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The New Zealand Footprint Project: the Ecological Footprint of Kiwi Lifestyles and Urban Form

Abstract
This new research project intends to highlight the degree to which and in what ways New Zealanders are living beyond their 'fair earth share' of global resources and how they could reduce their share. International case studies support the use of the Ecological Footprint (EF) to provide a 'snapshot' of a population's environmental requirements based on their use of resources and services. The EF has been proven as an effective indicator providing the means to communicate complex environmental data in a simplified form to diverse groups (Collins, Flynn, & Netherwood, 2005) and for high level long-term community planning and strategy formation (Aall & Norland, 2005; Wilson & Grant, 2009).

The importance of varying approaches when engaging with specific socio-economic groups has been clearly articulated (Barrett, Birch, Baiocchi, Minx, & Wiedmann, 2006). The '8 Tribes' research (Caldwell & Brown, 2007) provides some knowledge of the differing social, economic and cultural behaviour in New Zealand. Initial research, building on the 8 Tribes findings, has clearly highlighted the wide diversity of EFs within New Zealand and will be used for designing processes of community engagement targeted at specific 'tribes' which encourage behaviour change towards a fairer share of global resources.

The Framework for Strategic Sustainable Development (Robèrt, 2009a) will provide a guide for the project's collaboration process with local government and community stakeholders (Lawton, 2010). Working together with a range of demographically diverse New Zealand communities, a top-down and bottom-up approach to data gathering will allow for detailed measurement of a community's EF whilst highlighting which activities are the largest contributors to it. The outcome will be a set of footprinting tools to help guide future development decisions (Vale & Vale, 2009).

This paper will cover project design, footprint calculation methodology and the initial results of investigations into New Zealand lifestyles within a 'fair earth share' EF.

Introduction
This project has been designed to investigate how New Zealand will cope in a future world with increasingly scarce resources. The project is structured to incorporate end-users and beneficiaries of the research into the project so that the research findings can be applied directly in consultation with New Zealand communities. In many ways, the reactions to the scenarios proposed by this project may be one of its most important outcomes. Many people

are vaguely aware that living sustainably will mean living differently to the way they do now, but few people in New Zealand have yet attempted to live within what might be considered a 'fairer earth share' of the resources (Vale & Vale, 2009).

New Zealand is fortunate in being what is known as an 'ecological creditor' meaning that total biocapacity is less than what is needed to fulfil the national consumption footprint. Until recently it was also possible to fulfil the requirements for exports whilst staying within biocapacity but New Zealand has now moved into 'overshoot' by an excess of 1.8 million hectares (Ewing, et al., 2009). Now that it is clear that resources are being used up faster than nature can replenish them New Zealand, along with many other countries, must make some key decisions about how to plan for the future. Anecdotally it seems that societies do not act on such issues until forced to, as *planning* for a resource scarce future is a hard concept to sell.

There is also an ethical obligation to consider - the increasingly scarce resources that are being consumed are distributed unevenly. As calculated by the Global Footprint Network, New Zealand's EF in 2005 was 7.58 global hectares per person, nine times that of a person in India (Ewing, et al., 2009) and about four times the 'fair earth share' footprint of 1.8 global hectares per person (Moran, Wackernagel, Kitzes, Goldfinger, & Boutaud, 2007). As world population continues to increase, forecast to reach 9 billion by 2050 (United Nations Department of Economic and Social Affairs Population Division, 2009) the share of the planet's resources available to all will decline even further.

The resource use disparity is not only a global phenomenon but is also increasing locally. There is clear evidence of the increasing gap between the rich and poor in New Zealand (Wilkinson & Pickett, 2009). In 2009 a household in the top 80th percentile had an income 2.5 times higher than that of one in the lowest 20th percentile, compared with 2.2 times in 1986 (Perry, 2010). International research, particularly in the UK, clearly shows that with increasing income an individual's EF is also likely to increase (Barrett, et al., 2006). Therefore inequality can be demonstrated using the EF (Hughes, 2010). The differences in New Zealand lifestyles can be seen in the '8 Tribes' analysis below.

Thus, there is a need for New Zealand to explore ways in which to reduce what is taken from a finite world, both to enable others to have their fair share and to make communities more resilient for when resources become physically scarcer.

The "Footprinting Urban Form" Project is a three year project with funding provided by the Foundation for Research Science and Technology (FRST). The project team will work in partnership with local governments, in two Otago communities – Cromwell and Tarras, and two Auckland communities. The aim of the project is to understand key contributors to the 'unsustainability' of current individual and collective lifestyles, and to provide baseline data to better understand the amount of resources currently required as well as showing what social, economic and environmental opportunities may arise from a reduced EF. With these findings researchers can then work with communities to develop appropriate and feasible strategies to reach a 'fair earth share' community EF.

