, and 76% of respondents reported consuming either wild fruit, game or other foods in the previous month. As well as the nutritional importance of wild harvest products, their consumption appeared to also have cultural significance. For example, hunting and the subsequent consumption were expressly reported as being a component of Maya culture. In a free listing exercise performed by Baines (2012a), wild foods (alongside 'traditional' farm foods) were ranked as the most important factors in health and wellness. Again, the health benefits conveyed through the consumption of forest products were deeply embedded in cultural heritage, and holistic notions of "Mayaness" and wellness. Similarly, although bush medicine, or just "bush", was not mentioned during the interviews, it was apparent from field observations and informal discussions that it was commonly used to treat a range of ailments. Indeed, it was often favoured over alternative medical treatments. For example, during one discussion I was told that survival rates for snakes' bits were much higher when using bush medicine, with an experienced bush doctor, than formal medical treatment. Similarly, Amiguet et al. (2005) used consensus methods across nine traditional healers in Toledo, identifying over 169 plant species that were commonly and consistently used for a range of medical purposes.

Some of these forest products were reported as becoming scarcer in response to increased agricultural pressure. Informal discussions also indicated that overharvesting was leading to declines in the availability of bushmeat and other non-timber forest products. On one hand, using people's perceptions of changing environmental conditions is problematic for a number of reasons. For example, shifting baseline syndrome is a commonly referenced phenomenon where changes in environments are either misremembered by the individual, or imperfectly conveyed across generations (Papworth et al., 2009). On the other hand, this study is centrally interested in

the things that influence people's perceptions of their lives. In this respect, such data might be a poor measure of actual resource abundance, but may be a guide for how people experience perceived environmental changes.

Within the study, the majority of the focus was on human-forest *practices*: the perceived role of ecological processes in agriculture (both positive and negative), as well as the extraction of forest products. Similar to farming, these *practices* represent the intersection of human and natural sub-systems. However, on the human-nature spectrum presented in the Cultural Values Model (Stephenson, 2008), these *practices* are closer to the 'natural' end of the spectrum than farming. The perceived *relationships* with forest *forms* and *practices* were not explored within the study. In this respect, the cultural significant of engaging in *practices* or the opinions about a forest *form* are unclear.

Yet, within many of the studies mentioned in Section 2.4.4. (that claim to be measuring life satisfaction but were actually exploring perceptions) elements that could be classified as *relationships* were perceived to be the most dominant landscape benefits. For example, using the ecosystem service framework, Plieninger et al. (2013b) use participatory mapping exercises and interviews with 93 residents to identify cultural ecosystem services and disservices within a cultural landscape in Saxony, Germany. They found that aesthetic values and social relations (social meeting points) were the most common 'cultural services' linked to landscapes, and were strongly associated with the spatial distribution of landscape features. Larson et al. (2014) explore perceptions of the importance of the Great Barrier Reef in people's lives. They found that aesthetic and representational perceptions of healthy ecosystems were more important than the employment and income associated with the reef. Bieling et al. (2014) found that immaterial values associated with physical aspects of four landscapes in Germany and Austria were perceived to be highly valuable to individuals quality of life.

Within these studies, immaterial landscape values, or *relationships*, were perceived to be important for people's quality of life. Although immaterial values, or *relationships*, are explored in the context of farming, it appeared less dominant in relation to natural *forms* and *practices*. Therefore, it is possible that the importance of *relationships* between natural and human systems is underestimated in these results, or *relationships* with landscapes are more oriented around farming. The contrast between the results of our study, and landscape literature discussed above, could be attributed to the different symbolic position that 'nature' holds within subsistence and industrialised societies.

However, informal discussions and field observations did indicate a wide range of beliefs and values regarding forest. For example, *obeath* sometimes manifested itself in the possession of certain animals, including snakes and bats. When on hunting expeditions, if a hunter saw two monkeys mating then it was considered a sign that their partner was adulterous. Within the deep forest, certain areas were thought to be sacred to forest spirits - anyone trespassing within that area would be sent signals warming them to leave, and may even risk being killed by the 'Sesemite' (a malevolent ape like spirit). Similarly, it appeared to be highly unusual for women to visit the forest, especially alone, with the suggestion that a woman who entered the forest was considered promiscuous. However, these offer only a very superficial glimpse of the potentially wide extent of *relationships* that exist between people and forests, which were not explored in further detail in the study.

5.2.2.3. The perceived roles of health, religion, social-support and gender

Health, religion and social support were also mentioned as frequently as farming during the interviews. Gender was less explicitly mentioned. However, it did appear to permeate across all of the interviews, and therefore is included here. Other themes such as income, age, culture, education and alternative employment were also important but will not be discussed henceforth.

This is because the aspects most relevant to the Research Aim are satisfactorily explored in relation to the themes already discussed.

These factors, although identified as perceived determinants of quality of life, receive less attention than 'farming' and 'nature'. As mentioned at the beginning of Section 5.1.2., this is because they are considered less critical to the ultimate Research Aim of exploring landscapes effects on life satisfaction.

The relationships between health and capacity to work has been discussed in Section 5.1.2.1. However, it is worth reiterating the vicious cycle from poor health, leading to immobility, leading to incapacity to work and harvest sufficient amounts of healthy food, back to increased sickness. This cycle was explored extensively by Baines (2012a). Healthy foods was seen as a form of self-medication in times of sickness; eating certain foods would restore health and strength and others would degrade it. Clearly, another aspect of poor health is the suffering that it causes. Baines (2012a) characterised modern health care provision within San Jose as a foreign imposition, even a medium of neo-colonialism. However, during my informal discussions I had the impression that traditional and modern health care systems were often used in combination, or when one or the other was not able to treat an illness. Traditional medicine has also become institutionalised, with the establishment of the Traditional Healers Association (Waldram, Cal & Maquin, 2009). However, the function of traditional healers was broad, and extended beyond just knowledge about the properties of medicinal plants (Fink, 1987).

Religion was also perceived to be a major determinant of quality of life in a number of ways. It provided a practical and moral framework for living well and through prayer one could improve their life circumstances (indeed, one could not be successful without prayer). The belief that everything happened according to Gods higher purpose provided consolation and other members of religious congregations provided a source of material, emotional and informational

social support. However, during the surveys it also became apparent that not all individuals identified themselves as religious, citing inter-denomination conflict and perceived exploitation as reasons why they did not affiliate with organised religion. Baines (2012a) did not discuss the motivations for people to engage in religious belief, but she did find similar reasons why some individuals chose not to. She describes a number of conversations, where respondents suggest that organised religion was eroding 'traditional' beliefs and ways of living. This sentiment was also reflected by an online article written by an outspoken proponent of "traditional Maya belief", who states "Religion is the most destructive force on our Maya culture in my lifetime" (Saqui, 2015). However, the impression I have is that such sentiments are actually in the minority. Indeed, living and dynamic Maya culture (possibly like all cultures) contains many elements that are in tension - to suggest otherwise would be to imply that Maya culture is a static historic artefact that is being attacked or eroded by outside influences. Goldin & Brent (1991) highlight the rapid adoption of Christianity across Central and Latin America, citing many social and economic drivers of change among Guatemalan Maya. However, the adoption of Christianity in Central America is nothing new, and dates back to the 16th Century (Patch, 2012). Arvigo & Balick (1993) indicate that the majority of bush doctors use a combination of 'traditional' and Christian doctrine in their healing. For these reasons I question the extent that Baines (2012a) segregates Christian religions and Maya 'tradition', since they have comingled for hundreds of years and have amalgamated in many areas.

Social support was perceived to be a very salient feature of lives, mostly derived from family, but also wider social networks. Families, and to a lesser extent wider communities, provided material, financial, emotional and informational support. Such social support appeared to be aligned with the tradition of reciprocity - providing support, such as labour on another's farm, in the

expectation of reciprocated support in the future.[5] There is extensive literature on the role of social networks all over the world. Lack of social support is associated with higher rates of post-natal depression in Pakistan (Rahman, Iqbal & Harrington, 2003). Social capital (an extension of social support applying to groups) was found to significantly correlate with life satisfaction in rural conflict areas of Columbia (Wills-Herrera et al., 2011). Lack of social support in old age was strongly correlated with poverty and unmet basic needs across the 'developing world' (Barrientos, Gorman & Heslop, 2003). Woolcock & Narayan (2000) concludes that understanding and incorporating social support and capital considerations is highly important within development planning. The evidence of the importance of social support for wellbeing is substantial, and operates through a wide variety of mechanisms.

Although gender was rarely explicitly mentioned in the interviews, it appeared that all the themes discussed were gendered. The apparent economic depended of women on men was also observed by others, including Steinberg (2010). However, he also states "Traditional gender roles in which a woman's economic security is totally dependent on her husband's earning potential is also changing with the assistance of outside development agencies" (Steinberg, 2010). Gender modified the relationship with farming and 'nature' in multiple ways. For example, it was uncommon for women to farm or visit forests. Similarly, through field observation and informal discussions it would be rare for men to wash clothes in the river, be involved in cooking, or processing of farm products.

