

## Decline, adaptation or transformation: new perspectives on demographic change in resource peripheries in Australia and Sweden

Carson, Dean B.; Carson, Doris A.; Porter, Rob; Ahlin, Celia Yoshida; Sköld, Peter

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## **Decline, Adaptation or Transformation:**

### **New Perspectives on Demographic Change in Resource Peripheries in Australia and Sweden**

**Dean B. Carson, Doris A. Carson, Rob Porter, Celia Yoshida Ahlin, Peter Sköld**

**Abstract:** Many sparsely populated resource peripheries in developed countries are perceived to suffer from periods of demographic decline due to loss of employment opportunities and services, youth out-migration and population ageing. While these trends tend to apply at broad regional scales and for particular time periods, diverse patterns of demographic change may be apparent if different spatial, temporal and social scales of analysis are taken into consideration. Comparing the experiences of two case study regions in northern Sweden and inland South Australia, this paper proposes an alternative conceptual framework to the “discourse of decline”, which could be used to examine the nuances of demographic change within resource peripheries. The framework includes spatial scale considerations that contrast broader regional demographic patterns with the experiences of sub-regions and individual settlements. It also includes temporal scale aspects, examining demographic change over different time periods to understand the pace, duration and frequency of population growth and decline. The framework finally includes social unit considerations, emphasising that demographic change affects different social groups in different ways. The results of the case studies suggest that considering demographic change as adaptation or transformation rather than decline may be more useful for identifying new – and qualitatively different – demographic pathways that emerge over time.

**Keywords:** Demographic decline · Resource peripheries · Population ageing · Youth out-migration · Female flight · Mid North (Australia) · Western Lapland (Sweden)



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## 1 Introduction

This paper examines some of the nuances of demographic change in “resource peripheries” of developed countries, drawing on case studies from northern Sweden and inland South Australia. Resource peripheries are rural or remote regions which are, or have traditionally been, economically dependent on large-scale exploitation of minimally processed natural resources (e.g. minerals, oil/gas, lumber, grain, fish, and livestock). They are distant from both markets and major centres of political and economic power, and are located beyond the rural-urban fringe zones (*Nelson/MacKinnon* 2004). Such resource peripheries are found (among other places) in the vast, sparsely populated areas of Canada, the US, Australia, and the Arctic and sub-Arctic parts of Europe. They are known to be demographically dynamic, subject to rapid and dramatic changes in both population size and composition as a result of fluctuating resource commodity markets and changing technologies and labour needs (*Carson et al.* 2011).

Quantitative forecasting of demographic change in these areas is challenging because even apparently long term “trends” can be violated as a result of unforeseen or unforeseeable circumstances (*Taylor* 2011a). Understanding demographic dynamics in these sorts of regions requires attention to local detail and heterogeneity, fluctuations and variability over time, and diversity of experiences among different population groups (*Koch/Carson* 2012; *Carson/Koch* 2013). Specific local settlements may have experiences of demographic change that are dramatically different to even their nearest neighbours; population growth viewed over the long term may conceal periods of population loss; and different demographic or social groups may have very different experiences, as seen in the case of Indigenous people in the remote north of Australia (*Wilson* 2009) or young women working in the forestry sector in northern Canada (*Reed* 2008). In other words, changing the spatial, temporal and social scales of analysis may reveal different but important insights into processes of demographic change.

In recent decades, certain resource peripheries – typically those affected by resource depletion or a reduced demand for resources and labour – have become subjects of an academic and political “discourse of decline”. This discourse generalises demographic change as a process of persistent population loss, population ageing, and the out-migration of young adults, particularly young adult females. Decline is seen as problematic for service delivery and the prospects for ongoing economic development, and declining regions are commonly urged to identify strategies to promote population growth and retain young people. This research focuses on two resource peripheries which have been subject to the “discourse of decline”: western Lapland in northern Sweden (Fig. 1) and the Mid North of South Australia (Fig. 2). Some aspects of demographic development of these regions are examined from different spatial, temporal and social unit perspectives (*Koch/Carson* 2012) to provide alternative insights into the processes and consequences of demographic change. The paper does not intend to provide a detailed or comprehensive analysis of demographic change in the case study regions, rather it lays the foundation for such future analyses by alerting researchers to the need to consider the various

spatial, temporal and social scales at which demographic change can occur, and the risks of basing analysis on “accepted wisdom” that is often insensitive to spatial, temporal and social diversity.

## 2 Background

### 2.1 Demographic discourse in resource peripheries: a growth-decline dichotomy

Academic discussion of demographic change in resource peripheries tends to either focus on periods of population “growth” or periods of population “decline”, often in isolation from one another. Growth is seen as economically beneficial in the long term, although challenging in the short term when it comes to managing services and infrastructure. Decline is seen as an inherent challenge to the economic viability and social strength of a region. It is now generally acknowledged that growth and decline are characteristics of resource cycles over time (*Barnes et al. 2001; Tonts 2010*), but there has been very little demographic research which considers the relationships between those characteristics (*Carson et al. 2016*).

Typically, individual regions attract a label as either “growth” or “decline”, and that label helps determine how they are treated in continuing academic research and in regional development policy. This is apparent in parts of rural northern Sweden, where the discourse of decline has dominated academic, political and public thinking since the middle of last century (*Enequist 1960; Eriksson 2008; Nilsson/Lundgren 2015*). A similar discourse has emerged in parts of rural Australia, where issues around rural restructuring, recurring periods of drought, and a change in the national economic focus from agriculture to mining has led to concerns about the demographic futures of many rural communities, with those on the fringes of arable land deemed most at risk (*Connell/Dufty-Jones 2014; Argent et al. 2010; Race et al. 2010*).

During the last mining boom in Australia in the early 2000s, resource peripheries which were previously seen as problematic because of their relative isolation from major population centres and the poor living conditions of Indigenous inhabitants, very quickly became growth regions with long term prospects for increased population and economic prosperity. This adoption of the growth perspective led to substantial investment in new infrastructure, and planning for urban expansion (e.g. *Brueckner et al. 2013; Jones 2011; Chapman et al. 2014*). The unanticipated end to the mining boom in recent years, brought about by reduced global demand for raw minerals and the end of the construction phase for many of the larger mining projects, saw communities having to deal with new demographic realities which were not reflected in plans and developments. Collapsing house prices, underutilised social and physical infrastructure, empty shops and office buildings, and the disappearance of industries which had been crowded out by the demands of mining have become common experiences in many previously labelled “growth” regions (*Carson/Carson 2014; Maxwell 2015*).

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The strategies now being proposed to address the negative impacts of population loss in recently booming regions mirror those that have long been proposed for regions seen to be subject to more persistent decline. These include transitioning from dependence on a single or small number of resource related industries to become more multi-functional and economically diverse, particularly through embracing attractive industries such as tourism and lifestyle migration (*Carson/Carson 2014; Eimermann 2015; Lundmark 2006*). Numerous strategies have been proposed to aid in the recruitment and retention of economically active and/or structurally important residents such as entrepreneurs, health and education professionals, transactional workers (lawyers, accountants and the like) and young adults (*Vuin et al. 2016; Kilpatrick et al. 2011; Wilson et al. 2009*). That there are few examples of declining resource peripheries achieving long term demographic “success” from these strategies suggests that our understanding of “decline” may be as limited as our understanding of “growth” (*Taylor et al. 2011*).

