Engendering Ecosystem Services
for Urban Transformation:
The Role of Natural Capital in
Reducing Poverty and
Building Resilient Urban Communities

Sarah Bradshaw and Brian Linneker,

with Nilo Nascimento, Indira Nahomi Viana Caballero, Heloisa Costa, Yumi Oki,

Rogério Brittes W. Pires, Meri Juntti, Lian Lundy, Rebecca Wade

UK ESRC Project Report

January 2017

Contents

1. Introduction

The Millennium Ecosystem Assessment (MEA, 2005) recognises a number of concerns in the relationship between human development and ecosystem services. People are integral parts of ecosystems, and a dynamic interactive relationship exists between human activity and ecosystems, with changing human activity driving ecosystem changes, and ecosystem changes causing changes in people's well-being. Ecosystems have rapidly changed over the last 50 years, largely to meet growing demands for related services such as food, water, timber, fibre, and fuel. Human demands on ecosystem services (ES) has resulted in a substantial and largely irreversible loss in the diversity of species on the planet. The challenge of reversing the degradation of ecosystems while meeting increasing demands for their services may involve significant changes in policies, institutions, and practices for the management of ecosystems. The MEA notes the pattern of 'winners' and 'losers' associated with ecosystem changes has not been adequately taken into account in management decisions, in particular the impact of these changes on poor people, women, and indigenous peoples.

Degradation of ecosystem services are often being borne disproportionately by the poor, women, and indigenous peoples, and are contributing to growing inequities and disparities across groups of people, and are sometimes the principal factor causing poverty, conflicts, or the migration of refugees in developing countries. Growing urbanisation and climate change present further important challenges for the future, and how urban development is undertaken and managed has implications for present and future wellbeing. However, cities can be planned and built to ensure sustainability for people and planet and ES can be used to improve wellbeing and reduce poverty. The MEA suggests the notion of ES encapsulates the dynamic processes through which natural capital when mobilised, provides a range of services, goods and benefits that are critical to sustaining life e.g. oxygen, food, water, recreational and psychological benefits. Ecosystem Services frameworks allow us to conceptualise environmental functions as an explicit link between natural capital and human wellbeing.

This report focusses on how natural capital and its associated ecosystem services (ES) can be understood within the context of the urban environment. It focuses on how different ES can be incorporated into sustainable urban development and planning, as a natural asset that can reduce peoples risk and vulnerability, and improve their wellbeing.

This research aims to highlight how natural capital based ES can be seen as an 'asset', which can improve the well-being of communities, and the women and men, girls and boys that live within them.

It draws on existing findings about how environmental assets such as parks, street trees, water features and private gardens can contribute to human well-being, applied to the Brazilian context through an exploratory study centred in Nova Contagem, a peripheral suburb of Belo Horizonte.

The study explores:
- How people understand what the environment is, and how they value, or not, different types of urban environmental assets
- The ecosystem services and dis-services they derive from the natural environment
- How environmental assets interact with other assets to improve well being

The premise of the study is that access to urban environmental assets and the ecosystem services they provide, is not equal for all within a community or a household, and in particular women and men, will have different access to these and other assets. The study provides insights into:
- Differences in women and men's understandings of the environment and its potential for improving well being
- Differences in women and men's access to environmental assets and the ecosystem services they may provide
- Actions that could be taken to improve gender equality of access to ecosystem services

Section Two of the report considers some theoretical frameworks and key terminology relating to natural capital assets, ES and human well-being. Section Three considers the case study area and its rapid urban expansion and development. The methodology is presented in Section Four while the potential ecosystem services in the study area are presented in Section Five. Section Six presents the research results on how people actually use, and relate to their natural environment from a gender perspective. Section Seven presents some conclusions and recommendations on what local authorities and community organisations can do to ensure that the existing environmental assets are valued and protected and the beneficial services are maximised and made accessible to all, while the dis-services are minimised.

2. Frameworks and Key Terminology

Over recent years more attention has been paid to the relationship between the planet and people. On the one hand the threats raised by rapid urbanisation and climate change to livelihoods and wellbeing has led to a renewed interest in how to protect the natural environment, and to adapt to change. On the other hand, there has been recognition that the natural environment can be an asset in the fight against poverty and to improve people's wellbeing.

There is a large literature on human wellbeing and what this might mean (see McGillivray and Clarke, 2006; UNDP 2007). In environmental justice literature wellbeing is used to refer to the ability of individuals to fulfil their needs or even more broadly, the ability of individuals to lead the kind of lives in which they find meaning and happiness (Edwards et al 2016). But this raises questions about the meaning of happiness and highlights how wellbeing is a highly subjective notion. This project views environmental assets as having the potential for improving people's wellbeing. This could be through lessening risks of events that cause harm, such as landslides and floods, or through being able to exercise in a local park or able to enjoy seeing flowering plants there. This is not to say people should exercise, but that people understand the potential benefits and have the potential to enjoy these benefits if they so wish. Wellbeing is then about people being able to make informed choice to improve their own lives.

Within the discussion of poverty and wellbeing a number of frameworks have been developed that seek to incorporate the environment as an asset. In the environmental literature there have also been attempts to provide frameworks that allow a better understanding of how nature interacts with other social processes and the idea of 'ecosystem services' is one such framing. However, the discussions often occur in parallel, among different groups of people, and while each recognises the other, the links are not well developed. In this project, what we have tried to do is integrate two frameworks – one developmental and one environmental – and also to include a 'gender' perspective – that is to make sure that any differences between men and women are recognised within these framings. The different approaches and frameworks are presented below.

2.1 Assets and capitals

The terms assets and 'capitals' are often used interchangeably or sometimes the term 'capital assets' is used. While initially referring to income flows produced from financial capital, other capitals have been recognised - such as human capital, arising from investment in education or health, and social capital, arising from investing time in building

up assets such as networks and friendships on which you can draw when things are difficult. The idea is that stocks of capital can be changed through investment. Investment and disinvestment can change the size of capital assets and affects the flow of benefits over time. Understanding nature as a 'capital' comprising of 'assets' recognises that the environment can provide opportunities for investment that will yield benefits in the future, for example through planting a tree to harvest fruit. However, natural capital is often a public good, such as the atmosphere or biodiversity, which yields more intangible benefits such as oxygenating the planet.

Clearly different people will have access to a mix of different stocks of capital assets, and varying combinations of assets will produce differing levels of wellbeing. The UK Department for International Development (DFID) have used the idea of an 'assets pentagon' to express this, with the length of each 'side' of the pentagon varying according to the stocks of that capital an individual has.

Figure 1 - DFID's Capital Asset Pentagon
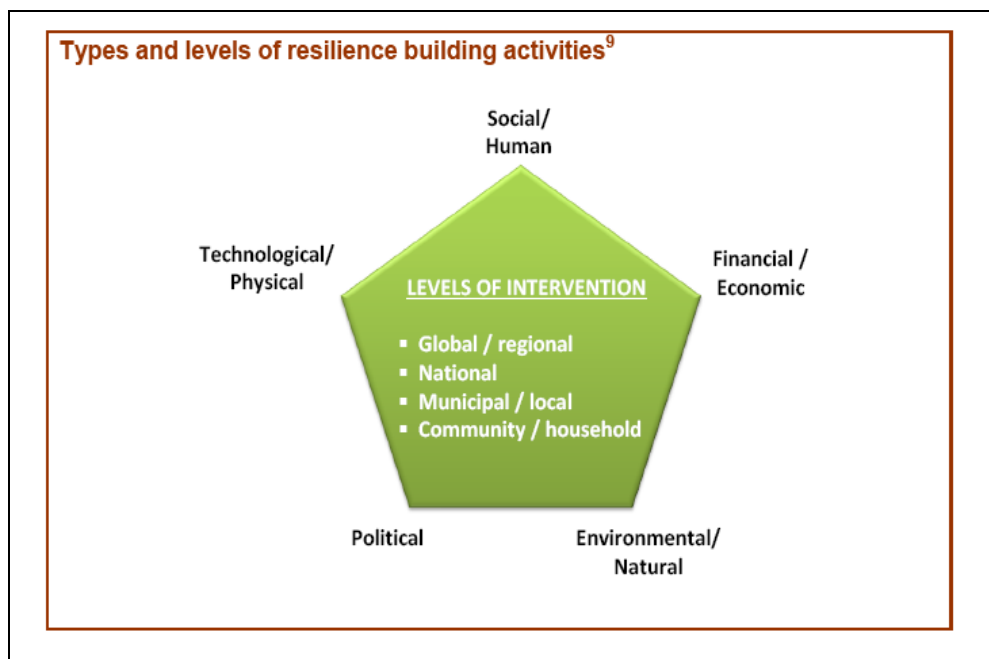
Source: UK Department for International Development (DFID, 1999)

While natural/environmental assets are included in this and other asset frameworks, often rather than focus on the services derived from natural assets, instead the poverty alleviation discourse tends to construct nature as risk. A DFID fact sheet for example notes "Many of the shocks that devastate the livelihoods of the poor are themselves natural processes that destroy natural capital (e.g. fires that destroy forests, floods and earthquakes that destroy agricultural land)". Nature then, and particularly in the climate change discourse, is often

constructed as producing vulnerabilities as opposed to an environmental perspective which perceives nature as the source of multiple benefits (e.g. food, fuel, clean air and water) on which we all depend.

Assets are useful in helping understand how people cope with poverty and reduce vulnerability and some models focus more on the transformative nature of assets (see Moser 2016). 'Transformation' in social science literature refers to changes in relations of power and access to resources that improve the ability of individuals (or households / communities) to independently make choices that contribute to wellbeing and/or experienced quality of life (Edwards et al. 2016). Positive transformations are therefore portrayed as the most sustainable form of poverty alleviation. This kind of transformative capacity depends on access to and ability to engage with a range of social, economic, physical and natural assets, but is also mediated by institutional factors and processes and individual perceptions and social norms such as those conditioning men's and women's roles and activities.

Figure 2 - Moser's Capital Assets Framework
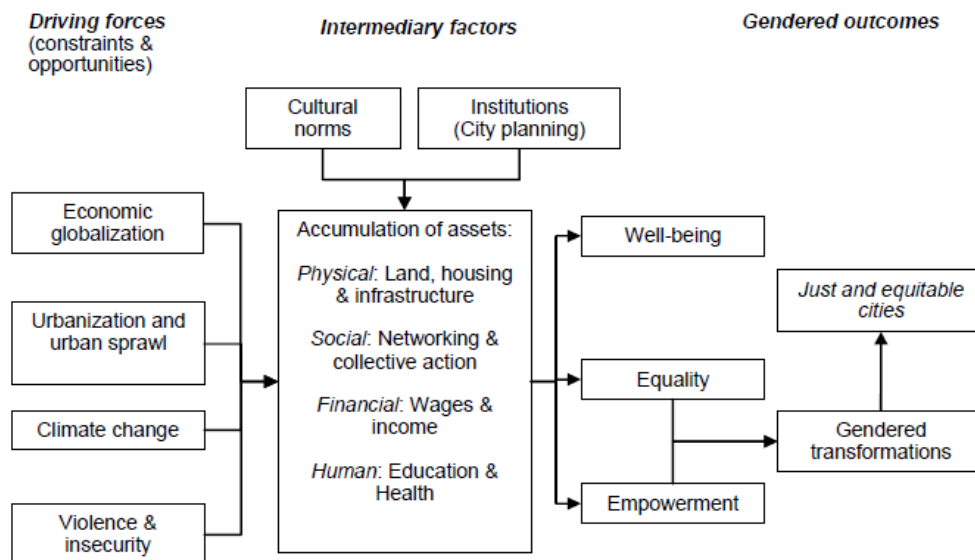
Figure 1: Gender asset accumulation pathways to empowerment and transformation

Source: Moser, C.O (2014) Gender, Asset Building and Just Cities. Briefing Paper WUF7 Networking Event
http://hummedia.manchester.ac.uk/schools/seed/gurc/working_papers/briefingpapers/GURC_BP6.pdf

Moser's Capital Asset Framework (Figure 2) focuses on assets for urban transformation, and is another useful framework through which to understand the role of assets in improving wellbeing – here not just looking at wellbeing of individuals, but also the role of assets in

wider societal processes such as constructing more just cities and improving gender equality.

While the environment is recognised in asset frameworks for poverty alleviation it is often the least developed of all the asset categories. Similarly, recent poverty measures that have moved away from only focussing on income to include multidimensional indicators of wellbeing incorporate a range of assets (see Alkire et al, 2014; Alkire and Foster, 2011; Alkire and Santos, 2010). While these measures could include environmental assets, they generally do not (although see Bader et al. 2016; Wisor et al 2014) and if they do include the environment it is as a 'risk' to wellbeing rather than an asset to improve wellbeing. This study focusses on how the urban environment can be understood and sustainably managed as an asset that reduces risk and vulnerability.

Outside of the poverty discourse advancements have been made in better understandings the potential goods and services that can be gained from the environment, and these has been termed 'Ecosystem Services' (ES).

2.2 Ecosystem services

The MEA (2005) considers the benefits provided by nature to people, and our current impact on the ability of nature to continue to deliver these benefits, through an ecosystem services (ES) framework. The MEA identifies four key categories of ES as follows:

- Supporting services e.g. nutrient cycling, oxygen production and soil formation
- Provisioning services e.g. fuel, food, water
- Regulating services e.g. climate regulation, water purification and flood protection
- Cultural services e.g. education, recreation and aesthetic value

These services can be derived from different land covers such as green spaces (the countryside, public parks and private gardens) or from blue spaces (such as lakes and streams). There are also grey/green spaces and this term is here used to suggest a more urbanised or 'built environment' such as a public square which has little vegetation but could still potentially provide some ES.

Early ES models often assumed the existence of natural resources means the ecosystem services they deliver exist by default (e.g. the services-cascade model of Haines-Young and Potschin, 2009), but more recent models have refined this view (see Figure 3). They recognise that 'service providing units' such as a tree or forest, can generate 'ecosystem

service potentials' such as producing harvestable products, but unless the benefits of this service (e.g. a fruit) are 'mobilised', in this case actually accessed and consumed, then the tree is not delivering an ecosystem service to individuals or groups of individuals. As mobilising ES potentials involves issues of access and control, then clearly not all people will have equality of access to, and control over, ES within communities, or indeed within households. Mobilisation' of ES also requires motivation – the willingness to undertake exercise or gardening activities for example, and subjective perceptions of identity, capability and knowledge, all of which are gendered also play a role in ES mobilisation. Different people will have different motives and capacities for 'appropriation' of and thus different capabilities to benefit from existing natural capital or 'biophysical structures'. However, there may be ES dis-benefits also, for example, when leaves fall from a tree they can block drains or become slippery when wet or instead of recreational opportunity, a nearby park can be perceived as providing opportunity for antisocial behaviour and crime. The last stage in most ecosystem service models is often the most controversial – commercialisation of the service generated. While harvesting fruit to sell at market clearly generates exchange value some are wary at attempts to put a price on natural assets more generally, and on the more intangible benefits they may bring. They are concerned that putting a market value on a local green space, for example, may lead to charging for access to it, or may be used to justify its sale for urban development.

Figure 3 - Linking the flow of ecosystem services from nature to experienced environmental quality
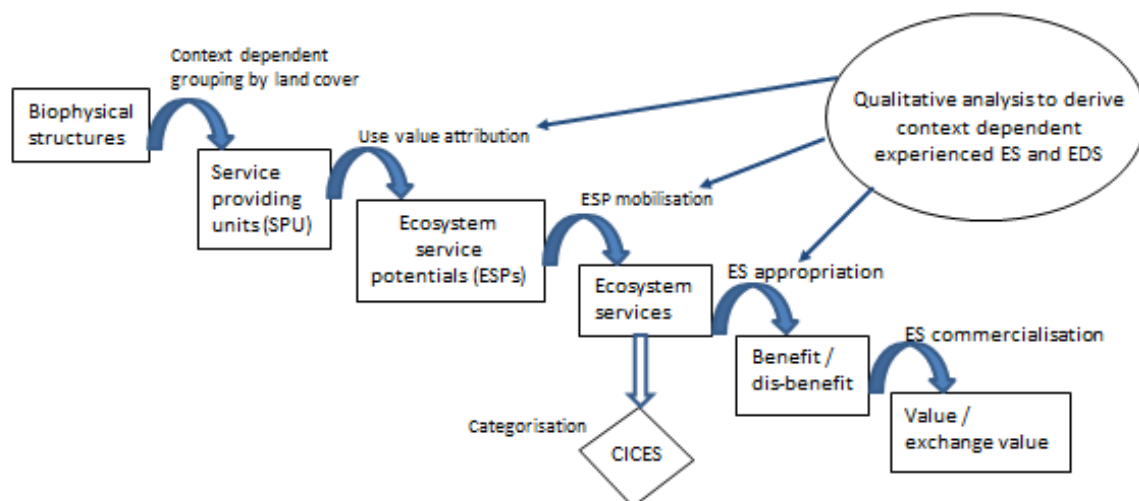
Source: Juntti and Lundy (Forthcoming), adapted from Spangenberg et al. (2014) 'The ecosystem service cascade' Ecological Economics, 104, 22- 32.

While ES then can help advance how we understand the natural environment as an asset or capital, there is clearly a lot to take into consideration about how it is mobilised particularly in

an urban development context. However, while the natural environment provides the potential to bring benefits to all people, to date little attention has been given to who can or cannot access ES, and why, including lack of consideration of gendered experiences of ES.

2.3 Gender differences

Since the 1990s there has been recognition that poverty 'wears a woman's face' (UNDP 1980). Women are assumed to be poorer than men for a number of reasons, that can be summarised as the fact that women are less able to change work into income, income into decision making, and less likely to make decisions to improve their own wellbeing rather than the wellbeing of others (Bradshaw 2002).

Lack of income, combined with social norms that give women less voice in the home mean that they have less access to, and control over, household resources and over the life course, men may accumulate more assets than women, and the assets accumulated may differ between men and women, and be used differently (Ahmed et al 2011; Kumar and Quisumbing 2010; Moser 2016; Munro et al 2014). However, while research exists on gendered differences in financial, human, social and political capitals, and increasingly around technological capital, there is less known about gendered differences in access to and control over environmental assets, and how these interact with other assets and capitals to promote well-being. This project addresses this gap in knowledge.

In general, those who write about gender and the environment have tended to present women as closer to nature, and in part this rests on the fact women give birth and are 'naturally' more attuned to the environment - the idea of 'mother nature'. As they are also seen to be 'naturally' more caring, so they are assumed to care for the environment more than men. Others agree that women may better understand nature but not because of their sex, but because they are the ones who have less access to modern practice and rely on the more marginal lands and thus their closeness to nature is as much due to economic as biological or social factors. Whatever the case, the idea of women being closer to nature is a persistent one, but this may not translate into women being able to access, and more importantly make decisions over, natural 'assets' such as land and its resources (see Bradshaw and Linneker 2014 for discussion).

As Moser's (2014) framework suggests, accessing and controlling assets can transform both individual lives and urban spaces. However, Moser's framework raises a series of questions around how this can be achieved, and around how to ensure wellbeing improvements

benefit both women and men. Further, and particularly relevant to this study, this framework has yet to integrate the role of environmental assets in bringing positive social change.

2.4 How might ES link with other assets?

Linking the capital assets framework with the ecosystem services associated with natural capital shows multiple intersections.

Figure 4 Overview of key cross-linkages between Moser's capital assets framework and the ES framework
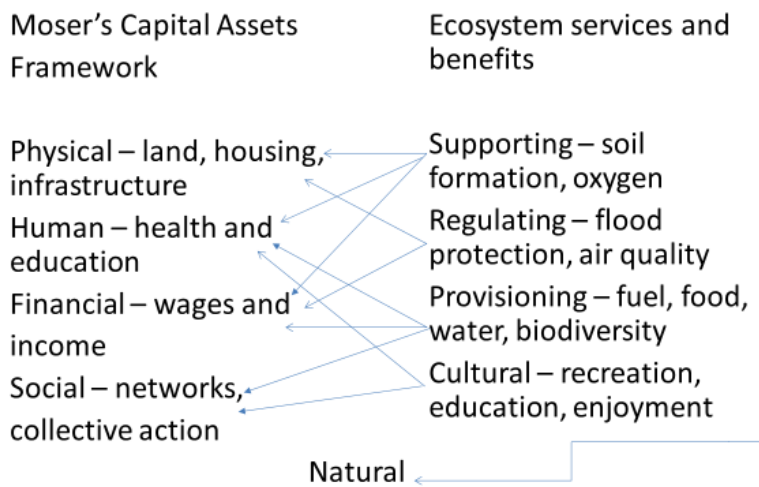
Source: Bradshaw (2016) presentation at: Engendering Habitat III: Facing the Global Challenges in Cities, Climate Change and Transport, Madrid, 5th-6th October 2016

Supporting Services such as soil formation contribute to the generation of Physical Assets such as land for agriculture, which in turn potentially interacts with Financial Assets if the land is cultivated. Regulating Services, such as improving air quality, impact on Human Capital through influencing health, but may have negative impacts on Physical Assets such as land and housing if their degradation leads to flooding or contributes to drought, for example, and of course this will also have an impact on income and Financial Assets. The impacts of Provisioning Services are perhaps the most obvious as nature provides resources such as food, water, and fuel stuffs necessary for day-to-day living and have an impact on Financial Assets. They bring related health benefits for Human Capital also, and if shared with family or friends help foster Social Capital. Social Capital can also be an outcome of the Cultural Services provided by nature, through collective recreational activities such as walking in the countryside, while the simple enjoyment of seeing a flower in bloom, for example, can improve mental wellbeing and thus Human Capital.

It is clear then that combining the MEA Ecosystem services and Moser's Asset frameworks may lead to new understandings of how different assets interact to improve wellbeing and new insights into the role of the environment in determining wellbeing. Applying a gender lens will allow better understanding also of any differences between women and men in accessing and utilising assets, particularly environmental assets. It will help answer the question of how we can ensure equality of access to natural assets that improve human wellbeing, while still protecting these assets, and the wider question of how to ensure sustainable and equitable urban growth.

3. The Study Areas and Context

In order to explore how women and men access and utilise assets, in particular environmental assets, fieldwork was undertaken which consisted of semi-structured interviews, walking interviews and a questionnaire to complement a scientific assessment of the natural capital and the potential ES it might yield in the study area. This centred-on Nova Contagem, a rapidly growing peripheral urbanisation in Belo Horizonte, Brazil, located close to a large prison and some industrial activity, but also close to open countryside and the Vargem das Flores reservoir. It also covered two neighbouring communities – Tupã and Solar do Madeira - small but growing communities in a preservation area on the shores of the reservoir.

3.1 The Historical Context of the Vargem das Flores Reservoir and Nova Contagem Urban Expansion

The Vargem das Flores reservoir was built in the early 1970s, in order to meet the demand for public water supply, mainly in the municipalities of Contagem and Betim, heavily industrialized cities in the Belo Horizonte Metropolitan Area. At that time, what is now the region of Nova Contagem was a mainly rural area of Contagem, approximately 15km northeast of the centre of this city and 30km from the centre of Belo Horizonte, the Minas Gerais' state capital. There was only a few scattered and small rural neighbourhoods there, such as Icaivera and Retiro[1].

Figure 5 - Study Region showing the Vargen Das Flores Reservoir, Nova Contagem, and the smaller waterside urban areas of Tupã and Solar do Madiera

---

[1] Retiro is now a part of the Nova Contagem region, but it is a much older neighbourhood. There is an old church there, São Domingos, where the traditional syncretic Afro-Brazilian tradition of "Congado" is still performed by the "Guarda de Moçambique do Sagrado Coração de Jesus" (lit. "Mozambican Guard of the Sacred Heart of Jesus").

REGIÃO ADMINISTRATIVA
MUNICÍPIO LIMÍTROFE
Bairro
- - - - · Limite Municipal
- - - Limite de Região Administrativa
Delimitação das Regiões Administrativas segundo a Lei Complementar 060/2009.
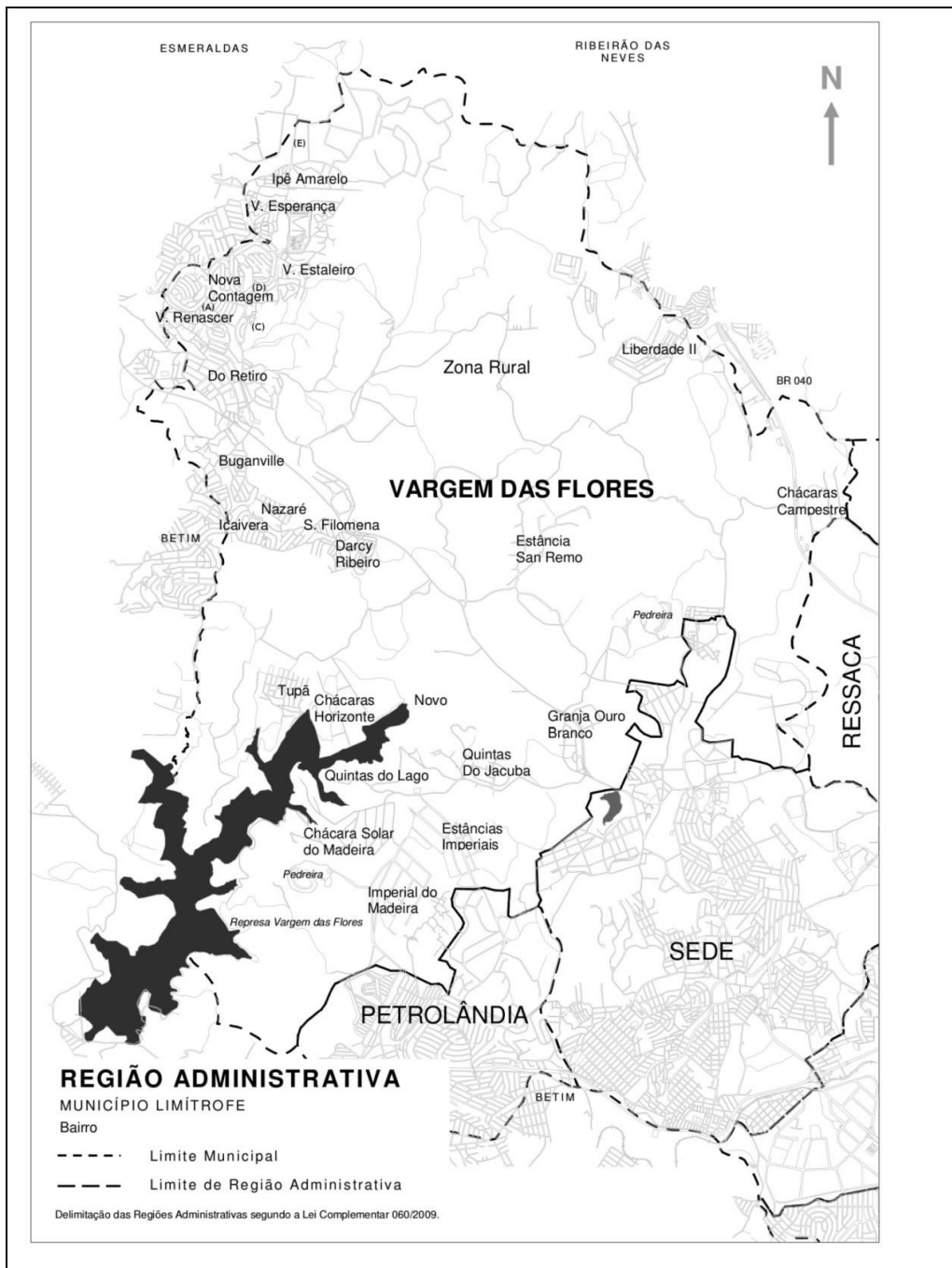
More than a decade later 'Newton Cardoso built Nova Contagem" or that is what many who live there see to be the case. It was during his second term as mayor of Contagem (1983-1986) that the first homes were built, although the project dates from 1982 (Figure 6). Cardoso was then a major political force in PMDB party (Partido do Movimento Democrático Brasileiro – literally Brazilian Democractic Movement Party), having already been mayor of Contagem from 1973 to 1977 and a federal congressman from 1979 to 1983.