[5] Many studies have noted the existence of reciprocal relationships within 'traditional' societies (extending to human-nature-spirit interactions), often where reciprocation is delayed over long periods of time (Gadgil, & Berkes, 1991). Indeed, there appear to be a wide range of mechanisms for controlling and managing free riders within reciprocal systems (Pomianek et al., 2011). In this respect, systems of social support and reciprocity reinforce often each other (Pomianek et al., 2011).

The literature on gender within rural communities is extensive. Lundgren (1993) describes her experiences of working in Belize between 1984 and 1989, and her conclusions contrasts strongly with Steinberg's (1999) "young women's revolution". Whereas Steinberg (1999) interprets the influxes of capital markets and opportunities for employment as a means by which women develop agency, Lundgren (1993) describes the proletarianisation and control of women by market forces. My observations tend to disagree with Lundgren; employment in rural areas remains highly unindustrialised and is only partially integrated into the market. My impression was that those that had their own sources of income appeared to be more independent of their husbands. Education for both younger men and women provided social and economic mobility. McClusky (2001), in her book "*Here, Our Culture Is Hard": Stories of Domestic Violence from a Mayan Community in Belize*", gives a taste for just how nuanced the relationship between violence, abuse and gendered power dynamic are within Maya communities. When reading her work, it becomes apparent that trying to draw simple conclusions about gendered relationships within Maya society is likely to be misleading.

5.3. Social, economic and demographic factors influencing life satisfaction

The following section focuses on social, demographic and economic factors associated with life satisfaction. In this respect, this section lays the foundations of answering Research Question 2, since it discusses the social, economic and demographic effects in the context of the qualitative evidence. Research Question 2. will be fully explored in Section 5.4.

Each of the social, economic and demographic variables will be discussed in turn, in relation to their respective SWB literature. However, the discussion of each variable will not be extensive, and seeks to build upon the literature discussed in Section 2.2.5. Although each of these effects could also be discussed in terms of *relationships* and *practices* within the Cultural Values Model, this will be omitted for brevity. However, the Cultural Values Model will play a more significant

function in Section 5.4., where the effects of landscape variables on life satisfaction will be explored.

Health and social support were the only two variables within the model that can confidently be said to correlate with life satisfaction. These correlations were positive and relatively large, with those with the highest social support and those in very good health each predicted to report over 20% higher life satisfaction than those that had the lowest social support and very poor health.

These findings are consistent with the majority of literature relating to socials support and life satisfaction. Siedlecki et al. (2014) found that enacted and perceived support were significant correlates of life satisfaction. Enacted social support is the actual support received, be it emotional, informational or material (Barrera, 1986). Perceived support is the anticipation that support would be provided if it were needed, and is consistently positively correlated with life satisfaction (Newsom and Schulz, 1996). The OSS-3 does not specifically identify which type of social support is measured, indicating that a number of dimensions of social support are covered in the instrument (EUPHIX, 2010; Małkowska, Mazur & Woynarowska, 2004). The questions appear to relate to perceived social support, since it inquires about anticipated support in hypothetical situations. However, perceived and enacted social supports are typically strongly correlated (Lakey et al., 2010), and therefore the OSS-3 is also a potential proxy for enacted social support. Engelbrecht (2009) suggests that the strength of the correlation between social support and life satisfaction is stronger in collectivist and poorer countries, and weaker in individualistic and wealthier countries. In 'developed' countries, safety nets such as unemployment benefits, relatively easy access to credit, relative ease of saving, etc. means that individuals can meet their material needs relatively independently of their social networks (Pichler & Wallac, 2007). Conversely, lack of liquidity, poor access to credit and limited civil support mechanisms mean that individuals in 'developing' countries are likely to be much more dependent on their social

networks during times of need (Cattell, 2001). This is also consistent with the findings of this study, where interviewees stress the importance of material and financial support from friends and family during times of need. It appears that as well as acting as important safety nets, having poor social networks actively leads to lower wellbeing, through the experience of witchcraft and *obeath*. A wider consequence of this is that researchers should be mindful of the presence or absence of formal institutional support mechanism (such as developed credit markets) that may substitute social network support.

Self-reported health is a strong predictor of mortality, and therefore is often treated as a useful proxy for general health status (McDowell, 2006; DeSalvo et al., 2010). The clear relationship between health and life satisfaction is also consistent with wider literature (Dolan, Peasgood & White, 2008). The strength of the relationships is reported to be partly a function of time and type of condition, with some acute illness only having temporary effects on life satisfaction, but others such as chronic pain causing sustained periods of lower life satisfaction (Shields & Price, 2005). However, owing to the bi-directional relationships between life satisfaction and health, happy people tend to be healthier, and healthier people tend to be happier (Howell, Kern & Lyubonmirsky, 2007). The interviews indicate that there may be multiple mechanisms that link health and life satisfaction. The most prominent is the relationship between health and work, described in detail by Baines (2012a). Within her study, supported by the results of this study, poor health leads to incapacity to work, and subsequently further poor health. The majority of studies looking at health and life satisfaction have been conducted in developed countries, where formal civil support mechanisms mean that individual are more likely to be able to meet their basic needs in times in poor health. Therefore, it is likely that the effects of poor health on life satisfaction in 'developing' countries is more dependent on informal support mechanisms, such as those provided by friends and family. In absence of this support, health may have a more significant impact on life satisfaction in 'developing' countries than developed countries. Further

research is required to test this hypothesis. Nevertheless, the health-capacity relationship with life satisfaction may be a feature in developing countries, which might otherwise be underestimated if extrapolating results from developed countries.

Age did not have a clear effect on life satisfaction. The so-called 'paradox of ageing' highlights the unexpected stability of life satisfaction in the face of increasing negative life events associated with ageing (Ryff, 1989). Hansen & Slagsvold (2012) suggest that set-point theory accounts for the continual adjustment of expectations as individual age, although this breaks down at very old age. However Swift et al. (2014) suggests that life satisfaction in poorer countries is much more adversely affected by aging than developed countries, as the result of the limited capacity to meet basic needs during ageing. However, within our study this effect is probably accounted for within the social support and health variables. Informal discussion indicate that the majority of people considered as 'poor' by community members, are those that are two old to work and do not have families to help support them. Conversely, those that are either able to continue working into older age (and it appeared that many people would work on their farms in their most senior years) and have families that provide various forms of support are considered to be happy members of society. Therefore, social support and health indicators probably mask the effect of ageing. This also has implications for further research. When seeking to investigate the effects of age on life satisfaction, particularly in 'developing' countries, social support and health effects also need to be considered.

Religiosity, measured in terms of church attendance, did not have a clear effect on life satisfaction. This is not consistent with much of the literature, such as Lim & Putnam (2010); Krause & Bastida (2012) or Greeley and Hout (2006), described in Section 2.2.5. This could be for a multitude of reasons. One reason is simply that frequency of church attendance is a poor proxy for the benefits derived from religion. However, from informal discussions and

observations it did appears that those that considered themselves to be highly religious would attend church frequently. Similarly, those that appeared less concerned with religion did not attend church regularly. Therefore, although certainly imperfect (for example old people might not attend church due to infirmity, regardless of avowed religiosity), I think it is a valid indicator. However, there are two more reasons that appear to be more likely. Firstly, those that are in need of many of the 'benefits' of religion are likely to actively seek it through church attendance. For example, during the interviews individuals would begin attending church convert from one domination to another because of certain problems (such as alcoholism, or 'living badly'), or would pray more intensely when seeking to archive a certain outcome (like recovering health or attaining a desired goal). This may partially explain the lack of significance. Another explanation is that, in this case, religiosity does not in fact change people's life satisfaction, despite it being perceived as important and the evidence of literature in other contexts. On a related note, one of the major benefits of religious service attendance - the provision of social networks - might be masked by the social support variable (Lim & Putnam, 2010). Similarly, some of the ambivalence towards religion (not reflected in the interviews in this study, but potentially revealed by informal discussion) described by Baines (2012a) may also account for the lack of a clear relationship between religion and social support.

Similarly, despite my impression that gender, and associated dynamics, was an important factor in peoples quality of life, it appears that there is no support for this theory in the model. McClusky (2001) highlights just how complex gendered relationships are within Maya communities. Simple sexual dichotomies probably poorly capture the ways that gender, social structures and cultures, orient peoples experience of their quality of life. Many studies find that gender has either no, or only a small, relationships with life satisfaction (e.g. Graham & Chattopadhyay, 2012; Shmotkin, 1990), although such a conclusion is controversial (see Tesch-Römer, Motel-Klingebiel & Tomasik, 2008). However, it may have proved insightful to model the relationship between age

and gender - informal discussions indicated that the rates of suicide were highest among young men. This phenomenon has been found to be highly common more generally. Möller-Leimkühler (2003) suggests that vulnerability among young men may be a consequence of maladaptation of coping strategies based on traditional idealised masculine identities.