The Ecological Footprint

The theoretical basis of the EF was first developed by Wackernagel and Rees (1996). It is a response to long-standing concerns about the tendency of modern economic development and neo-classical economic rationalities to hide the ecological reality of human activity. The

argument is that societies need to understand the material, ecological consequences of their actions, which are obscured by a central occupation with monetary measures of value (Collins, Cowell, & Flynn, 2007). The EF as distinct from the carbon or water footprint methodologies takes a broader variety of resource requirements into consideration when calculating the total amount of productive land required for the given activity, product or population.

Even though sometimes used as such, the EF is not a measure of sustainability but rather a measure of unsustainability with regard to certain resource use and consumption patterns within society. In relation to the three inter-related factors (Ott, 2003) of sustainability – economy, society and environment, the EF focuses on availability of resources within the environment. EF measures the supply of resources through available biocapacity and the demand on that biocapacity caused by society's consumption which drives the economy.

Governments in the United Kingdom have used the EF to indicate society's biggest impacts on the environment (Best Foot Forward Ltd., 2002; Calcott & Bull, 2007; Collins & Flynn, 2005). There is increasing research to show that at least a 50% reduction can come from an individual's change in lifestyle. The other half would have to come from changes in government procurement and improvements in the eco-efficiency of products and services (Barrett, et al., 2006).

The EF methodology has been under scrutiny since its conception. A number of authors have focused on highlighting the tool's perceived weaknesses (Ferguson, 2002; McDonald & Patterson, 2004). The Global Footprint Network, an international NGO, has dedicated itself to increasing the rigour of the EF methodology and is attempting to collaborate with users to create a set of EF Standards (Global Footprint Network, 2009).

Use of the Ecological Footprint in Policy and Strategy

Initially developed for measuring national consumption, the EF has also attracted interest in its application at the regional and local level, particularly for providing information to local government for policy and strategy creation (Aall & Norland, 2005; Collins & Flynn, 2005, 2008; Monette, Colman, & Wilson, 2001; Wiedmann, Wood, Lenzen, Tovey, & Moloney, 2007; Wilson & Grant, 2009). Community planners, policy-makers, and leaders see the EF as a tool to measure the state of unsustainability in their communities, raise awareness about sustainability issues, and assist them with defining sustainability goals (Wilson & Grant, 2009).

Previous regional and local projects have experienced some benefits from using the EF for communicating global problems locally but have also found much frustration with regard to the inactivity and limited ongoing use of the EF in local policy and planning (Collins, et al., 2005; Wilson & Grant, 2009). The Footprinting Urban Form project team proposes that by using a community wide integrated approach based on community partnerships and working alongside current community planning processes, there is potential to overcome these barriers.

The 8 Tribes and communication strategies

The importance of understanding the drivers of consumption at a smaller scale when engaging with specific socio-economic groups has been clearly articulated (Barrett et. al 2006). However, few projects have tried to ensure that specific audiences are targeted when communicating the main influences on an individual's EF.

New Zealand is known as the 'melting pot' of the Pacific with a large variety of cultures and experience, and within cultures there is a range of socio-economic backgrounds. The '8 Tribes' research (Caldwell & Brown, 2007) provides some knowledge of these varying cultural and socio-economic backgrounds in relation to their differing cultural behaviours. The use of the 8 Tribes research as a source of initial insight into differing patterns of consumption and behaviour gives the project a greater understanding of the largest natural resource pressures for a range of existing New Zealand lifestyles.

The next step is to identify those aspects of lifestyle that are most important to each tribe's human needs and those tribal attributes that may provide 'low hanging fruit' with regard to lowering their overall footprints.

Framework for Strategic Sustainable Development

The Framework for Strategic Sustainable Development (FSSD), also known as The Natural Step Framework, encourages dialogue, consensus-building and incremental change to create the conditions necessary for significant transition towards sustainability. Based on scientific consensus at the level of principles the framework provides a widely applicable approach to sustainable development at multiple scales and has been proven successful in planning towards sustainability in numerous endeavours (James & Lahti, 2004; Nattrass & Altomare, 1999; Ny, MacDonald, Broman, Yamamoto, & Robèrt, 2006; Robèrt, 2009a).