The official idea behind Nova Contagem was to build a housing project for underprivileged people living in other regions in Contagem – mainly people living in illegal occupations

(*favelas*) in the central and more affluent parts of the city, but also people affected by floods, multiple families cohabiting a single home, and people overburdened with rent. In short it was part of a plan to alleviate Contagem's housing deficit. There is no suggestion that people were removed from their existing homes, or forced to move, and instead most decided to move to the new neighbourhood after being granted a house, or at least a plot with the promise of a house (Pires et al 2016).
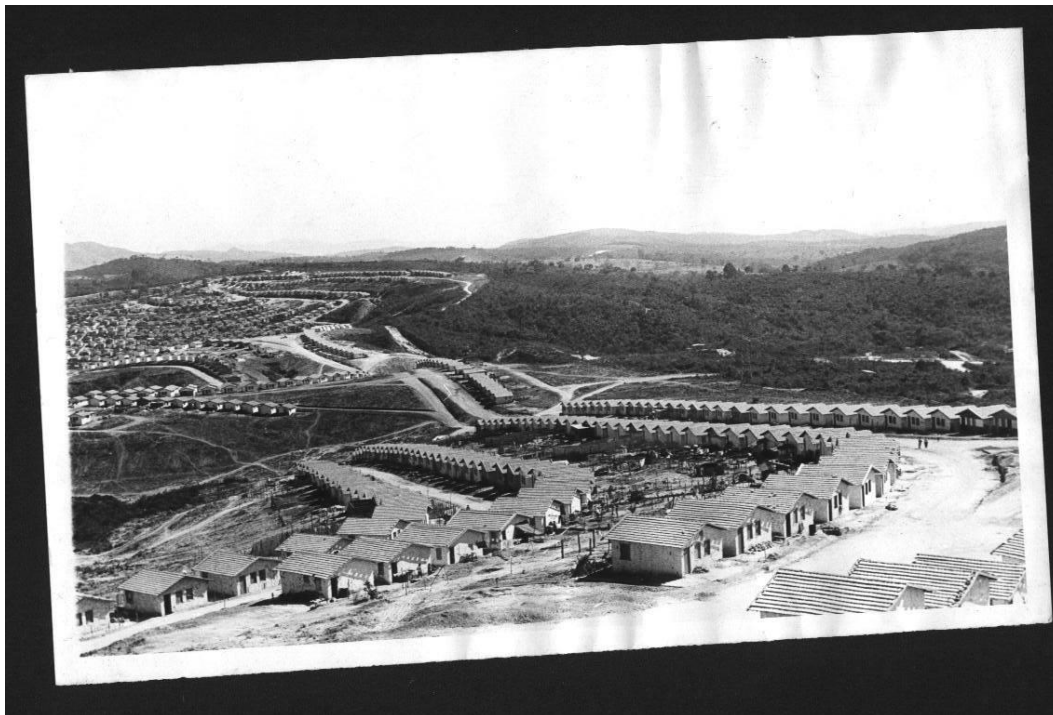
Figure 6. Nova Contagem neighbourhood under construction (source: A Folha de Nova Contagem)

Newton Cardoso promoted the project as a great success – using it as one of the major selling points for his electoral campaign to become the Government of Minas Gerais, which he won in 1986. However, some of the early residents of Nova Contagem, especially those who moved in the 1980s, remember it differently. They remember this peripheral neighbourhood had no proper public transport linking it to central Contagem, Betim or Belo Horizonte (where most of the inhabitants worked). The main road leading to Nova Contagem (LMG-808), built around 1983-4, was not yet paved. A lot of the people moved before their homes were actually built, and for months had to live in make shift housing. Electricity was only implemented in 1986, a water system in 1987, and no or almost no commerce, hospitals, schools, existed, in the first few years.

Changes came slowly throughout the 1980s and 1990s. The Nelson Hungria State Penitentiary (maximum security prison) was built in 1988 (Figure 7), which helped by

bringing paved roads, more widespread law enforcement, and a number of other public services to the area. While bringing some benefits, its existence was heavily criticized for also bringing a feeling of insecurity to the surrounding neighbourhoods and a 'bad reputation' to Nova Contagem.

Figure 7. View of Nelson Hungria State Penitentiary (source: A Folha de Nova Contagem)

In the 1990s, illegal occupations started around the existent Nova Contagem neighbourhoods. Some were informal settlements but others were reportedly built with incentives from local politicians, eager to repeat Cardoso's fame as a 'house-builder for the poor'. As is common in Latin American cities 'self-help' housing involving some level of self-build was often practiced.   At times this housing built by the individual households on illegally occupied land, while at others it is the consolidation of existing housing over time, as was the case of Nova Contagem, where most of the original houses built in the 1980s were improved or remodelled over the last 30 years (Figure 8). Common consolidation includes adding extra rooms or floors, or even building a second house, with separate entrance, inside the family plot, for a recently married son or daughter, for instance. After years of self-build, Nova Contagem does not look like the original housing project any more.

Figure 8. Nova Contagem neighbourhood: an almost original house in the bottom right of the picture and three rebuilt houses on the top of the hill

The region grew in all directions, sprawling all the way to the neighbouring municipality of Esmeraldas, and gradually spawning many neighbourhoods such as Darcy Ribeiro, Buganville, Ipê Amarelo, Estaleiro I, Estaleiro II, Vila Esperança and Vila Renascer, Rato Molhado, Vila Feliz, Vila Bastilha, Buraco da Coruja. In figure 9, the Landsat images show the process of rapid urbanisation in four stages: (i) 1989, with the original limits of the planned neighbourhood and some developments Northwards (Esperança), probably influenced by the construction of the prison, and Southwards (Renascer, Retiro); (ii) in 1995, Renarcer, Retiro and Esperança are completely linked to the original neighbourhood, while Bouganville, in the South, is consolidating as a new development; (iii) 2009, showing a large urban expansion toward Emeraldas municipality (Westward), and (iv) 2015, with all the new and formal developments connected (see also figure 10 for the name of neighbourhoods). Most of these were not built as housing projects: new residents were either given a plot to build their own houses; or they bought the plot (mostly through illegal parceling of larger plots[2]); or occupied the land spontaneously and illegally. This process has not yet stopped, as the population in Nova Contagem continues to grow (Figure 10). Some newer neighbourhoods, such as Buganville, are still in urbanizing, not connected to the sewage network and poorly served by bus routes. The original area of the Nova Contagem housing projects is now often referred to as *centro de Nova Contagem* ('downtown Nova Contagem'),

---

[2]The relevance of the Vargem das Flores catchment for the water system in Contagem makes a good deal of the area surrounding Nova Contagem environmental protection sites, legally Áreas de Proteção de Mananciais (Water Source Protection Areas). To prevent high population density, Contagem's Master Plan (Plano Diretor), established in 2006, classifies most of these areas as ZEU-3 – Zonas de Expansão Urbana-3 (Zones of Urban Expansion 3) – meaning plots in the region should have at least 2.000m^2. However, owners often parcel the plots illegally, selling tracts of land smaller than 500m², which creates a legal problem for the buyers, that must, often unknowingly, have to deal with great amounts of bureaucracy to regularize their land – as described by a participant living in Bugaville neighbourhood. The Master Plans classify areas closer to central Nova Contagem as legal exceptions within the Vargem das Flores catchment: plots of at least 360m² are allowed.

indicated in figure 6, because this is where most of the commercial areas and public facilities are.

By the early 2000s, Nova Contagem was already one of the most densely populated areas in Contagem, with approximately 100,000 inhabitants, but infrastructure was still very poor. A major turning point, as described by interviewees was the Marília Campos administration as mayoress of Contagem (2004-2012)[3]. Most participants claim the main advances in the area came during Campos' terms as mayor – more and more frequent bus routes; asphalting on most of the main roads; street signs; squares, sports courts and fields; channelling of the streams and open-air sewage; construction of an emergency care unit, (UPA – *Unidade de Pronto Atendimento*, in 2012), and several minor family health clinics *(Postos de Saúde da Família)*; and construction of several public schools. For residents, over the last decade, Nova Contagem has become more of a 'proper neighbourhood'.

The Campos' administration ran in parallel to the victory of her party's leader, Luís Inácio "Lula" da Silva, for president in 2002 – until recently, and during the fieldwork, the party was still in power, with Dilma Rousseff as president until the 2016 impeachment. The Campos administration meant that Contagem's municipality had easier access to federal investments, but also because the period from 2002 to 2013 was a period of rapid economic growth in the country, fuelling – and partly fuelled by – large public works, such as those in Contagem. These years saw the increase in access to consumer goods by the so-called 'C class' (or *nova classe media* - 'new middle class'). These families have a monthly income of around R$291 and R$1.019 (~US$75 to 260), in occupations such as factory work, are local merchants, or employees in the lower ranks of the service sector, etc.[4]

---

[3]Marília is a member of PT (*Partido dos Trabalhadores*, lit. "Worker's Party", the major left-wing party in Brazil) since the 1980s. She ran for mayor in Contagem in 1996 but lost to Newton Cardoso. She was elected for city council in 2000, for State congress in 2002, and for mayor in 2004, being re-elected in 2008. In 2014 she was elected again for state congress. She supported her party's Durval Ângelo in the 2010 municipal elections, but he lost to Carlin Moura, who ran for PC do B (*Partido Comunista do Brasil*, lit. Communist Party of Brazil). Moura's popularity among the research participants in Nova Contagem seems to be not as solid as Campos'. Some interviewees claim he is following Campos' policies for the area, but a bit less competently.

[4]Definitions of the 'C class' are, of course, highly controversial. Some authors even claim that, sociologically, there is no such thing as a "new middle class".

Figure 9. Nova Contagem urban sprawling (Landsat 8 images: 1989, 1995, 2009, 2015).
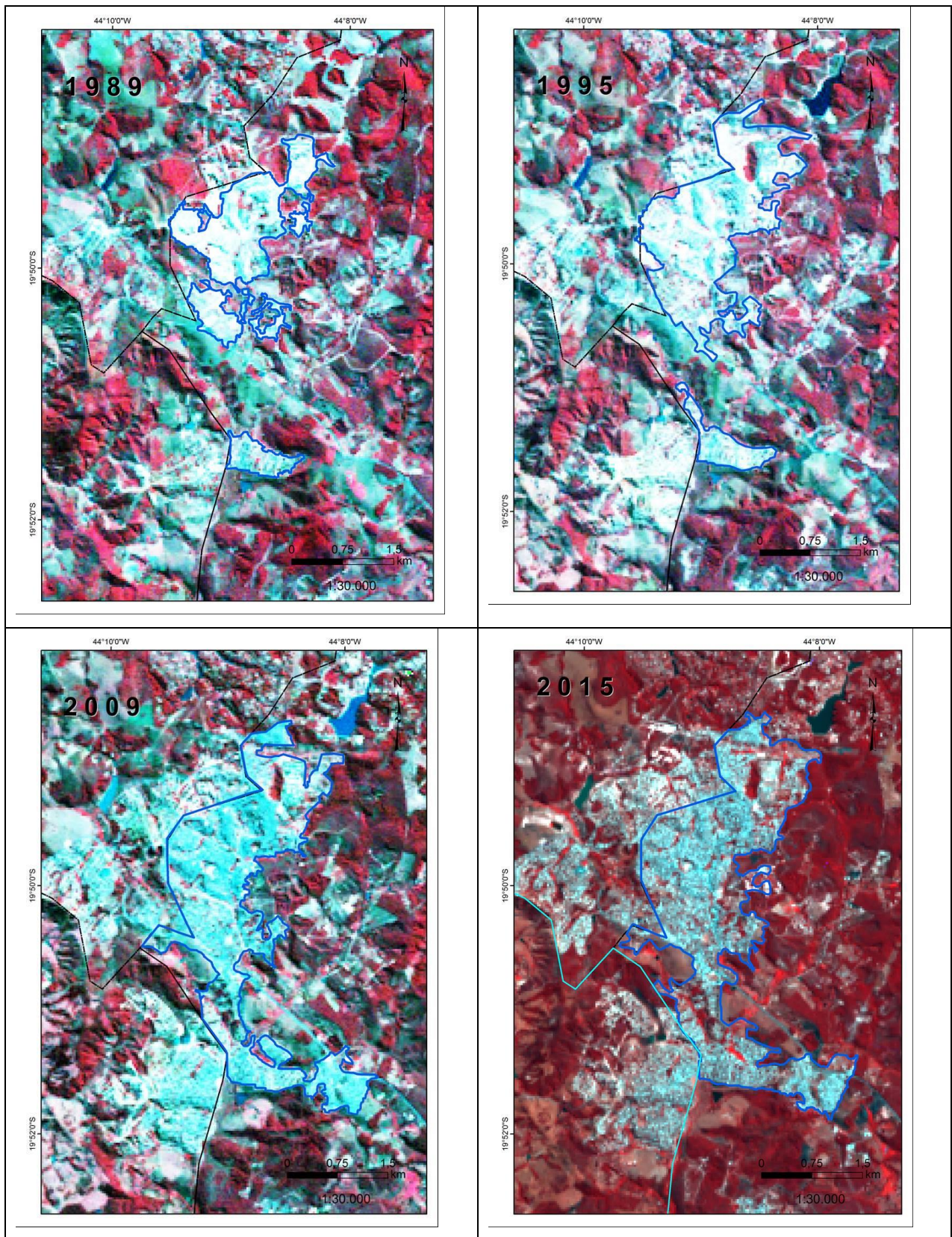
Legend: ——————— municipal border between Nova Contagem (East) and Esmeraldas
——————— border of the urbanised area in Nova Contagem municipality

Figure 10. Nova Contagem and associated neighbourhood (Source: Contagem municipality, edited)
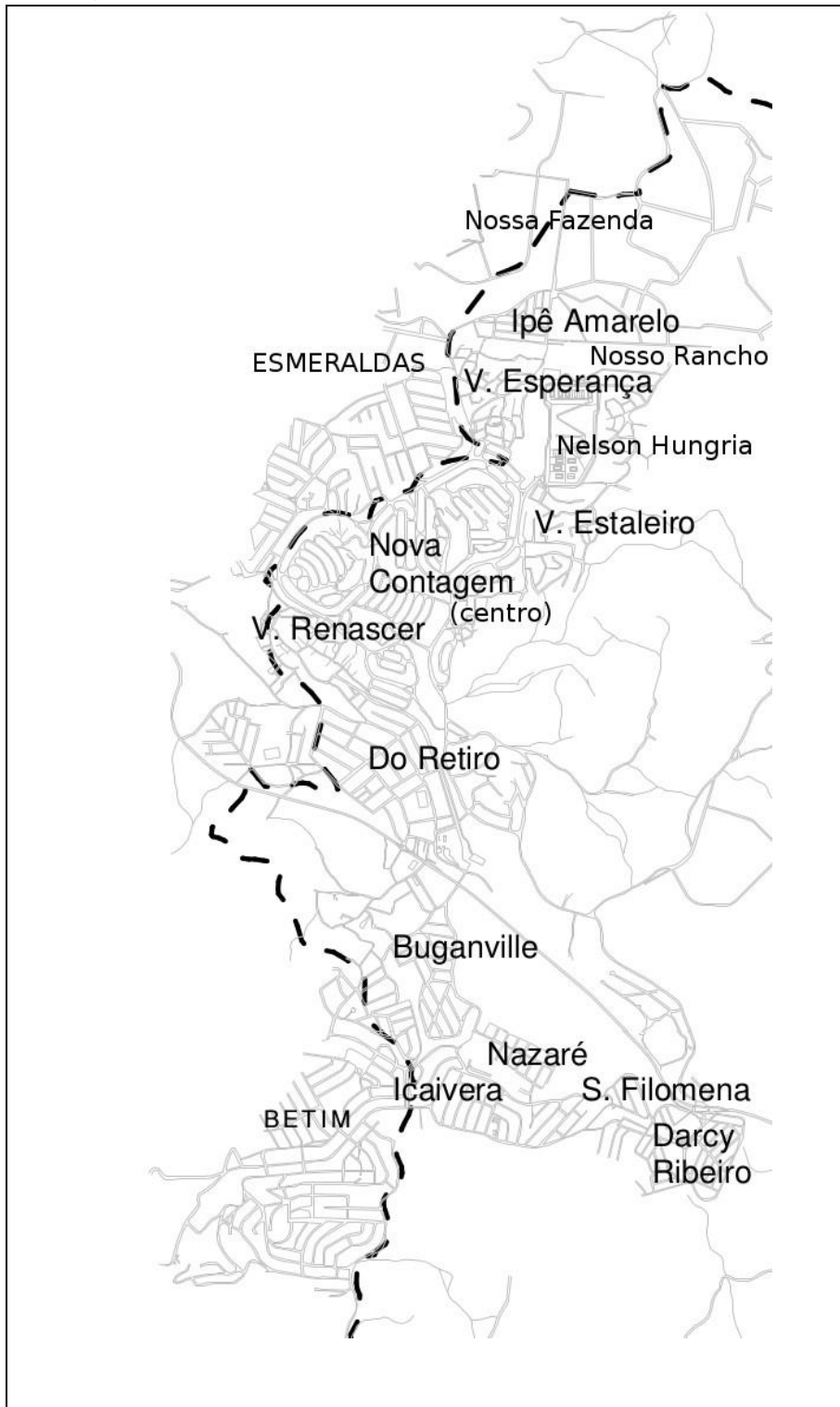
Welfare projects such as *Bolsa Família*[5] and a fiscal policy of tax exemption for some products enabled a large sector of Brazilian society to buy, often for the first time, home appliances, cars, computers, mobile phones, and other consumer items that are not basic necessities. This part of the population, largely seen as having benefited from the Lula administration, is basically what constitutes the populace of Nova Contagem. This means it was not only Nova Contagem's public infrastructure that changed, but also local average incomes, and with it, local commerce, local car traffic etc. (Figure 11).

Figure 11. Nova Contagem, from top left: commercial area, technical education high school, health care unit, square equipped with gym facilities (taken during walking interviews).

Currently most of the Nova Contagem neighbourhood has running water, electricity, commerce is plentiful, and educational and health services have improved. While improved also, road access remains problematic and public transport, while better, still an issue for many people. Getting to central Belo Horizonte by bus takes at least one and a half hours without traffic, and by car, one hour. Moreover access by public transport to Contagem and

---

[5]Literally 'Family Allowance', a federal social assistance program with nationwide coverage, often described as an income transfer program. Families with expectant mothers and/or children under 17 years, and with a monthly income under R\$154 (~US\$40), are granted R\$35 to R\$336 monthly (~US\$9 to 86). This program is the chief banner of PT's federal welfare policy, and the party's supporters claim that it drove a large part of the population out of extreme poverty. There is, however, heavy economically liberal criticism of *Bolsa Família*, which claims it is "a handout" – one participant in this research emphatically defended this critical view.

Belo Horizonte suffers from the 'fishbone' model of the road system, lacking transversal connections.

Residents suggest that Nova Contagem has became 'more like a city'. This claim is interesting because it points not only to the region's growing urbanisation, and growing population density – it also points to the fact that Nova Contagem is becoming gradually more independent and self contained in some respects, relative to other areas of Contagem. People still feel some services are lacking – a bank, a notary's office, a proper hospital, etc. – but the need to go to central Contagem (or even Belo Horizonte) to buy things, run errands for other purposes is diminishing. The independence is such – and the region is so far away – that a lot of people refer to neighbourhoods such as Eldorado and Sede – more central and closer to Belo Horizonte – simply as 'Contagem', as if Nova Contagem was a different town. However, a lot of people claim they still feel the need to go to 'Contagem' especially for work and leisure. There are no shopping malls, movie theatres, nightclubs and other such recreation facilities in Nova Contagem. Regarding work, the fairly large amount of jobs in the commerce sector are seen as not sufficient for Nova Contagem's population, and a great number of people – especially men – are employed in the industrial zones of Contagem and Betim. Aside from a few small exceptions (such as the garlic processing facility in Vila Esperança), there are no larger businesses in Nova Contagem.

An important issue is that, even though residents claim to have seen 'a lot of improvement' over the last years, it was not evenly distributed within the region. The central part of Nova Contagem saw urbanization earlier, and other, more peripheral areas – such as parts of Vila Esperança – still have dirt roads, open sewage, lack of schools, etc.. Thus, parts of the region are peripheries of a periphery of a periphery – Contagem is the periphery of Belo Horizonte, Nova Contagem is the periphery of Contagem and some of these more recent poorer sections might be seen as peripheries of Nova Contagem.

The differences between the areas is particularly clear in the area where the official boundary between Contagem and the much poorer neighbouring municipality of Esmeraldas stands. The exact road where the cities meet (Rua do Ipê, in Ipê Amarelo neighbourhood) is where the asphalted road ends and the dirt road begins. Residents of Esmeraldas, of newer neighbourhoods in Contagem, and of recently built illegal occupations, thus, see themselves and their sub-regions as living in the "stages" Nova Contagem was in the past.

On the other hand, close to the study area are two high-income semi-rural condominiums. – Nosso Rancho (Our Ranch) and Nossa Fazenda (Our Farm) – where properties are

respectively worth up to R$300.000 and R$3.000.000 (~US$77.000 and US$770.000). In Nova Contagem today, some residents are reasonably well-off – local businessmen are the most common examples. However, there are still no wealthy, high-class inhabitants in Nova Contagem proper. Plots in Nosso Rancho might be accessible to upwardly mobile residents of Nova Contagem, but Nossa Fazenda is considered a luxury condo for the elite, with plots of over 5.000m², private lakes and forests. It is separated from Nova Contagem by double barbed-wire fences guarded by private armed security. The latter was established in the 1970s, and is older than Nova Contagem, therefore this is not a case of gentrificantion. Some people from Nova Contagem work as housekeepers or maids in these condominiums and through them family and friends at times can also access the resources behind the barbed wire.

Figure 12 - Time line with some of the key interventions in the study area.
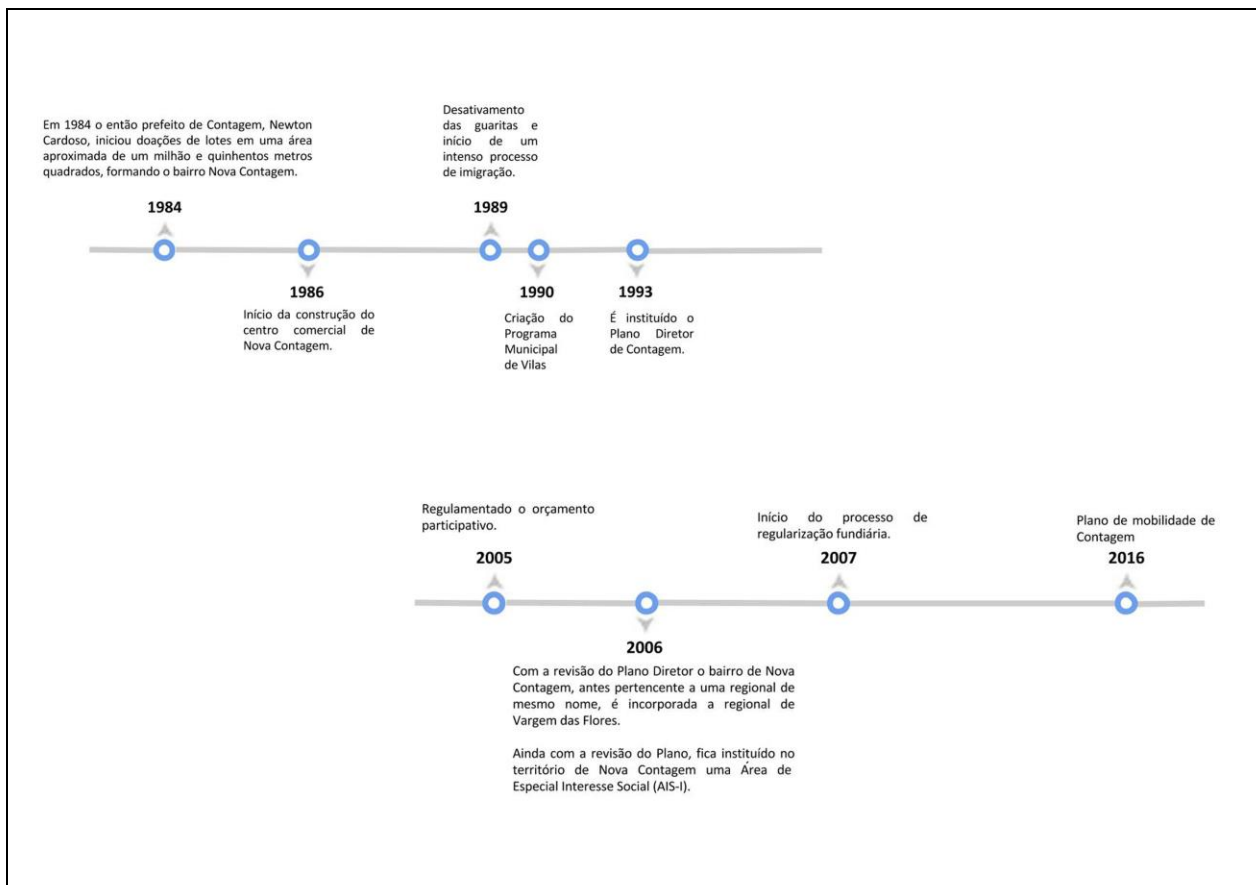
Figure 13 - The main social services, education and health centres in Nova Contagem

2542 m

(health icon) UNIDADE DE SAÚDE

(education icon) UNIDADE DE EDUCAÇÃO
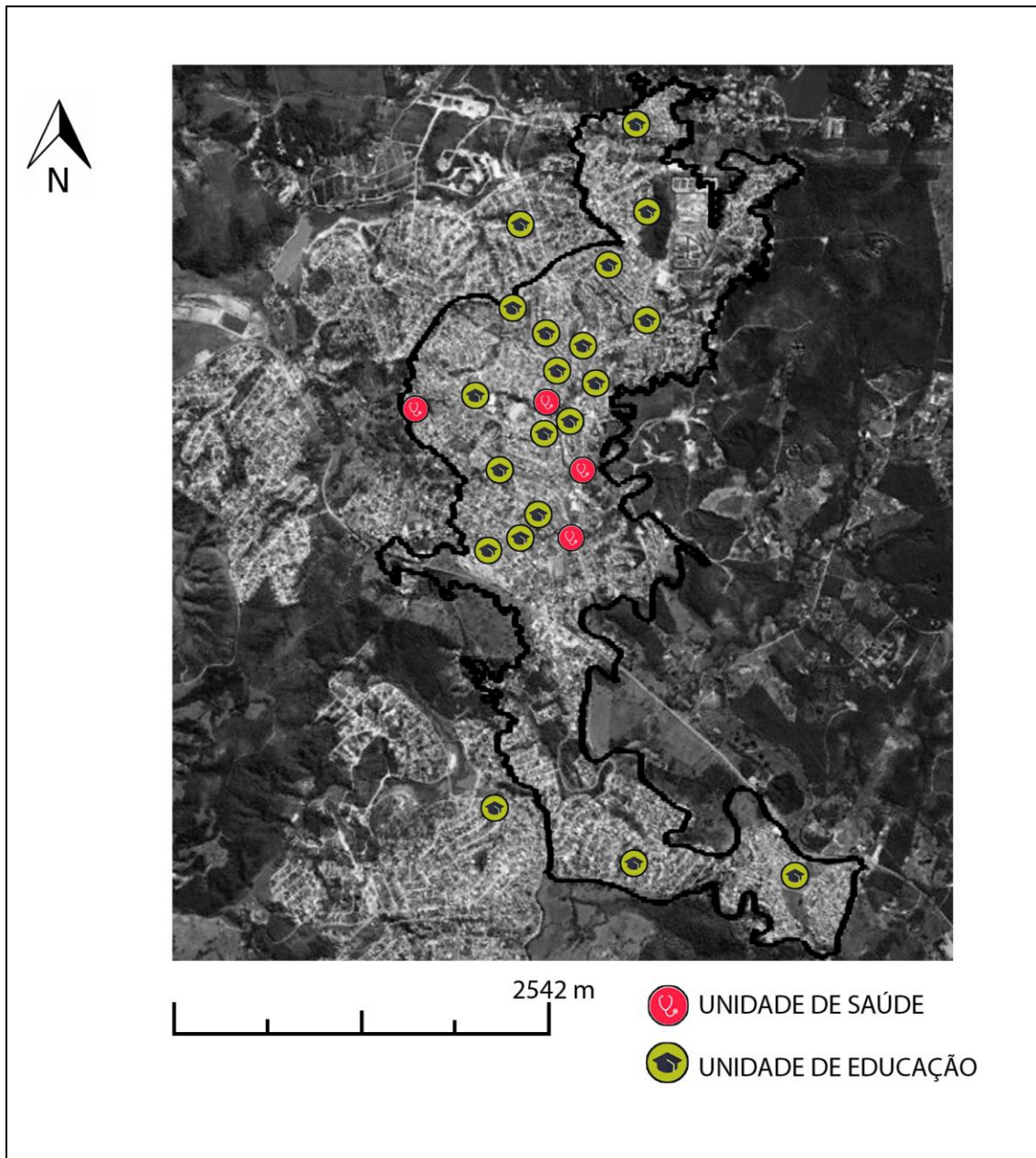
Source: Internet research by Camila Saraiva

3.2 Local NGOs and Civil Society Organisations

Many of the NGOs in the study area focus on issues of drugs and violence, and none of
these organizations focus on environmental issues. All those interviewed had concerns
about levels of violence. Violence, particularly drug-related violence, is seen to be a problem
in Nova Contagem. However, a common discourse is that violence happens among rivalling
drug dealers and between users and dealers, so the rest of the population isn't directly
affected by violence unless caught in the cross fire. Robberies, muggings, assaults and the
like are seen not to be that common. Feelings of insecurity however are common, and

common to both men and women and in fact violence may be masculinised. Many of the respondents suggested that the problem with young men and drug-related violence should be approached by giving them a good formal education and 'things to do' in their free time, instead of hanging around, which often makes them easily seduced by the status and income derived from drug dealing.