Within the study, those that identified themselves as neither Q'eqchi' or Mopan Maya may have also be more likely to report lower levels of life satisfaction than those that identified themselves as Q'eqchi'. However, this cannot be claimed with sufficient certainty. Yet, there is slightly higher certainty that those that identify themselves as Mopan report lower life satisfaction than those that identify as Q'eqchi'. However, there is moderate to low confidence about this conclusion. If we assume that this relationship is an accurate reflection of wider populations then this might lead to a number of conclusions. One conclusion is that there is a cultural difference, which are correlated with ethnic identify, in the ways that people evaluate their life satisfaction. However, during interviews and informal discussions there was no indication that this might be the case. Potentially more likely is that ethnicity is co-correlated with some unmeasured spatial factor. A tentative piece of evidence for this claim is that when re-running the model without spatial variables (which actually leads to much poorer model fit), the size of the effect of ethnicity becomes larger and 'significant' (i.e. >95% CI). Therefore, ethnicity may not have a distinguishable effect on life satisfaction, but the spatial distribution of Mopan communities is also correlated with some other unmeasured landscape factor. Within the literature, much of the focus has been on ethnic minorities, particularly those that have emigrated from their countries of birth. For example, a UK study by the Understanding Society work group found that ethnic minorities tended to report lower life satisfaction than the white majority. Although highly variable, they also found that individuals living within communities of their own ethnicity tended to report higher life satisfaction than those in more diverse communities. They found that both of these effects held when accounting for socio-economic differences between ethnicities

(Institute for Social and Economic Research, 2014). However, De Vroome, & Hooghe (2015) found, among 36,000 respondents in twenty European countries, there was no effect of ethnicity when accounting for socio-economic factors. Yet, within South Africa, Neff (2007) found that when controlling for socio-economic factors there remained a difference in subjective wellbeing between fifteen ethnic groups identified within the study. In summary, there is no consensus of if ethnic identify, often assumed to also correlate with cultural factors, influences subjective wellbeing.

There is lack of convincing evidence that education has an effect on life satisfaction. Although the two were negatively correlated, there was insufficient confidence in this relationship. If it were assumed that there was higher confidence, then the negative effect may be explained by unmet expectations. It could be speculated that those sampled within the communities were the portion of individuals that were unable to find paid employment outside of their communities, and therefore their unmet aspirations (compared to those that did not attend higher education) yielded a negative effect on their life satisfaction. This speculation is partly inspired by Diener (1999) who suggests that more educated people are more distressed when they do not attain goals than less educated people, as the result of different levels of expectation. However, this is speculation and the effect remains unclear. Blanchflower & Oswald (2004) found a positive linear correlation with education and life satisfaction, whereas others (e.g. Stutzer, 2004) found non-linear effects. Ferrer-i-Carbonell (2005) found that education was more important with 'developing' countries, probably because of the increased economic agency associated with it (Graham & Pettinato, 2001). However, since it is likely that only a sub-set of those that attained higher education remained in the communities, and therefore an unequal distribution were sampled, there is a potential availability bias this study. Indeed, individual reported education as being very important for their children's futures, which may indicate that education does lead to greater economic mobility, and subsequently individuals exodus from rural communities. One

interviewee described how his daughter prioritised her education over marriage, and subsequently completed an undergraduate degree. This facilitated her acquisition of a job within a government ministry in the capital, Belmopan. This 'rural brain drain' is common within 'developing' counties (Beine, Docquier & Rapoport, 2008).

5.4. The relationship between landscape elements and self-reported life satisfaction

This section seeks to build on Section 5.3. in answering Research Question 2.

2. What is the strength of the statistical relationship between landscape variables and self-reported life satisfaction, accounting for social, economic and demographic effects?

However, it will discuss the statistical relationship between landscape variables and life satisfaction in the context of the qualitative evidence discussed in Section 5.1. It will do so drawing on both the Cultural Values Model and SWB literature. In doing so, this section also seeks to explore the overall Research Aim:

- To empirically explore the relationship between landscape elements and individuals self-reported life satisfaction, within Maya communities of southern Belize.

However, before discussing the results of the model in light of the qualitative evidence it is worth re-iterating the proposed causal interface between the Cultural Values Model and life satisfaction frameworks, described in Section 2.4.3.

As described above, the integrated framework begins from the suggestion that *forms*, *relationships*, and *practices* emerge from complex hierarchical socio-ecological systems, including its temporal dimensions (Liu et al. 2007; Neveh, 2000). Individuals, by definition, experience these *forms*, *relationships*, and *practices* (Stephenson, 2008). They are of value because of the 'cultural' function that they fulfil (e.g. basic needs fulfilment is valued in many cultures). In this respect, using a broad interpretation of 'want' and 'need' (which also includes eudaimonic 'wants'), they can act as want and need satisfiers. The fulfilment of wants and needs allows individuals to attain goals,

aspirations or desired life conditions (King, Renó & Novo, 2014). Fulfilment of these aspirations modifies cognitive evaluations of life satisfaction (although it is recognised that this process is highly modified by cognitive devices, personality traits and normative pressures) (Cummins, Lau & Davern, 2012). Individuals' life satisfaction, in turn, forms a component of SWB, alongside positive and negative affect (Diener et al., 1999). SWB provides an alternative measure by which decisions makers, such as those involved in integrated landscape management, may set objectives, activities and means of evaluation (Brereton, Clinch & Ferreira, 2008)).

It is also useful to highlight that this statistical model primarily measures life satisfaction at the margin - the observations associated with *differences* in landscape variables, not their absolute importance. This marginality is temporal as well as physical. It is those most recent changes or effects that are expected to register in differences in life satisfaction, owing to the phenomena described in 'set-point theory' and shifting baseline syndrome (Cummins, Lau & Davern, 2012; Papworth et al., 2009). It is also worth remembering the limitations of using a highly reductionist statistical model to attempt to describe the effects of complex adaptive socio-ecological systems, such as landscapes (Nevah, 2001). Nevertheless, as a prescriptive science that recognises the utility of embracing elements related to complex social cultural, economic and biological systems, such reductionism may still be useful within integrated landscape management. Since this study is applying a pragmatic knowledge claim position, usefulness is exactly the matrix by which the conclusions are evaluated and valued (Creswell, 2002).

The qualitative component of the study, reinforced by the work of Baines (2012a & 2011) and others, highlights the dynamic interactions between farming, farms and forests. The *practices*, *relationships* and *forms* described here are only a small sub-set of those that could have been explored. Indeed, Section 5.2. explores *practices* and *relationships* within cultural landscapes, each of which could have been the focus of extensive study in their own right. However, it appears from

observations and interviews that the most salient landscape *forms* are forests and agricultural cover - they are also by far the largest land-uses within Toledo, by area. Although other landscape *forms*, such as roads, rivers, protected areas, villages, fences, pastures, etc., could have been included in the analysis, they did not appear to be as core to peoples lives as the interplay between agriculture and forests. Similarly, the interaction between landscape and social, demographic and economic variables would have probably revealed some very interesting insights. However, on a practice note, including these variables would have over fitted an already parameter heavy model. For these reasons the discussion of the results must be made in the awareness that the model seeks to be parsimonious (and therefore statistically valid) as well as a useful approximation of cultural landscape systems.

The following discussion will proceed through the agricultural cover and agricultural pressure spatial variables. The 'farming household' variable is included here, and not in Section 5.2., since it is a critical landscape *practice* alongside the spatial variable *forms*. Following the general discussion of agriculture (although it will touch on the forest cover variables), the discussion will move onto the forest loss and forest cover variables. Although the focus will be the quantitative component, this discussion will draw strongly on the proceeding qualitative results and discussions.

5.4.1. Agricultural forms, practices and relationships

Agricultural cover, a *form* within the landscape, did not have a clear effect on life satisfaction (<90% CI). This appears controversial in light of the qualitative results of the survey, which suggested that greater agricultural *forms* would be correlated with valued agriculture *practice* and *relationship* benefits. These include the importance of farming for subsistence, income, and identity. Baines (2012a) highlighted the importance of agriculture as a practice embedded in traditional ecological heritage. She argues that alignment to this traditional ecological heritage is

an important part of wellness and 'Mayaness' in Maya communities. Levasseur & Olivier (2004), Wilk (1984) and Steinberg (1999 & 2010) all emphasize the importance of farming *practice* as a source of nutrition, income and cultural continuity. However, Steinberg (1999 & 2010) and Wilk (1984) also underscore how this varies across generations, and how market economies interact with differing farming *practices*. It is reasonable to assume that farmers engage in agriculture as a means of satisfying wants and needs. The satisfaction of these wants and needs could be expected to influence life satisfaction (Emmons, 2003). Assuming these assumptions are correct, the evidence provided within the interviews would suggest that areas with high agricultural cover also yield higher levels of need satisfaction. Yet, the results of the model do not reflect this.

There are a number of possible reasons why agricultural cover does not appear to influence life satisfaction. Firstly, this study employs community levels spatial characteristic to understand individual level life satisfaction. Yet, the study does not use a per capita measure of agricultural cover. Therefore, extent of agricultural cover might be linearly correlated with community population and subsequently not reflect the per capita effects of agricultural cover on life satisfaction. However, when re-running the model with all spatial variables calculated per capita, the effect of agricultural cover remained inconclusive (<90% CI), although the effect size did increase. (Similarly, the other spatial variables do not significantly change and the model fit was very similar, with a ΔAIC <2. This is probably because, apart from the outliers Tambran and Na Lum Ka, community populations were reasonably similar. Even if there were significant differences, it would violate the philosophical assumptions of information theoretic approaches to perform *post hoc* model adjustment.)

