Trade-offs between high class land and development: Recent and future pressures on Auckland's valuable soil resources

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A B S T R A C T

Sustainable land management is essential to meeting the global challenge of securing soil and water resources that can support an ever increasing population. In Auckland, New Zealand's largest city, population growth is forecast to increase from 1.5 to 2.5 million by 2040 which will put immense pressure on the region's soil resources. The objective of this study was to robustly quantify the amount of high class land (Land Use Capability Classes 1–3) that has been converted, and what is likely to occur, to urban development in Auckland using both long term trend records and future growth projections.

Spatial analysis indicated that over the various spanning datasets 10,399 ha (or 8.3%) of Auckland's high class land has been converted to urban development through incremental urban extension, operative/approved greenfields and building consents. Of this, 10,080 ha of high class land was converted to development between the years, 1975 and 2012. The rate of urban extension onto high class land has accelerated since 1996. Furthermore, the majority of land allocated to urban extension since 1996 has been high class land. Looking into the near future, lodged/future greenfield developments equate to an additional potential development of 6010 ha (or 4.8%) of current high class land. Future growth pressures indicate that this trade-off will continue.

There is a real need to analyse the economic benefits and long term sustainability of future development against the protection of high class land for current and future production requirements. Further research should account for the true cost of lost provisioning, regulating and cultural soil ecosystem services to ensure that these values are recognised and considered not only by urban planners but also by both policy and decision makers.

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Introduction

Securing adequate food supplies for an ever increasing global population is an emerging international challenge, and healthy soil and water ecosystems are fundamental to ensuring that these needs are achieved (Busscher, 2012). However, the value and importance of soil is often overlooked (Daily et al., 1997; Robinson et al., 2013). Soils are natural capital assets and are a non-renewable resource once lost through irreversible damage and degradation they are effectively lost forever (Haygarth and Ritz, 2009; Mackay et al., 2011). The global population is projected to reach 8.1 and 9.6 billion by years 2025 and 2050, respectively (UNESA, 2013), putting immense pressures on our natural resources to meet basic human needs. More than half of the global population currently reside in cities and it is estimated that 60% of the global population will live in urban areas by 2030 (Pickett et al., 2011). High quality agricultural soils are increasingly under pressure to meet the land demands of these growing cities (Tóth, 2012). Tóth (2012) reports that for several European states, urban development occurs at the cost of highly productive croplands.

In New Zealand, there are growing concerns about the competition of high class land on the fringe of large cities for rural versus urban use (Andrew and Dymond, 2012; Mackay et al., 2011; Rutledge et al., 2010). High class land has been defined by some practitioners as Land Use Capability (LUC) Classes 1–2 and other practitioners as LUC Classes 1–3 (Bloomer, 2011). Class 1 (or elite land) is the most versatile, multiple-use land on flat to undulating land. Classes 2 and 3 (or prime land) are also very good prime agricultural and horticultural land with slight (Class 2) or moderate (Class 3) physical limitations to arable use (Lynn et al., 2009). Classes 1–2 land represent 5% of total New Zealand land areas and Classes 1–3 land represent 14% (Rutledge et al., 2010).

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Domestic retail sales of fresh and processed vegetables are estimated at NZ$1 billion each year while export earnings range between $500 and $600 million (Ministry for Primary Industries, 2013). These operations are only suitable on multiple-use, highly versatile land. However, Rutledge et al. (2010) report that urbanisation disproportionately affects New Zealand's most high class and productive soils which could have a negative impact on New Zealand's primary production capacity in the future. These authors report that urbanisation rates in New Zealand were highest for LUC Class 1 (5.86% converted land) and Class 2 (3.96%) compared with LUC Classes 3–8 that ranged from <0.01 to 2.0%. Furthermore, non-productive rural community lifestyle blocks currently cover 187,000 ha of land and occupy 10% of New Zealand's high class land (LUC 1–2) (Andrew and Dymond, 2012). Both urban encroachment and lifestyle block expansion onto high class land have the potential to constrain future land productivity and other soil ecosystem services (Daily et al., 2000; Dominati et al., 2010; Haygarth and Ritz, 2009; Metzger et al., 2006).