This is where *Casa de Apoio à Criança Carente de Contagem* comes in (lit. House of Support to the Deprived Children of Contagem). *Casa de Apoio* is by far the most often mentioned non-governmental organization acting in Nova Contagem. The association's website (http://www.casadeapoio.org.br) describes *Casa de Apoio* as a "non-profit and philanthropic civil society that acts in the areas of education, health, social development and youth leadership." The association was established in 1994, with connections to North-American and Brazilian Baptist churches, and to the International NGO World Vision (*Visão Mundial*). It currently has three units, two of which are in the Nova Contagem area, both acting mainly as educational centres and vocational schools, offering workshops in sports, dancing, martial arts, bread-making, among others. They also have a community library, and occasionally promote events dealing with children with special needs, and teenage mothers.

Another important NGO based in Nova Contagem is *Acorda Povo* (Wake Up, People), established in the 1990s. It acts on the issues of "political awareness, literacy, environmental valuation, group activities for the elderly, courses and lectures", according to their blog (http://movimentoacordapovo.blogspot.com.br). Their two units in Nova Contagem (Retiro and Vila Esperança) offer legal and psychological assistance for residents, physiotherapy, host dances for the elderly and run water aerobics classes at a community swimming pool. One of the *Acordo Povo* founders, Rodinei Ferreira, a Nova Contagem inhabitant since 1986, was elected for city council in 2004 (PMDB) and once again in 2009 (PT). Other NGOs acting in the region (not mentioned by the interviewees) are: *Associação Crescer* (Darcy Ribeiro neighbourhood); *Obra Social Dom Bosco* (Retiro); *Viva Bem* (central Nova Contagem); *Associação Ágape* (Vila Esperança); Fica Vivo (Nova Contagem).

Like most Brazilian neighbourhoods, Nova Contagem also has neighbourhood Associations: AMANCA – *Associação Dos Moradores E Amigos De Nova Contagem e Adjacências* (lit. Association of Residents and Friends of Nova Contagem and Surroundings), but there are also smaller associates for specific neighbourhoods, such as AMOVINE – *Associação de Moradores do Bairro Vila Nova Esperança* (Association of Residents of Vila Nova Esperança neighbourhood). Neighbourhood Associations often play an important role in poor urban areas of Brazil, acting as the main link between public administration and residents. AMANCA's role in Nova Contagem may be less important as there are spaces for direct

political participation established by the municipality, such as participatory budgeting (*Orçamento Participativo*) and participatory planning (*Planejamento Participativo*).

4. Methodology - Establishing the Potential and Actual ES in an Urban Area

This project considers understandings of how environmental assets interact with other capital assets to improve women and men's well-being, reduce poverty and vulnerability, and promote more resilient and gender just urban spaces.

A number of different interdisciplinary methods were used to establish the potential and actual ES in the area, these included:

1. A scientific environmental assessment of the potential ES in the catchment
2. Qualitative interviews around the natural environment and how it is accessed and understood by those living in Nova Contagem, Tupã and Solar do Madeira
3. Narrative walks using a phone application to record thoughts on, and images of, the natural environment in which the participants live
4. A small survey (400 questionnaires) measuring asset stocks, and exploring understandings of assets, how they interact with each other for those living, working, or frequently visiting Nova Contagem

4.1 Scientific Environmental Assessment

Given the potential the natural environment provides for promoting stocks of human, social and financial capitals and promoting wellbeing, the first step in transforming this potential into real benefits is understanding what the potential ecosystem services are in any given neighbourhood.

The first step uses existing resources to get a general idea of biophysical structures in the area or neighbourhood. Satellite images allow a general overview of land use at present, and depending on the quality, can also allow a first classification of the nature of the green, blue and grey spaces.

While land use data provide a general idea of the extent to which there are green areas or lakes, this does not tell us much about the potential for them to yield ES. A large expanse of green viewed from above may suggest extensive tree cover and the potential for regulating and supporting, provisioning and cultural services – but if underneath the canopy the trees are growing on the sides of a steep ravine then the latter two services, while potentially existing may not be mobilised due to the danger involved in accessing the trees. As such then it is important to complement the use of any existing maps and satellite images with ground level evaluation – or undertake a 'ground truthing' exercise.

Ground truthing seeks to establish the nature of the green and blue resources identified by the imagery and the extent to which they provide the potential to yield ecosystem goods and benefits or indeed dis-benefits. Walking through the area and recording the nature and extent of different habitats allows an assessment of potential, as illustrated by the table below.

4.2 Qualitative semi-structured interviews

Some 26 qualitative semi-structured interviews were undertaken in the home of residents within the communities studied and were recorded and then transcribed (Table 1). Typically lasting 40 minutes to an hour, they covered issues such as how the participant came to live in the neighbourhood, what they most liked about it and most disliked, what they thought of the local public parks and squares, of the countryside surrounding the neighbourhood and of the reservoir and other blue space. It sought to understand how the participants engaged with the environment and how they understood nature and what it meant to them in terms of wellbeing.

The qualitative interviews were undertaken in 3 growing urban communities, in Nova Contagem 10 (6 women and 4 men), and two smaller urban areas which had expanded on the banks of the Vargem das Flores reservoir, Tupã 10 (5 women and 5 men) and Solar de Madiera 6 (2 woman and 4 men). Visitor interviews were also undertaken with people visiting the Vagen de Flores (VF) Reservoir 11 (5 women and 6 men).

Table 1 – Qualitative and Quantitative Interviews Undertaken

A	Qualitative Interviews			Walking Interviews		
Location	Men	Women	All	Men	Women	All
Nova Contagen	4	6	10	1	2	3
Tupa	5	5	10		1	1
Solar de Madiera	4	2	6	4	1	5
VF Visitor Interviews	6	5	11			
Total	19	18	37	5	4	9
B	Quantitative Interviews					
Location	Men	Women	All*			
Nova Contagem	170	216	395			

Note: *Gender missing in some quantitative interviews

4.3 Walking Interviews and the 'Urban App'

In addition to the qualitative interviews a selection of the same respondents also undertook a walking interview (9) through their urban environment. The walking narratives used a smart phone application, which allowed images of 'likes' and 'dislikes' to be recorded.

The 'Urban App' used in this study is a freely downloadable application for Apple and Android systems that has the capacity to record and send geo-referenced visual and textual data. Data is stored on a secure domain where it is visible in the form of either a list of participants and entries or a GIS map of entries.

The Urban App allows recording of the environmental assets and their related eco-system services within a community, as perceived by the residents themselves, and also has the potential to monitor these over time, for local people to highlight any aspects of concern and aspects that bring them positive benefits. This means that as residents walk around their neighbourhood and notice rubbish dumped in a stream, for example, they can quickly and easily record this through taking a picture, adding a caption, and uploading this to the secure site. Similarly, the methodology encourages people to capture images of natural beauty such as a tree in full bloom, or resurgence of green spaces, not just degradation.

To date the Urban App has been used for research purposes, including lending a phone to a participant for a week if they do not have their own. However, it has proved most successful when used as part of a walking interview, led by a researcher- as it was used in this study. The photos and text entries were made by the participant and the narrative produced during the walk recorded and transcribed. The benefits of this methodology are that walking through the environment may lead to better discussions of the environment and what it means to participants as the changing landscape acts as visual prompts to what the participant sees to be important or not, useful or not, beautiful or not etc.

The main problem with using the App lies with the good internet connectivity needed to allow geo-referencing of the photos – weak or no signal limits the ability to utilise the methodology fully. Some people, especially older people, may not be used to smart phones and wary of using such expensive and modern technology. If loaned to them, use of the App could also help engage older people with modern technologies. Some may also be wary of taking photos in some locations or of some activities, for fear of how others might interpret this.

Findings generated by local people using the App have shown good overlap with the ES 'expert' assessments undertaken prior to the App's use. It has also provided richer detail and insights that the scientific assessment did not provide. It provided the researchers with

a different perspective on the area, closer to that of the participants. Most importantly, walking with the purpose of presenting and analysing the environment for the researchers made participants aware of features they had overlooked during the 'sit down' interviews. One participant in the study, for instance, chose as a relevant feature a tree she used to climb and play in when she was a child. Another tagged as a negative feature a maximum-security prison near her house. Neither of these features had been mentioned in the interviews with them.

The added insights it brings give confidence in the App as a good means of data gathering and to provide a continued assessment of ES in a community. It would help to promote the active engagement of local people in protecting and promoting the environment in which they live, potentially providing a mechanism for collective action contributing to social cohesion as well as providing a means for local authorities to easily (and cheaply) address any evolving environmental issues.

Developing a more nuanced understanding of which urban ES are generated and how they are used and valued by local people can inform a more developed understanding of the types of benefits accrued, as well as any associated dis-services. It can allow for future local level planning that responds to the needs of the local people and enhances both the natural environment and their wellbeing.
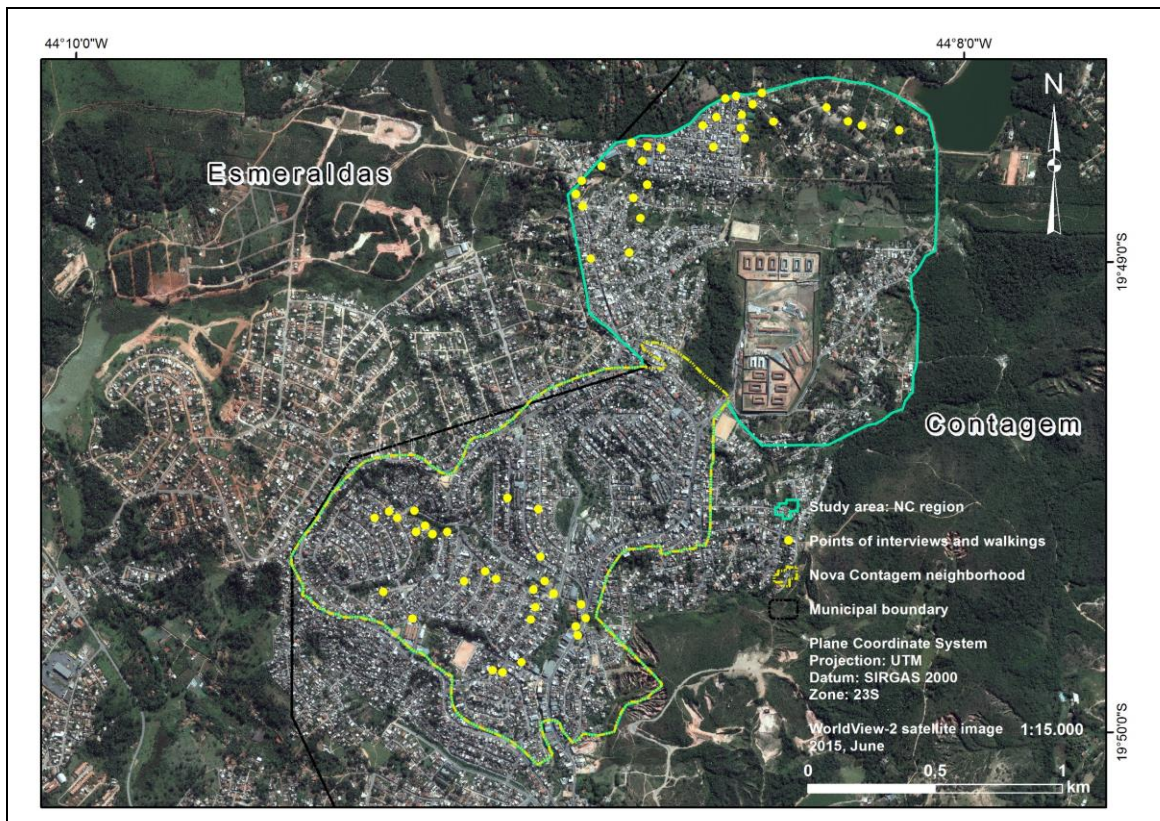
Figure 14 – Municipality of Nova Contagem and Points of Interviews and Walking

4.4 Questionnaire survey interviews

A questionnaire survey (395 respondents) was also undertaken with men and women living and working in the 'downtown' area of Nova Contagem. The survey sought to get some measure of the assets of those questioned – physical, human, social, financial and natural and the extent to which they valued the natural environment as an asset. The quantitative interviews allowed associations to be draw between different assets, and logistic regression modelling was used to provide a robust assessment of how different assets impact on each other and what predicts, for example, greater engagement with the natural environment. It sought to analyse the data patterns and differences by gender and 'income' (MEIOS 2016; Linneker 2016).

5. Potential Ecosystem Services of a study area – Scientific Assessment

Using land cover maps, the three case study areas were classed as containing varying combinations of biophysical structures. Satellite images were then used to further interrogate the case study areas to identify and group biophysical structures according to their dominating structures (e.g. scale, level of management, presence of water). Site walkovers were undertaken during which the presence of biophysical structure types were verified and subjectively translated into service providing units (SPUs; see Table below). This translation activity is undertaken as a way to link biophysical structures with land use cover typologies. ES data from the literature (e.g. MEA, 2005, UK NEA 2011, Gomez-Baggethun et al., 2013, Lundy and Wade 2011), combined with field notes, were used to identify the potential ES and goods delivered by each urban SPU.

5.1 Service Providing Units - SPUs

Based on land use cover a number of Service Providing Units (SPUs) were defined for the study area. These were; 1. urban fringe native vegetation, 2. vegetation in squares, urban parks and streets, 3. urban agriculture, 4. trees in private areas, 5. streams, riparian areas, wetlands, 6. soil. The Units vary in spatial scale, and are capable of providing different ES over time (Figure 15, Table 3).
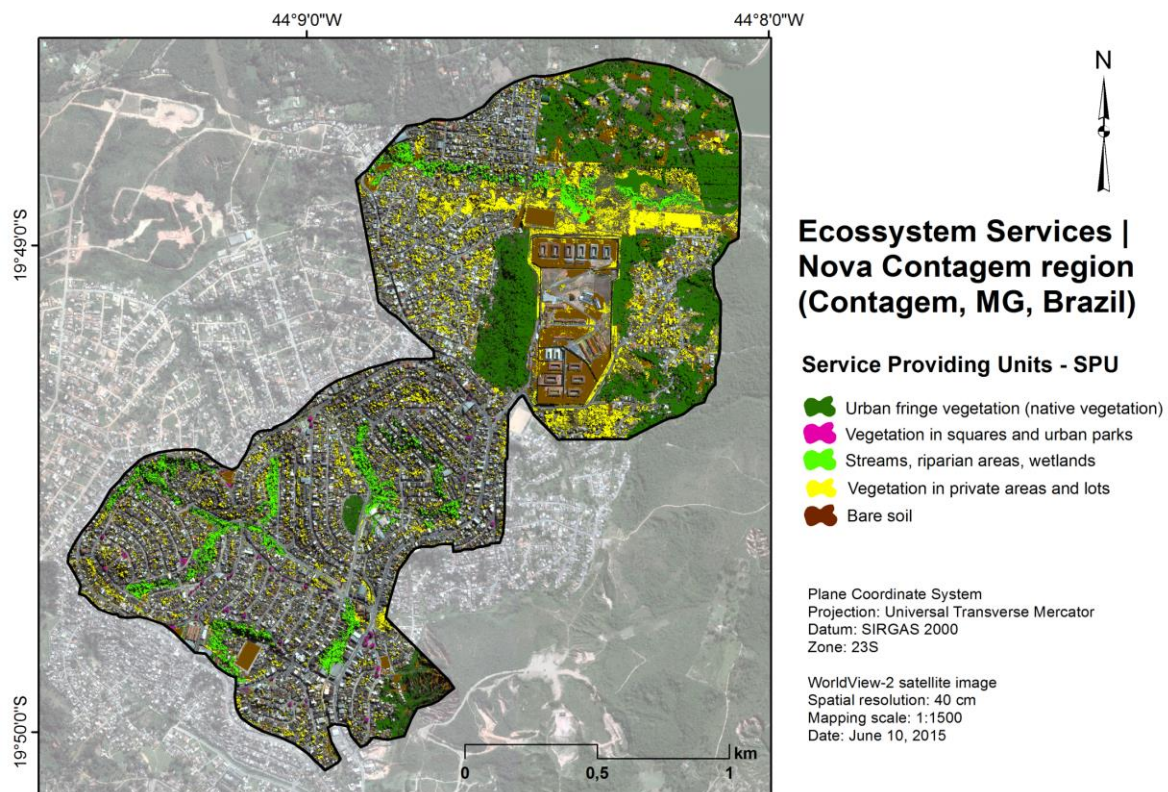
Figure 15 – Service Providing Units in Nova Contagem

Table 2 – Service Providing Units (SPUs), Spatial and Temporal Scale

Ecosystem service	SPU	Spatial scale	Temporal scale
Provisioning			
Food: fruits and vegetables	1,2,3,4	Local	Seasonal
Food: fish	5	Local, regional	Seasonal
Drinking water (surface and groundwater)	5,6	Local, regional	Constant or seasonal
Ornamental vegetation	1,2,3,4	Local	seasonal
Wood and fiber	1	Local, regional	Constant or seasonal
Natural medicines	1,2,3,4,5	Local, regional	Constant or seasonal
Energy production	1, 4, 5	Local, regional	Seasonal
Mineral raw materials	6	Local, regional	Constant
Regulating			
Erosion control	1,2,4,5	Local	Event, constant
Flood control	1,2,4,5	Local, regional	Event
Storm water runoff mitigation	1,2,3,4,5,6	Local	Event
Water quality enhancement	1,2,4,5,6	Local, regional	Constant
Water cycle	1,2,3,4,5,6	Local, regional	Constant
Air purification/air quality regulation	1,2,4,5	Local, regional	Constant or seasonal
C sequestration/storage	1,2,3,4,5	Local/Regional	Constant or seasonal
Temperature regulation	1,2,4,5	Local, regional	Seasonal, event
Noise reduction	1,2,3,4,5	Local	Constant, event
Supporting			
Carrier services: Transport of water, sediments, chemicals by water	5,6	Local, regional	Constant
Geological substrate for crops and buildings	6	Local	Constant
Storage capacity for water, humidity	5,6	Local, regional	Constant, seasonal
Soil formation	1,4,5	Local	Seasonal
Biodiversity support	1,2,4,5,6	Local, regional	Constant
Nutrient cycling	1,2,3,4,5,6	Local	Constant, seasonal
Cultural			
Aesthetic value	1,2,3,4,5	Local-regional	Constant,
Recreation and cognitive development	1,2,3,4,5	Local-regional	Event, seasonal, constant
Educational opportunities	1,2,3,4,5	Local, regional	Constant, seasonal, event

Based on Anderson et al, 2015

5.2 Ecosystem Services in Nova Contagem – a qualitative assessment

Table 3 – Potential ES Assessment

Ecosystem services	SPU	Qualitative assessment
PROVISIONING		
Food: fruits and vegetables	1,2,3,4	Field visits and the analysis of satellite images do not suggest important agricultural activities for food production in the Nova Contagem study area. There are some urban agricultural plots, and vegetation in private areas is significant. In several dwellings, there are trees and many of them provide fruits.
Food: fish	5	The NC development is located on the uphill of the Agua Suja creek catchment, a tributary to the Vargem das Flores reservoir. All the streams in the urban area are small creeks close to the water springs. There is no fish production in those small creeks. On the other hand, the reservoir downstream is currently used for fishing, without commercial purposes.
Drinking water (surface and groundwater)	5,6	In Contagem municipality, Nova Contagem neighbourhood and the neighbouring urbanised areas are all located in the Agua Suja creek catchment. The Agua Suja creek is a direct tributary to the Vargem das Flores reservoir. This reservoir provides drinking water for the Metropolitan Region of Belo Horizonte. The creeks in the Nova Contagem study area do not provide drinking water locally, all contributions are concentrated in the reservoir, treated to reach conditions of drinking water and then distributed.
Ornamental vegetation	1,2,3,4	This is only produced on a small scale for household use.
Wood and fibre	1	No register is available about wood or fibre production in the NC area. Field visits and satellite image assessment did not reveal this kind of exploitation.
Natural medicines	1,2,3,4,5	There is no organised or commercial production of natural medicines. Nevertheless, it is common that plants with this purpose are produced for personal or family consumption
Energy production	1, 4, 5	No register is available about use of wood for firewood, cooking etc, although this may be practiced at small scale. Streams are not used in the NC study area to produce energy.
Mineral raw materials	6	Satellite image assessment and field visits have not revealed commercial exploitation of mineral raw materials in the NC study area

REGULATING		
Erosion control	1,2,4,5	All these SPUs play a relevant role on erosion and flood control, stormwater runoff mitigation and water quality enhancement in the NC study area. The urban fringe native vegetarian occupies a small area of the NC study area. This vegetation located in narrow and deep valleys and in steep hillslopes can avoid the development of intense erosion processes.
Flood control	1,2,4,5	Urban squares play a minor role in erosion control and runoff reduction mainly because even when equipped with large canopy trees, most of the square surfaces are paved and surface water is directly drained to the mains. In other terms, squares are not conceived as potential structures to
Storm water runoff mitigation	1,2,3,4,5,6	promote rainwater infiltration and to reduce runoff. Conventional urban drainage may result in aggravated erosion processes downstream of the study area. There are almost no trees or other vegetation in the streets of NC. Nevertheless, many dwellings have trees and green areas in their backyards, playing an important role in intercepting
Water quality enhancement	1,2,4,5,6	and promoting infiltration of rainwater and reducing runoff, with positive impacts on erosion control. In contrast with normal urban practices during the 20th Century in Brazil, part of the riparian areas of NC has not been developed and creeks have not been lined. Field visits pointed out that trees typically present in riparian areas in this environment have been removed, although some still exist, particularly along the borders of the streams. Nevertheless, the existing vegetation cover mainly composed by green fields and bushes play an important role in absorbing runoff produced by the road system and other impervious areas nearby, reducing runoff velocity, producing some infiltration and acting as buffer zones for the streams in the bottom of the valleys. These buffer zones are therefore very positive in terms of erosion control and diffuse pollution abatement. Field visits also allowed to perceive that most of the stream reaches which are part of riparian areas are stable and one cannot identify process of intense stream bed erosion, pointing out that the riparian areas are playing a positive role on reducing the impacts of the changes in flow regime caused by urbanisation. Regarding flood control, the large riparian areas kept in NC are relevant in reducing flood risk and flood damages.
Water cycle	1,2,3,4,5,6	The Agua Suja creek catchment is not monitored, except for water quality in a station located in the mouth of the creek in Vargem das Flores reservoir. Therefore, it is not possible to assess the impacts of

		NC development and of the different SPU on the water cycle. Nevertheless, considering the brief discussion about erosion and flood control, runoff and water quality abatement above, one can expect that the identified SPUs play a significant role in reducing the impacts of urbanisation on the water cycle in NC.