A second explanation may be that agricultural *form* is not linearly associated with agricultural output. For an individual, it is assumed that planting more leads to roughly proportionately higher yields. However, between communities, other factors such as soil quality or type of

agricultural practices may be a more important determinant of agricultural productivity. As a result, the capacity for agricultural productivity to fulfil individuals' aspirations might be more influenced by other factors aside from area under cultivation (this will be discussed more in relation to the agricultural pressure variable). As a consequence, agricultural area may be less relevant than agricultural 'quality'.

A third reason could relate to the nature of wellbeing homeostasis (Cummins, Lau & Davern, 2012). Since the effects of life events generally diminish over time, as individuals revert back towards their 'set-point' (Tomyn, Weinberg & Cummins, 2014), it may only be those recent changes in agricultural cover that yield clear impact on life satisfaction. However, one major challenge to this is that chronic incapacity to meet basic needs has been found to affect life satisfaction. Ryan & Deci (2001) describes how those that live in chronic poverty consistently report lower life satisfaction. Many survey respondents (28.3%) reported that they were unable to meet nutritional needs from their main occupation (farming or other). However, this measure is biased against those that meet their needs through multiple activities or mechanisms. Interviews suggest that one of those mechanisms may be social support. Therefore, the social support variable may account for some of the variation that would have been described the by farming landscape variable.

However, a fourth reason may relate to the ambivalent position that agriculture may hold in Maya communities. This theory is partially contradictory to some of the interview material, although supported by other. The potential partial bias towards the importance of farming in peoples lives, as a result of a biased interview sample, has already been discussed. However, evidence provided by Wilk (1984) and Steinberg (1999 & 2010), as well as informal discussions and observations, suggest that the significance of farming may only hold for those engaged in the *practice*. As discussed in Section 5.2., there are many reasons why individuals may choose not to engage in

farming *practice*. The opinions expressed by the farmers, about the superiority of farming over alternative livelihoods, may hold only within farming circles. Those that are willing and able to engage in non-farming activities may do so to fulfil goals and aspirations through other mechanisms. Indeed, interviews viewed education as a means by which children could leave rural areas and find (superior) paid employment. Accordingly, the expressed importance of farming as an axis by which rural Maya cultures revolve may need to be placed in the context of capability constraints on engaging in other livelihoods.

I suggest that this ambivalence towards farming may explain why 'farming household' was not a significant correlate of life satisfaction. Another reason why 'farming household' was not significant could be explained by 'set-point' theory (Tomyn, Weinberg & Cummins, 2014). Only recent transitions between farming and non-farming livelihoods are likely to yield an effect on life satisfaction, as individuals adapt to life conditions.

Although I am not aware of any papers looking at the relationship between spatial characteristics of agricultural on life satisfaction, a number of studies have looked at SWB and life satisfaction in rural parts of 'developing countries'. Davey, Chen & Lau (2009) used the Personal Wellbeing Index (a means of measuring SWB across a number of life domains) to measuring SWB with a rural Chinese community. They found that reported levels of SWB were comparable to those found in urban areas. According to Davey, Chen & Lau (2009), although the rural community was less economically developed, interviews indicated that basic needs were generally met, and therefore differences in income were less likely to generate a significant difference in SWB. Additionally, they suggest that it is the relative life conditions among peers, as opposed to absolute life conditions, that are likely to influence life satisfaction, as suggested by social comparison theory (Diener et al., 2009). However, I suggest that these results should be treated with caution since the reported internal consistency of the Personal Wellbeing Index was very

low (a Cronbach's alpha of between 0.19 and 0.45, below the 0.70 threshold often used). Within this study, social-comparisons might also be expected to affect the way that farming and non-farming livelihoods influence life satisfaction, according to the degree of livelihood heterogeneity within communities.

Masferrer-Dodas et al. (2012) explored the effects of commodity consumption on the SWB of 600 participants in a foraging-horticultural society in the Bolivian Amazon. They found no significant relationship between expenditures on market goods (consumable commodities) and SWB, when controlling for household and community characteristics. However, they also note a number of limitations within their study, which curb confidence in the conclusions. One conclusion was that success in subsistence activities, and quality of social relations, was more important for SWB than consumption behaviour. Although the 'best' model within this study did not include measures of wealth or basic needs fulfilment (since these variables reduced the explanatory power of the model), social support was strongly correlated with life satisfaction. Similarly, interviews indicated that skills in farming, as a subsistence and non-subsistence activity, were associated with a good life. An appropriate measure of the role of farming in Maya communities might relate to preserved farming ability and success.

Väth, Gobien & Kirk (2014) compare the reported life satisfaction of 824 contract and non-contract farmers in Ghana, accounting for social, economic and demographic factors. They found that contract farmers reported around 15% high life satisfaction than independent farmers ($p<0.01$). They attribute this difference to the increased security associated with contract farming (or secure property rights). This security allowed farmers to make more confident investments and reduced their vulnerability to commodity market volatility (Väth, Gobien & Kirk, 2014). However, it appeared that their study assumed a causal relationship between property rights and other variables such as wealth. However, I believe the direction of causality is questionable;

economic and social agency may have been a factor in securing farming contracts, as well as the other way around. Within this study, the potential role of land tenure in life satisfaction was not research in detail.

In contrast to agricultural cover and engagement in farming, agricultural pressure appeared to have a more substantial effect on life satisfaction. Although only moderately confident about the effect, there appeared to be a strong negative relationship between agricultural pressure and life satisfaction. This may indicate that 'quality' of agriculture, and not 'quantity' (agricultural cover), is an important determinant of want and needs fulfilment, and ultimately life satisfaction. Interviewees attributed declines in soil quality to increased agricultural pressure. Crop failure, as the result of poor soils (and other factors), was cited as a major challenge to wellbeing. This suggests that the observed relationship between agricultural pressure and lower life satisfaction is valid.

One possible cause for why agricultural pressure (and not agricultural cover) has a potential affect on life satisfaction arises from differences in expectations before and after planting. I suggest that planting area is determined *a priori* according to a function of anticipated food and income needs, within the constraints of labour, capital and other inputs (Ellis, 1993). In other words, agricultural effort is determined according a heuristic estimation of required yields in light of scarce inputs. However, there is substantial evidence that people perform poorly in estimating probabilities and often systematically overestimate the likelihood of success (Brunnermeier & Parker, 2005). In subsistence contexts, this anticipated yield may be close to the threshold of subsistence needs (indeed, the fact that people sometimes harvest insufficient amounts to meet their nutritional needs indicates that this is the case). Successful harvests mean that individuals are able to meet and exceed their subsistence requirements. However, unsuccessful harvests may limit the capacity of households to meet basic needs (without buying food or relying on social support). The

negative life satisfaction effect of failing to meet basic needs is likely to far outweigh the positive life satisfaction effects of being able to generate additional income from a successful harvest (consistent with findings by Howell & Howell, 2008; Hinks & Davies, 2008; Copestake et al. 2009). However, agricultural pressure could not only degrade soil quality, but also destabilise wider agricultural systems integrity, such as the presence of natural pest predators (Pretty, 2008; Scherr & McNeely, 2008; Stocking, 2003). Generally, degraded landscapes are more prone to crop failure (Cassman, 1999). As a result, following crop failure, the increased likelihood of being unable to meet basic needs is likely to yield a significant negative effect on life satisfaction. Similarly, the *fear* or concern of being unable to meet basic needs, within landscapes of lower systems integrity or stability may also yield a negative effect on life satisfaction. In these respects, agricultural pressure is more likely, than absolute agricultural extent, to capture landscape characteristics that influence agricultural yield and productive stability. Alem & Colmer (2014) model effects of atmospheric parameters on life satisfaction in rural Ethiopia, finding a significant negative association between climate variability, consumption and life satisfaction. Inadequate credit markets and agricultural insurance heighten vulnerability to such risks (as is the case in southern Belize (Ministry of Agriculture & Fisheries, 2003)).

One challenge to this theory could be raised; if this were the case, then agricultural extent would positively correlate with life satisfaction. However, since the agricultural pressure variable is a function of both extent of agricultural land and intensity of use, it may provide a more accurate measure of the capacity of agricultural areas to fulfil subsistence and income functions. Additionally, the agricultural cover variable does not account for differences in risk, in the way that the agricultural pressure variable might.

Subsistence livelihoods can often exist on the margin of transitory poverty, and agriculture in degraded landscapes is innately risky (FAO, 2011; Eswaran, Lal & Reich, 2001). Subsistence

communities in Toledo appear to be no different, with the Halcrow Group (2010) suggesting that 56% of inhabitants are unable to routinely meet minimum calorific requirements necessary for healthy. The capacity of farmers to buffer against agricultural risk, through multiple risk management strategies, is often limited by economic, institutional and social capital (Ellis, 1993). Crop failure has characteristics that suggest it may influence life satisfaction - it can be an acute livelihood 'shock' and directly compromise capacity to meet basic needs. The increased risk associated with farming in degraded landscapes appear to be one plausible explanation for why agricultural pressure (and not agricultural extent) is correlated with life satisfaction.