Measuring the footprint of a community is a useful 'snapshot' of their current state, but unless there is strategic intent aligned with the results, change will be limited. Framing the EF within the broader FSSD could allow project managers not only to ensure that the community project is strategic, but that there is a clear understanding of both what is unsustainable and what is required to move towards a more sustainable future (Lawton, 2010).

The FSSD will also be used when engaging communities with regard to their long term planning processes. Use of the FSSD has been shown to be valuable in a number of community engagement processes in New Zealand, such as the Manukau 2060 project (Manukau City Council, 2009) and internationally, in communities such as Whistler, Canada (Whistler Centre for Sustainability, 2010).

Methodology

The conceptual design for the project combines a number of methodologies. The FSSD will guide both the strategic intent of the project and steer the community engagement processes. The project will use a simplified component-based method for the EF calculations using community apportioned "top-down" national data and locally sourced "bottom-up" aggregate data from the individual and household levels. The 8 Tribes research will become the basis for communicating the EF concept to a variety of audiences.

An overarching Framework for Strategic Sustainable Development

The FSSD provides the ability to plan using transparent (non-aggregated) core components which are defining success, backcasting and the ABCD planning process (Holmberg, Lundqvist, Robèrt, & Wackernagel, 1999; Robèrt, 2009b)

The use of the FSSD framework should ensure that there is general understanding about the process itself and may help to achieve buy-in from the participants to obtain a higher

likelihood of agreement on the outcomes. The engagement process will also provide resources to assist understanding of what the EF is, the purpose of the project and the goal of living within the Earth's carrying capacity, through online calculators, learning tools and open public forums and workshops.

The Ecological Footprint methodology

The EF is a measure of the population's environmental requirements, based on their use of resources and services. However there is no clear methodology to define which resource and service categories should be taken into consideration when calculating the EF whilst case studies vary depending on the priorities for the project (Aall & Norland, 2005). Categories chosen for the current project are those that have been shown by other case studies, to have large environmental consequences and long term impacts as a result of lifestyle choices and community decisions.

There is not yet a one-size-fits-all clear and common EF methodology for communities (Aall & Norland, 2005; Klinsky, Sieber, & Mered, 2009; Wilson & Grant, 2009). Klinsky et al. (2009) highlight that 'the costs of breaking down a national footprint include increased abstraction and the inability to capture local actions such as, public transit, local green energy or effective waste management'. On the other hand, "bottom up" component data calculation using household surveys and local data is extremely resource intensive and often the required local data are not available. Also important is to limit the analysis of consumption to those aspects that are relevant to the local environmental policy agenda (Aall & Norland, 2005); and reflect the scope of local jurisdictions (Klinsky, et al., 2009). However, ultimately the decision for what data are gathered will depend on the quality and quantity of data available for the local and individual levels.

The NZ Footprint Project intends to capture local variability at the community, household and individual level. Due to the relatively detailed data required the project will use a component "top-down, bottom-up" approach to ascertain the EF of the communities involved.

As shown in table 1 below, the EF has been broken into three levels – the collective national EF, the household EF and a lifestyle EF, containing nine resource and service categories as shown in table 1.

Table 1. Three levels of the EF containing resource and service categories, which together make up an individual's Ecological Footprint (Vale & Vale, 2009).

Footprint Level	Category	What it means
1. Collective Footprint related to central and local government and services	Infrastructure	Motorways, railways, bridges, stadia
	Government	Consumables and durables for local and central government
	Services	Water, phone, post, hospitals, education, finance, police etc.
2. Household footprint related to the built environment	Energy	Energy used in the home
	Housing	House building, maintenance and repairs
3. Household Footprint related to individual behaviour and	Food and drink	Food at home and eating out

choices		
	Travel	Car, bus, train and air travel
	Consumer goods	Clothes, computers, tvs, books, furniture, appliances
	Holidays	Holidays at home and abroad

The "top-down" approach will use national data to reveal New Zealand's overall resource requirements for each of the categories in Table 1 above. These data will then be divided by the number of New Zealand residents to obtain a per capita EF for New Zealand. The majority of this national data is available to the public through government agencies such as Statistics New Zealand, NZ Transport Agency and NZ Trade and Enterprise.

Using the "bottom-up" approach, locally specific data - if available – will be used to replace the top-down New Zealand 'average per capita' data to generate local area footprints. Local data will used to inform levels 2 and 3 in Table 1 above.