Air purification/air quality regulation	1,2,4,5	Vegetated SPUs in NC, including those in private areas, form belts of trees with positive effects on air purification, C sequestration, temperature regulation and noise reduction. Unfortunately, no data are available to confirm expectations of positive results of these services. In any case, the urban fringe vegetation and the vegetation in part of riparian areas is dense and composed by big trees, conditions which are important to ensure services such as noise reduction, temperature regulation and air purification. Trees in the private areas form vegetation corridors inside the blocs and compensate the lack of vegetation in streets. The area of private vegetation in NC is large, nevertheless, in some blocks it is not dense, reducing their positive impacts in the ecosystem.
C sequestration/storage	1,2,3,4,5	
Temperature regulation	1,2,4,5	
Noise reduction	1,2,3,4,5	
SUPPORTING		
Carrier services: Transport of water, sediments, chemicals by water	5,6	Creeks in the NC study area are of feeble discharge capacity. In any case, they provide carrier services. The study area is equipped with a sewage system including a wastewater pumping station aimed at transferring collected sewage to a wastewater treatment plant located in a neighbour catchment, in Esmeraldas municipality. Other than local sanitation, the objective of this system is avoiding contamination by wastewater of the Agua Suja creek and, in consequence, of the Vargem das Flores reservoir. Nevertheless, field visits suggest that kind of contamination in some creeks of the study area, particularly those located downstream of the NC central area. Long term Agua Suja water quality monitoring near its mouth in the Vargem das Flores reservoir suggests a progressive degradation of its water quality mainly due to excessive concentration of organic matters. This Is probably due to misconnection of sewerage systems into the stormwater system and lack of main interceptor pipelines. The rapid and sometimes informal urban development in the area, after the first settlement is probably in the origin of this process. According to 2010 Census data (IBGE, 2010), about 15% of the volume of wastewater generated in NC area is dumped in the

		soil (pit latrines, septic tanks) and 2.5% are dumped in thalwegs and creeks.
Geological substract for crops and buildings	6	NC case study, considering only the area where the interviews and walks were performed, has an area of 3,02 km^2. It is located in a large region of limestone outcrops over river terraces in between the fluvial plains of the Paraopeba and Velhas rivers. The local geological characteristics suggest that the substract for buildings is adequate not offering risks of landslides. Very steep areas are mostly protected by dense vegetation which contributes to structure the soil, reducing landslide risks and erosion.

Storage capacity for water, humidity	5,6	Soils of limestone origin usually have high infiltration capacity. On the other hand, NC topography is characterised by medium to high slopes which combined with high infiltration rates suggests a well-drained soil behaviour, conducting infiltrated waters to the bottom of the narrow valleys of the region. Impervious surfaces disrupt these processes, increasing the volume and velocity of surface runoff. The fact that creeks show stable beds and that no erosive processes are detected in the riparian areas suggests that those areas are contributing to absorb part of the excessive runoff volume, reducing flow velocities and peak flows. Despite the rainfall seasonality of the local climate, with 6 months of almost no rain, all the creeks in the area are perennial streams suggesting that groundwater reserves are enough to feed these streams and that riparian areas contribute to keep soil humidity for large dry periods.
Soil formation	1,4,5	Since large extensions of streams in the study area have their riparian areas relatively protected, one can expect that annual flooding processes contribute to soil formation in those areas. Processes of soil formation also exist in the vegetated areas of NC, particularly in the private areas and the urban fringe.
Biodiversity support	1,2,4,5,6	NC study area shows a particularity of its urban development which is not common in the Contagem urban area itself, in Belo Horizonte and in other urban areas of the region which is the connectivity existing in its vegetation cover. Riparian areas naturally develop as large green corridors and the vegetation in private areas create additional green corridors along the blocks, materialising additional links between urban green areas and the vegetation in the urban fringe and beyond. These patterns are very positive in creating support to biodiversity, with positive effects for a variety of processes such as soil development, pollination, production of natural medicines, among

		others.
Nutrient cycling	1,2,3,4,5,6	All the SPU in NC study area contribute to nutrient cycling. Water quality data from the Agua Suja stream suggest heavy water contamination by raw sewage dumping in the local streams which do not have flow capacity to treat and absorb it by natural processes, contributing to the development of eutrophication processes in the lake of Vargem das Flores.
CULTURAL		
Aesthetic value	1,2,3,4,5	Riparian areas and the urban fringe vegetation have high aesthetic values in spite of some issues such as the deposition of litter, trash and debris. Some of the squares have a vegetation cover composed by big trees with relevant and much praised aesthetic value.

Recreation, cognitive development, social cohesion	1,2,3,4,5	Per observations made during several field visits, natural vegetation in the urban fringe and in the riparian areas are not regularly used for recreation or cognitive development. Larger squares and those located near commercial areas are frequently used and one can find many people in this kind of urban equipment all day long, resting, chatting, observing vegetation and life going by. It is possible that some commercial activities also take place in those squares. The lake of Vargem das Flores is a clear destination for sport practices and recreational activities, such as swimming, skiing, fishing, sun bathing, picnicking, among others. Bars exist along the lake shore where people go for a beer and for chatting.
Educational opportunities	1,2,3,4,5	All the SPU in NC offer educational opportunities. We have no detailed information on how frequently they are used in formal education.

Note SPUs are: 1. urban fringe native vegetation, 2. vegetation in squares, urban parks and streets, 3. urban agriculture, 4. trees in private areas, 5. streams, riparian areas, wetlands, 6. soil

5.3 Ecosystem Disservice Problems in Nova Contagem – a qualitative assessment

In Nova Contagem study area, some SPUs are not providing ecosystem services to their full potential, or due to inadequate intervention or lack of maintenance / management, they are providing disservices. This is, for instance, the case of unpaved roads in the urban area, particularly those located in steep hillslopes, which are source of sediments that will settle in the riparian areas, streams and other water bodies and reduce transparency of the water with an impact on the ecology of these environments.

Lack of sanitation infrastructure is source of water contamination due to the dumping of raw sewage in streams and other water bodies. This is a source of many disservices such as aesthetics, odour, nutrient cycling and eutrophication processes, and health issues. Poor

solid waste management leading to litter and trash thrown in vegetated area, particularly riparian areas, contributes to reduce the aesthetic value of these areas, may be source of bad odour and house mosquitoes and rats. The trash may also block the flow in creeks and drainage structures aggravating the consequences of floods.

Other than the ecological impacts of wastewater, solid waste and excessive amounts of sediments in the riparian areas and water bodies, these pollutants compromise the use of water for drinking purposes and may give argument for those who support the ideas of stream channelling.

Regarding vegetated urban areas, particularly those with large trees, they may be seen as sources of insecurity and places for the practice of illegal activities. Old trees, particularly those affected by urban air pollution, may fall, representing a risk for buildings, roads and the traffic. Roots of big trees sometimes disrupt sidewalks, the pavement of roads and the foundation of buildings. Although field visits in Nova Contagem did not point out these disservices as major problems, they were mentioned by interviewed people in the area. Diseases transmitted by mosquitos of forest origin such as dengue, chikungunya and zika virus disease are also source of concern regarding vegetation and detention storage in the urban environment and in the urban fringe vegetation.

The use of the lake of Vargem das Flores for recreational and sport activities in an informal way may be a source of pollution for the water body (sewage and solid waste contamination). The lack of a risk management policy in the area leads to frequent drowning accidents.

6. Findings and Results - Natural Capital Asset Use and Ecosystem Services

The scientific processes of how natural assets provide ecosystem services and the how ES in turn can influence a range of assets and impact on wellbeing is relatively well understood, as is the 'expert' view of what natural assets exist, the potential ES they provide and the potential to improve wellbeing. But what is the reality?

- How do women and men feel about the natural environment, do they see it to be an asset?
- Do they have access to natural assets or 'service providing units'?
- Do they see that potential services arise from these assets?
- Do they receive any ecosystem services and dis-services?
- How do these relate to other assets and impact on their wellbeing?

These questions will be addressed below drawing on the survey fieldwork undertaken in 2015 and 2016. It consisted of 37 semi-structured interviews including 26 resident interviews (13 women, 13 men) in three areas - Nova Contagem (NC), Tupã (TP) and Solar do Madeira (SM) plus walking interviews and interviews with visitors to the Reservoir (VF). It also consisted of 395 survey questionnaires undertaken with men and women living and working in the 'downtown' area of Nova Contagem.

Of those surveyed 56% were women, 30% of all the sample were 30 years of age or less, and 10% were over 60 years of age. Of the respondents 75% lived as couples with children, but only 13% were married, and 9% were single. While 81% were not born in Nova Contagem, 80% had lived in the area for over 10 years. Of the sample 60% stated their religion to be evangelical.

6.1 Capital Assets Priorities in the Nova Contagem area

The questionnaire survey provided some insights into community levels and access to human, social, financial, and physical capital assets, all of which will help to inform the findings around natural capital assets.

Financial capital: In terms of financial capital 76% of respondents have an income, but 29% were poor – reporting having enough money to buy only food and/or having difficulty covering everyday costs. Being poor is also related to other wellbeing indicators such as feeling where they live is overcrowded and having poor health. Importantly sex is significantly correlated with being poor, with 34% of women compared to 23% of men reporting difficulty paying bills.

Physical Capital: In terms of private physical capital a large majority (86%) lived in housing they 'owned' and most had private green/grey space in the form of a yard or garden (68%). Only 14% reported overcrowding suggesting they had insufficient space for those who lived there. In terms of local infrastructure or public physical capital, 38% want improved security, 30% want better recreation facilities and lights, 18% improved cleaning, and 7% more trees.

Human capital: In terms of human capital, some 69% reported good health and 46% had secondary or higher education levels.

Social Capital: Levels of social capital seemed relatively high with 84% having family in the neighbourhood, and 89% having friends. Some 79% could ask neighbours for help, 51% reported being able to borrow cash from a neighbour in times of need, and only 10% reported a distant or conflictive relationship with a neighbour. However, fewer of the people who might actually need help – such as those that have difficulty paying bills – feel they can ask for help (77%). It is the poor, and women, who are more likely to report conflict with neighbours. Within households, women were responsible for decision making in only 36% of households. In terms of feelings of space and place and future aspirations, the majority thought they would remain in the neighbourhood in the future (63%) but just over half (54%) would prefer to live in a more rural community or the 'countryside'.

When asked to prioritise capitals, most respondents prioritised the public physical capital of their built environment in their top 3 most important assets, over natural capital assets. Within the top three assets 57% mentioned shopping centres, 32% infrastructure services such as water and electricity, and 20% access to the town centre. The next group of assets prioritised were human capital assets - good health services (24%) and good schools (19%), and also local jobs (18%). People did value natural capital assets in that 21% mentioned local green spaces in their top 3 assets.

However, it is important to note that the findings suggest this lower priority may be because nature may not be conceptualised as an 'asset' in the same way the built environment and other services are. Some 21% included green spaces in their top 3 local assets, when asked if they thought public green spaces were essential 52% agreed they were, and some 88% said they would be bothered if there were less green spaces.

6.2 Green and Grey/Green spaces

Before discussing perceptions of green and grey/green spaces it is important to briefly consider how people view the increasing urbanisation that defines the research areas. At times in communities such as TP and SM the 'urban-ness' was questioned by respondents and planners. One respondent's wife *(MRRIC TP)* noted how the community was very small, consisting only 600 plots, and that these plots are *"within a rural area"* but that Tupã is not considered as rural but that it would be considered *"an urban area within the rural area"*. The notion of being 'urban' seems for the respondents to be more related to the density of the built environment, and the accessibility of services, than size. It is also about taming or taking over nature, as the recollections from one of the first residents who lives in the now 'urban' NC suggests: "*Ah, what was here, it was just dirt roads and overgrown land. It was just dirt roads and overgrown land"* (MRD 22 NC) indeed 'asphalt' or the coming of paved roads is of particular importance to the respondents not only for the greater accessibility this brings via better access to public transport, and for walking around the area, but more generally as a symbol of 'urban'. Even though the negative consequences for the environment are recognised, it is still desired by those living in the more peripheral communities in the preserved area of the dam: "*Because they say it's a place ... Yeah ... They say that if asphalt it will not be, it will not be the same again. Because they say here is an environmental area, it will not be the same with asphalt, the environmental ambient will not exist anymore, you know, that's what they say. I think so, I guess it will change a lot. But it would be better for us*" (FRK 20 TP). There is then a conflict between understanding the need to preserve the local Environmental Assets and the desire for better Physical Capital through built infrastructure.

However, not all residents welcome asphalt because the lack of a paved road while often seen as marking out low income settlements, can also be a sign of status: "*But [here] they are residents of a social stratum with higher income, because you need a car to live in this place, there is no bus line. Where I live, for example, every day is three kilometres of dirt road to the asphalt, so that is why there aren't people who depends on public transportation to live in this place. So I would say that income is a little higher [here]*" and "*When they offered to asphalt here for us, and us "no, we do not want asphalt here no" because we do not want to give the appearance of a city over here*" (FRCVdeF 50). As noted above, and for many interviewed the lack of access to regular and fast public transport was one of the biggest problems associated with living in the communities around NC limiting this access not only to Contagem and Belo Horizonte, but those in NC with the surrounding countryside.

As the context section has highlighted Nova Contagem has become larger and larger and increasingly built up and the centre is now seen to be a small town. On the one hand this is seen as a good thing with one female respondent explaining how she felt when she first arrived and now: "*I hated it here, I couldn't stop crying wishing to leave. Nowadays, I won't change Nova Contagem for any other place, you know, Nova Contagem became... You can find everything here, you don't have to go anywhere... (FRMde C 51 NC).* However, there is sometimes a feeling of ambivalence about these changes and the fact it is seen to bring increased violence and problems with drugs as well as 'progress' as this male respondent from the still not well developed community of SM sums up: "*It was very good here, excellent, but it has progressed, progressed, and became worse" (MRRon SM 70).* The use of language is interesting here with the idea of progression, usually seen to be a positive thing, seen as bringing negative change also. Feelings may also be related to the loss of green areas around the original community that have become filled in and built on with one female resident of NC noting development is: "..*taking the bush, so taking the trees, so taking everything and [putting] 'asphalt on top! Let's go! Let's go ahead! Build houses for the people!' I think they should stop doing this soon, and think of leaving a bit of bush, for the population that already exists. But the way things are going that's not what will happen*..." (FRVin 66 NC).

Many of those in the study seem to aspire to a more 'urban' style of living and want improved physical infrastructure, and while they value the environment as an 'asset' green spaces are seemingly not valued as highly as built spaces at least among the lower-middle/lower income group largely represented here.

6.2.1 The Importance of green space

Overall 21% of respondents included green spaces in their top 3 local assets, and men were more likely to mention green spaces in the top three than women (27% v 17%) and as we shall see below, green attitudes generally are more closely related to being a man than being a woman – which goes somewhat against the existing literature (see above). Despite green assets being of lesser importance relative to physical assets and services for most people, natural capital can help build human capital, for example, achieving better health outcomes. People do understand the importance of green spaces, and 52% reported public green space as being essential, with those with higher education levels more likely to have this view. The majority (88%) said they would be bothered if there was less green space, with the majority enjoying urban public green space (64% thought parks were good and 58% liked parks and green areas for sitting) and a significant minority (40%) reported walking in the surrounding countryside.

Those classified in the questionnaire as poor were more likely to be bothered if there was less green space. This may be related to living conditions in low-income, high-density communities: "*I came from the slum... I want some place calmer... Slums are too hectic... I want to take a break from it.*" (MRFar 33 SM.) The mental well-being green spaces bring may also be valued as one participant notes, the natural environment "*…softens, breaks a little the weight of the concrete and steel urban environment, right... I think we, I think even being a urban being, when we enter a greener environment, we feel naturally good..*" (MRA 31 NC).

While green spaces can bring feelings of well being, it is perhaps surprising that it is those people who report poor health in the family who were less likely to be bothered about there being less green space. The fact they were more likely to identify pollution as a problem in the community may help explain this. Dust was noted as a problem in all the communities, in TP due to the lack of paved roads: "*..there is nothing, no asphalt...... It's bad, too much dust...And this dust, we get very affected by it, the children do not feel well because of it, even for us adults, the air here is very dry, really dry here. I think we get ill because of it*" (FRK TP 20). Here the 'natural environment' is being seen as a health hazard and pollutant not a benefit. On the other hand even in communities with paved roads such as NC: "*...there are only a few cars here, but even still, when it is too dry and they pass by the door, oh my God... On the street there, a lot of dust...*" (FRC 27 NC). Many participants recognised the benefits trees potentially bring but as one participant notes: "*I feel, the dry air, low humidity, here at home, we have to put a bowl of water in my daughter's bedroom for her to sleep, because the air is too dry. And look, we live in a wooded area, so, why do I live near trees and the air is so bad? Because of the pollution that's coming from there to here, from the passing cars … and the pollution is coming to my house.*" (MRF 36 NC). People then understand that cars bring pollution and that the natural environment brings regulating services. However, natural capital – in this case trees - were not enough to overcome the problems caused by the increase in physical capital – the built environment – instead it was suggested it needs investment in other types of physical capital – here the need for better and more frequent public transport linking the communities to the centre. When asked what would be the solution for pollution one responded: "*Efficient public transport, for example, subways, they are clean and basically don't cause... cause impact….. the subway for me is the most efficient public transport there is*" (MRA 31 NC).

As noted above, while green space is seen as important most want it regulated to stop dust, for example, but at the same time saw the benefits of its regulatory properties and valued these.

6.2.2 Private green spaces: Backyards

In terms of private green space, some 68% had a yard or garden, and 73% report that they cultivate something in the home, with 60% having a tree, and 46% reporting food benefits from a private garden. Cultivating plants and trees is a general tendency not one related to any personal characteristics such as sex, religion, or age. It is also rated very highly by some: "*If I had conditions, I would move. Not because of the neighbourhood, because of the plot, there is no way to plant, there is nothing*" (MRRon SM 70).

All types of people are growing things when they have the space – and from the survey data it is space rather than poverty that determines cultivation (74% of those who don't feel their home is overcrowded plant compared to 57% of those who report they don't have sufficient space for the family to live). If there is a trade-off between access to private green space and the need for an extra room, development often wins. While there may not be much space for planting, of those who have a yard, 60% have a tree(s) and in fact in the interviews it was noted how trees are more common in private than public spaces: *"Let's put it that way, it's more in the gardens of people's houses, because people buy the plots with trees and do not cut them down. They kept them and if you look up here, on my street, you see those houses at the back, all have large trees, with large canopies. … But parks with trees or woods, there are not many here" (MRF NC 36).*

While there is no strong predictors of who will/ will not have trees, women were less likely to report having a tree, as were those who have less than 10 years in the neighbourhood, and those who only have primary education. There is also some support for the idea that the poor are less likely to report they have a tree. However, all these factors may reinforce each other and may be related to space or lack thereof. As one participant explains: *"...I like vegetable gardens, but my house is small, there used to be a vegetable garden here, but my sister, my daughter built her house, then there's no more space here, but vegetable gardens are good.....But [now], in the backyard, there's a few mangoes, Acerola trees... I guess that's it, I had a Surinam cherry tree there, but I think the shadow [of the building] killed the tree..." (FRC 27 NC).* So if those that would usually move away and start their own home cannot do so due to lack of income (Financial Capital) then houses are extended (Physical Asset) and this is at the cost of backyards, trees and plants (Natural assets). This is not only an issue of space but also the case when tree roots seem set to disrupt built structures such as pavements and walls. One woman recounts the demise of a large Mango tree, her thinking around this and the consequences, "*the root of this tree will come under this home, will break the pipes, and even the walls, right, the foundation ... I had to cut the mango tree. Oh*

my God, why did I do that? The back of the house became so hot, really, really hot." (FRVin 66 NC). In this case physical capital won out over the Regulating Services of Natural Capital but she recounts of a new tree that is getting large that she has not cut because "*When I look at it, I feel 'sorry' for it…*" and reminds herself of its cooling properties. Another tree was cut as it was "*making a mess in the yard, really bad*" while another had negative outcomes for Social Capital from this Natural Capital – "*I even had a plum tree there, I had to cut it because they [the kids] were always climbing the wall to get the plums.*" (FRVin NC 66).

It is interesting to note that although eco-feminist literature suggests women as 'closer to nature' when women make the decisions in the household there is no quantitative evidence from the survey that this leads to more 'green outcomes' over planting or use of environmental resources. The qualitative interviews do suggest it is women who look after private green assets such as gardens, but the extent of the engagement may be limited. To the question 'who takes care of the garden?' one male respondent noted: "*The weather [laughs], the water when it rains*" (MRA 31 NC). There may be some division of labour over who does what as he goes on to say his mother 'just harvests' the garden rather than takes care of it, and of his own role he notes: *"I like planting a lot... I planted the fig tree and the custard apple tree... What else? There was a rosebush here in the front of the house, which was cut, I planted it... Hmm.." (MRA 31 NC).* Nor is it always the case women feel closer to nature, as this response from one man when asked if he would like to make a vegetable garden demonstrates: "*I would, my wife, she doesn't like it very much, but I do …. if I stay here I am going to do it, I like it. It is good to have a lettuce, cabbage...*" (MRE 40 TP). Hence it is the provisioning services he is interested in generating from this private garden.

The benefit to be gained from gardens in terms of cultural services – the beauty of the flowers for example - were also recognised, as was the potential for building social capital, here with a female respondent talking about gardening with a friend: *"Oh, in order to make the backyard more pleasant, right, it is life, to provide some colour, happiness.. that moment with the land, contact with the land, weeding, 'come here, lets weed.' Then, it is that moment for us to start talking…..it becomes a connecting point, right?"* (FRL 44 TP).

While backyards and gardens and the cultivation they allow is highly valued and this is not dependent on age or sex, yet once again nature is seen as something that needs to be regulated, especially trees, that were highlighted as potentially bringing many ecosystem dis-services if not controlled and managed.

6.2.3 Public grey/green spaces: Local parks and squares

Of those surveyed 58% said they liked local parks as 'green areas' and for sitting in them. However, in TP and SM the existence of parks was limited, while in all areas perceptions of the extent to which the 'parks' conformed to the respondents' notions of what a park should look like was an issue. Some in TP questioned the naming and notion of the grey/green space as a 'square' at all: "*The little square there ... For me it is not a square, it is a roundabout, but the people say that is square … for me it is not much of a place for recreation*" (MREd 20 TP). The potential benefits of public grey/green spaces are recognised, with one participant noting she knew of nowhere *"…where we can go, to let the boys play, have fun at will … It would improve health, right?"* (FRMC NC 47). The parks that do exist, while again potential benefits/services are recognised, the actual benefits/services are less so, given as 'green spaces' they are far from ideal: "*Here there are no parks, they are covered with concrete, no trees, no nothing. ... I think of parks as a natural environment, right, flowers, trees, here we do not have these. …. in a park with plants a person is more aware of nature, 'wow, that's beautiful, I can preserve this plant … as it is wilting I will start looking after it ... ' and stuff like this*" (FRMir NC 30) The potential cultural services are recognised by this participant, as is the potential for building community social capital – but this is not realised as this local park/square is not planted.

While many saw parks as not well maintained if and when the local community takes charge of maintaining a local space it can become a real asset. During a walking interview one woman noted how the square was so good because it was 'very organized' "*Because the people of this street here take care of the squares very much, they take care of the squares very much, you know?... But this is not a municipal administration service, you can be sure.*" (FWMdC *51 NC*). One female respondent dreams of trees in her local square *"…I imagine some trees, a square with some beautiful trees"* (FRA 42 TP). On the other hand her views highlight the desire for these spaces to be more formalised, rather than less in the sense many want them to be more recreational than environmental "*I think that leisure, leisure is lacking here. … [if] we want leisure, we have to go to another place. …X Square, a square which has even those things, how do you call that? To do gymnastics right? … there are places for children to go skating, what do we have here? Nothing…". (FRA 42 TP).* It is of course interesting to note that TP is close to the reservoir, countryside and forest, yet 'leisure' is constructed as existing around a formalised or urbanised space.

Liking local parks was significantly correlated with a number of neighbourhood related variables including wanting to stay living in the area. This suggests that local grey/green

spaces help build connection to place. Stronger still was the relationship between feeling safe walking during the day and during the night in the area and liking parks. If people feel safe in the neighbourhood they are more likely to like parks (and presumably visit them) while those who like parks also have a stronger sense of place. For other people parks are seen as dangerous as one woman notes: *"…because sometimes you're there, there will be a shooting, you have nowhere to run, nowhere to hide….now, with the violence that is in the neighbourhood, people are afraid to go out, to go to the parks…." (FRMdeC 51 NC).* While squares may be related to violence the lack of areas for young people to go to, or more importantly things for them to do was seen as helping breed violence and drug misuse so squares could be part of the solution also, but only if the balance of activity is more recreational than environmental: *"Why do you think that an ecological park will get them off drugs? It will not, but they will have a leisure place, a court here, paved, for them, some exercise equipment" (FRL T 44).* Yet there does seem to be a mix of users, at least in the less urbanised communities as one person's summing up demonstrates, when asked who are the most common users of the parks and squares *"… Some of them use drugs, others waiting for the bus, some children also ride bicycles." (MRR 48 TP).*

So who does go to the parks and squares? The quantitative data suggests it is those who lack private green space, the poor, young, childless, and less well educated that seem to favour public parks. Perhaps this is because they have few other options for spending time 'outside' and they value this possibility, however problematic.   This is supported by the fact those that those who like parks are more likely to report green areas in the top three most important assets.

Local parks then seem important to the poor and these spaces are recognised as a local asset which is linked to feelings of place and the desire to remain. This is in contrast to understandings of the countryside or non-formalised or urbanised spaces.

6.2.4 Public green space: The countryside
While the general feeling can be summed up as *"…people here, from the neighbourhood, they all stay home…"* overall 40% of people surveyed in downtown NC reported walking in the countryside. The analysis suggests walking in the countryside is significantly related to sex of respondent, with 46% of men reporting walking compared to 36% of women. As one male participant noted, after eloquently explaining how beautiful a local natural area was, "*Men can go anywhere, but women unfortunately don't go and they don't want to*" (MRA 31 NC). The idea that women 'don't want to go' is of course debatable, and while sex is

important it is perhaps gendered considerations that are more important in determining access – in particular fear of violence seems to be important.

On the one hand violence is seen as masculinised, as it is gang based, and between rival gangs so more young men are the victims of violence: "*sometimes, when it kills the boys there. .. God forgive me - but, unfortunately, we talk about "minus one". You know? One less to give work to, one less to attack people, to steal, you know? To take your security, your peace ...*" (FRVin 66 NC). On the other hand there are gender stereotypes of women being 'at risk' for being 'weak' including by one woman: "*... Because, men always find a way, right, for women it is kind of complicated. They are more fearful, right, not all of them, of course .... women are more fragile, right, women do not offer so much resistance as the men…*" But when asked about walking alone in the less urbanised and perceived safer neighbourhood of TP she said "*I am not afraid, it is a fear I never had, I have already walked here until late, going from a neighbour to another... But, after these things, these robberies, I have started to be afraid… *" (FREI 41 TP). In NC the fear was not so much of robbery but a fear of being caught in the cross fire for being in the "*wrong place at the wrong time*" and this leads to a "*general panic*" (FRMir NC 30). However it is suggested there is nothing to fear for those "*who know how to live*" as harm will only come if the person "*gave a motive*" and he goes on to note "*So, in regards to time, the person could go walking in the middle of the night, in the morning, in the evening, but you must know who you are walking with*" (MRD 22 NC).