Although there is limited evidence for this conclusion, it does add weight to the importance of agricultural risk management. Agricultural risk management has been long recognised as being critical, especially in light of environmental and climatic changes (Cervantes-Godoy, Kimura & Antón, 2013). However, these results might also highlight how life satisfaction - people's experience of their quality of life - might be vulnerable to agricultural risks. Indeed, it may also indicate that risk management is a greater priority than increasing absolute agricultural output, when considering how individuals experience the quality of their lives. Although this is a tantalising conclusion, there is insufficient evidence to be able to claim this with confidence. However, Väth, Gobien & Kirk's (2014) comparisons of life satisfaction among 824 contract and non-contract farmers in Ghana, could be considered consistent with this theory. Within their study, there was a significant positive correlation between the security offered by contract farming and life satisfaction. Similarly, Caria & Falco (2013) found that the risk of poverty has a large and significant negative correlation with life satisfaction (accounting for income effects) of the urban poor in Ghana. Using a matched behavioural experiment they find that that respondents were significantly loss-averse. Loss and risk aversion are often considered characteristics of subsistence existences, especially among those at risk of transitory or chronic poverty (Ellis, 1993).

At a wider systems level, agricultural *practice* and *form* may be linked through a positive feedback relationship, similar to the one described by Liu et al. (2007) in Kenya. Increasing agricultural pressure (as the result of increasing desire for income or raising populations) may lead to shorter fallow periods and/or expansion onto marginal land. This in turn could lead to declines in soil quality, and subsequently reduced yield (depending on management practices). This reduced production could encourage further agricultural pressure to maintain desired yield, creating a 'vicious circle' of agricultural degradation. Such 'tragedy of the commons' phenomena are often referenced (and often contested) in these cases (Scherr, 2000). It appears that the influx of migrants from neighbouring Guatemala and Honduras, and historic appropriation of land by external agents, appear to have destabilised 'traditional' communal land rights regimes. This may change in light of the recent Maya Customary Lands Rights case, recently heard at the Caribbean Court of Justice. Among other things, the case granted land ownership rights to communities, and requires the government to consult with them before issuing concessions for resource exploitation.

5.4.2. Forest forms, practices and relationships

Forest loss between 2012 and 2014 was not an important determinant of life satisfaction. There is an estimated positive relationship between recent forest loss and life satisfaction, but the confidence in this effect is minimal. If there was greater confidence in the relationship, a number of possible explanations could be offered. The most salient explanation could be that disforestation is typically performed to clear land for agricultural. Recent conversion to agricultural would increase the *practices* and *relationships* associated with agricultural *forms*. Recent conversion, and its associated *practices* and *relationships*, are more likely to register in reported life satisfaction, than historical agricultural cover. This is because recent changes in life conditions, associated with agricultural *practices* and *relationships*, may lead to a positive departure from

individuals' baseline life satisfaction, whereas older changes are likely to have been adapted to (Tomyn, Weinberg & Cummins, 2014). This is one possible theory that might have been expected based on the theoretical framework. However, since the effect was not statistically convincing (<90% CI), this remains speculation.

One possible reasons why this effect was not significant is that effects between 2012 and 2014 may have been to old too register as significant in terms of life satisfaction - individuals life satisfaction may have already reverted towards their 'set-point' (Tomyn, Weinberg & Cummins, 2014). Another explanation is that observed forest changes follow historic trends, and as a result, do not represent deviations from 'normal' trends. If deforestation rates are considered as consistent, the *practices* and *relationships* supported by increasing agricultural *forms* may not yield any additional effect on capacity to meet aspirations, beyond what was expected (consistent with Michalos, 1985). However, there is insufficient evidence to be able to adequately explain the observed results. Therefore, such conclusions may highlight areas for future research, but in themselves do not offer convincing conclusions.

Total forest cover was found to strongly negatively correlate with life satisfaction. However, there is only moderate confidence about this result (>90% CI). One explanation could be that areas with very high forest cover (as high as 97.5%) are also likely to have very low agricultural cover, and therefore, such areas generate less agricultural benefits. However, if this were the case then agricultural cover might be expected to have a more significant effect in the model. However, the relationship between agricultural cover and forest cover is only partially correlated; high rates of forest cover do not necessarily mean low rates of agricultural cover. Therefore, it is likely that there are other dimensions that link forest cover to life satisfaction (assuming they are associated).

One potential explanation for the negative correlation between life satisfaction and forest cover stems from a consideration of the type of forest found around communities. Communities such as Tambran and Median Bank have high forest cover compared to other communities. Most of this forest cover is within protected areas. These protected areas are essentially off-limits to the public (Meerman et al., 2005). Within Sen's capabilities approach, people's wellbeing is partly determined by the economic and social agency they possess (Sen, 1999). Prohibited access to resources within protected areas may limit individuals' agency to engage in important *practices* such as farming, hunting or collecting forest products (Borrini-Feyerabend, Kothari & Oviedo, 2004). Therefore, the forest cover variable may actually be a proxy for agency in pursuing important *practices* with, and within, landscapes. During the interviews, no opinions were expressed about the role of protected areas or private lands in people's wellbeing. However, during informal discussions, especially in communities such as Golden Stream and Tambran, negative sentiments were expressed about the lack of access to areas that were considered within the rights of Maya peoples (also reflected in Baines, 2012b). However, there remains a lack of evidence to substantiate this theory.

Another potentially more viable explanation for the possible negative relationship between forest cover and life satisfaction, is that forest cover is co-correlated with other important but unmeasured factors. Drawing on field observations, potentially the most important of these unmeasured factors relates to the relationship between how 'developed' a community is, and its history of land-use within an area. The communities of Tambran, Medina Bank, Aquacate, Na Lum Ka and Crique Jute have the highest levels of forest cover in the sample (all exceeding 90%). Out of the total sample, these communities generally share a number of characteristics; they are smaller than average community sizes, generally less connected to municipal utilities and/or remoter, and appear to have less secure land tenure. The recency and size of the communities might be co-correlated with a) lack of amenities, b) inadequate land tenure and, c)

limited recent forest clearance (as indicated through inspection of forest cover values). Therefore, if having limited access to amenities and/or limited transport connectivity, and poor land tenure yields an effect on life satisfaction, then it is possible that forest cover is partially masking these, and similar, effects. Nonetheless, yet again there is insufficient evidence from the interviews or informal discussions to support this potential hypothesis.

However, potentially the most interesting aspect of the results was the *lack* of a positive relationship between life satisfaction and forest cover. A huge range of literature describes the value of ecosystem services for human wellbeing (MA, 2005; Haines-Young & Potschin, 2009, Daw et al., 2011). Using the ecosystem services framework, a number of scholars argue that the value of intact and functioning ecosystems often exceeds the value of simplified alternative land-uses (such as agriculture) (Balmford et al., 2002; Nelson et al., 2009). The Millennium Ecosystem Assessment's (2005) report '*Ecosystems Services and Human wellbeing*' highlights the importance of ecosystems according to an objective view of wellbeing - i.e. how ecosystems fulfil important normatively endorsed functions. Yet, it also highlights the seemingly paradoxical situation where human welfare has increased, despite declines in ecosystem services. During the interviews, the *perceived* importance of forests as a source of firewood, game, wild foods, bush medicine, etc., were apparent. Theoretically, when situating these results within the ecosystem service framework, it might be expected that respondents in areas with greater forest cover and, by extension, potential for ecosystem services provisioning, might report higher levels of life satisfaction. However, this was not the case - indeed, the opposite is suggested. The lack of evidence to suggest that ecosystems are correlated to *subjective* life satisfaction raises some interesting questions about 'ecosystems services and human wellbeing'. Firstly, it suggests that *objective* and *subjective* relationships between ecosystems and wellbeing are not necessarily the same. This could be the result of the many cognitive factors that mediate individuals' experience of their life conditions. Secondly, building on the first point, it suggests that a more nuanced

definition of wellbeing needs to be employed when using the term. It challenges decisions makers to ask questions such as 'what aspect of wellbeing are we interested in: wellbeing measured by society or subjectively experienced by the individual?' The types of policy responses may be very different depending on the chosen wellbeing outcome. However, clearly the case for such claims would need to be substantiated with further evidence, potentially using other SWB measurement methods, longitudinal data with appropriate counterfactuals, and within more 'disrupted' landscapes.

Raudsepp-Hearne et al. (2010) underscore how environmentalists have claimed that ecosystem degradation leads to declines in wellbeing (as measured in objective terms). However, they highlight the paradox identified by the Millennium Ecosystem Assessment (2005) - globally, objective wellbeing appears to increase despite global declines in ecosystem services (although this overall trend obscures important local variation). They present four explanations, synthesised from the literature, to explain this paradox. Firstly, that wellbeing has not been measured correctly, and in fact wellbeing is declining. Secondly, food production from agro-ecological systems is more important than other ecosystem services, and therefore increasing food production outweighs the loss of other services, in terms of wellbeing. Third, human wellbeing has been decoupled from ecosystem by technological innovation. Fourth, there is a time-lag between ecosystem service degradation and its impact on wellbeing. Synthesising a wide range of evidence, they conclude that the first explanation is not supported at a global scale - human wellbeing is not declining globally. (Yet, they highlight that ecosystem service degradation has lead to local declines in wellbeing). However, they find more support for the remaining three explanations. Human wellbeing has increased as the result of positive trade-offs between increasing food production in agro-ecosystems, at the cost of declines in other ecosystem services. However, these global trends mask significant local variation - in some areas, the gains afforded by increased food production are outweighed by losses in other services. Technology

has increased the benefits extracted from modified ecosystems, but human wellbeing is not decoupled from natural systems. Finally, there are many potential time-lags associated with ecosystem degradation, whose effect on wellbeing remains unclear. These results partially explain the observed paradox between declining ecosystem service health and human wellbeing. (Raudsepp-Hearne et al., 2010).