## **2.2 The problematic problematisation of demographic decline in resource peripheries**

Decline regions are typically characterised by a loss of young adults, population ageing, and the inability of particular sub-populations (such as retirees, women, Indigenous people) to address economic and social challenges (*Taylor et al. 2011*). Out-migration of young adults or skilled workers from these regions is considered a negative impact, as is any proportional increase in older, Indigenous or economically disengaged populations. This “demography of disadvantage” means that research and policy-making is directed by assumptions of negativity, making decline more obvious whilst also taking attention away from other demographic resilience processes such as adaptation and transformation. Adaptation in this context refers to changes or re-organisations within a (demographic, social, economic) system in response to shocks or disturbances, whilst essentially retaining the same systemic structure, function or identity. Transformation, on the other hand, leads to the emergence of new and functionally different systems (*Walker et al. 2004*).

Out-migration of young adults, sometimes called “youth flight”, continues to be portrayed as the key marker of decline (*Stone/Tyrrell 2012*), despite clear evidence that young adults have always been highly mobile, and in net terms tend to leave rural areas whether they are declining or not (*Seyfrit et al. 2010*). Recently, particular alarm has been raised about the gendering of youth flight, with “female flight” depicted as a substantial new challenge for resource peripheries (*Martin 2009; Rasmussen 2009*). Yet, recent research in northern Sweden (*Johansson 2016*) reminds us that the process of such rural female flight is much more complex, as out-migration of young females may coincide with in-migration of slightly older women, thus calling for a more nuanced analysis that considers youth flight and female flight at different social unit scales. Another limitation in this field of research is the lack of long-term comparisons. While contemporary patterns of migration are well considered in many youth flight and female flight studies, they are rarely compared to historical patterns, particularly those that may have existed during times of population

growth. As a result, there is the risk that “what is known” in rural demography is in fact only a small part of what could be known.

Literature on population ageing in resource peripheries also tends to problematisation. Older people are seen as less economically active than younger people, more likely to be a burden on public services, and ultimately represent a demographic deficit (by dying) with no prospects of demographic gain (through reproduction). However, research in rural Scotland, for example, has shown how rural populations can be “refreshed” through in-migration of older people who are nonetheless younger than those who they replace (*Skerratt et al.* 2014). Ageing communities may become attractive to new older (retired or semi-retired) in-migrants who strengthen social and cultural capital in rural communities (*Vuin et al.* 2016; *Stockdale/MacLeod* 2013; *Thulemark* 2011). Older people may also provide economic stimulus through creating service and other jobs that would not otherwise exist (*Ryser/Halseth* 2013). Population ageing, therefore, can accompany multi-faceted economic and demographic restructuring processes.

Another important aspect of problematisation is that decline in resource peripheries is typically considered a regional problem. Resource peripheries remain relatively sparsely populated even during periods of growth, and public, private and third sector services continue to operate across large geographic areas. The threat of population loss, even if it occurs in specific locations, therefore becomes a regional threat (*Carson/Carson* 2014; *Robertson/Blackwell* 2016). The rural geography literature thus far has only poorly examined the ways in which regional demographic processes reflect or are distinct from local processes (*Carson/Koch* 2013; *Koch/Carson* 2012). This is somewhat in contrast to urban geography, which is replete with studies on demographic change in different parts of cities, and their varying experiences of segregation, gentrification and suburbanisation for example (*Grundström/Molina* 2016). The subregional analyses which do exist focus primarily on the extent to which tourism and “attractive” industries compete with the resource “extractive” sectors for access to particular rural locations (*Farstad/Rye* 2013; *Hughes* 2014; *Luke* 2003). However, tourism locations are not necessarily the same as resource extractive locations (*Hedlund* 2016), and tourism in remote areas may also experience booms and busts similar to resource industries (*Schmallegger/Carson* 2010). Consequently, “favoured” locations in resource peripheries can change over time, and favoured and non-favoured locations will have vastly different demographic experiences. Not all locations are expected to survive cycles of booms and busts from a demographic perspective, with demographically adaptable locations being most likely those which are able to be inhabited and re-inhabited as the cycles demand, even if this requires phases of change to the nature and composition of local populations.

In sum, the dynamic and diverse nature of settlements in resource peripheries requires attention to a more detailed analysis of demographic change that can identify the nuanced experiences of changing population trajectories at the local level. Generalising local trajectories at a broader regional level, over a short and fixed period of time, and without considering the experiences of different sub-populations, runs the risk of painting a simplified homogenous picture of demographic

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change that does not reflect the experienced realities of individual settlements. It may further conceal localised and small-scaled processes of adaptation and transformation, thus re-generating and perpetuating the general regional discourse of decline. This research will, thus, analyse indicators of demographic change in two case study resource peripheries by considering different temporal perspectives, the experiences of different social units and sub-populations, and the experiences of localities and regions at different spatial scales.

### **3 Introducing the cases: Western Lapland (northern Sweden) and the Mid North (South Australia)**

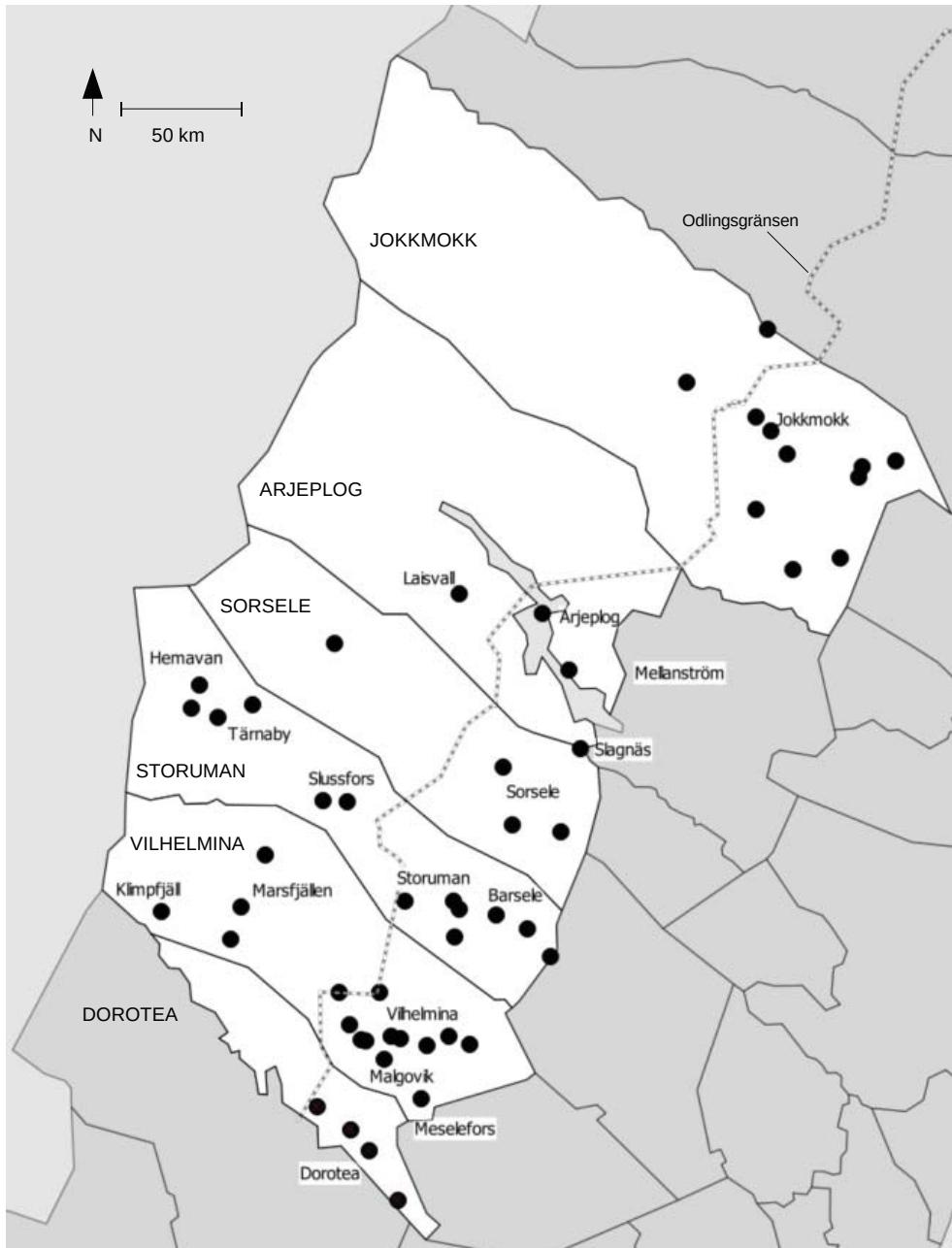
The two cases examined in this research are interesting examples of resource peripheries, with economies that have experienced some transition from minimally processed resources (minerals, wool and grain in the Mid North, and minerals and timber in western Lapland) to different forms of agriculture, and public and private services. Their economic foundations, however, remain in the “staples” that have defined resource peripheries in the literature (*Cashin/McDermott 2002; Carson/Carson 2011; Carson et al. 2016; Howlett/Brownsey 2008; Schedvin 1990*). While some of the resources are “native” (primarily minerals), others (wool, much of the timber) have been imported to take advantage of the large land area available for resource production. The resources are minimally processed locally, and exported to distant markets. Both regions have been subject to impacts of fluctuations in demand and pricing – driven by these external markets.