The variable which most strongly influenced whether someone walked in the countryside or not was whether they felt safe walking around the neighbourhood during the day or not. So from the survey those who report feeling safe walking round the neighbourhood during the day are more likely to report that they walk in the countryside. The dangers of walking in open areas were highlighted by one man interviewed: "*Look, I used to go a lot up here, have a meadow where I used to go, take my daughter to play, fly a kite, I took the dog to run there, …. But, as the violence is spreading, unfortunately, we started to see drug users there, under the trees, taking ... Then I start to get scared and stopped going there*" (MRF NC 36). It is interesting that there was no violence or threat of violence from the 'drug users' but their mere presence was enough to evoke fear and prevent this, and many participants, from going outside their local area and into open ground. Yet it can also have the opposite effect as one male participant notes: "*There are some beautiful places to pass through in small routes, and you forget entirely about the violence here, these are really beautiful places.*" This is interesting as this same male participant notes when discussing his movements within the urban neighbourhood they are constrained by what he sees to be a 'war of gangs', meaning: "*I only leave the house when necessary … I'm always inside the*

house… because I don't want to be hit by a stray bullet.. I think it is better to stay home, I'd rather stay home quiet" (MRA 31 NC). So here the threat of violence in the urban context is more strongly felt than in the non-urban countryside, and it is recognised that green spaces can also bring not just physical but mental health benefits to those that go there.

Walking in the countryside was significantly correlated with reporting green and also blue space to be essential, suggesting if people do enter these spaces they understand the importance of them valuing them for the less tangible benefits offered such as stress relief. Stress was related to urban living "*then in your day off, you try to go to a place where you can relax, [because] in your own neighbourhood you don't have it, you don't have it". (MWA 31 NC).* As another notes during a walking interview in a green space: "*The noise and visual pollution is visible [in the urban context], you feel them, you get stressed, here you don't...* " (MRA Adevaldo 31 NC) so in the countryside is "*an area that gives you space to relax, good place for you to stop, think a little bit, think .. ease the mind*" (MREd 20 TP)   The countryside gives the chance to reflect "*Reflecting about life, it's good there [the local pond] because when you are somewhere entirely different from your natural environment you can stop and think to yourself. ….*" (MRA 31 NC). It is interesting that the 'natural environment' is here constructed as different from the respondents own 'natural environment' and many see the countryside as other to their daily lives. As another respondent notes: *it's cool, it's different, right? Things you can enjoy with peace and go back home in a peaceful state, you know...*" (MRD 22 NC). This 'rural difference' allows a re-charging of batteries and hence the natural environment aids financial capital formation through productivity gains for the workforce. One visitor talked about the 'detoxifying' properties of the countryside (around the reservoir) noting, "*You feel good in a place, you feel excellent in a place, you feel you are recharging the batteries, the energy, you arrive with more willingness at home, on the other day you go out to work because you were in VF [the reservoir area]" (*MVRqandwife).

Those who do walk in the countryside were more likely to have aspirations to live in a more rural area often precisely because of this perception of the peace and quiet that it would bring. This for some women may be related to the desire to bring up children in a non-urban context. One woman when asked why she moved to a remote location noted, *"it was because I got pregnant. It was the desire to raise my daughter in touch with nature"* (FRCVdeF 50). Another (FRL TP 44) talks of quite profound changes from moving to a more 'rural' location, both financial and personal: "*we decided to have our own home, a space that was only ours, for our independence, and at the same time that we had contact with nature, …because I had just lost my mother too, … and I also had postpartum depression*" She talks of moving there allowing her to fulfil two goals: "..*to get rid of*

51

depression, to have peace, to have tranquillity, to have what is ours too, right? And what we could afford also, at that time." And of the social benefits: " *I left the periphery of the urban zone, of shots, of stray bullets, of drug dealers, of everything and came to the wisdom, to the knowledge…*" including gendered well being: " *I have learned to be a mother in Tupã, I learned to be a woman in Tupã*".

For others who cannot move to the area a visit is enough: "*it is a place where you clear your mind, take a chance for you to see how you get calm...*" (MVAlex 37) a chance to sit down "*under the tree … without anything to do. This is the best part*". (MVC livesnear). This notion of 'doing nothing' was strongly attached to visiting the countryside (including around the reservoir) for many. In contrast for many locals and particularly the poor, the lack of regular work/income meant financial capital was being subsidised by natural capital assets through their ES provisioning services. One recent migrant into Tupã, who lacked social capital networks through which to secure regular local employment noted "*The money I make barely covers food*" (MRE 40 TP) and thus valued his ability to freely access fish from the lake and fruit from trees, and to hunt small birds and animals from the local green and blue spaces. Ecosystem provisioning services from natural capital then can act as a form of social safety net. The effect may not be limited to reducing the food available to low income hosueholds but also the income as some not only fish for food, but for sale: "*I fish every day and I still sell the fish, Tilapia, very small …. I enjoy myself and make money*" (MRRon 70 SM). This use of natural resources can help complement incomes and reduce poverty, however, increasing environmental degradation may reduce the ability of these natural areas to generate such resources and hence the opportunity for the poor to have access to these ecosystem provisioning goods. This degradation is already occurring as noted by some respondents: "*before I lived here, we came here to fish in the stream, nowadays you won't be able to fish, it's all polluted*" (MRW 61 TP).

While some go to the countryside to obtain food and fuel, others relate the countryside not only to doing nothing but to 'quietness'. This was something valued by those interviewed that lived in the more 'rural' areas suggesting those that live there *"…came seeking for quietness, right"* and it being something that keeps them there, including through the social capital a small, rural community allows to be built *"yes, the quietness, and we make friends with people also, then we become a family right, because the neighbourhood is small, then, we make friends, then, we strengthen the place, you don't want to leave from here...*"(FREI 41 TP). The problems associated with building a community in the non-urbanised context was seen to help build social capital through the 'sacrifices' that had to be made: "*Ah, the people are easy to deal with, because there are many people around here that open the doors of*

their houses and treat everyone well, I believe that people are very humble, especially people that started their lives here when there was no asphalt and went through lots of sacrifices .. "(MRD 22 NC). The ability for 'rural' compared to urban environments to cement social capital was reiterated by a long standing resident of NC as she reflected on constructing social capital when the residents first arrived compared to now: "*..I do not know if today we would have this facility to create that bond. Because today it's all very difficult. …So, the drugs came to disrupt a lot of it, because they generated marginalization and lack of trust of the people ... it [lack of trust] spreads like a weed* (FRVin 66 NC).

While valuing the natural environment some participants also see it as 'risk' in line with how it is often conceptualised in asset frameworks. The survey data suggests those that engage with the natural environment through walking in the countryside are more likely to identify natural hazards and landslides as one of the top three risks they face in the neighbourhood. Going into the countryside appears to raise consciousness about nature, including the possible risks it poses and as such, if these risks pose a real threat, allow for better response to natural hazards.

Having talked about what stops people going to the countryside and how they value it when they do go, the question 'who is going' still needs to be addressed. Logit modelling suggests that the most important predictors of someone walking in the countryside or not, is their education level, with those with higher education more likely to visit the countryside (50% of those with higher education walk in the country compared to 33% of others), and perhaps related to this, not being poor also emerges as key in some models (45% of the non-poor walk in the countryside compared to 31% of the poor).

Overall then, women, the poor and those with low levels of education have less access to this public natural asset than men, the non-poor and the more educated – meaning that the countryside is a site of intersecting inequalities, allowing differential access to the potential ES it offers.

6.3 Blue spaces: The reservoir

It is perhaps not surprising that opinion on 'blue spaces' (streams and lakes) was positively related to favourable opinions on green spaces. Overall 47% of the people surveyed in NC saw blue spaces as being essential, although there was an age dimension and fewer of those over 60 (26%) saw blue space as essential compared to other age groups (49%). More important as a predictor was, once again, education, and those with higher education levels are more likely to view blue space as essential.

While a general view of blue spaces is interesting the fact that there is a large 'blue space' – a reservoir – near the study area allows further exploration of how people see and value a natural asset which has the potential to yield two different ecosystem services that in this case are in some way potentially conflictive – a source of drinking water (Provisioning Services) but a source of recreation including swimming, fishing and other sports activities as well as socialising more generally (Cultural Services). Indeed recreational activities are discouraged in the surrounds of the reservoir and often controlled, especially at carnival when entrance is blocked altogether.

Overall 73% of those surveyed knew the reservoir is a water supply and this knowledge was related to higher education levels as well as a general 'green' outlook i.e. thinking green spaces were important. Perhaps related to this only 27% report swimming in the reservoir at VF was not a problem, but 81% want use of the VF area controlled. Interestingly of those interviewed in downtown NC only 17% visit the VF reservoir, and it is those that know what the reservoir is for, that are more likely to visit, or perhaps, given the relation of knowledge to education and attitude, they know its use because they visit.

When respondents in the interviews were asked what the reservoir is for there were a variety of answers and many did state it to be a source of drinking water. Others were less clear this is its main role. One NC resident notes its multiple uses: "....*It has several uses ... It is leisure, nature, rest* (MVAlex 37 NC) but not that it is a water source. Another, a visitor, sees the water as more a private than a public good: "*This water here, it is calling me to swim, … there are millions and millions of litres of water just for me to bathe in [laughs]*" (MVRqandwife). This understanding of the area as a private / public place is reflected in the comment from another visitor: "*Oh, the neighbourhood where we live is a residential one, right? Where there is a lot of houses, there is no forest, there is nothing. … I am not going to place a barbecue pit in your backyard, am I? And here I can place it anywhere that I want*" (FVNilce 36).

However, relatively low levels of people in both the quantitative and qualitative components of the study visit the reservoir and there are various reasons for this. Some used to visit the reservoir much more than they do now and the reasons for not going vary but generally relate to the degraded quality of the reservoir, not just because of the drought, but also due to overcrowding, littering, and water pollution as well as safety concerns over swimming and crime. Moreover, as with the surrounding countryside, accessibility is an issue, even for those who live in NC. Those who have to rely on public transport face a challenge as there

is no direct route and visiting implies two buses and a walk of around 20 minutes. Those who drive also see it is difficult, this visitor discussing a 40 minute drive on bad roads weighs up the cost/benefit of visiting: *"We have to make a sacrifice, to come, to get some fresh air, to enjoy ourselves, see the dam. It is really very good, but it is difficult……We make a huge sacrifice to get here, but to compensate it is good, here, there is pleasant wind, it is cool, although at home we don't have this...* (MVC husband FVA). Another includes not just a time and comfort analysis of cost/benefit but also the financial cost deciding on balance that: *" … wow, it is worth being here. It is worth what I spent with gas, what I bought, it is worth everything being here"* (MVRqandwife)

Many noted how the reservoir used to be seen as a beautiful place to visit but now less so due to the drought: *"…when I moved here, the dam was beautiful, there was a lot of water. Nowadays, with the drought, it got dry, it became ugly… there is little water, the water there is smelling bad"* (MRC 37 SdeM). This respondent goes on to note the reservoir is also increasingly seen to be linked to death but the nature of this is changing: *"In the old times, it was more because of the drownings, because a lot of people used to swim there, isn't it? Nowadays, it is because of the crimes, because almost nobody swims there."* The crimes in question were often related to the phenomenon of dumping bodies in and around the reservoir. However, some do highlight the danger of getting to the reservoir –being attacked and robbed on the roads – and danger once there from those there solely to fight, drink and take drugs. These 'anti-social visitors' put others off walking in the areas around the reservoir. These ecosystem dis-services also apply to the surrounding countryside… One respondent on a walking interview noting*: "For nature this forest here is a very good thing, but it also serves as, like some hiding places for bandits..."* (MWC 37 SdeM). Danger is seen as a new problem, not just because these are new types of visitor but because there is less policing of the area: *"Yes, the criminality increased very much. In the old times there was a lot of security, the police were more engaged. Nowadays no, there is little security. We go camping here and we are afraid to camp … And in the old times no, we camped without concerns.."(MVP 64).* Danger is not just around the water, but in the water and again is seen as a problem of lack of 'policing': *"It's really poorly organized that Lake... A lot of trash, a lot of stumps. Now, if the city government would come and yanked those off it would be really good"* (MRFar 33 SM).

However, although the local residents see the reservoir as no longer a nice or safe place to go, they also see there has been an influx of outsiders visiting the place – not just those coming to take drugs, to drink or to fight, but rich outsiders coming with jet-skis and quad bikes. As one local woman notes: *"They are rich people's invasions! Rich people's invasion!*

Yes, they are!" (FRVin 66 NC). The same respondent thinks this has brought segregation suggesting *"…the part where there's a marina, I think it's more on this side, on this bank of the lake here [north shore]. The opposite bank [south shore] is where it is frequented by the common people*" (FRVin 66 NC). However, another respondent, a visitor, notes: "*Oh, I think that…It is... Humanizing, right? Humanizing, because everybody is here, of all the colours, of all the qualities, social class, there are rich people, poor, black, white*" (FVNilce 36).

The invasion of the rich has brought problems in terms of how locals perceive these outsiders to behave for example leaving rubbish behind them, noting how local people responded: "*.. We even tried to do a campaign in order to place garbage baskets, at least a skip. People who came to camp … they went away, but left the place dirty, including the fact that there were no bathrooms, right?* (FREI 41 TP). The lack of public bathrooms was noted as a problem given the large number of bars, leading to people urinating and defecating in the surrounding 'green' areas with the resultant issues of visual and olfactory pollution and health issues. Local bar owners interviewed had wanted to build eco-toilets but said they had been blocked by the municipality and instead: "*This is an embarrassing thing for us, because our customer comes, asks for a restroom and you say 'no, it is the bush'…* " (FVE 49). As one woman comments when asked what would improve the place: "*Toilets, right? Toilets. Because as we urinate and defecate in the places, we lead to contamination, right? Then, I believe that it is this. Security and toilets.*" (FVNilce 36).

Some visitors do try and behave responsibly and not only clean up after themselves but others also "*When we can, I mean, we do something, I try to collect the waste, whether mine or belonging to someone that I see*" (FVA 37 visit). Others are less conscientious, blaming the general lack of care/maintenance of the area for their behaviour as this story about the time a respondent was challenged by another visitor for leaving rubbish demonstrates: "*I said but everything is dirty, taking care of what, if everywhere you look is all dirty?" But it is wrong, I know that he is right and I am wrong. Right, I should take the waste and take it to my home …*" (FVM 67). One of the respondents is a visitor who does try to police the area in this way: "*I collect the waste around me I make people aware, I complain when I see people making fires [barbeques] in the bushes, when I see the people breaking the trees' branches Whether or not, I believe I am doing my part. Wow, I picked so many fights in the lagoon edge, you can't even imagine*" (MVC lives nearby) and he wants better enforcement of his voluntary policing of the area "*…although from my point of view I think that everybody knows, right? But then you have to enforce, you have to insist for people to take better care...*", suggesting then the need for better formal 'policing' of the area.

However, even this invasion of badly behaved 'leisure polluters' has now declined as the water level has dropped and the dam become less attractive, or at least it has changed: "*.. it [the dam] got dry, it became ugly, even the visitors stopped. People came with speed boats, jet-ski, nowadays they come here with quad cycles to play on the sand. But… from the neighbourhood, here, a lot of people went, but, now, in the recent times now, a lot of people stopped going there, because… the water is low, the water there is smelling bad*" (MRC 37 SdeM). So to some extent outsiders still come to the site to use things such as jet-skis and quad bikes which go on, not in, the water but locals who cannot access such expensive goods go less as they can no longer enjoy (free) recreational activities such as swimming. In fact these intrusive activities of the 'rich' may disrupt the activities of the poor which are non-intrusive: "*Oh, the fishermen come here in order to fish, right, not to drink, not to make a mess, not to shout, or dance, nothing, then, they come in order to fish, they get their fish, and go away…*" (MRRon SM 70).

A women living in TP notes the impact on their ability for recreation with the reservoir drying up and also the masculinised nature of these recreational activities: "*Even nowadays we go there once in a while, look around for pleasure. But is not possible to go swimming there anymore, do those things that the boys like very much. There's no way to do them anymore*" (FRK 20 TP). This is an example of where degradation of a natural asset impacts on its ability to provide ecosystem services, with this impact being greater on the poor due to their limited financial assets.

Those who felt it was OK to swim in the reservoir (27%) are more likely to be those that visit and also not feel swimming and other activities should be controlled. Interestingly they are also more likely to know what the reservoir is for, so even though they are also more likely to know that the reservoir is a source of water they still think swimming there is not a problem. This may be related to lack of options rather than lack of education since they are also less likely to own their home and to have a yard, so lack their 'own' outside space, and as such like the reservoir in the same way they are also more likely to like parks. Those who feel it is OK to swim are also more likely to perceive their local neighbourhood to be safe, i.e. for walking round in – perhaps because they are actually forced to enter these 'dangerous' spaces, including around the reservoir. If the area is to be controlled and swimming prohibited it is these people, who already lack many options for recreation that will suffer: "*They say that the center of the roundabout is a park but for me it is not a park. And what was good here was the pond, otherwise [in terms of] good things here, there is nothing else. Nothing at all, nothing*" (FRK 20 TP). As one notes then: "*I think that this here [swimming in the dam] has to continue, because this is the only thing that the poor have*". (FVNilce 36).

However, this is provisioned on them needing to be responsible for the area "*I think it's important that low-income people have a leisure area, but they have to have a leisure area that they take care of*"(FRCVdeF 50). It is interesting that this visitor sees it as the 'poor' locals who need to act responsibly, while they see the rich 'invaders' as being the main problem.

While the majority did not think it was OK to swim in the reservoir the qualitative interviews suggest what is seen to be a problem is the state of the reservoir nowadays due to the drought, the lack of water and the fact the water is 'smelly' – that is, the condition of the water makes it unsuitable for swimming rather than the purpose of the reservoir being seen as making it unsuitable. As such people still go and 'misuse' the reservoir "*But most of the times we go fishing, because there is no way to swim there, we are not keen to get into the water" (*MRC 37 SdeM). This use of the reservoir is also a more 'male' than female activity as one respondent notes when she went to the area with her husband while he went fishing she went for a walk "*to know the place, exactly to know the place...*" (FRC 27 NC). Other attractions such as bars may attract other, presumably different types of people: *"Because there are trailers, there are bars, then they go in order to drink some beer, something like that, and go away. But not to swim anymore, to enjoy themselves, to have a barbecue…"* (MRC 37 SdeM). This idea of the natural environment needing to be, not so much organised as socialised is summed up by a visitor: *"what's the fun in being in the middle of these bushes here without the bars, without anything? This, it is controversial, isn't it?"* (FVNilce 36). This was a view echoed by a local bar owner interviewed who wanted to provide recreational facilities on the lake shore, as well as formalised barbeque pits to ensure the surrounding area did not suffer fire damage. more rubbish bins etc. As she notes: *"… in addition to supplying [water], because I think this comes first, and we have to really take care of it because it supplies us [water] … But it is a tourist point, why can't it be a place which can provide sustainable leisure? Respecting the lagoon, respecting the environment?" (FVE 49).*

The survey asked if people felt the reservoir should be a controlled area and although some respondents are clearly using the reservoir themselves the majority (81%) want its use controlled – and these people are more likely to be those that do not visit and do not think it is OK to swim there. However, the best single predictor of wanting the area controlled is being female. Correlations support a gendered preference to control the area also, since wanting the reservoir controlled is related to feeling unsafe walking during the day, which is in turn related to being female and not visiting the reservoir. While the desire for 'control' may be more around fear of violence and the perception of the reservoir as a (gendered)

dangerous space it may also indirectly link to the issue of the reservoir being a source of water - those who want the reservoir controlled are more likely to prioritise basic services in the top three important assets in the neighbourhood (e.g. water supply) – and also be linked to ideas around keeping areas clean - those that want the VF area controlled also want neighbourhood cleaning improvements. That is, those concerned about better service provision and about the cleanliness of the local area are more likely to want the reservoir controlled. One female participant sums up these ideas: "*And the person [who goes there] is ignorant, because if you know, there is not a place for fun, it's a reservoir, it is a place that has to be preserved, you should not go there. Even if you go there, just go to admire the scenery, have a picnic nearby, do not go into the water, pick up the trash and bring it back to discard it in the right place. But most people who go there, they go there to swim, eat, leave rubbish there, then an accident happens, you know, drown, die, a tragedy strikes* " (FRM NC 30). All three issues – that is a water supply, the issue of cleanliness and the issue of danger are apparent and seem to influence opinions around access to the reservoir, especially for women.

The need for 'control' of the area may also be related to the encroachment of the built environment that had not been 'controlled': "*The municipal administration allowed…the real estate speculation, the construction of small farms around the lagoon… The riparian forest was entirely destroyed… Then, the lagoon became practically unprotected… Then, this causes the lagoon to be polluted*" (MRO 53 NC). Pollution/sewerage entering the reservoir from the local communities and from people dumping rubbish there for some leads them to question : "*Then, I wonder if that water is really pure, I drink it and think about it 'is it really pure?', I have my doubts*" (FRC 27 NC). Another notes "*Where does the sewage go to? Into the lagoon! Oh, you get into it [the reservoir], swallow water, you are drinking sewage. [laughs]*" (MVC lives near).

6.4 Benefits from the natural environment

Clearly the above discussion highlights that some people value the natural environment for the Cultural Services it provides such as recreation, beauty, peace and quiet and the space to reflect suggesting also appreciation of such public spaces for mental and physical wellbeing and as such Human Capital. The changes in the reservoir were mentioned by many in the qualitative interviews expressing their sadness of the changes not just from a recreational or environmental position but also an aesthetics issue: "*….photos of when it was full, it is beautiful. You know? That green grass, that sea, you go there today and see only bushes, you don't see anything, it was all full of water, you only see that cracked mud there, it is sad to see that.…*" (MRA 31 NC). However, nature is not always viewed favourably at

the reservoir but rather as getting in the way *"Yes, and these bushes all around too, we don't even get close the water. Can you see how the bushes are taking control of everything? Except [for the bushes], it is a pleasant place for you to spend the weekend.... I particularly like to come here, but, I liked it more in the old times."* (MWC 37 SdeM). The financial implications for local business are also indirectly recognised in that as one notes *"And today it is over, this tourism no longer exists, there is no lagoon not even for the people from the neighbourhood"* (FREI 41 Tupã).

Thus the reservoir is seen to be a lost 'asset' as a tourist draw and for the local people. While in simple models of ES the very fact a natural asset exists would be seen to produce services, as noted unless these are mobilised and appropriated then no services are generated. Here also it is clear that the changing nature of an 'asset' may mean mobilisation and appropriation is lessened or altered (such as the use of quad bikes over jet-skis over swimming as the water levels dropped) and/or with implications for both its delivery of services and those who can access them. Other natural assets and who can access them and how are now considered.

6.5 Ecosystem services of plants and trees

All those surveyed were asked about the benefits from having a garden or yard. In terms of tress the regulating benefits of private trees was most frequently mentioned with 61% reported tree cooling / shade, followed by 50% reporting improved air quality, and 14% rating trees as absorbing rain water. Of those with trees 35% noted provisioning and use of their fruit and the provisioning benefits of private gardens was also noted, with 46% reporting food benefits to arise from a private garden.

As noted above the availability of fresh produce from gardens was seen as a positive for health as well as financial reasons. Medicinal plants were also still utilised and seen as a 'tradition' that was 'learnt from parents'. It is important to recognise also the goods that are obtained from public green and blue spaces such as fruits, firewood and fish can be a very important addition to low income households: *"This lagoon has already satisfied my hunger many times, this lagoon has already satisfied my children's hunger, it has already helped my children grow..." (FWD SM).*

The qualitative interviews highlight that most trees in the neighbourhood are in private gardens and yards and indeed some people will go out of their way to keep existing trees: "*some people when they buy a piece of land the first thing they do is cut down the trees. The neighbour down here, he made an adjustment to the wall of his house so the tree was not cut down*" (MRF 36 NC). However, others cut down trees to improve their built environment

opportunities, despite the fact this might have an impact not just for them, but for their neighbours. One man related how a neighbour insisted another neighbour cut down a tree that was infringing on his property and how this then impacted on three people's lives:

[O]: "*It provided shadow here and also where the birds slept, spent the night, made their nests. After the tree was cut, it finished. There were many of them, there were many sanhaços, there was, these seedeaters…*

[I]: And do you miss the birds here?

[O]: I do, I miss them. (MRO 53 MC)

Another respondent suggested people should be penalised for cutting down trees and that he himself had tried to intervene to stop private benefits overruling the public good that comes from trees*: "people here want to cut a lot of trees... Why … Just leave it alone. It gives a fresh, free air... Shade. There is no need to cut trees... If it were for me I wouldn't cut any. But they want it, so they do it. I even called the department of environment there..."* (MRFar 33 SM)

The lack of trees for shade was noted by those who have to walk around the neighbourhood: "*When we're walking, and the sun is hot, "Oh my God, why aren't there some trees here for us to walk under them until we get home?" Oh my God...Not even in the square, the square is hot...*" (FRC 27 NC). This is seen to be a public issue, and one for the local authorities to respond to: "*it is not sufficient, I think that more trees should be planted. Particularly here in the urban area, isn't it? .. in the sidewalks, they should, … the municipal administration should provide some tree seedlings, shouldn't they? I think it would get much better*" (MRO 53 NC).

Given squares and parks are designed for people to come together and socialise then the lack of trees and the shade they give is a problem. However, obviously there may be dis-services too and the shade may be utilised by those who wish to congregate for 'anti-social' reasons such as drug use, as the participant previously cited noted, he stopped going to the meadow because "*we started to see drug users there, under the trees*". Similarly a female respondent during a walking interview remembers her mother cut a tree down as on the street "*.. there are some users of... of drugs, right? Then, there was that shade [from the tree] right? Then, it was a reason for the people to stand there, right? Smoking their things, there. Then, she cut the tree*" (FWM NC). She also notes now there are no trees left on that street, this is because of the roots of the trees were seen to be a problem – nature needing to be controlled for the benefit of people, with trees having to be cut down as if not: "*the root would take control, destroy the houses around it".* Nature here needing to be 'tamed' within the built environment that takes precedence.

While shade is the key benefit, the second most frequently cited benefit to accrue from trees was improvement of air quality. Interestingly income is associated with appreciating trees as improving air quality, in that those with lower incomes are more likely to mention improving air quality as a benefit from trees. In the quantitative study those who mention air quality are more likely to aspire to live in a more rural area, be concerned if there were less green spaces, and want tree improvements in the areas more generally. This may point to a general understanding of the value of trees as providing Regulating Services. In the qualitative interviews some good understandings of the more intangible benefits of the environment were expressed: *"…. global warming, the more you cut trees, worse it will be, … now if you come and cut the trees, and have impermeable surface, that's bad" (MRF 36 NC).* This understanding of the importance of the environment and how nature/human interactions are important was particularly expressed when discussing climate change. For example, when asked what caused climate change: "*It is because as man is cutting the trees, right, the planet becomes hotter. And the waste recycling also, because of the ozone layer*" (FRL 44 TP). Or when asked about the outcome of changes: "*The temperature increased a lot, also, I believe that's because of the asphalt, isn't it? … impermeabilization of the sidewalks, the asphalt, led the heat to increase, the climate has changed a lot here*.." (MRO 53 NC).

Whilst the benefits from trees – not just tangible benefits such as shade but also more intangible planetary benefits – are recognised, again there is a trade-off between this form of natural capital and other capitals such as physical and social capitals, and the 'dis-services' at times outweigh the percieved ecosystem-services.

6.6 Ecosystem Dis-services – Pollution Problems

Despite it being a peripheral urban neighbourhood and relatively close to open countryside, there is a perceived problem with pollution and overall 66% of those surveyed identified pollution problems. From the logistic regression models women appear to be very sensitive to pollution problems (see Table 4). Perception of pollution is also associated with being young (under 30) and a general lack of fondness for the neighbourhood i.e. not wanting to stay. Perhaps most importantly those who report poor health are also more likely to see pollution as a problem.