Raudsepp-Hearne et al. (2010) only consider objective measures of wellbeing. However, similar mechanisms could be suggested for why those in more deforested areas report higher levels of life satisfaction (>90% CI) than those in more 'intact' landscapes. Explanations two and four appear to be particularly relevant here. Firstly, the importance of food production within agro-ecosystems appear to outweigh the value of intact ecosystems - individuals are motivated to convert forest *forms* to agricultural *forms* as a means of generating important agricultural *practices* and *relationships*. Secondly, loss of ecosystems, as the result of agricultural pressure, may have a lag effect on wellbeing. The fact that agricultural pressure might (>90% CI) be associated with declines in wellbeing, indicates that short term benefits of (intensive) agriculture land-use can lead to long term declines in wellbeing, at a community level.

6. Conclusions: landscapes and life satisfaction

The rapid adoption of SWB measures, within development and economic theory and practice, lead Austin to suggest that "Policy fetishism about GDP is being replaced by an unthinking devotion to simplistic happiness indicators" (Austin, 2015). Indeed, there appears to be surprisingly little critical discussion of the political, ethical and social implications of using SWB to guide policy, beyond relatively trivial discussion of pitfalls in interpretation and issues that could apply across national indicators (e.g. Bache & Reardon, 2014; Austin, 2015; Spencer, 2014). However, Kenny & Kenny (2011) suggests that, although conceptually valid, the remarkable stability of SWB at aggregate levels means it is insensitive to policy interventions. Therefore, Kenny & Kenny suggests it is a 'blunt' guide for policy decisions (at least in the short term). Similarly, they also argue that if policy is guided by SWB measures, some normatively valued areas of policy might be overlooked. This raises the issue of potentially competing primacy between what society deems important, and what is identified as important using SWB measures, in policy making. Indeed, many ethically and morally motivated policies may not be considered of value according to a subjective wellbeing lens.

Nevertheless, within this study it appears that factors that are amenable to policy intervention, such as health, social support or land-use, may influence life satisfaction. Additionally, promoters of SWB in policy discourse often argue that such measures complement, not substitute, existing indicators. In this way, policy can be guided by a more balanced and holistic account of wellbeing without necessarily displacing more conventional approaches.[6]

[6] Exactly what these 'conventional approaches' are is contestable. Best practice in national accounts of wellbeing includes a much broader spectrum of indicators, beyond traditional measures such as GDP or Gini coefficients. It could be argued that measures such as the Human

These topics have been explored in the realm of national development planning and indicators (e.g. Clark & Fischer, 2011; Dolan, Layard & Metcalfe, 2011). However, this thesis is principally interested in the potential role of SWB theory and practice in sub-national integrated landscape management. Vemuri & Opdam (2014) suggest that there is a need for approaches for generating a "value-based vision on landscape adaptation that contributes to all wellbeing dimensions", emphasising the important of subjective accounts of wellbeing. This study contributes to this project by empirically exploring the relationship between landscape elements and individuals self-reported life satisfaction, within Maya communities of southern Belize.

A number of key points can be drawn from the study, regarding this Research Aim. Firstly, there is reasonable confidence that there is indeed a relationship between landscape elements and life satisfaction (as a component of SWB). Secondly, degradation of landscapes, and resultant changes in landscape function, may lead to declines in life satisfaction. Third, the 'environmentalists paradox', where ecosystem loss is not universally correlated with declines in objective wellbeing, and its potential explanations provided by Raudsepp-Hearne et al. (2010), may hold for subjective accounts of wellbeing.

These conclusions have possible implications for integrated landscape management. Firstly, it highlights the potential importance of distinguishing between subjective and objectively measured wellbeing, when choosing approaches to enhance quality of life. Secondly, it indicates that simple narratives linking land-use (such as forests or agriculture) and subjectively experienced wellbeing are likely to be misleading. Thirdly, I believe it highlights potentially fruitful lines of future research. For example, the configuration of 'landscape services' provided by land-use mosaics may have a stronger relationship with life satisfaction than the absolute extent of any particular

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Development Index capture much more of the contextual conditions that influence quality of life, and in light of the wide adoption of these measures, SWB measures are not needed.

land-use. Assuming that SWB is a valid subject within integrated landscape management, it may prove useful to explore how peoples' experienced life satisfaction varies across combinations of landscape gradients, and changes over time. Similarly, agricultural risk management may be further prioritised if agricultural vulnerability was found to be a significant determinant of life satisfaction (the loss aversion often attributed to subsistence households may support this suggestion).

However, this study was exploratory. The validity of integrating the Cultural Values Model, as a means of understanding cultural landscapes, and the SWB framework requires further study. A number of conceptual challenges with reconciling the ontological and epistemological assumptions of the framework remain. For example, within the statistical analysis it was assumed that each type of landscape cover has the *potential* to offer the same services across all participants. However, within the Cultural Landscapes Model, the unique worldview of individuals mean that the same landscape feature may fulfil very different, and non-comparable, functions. Additionally, it is unclear if the SWB framework resonates with non-western cosmologies, such as those of Maya peoples. In this respect, the 'expert' lead, and non-participative approach towards conceptualising SWB, may not align with the Cultural Values Model, which stresses the importance of collective identification of landscape elements.

Nevertheless, I believe this study provides some potentially useful insights for the management of landscapes within the Toledo District, and more generally. Below are a number of comments that may be relevant for Ya'axché, in its mission of "Harmony between nature and human development for the benefit of both!"

- It is feasible that (presently) the protection of ecosystems may not enhance the experienced wellbeing of community members (e.g. through the supply of 'ecosystem services'). As such, it should not be uncritically assumed that protected areas management is enhancing the wellbeing of residents. However, the results could

indicate that protected areas management helps avoid future losses in life satisfaction associated with unsustainable land-use practices.

- Agriculture may potentially be more important for community members experienced wellbeing that forest cover, in the current land-use context. However, this relationship might be expected to change if future forest loss is associated with increased agricultural pressure, reduced agro-ecological systems integrity, and ultimately reduced yield and increased crop failure. Similarly, the observed relationship between land-uses and life satisfaction may also obscure important lag effects. (Indeed, those areas with the highest rate of agricultural pressure may also have had the longest (recent) history of intensive land-use, and as a result, whose system dynamics may have transitioned into a regime (or 'basin of attraction', in systems language) that has lower and more volatile agricultural yield.)
- Therefore, I suggest that Ya'axché should continue its efforts to promote sustainable agricultural practices, but also consider means of increasing access and use of protected forests, in a sustainable manner. Similarly, Ya'axché may also consider more participatory management of protected areas, to manage negative outcomes associated with limiting individuals' landscape interactions.
- Ya'axché should also be aware of the interaction between different life domains, such as health, social support, and religion, within cultural landscapes. Management interventions may influence life satisfaction through a wide range of mechanisms. For example, restricting or otherwise 'disrupting' traditional agricultural practice, with its associated role in identity and cultural continuity, may impact wellness and 'Mayaness' in unanticipated ways.

This serves more of a means of illustrating a practical application of these results, than conclusive recommendations. However, it does highlight how this research may be of applied use within wider integrated landscape management.

More generally, distinguishing between objective and subjective measures of wellbeing within integrated landscape management appears to provide a number of benefits. Firstly, measuring effects of differences in landscape conditions, or changes in those landscape conditions, according to their manifest effects on life satisfaction may provide a 'universal currency' by which

different land-use options can be compared. In other words, bundles of non-market elements that are often challenging to quantify, such as 'cultural ecosystem services', could be valued according to their effects on life satisfaction, as a common criteria of comparison. However, the relationship between landscape elements and life satisfaction are unlikely to be linear: a mosaic of land-uses, fulfilling different 'life satisfaction services' may be more important than the absolute extent of any single land-use. Secondly, if subjective experiences of wellbeing are recognised as valid targets for policy action, then integrated landscape management policy could be better guided by the complementary use of objective and subjective measures. Thirdly, exploring the subjective wellbeing effects of different land-uses may offer additional insights into existing landscape discourse. For example, if the 'environmentalists paradox' was also reflected in subjective wellbeing then it may challenge environmental thinkers to critically evaluate dominant rationales for environmental protection from new perspectives.

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Mr. Cal, Kenny. Community Outreach and Livelihoods Director, Ya'axché Conservation Trust. Informal interview. Punta Gorda, 3rd February, 2015.