The two cases have been considered as declining areas in academic and grey literature for several decades. In Sweden, Professor *Erik Bylund* and colleagues were examining the “advance and retreat” of settlements in the north by the end of the 1950s (*Enequist 1960; Bylund 1960*). In much of the subsequent Swedish literature, the focus has been primarily on “retreat”. In South Australia, the work of Dr *Peter Smailes* and Professor *Graeme Hugo* has dominated rural geography research since the 1970s (e.g. *Smailes/Hugo 1985; Hugo/Smailes 1992*). *Smailes* was particularly interested in the impact of changing farm and agricultural economies on the towns and villages of the Mid North of South Australia. *Hugo* documented the changing patterns of human settlement across South Australia, with a focus on the relationships between the metropolitan and rural areas. Both were concerned about the demographic threats to the social and economic wellbeing of the Mid North.

The two regions offer interesting comparisons for the purpose of this paper, as they have a number of similarities when it comes to their demographic histories. They were both colonised quite late in their respective national processes. In Sweden, the northwestern regions between Jokkmokk in the north and Vilhelmina in the south were the last to be settled by non-Sami people, with major development beginning only during the second half of the 18<sup>th</sup> century and early 19<sup>th</sup> century. Figure 1 shows the Odlingsgränsen (literally the “cultivation border”) which was created in the mid-19<sup>th</sup> century as a division between non-Sami settlement (to the east) and traditional Sami economic activity (to the west) (*Weinstock 2013*). A harsh



**Fig. 1:** Western Lapland (Sweden) case study region



Note: showing localities with populations of more than 50 persons in 2015; local government names are in capital letters

Source: own design



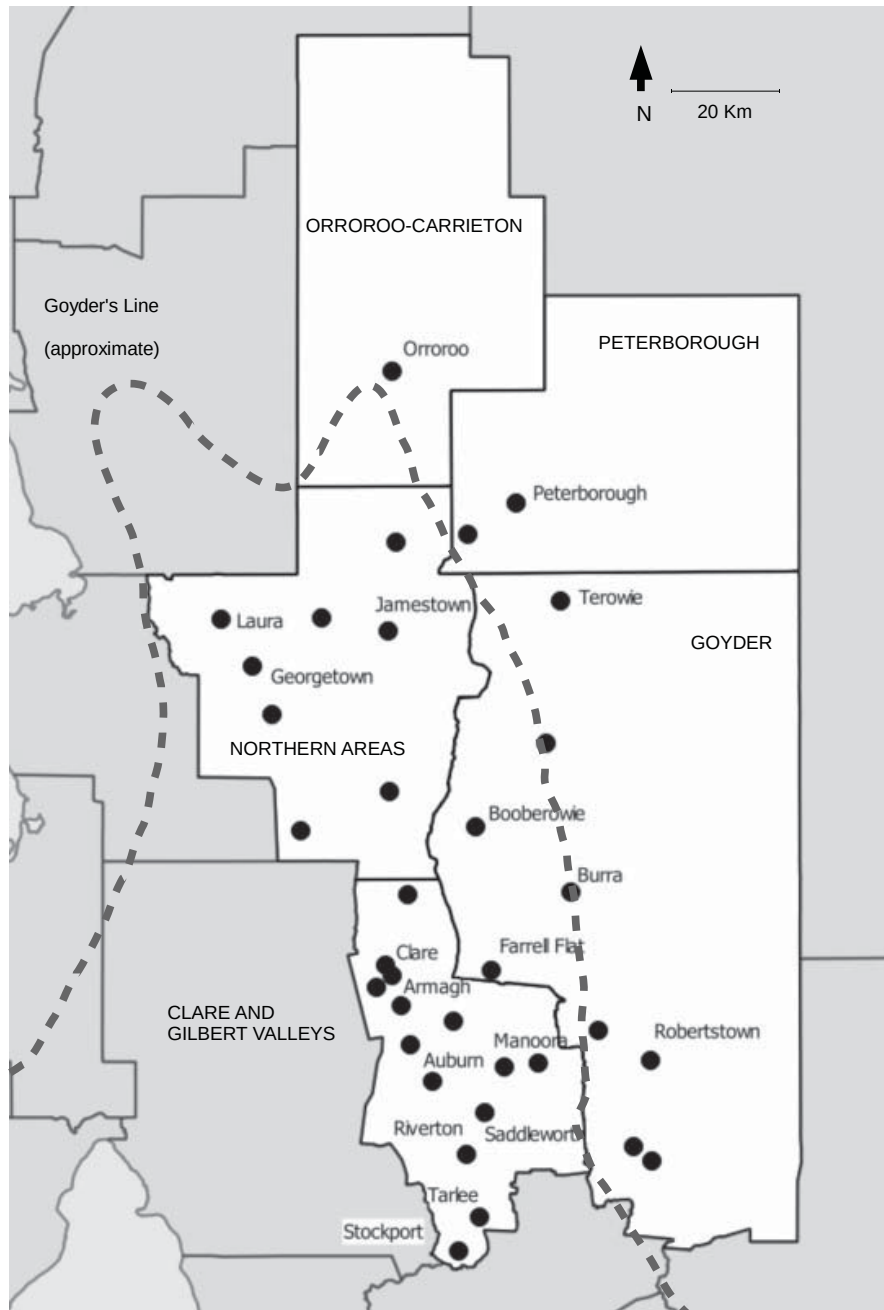
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climate, poor soils and slow growing forest made the new human occupation of the north inherently fragile, and it remained dependent on political interest in colonising the north and continued international demand for northern forestry and mineral resources. In turn, these factors led to a period of rapid development in the early and mid-20<sup>th</sup> century with the construction of railways, roads, hydro-electric power stations, farming settlements and sawmills. The corresponding rise of the Swedish social democracy movement in the mid-20<sup>th</sup> century meant that much of the social infrastructure and governance processes were developed as these projects reached their peak. By the 1960s, however, new construction projects were not so numerous, and the political interest in developing the north had begun to wane. Additionally, industrialisation of the forestry sector reduced the need for locally resident labour and encouraged labour that did remain to reside in larger towns to reduce costs of transport (*Remröd et al.* 1990). Within the context of this history, the resident population of the region grew from around 15,000 people in 1880 to nearly 50,000 people in 1960. Between 1960 and 1970, the region lost nearly one quarter of its population, and currently has just over 25,000 residents (*Statistics Sweden*, [www.scb.se](http://www.scb.se)).