Table 4 – Women's Sensitivity to Pollution Problems

Variable and Coding	Mean	Model A				Model B (Parsimonious)			
		B	S.E.	Sig	Exp(B)	B	S.E.	Sig	Exp(B)
Dependent									
Identify Pollution Problems, 1=Yes, ,0=Otherwise	0.66								
Independent									
Constant		0.12	1.28	0.93		1.21	0.43	0.00	
Born in NC,1= Yes, 0=Otherwise	0.19	0.19	0.55	0.72	1.21				
Over 60 yrs age, 1= Yes, 0=otherwise	0.10	-0.49	0.73	0.50	0.61				
Under 30 yrs age, 1=Yes, 0=otherwise	0.34	0.48	0.50	0.33	1.62				
Married, 1=Yes, 0=otherwise	0.13	-1.64	0.52	**0.00**	0.19	-1.27	0.45	**0.01**	0.28
Time in NC, 1=less than 10 yrs, 0=Over 10 yrs	0.20	0.78	0.57	0.17	2.17				
Evangelical religion,1=Yes, 0=otherwise	0.60	-0.23	0.39	0.55	0.79				
Sex, 1=female, 0=male	0.56	0.96	0.41	**0.02**	2.60	0.77	0.33	**0.02**	2.16
Higher Education, 1=secondary (complete) + higher (complete or not), 0=Other	0.46	0.41	0.41	0.31	1.51				
Lower Education, 1=primary incomplete, 0=Otherwise	0.20	0.33	0.61	0.59	1.38				
Health, 1=good, 0=otherwise	0.69	-0.90	0.44	**0.04**	0.41	-0.75	0.38	**0.05**	0.47
Stay NC in future, 1=Yes, 0=move	0.63	-0.05	0.39	0.90	0.95				
Poor, 1=food only & difficult covering costs, 0=otherwise	0.29	-0.11	0.44	0.81	0.90				
Social Capital, 1=borrow cash from neighbour, 0=otherwise	0.51	0.25	0.36	0.49	1.28				
Housing Over Crowding, 1=insufficient space, 0=otherwise	0.14	0.60	0.56	0.29	1.82				
Household Reproduction, 1=woman responsible, 0=otherwise	0.53	0.35	0.37	0.33	1.42				
Have Private yard/garden, 1=Yes, 0=otherwise	0.68	0.36	0.86	0.68	1.43				
Plants, 1=Yes, 0=otherwise	0.73	0.36	0.42	0.39	1.43				
Have Tree, 1=Yes, 0=otherwise	0.60	0.41	0.41	0.31	1.51				
Household Decision Making, 1=woman responsible, 0=otherwise	0.36	-0.12	0.38	0.76	0.89				
Health Centres, 1=mention in top 3 assets, 0=otherwise	0.24	0.62	0.48	0.20	1.86				
Schools, 1=mention in top 3 assets, 0=otherwise	0.19	-0.69	0.48	0.15	0.50				
Drugs & Violence, 1=mention in top 3 risks, 0=otherwise	0.92	-0.26	0.73	0.72	0.77				
Epidemics, 1=mention in top 3 risks, 0=otherwise	0.39	-0.05	0.39	0.89	0.95				
VAWG, 1=mention in top 3 risks, 0=otherwise	0.16	0.47	0.50	0.35	1.60				
Natural Hazard, 1=mention either flooding, landslide, fire risk, 0=otherwise	0.15	-0.25	0.52	0.63	0.78				
Improve Security, 1=Yes, 0=otherwise	0.38	-0.66	0.38	0.08	0.52	-0.74	0.33	**0.03**	0.47
Improve Trees,1=Yes, 0=otherwise	0.07	0.02	0.81	0.98	1.02				
Feel Safe walking in day,1=Yes, 0=otherwise	0.68	-0.23	0.40	0.57	0.80				
N		190.00				190.00			
Log Likelihood -2		207.04				223.1			
Goodness of Fit		191.27				183.5			
Cox & Snell - R^2		0.188				0.117			
Nagelkerke - R^2		0.259				0.16			

Note: sig = p<0.05

Pollution in the neighbourhood was associated with car emissions for those close to roads but the regulating properties of trees was also recognised: " ...*every time I go out, that I have to go sometimes, to the bank, or that I have to pay something, I come [back] with a strong headache because of the carbon gas right, from the cars, right? It is not that this does not happen here [Tupa], and that it does not circulate, but the air is different*…" (FREi 41 TP).

Pollution is also understood more broadly, including the idea of rubbish accumulating on streets as 'visual pollution'. One participant notes the bad impression of the neighbourhood that arises due to the rubbish in the streets, and suggests that it is not due to lack of services: *"But there is! There is garbage collection, every day of the week, but ... they prefer to throw it on the street. And then, there is pollution of all sorts. Visual pollution, right?"* (FRVin 66 NC). Others called for better enforcement of existing prohibitions "*We have to report them, right! We have to do it because they are not polite. Why don't you put it on your door for the garbage truck to take it? You throw some on the neighbor's yard, plastic bottles, glass bottles..."* (MRFar 33 SM).

Rubbish was identified as a problem in itself but all as a pollutant when 'dealt' with by being burnt: "*And that toxic rubbish smoke, dogs go there and tear everything, so the rubbish gets spread all over the place, people throw everything away there,..."* another noting that: "*So, when the truck does not come here on Wednesday people gather everything and burn it, and near the forest here, not considering that the fire can get out of control" (MRF 36 NC).* Thus rubbish is not only an eye sore and a pollutant but also dealing with the problem creates a risk to the natural environment. It may also be a product of the natural environment: ***"Then, the people have more excuses, because there are bushes, you know? I think they take advantage of this issue to use it to discard waste, you know?"* (FRMdC 51 NC). Bushes were seen by this female respondent as creating dirty and dangerous spaces, liking a local square because: *"There are only trees. There's nowhere a person can hide, right, I think it is very safe...."* Even when square do provide facilities to dispose of rubbish they sometimes do not last: "*… there were a lot of garbage cans in this square here, they were burnt, removed..." (MWA 31 NC).* On the other hand, one way to deal with the anti-social dumping of rubbish might be through establishing 'green spaces'. One respondent noted how her mother had 'occupied' a public space after the accumulated waste dumped there was cleared by the local authorities. She brought seedlings to the area, and began to plant there and as the garden grew so new dumping did not occur as: *"And now, who is going in good conscience to discard waste over there, right?"* (FWM NC).

Some did talk of recycling and the desire to be able to separate waste. One issue is that at present individuals who can make money through selling materials to recycling warehouses may go through rubbish bags looking for plastic, for example, tearing the bags and adding to the problem of rubbish accumulating in the streets. One respondent notes the multiple and negative environmental outcomes of these informal 'recycling' for money initiatives: "…*there is no selective collection here, there is no material separation, everything is placed together there. Plastic, some recyclable material, cardboard, bags, then, the collectors [collecting to sell] pass in the street… sometimes they open the garbage bag, they don't close it, the dogs come and spread the garbage on the street... Then, the… There is no street sweeping. … then, what happens? The garbage is taken by the rain waters…*" (MRO NC 53). Concern, was not only rubbish as a 'pollutant' but other wastes that were discarded such as cooking oils "*but I should not discard the oil in the [cess] pit, I can make soap and donate it. I am doing something good for the environment and for human beings at the same time" (FRL TP44)*. There were wider and more general environmental concerns over pollution: "*The water itself has to be cared for …Water is a finite good, right? One day it will finish, the planet is formed, most of it, by water, but it is not water for human consumption right? It is saltwater …in a short time we will have shortage of water… "(*MVRqandwife*)*. Water was seen as a real concern, possibly because the interviews were undertaken during a severe drought that had brought attention to the issue. Many expressed concerns more for the future and the need to act now to protect the water sources: "*….. thinking about the future generation of our children, in the future, my son is not going to have water in the neighbourhood because I helped pollute it...*" (MRW 61 TP).

Before considering the problems that arise with natural asset degradation, one big issue raised by many people was the issue of sewerage and sewerage disposal. This is unpleasant: "…*there are times the sewage runs here at my door step, at the neighbour's gate….there is a septic tank there, from a neighbour there that sometimes it overflows and runs on the street, when we go out we try to cross over it but is not possible, the house gets dirty, the wall there, a foul smell*" (FRK 20 TP). It is not only households that are affected but schools too, with children having to walk through the overflow to get into the school potentially taking the waste into the classroom and raising health issues. It also interacts with the natural environment getting into and contaminating streams, lakes and the reservoir and as it flows down streets, compromising green spaces also: "*there was a vegetable garden.. but as the neighbourhood developed they built a lot of cesspits .. we cannot plant any more .. we had to stop the garden...*" (MRRon 70 SM).

In the smaller communities of TP and SM most residents had cess pits that needed to be emptied once full, demanding the resident phones to book the service which may take up to a month. Because the pits need to be emptied it was suggested by those interviewed that many tried not to put too much into the pits and saved this for faeces only, discharging other water into the street instead: "*You can see that everywhere you go, there is a pit, but the water, the kitchen waste, which is fat, which causes a bad smell, all this goes onto the street. And it also help to make so many holes in the street, because the place where such waste is discarded in the street remains wet all the time*" (MRRic 26 TP).

The other issue is around the fact that, even when drainage systems are in place such as in NC, some still discard waste into streams*: "But when it gets blocked I think that they consider it is easier to discard it in the stream. You know, I don't think this is the administration fault, I think the person himself/herself is responsible for that... You know, if the sewage network exists, let's use it, right?"* (FWMdC 51 NC). There was evidence of this on a walking interview: "…*you can see the sewage collection pipeline, and even so there are people who still discard the sewage in the natural affluent" (MWA 31 NC)*.

This concern over the bad behaviour of others was not confined to issues around sewerage and many do understand the importance of natural assets such as streams, trees and land more generally and are concerned by the lack of knowledge and 'bad' behaviours of others. One respondent commenting on the behaviour of a neighbour notes: *"He does it even without realising and may be thinking 'I will burn this because it is easier to clear my land, otherwise I would have to excavate it, weeding later', But he's taking an important layer of soil which serves to absorb the water, and then global warming will increase much more" (MRF 36 NC).*

At times the natural environment is seen to bring dis-services, often related to providing cover for 'anti-social' behaviour such as drug taking, hiding places for robbers or un-managed scrub land and bushes promoting littering. However, more important concerns were around rubbish and sewerage and how its disposal damaged the natural and the built environment, and pollution and how the natural environment was not able to neutralise the negative outcomes of urban living such as car emissions and household waste. Women were particularly sensitive to pollution as a key 'risk' in the neighbourhood.

6.7 Urban Risks, Natural Hazards and Security

The main perceived risks in the area were drugs and violence with 92% reporting this social risk, with women more likely to identify drugs and violence as being a risk (but only 16%

mentioned violence against women and girls as a specific risk). Given this high perception of drugs and violence as 'risk', perhaps surprisingly 68% of respondents felt safe walking during the day. However, only 18% felt safe walking at night. In terms of other risks, 39% reported health epidemics risks – and the perception of epidemics as risk was related to being poor (interviews were undertaken during the time zika was becoming an issue). While cars and pollution were seen to be a problem, only 14% reported traffic accidents as a risk in the area.

Only 15% reported natural hazards risks (flooding, landslide, fires). The latter is interesting as the area is prone to both small scale floods and landslides, yet there seems to be a relatively low perception of this as risk – the literature would suggest this is due to the normalisation of risks through adaptive realism given they may feel there is little than can be done (see Nathan 2008). Some who were the first settlers in the community were relocated after a flood in the 1980s: "*Many people, I think 200 families were moved from those regions which had floodings before. … because it was not a place for people, it is a place for water*" (FRMir NC 30). The literature suggests that what constitutes 'flooding' is of course subjective and for those who have been through a major event unless this is widespread and life threatening it may not be seen to be a real 'flood' just a nuisance. For example: *"When it rains here in the neighbourhood, it is 100% guaranteed that the power ends, the power stops, the streets become all mud floods….."* When asked if some local flooding worried them: *"Yes, because, I mean… in case you have to take a bus to go to work, the buses did not come, they did not pass by."(MREd 20 TP).* Interestingly, time spent in the neighbourhood was not a significant factor in the quantitative analysis in perceiving flooding as a risk, but it was in terms of perceiving landslides as a risk.

Quantitative analysis suggests the factor that most influences the opinion that flood is a risk is not having an income and not being an evangelical. The former may suggest this fear is related to a general feeling of insecurity of livelihood, or experiences of only being able to source accommodation in undesirable locations such as river banks, flood plains and steep slopes, areas with the greatest vulnerability to these risks. The latter may reflect what has been found elsewhere in the literature – that religious people may see 'disasters' as Acts of God rather than as preventable outcomes of natural hazards.

However, the qualitative interviews give some support to the fact people do understand the connection between human interventions and 'natural' disasters: "*[with more] asphalt we will have flooding in our homes, right? I believe so, because when it rains a lot there my alley becomes a waterfall..*"(FRAt VdeF). They also understand that more direct 'human' actions

can also cause flooding: *"It is because, as I told you, everybody throws waste on the floor, then it accumulates... when the rain comes …The waste does not go down, this stream is narrow …this stream gets full, the water overflows and causes the floods. ... Close to my sister's home there is always a flood, always"* (MRK 31 SM). These human factors included building on slopes that has led to landslides "…*the houses, you see in Nova Contagem, there are regions that the houses are like this, built on the slopes of the hill, on those places, when there is heavy rain, landslides occur*" (FRMir 30 NC).

For some it is clear the issue is a lack of balance between the natural and the built environment: "*Because we invaded the natural place, right, … So people build there and they are wrong, we are the wrong ones, because … the water will run its course, …it is there long before us*" (FRMir NC 30). However, one respondent suggests that such events are not seen necessarily as environmental issues: "*Because the person constructs in the risk area, constructs there knowing that he/she is at risk, removed the vegetation, when the rain falls it will cause a landslide. He is not protected, then it becomes a risk, …. It is not exactly an environmental issue, I think this is more a question of consciousness, of the person who will occupy these areas*" (MRO 53 NC). While defences have been put in place they are not seen to be enough: "*Move the people out, because the flood barriers/prop wall you build last only a short period, then rain comes, rain and more rain, and destroy it" (FRM 30 NC).*

Combining the flood, landslide and fire risk variables into a single natural hazard risk variable suggests that perception of risk of natural hazards was significantly related to the levels of education, those with higher education levels being more likely to identify natural hazard risk. The regression analysis also showed that it was younger people (less than 30 years of age) who were more likely to identify natural hazards risks, and there is some evidence that this was more likely to be women. Those that view green space as essential were less likely to identify natural hazards as risk, and were also less likely to identify drugs and violence as a risk in the neighbourhood, and to see disease as 'risk'– suggesting green space is related to better natural, social, and health outcomes.

6.8 Links between Natural Capital and Other Capital Assets

Natural capital and the ES services it provides surround and influence all other capital asset types (Physical, Financial, Human and Social) as seen in Figure 4. The relationship between capital assets is a dynamic one within the urban development process, and other capitals assets such as physical and financial capital also impact on natural capital, through environmental degradation and pollution, producing ES disservices which ultimately influence health outcomes, and physical and financial capital assets.

Relations between and within capital assets were explored from the survey evidence using correlation and regression analysis. The statistically significant results (p <0.05) of the multi-dimensional logistic regressions and the bivariate correlations are presented in the Annex. These relations can be positive or negative reinforcing relationships, or can be trade-off-type relations revealing preferences between different capital types. The qualitative interviews often demonstrate the actual capital asset trade-offs in practice.

6.8.1 Physical Capital and Natural Capital

Many in the quantitative interviews in downtown NC highlighted pollution as an issue. The analysis highlights that those that identify trees as improving urban air quality were also more likely to identify pollution as an issue. The qualitative interviews also show how the relationship between the natural and the physical environment has changed over time with the coming of 'asphalt' and increasing density of housing, particularly in NC. They note how, while trees can provide cooling properties the urban built environment retains heat seeing NC in particular as producing 'heat islands': "*It is just slab, pavement, windows, energy, generators so many heat islands near here*" (MRO53 NC). There is also a problem in that "*they destroy everything to build*" and there is then a need for more green areas in the urban environment "*for us to breath fresh air..* "(MRRon 70 SM). Another noting of green areas: "*Why, it's the life! That's life! It is the oxygen ... It is she who brings that protects from the heat*". (FRVin 66 NC). Many then see the need for a better balance between the physical/built and the natural environment: "*you cannot plan a neighbourhood and forget that nature is needed there. We need to preserve a bit of nature, …, because if not it [the population] does not live!"* (FRVin 66 NC). However, this suggests the built environment is planned but in many parts of the Nova Contagem neighborhood newer housing is 'informal', where plots and dwellings have been informally subdivided and dwellings constructed on previously green spaces, in gaps between houses and in backyards. Such informal housing tends to suffer from lack of attention form the council and subsequently also poorer sewage and waste collection services which all collude to degrade the quality of and access to the potential ES from private and public greens spaces. However, the municipality also does not necessarily act against this building as one resident notes: "...*here was an alley ...it was almost in front of my home. But the people invaded the alley, constructed [buildings] in the alley, the City Hall representatives came, conducted an inspection, and said "no, they have already made improvements there, there is no way to remove them from there and so on", despite of, even being an area belonging to the State [a public right of way], and the municipal administration did not have the power, to go and speak with the people..."* (MRO 53 NC).

Despite a key complaint being about the lack of paved roads and pavements, paved surfaces in NC have had a negative impact bringing flash floods. On the other hand there has been erosion due to building on steep slopes and this has led to landslides. The problem with managing this issue is that while it may be caused by individual of 'private' actions there is the demand for a public or authority response: "*There are still some landslides, our passageway was blocked because of this.. there is lack of action by the municipal administration..*" (MRO 53 NC).   How the relationship between productive capital and natural capital is managed both privately and publicly is major challenge.

6.8.2 Financial Capital and Natural Capital
"I do not know why is it that money is so important, that turned so the most important thing in the world is money, is to have the money" (FRVin 66 NC)
From the survey evidence, being poor and having low financial capital is associated with liking parks – presumably because they provide some benefits - and an increased likelihood of having concerns over there being less green space. This may also be related to the poor being more likely to live in over-crowded housing with limited private green spaces, hence valuing public green space more. However, it should be noted this is urban green space, since in the survey it is the rich who are more likely to access the countryside. As noted above, to go to the reservoir and surrounding countryside is seen as a time consuming and costly business – involving 2 buses and walking. So lack of financial capital may limit engagement with natural capital, however, the opposite can also be the case for those that live in the more rural locations and do have natural capital 'on their doorstep' and here natural capital can subsidise a lack of financial, and indeed social capital. The story of one respondent - a poor recent male migrant into Tupã - mentioned above illustrates this. He had previously worked in construction but was unable to secure regular local paid employment due to lack of networks (social capital) and often lacked enough money (financial capital) to cover the costs of basic food. This lack of financial capital was often substituted for by utilising natural capital related provisioning services, through fishing, and through hunting birds and small animals.

6.8.3 Human Capital and Natural Capital
From the survey, higher levels of educational human capital reinforce knowledge of natural capital and provisioning services. Respondents with higher levels of education were more likely to know the VF reservoir was a water supply, and those that know this were more likely to plant things and have a tree. Reinforcing human capital and natural capital relationships

were found around health also – with those who named health centres in their top three assets being more likely to think green space was essential.

A number of the interviews highlighted how lack of education impacted on degrading natural capital through environmental pollution. This was particularly identified in terms of visitors to the reservoir discarding rubbish (plastic bottles) polluting the environment: "*People in the neighbourhood are very careful… they do not throw away rubbish, but people who come from outside don't have much respect…after Carnival they threw a lot of rubbish, we made a joint clean-up effort with students of the neighbourhood school, and city hall sent some trucks.. you have to educate your children so they don't do it*" (MRW 61 TP). He also noticed noise pollution from loud radios, and car pollution reducing air quality and leading to poor health. Deforestation of natural capital was also related to poor health and human capital as one respondent notes: *"... if there is no forest, the air is less pure.. I have asthma, bronchitis*" noting the need for "*more campaigns about pollution in order to prevent it*" (MRRic 26 TP). The suggestion being that building human capital through education can reduce pollution, improving personal health human capital and also the functioning of natural capital.

6.8.4 Social Capital and Natural Capital

There was survey evidence of natural capital reinforcing social capital, in that respondents who named green space in their top three most important assets were more likely to be able to borrow cash. This could be related to longevity of time spent living in the neighbourhood and a greater feeling a place which is associated with valuing green spaces. It could also be related to the fact living in a more 'rural' context, without services, as was the case when NC was first established as a bonding experience leading to high, historical, stocks of social capital for those who have made a home in the area since the beginning: *"I believe that people are very humble, especially people that started their lives here when there was no asphalt and went through lots of sacrifices ..." (MRD 22 NC).* High stocks of social capital were evident more generally, for example, when one woman was asked what she would show to a visitor as the best thing about the area said: "*Ah, first I would take to meet the people.*(FRMir NC 30).

6.8.5 Links within Natural Capital Assets

From the survey, there was evidence of links within capital assets and these were often reinforcing relations. Most within capital relations were found within natural capital assets and their ES services, and some related to changes of natural capital ES use.

This means that positive green environmental attitudes were often reinforcing. For example, if a respondent prioritised green space in their top 3 most important assets in the area, they were also more likely to plant something. If a respondent liked parks and green spaces, they were more likely to have a (private) tree, and if a respondent used regulatory cooling of trees, they were more likely to use fruit for provisioning also.   The multiple advantages of trees and other environmental assets were known: "*The role of trees is it improves the air condition, better visually, if they planted in the sidewalks it would improve the shade... it would prevent landslides*" (MRO NC). Similarly, for 'blue spaces' - if respondents mentioned regulatory water run-off abatement of trees, they were more likely to know VF lake was a provisioning water supply.

While green attitudes are reinforcing they are not egalitarian and higher levels of Natural Capital were associated with higher income – and it is richer people that have better access to private green space and also use public green space in terms of the countryside. The countryside is a site of intersecting inequalities, and access to the countryside, and the multiple ecosystem services it provides is less for women, less for the poor, and less for those with low levels of education.

6.9 Links between Physical, Financial, Human and Social Capitals
Apart from the links between natural capital and other capitals, there were also links between the Physical, Financial, Human and Social Capitals.

6.9.1 Physical Capital and Financial Capital
There was evidence of a trade-off between physical capital and financial capital. Respondents who named the shopping centre as a top three asset were less likely to mention local work opportunities and also health centres in their top three – prioritising physical capital over financial capital and human capital. This may be because most people in the sample were in good health and may travel to work outside the area.

6.9.2 Physical Capital and Human Capital
Those who named shopping centres in their top 3 assets were less likely to mention health centres – again, this prioritisation of physical over human capital is perhaps due to the reasons mentioned above. There was also evidence of physical capital reinforcing human capital, as those who own their home were more likely to name schools as a top 3 asset.

6.9.3 Physical Capital and Social Capital

There were few examples from the survey evidence of trade-offs or reinforcing relations between physical capital and social capital. However, there was evidence from the qualitative interviews of poor quality road transport accessibility restricting social interactions and access to leisure. One respondent highlights two issues with living in an area with poor physical capital (here good roads and due to lack of good roads little or no public transport): "*I got pregnant and it was hard to live here because the lack of medical assistance here, it is very bad, you know. And I could not afford take buses all the time, you know. Then I had to move there to my father's house during my pregnancy, but after that I came back*.(FRK 20 TP). Here then the lack of physical capital (roads and medical centre) and a lack of financial capital (money for the bus) was resolved through calling on stocks of social capital (moving to live with family). She talks more about her family and problems of maintaining links with them (maintaining stocks of social capital) giving the lack of physical capital in the area: "*They [family] come [to visit]. There are some that come, right, but others would say "ah, I am not going, what am I going to do there?" My brother, for example, every time I invite him "Let's have a barbecue at the weekend ", he says" I am not going, what I am going to do there? So, there is nothing in this neighbourhood ... " but we invite people. ....there are times we get together a lot. But they say it is very difficult to get here, difficult access for the other people who live over there, they find it very difficult*".(FRK 20 TP)

6.9.4 Human Capital and Social Capital

There was some survey evidence of social capital reinforcing human capital or vice versa, as those who reported having family in the area were more likely to have good heath. As noted above, social capital was being used to fill in the gaps in the local health service, but not always through moving out of the area: "*we have cases of pregnant women whose husbands do not have a car.. call us any time, we will be able to take her to the hospital.. I'm trying to implement this project with the church*" (MRW TP 61). Here then local social capital helps build human capital assets.

Good stocks of social capital were found to be related to reporting good health, and those reporting good health were also more likely to have higher stocks of financial capitals in the terms of income and wellbeing – being less likely to report overcrowding in the home. One indicator of Human Capital – good health - was also related to the other key indicator - higher levels of education.

If high stocks of Social Capital is related to good health, and health to education, then not surprisingly education too is related to social capital. Those with lower levels of education –

having primary only education - were less likely to report having friends and more likely to say they had a conflictive relationship with neighbors. Lower educational attainment was not surprisingly related to being poor – and low human capital related to low financial capital as well as low stocks of social capital.

6.8.5 Financial Capital and Social Capital

Social capital also seemed to be reinforcing financial capital, often in a negative way. Very few people suggested they had poor relations with neighbours in the survey but of those that did, significantly more women than men (13% compared to 6%) report being distant or conflictive with neighbours. Not surprisingly reporting conflict with neighbours is negatively associated with feeling able to ask for help (of those who do not report conflict 83% feel they could ask for help and 55% feel able to ask for cash compared to 43% and 11% who do report conflict).   Those who reported low levels of social capital and had distant and / or conflictive relations with their neighbours, were more likely to be poor and have low levels of financial capital, and were also more likely to be in poor health.

6.10 Barriers to accessing natural environment and ecosystem services – understandings of nature

The study findings suggest that despite having the countryside 'on their doorstep' relatively small proportions of people visit the green and blue areas. Visiting public green and blue spaces is further dependent on sex, income and education. So what barriers reduce access?

Perhaps the biggest barrier to accessing all green and blue spaces as highlighted above is the fear of violence. It is important to note that for the majority this is a perception only – in that they have not been involved in or witnessed violence themselves.   Some also understand the violence is not a direct threat to them: "*The problem is, thieves deal with themselves, they kill each other, but we have no connection with them, so they don't bother us" (FRMdeC 51 NC)* and as another notes: "*these fights, gang wars, but these are isolated facts. There isn't much risk for good people"* (MRO 53 NC). While 'good people' might not be at risk the perceived threat seems to keep them from the spaces and so this notion of high risk of violence is not challenged or indeed reinforced by visiting the places – instead through non-engagement it becomes established as 'fact'.