Variations in resource use depending on lifestyle choices will also be calculated using the 8 Tribes research. Initial results are outlined below. These individual lifestyle footprints will be applied to different types of built settlements to establish what forms of existing settlement pattern may have the lowest footprint and, hence, the lowest environmental impact. This part of the research will draw on earlier research that looked at the environmental impact of a range of settlement types at the small scale (Ghosh, Vale & Vale, 2008; Ghosh & Vale, 2006).

8 Tribes Methodology

The 8 Tribes work builds on existing research by Jill Caldwell and Christopher Brown which breaks down the 'typical New Zealander' into *'8 Tribes – The hidden classes of New Zealand'*. Initial results using the 8 Tribes marketing research supported the need to work with the 'tribes' in different ways based on their various lifestyle attributes.

Initial Results

The 8 Tribes Results

An analysis of the lifestyle tendencies of each the 8 Tribes of New Zealand shows a considerable range in resource requirements. The calculations were undertaken using an online calculator, equipped with New Zealand specific data (Redefining Progress, 2006). The EF calculations in this particular calculator are shown in 'Earth' equivalents, being the number of Earths required if everyone on the planet wanted to live like an individual within that tribe.

Preferences for the highest goods and services consumption, large houses and long distance travel put the North Shore tribe well ahead of the other tribes. Balcultha is also high but this is due to their rural lifestyle, a high number of kilometres travelled and being substantial meat eaters.

At the other extreme, a relatively small portion of New Zealanders share Raglan tribe tendencies whereby preferences for 'simple' lifestyles and working from home with a reasonable level of self-sufficiency put them well below the New Zealand average. However all of these tribes have a level of consumption which greatly exceeds their 'fair earth share' of one planet to produce the resources they consume and absorb their waste.

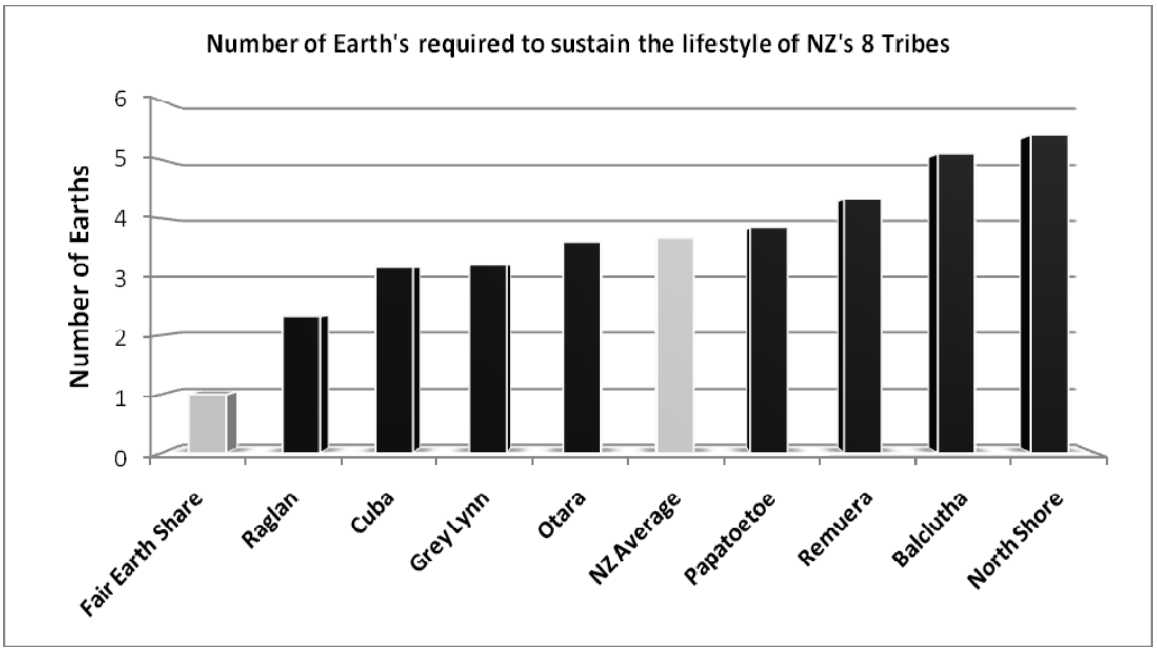

Figure 2. Initial results of the 8 Tribes analysis using the Ecological Footprint to show the number of earths that would be required if everyone lived like each of the tribes.