Appendix I: Interview guide

"Thank you for participating in this interview. Within this interview we are interested in learning about your thoughts and opinions about what is important in a good life. This interview will help us understand people's opinions about what contributes to a good life in Toledo. I am also conducting this interview with other people in your community. Before we start I would like to tell you a few things. This interview is for a research project conducted for the Central European University in Europe. All information we collect during the interview will be kept anonymous and confidential, and will be mixed with others data so you will not be identifiable. If there are any topics that you do not feel comfortable discussing then please tell us. There is no obligation to participate in the interview. We cannot offer any compensation and this research will not lead to any project here in Belize. This interview has nothing to do with law enforcement or taxation and the information you provide will be kept confidential.

The interview may take around one hour, but of course you are free to stop at any point. Please feel free to ask questions at any point during. Do you have any questions before we start? Can we please record the interview, so we can remember your words correctly? (If yes: if there is anything that you do not want recorded then please tell us). Can we please continue the interview with you? We are mainly interested in your opinions and ideas about what makes a good life, and we have a few questions that we wanted to start with:"

Themes	*Guiding questions*	*Possible follow-up questions*
What is a good life?	• What is a good life?	• What do you think makes a happy or good life?
	• What makes people unhappy with their life?	• What can make a life less good?
	• Is there anything you want to do in the future that might change your life?	
Income and wealth	• In your opinion, how does your income influence your life and the things you want to do?	
Social support	• How do your family and friends affect how happy you are in life? • How do your family and friends support you to do the things you want to do?	• How does your family make you happy or sad?
Physical health	• How does health affect how happy people are in their lives?	• How does your health status affect your life?
Religion	• Does religion affect your life and how?	• Are you religious? How does your religion influence how you feel about your life?
Marital status	• What is your marital status? • Would you feel differently about your life if your marital status was different? How?	• How did it make you feel when you married / divorced / when you partner died? • How long did you feel like this?
Occupations	• Apart from the money you earn, does your occupation influence your life? How?	
Education	• How many years did you spend in school? • Do you think that education affects how happy people are in their lives and how?	
Nature	• Does the surrounding nature, including the forests, rivers and the things your get from nature, affect your life? How? • Have you seen any changes to the nature around your community since you were younger? • How do you think these changes have affected people's lives?	
Other	• Do you think there are other important things to think about when considering what makes life good? What are they?	

Do you have any questions you would like to ask?			
Age	Gender	Number of dependents	Community

Appendix II: Survey (English)

Introduction: My name is _____. Thank you for giving me the opportunity to talk to you. I wanted to talk to you because I am interested in understanding people's quality of life in Maya communities. I would like to ask you a number of questions that will help me understand what influences your life. I am also conducting this survey with other people in your community. Before we start I would like to tell you a few things. This survey is for a research project conducted for the Central European University in Europe. All information we collect during the survey will be kept anonymous and confidential, and will be mixed with others data so you will not be identifiable. If there are any questions that you do not feel comfortable responding to then please tell us. There is no obligation to answer any of these questions. We cannot offer any compensation and this research will not lead to any project here in Belize. This survey has nothing to do with law enforcement or taxation and the answers you provide will be kept confidential. The survey may take around 15 minuets but of course you are free to stop at any point. Please feel free to ask questions at any point during the survey. Do you have any questions before we start? Can we please continue the interview with you?

Respondent #: R	Community:	Date:	Time:	Gender: M/F

1. What is your age? _____

2. What is your ethnic background? Queq'chi / Mopan / Spanish / Other (_____)

3. Who is the head of your household? You / Partner / Sibling / Grandparents - parents / Other (_____)

4. Marital status: Single / Married / Widow or widower / Divorced / Other (_____)

5. How many people does the head of your household support? _____

6. What is your occupation? Farmer / Farmer + other / Hunting / Housewife / Farmer + housewife / Basket weaving + housewife / Housewife + other / Other (_____)

(Does anyone in your household farm?)

6a. (IF FARMING HOUSEHOLD) In the last month, from your households farm do you get: Not always enough to eat / Enough to eat / Enough to eat and sell?

6b. (IF FARMING HOUSEHOLD) How many acres of land is your household currently working? _____

6c. (IF FARMING HOUSEHOLD) How many acres of land does your household have access to? _____

6d. (IF NON-FARMING HOUSEHOLD) In the last month, from your work do you earn: Not always enough to buy all your food / Enough to buy all your food / Enough to buy all your food and save?

7. During the last two weeks did your friends or family assist you in your work? Yes / No

8. Please look at this ladder (show visual scale). I would like to read out five statements in turn and I would like you to show me which step of the ladder best describes your answerer. (Whilst indicating steps) the first step of the ladder is strongly disagree (1), the next step is slightly disagree (2), the middle step is

neither disagree nor agree (3), the next is slightly agree (4) and the top step is strongly agree (5). Do you understand? (Read statements and record indicated response.)

_____ In most ways my life is close to my ideal. (PROMPT: In most ways my life is how I want it to be)
_____ The conditions of my life are excellent. (PROMPT: The things/ways in my life are excellent)
_____ I am satisfied with my life.
_____ So far I have gotten the important things I want in life. (PROMPT: So far I have achieved the things I want to do in life.)
_____ If I could live my life over, I would change almost nothing.

9. I am also interested in learning about your health. How would you rate your general health status? Would you say it was: Very good / Quite good / Neither good nor poor / Quite poor / or Very poor?

10. I am interested in learning about some of the things that you have in your house. Can you tell me:

What type of floor do you have: Concrete / Wood / Bare / Other (_____)
What are your walls made from: Concrete or block / Wood / Other (_____)
What is your roof made from: Cement / Zinc or tin / Thatch / Other (_____)
For cooking do you use: Just gas / Mostly gas but sometimes wood / Mostly wood but sometimes gas /
Just wood / Other (_____)
Where do you get your main drinking water: Well / Pipe / River, steam or creek / Other (_____)
Does your household own your own vehicle? Yes / No
How many bicycles does your household own? _____
Do you have a radio? Yes / No
How many rooms for sleeping do you have in your house? _____
Does your household own a chainsaw? Yes / No
Does your household own a lawn mower or weed eater? Yes / No

11. How many years did you attend school? _____

12a. How many children of school age do you have in your household? _____
12b. (IF >0) How many of them attend school? _____

13a. Are you religious? Yes / No
13b. (IF YES) During the last two weeks how often did you visit church? 5 or more times a week / 3-4 times a week / 1-2 times a week / Once in the two weeks / I go less than once a month / I never go to church.

14a. How many people are so close to you that you can count on them if you have serious problems? None / 1-2 / 3-5 / 6 or more
14b. How much concern do people show in what you are doing? A lot of concern / Some concern / Uncertain / Little concern / No concern
14c. How easy can you get practical help from neighbours if you should need it? Very easy / Easy / Possible / Difficult / Very difficult

15. During the last two weeks how many times did you have game meat or wild fish? _____

16. During the last two weeks how often did you go into the forest? 5 or more times in a week / 3-4 times in a week / 1-2 in a week / Once in the two weeks / I go once a month or less / I never go to the forest.

17. During the last two weeks did you use:

Firewood? Yes / No
Bush medicine? Yes / No
Wild fruit? Yes / No
Game meat? Yes / No
Other wild foods? Yes (_____) / No
Wood for building? Yes / No
Thatch? Yes / No
Materials for crafts? Yes / No
Enjoyment from the forest? Yes / No
Anything else from the forest? Yes (_____) / No

Mas batiox acue nak xac'am a jonal chintenk'anquil riq'uin li moloc caux ain. Ut nacuaj cuichic xy'ehbal acue nak ma ani oc re chi naoc re ain chi moco ta nauman ani qui jec'oc re li caux ain. Ut malaj cuan ta put junak chic li taapatz malaj a y'ehom? Mas bantiox acue re la jonal.

(CONTACT: (+501) 629 5390 or thomas.pienkowski@mespom.eu).

Appendix III: Survey (Q'uiché)

Introduction: Inc'ab'a lain aj _____ Bantiox acue xquehbal injonal re nak tinaatinak acuiquin. Qui julac chicuu aatinac aaquiq'uin xban nak mas najulac chicuu xtaubal ru chanru nak eb li cristiaan nequextau ru xch'ina usal li yuam sa' xc'alebaal eb. Nacuaj raj xpatz'bal cuib oxib chi us patzomj li ta tenk'ank cue chi xtaubal ru c'aru na uxmanc sa' la y'uam. Yoquin chix banunquil li moloc na'leb ain riquineb ecomoneb sa' c'alebaal ain. Chiru nak tkayoob nacuaj xyeebal acue ain. Li moloc naaleb ain, ain jun c'anjel quik'e' cue re tinbanu re li tzol leb Central European University se' Europe. Chixjunil li c'a'uxlaal takamol ain ma ani oc re chi naoc re chi moco texnau ani quiyehoc re. Cui cuan patz'om reheb ain inc'a sa ach'ool xsumenquil malaj inc'a nacacuaj xsumenquil naru ajcui tay'e ke banu usilal. Moco cuan ta xtentoquil nak tesume chijunil eb li patz'om ain. Moco ockex ta re kac'ajcomohom ut moco xic ta re li caux ut na'leb ain re junak ch'uut/project arin se Belis. Li chak'rab ut eb laj titz'ol toj mac'a re riquin li moloc na'leb ain ut li sumenc teq'ue ma ani oc re chi naoc re. Mare oc re ka c'amom o'laju menuut abanan jon nocoa xakab atyaal jok'e. Ut jon nacat ru chi patzoc atyaal jok'e nak yok'o chi aatinac. Maraj cuan ut pat'om acuiquin chiru nak' tkayoob? Ma jon naka choy ru patzoc?