South Australia was only proclaimed as a British colony in 1836, some 50 years after the establishment of the New South Wales colony at Sydney. Settlers pushed north from the capital city Adelaide into the Mid North throughout the mid-19<sup>th</sup> century, but many towns and villages were not established until the 1870s. There was substantial government interest in agricultural industries in the Mid North, with settlers given land under favourable financial conditions in return for promises to establish agricultural businesses and contribute to the construction of towns and villages. However, conditions for broad-acre grain farming were poor. Figure 2 shows an approximate location of Goyder's Line, which was declared in 1865 as a border between viable (to the south) and non-viable agricultural land (*Sheldrick* 2013). The region's distance from the coast and from the River Murray further marginalised prospects for economic development through shortage of water and isolation from transport infrastructure. However, the region attracted substantial investment throughout the late 19<sup>th</sup> century as a result of a copper mining boom based at the town of Burra. At various times, the Burra mine was the largest mine of any kind in Australia, and produced over one third of the world's copper (*Evans/Saunders* 2015). Mining stimulated investment in roads and railways, which in turn allowed the agricultural activities to thrive during a period of relatively high rainfall through the first part of the 20<sup>th</sup> century. By the middle of the 20<sup>th</sup> century, various droughts, changes in world sheep and wool markets, the negative impacts of the World Wars, and the continuing industrialisation and globalisation of farming heralded economic and demographic decline. Within this context, the resident population of the Mid North grew from about 18,000 people in the early 1870s to a peak of nearly 35,000 in the 1930s. Population declined by nearly one fifth by the mid-1950s, and there are currently around 20,000 residents (*Australian Bureau of Statistics*, [www.abs.gov.au](http://www.abs.gov.au)).

Both western Lapland and the Mid North of South Australia are distant from larger regional population centres, yet not so distant as to be considered beyond

**Fig. 2:** Mid North (Australia) case study region



Note: showing localities with populations of more than 150 persons in 2011; local government names in capital letters

Source: own design

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the reach of those centres. The Mid North is within a few hours' drive of metropolitan Adelaide (currently approximately 1.3 million residents), and western Lapland is similarly distant from the coastal centres of Umeå in Västerbotten (approximately 120,000 residents) and Luleå in Norrbotten (population of approximately 75,000). As a result of this proximity, and the concentration of political and public services in these larger cities, there is no clear "regional capital" in either case. The largest town in the Mid North is Clare, with nearly 3,500 residents, and while Clare has a bigger hospital and more schools than other towns, it is by no means a regional service centre. The case is similar in western Lapland, with Vilhelmina (population of approximately 3,700) being the only town of more than 3,000 residents. It is important to note that while these regions are proximate to larger population centres, they remain very distant from the markets for their resources, marking them clearly as "peripheries" for the purposes of this research. Nevertheless, the regions internally have some heterogeneity when it comes to remoteness and accessibility. In Australia, several indices have been developed to describe degrees of remoteness, including the recently described Modified Monash Model (*McGrail/Humphreys* 2009) which is used to determine aspects of health funding. The Model includes seven "zones" of remoteness. The entire Mid North region is classified within Zone 5 (essentially covering small rural towns and their hinterlands) of the Modified Monash Model, and Zone 3 ("outer regional") of the Australian Bureau of Statistics Remoteness Areas classification.<sup>1</sup> There is no similar index used in Sweden, although the entire western Lapland region is within the Northern Periphery and Arctic Region as defined by the European Commission. In general, the southern parts of the Mid North are closer to Adelaide and the city's northern commuting belt, while the eastern parts of western Lapland are closer to the larger population centres of northern Sweden.

Both regions contain very large jurisdictional units. They include some of the spatially largest local government districts with the smallest populations (actual and per unit of land area) in their provinces. Both regions are distant from major transport networks, particularly since the downgrading of railway networks over the past 20-30 years. Though a limited number of major roads exists, these are not nationally significant in terms of volumes of traffic. Air transport is very fragile in western Lapland (there are two small commercial airports, both considered financially at risk, with a third airport recently closed). There are no commercial air services to the Mid North.

Neither region was particularly associated with the global mining boom of the first decade of the 21<sup>st</sup> century. Apart from some small-scale mining operation and exploration activity, both regions continue to have their economic foundations in other resource activities which underpinned their periods of growth – agriculture

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<sup>1</sup> This classification draws on the Accessibility/Remoteness Index of Australia (ARIA+ and ARIA++), which is based on the road distance between populated localities and their nearest service centres. Settlements in the southern part of the Mid North (closer to Adelaide) generally have a lower ARIA score (i.e. they are less remote) than settlements further north.

and pastoralism in the Mid North, and forestry and hydropower generation in western Lapland. Hydropower developments have been particularly important in the municipalities of Jokkmokk and Storuman. The end of the main period of hydro development in Jokkmokk in the 1970s-80s coincided with the planned closing down of several villages and workers camps that were located throughout the region (*Granström et al.* 1994; *Hallin* 2004). New economic developments have since taken place in both regions involving wind power generation and tourism. There is a small number of tourism focused resort developments in the high mountains in western Lapland (e.g. Hemavan-Tärnaby in Storuman municipality, or Klimpfjäll and Kittelfjäll in Vilhelmina municipality), along with multiple smaller scale developments servicing both winter (husky farms, skiing and snowmobiling) and summer (camping and fishing) tourism markets. The Mid North has two well-developed tourism centres in Clare (focusing on wineries) and Burra (known for its mining heritage), and some smaller developments elsewhere focused on caravan and camping tourism.

There are very important differences in the cultural landscapes of the regions. Western Lapland has a strong Sami presence, with reindeer herding still an important cultural and economic activity, and non-reindeer herding Sami also playing important roles in local, regional, national and international political processes. In contrast, most Indigenous inhabitants were forcibly removed from the Mid North by the end of the 19<sup>th</sup> century and relocated to distant government missions, so that Indigenous people comprise less than 1 percent of today's resident population in the Mid North.

Summing up, the regions are similar when it comes to their relatively peripheral location, their sparse populations, their relatively harsh climates and fragile environments, their experience of demographic growth and decline, and even their areas of new economic activity. They are, however, different in terms of the timing of the growth and decline periods, the type of established resource industries, their political organisation, and their Indigenous populations. For the purpose of this paper, they are most importantly similar in having attracted the "decline" label in academic and policy literature. That literature in Sweden tends to focus on the period since the 1960s, both because of the *Bylund* legacy (making the decline and retreat of settlements in the north a prominent issue in Sweden), but also because of the framing of a lot of Swedish social research around the social democracy era. There are also practical reasons for such a time period focus, with detailed demographic data sets (e.g. Umeå University's Astrid database) covering the period from 1960 onwards, with more limited access to data from the first half of the 20<sup>th</sup> century. The particular data context in Australia may have similarly influenced the temporal research focus of Australian demographic studies, with the national Census having substantially improved in quality and coverage since the late 1960s, allowing for more detailed regional analyses. As well as the coincidence of *Hugo* and *Smailes'* work commencing in the 1970s, contemporary rural research in Australia has often been concerned with developments since the beginning of the trade liberalisation period in the 1970s, when government protections for Australian rural industries began to be removed (*Thorpe/Leitão* 2014).

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Consequently, there exists a particular set of social, temporal and spatial units of analysis which have dominated the literature and which have defined how demographic change is viewed in these regions. The question for this research is the extent to which analysing change from different scale perspectives can offer new insights into the processes of demographic decline in resource peripheries. The intention is not to suggest that the regions have not been subject to decline in a collective sense, nor to suggest that population loss is not a problem for political and community stakeholders. Instead, we suggest that a more nuanced understanding of the social, temporal and spatial characteristics of demographic change in resource peripheries can lead the discourse away from a “demography of disadvantage” toward some fresh thinking about what the future might hold.