'Fair Earth Share' Results

An EF project undertaken in Cardiff, Wales calculated how much of an individual's existing footprint was apportioned to each EF category. (Collins, et al., 2005). This has then been used to create a pilot for how the current project might go about creating combinations of lifestyle and urban form that are equal to or below an individual's 'fair share' of the Earth's resources (Vale & Vale, 2010). An example is passenger transport, which is approximately 18% of a currentEF. A 'fair share' EF is 1.8 global hectares, which is a 65% reduction in the current footprint. Current transport energy demand per person is around 71GJ and 65% of this provides 24.8GJ of energy per year to be rationed by the individual on appropriate modes of travel and for those purposes which are most important to their lifestyle (Vale & Vale, 2010).

Discussion

The New Zealand Footprint Project aims to provide a greater level of detail regarding the largest environmental impacts created by urban design and lifestyle choices in New Zealand. Identifying the true environmental cost of individual and community decisions will provide an opportunity for community members to discuss what environmental, social and economic impacts these activities might have on the future resilience of their community.

Urban versus rural communities

It has been assumed that urban living reduces an individual's footprint because of an increase in shared infrastructure, smaller dwellings and shorter distances to travel to work and the shops. (Jenks et al, 1996) Initial research by Ghosh, Vale and Vale (2007) shows low-density urban forms may have more potential to be sustainable compared with other compact urban forms due to an increased ability to be self-sufficient (Ghosh, Vale, & Vale, 2007). However, with at least 50% of an individual's EF dependent on lifestyle, this is just as influential as urban form. These findings will be of use as NZ continues to design community scale settlement patterns for the future.

Barriers to implementing the EF at the local government level

There are currently a number of limitations to using the EF at a regional or local level primarily due to the information needed to consider the unique geographical, political and socio-economic make-up of these communities (Aall & Norland, 2005; Wilson & Grant, 2009). Due to these barriers EF calculations and methodologies have not had a great deal of influence on government and local government policy.

An outcome for the current project is to create EF tools that can be used and understood by policy-makers and planners so that the results from the tools can be integrated into the local government planning and policy making processes. This requires understanding and acceptance of the tools by local government staff. In a detailed review of the limited success of integrating the EF into policy and strategy within Cardiff Council, Collins, Cowell & Flynn (2009) highlighted that "its influence depended only partly on claims to technical credibility; it also depended upon an array of other institutional and personal commitments". These considerations are important because although the current project is not focused wholly on integration of the EF into policy, the EF tool intended as an outcome must be in a usable form for local government processes.

Engaging with individuals and community groups and aligning with existing community processes

Considerable time is being spent in ensuring that relationships with communities and local government partners are established and trust between the project stakeholders is solidified. Community engagement will be initiated first with an Auckland community previously engaged in the Manukau 2060 project (Manukau City Council, 2009) on the premise that the community is already involved with a reasonably high level of engagement and have a basic understanding of the imminent sustainability issues.

The project needs to align with local government planning processes and could be used at a range of scales, e.g. to guide Community Outcomes, in District Planning processes and in Auckland as a high level goal to drive strategic documents such as the Auckland Spatial Plan.

EF Methodology Limitations

A community EF methodology that is often cited follows the standard set for sub-national calculations by Global Footprint Network (GFN) (Global Footprint Network, 2009). This method adapts the national results to sub-national populations which offers a logical starting point and provides results comparable with the GFN National Footprint Accounts (Wilson & Grant, 2009). However, this starting point comes into question as GFN's 'one-size-fits-all' methodological design shows significant inaccuracies. A recent paper provided by the New Zealand Centre for Ecological Economics (NZCEE) show that in GFN's attempt at using a generic methodology for over 120 countries and international datasets (Ewing, 2008) the final calculations for New Zealand were grossly over exaggerated. NZCEE's recalculations dropped New Zealand 10 places, from 6th to 16th in world ranking for highest EF (Andrew & Forgie, 2009). Use of GFN's National Footprint Accounts in the current project was considered, however the findings by Andrew and Forgie (2009) provided additional support for the project to provide its own data for the footprint calculations. The source and analysis of data will be well documented for transparency and duplication by other projects.

Conclusion

The New Zealand Footprint Project will be publicly launched with community partners in early 2011. Although the current paper focuses on explaining the strengths and weakness of the EF and its methodology, it is important to emphasise that the EF tool itself is not the

primary focus of this project. The overarching intent is to further understand the ecological impacts of the current physical and social infrastructure of New Zealand communities. A highly effective means to communicate these ecological impacts is through the use of the EF, particularly once the methodology has been contextualised for New Zealand communities.

By understanding current baseline EF in light of a theoretical 'fair earth share' community, it becomes possible to collaboratively discuss the collective goal then plan how to get there using community decision-making towards 'fair share' living.

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