Auckland is the largest city in New Zealand with a population of about 1.5 million at 2012. The population is projected to reach between 1.8 to 2.5 million by 2040 according to Statistics New Zealand's low and high population projections, respectively (Auckland Council, 2012; produced from a custom built order by Statistics NZ (2006)). The medium population projection for Auckland by 2040 is 2.2 million. The Auckland Plan (a 30 year strategic spatial plan for Auckland to 2040) is based on the high projection, which translates to a population increase 5.5 times the population in Auckland half a century ago (Mayer, 1962). The conversion of high class land to urban development will be a highly political land use planning issue in Auckland with the forecast growth driving demand for a possible additional 400,000 new dwellings by 2040 (Auckland Council, 2012). In line with this, two satellite towns have been proposed for future growth, namely Warkworth and Pukekohe (Auckland Council, 2012). Pukekohe is located where the majority of Class 1 or elite land in Auckland is and is an area that supports a significant proportion of New Zealand's outdoor vegetable production (Fresh Facts, 2011; Hunt, 1959; Statistics NZ, 2011). Future growth identified in the Auckland Plan also requires the need for additional greenfield developments over and above what is already planned and have been noted as 'Greenfield Areas for Investigation' in the plan's Development Strategy (Auckland Council, 2012).

Loss or development of highly productive agricultural and horticultural land in and around Auckland caused by the continuous extension of the urban frontier can be traced back to the early to mid 1900s (Hunt, 1959). However, there have been few in-depth, evidence based investigations of this long-standing land use issue in Auckland. While some studies in New Zealand and overseas have focused on the encroachment of urbanisation onto productive agricultural or horticultural land, datasets have been limited to broad scale or short spanning records of between 6–18 years (Andrew and Dymond, 2012; Tóth, 2012). For example, Andrew and Dymond (2012) calculated that 4.1% of high class land was converted to urban use in Auckland between 1990 and 2008. However, high class land was defined as LUC Classes 1 and 2, and national datasets were used to assess urban growth (Andrew and Dymond, 2012). Although such research provides a useful indication as to what has occurred, the datasets used were not necessarily designed for analysing urbanisation trends (Rutledge et al., 2010). Additionally, future growth projections are often not accounted for. The aim of this study is to address this gap for New Zealand's largest city.

The objective of this study is to robustly quantify the amount of high class land (LUC Classes 1–3) that has been converted to urban development, and explore what is likely to occur in Auckland using both long term trend records and future growth projections. Urban development categories and corresponding datasets are based on four inter-related criteria: (1) the progressive extension of the built-up core urban area of Auckland over time; (2) greenfield developments (operative/approved and lodged/future) defined as large scale developments, primarily on the city edge, converting land that has previously been used for rural-based purposes to urban use; (3) building consent footprint; and (4) greenfield areas for investigation for future growth. Following the quantification and presentation of findings, the paper will discuss the planning and policy implications of the research findings.

Data and methodology

The spatial assessment of the long term trend in the conversion of high class land to urban development was based on several datasets. The 1970s/1985 Land Use Capability (LUC) layer from the New Zealand Land Resource Inventory (NZLRI, 2009) was used to measure the proportion and spatial distribution of high class land in Auckland. For the purposes of this study, LUC Classes 1–3 are defined as high class land, with Class 1 land defined as elite and Classes 2 and 3 land defined as prime land in accordance with the ACRPS (2008b). Land Use Capability mapping became effective in and around the 1980s and therefore parts of the core urban area were not mapped because of pre-1980 urban development i.e. land was already developed upon before the LUC concept came in effect.

Four other datasets and layers held by Auckland Council were used to determine the recent and anticipated conversion of high class land to various urban developments. These datasets include (with length of dataset establishment in parentheses):

1. Extension of the urban boundary (1915–2010):

The periodic incremental extension of the urban boundary was mapped from 1915 to 2010 (hereafter referred to as 'urban extent' or 'extension'). The dataset has been continuously updated over time and was last updated in 2010. Older urban extents contained in this dataset were captured using historical data, and illustrate urban extension since 1915. The new aerial photography captured for the region is digitised at the parcel/property level.

2. Greenfield developments (operative/approved and lodged/future) (2010–2036):

Greenfield developments are large scale developments, primarily on the city edge, that convert land that has previously been used for rural-based purposes to urban use. The greenfield developments dataset includes spatial information for current and proposed developments. For the purposes of this study, the greenfield developments dataset has been divided into two categories; (i) operative/approved and (ii) lodged/future. The former describes those developments that have been approved. Any greenfield developments approved prior to 2010 have been captured in the urban extents dataset. Lodged greenfield developments are those that have been lodged with Auckland Council for planning consent consideration.

3. Building consents (1991–2012):

The building consents dataset is a compilation of building consents data between 1991 and 2012. The data have been collated following the enactment of the Building Act in 1991 (DBH, 1991) when building consent reporting became mandatory, complementing the new planning regime created under the Resource Management Act 1991 (RMA, 1991). The growth of impervious built up areas was recorded in terms of floor area or footprint of new building structures.

4. Greenfield areas for investigation for future growth (2012–2040):

Greenfield areas for investigation for future growth have been identified in the Auckland Plan's (2012) Development Strategy to accommodate up to 90,000 dwellings (using the high growth scenario) outside the current urban extent. The proportion of high class