#### 4 Methods

The research used similar social unit indicators to those which are typically problematised in the decline literature. Those indicators were then examined at different temporal and spatial scales. The indicators were:

- Total resident population;
- Age and sex distribution (using five-year age groups with the highest value being 65 years and over);
  - “youth” or “young adults” were considered to be people aged between 15 and 24 years;
  - “older” people were those aged 65 years and over;
- Child-woman ratio (the number of living children aged 0-4 years divided by the number of living women aged 15-49 years);
- Volumes and rates of in-migration, out-migration and net-migration for each age and sex class. Rates were calculated as percentages of the total population at the end point of the migration period being examined (e.g. migration rates between 2006 and 2011 were calculated as a percentage of the 2011 resident population).

Migration data were not available in most of the datasets used in this research. Consequently, the methods most recently described by *Taylor* (2011b) were used to infer the presence and extent of youth and female flight. For youth flight, the number of people aged 15-24 years is compared with the number aged 5-14 years and the number aged 25-34 years. Low proportions of 15-24 year olds indicate youth flight. High ratios of men to women in the 15-24 year age group was used as an indicator of female flight. Population ageing was assessed as the changing volume and proportion of older people in the population over time.

Data were available for different spatial units at different times. The core of the analysis for the western Lapland case was the period 1865-2015, while for the Mid North case it was 1861-2011. Data for the Mid North were drawn exclusively from the various South Australian (up until 1901) and Australian Census. Census records with sufficient geographic and demographic detail were available for 1861, 1871, 1876, 1881, 1891, 1901, 1921, 1933, 1947, 1954 and every five years between 1961

and 2011. Data prior to 1921 were accessed from the Historical Census and Colonial Data Archive ([hccda.ada.edu.au](http://hccda.ada.edu.au)). Data between 1921 and 2001 were accessed from the public digital archives of the *Australian Bureau of Statistics* ([www.abs.gov.au](http://www.abs.gov.au)). Data for 2006 and 2011 were accessed using the subscription Tablebuilder online database. Census data allowed exploration at a range of spatial scales, with a focus here on contemporary local government areas, and urban centres and localities.

Data for western Lapland were drawn from the Demographic Database at Umeå University ([www.cedar.umu.se](http://www.cedar.umu.se)) covering the period 1860-1880, and from the 1890 and 1900 Swedish Census records stored with the North Atlantic Population Project ([www.nappdata.org](http://www.nappdata.org)). Data for the period 1910 to 1960 were drawn from the Historical Census Database of Statistics Sweden ([www.scb.se](http://www.scb.se)). Data for 1970, 1980 and 1990 were drawn from the Swedish Riksarkivet (National Archives) ([webbutik.riksarkivet.se](http://webbutik.riksarkivet.se)), and data from 1970 to 2014 were drawn from the Statistics Sweden Statistical Database ([www.statistikdatabasen.scb.se](http://www.statistikdatabasen.scb.se)). Additional data for 2015 for the Vilhelmina, Storuman, Sorsele and Arjeplog local government areas shown in Figure 1 were provided by the respective local government authorities.

The data were analysed with the intent of identifying different indicator values for different units of analysis at different scales. For example, rates of population growth or decline were analysed at different temporal and spatial scales, and for different sub-populations. Indicators of youth and female flight and population ageing were calculated for different spatial units and at different points in time. The results reported in this paper cover just a small part of the total possible analysis, and are used to highlight cases where changing scales and units of analysis resulted in substantially different interpretations of demographic processes.

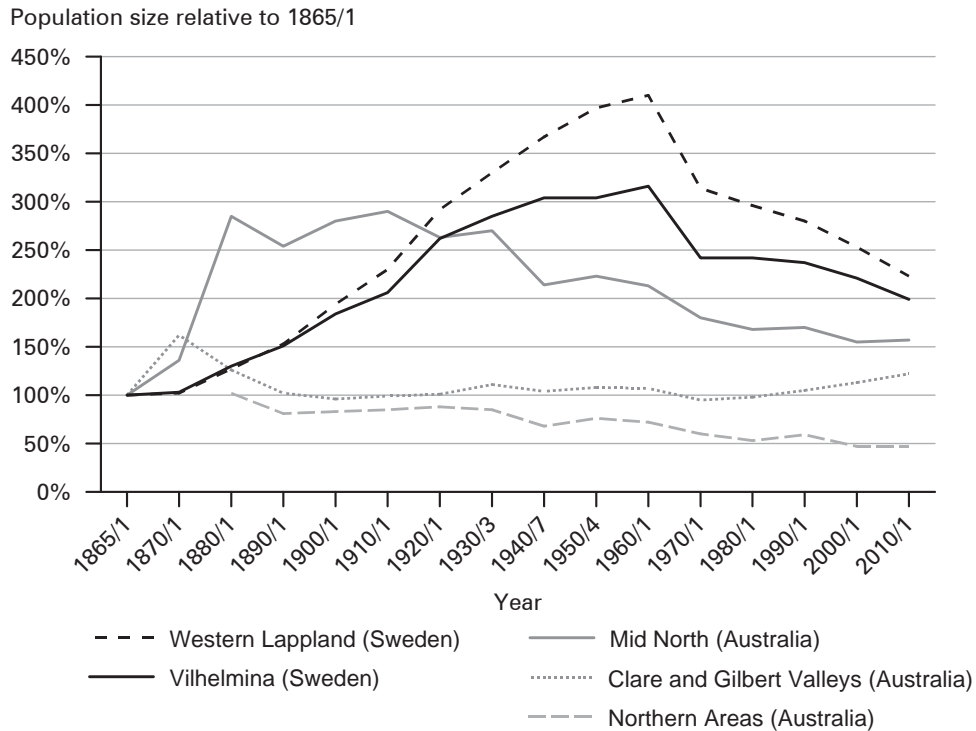
## 5 Results

### 5.1 Examining demographic change from different temporal scale perspectives

Figure 3 shows the population development in the two case regions since the 1860s (in black lines). Four periods of population development can be ascertained for the Mid North region. The first is a rapid growth period between 1861 and 1881 when the population neared its peak at 285 percent of the 1861 population. Population was relatively stable during the period 1881 to 1933, remaining at between 250 percent and 290 percent of the 1861 population ("stable period"). From 1933 until 2001, there was a steady loss of population ("decline period"). The 2011 population was slightly larger (157 percent) than the 2001 population (155 percent) ("current period"). Otherwise, the 2011 population was greater than only the 1861 and 1871 populations. The two middle periods of stability and decline included intervals where the population grew, declined, or was relatively stable. In contrast, the periods for western Lapland were more linear. There was a growth period between 1870 and 1960 (to a peak of 410 percent of the 1865 population), and a decline period from 1960 to 2014 (215 percent of the 1865 population). Nevertheless, the 2010 population was

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**Fig. 3:** Population development in the case study regions from 1865/1-2010/1



Note: The measurement years are shown first for western Lapland, then for the Mid North (1870/1 means data for Lapland from 1870 and data for Mid North from 1871). Measurement years align closely except for 1865/1, 1940/7 and 1950/4. The base population is 1865/1, and the populations for other years are expressed as a percentage of the base population.

Source: own design based on census and register data (refer to section 4 for further details)

higher than populations before 1910. Thus, when using a long-term temporal unit for analysis, the net result over the 150 year period has been population growth in both regions.