Another key barrier may be the way 'nature' is perceived or at least how best it can be enjoyed. A number of understandings of the natural environment emerged - one that values

nature as untamed as 'wild' and a home to plants and animals, one that understands its importance for human existence and the interactions between the two, one that enjoys nature as bringing peace and quiet, and one that seeks to bring order to nature in order to enjoy it. There is also the notion of nature as being 'God given': "*Nature. Nature, for me, is…it is a God thing, right, because…the trees, the birds, a lagoon, for example, where did this water come from? Right? Where did so many fish come from? This is a God thing*" (MRE 40 TP)

Many value nature for the aesthetic pleasure it brings and the animals that live in 'the wild' ': "*I like nature. And here is nice because early in the morning, you see toucans, little monkeys, you know, nature is very close. Now, the central area, right, there is only pollution, not here, here you see, the hawk flying, stop and land, beautiful hawk, beautiful to look at, [that] is nature, right?" (FRMir 30 NC).* Within this discourse there are those that understand the need to keep the natural environment as natural for these animals to survive: "*Animals, trees, I am a fan of all this, I like it very much, and, all of them, all of them, here is good, here is already more nature, we are the ones who are entering in it, in the middle of nature, we are the ones who are taking their space*" (MRE 40 TP) and they understand the impact of entering into natural spaces: " …*because people are deforesting a lot in order to build in the surroundings, then the animals are becoming without a place to hunt in the forest, then, they eat the people's hens...*" (MRRic 25 TP)

Others stress it as important due to its role in human survival: "*Because nature is not only trees, it also brings food, feeds the animals that we eat, so I think it is the end too, because if it ceases to exist it will be our end as well, right. We also cease to exist. Then nature is essential to our existence, people have to be aware of it. So nature is this. It can be the beginning or the end of us, if we do not realized it…" (MRF 36 NC).*

Others focus less on the flora and fauna and more on the peace and quiet it brings. As highlighted above it is seen as different from, or other to, their 'normal' environment. While seeking out this otherness they seem at the same time to seek normalness, and many like the more formalized green spaces such as municipal parks and visit houses in the countryside to 're-enact' their normal lives. 'Nature' then for some is best enjoyed when there is security and order and is about being in more formalized recreational places like parks or formalized places to stay like farmhouses, which they go to during weekends and holidays. For example, one female participant when asked 'Where do you see nature?' replied "*Oh, just when I go to Municipal Park, downtown*" (FRC 27 NC). The idea of nature being best enjoyed in an 'urbanised' and convenient form is summed up by another female

respondent: "*... but imagine if you start picking fruits in the orchard, orange, apple, banana, imagine this in the city downtown, you arrive there with a basket and pick the fruits, then it would be very pleasant, it would really be a city to live in, it would be the paradise, right? You can say, instead of being called Belo Horizonte, it could be called Paradise, if it was like this*" (FRL T 44).

When discussing local parks and squares when they were highlighted as being well used for recreation was in reference to organised activities. Individual use was constructed as non-active unless it was 'anti-social' actions – such as drug use and drinking. Thus, seeing open spaces as areas to be actively used by individuals for social activities was not a common opinion, and not only for fear of violence but for seemingly lack of experience of doing so.

This despite the fact nature existed all around her the respondent quoted above did not access these spaces, but travelled instead 'downtown' to view nature. When asked specifically about the countryside she noted she had been once *"…let me see when... It was on new year's day I was on a farm, in Topázio..."* Visiting the 'countryside' for a number of respondents meant going to dwellings there such as small farmhouses. Indeed for one the built environment was what was beautiful about the green/blue space: "*Because I think it is beautiful, right? The green, take a look, the green, the houses, because there are also several beautiful houses around the lagoon there…… I don't think it is ugly, I think this is beautiful, nice.*" (MWK 31 SM).

If visiting is dependent on having a dwelling to go to this may limit who can visit and how often, and access is often mediated through the housekeepers who look after these holiday homes for absent owners, although not always:
[E]"*.they are the housekeepers right, who take care of the small farms, then they are friends of us, they invite us to go and we go. There are some owners too, of whom we become friends, invite us to spend the weekend….*
[I]: I see, and what do you usually do in such places? Is it, spending the night?
[E]: Yes, spending the night, sometimes to have a barbecue, sometimes we prepare a dinner, that's it..." (FREi 41 TP).

The 'that's it' highlights that there is little further engagement and the activities to be carried out in the countryside are the same as in the town. Rather than actively engage with the surroundings through hiking for example, it is a passive consumption of just being there. Even when it is thought walking to somewhere would add to their enjoyment this is generally not something that occurs. One male respondent noted that he will drive to a local green

area and sit and maybe picnic but: *"I never got into the forest, but I believe that, as I see people going there, there must be a stream, which supplies this lagoon, right? And there must be a natural environment better preserved and more beautiful than here, but I have never been there"* (MWA 31 NC). Another notes: *"Yes, the forest, it is kind of preserved, right?... But I, particularly, almost do not come here, and this forest, we do not walk through it very much, because it is dangerous there..."* (MWC 37 SdeM). When asked if they went hiking one respondent suggested they might if there was an organised activity: *"Yes, hiking, walking, that's right. Certainly if there were such projects people would take part. But there are not people with enough determination to start such projects"* (MRD 22 NC). This idea of the use of public green space needing to be organised by an outside agency such as an NGO rather than being something people just do as individuals continues this passive rather than active engagement theme, lending support to the notion that ES are not provided by default; that there is a difference between the provision of an asset and whether the service the asset can provide is accessed and generates a benefit.

In the urban space it was seen as important to keep young people out of trouble one suggesting the need for NGOs *"that can take the focus of people, right. Diverting focus, right, because one only goes to one side, to the bad side, if the person has nothing to do" (MRD 22 NC)*. These organised activities also happened in the countryside: "*my son, also, he and some boys from here, on Sundays, play football. Then, they go to a small farm, and in this small farm, it is a man who let them play football on Sundays. Every Sunday, then there is a lot of green there, it is beautiful, it must be beautiful, mustn't it…But the small farm must be very beautiful, I don't know there, but my son, according to what he says, it must be a very beautiful small farm, that they play football there, there is a swimming pool*" (FRA 42 Tupã). Here again, she has not taken the opportunity to visit herself, and what she seems to be the main attraction is playing football and a pool – two things that could be found in an urban context.

Similarly, for some the most beautiful 'natural' places close to them were not the open countryside and streams – seen as difficult to access and engage with - but the manicured lawns and pools of gated communities. One respondent when asked what he would show a visitor to the neighbourhood suggested it would be the 'beautiful' gated areas he would show them: "*Ah, the good areas, right. Where would I take you? There are very good places, landscape here, there in X, people are building there a gated development… here are beautiful places there…. Quieter areas, with beautiful landscape views ..*" (MRD 22 NC). Access can be gained to these areas and stocks of 'natural' (or physical/natural) capital through utilizing social capital as access is dependent on having a friend or relative on the 'inside' working as a housekeeper or security guard: *"… lots of the guys working at the gates*

*which are from here, "ah, let me enter in the development so I can swim/dive in the pond? ",
they let me in, the guys are nice, but it is a private area....."* (MRD 22 NC). This constructed
environment is seen to be 'nature' *" I used to work there. I get there and don't even ask... I
go right in... I lay on the grass... I like the nature. (MRFar 33 SM).* Another highlighted such a
community on a walking tour noting*: "It is a paradise, here. This one here is a paradise"
(FWM 30 NC).*

If nature is best enjoyed through more 'formalized' spaces such as parks then barriers to
access become those of income and distance, making them inaccessible to the poor.
However the private development above offers an accessible space as it takes only 5
minutes to get there and while this is a private development, where houses fetch a high
price, many local people have a friend or relative that works there as security or
housekeeper who let them in to use the pool – providing access and order 'on the doorstep'.

While the 'real' countryside was on the 'doorstep' of those involved in the study it was not
necessarily perceived as 'accessible' even when 'free' to use. Some previously visited sites
had been closed up for private use following development and many describe how it was
necessary to have a contact, someone to stay with in order to be able to visit. Moreover, to
reach local blue spaces was difficult involving two buses or a long bike ride, and perceived
as too far away to walk to. As such, those without the money to own and run a car, and
those without large amounts of time to invest in taking public transport, available and 'free' to
access spaces become effectively inaccessible. This may explain why it is the poor that
value local parks and squares, despite perceiving problems with these spaces, especially
fear of violence.

7. Conclusions and Recommendations

The MEA (2005) suggests that effective responses to ensure the sustainable management of ecosystems must address causes and overcome barriers related to: Inappropriate institutional and governance arrangements; Market failures and the misalignment of economic incentives; Social and behavioural factors, including the lack of political and economic power of some groups dependent on ecosystem services or harmed by their degradation; Underinvestment in technologies that could increase the efficiency of use of ecosystem services; Insufficient knowledge (as well as the poor use of existing knowledge) concerning ecosystem services and management, policy, technological, behavioural, and institutional responses that could enhance benefits from these services while conserving resources.

All these barriers are further compounded by weak human and institutional capacity related to the assessment and management of ecosystem services, underinvestment in the regulation and management of their use, lack of public awareness, and lack of awareness among decision-makers of both the threats posed by the degradation of ecosystem services and the opportunities that more sustainable management of ecosystems could provide.

This study has highlighted both the threats posed by the degradation of ecosystem services and the opportunities that more sustainable management of ecosystems could provide for the urban poor, and how this is gendered. This section will focus not on the findings themselves, as much as what they mean for regulation and management and for those seeking to ensure that existing environmental assets are valued and protected and the beneficial services are maximised and made accessible to all, while the dis-services are minimised (see also Bradshaw et al 2016). It begins by using the study's findings to highlight why a focus on the environment is important for feelings of wellbeing in peripheral communities such as those studied.

7.1 Ecosystems and assets: Their interaction to influence wellbeing

- The study demonstrates the links between social capital, human capital, physical capital and financial capital and the extent to which natural capital impacts on them all.

Higher Social Capital such as being able to ask neighbours for help, or borrow money, was related to higher Human Capital such as being in good health. In turn being in good health was related to higher levels of education, and education too was related to stocks of Social Capital – with those with lower levels of education less likely to report having friends, and more likely report conflictive relations with neighbours. Education was also related to Financial Capital in that those with higher education are less likely to be poor.

Financial Capital, or lack of, was to some extent made up for by mobilising Natural Capital and Provisioning Services such as fishing, collecting fruit, hunting birds and small animals, and were part of coping strategies for low income males in particular. Natural Capital was also related to Human Capital and those with higher education showed a greater appreciation of the countryside and had more 'green' attitudes. Health too is linked to Natural Capital as respondents valued trees for improving air quality and helping with physical ailments and, given the countryside is associated by those in the study with peace and quiet, stress release - providing an escape from the perceived violence of urban life and bringing improved mental health. The fact caring for public plants and trees could improve community relations – Social Capital – was also recognised and local squares and parks helped to build a sense of place or belonging.

→ The study reveals that it is the poor that have less access to non-urban public green space such as the countryside, and less access to private green spaces and, therefore, the benefits plants and trees can bring for wellbeing.

- The study shows that green spaces – especially the countryside – are sights of intersecting inequalities.

The poor are more likely to say they would be upset if green spaces were reduced but less likely to visit the countryside, so they see green as 'urban green' spaces – parks and squares then are important to/for them.

Those that have lower incomes are more likely to mention trees as important for air quality but less likely to have access to trees and the overcrowded conditions in which they live mean they have less access to the provisioning, cooling and regulating services trees bring.

There is no equality of access to the countryside and to public blue spaces such as the reservoir even when access is 'free' and open to all, as other factors such as time and money may limit ability to take up these opportunities if a bus journey is required.

While the poor who live near these public green and blue spaces utilise them for provisioning services to supplement incomes, it is the richer and more educated local people who tend to use them for purely recreational purposes. Those that visit from outside the area for recreation may upset the provisioning abilities of those that live near there – the rich visitors bringing jet skis that disturb those fishing, for example.

Women too are a group that have little engagement with the countryside and here it seems to be a feeling of insecurity that limits access. Feeling afraid to walk alone around their neighbourhood even during the day, emerged from the survey as the key factor limiting access to all public green spaces – including urban green space.

→ It is women who access green spaces least, and the countryside is a masculinised space for provisioning services, while recreational use is related to higher incomes and higher education.

- People value plants and trees and understand their value for reducing risks from natural hazards, such as floods and landslide.

People like to cultivate plants and trees in their back yards and there is no difference by sex or income – it is space that determines if they can plant in their own homes.

While there is evidence that people seek to preserve existing trees, an asset trade-off is apparent given if they need the space to build an extra room (physical capital) often driven by a relative not being able to afford to set up home alone (financial capital) then the cost is outdoor space, plants and trees (natural capital).

People first and foremost recognise provisioning services to be gained from environmental assets such as access to food and fuel, some people fish not for

recreation but to eat the fish, and some even sell the fish adding a financial aspect.

Many people want more 'public' trees on pavements and in parks to provide shade, and want more plants in public places for the beauty they bring. Trees are also recognised as regulating air quality, and to some level their role in ensuring rainwater absorption is also recognised. The latter is more apparent when it ceases to function, and the lack of trees and poor soil structure is understood to impact on floods and landslides. So too is the role of the built environment, such as tarmacking and pavements, recognised as a factor in flooding, and building housing on previously forested slopes recognised as causing landslides.

→ People understand there may be a trade-off between developing the built and preserving the natural environment and the need to find a balance between the two.

- Going into the countryside raises awareness of risks of floods and landslides

The role of impermeable surfaces, cutting down trees, and poor soil structure as increasing flood risk is recognised, as is the role of people in directly influencing flooding through leaving rubbish in the streets (blocking streams and drainage channels) and landslide through unregulated building on slopes.

Most do not see floods and landslides as a big threat – more an inconvenience – and see them as occurring in the same place and regularly – normalising the threat. However, there have been destructive landslides and these are often seen as self-inflicted, occurring due to land having been developed in an inappropriate manner.

There is some doubt around how well or how long technical solutions will work and instead a feeling that there is the need to educate those that add to the risk (through dumping rubbish for example) and to regulate the area, including housing.

→ As awareness is the first step to 'taking-action' to mitigate the risk and improve response it is important to note that it is those that go into the countryside that are more likely to see flood, fire and landslide, as a threat, suggesting a raised consciousness of natural hazards through engagement with nature.

In summary, it is important to focus on environmental assets because they:
- o Bring gains in Human, Social and Financial capitals and wellbeing more generally.
- o Are a site of inequality with women, the poor and the less educated having less access to them and the potential benefits they bring.
- o Are valued by people, and they like green spaces, plants and trees. While the poor access the countryside less they value urban green space more.
- o Can bring risks as well as enjoyment, and engagement with nature may help understanding of these risks and promote actions to mitigate them.

7.2 Improving interaction with nature and protecting the environment
This section uses the results from the study to make some suggestions around what might enable peoples' greater interaction with the environment. There are many advantages to be gained through improving access to natural capital, including positive gains for human capital, for social capital and for financial capital. The study finds that people already do value green, blue and green/grey spaces and so enabling greater access would be something many would welcome and have positive wellbeing effects.

While in the questionnaire only 21% of the people questioned rated green spaces in their top 3 key assets this is relatively high given that through necessity many would more obviously focus on basic services as 'essential'. The fact 52% rated green spaces as essential and 88% would be upset if there were less green spaces where they lived suggest the percentage that rate green spaces as a key asset could be made higher with a few changes. The use of local urban green spaces was more determined by the facilities – environmental and recreational – found there.   When talking to people, those who live closer to the countryside or reservoir were more likely to use these spaces for recreation and for provisioning.
→ If the public green spaces were more accessible through better public transport to them, or signage once there, they might be used more and valued more highly.
→ The provision of more green features and trees for shade in urban green spaces, as well as recreational services such as gyms would make them more attractive.

→ Safety is also a significant concern and people would be more likely to engage with and care for local green spaces if they felt more secure there.

→ Highlighting the benefits green spaces bring, through providing educational signs and materials, could help make people more aware that nature is an asset, and value it more as such.

→ Importantly it is men who recognise green spaces as an important asset so campaigns to raise awareness of the benefits of wider green spaces should be aimed at women.

Many people have a good understanding of the environment and the need to protect it due to its importance for providing Regulating Services particularly in relation to Climate Change.

→ The study suggests the importance of education – the higher the education level the more people expressed 'green' attitudes, so formal education within schools may be important for future sustainable use of environmental assets.

Many people feel angry at other people's actions that harm the environment such as cutting down trees or clearing land through burning, dropping or burning rubbish. They also feel there is little done to deter such behaviour through enforcing penalties, for example. People highlight how in parks and squares a well maintained garden will deter people from dumping rubbish there, but a poorly maintained space with scrub and bushes that look untidy or 'dirty' may encourage dumping. This was echoed by those who visit the reservoir who see spaces that are not 'cared for' as 'dirty' and thus feel justified in leaving their rubbish. The lack of public toilets means there is further fouling of green and blue spaces, through necessity not choice.

→ The study highlights the desire for a governmental response, providing adequate public facilities in areas such as the reservoir, maintaining public green areas, or enforcing penalties on those that violate existing regulations.

While services such as rubbish collection and maintenance of open spaces do need to be improved, the dumping / burning of rubbish is often not because there is no collection service but because people don't bother with it/wait for it. If dumped rubbish is not cleared and there is no penalty for such actions, they will continue with them. However, there are areas of the study site where people feel that the authorities do not care for them, and accessing services such as public transport and rubbish collection is a constant struggle, making them less inclined or less able to act in ways that will protect the local environment.

→ Paying more attention to these areas of concern might well incentivise residents to take more responsibility for environmental quality as well, while improving environmental quality in parks and squares may deter dumping rubbish and other anti-social behaviour there.

Local squares and parks are valued, especially by the poor, and the young, childless and less educated, and those that do like parks value them highly, being likely to include them in their top three key community assets. The study suggests that local grey/green spaces are recognised as an asset and help create a sense of place and belonging, especially for the poor.

→ Improving access to local parks could go some way in overcoming the difference in access to ES between those who have private green space and those that have not, and the differential access to the countryside.

→ The production of space and/or local land use planning at present, does not seem to pay much attention to developing urban green spaces, missing out on the provision of a range of benefits this can provide.

Respondents appear to value parks as a recreational and environmental asset, but planners need to get the right balance of recreational to environmental land use.

The gyms are a good addition, for example, but not if there is no shade for those using it. Trees are nice, but nicer if you can sit on a bench in the shade they provide.

People understand the multiple benefits to come from plants and trees, including those which fall within the Provisioning, Cultural and Regulating services categories, and the potential they bring to strengthen Social Capital.

→ The findings suggest if trees and hardy plants were planted they would be valued and cared for by local residents, such collective action could aid social cohesion as well as bring the other wellbeing outcomes mentioned above.

Even small pockets of green or a few trees can make a difference to people and the planet, and have knock on benefits for other asset accumulation.

The lack of 'kerb side' trees was highlighted as a problem – the planting of which might also encourage people to walk more during the day due to the shade.

Trees and squares have been suggested as creating spaces for 'anti-social' behaviour, but in and of themselves they are not to blame for this and the negative effects of trees are less recognised by the respondents than the positives.

→ Recognition of the potential dis-services to be generated by trees and bushes can lead to identification of ways that such unwanted effects can be mitigated e.g. use of street lighting to avoid the generation of 'cover' for illicit activities.

→ Even small additions of 'green' in existing grey spaces, through planting on walls or around trees could bring the multiple wellbeing benefits documented in the study.

While people like the parks and squares, especially the poor, they also feel they lack recreational and environmental elements. Providing more play areas and planting more would encourage more visits and visitors, however it is security which is the real deterrent. Parks and squares are associated with gangs, violence and drug use. It is not clear what threat the drug users pose in reality to respondents except perceptive dislike and an associated perception of danger. The fear is not necessarily of violence against the person themselves, but of being caught in cross-fire.

→ Fear of violence between others keeps people from accessing the existing green and grey/green spaces in their community and suggests the need for better policing.

Fear also keeps people from engaging with the countryside, a key predictor of walking in the countryside is feeling safe walking around the neighbourhood during the day, those that do not, and here fear is associated with being a woman, do not go to the countryside.

On the other hand, the feeling of wellbeing experienced by being in the countryside allows people to forget violence and enjoy peace and quiet, as noted when respondents do go there.

People like to visit 'organised' spaces such as municipal park or the gated communities.

→ Bringing order and security to the countryside – via more formalised and sign posted paths – may encourage visits as may holding organised walks.

→ Promoting 'eco-tourism' in the local area - providing public eco-facilities such as compostable toilets, encouraging organised and educational recreational activities, and incentivising local bars to take environmentally friendly actions to reduce pollution and degradation.

The study highlights that to foster engagement with green spaces – both urban and the countryside – may need an 'organised activity' approach such as an exercise class in a public square, a walking group around the neighbourhood and the local countryside.

→ To encourage engagement with the countryside seems to need some level of organised activity to provide the access (more direct transport), create the order (set paths/routes to follow) and ensure security (going as a group with a 'lead') that seems to be important to people, especially women.

The reservoir is an environmental asset that has multiple uses – as it is a source of drinking water and a source of various recreational activities – which can be conflictive if not managed properly.

Some visitors from 'outside' are perceived to come to drink, to take drugs and to fight – they are then 'anti-social visitors' and leave evidence of their activities behind. Local people fear the potential for violence that comes with these visitors.

The others who come are 'leisure polluters' as they bring jet-skis, which disturb wildlife and those fishing, quad bikes, with noise, air and ground pollution, they have barbecues, which bring a potential fire risk, and leave their rubbish behind, including human faeces.

Fewer local people visit the area now as the opportunities for swimming there have lessened through drought and degradation – including through sewerage being released into the water.

Few like to walk through the forests, preferring to sit and enjoy the peace and quiet, which may be more difficult given the nature of the outsiders who visit.

→ Local people who use the reservoir do so for less intrusive recreational activities such as fishing and walking, than those that come from outside, and tend to take their rubbish home with them.

→ Local leisure use of the area is low intensity and non-intrusive. To protect this area the focus then needs to be on the visitors, not the residents – to target the 'anti-social visitors' and the 'leisure polluters'.

→ Women are those who most want to area controlled so any locally led action should engage women to be effective, which would have the added benefit of increasing their engagement with wider green and blue spaces, which is presently relatively low.

Swimming is less of an issue now due to low water levels, but it is clear that just explaining to people the reservoir is a source of drinking water is not enough to deter them, as those that swim there know this. Local people are aware that it is dangerous as there are hidden tree stumps and other hazards.

→ If swimming in the reservoir is a problem for the Authorities (contamination) then as many know what the water is for (but still swim) then 'danger deep water'/ 'death through drowning' signs may be most effective.

→ If targeting local residents, and /or visitors who swim is a priority, then campaigns should be aimed at men, as they swim most there.

→ Those who lack a 'private' green space such as a yard are the ones who are most likely to swim in this 'public' green space, so there is a need not just to prohibit activities but to provide alternative leisure facilities.

→ If deterrent action is needed it is men that should be targeted, but as those who most want the area controlled are women, if local action is needed it is via women that initiatives should be developed.

Women have a heightened sense of local pollution as a problem, but they also engage less with wider green spaces.

→ If local actions can reduce pollution, then it is women who should be targeted to mobilise around this.

People who report poor health in the family were also more likely to identify pollution as a problem, but they were also less likely to be bothered about there being less green space.

→ This suggests the need to educate people on the benefits to health of green spaces and how green spaces can help reduce pollution to encourage those that would benefit into taking actions which allow them to benefit.

As those that report pollution are less likely to say they want to stay in the area, an indirect effect of any actions to improve air quality may be an increased association to place and sense of belonging.

→ Again, as it is women who most keenly feel that pollution is a problem it is they that the issue should be discussed with and from whom possible solutions may arise.

7.3 Ensuring Gender equality of access to ES and its associated wellbeing gains

When thinking about gender within a capital asset framework we need to think about the characteristics that define the women of the community being studied/target area, and what 'being a woman' is correlated to. From the study women are:

- More likely to be poor
- More likely to be responsible for housework

- Less likely to feel able to ask neighbours or friends for help
- More likely to be distant or conflictive with neighbours
- Less likely to think it is safe to walk around their local area in the day and during the night
- More likely to be evangelical

- Less likely to have a tree in their home
- Less likely to walk in the countryside
- Less likely to visit the reservoir

- Less likely to know the service the reservoir provides
- Less likely to think it is OK to swim in the reservoir
- More likely to want public access to the reservoir controlled

- More likely to report pollution is a problem

- Less likely to aspire to live in a more rural area
- Less likely to attach importance to green areas, woods and blue spaces

The study demonstrates that there is a gender inequality in accessing and benefiting from Natural Capital and that women have intersecting inequalities related to lower levels of intersecting Capitals.

Women have lower levels of Financial Capital (being income and time poor), lower levels of Social Capital (less able to ask for help, feel more afraid) and lower levels of Natural Capital (less access to trees, green and blue spaces) – and the latter is related to the former, access to Natural Capital being limited through lack of income, space and fear of the local neighbourhood and beyond.

Women are also less likely than men to express 'green attitudes' (seeing green and blue spaces as an important asset) and this somewhat contradicts the existing notions of women being closer to nature.

The qualitative interviews highlight that women and men have a different relationship with nature. When seen as a site for Provisioning Services, the countryside is a masculinised space as it is men that a more likely to say they go fishing and hunting. As a site for Cultural Services, here recreational use, it is those with higher incomes and higher education that are more likely to visit and again given women in general have lower levels of both, this may help explain their limited engagement.

Women also tend to be more 'time poor' – with many engaged in income generating or productive activities as well as taking responsibility for reproductive activities, or housework within the home. If visiting the countryside demands a long and arduous trip on bad roads, they may be less inclined (as being more likely to be poor, may have less access to a private vehicle) and have less time (due to dual workload) to visit. Time may also limit their ability to visit local green spaces.

However, feeling afraid to walk alone around their neighbourhood even during the day, emerged from the survey as the key factor limiting access to all public green spaces – including the countryside, the reservoir and urban green space.

Many respondents talked about green areas that were not 'maintained' as 'dirty', favoured more formalised urban parks, admired country houses, and saw nearby gated communities with manicured lawns as being beautiful spaces. As such, the countryside was often seen as something that needs to be tamed or given order to.

To encourage engagement with the countryside may need some form of organised activity to provide the access (more direct transport), create the order (set paths/routes to follow) and ensure security (going as a group with a 'lead') that seems to be important to people, especially women.

The feeling of insecurity around public green spaces ultimately, however, stems from how safe people do/do not feel in their daily lives. Making the local urban context feel more secure – through policing and maintaining urban public green spaces – may not only increase engagement of women with these spaces but also the wider countryside.

It is important to increase women's access to green and blue spaces not only for the potential wellbeing improvements this may bring for them, but also for the environment. The study demonstrates, women are more likely to want the reservoir area controlled, and this is related to wanting cleaning improvements in the local area also. Women's engagement with public green and blue spaces may be important for maintaining and protecting these areas.

The evidence finds women to be very sensitive to pollution problems, and are more likely to report these issues. Woman should be spoken to about what the existing pollution problems are perceived to be and should be central to any campaigns or local actions to address these issues.

Although this study highlights the need to work with women to promote local action to protect and improve the environment, it is important to note that the women in the study, as is the case for women the world over, are not only more likely to be income poor, but more likely to be time poor. As any actions that target women will add to their already heavy workload then they must bring some direct benefit to them also if they are not merely to use women to achieve wider wellbeing aims.