---

1. Jarub hab'at? _____

2. C'aru aacostuumbr acüatinobal? K'ek'chi'/ Maay mopan / Español / C'a chic ru (_____)

3. Ani xjolomil ajun cab'al? La'at / Acuochbeen / Alalb'ej / yucuabejeb - yucuachinbejeb / Canabanbil / C'a chic ru (_____)

4. Chanru cuancat chac'uibil: Ajunes / Sumsu / Xma'al malaj Canajenak / C'a chic ru (_____)

5. Jarub chi cristiaan naca / neque c'ac'ale sa' e jun cab'al? _____ (PROMPT: how many people do you look after in your family?)

6. C'aru nacabanu / aac'anjel? Aj c'alenel / Aj c'alenel ut c'a chic ru / Aj muntyaar / Ixakilbej / Aj c'alenel ut ixakilbej / Tz'uluc chacach ut ixakilbej / Ixakilb'ej ut c'a chic ru / C'a' chic ru (_____)

6a. (CUI AJ C'ALENEL A JUN CABAL) Sa' li po quinume', ma cuan xa xxoc: Moco tzakal ta re ka cua / Tzakal re ka cua/ Tzakal re ka cua ut re tka cay'i?
6b. (CUI AJ C'ALENEL A JUN CABAL) Jarub aacr la ch'och' y'ocat chixc'anjelanquil ru? _____
6c. (CUI AJ C'ALENEL A JUN CABAL) Jarub aacr chixjunil ch'och cuan re tac'anjela ru? _____
6d. (CUI INC'A' AJ C'ALENEL A JUN CABAL) Sa' chak li po xnume', sa' la c'anjel jarub xab'aanu: Moco tzakal ta re ta lok' chixjunil acua / Tzakal re ta lok' chixjunil a cua/ Tzakal re ta lok' a cua ut re tat c'uulank?

7. Sa' chak li cuib xamaan ma xate' xtenk'a eb a cuamiig ut la comoneb? Heh he'/ Inc'a

8. B'anu usilal il chi us a caleer ain (C'UT LI HU CUAN CUI). Nacuaj rajlanquil ob chi yehoc ut nacuaj raj nak te c'ut chi cuu b'ar re xtaklebaalil li caleer tzakal naxc'ut na tauliman li ta sume. (Y'OKAT XC'UTBAL LI CALEER) li xb'enil taklebaalil li caleer a'an tzakal moco naxc'ul ta ach'ool (1), lix cabil taklebaal a'an bayak nak inc'a' naxc'ul inch'ol (2), sa' xy'i takleb'aal a'an moco naxc'ul ta a ch'ool chi moco naxc'ul a ch'ool (3), li xcahil taklebaal a'an bayak naxc'ul a ch'ool (4), ut li rela' takleb'aal chi tzuul a'an tzakal naxc'ul a ch'ool (5). Ma xatau ru? (Ajla li yehom ut chap chiru hu lix sumehom)

_____ Nab'al bar nak inyu'am a'an chan ru nak nacuaj
_____ Lix cuanco'jic inyuam kaxal chab'il'
_____ C'ojc'o inch'ool riq'uin iny'uam.
_____ Chalen anakcuan cuan cue li mas ajel ru sa iny'uam.
_____ Cui ta raj tiny'oob cui chic inyuam, jo' ta li mac'a raj chic tinjal ru xbanunquil.

9. Ut nacuaj ajcui naoc chirix a cacuilal. Chan raj ru ty'e jo cacuil at? Ma jon nacay'e nak: Mas chabil / Yal chabil / Mocochabil ta chimoco y'ibru / Yal yi'b'ru / Mas y'ib'ru?

10. Ut nacuaj ajcui chi cūu naoc chirix li c'aru cuan sa cuochoch. Ma hon nacay'e cue:

Chan ru xsa' acuochoch ma: Tzac / Taabl / Ch'och' / Ca' chic ru (_____)
Chan ru xcuukil/rix acuochoch ma: Tzac / Che' / C'a' chic ru (_____)
C'aru xb'ehen acuochoch ma: Tzac / Simb / k'im / C'a' chic ru (_____)
Re chikoc c'aru naca cuusari ma: Junes cas / Junes cas jok'e hak si' / Junes si' jok'e hak cas / Junes si' / C'a' chic ru (_____)
Bar nequetau eruc'a': Cumb'- pump / Payp / Nima', coc' ha, ut rok ha' / C'a' chi ru (_____)
Ma cuan e b'e leb'aal ch'ich'? Heh he' / Inc'a'
Jarub chi b'ajlak ch'ich' cuan sa jun cab'al? _____
Ma cuan a raay sa'la cuochoch ? Heh he' / Inc'a'
Jarub chi rakb sa cuochoch cuan re cuarib'aal? _____
Ma cuan e powosa? Heh he' / Inc'a
Ma cuan e c'aleel pach'aya' chiquinbil malaj yal chapb'il? Heh he' / Inc'a

11. Jarub hab xat cuanco' se' tzoleb? _____

12a. Jarubeb ecoc'al cuan sa' xhabil re xic se' escuel? _____
12b. (CUI CUAN) Jarub reheb e coc'al y'oqueb chi tzoloc?_____

13a. Ma nacat paaban? Heh he' / Inc'a
13b. (CUI JOCAN) Re chak li cuib xamaan jarub sut xat juulac chak se' iglees? Oob sut re xamaan / Oxib malaj cahib sut re xamaan / Jun sut ca' sut re xamaan / Jun sut re cuib xamaan / Nin xic jok'e hak chiru jun po / Ma jun sut naquin xic.

14a. Jarub poyanam mas nach' cuanqueb acuiq'in bar cui hon nacat ru chixpatzbal a tenk' cui cuancat sa' junak nimla cha'ajquilal? Ma jun / Jun ut cuib / Oxib ut oob / Cuak'ib ut mas.
14b. Jo' quehal nequex c'ut chacuu eb li poyanam riquin chixjunil li nacabanu? Nabal nequexy'e / Bayak nequexy'e / Moco ch'olch'o ta / Cach'in nequexy'e / Mac'a nequexy'e.

14c. Jo k'unil hon nacatau a tenk' riq'uin eb a cuech cabaleb? Mas k'un / K'un / Hoon / Cau / Mas cau.

15. Re chak li cuib xamaan jarub sut xat c'uxuc xtib'el xul malaj car se ha'? _____

16. Re chak li cuib xamaan jarub sut xat julak chak se' q'uiche'? Oob sut ut mas chiru jun xamaan / Oxib ut cahib sut chiru jun xamaan / Jun sut cuib sut chiru jun xamaan / Ninxic jun sutak chiru jun po / Moco ninxic ta se' q'uiche'.

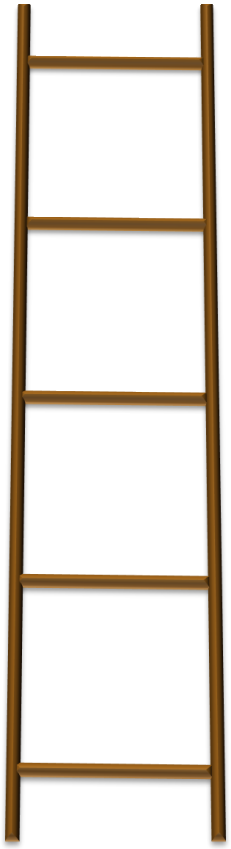
17. Re chak li cuib xamaan ma xat usarinc

Si'? Heh he' / Inc'a'
Pim re b'an? Heh he' / Inc'a'
Q'uiche' ru acuimk? Heh he' / Inc'a'
Chib' xul? Heh he' / Inc'a'
C'a chic chi q'uiche' cuahil? Heh he' (_____) / Inc'a'
Che' re cablac? Heh he' / Inc'a'
K'im? Heh he' / Inc'a'
Li c'aru nausariman re banunc c'ay? Heh he' / Inc'a'
Xsahilal li naxq'ue li q'uiche'? Heh he' / Inc'a'
C'a'atk chic ru se' q'uiche'? Heh he' (_____) / Inc'a'

Mas batiox acue nak xac'am a jonal chintenk'anquil riq'uin li moloc caux ain. Ut nacuaj cuichic xy'ehbal acue nak ma ani oc re chi naoc re ain chi moco ta nauman ani qui jec'oc re li caux ain. If you would like to contact me at thomas.pienkowski@mespom.eu (HAND OVER CONTACT DETAILS SLIP). Ut malaj cuan ta put junak chic li taapatz malaj a y'ehom? Mas bantiox acue re la jonal.

Appendix IV: Visual aid - ladder (Q'uiché)

SWLS visual aid



Tzakal naxc'ul ach'ool

Bayak naxc'ul ach'ool

Naxc'ul ta ach'ool chi moco naxc'ul ach'ool

Inch'ool bayak

Naxc'ul ta ach'ool