## 5.2 Examining demographic change from different spatial scale perspectives

The major spatial sub-units are the contemporary Local Government Areas (LGAs) in each region. Three particularly interesting examples of LGAs have been plotted (in grey) in Figure 3. In the Mid North, the Clare and Gilbert Valleys LGA experienced an initial growth period similar to the total region, but then declined quickly until 1901. Population was relatively stable between 1901 and 1986, when a growth peri-



od began. The neighbouring Northern Areas (Australia) LGA was first settled as part of the overall growth period in the mid-1870s, but lost population from 1881 to 1986. There was a brief period of growth between 1986 and 1996, but the population then declined until 2001. In western Lapland, Vilhelmina LGA experienced lower growth than the total region up until 1960 (due to the relative absence of large industrial construction projects), and since 1970 has also declined more slowly. Its population was relatively stable between 1970 and 1990, while the total region continued to decline, emphasising that demographic trajectories may differ according to different spatial scales used for analysis.

Spatial scale differences were also observed within local government areas at the town and village level. Five of the six municipal capitals in western Lapland experienced an increase in population during the 1960 to 2010 “decline period” (the exception being Sorsele, which declined by 12 percent during this period). A number of other villages also grew during this period, with more of these villages being in the western mountain areas (e.g. Klimpfjäll and Marsfjällen in Vilhelmina LGA as shown in Fig. 1) than in the eastern forest areas (e.g. Malgovik and Meselefors, to continue with examples from Vilhelmina). In the Mid North, 22 towns and villages lost population during the 1860-1880 regional growth period, including larger towns like Burra (from about 3,000 residents in 1860 to 2,500 in 1880), Laura (from 950 to 800), and Terowie (from 800 to 700). Likewise, 24 towns and villages grew during the decline period from 1947 to 2001, including two of the municipal capitals (Clare and Jamestown) as well as Laura.

Of the 30 villages in the Mid North with populations between 50 and 200 people in 1947, only six had fewer than 50 residents in 2011. In contrast, seven villages that were not recorded in the 1947 Census had populations larger than 50 persons in 2011. Towns and villages that grew during the decline period were distributed mainly across the southern and central parts of the region, with no growth towns in Orroroo-Carrieton or Peterborough LGAs. In western Lapland, of the 42 villages in Vilhelmina LGA with populations between 20 and 100 people in 1890, only six had populations of fewer than 20 persons in 2015. Four new villages had emerged during this time. The experience of Jokkmokk has been rather different, with a number of villages located in close proximity to the hydro-electric power stations declining substantially and even disappearing during the decline period (such as the village of Messaure, which had nearly 3,000 residents in 1960 and none by 1990).

The relationship between demographic change and remoteness/accessibility is quite different for each of the case study regions. In the Mid North, populations have generally (but not always) grown more in the southern parts of the region, correlating with proximity to Adelaide. However, in western Lapland, populations have generally (but not always) grown more in the western mountain parts of the region, most distant from the larger urban centres of northern Sweden. This relationship was also observed for variables which are discussed in the proceeding section of the paper, with lower youth out-migration, lower rates of population ageing, and more balanced sex ratios apparent more often in southern parts of the Mid North and western parts of western Lapland. However, there were important exceptions to this rule, including very high young adult sex ratios in Clare in the Mid North (one

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of the most southerly towns) and Arjeplog in western Lapland (one of the most westerly towns).

### **5.3 Examining demographic change from different social unit perspectives**

In the Mid North, the ratios of young adults and the immediately younger and older cohorts were the same in 2011 (at the end of the decline period) as in 1921 (in the middle of the stable period). This finding suggests a persistent pattern of youth flight independent of the overall population development (Tab. 1), and thus emphasises the value of examining social sub-units across different time periods. These ratios have been similar for much of the period, with the exceptions of the post-war period around 1947 and 1954 when the young adult population was substantially smaller. Young adult populations were also smaller in 1996 and 2001. In western Lapland (Tab. 2), changes in these ratios as measured in 1900 and in 2010 indicate a decrease in youth flight over the long term. Throughout the decline period, the young adult population was about the same size as both the younger and older cohort.

Young adult sex ratios have been consistently high in western Lapland across the entire period. Sex ratios were higher in 1970, but lower in 1980, when most of the hydro-energy construction activity (typically associated with male labour) had finished. Sex ratios were also high across the period for people aged 15-19 years. The situation was similar in the Mid North for both the 15-19 and 20-24 year age groups, with the exception of the 1947 and 1954 post-war period when there were fewer males.

In the Mid North, female net out-migration was larger than male net out-migration in the 15-19 and 20-24 year age groups in the periods 2001-2006 (around 20 percent net out-migration for males and nearly 35 percent for females) and 2006-2011. However, female net in-migration for the 25-29 and 30-34 year age groups (at around 20 percent) was double that of males. In western Lapland, at least for the period 2010-14, male and female net out-migration for the 20-24 year age group was both around 25 percent. Women aged 15-19 years had net out-migration of 12 percent, but there was a net in-migration of 5 percent of males in this age group. Women aged 30-34 years had a net in-migration of 5 percent, while there was 0 percent net migration for males. Such small-scale growth in particular social sub-units over particular periods of time appears to have previously been overlooked in research on female flight from rural areas.

In western Lapland, the proportion of the population aged 0-4 years declined from 15 percent in 1900 to just over 5 percent in 1970, but has remained at about that level since. The child-woman ratio declined from 0.71 in 1900 to about 0.25 at each time since 1980, except in 1990, when it was substantially higher (0.33). In the Mid North, the proportion of the population aged 0-4 years was 10 percent in 1971, but had declined to 6 percent by 1996 and has remained at that level. The child-woman ratio peaked at 0.56 in 1954 and 1961, and was 0.29 in 2001 and 2006. There has been substantial temporal variability in this indicator (0.33 in 1933, 0.32 in 2011,

for example), as well as spatial variability, with rates in Clare LGA being typically lower than elsewhere.

The Mid North region as a whole had a lower proportion of young adults in 2011 (10 percent of the total population) compared to the capital city Adelaide (14 percent), Australia (13 percent) and South Australia as a whole (13 percent). It also had a very high young adult sex ratio (123 men for every 100 women aged 15-24) compared with these other places (around 103). However, seven towns and villages had young adult populations of similar proportion to Australia, including relatively large towns like Clare and Robertstown, and small settlements like Tarlee and Manoora. Similarly, 13 towns and villages had lower young adult sex ratios than Australia, including smaller settlements such as Georgetown, Orroroo and Booberowie. Larger towns in the south like Stockport, Armagh, Riverton and Auburn also had relatively low young adult sex ratios, although Clare (119) and Burra (106) did not.

In western Lapland, Vilhelmina, Sorsele and Jokkmokk LGAs had the same proportion of young adults (12 percent) as Sweden in 2014, along with larger towns like Storuman, and small villages like Barsele and Slussfors. The total region also had 12 percent young adult population. However, the region had a young adult sex ratio of 124 compared to 106 for Sweden. Interestingly, the Arjeplog LGA had a ratio of 145, although two of its neighbouring small villages – Slagnäs and Mellanström – had very low young adult sex ratios (57 and 86). Mountain “growth” villages such as Hemavan (200), Tärnaby (118) and Laisvall (200) also had high young adult sex ratios.

Between 1900 and 2010, the proportion of the population of western Lapland aged 65 years and over increased from 5 percent to 26 percent (Tab. 2), whereas 19 percent of Sweden’s population were aged 65 years and over in 2010. All spatial units had relatively high proportions of older people, except the town of Arjeplog (known today for its booming winter car testing industry) which had just 4 percent of its population aged 65 years and over. The actual number of older people in the region increased between 1900 and 1990, but has since declined. In contrast, while the proportion of older people in the Mid North region also increased between 1901 and 2011, the actual number of older people has continued to grow (Tab. 1). The growth has been driven in part by net in-migration rates of between 5 percent and 10 percent for this age group during that period. Conversely, there has been slight net out-migration of older people from western Lapland (around 2 percent since 2010, for example). There is again great spatial variability in the Mid North when it comes to the older population. Older people were more than one quarter of the population of towns like Saddleworth, Orroroo, Peterborough and Riverton in 2011, but less than one seventh of the population in Stockport, Georgetown, Tarlee and Farrell Flat. In general in the Mid North, larger towns had higher proportions of older people, while the older population was more evenly distributed and marginally favoured smaller villages in western Lapland.