The wider policy literature highlights also that just involving women in actions to improve or maintain, for example, the reservoir and surround, will not necessarily improve their ability to enjoy the benefits of the reservoir – for this actions that directly target equality of access to and benefits from, natural capital are also needed (see above).

As access to Natural Capital interacts with other capitals it also suggests gender equality programmes need to consider the environment as an important factor in determining women's wellbeing.

Local NGOs might think about incorporating environmental issues into their work given that access to green and blue spaces is limited by poverty and education, but that in turn access to these spaces improves wellbeing. Access is also related to concerns around violence and drugs, but maintaining and improving green spaces may lessen anti-social behaviour in them and improve access. As women have lower levels of access to green and blue spaces, higher feelings of insecurity, and lower levels of social capital then environmental recreational programmes for women, such as guided walks, may help address these gendered inequalities and improve women's wellbeing.

8. Acknowledgments

9. References

Ahmed AU, Khondkar M, Quisumbing AR (2011) Understanding the context of institutions and policy processes for selected anti-poverty interventions in Bangladesh, *Journal of Development Effectiveness*, 3, 2, 175-192.

Alkire, Sabina; Conconi, Adriana and Seth, Suman (2014) *Multidimensional Poverty Index 2014: Brief Methodological Note and Results* (Oxford: Oxford Poverty and Human Development Initiative [OPHI] (http://www.ophi.org.uk/wp-content/uploads/Global-MPI-2014-Brief-Methodological-Note-and-Results.pdf?a7648b).

Alkire, Sabina and Foster, James (2011) Understandings and Misunderstandings of Multidimensional Poverty Measurement, *Oxford Poverty and Human Development Initiative (OPHI) Working Paper 43*, Oxford Department of International Development, Queen Elizabeth House, University of Oxford (http://www3.qeh.ox.ac.uk/pdf/ophiwp/OPHIWP043.pdf).

Alkire, Sabina and Santos, Maria Emma (2010) Acute Multidimensional Poverty: A New Index for Developing Countries, *Oxford Poverty and Human Development Initiative (OPHI) Working Paper 38*, Oxford Department of International Development, Queen Elizabeth House,,University of Oxford (http://www.ophi.org.uk/wp-content/uploads/ophi-wp38.pdf).

Andersson S, McPhearson T, Kremer P, Gomez-Baggethun E, Haase D, Tuvendal M, Wurster D, (2015) Scale and context-dependence of ecosystem service providing units. *Ecosystem Services* 12: 157-164.

Bader, Christoph; Bieri, Sabin; Wiesmann, Urs; Heinimann, Andreas (2016) 'Differences Between Monetary and Multidimensional Poverty in the Lao PDR: Implications for Targeting of Poverty Reduction Policies and Interventions', *Poverty and Public Policy*, 8:2, 171-97.

Bradshaw S. (2016) presentation at: Engendering Habitat III: Facing the Global Challenges in Cities, Climate Change and Transport, Madrid, 5th-6th October 2016.

Bradshaw, Sarah (2002) *Gendered Poverties and Power Relations*. Managua: Fundación Puntos de Encuentro.

Bradshaw, S. with Linneker, B. (2014) *Gender and Environmental Change in the Developing World*. IIED Working Paper. IIED, London. http://pubs.iied.org/10716IIED

Bradshaw S, Chant S, Linneker B (2016) Gender and Poverty in the Global South: What We Know, What We Don't Know, and What We Need to Know for Agenda 2030, Working Paper, London School of Economics and Political Science, August 2016.

Bradshaw Sarah and Linneker Brian, with Nilo Nascimento, Indira Nahomi Viana Caballero, Heloisa Costa, Yumi Oki, Rogério Brittes W. Pires, Meri Juntti, Lian Lundy, Ken Scott-Brown, Rebecca Wade (2016) *Guidance Report for Engendering Ecosystem Services for Urban Transformation*, Middlesex University, Abertay University, Universidade Federal de Minas Gerais in Brazil, November 2016.

Casa de Apoio à Criança Carente de Contagem, http://www.casadeapoio.org.br

DFID (1999) *Sustainable Livelihoods Guidance Sheet*, UK Department for International Development DFID , April 1999, http://www.eldis.org/vfile/upload/1/document/0901/section2.pdf

Edwards G.A.S., Reid L. and Hunter C. (2016) Environmental justice, capabilities and the theorisation of well-being. *Progress in Human Geography* 40(6) 754–769.

Gómez-Baggethun, E., E. Corbera, and V. Reyes-García (2013) Traditional ecological knowledge and global environmental change: research findings and policy implications, *Ecology and Society* 18, 4, 72. http://dx.doi.org/10.5751/ES-06288-180472

Juntti, M and Lundy L. (Forthcoming) A mixed methods approach to urban ecosystem services: experienced environmental quality and its role in ecosystem assessment within an inner-city estate*, Landscape and Urban Planning*, Forthcoming Under Review.

Haines-Young R., Potschin, M. (2009) *Methodologies for defining and assessing ecosystem service*s. Final Report, JNCC, Project Code C08-0170-0062, 69 pp.

Linneker B (2016) Gender, Green and Blue Space and Eco-System Services in Nova Contagem - MG, Brazil: ADEPT Summary Report of Key Findings and Data Evidence Base, Report to Middlesex University, August 2016.

McGillivray, M and Clarke, M (eds.) (2006) *Understanding Human Well-Being*. Basingstoke: Palgrave MacMillan.

MEIOS (2016) Relatório de Pesquisa, Relatório descritivo da aplicação de questionários Nova Contagem, MEIOS – Empresa Júnior de Ciências Sociais, UFMG, Avenida Antônio Carlos, 6627 / FAFICH– SALA 3009 A Campus UFMG Pampulha, Belo Horizonte - MG, Brazil, Junho de 2016.

Millennium Ecosystem Assessment (MEA) (2005) *Ecosystems and Human Well-being: Synthesis*. Island Press, Washington, DC.
http://www.millenniumassessment.org/documents/document.356.aspx.pdf

Moser C O (2016) *Gender, Asset Accumulation and Just Cities: Pathways toTransformation,* Routledge, London, ISBN 978-1-138-19353-6.

Moser, C.O (2014) *Gender, Asset Building and Just Cities*. Briefing Paper WUF7 Networking Event,
http://hummedia.manchester.ac.uk/schools/seed/gurc/working_papers/briefingpapers/GURC
_BP6.pdf

Munro A, Kebede B, Tarazona-Gomez M, Verschoor A (2014) Autonomy and efficiency: An experiment on household decisions in two regions of India, *J. Japanese Int. Economies*, 33, 114–133.

Nathan, F. (2008). 'Risk Perception, Risk Management and Vulnerability to Landslides in the Hill Slopes in the City of La Paz, Bolivia. A Preliminary Statement'. *Disasters*. 32, (3), pp. 337-357.

Nova Contagem LA (2006) Plano Diretor - Nova Contagem's Master Plan.

Rogério Brittes W. Pires, with Heloisa Costa, Lorena Gutierrez, Baruc Geremias, Yumi Oki, Camila Saraiva and Nilo Nascimento (2016) Nova Contagem: Context and General Findings, working paper, UFMG, Brazil.

Spangenberg J., von Haaren J. and Settele J. (2014) The ecosystem service cascade: Further developing the metaphor, Integrating societal processes to accommodate social processes and planning, and the case of bioenergy, *Ecological Economics* 104: 22–32.

UK NEA (2011) *The UK National Ecosystem Assessment*. UNEP-WCMC: Cambridge.

UNDP (2007) *Measuring Human Development: A Primer*. United Nations Development Programme, New York,
http://hdr.undp.org/sites/default/files/primer_complete.pdf

Wisor, Scott; Bessell, Sharon; Castillo, Fatima; Crawford, Joanne; Donaghue, Kieran; Hunt, Janet; Jaggar, Alison; Liu, Amy and Pogge, Thomas (2014) *The Individual Deprivation Measure: A Gender-Sensitive Approach to Poverty Measurement* (Melbourne: International Women's Development Agency Inc) (https://www.iwda.org.au/assets/files/IDM-Report-16.02.15_FINAL.pdf).

10. Annexes

10.1 – Questionnaire Survey

U F *m* G

Somos alunos e professores da UFMG e estamos interessados em saber o que vocês acham sobre Nova Contagem e como é viver aqui. Essa é uma pesquisa da universidade para conhecer melhor a qualidade de vida na região. Você não precisa dizer o seu nome. Nenhuma informação pessoal será divulgada. Vamos dar um retorno dos resultados de todos os questionários dessa pesquisa juntos para os moradores de Nova Contagem. Agradecemos muito a sua colaboração!

1 – Você nasceu aqui em Nova Contagem?
( ) **Sim** ( ) **Não**
2 – Há quanto tempo você vive no
bairro?_____
4 – Qual são as três coisas mais importantes para se viver aqui?
( ) acesso ao centro
( ) serviços básicos de eletricidade, água, esgotos
( ) comércio
( ) áreas verdes
( ) oferta de trabalho
( ) boas escolas
( ) bons postos de saúde
_____
_____

5 – Qual é a pior coisa de se viver aqui?
_____
_____
6 – Qual é para você a importância das coisas da lista abaixo?

Essencial	Importante	Pouco importante
1	**2**	**3**

1. As ruas e espaços públicos são limpos	
2. Espaços abertos para prática de esportes e para jogar	
3. Praças e outros espaços abertos para encontrar amigos, conversar	
4. Espaços verdes, com arvores e plantas	
5. Natureza, bosques, rios e lagos nas proximidades	

7 – Quais são as vantagens de se ter espaços abertos, praças, no bairro?
_____
_____

7 – Sua casa possui quintal ou jardim?
 ( ) **Sim**   ( ) **Não** – Você gostaria de ter? Por
que?_____
_____
_____
8 – Se **SIM**, como você usa essa área? (*pode escolher mais de uma*)
( ) Para descansar, convidar amigos para um churrasco, essas coisas.

( ) Para lavar roupa, cozinhar, essas coisas.
( ) Para trabalhar.
( ) Para plantar, para criações (galinhas, porcos, cabritos, passarinhos, cachorros, etc)

9 – Você tem árvores em seu quintal ou jardim?

( ) **Sim**   ( ) **Não**   ( ) **Tinha, mas não tenho mais**. Por quê?_____

_____
_____

10 – Quais são as boas coisas de ter árvores? (NÃO LER AS OPÇÕES PARA O ENTREVISTADO)

( ) Sombra e frescor   ( ) Frutas   ( ) Beleza   ( ) Melhora a qualidade do ar

( ) Você pode subir nas árvores, brincar   ( ) Atrai passarinhos, borboleta

(   ) As árvores absorvem água da chuva e ajudam na umidade da terra

( ) outro ....

10 – Quais são as desvantagens de ter árvores? (NÃO LER AS OPÇÕES PARA O ENTREVISTADO)

( ) sujeira de galhos e folhas

( ) raízes quebram os passeios e o asfalto

( ) árvores podem cair sobre casas e carros

( ) árvores podem deixar a área insegura

( ) frutas podem cair sobre pessoas e carros

( ) podem atrair pássaros e insetos indesejados

( ) outro ....

11 – Você planta alguma coisa no seu lote?

( ) Sim

Se sim, o que?

Se sim, por quê? (NÃO LER AS OPÇÕES)

( ) Para produzir comida e remédios   ( ) Para me distrair, porque me faz bem

( ) Porque é bonito   ( ) Atrai passarinhos, borboletas

( ) para a terra e as plantas absorverem a água

( ) Não

Você gostaria de plantar? Por quê?_____

12 – Te incomodaria muito se as áreas verdes no bairro diminuíssem?

_____

_____

Se sim, por quê?

_____

14 – Te incomodaria se os córregos do bairro fossem canalizados e cobertos?_____

_____
_____

Por quê?

_____
___

15 – Como você descreveria sua saúde no momento?   ( ) **Boa**   ( ) **Razoável**   ( ) **Ruim**

16 – Alguém na sua casa possui um problema de saúde? ( ) **Sim**   ( ) **Não**   ( ) **Não sabe**

17 – Você possui familiares que vivem neste bairro? ( ) **Sim** ( ) **Não**

18- Você diria que possui amigos neste bairro? ( ) **Sim**   ( ) **Não**

19– Como é a sua relação com os vizinhos?

( ) Excelente (   ) **Boa**   ( ) **Razoável** ( ) **Distante** ( ) **Com conflito**

20 - Se você precisar de uma ajuda do tipo uma carona, alguém para cuidar do seu filho por um tempinho, uma ferramenta emprestada, você se sente à vontade para pedir a um vizinho?

( ) **Sim** ( ) **Não**

21- Se você tiver uma despesa inesperada, como um problema de saúde, você poderia pedir dinheiro emprestado a um vizinho?

( ) **Sim** ( ) **Não**

22 – As áreas abertas, as praças do bairro, onde as pessoas se encontram, são atrativas para você?

( ) **Sim** ( ) **Não**

22.1 - Por quê? (escolher a principal razão)

( ) Por causa das áreas verdes   ( ) Por causa dos espaços pavimentados

( ) Porque tem lugar para se sentar   ( ) Porque são próximas

( ) Por causa da iluminação   ( ) Por causa da segurança

23 – Como você acha que elas poderiam ficar mais atrativas?

_____

_____

_____

24 – Quem tem a responsabilidade de melhorar essas áreas?_____

_____

_____

13 – Você acha que áreas verdes trazem problemas para o bairro?

( ) **Sim** - Se sim, quais tipos de problemas?_____

_____

_____

( ) **Não**.

25 - Você se sente segura(o) para caminhar no bairro durante o dia?   ( ) **Sim**   ( ) **Não**

26 - E durante a noite? ( ) **Sim**   (   ) **Não**

26 – Há lugares no bairro em que você não se sente segura(o) de ir sozinha(o)? Se sim, onde?

27- Você vai às vezes passear no campo, nas redondezas?

( ) **Sim** - O que você gosta de fazer lá?_____

_____

_____

( ) **Não**- Porque não?_____

_____

_____

( ) **Costumava ir** - Por que não vai
mais?_____
_____
_____
28- Se você visita ou visitava o campo perto daqui, você se sente mais seguro andando no seu bairro ou no campo perto daqui?
( ) **No bairro**   ( ) **No campo**
29 - Quais os principais riscos de se viver aqui? Escolha as três mais importantes:
 ( ) Acidentes de trânsito   ( ) Inundações   ( ) Violência doméstica
( ) Epidemias   ( ) Deslizamentos   ( ) Incêndios   ( ) Violência e drogas
30 -Você considera que esse bairro tem problemas de poluição?
Quais?_____
_____
_____
31 – Você sabe para que a represa de Vargem das Flores
serve?_____
_____
_____
32 - Você vai na represa de Vargem das Flores?
( ) **Sim** – Com qual frequência você vai? ( ) Regularmente   ( ) de vez em quando
        O que você gosta nesse
        lugar?_____
         O que você não gosta nesse
lugar?_____
( ) **Não** - Por que não?
_____
( ) **Costumava ir** - Por que não vai
mais?_____
33 – Você acha correto que pessoas usem a represa para nadar? ( ) **Sim**   ( )
Não
Por quê?
_____
___
34 – Você acha que o acesso público à represa deve ser controlado?
( ) **Sim** – Por que?
_____
( ) **Não.**
35 - No futuro você gostaria de permanecer nesse bairro ou viver em outro bairro?

( ) Permanecer nesse bairro   ( ) Viver em outro bairro. (Por quê?)

Por
quê?_____
__

36- Você preferiria viver em uma área mais rural?
( ) **Sim** – Por
quê?_____
( ) **Não** – Por
quê?_____

37- A sua casa é?   ( ) Própria   ( ) Alugada ( ) De favor

38 - Com quantas pessoas você mora?_____

39- Com quem você mora?

( ) Sozinho   ( ) Casal   ( ) Nuclear (Pais e Filhos)

( ) Estendida: você divide os custos da
casa?_____
( ) Composta: cada um paga as suas
despesas?_____
40– Você considera que a sua casa possui espaço suficiente para todos? ( ) **Sim**
( ) **Não**
41- Em sua casa, quem é responsável pelas decisões mais importantes, como comprar uma nova TV?
_____
43 – Quem na sua família é responsável pela manutenção da casa (limpeza, alimentação)?
_____
_____
44 – Qual o grau de escolaridade que você atingiu?
( ) Ensino Fundamental, incompleto.
( ) Ensino Fundamental, completo.
( ) Ensino Médio, incompleto
 ( ) Ensino Médio, completo.
(( ) Ensino Superior, incompleto.
 ( ) Ensino Superior, completo.

45- Você gostaria de ter estudado mais?

( ) **Sim**   ( ) **Não**

46- Quais vantagens mais anos de educação podem trazer?

_____
_____

47- Você possui renda? ( ) **Sim**   ( ) **Não**

48: Em geral, a sua família possui dinheiro o suficiente para:

( ) pagar a comida da semana?

( ) pagar as contas com despesas correntes (luz, eletricidade, roupas), além da alimentação.

( ) Possui dificuldade para pagar suas contas.

49- Você tem uma reserva?

E agora só para terminar, você se importa de

50 – me dizer a sua idade? _____

51 – se você é praticante de alguma religião?

Qual?_____

_____
_____

Muito grato por sua colaboração!!!!!!

52 – Sexo do entrevistado:

( ) Feminino   ( ) Masculino

10.2 – Summary of Key Links Between Capital Assets based on the Regression and Correlation Analysis

Table 5 – Summary Links Between Natural Capital and Other Capitals

Links Between and Within Capital Assets				Green Space: Public					Green Space Private		Blue Space: Public					ES Regulating			ES Provisioning		
				B_GREEN	B_SPCGRN	B_LESSG	B_PARKGS	B_COUNTY	B_PLANT	B_TREE	B_SPCBLU	B_VFSERV	B_VFCONT	B_VFSWIM	B_VFGO	B_COOL	B_AIR	B_ABSORB	B_FRUIT	B_FOOD	B_POLLUT
Capital Asset Types	**Variable**	**Indicator**	**Mean**																		
Gender	B_SEX	1=female, 0=male	0.56	Minus				Minus		Minus		Minus	**Pos**	**Neg**	**Neg**						**Pos**
Physical Capital: Public Services																					
Shopping Centre	B_SHOPS	1=mention shopping in 3 most import in Neighbourhood, 0=otherwise	0.57								Plus						Minus				
Water, Electric, Sanitation	B_SERVIC	1=mention public services (water, electric) in 3 import in Neighbourhood, 0=otherwise	0.32										Plus				Plus				Plus
Road Accessibility	B_ACCESC	1=mention access to centre in 3 most important in Neighbourhood, 0=otherwise	0.20		Minus			Minus			Minus					Plus					
Physical Capital: Private Housing																					
Housing	B_OWNH	1=own home, 0=otherwise	0.86															Plus			
Yard / Garden	B_YARD	1=Have Private yard / garden,	0.68						Plus	Plus				Minus				Plus			

102

		0=otherwise														
Over Crowded	B_CROWD	1=insufficient housing space, 0=otherwise	0.14						Minus						Plus		
Financial Capital																
Income	B_INCOME	1=has an income, 0=otherwise	0.76			Plus										
Local Jobs	B_WORK	1=mention work opportunity in 3 most important, 0=otherwise	0.18		Minus		Minus	Minus								
Poor	B_POOR	1=food only & difficulty covering costs, 0=otherwise	0.29			**Pos**	**Pos**	Minus					Plus			
Human Capital																
Health Centres	B_HEALSV	1=mention health centres in top 3 assets, 0=otherwise	0.24		**Neg**		Minus			Minus	**Neg**		**Pos**	**Pos**		
Good health	B_HEALTH	1=good health, 0=otherwise	0.69			**Pos**										**Neg**
Schools	B_SCHOOL	1=mention schools in top 3 assets, 0=otherwise	0.19		Minus			Minus			**Neg**					
Education Level	B_EDUCM	1=Secondary education (complete) + higher (complete or not), 0=Other	0.46		**Pos**		Minus	Plus			**Pos**	Pos				
Social Capital																
Family Near	B_FAMILY	1=Family in NC, 0=otherwise	0.84									Plus		Minus		
Cash Loan	B_CASH	1=can borrow cash from neighbour,	0.51	**Pos**											**Pos**	Pos

		0=otherwise		
Conflictive	B_CONFLI	1= distant and conflict with neighbours, 0=otherwise	0.1	Plus

Notes: **Pos** = Significant (Sig <0.05) Positive Relation in Logit Models, **Neg** = Significant (Sig <0.05) Negative Relation in Logit Models, Plus = Significant (sig <0.05) Positive Correlation, Minus = Significant (Sig <0.05) Negative Correlation, Mean = sample mean proportions (% in binary coding)

Table 6 – Summary Links between and within Physical, Financial, Human and Social Capitals

Links Between and Within Capital Assets				Physical Capital Public			Physical Capital: Housing			Financial Capital			Human Capital				Social Capital		
Capital Asset Types	Variable	Indicator	Mean	B_SHOPS	B_SERVIC	B_ACCESC	B_OWNH	B_YARD	B_CROWD	B_INCOME	B_WORK	B_POOR	B_HEALSV	B_HEALTH	B_SCHOOL	B_EDUCM	B_FAMILY	B_CASH	B_CONFLI
Gender	B_SEX	1=female, 0=male	0.56				Plus							Plus					
Physical Capital: Public Services																			
Shopping Centre	B_SHOPS	1=mention shopping in 3 most import in Neighbourhood, 0=otherwise	0.57				Neg				Neg		Neg	Pos	Minus				
Water, Electric, Sanitation	B_SERVIC	1=mention public services (water, electric) in 3 import in Neighbourhood, 0=otherwise	0.32																
Road Accessibility	B_ACCESC	1=mention access to centre in 3 most important in Neighbourhood, 0=otherwise	0.20															Plus	
Physical Capital: Private Housing																			
Housing	B_OWNH	1=own home, 0=otherwise	0.86	Neg				Pos							Pos				
Yard / Garden	B_YARD	1=Have Private yard/garden, 0=otherwise	0.68				Pos										Plus		
Over Crowded	B_CROWD	1=insufficient housing space, 0=otherwise	0.14							Neg		Pos	Pos						
Financial Capital																			
Income	B_INCOME	1=has an income, 0=otherwise	0.76						Neg								Pos		
Local Jobs	B_WORK	1=mention work opportunity in 3 most important, 0=otherwise	0.18	Neg									Pos		Pos		Neg		

Variable	Code	Definition	Mean															
Poor	B_POOR	1=food only & difficulty covering costs, 0=otherwise	0.29					**Pos**					**Neg**				**Pos**	
Human Capital																		
Health Centres	B_HEALSV	1=mention health centres in top 3 assets, 0=otherwise	0.24	**Neg**						**Pos**		**Pos**	**Pos**					
Good health	B_HEALTH	1=good health, 0=otherwise	0.69	**Pos**	Plus			Minus			**Neg**				**Pos**		**Neg**	
Schools	B_SCHOOL	1=mention schools in top 3 assets, 0=otherwise	0.19	Plus		**Pos**				**Pos**		**Pos**						
Education Level	B_EDUCM	1=Secondary education (complete) + higher (complete or not), 0=Other	0.46				Plus		**Pos**	**Pos**			**Pos**					
Social Capital																		
Family Near	B_FAMILY	1=Family in NC, 0=otherwise	0.84										**Pos**					
Cash Loan	B_CASH	1=can borrow cash from neighbour, 0=otherwise	0.51															Minus
Conflictive	B_CONFLI	1= distant and conflict with neighbours, 0=otherwise	0.1								Plus			Minus	**Pos**	**Neg**		

Notes: **Pos** = Significant (Sig <0.05) Positive Relation in Logit Models, **Neg** = Significant (Sig <0.05) Negative Relation in Logit Models, Plus = Significant (sig <0.05) Positive Correlation, Minus = Significant (Sig <0.05) Negative Correlation, Mean = sample mean proportions (% in binary coding)

Table 7 – Summary Links between and within Natural Capitals

Natural Capital	Variable	Indicator	Mean	Green Space: Public					Green Space Private		Blue Space: Public					ES Regulating			ES Provisioning		
				B_GREEN	B_SPCGRN	B_LESSG	B_PARKGS	B_COUNTY	B_PLANT	B_TREE	B_SPCBLU	B_VFSERV	B_VFCONT	B_VFSWIM	B_VFGO	B_COOL	B_AIR	B_ABSORB	B_FRUIT	B_FOOD	B_POLLUT
Green Space: Public																					
Green space Top 3	B_GREEN	1=mention green space in 3 most import in Neighbourhood, 0=otherwise	0.21						Plus	Plus		Plus			Plus						
Green space Essential	B_SPCGRN	1=green space essential, 0=otherwise	0.52			Plus						Plus					**Pos**				
Less Green Space Worry	B_LESSG	1=bothered if less green space, 0=otherwise	0.88		Plus						Plus	Plus							Plus		
Green / Grey Space: Like Parks	B_PARKGS	1=like parks for green areas or can sit, 0=otherwise	0.58	Plus				Plus		Plus				Plus							
Walks in Countryside	B_COUNTY	1=walk in countryside, 0=otherwise	0.40				Plus				Plus	Plus			**Pos**						
Green Space: Private																					
Plants	B_PLANT	1=Plants, 0=otherwise	0.73	**Pos**						Plus		**Pos**									
Has Tree	B_TREE	1=Have Tree, 0=otherwise	0.60	Plus			**Pos**		Plus		**Neg**	**Pos**							**Pos**	**Pos**	
Blue Space: Public																					
Public Blue Space: Reservoir	B_SPCBLU	1=nature and blue space essential, 0=otherwise	0.47		Plus	Plus		Plus													
ES Provisioning:	B_VFSERV	1=know VF is reservoir,	0.73	Plus	Plus	Plus		Plus	Plus							Plus		**Pos**			

	Code	Coding	Mean									
Water Supply		0=otherwise										
ES Provisioning: Use Control	B_VFCONT	1=want use control, 0=otherwise	0.81						**Neg**	Minus		
ES Recreation: Leisure / Swim	B_VFSWIM	1=OK to swim, 0=otherwise	0.27		Plus			**Neg**		Plus	Minus	
ES Recreation: Leisure Visits	B_VFGO	1=Visits VF, 0=Otherwise	0.17	Plus	Plus		Plus	Minus	**Pos**			
ES Regulating												
Private tree use: cooling / shade	B_COOL	1=cooling/shade, 0=otherwise	0.61						Minus			
Private tree use: air quality	B_AIR	1=air quality, 0=otherwise	0.50									
Private tree use: absorb run-off	B_ABSORB	1=absorb rain water, 0=otherwise	0.14									
ES Provisioning												
Private tree use: fruit	B_FRUIT	1=Use fruit, 0=otherwise	0.35			Plus					**Pos**	Plus
Private Tree: food	B_FOOD	1=food benefits of garden, 0=otherwise	0.46									Plus
ES Disservices												
Pollution	B_POLLUT	1= Identify Pollution Problems, 0=Otherwise	0.66								**Pos**	

Notes: **Pos** = Significant (Sig <0.05) Positive Relation in Logit Models, **Neg** = Significant (Sig <0.05) Negative Relation in Logit Models, Plus = Significant (sig <0.05) Positive Correlation, Minus = Significant (Sig <0.05) Negative Correlation, Mean = sample mean proportions (% in binary coding)