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**Tab. 1:** Young adult and older people indicators for the Mid North

Indicator	1921	1933	1947	1954	1961	1971	1991	2001	2011
15-24 year olds: 5-14 year olds	0.77	0.89	0.87	0.67	0.57	0.72	0.62	0.60	0.77
15-24 year olds: 25-34 year olds	1.03	1.26	0.99	0.84	1.02	1.30	0.73	0.92	1.13
Sex ratio 15-19 years	111	110	95	98	111	102	116	123	125
Sex ratio 20-24 years	103	107	102	121	123	108	96	116	121
Number aged 65 years and over	1831	2258	2531	2671	2748	2391	2581	3319	4027
Percentage aged 65 years and over	5%	7%	9%	9%	10%	10%	12%	17%	20%

Source: own calculation based on census and register data (refer to section 4 for further details)

**Tab. 2:** Young adult and older people indicators for western Lapland

Indicator	1900	1950	1960	1970	1980	1990	2000	2010
15-24 year olds: 5-14 year olds	0.74	0.75	0.91	0.95	1.09	0.98	0.82	1.30
15-24 year olds: 25-34 year olds	0.93	0.92	1.06	1.21	0.94	1.08	0.98	1.01
Sex ratio 15-19 years	102	109	119	120	107	107	115	116
Sex ratio 20-24 years	106	126	134	138	125	131	112	123
Number aged 65 years and over	1257	3467	4076	5451	6633	7263	7105	6994
Percentage aged 65 years and over	5%	7%	8%	14%	18%	21%	23%	26%

Source: own calculation based on census and register data (refer to section 4 for further details)

## 6 Discussion

The results suggest substantial spatial and temporal diversity in demographic change between and within the two case study regions, even when only focusing on two social unit groups (young adults and older people). In terms of overall population development, the research reveals that it is possible for spatial sub-units such as Clare and Gilbert Valleys (local government area) and Laura (a town/village within that same LGA) to experience almost opposite patterns of development to the broader Mid North region across much of the time period under investigation.

Similarly, while the western Lapland region and its constituent local government areas have experienced population loss since the 1960s, this is not the experience of the municipal centres which have, with the exception of Sorsele, experienced growth. This recent trend of growth and micro-urbanisation in municipal centres and amenity-rich locations emphasises one of the substantial fallacies of analysing population change at broader regional scales (e.g. local government areas or even larger administrative or functional regions), essentially hiding localised growth outliers within the aggregated picture of regional decline.

In some cases, the specific characteristics of locations help explain different development paths. For example, the different timing of mining and agricultural development cycles explain why Burra (a former mining town) lost population during the major growth period for the rest of the Mid North region. Recent substantial investments in mountain based tourism in western Lapland explain growth in specific towns and villages in the mountain area. In other cases, however, such as Laura in the Mid North or Meselefors in western Lapland, the localised reasons for differentiated demographic development are not as clear. The total population analysis also suggests that it is relatively rare for towns and villages to disappear during periods of decline, and that new towns and villages are as likely to emerge as old ones are to disappear. The exceptions again involve localised explanations, such as the planned village closures in Jokkmokk municipality associated with the completion of hydro-electric power station construction. Of course, localised explanations are typically difficult to obtain from analysing secondary datasets without a thorough understanding of local histories and socio-economic contexts. Using a more comprehensive temporal perspective (including long-term views and focussing on intermittent periods of growth and decline) can help identify bifurcation points in the villages' population trajectories, and provide hints as to where to start "digging" for local historic or contextual explanations.

Overall, there were recognisable changes in patterns of settlement throughout the decline periods. In western Lapland, settlement concentration moved from smaller villages and the eastern parts of the municipalities to larger towns and the western mountain areas. In the Mid North, settlement has become more concentrated in the south, which is closer to the gentrifying rural-urban fringe and commuting belt. Even within these broad patterns, however, there are exceptions at the local level. Consequently, while relative remoteness or accessibility within the region is likely to be important in determining demographic differences, the impacts are not universal and remoteness/accessibility is not the only intervening factor. In terms of the comparison between the two regions, it is apparent that lower remoteness and higher accessibility (assessed purely by distance) is somewhat linked to growth and more "balanced" demographic characteristics in the Mid North, while the opposite applies in western Lapland.

The markers of demographic change in the Mid North were perhaps clearer than those in western Lapland, despite the latter having a very clear "turning point" around 1960. In the Mid North, the very different state of key indicators in 1947 and 1954 reflect the impact of World War Two on the region. A single specific explanation for the dramatic change in western Lapland is not so apparent, although the

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1950s and 1960s saw the end of some of the major construction projects related to transport and hydro-electric development, as well as increased labour efficiencies through industrialisation of forestry (*Enequist 1960*). This “multi-factored” demographic environment may also help explain why western Lapland experienced comparatively small changes in the values of key indicators even during the time of dramatic change from growth to decline.

While the increasing proportion of older people in regional and sub-regional populations was common to the two regions, the growth in actual numbers of older people in the Mid North as a result of migration was not reflected in western Lapland. The recent arresting of population decline in the Mid North can at least partially be credited to its increasing attractiveness for older people, pointing towards a gradual transformation from traditional agricultural to retirement and lifestyle communities. Thus, combining different temporal and social unit considerations to understand changes in population size and composition can yield useful insights into the importance of particular population sub-groups in shaping local demographic trajectories.

The values of the youth indicators over time were particularly interesting. While the literature generally tends to present “youth flight” and “female flight” as a relatively new phenomenon linked to rural decline, the evidence suggests that these patterns have been persistent characteristics of at least these two case study regions, even during periods of population growth. There is also some evidence that the impact of “female flight” is tempered by a net in-migration of women just slightly older than the “young adult” cut-off age used in this research. So, while these areas lose young women in their teens and early 20s, irrespective of the overall pattern of demographic development, they also regularly gain women in their late 20s and early 30s. This may explain why youth flight, at least since the 1970s, has not dramatically impacted the proportion of infants or the child-woman ratio, although the latter in particular appears subject to some variability. The causes and consequences of young adult female in-migration to resource peripheries, as well as their impacts on changing sex and child-woman ratios, have so far been largely overlooked in the literature on rural demographic change.

As with overall population development, specific localities and regional sub-units had different experiences of age and sex specific demographic change. When benchmarked against the region as a whole, or even against other units of analysis (such as the country, province or larger cities), some rural “decline” areas have smaller older populations, larger young adult populations, and higher proportions of young adult women. Again, this emphasises the need to more systematically consider different social units and sub-populations when trying to understand demographic change across different settlements in a region, and over time.

## **7 Conclusion**

Rural demographic decline is not a universal experience that can be applied as a label to entire regions and used as a pretext for centrally designed regional policy,

funding and service responses. Instead, this research suggests that a more nuanced and integrated examination of demographic change is required that considers different spatial, temporal and social scales when analysing the particular experiences and needs of different settlements, communities and groups of people in resource peripheries.

Spatial, temporal and social units of analysis are each, to a greater or lesser extent, artificial constructs. This is, of course, a factor to be considered in assessing the contribution of this research. Different spatial boundaries for the Mid North and western Lapland could easily have been selected for this research. Arbitrary boundaries have different levels of relevance compared with bureaucratic borders or functional boundaries that reflect some other historical sense of connectivity, yet they may generate different results when analysing regional demographic change. There is no particular reason for the temporal boundaries used in this research apart from the relative ease of accessing data at specific points in time but not at others. In this way, the research here is limited in the same ways as other studies criticised above. What has been done here, however, is at least an attempt to extend and change the units of analysis to identify the impacts of arbitrary selection.

Likewise, defining “young adults” as a particular age group is an arbitrary decision, and key indicators such as “female flight”, for example, would likely be differently interpreted if the young adult age group was extended even a few years (also see *Johansson 2016*). The point of the research has not been to declare the “ideal” spatial, temporal and social parameters for investigating rural decline, but to demonstrate that the selection of such parameters is an important part of the process of describing and interpreting rural decline. The most outstanding examples of this are in the re-interpretation of the role of youth (and female youth) migration in the demographic development of these regions, and the identification of exceptions to the rules of population loss, ageing and deficits of youth at a variety of spatial scales. The key conclusion is therefore that research into demographic processes in rural areas needs to have a more nuanced view of the objects of study, and of the impacts that the selection of units for analysis may have on the interpretation of results.

This is not to say that loss of population over a relatively long period of time is unproblematic. In both cases, the continuing delivery of services and the opportunities for future economic and social development have clearly been affected by the broad processes of demographic change particularly in the second half of the 20<sup>th</sup> century. In both of the cases examined here, the structures for service delivery and development were set up during (and in response to) growth periods. That they are no longer as well suited for the context as they once might have been is a function of the unpredictability of the demographic changes that were experienced, and a function of the frameworks for development that have emerged around the very different processes of demographic change (population growth and centralisation) that have occurred in other urban parts of the respective jurisdictions. Whereas in western Lapland, for example, villages of 20 to 100 residents were seen as an integral part of the process of growth in the first half of the 20<sup>th</sup> century, they are now seen as markers of decline. Clearly, the frameworks for (particularly public) support of these villages have not been able to adapt to their persistence.



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The case studies reflect localised examples of demographic persistence, adaptation and transformation. Most of the small villages continue to survive, despite the challenges they pose to service delivery and new models of development. Whether this demonstrates positive or negative resilience is a value judgement that is also influenced by perceptions of scale. For example, the key processes of adaptation at a municipal level have included centralisation of population in the municipal capitals and in selected areas which are currently subject to more positive economic conditions. This has meant localised population growth or stabilisation during times of broader regional decline, yet at the expense of smaller settlements in the region. This may signify a re-organisation of populations which may help peripheral municipalities absorb unfavourable socio-economic circumstances whilst essentially maintaining the same or similar function and identity at a municipal level. Yet, it may also mark the start of a new transformation process, converting the municipal centres into increasingly urbanised environments (e.g. characterised by urban-style housing, infrastructure, and service provisions) to be able to compete with larger urban centres for human and other resources.

Another form of demographic adaptation and re-organisation within the migration system has been the substitution of particular social groups for others, as evidenced by the strong in-migration of middle aged women replacing young women leaving rural communities. This suggests that the highly problematised discourse around female youth flight from rural areas may be less of a problem, so long as communities manage to attract slightly older women as new or return migrants to compensate for demographic imbalances. Such adaptive changes may not necessarily be recognised (and consequently pursued) as such by rural communities, thus highlighting the importance of more nuanced social unit analyses in studies on demographic change. For how long these locations and social units will retain their advantage is difficult to judge, but the indicators are that there is sufficient diversity of locations and populations within the regions for new demographic patterns to emerge over time. Continuing spatial and social adaptation may result in continuing overall population loss (as evidenced in western Lapland) or transition to a new period of growth (as may be the case in the Mid North in very recent times).

A critical example of transformation has been population ageing. In this regard, the two regions have very different experiences. The Mid North appears to have taken advantage of this transformation, becoming an increasingly attractive place for older people as evidenced by in-migration and growth in the actual number of older people. Many communities in the Mid North have thus transformed themselves from traditional agricultural or pastoral communities into attractive retirement and lifestyle communities. Though such change is not without challenges, for example when considering the provision of adequate services and infrastructure for the elderly (see *Ryser/Halseth 2013*), it also presents communities with a range of opportunities for new development pathways. In the case of the Mid North, such change seems to represent the starting point for new – qualitatively and functionally different – growth patterns that are separate from the region's historic resource industries. In contrast, western Lapland has consistently experienced net out-migration of its older population, meaning that ageing has contributed to, rather than

mitigated, demographic decline. The reasons for these diverging experiences are not immediately clear from this research, but may be linked to different climatic, historic, and socio-cultural circumstances, thus requiring further comparative and in-depth research into different ageing experiences.

The diversity of experiences of demographic change in declining resource peripheries such as the two regions covered in this paper makes it difficult to anticipate what the future might hold. Some trends, such as the deficit of females in younger age groups and the growing proportion of older populations, seem quite persistent. Others, such as micro-urbanisation within rural municipalities and the favouring of “high-amenity” locations, also appear likely to continue for a relatively long period. However, it is the nature of resource peripheries that the resources (minerals, forests, water and wind) are not always found in the locations most attractive to tourists and lifestyle seekers. Should either of these regions be caught up in future resource booms, the geographic distribution of the population (as well as its size and composition) could change dramatically and within a relatively short period of time.

The processes of demographic change in resource peripheries are complex and scale dependent. The natural resources themselves are fixed in location, and their value fluctuates over time. Due to their sparse populations, isolated settlements, and entrenched dependence on external economic and political centres, localised cycles of “boom and bust”, along with dramatic and dynamic changes in the nature and composition of populations, are very common. The relative merits of different sorts of populations (young, old, male, female, resident, visiting) also changes over time as regions adapt to the vagaries of resource economies. The challenge for demographers and geographers is to understand that complexity and scale dependence are central forces, and to try and look more deeply into the nuances of demographic growth and decline, adaptation and transformation. It is also important to note that it is often combinations of attributes which may be unique to particular points in time and space that are important in determining the future. For example, a combination of high but “normal” levels of female youth out-migration with unusually low levels of fertility at a point in time could be the trigger for a period of extended population decline. This paper has largely ignored how some of the attributes discussed interact with each other over time, and a more detailed understanding of these specific cases would require more research.

The extent to which this framework may be applicable to other types of rural peripheries (e.g. areas closer to the urban fringe; manufacturing peripheries; or pleasure peripheries) has yet to be examined. Peripheries that are less remote and less dependent on externally dominated resource industries may be less dynamic, less fragile and less affected by fluctuating change over time, in part because they have closer and more stable (demographic and economic) linkages with larger population centres (*Carson et al.* 2011). Nevertheless, the consideration of different temporal, spatial and social scales, along with examinations of the specific historic, political and institutional contexts, may yield equally valuable insights into the nuanced experiences of demographic change in other types of rural peripheries (*Carson/Koch* 2013).

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Prof. Dean B. Carson. The Northern Institute, Charles Darwin University. Australia.  
Arctic Research Centre at Umeå University (ARCUM), Umeå University. Sweden  
E-mail: [dean.carson@cdu.edu.au](mailto:dean.carson@cdu.edu.au)  
URL: <http://www.cdu.edu.au/northern-institute/our-teams/dean-carson>

Dr. Doris A. Carson (✉). Department of Geography and Economic History, Umeå University. Sweden.  
The Northern Institute, Charles Darwin University. Australia. School of Natural and Built Environments, University of South Australia. Australia  
E-mail: [doris.carson@umu.se](mailto:doris.carson@umu.se)  
URL: <http://www.geoekhist.umu.se/om-institutionen/personal/doris-carson/>

Rob Porter. The Northern Institute, Charles Darwin University. Australia  
E-mail: [robert.porter@cdu.edu.au](mailto:robert.porter@cdu.edu.au)  
URL: <http://www.cdu.edu.au/northern-institute/our-teams/robert-porter>

Celia Yoshida Ahlin. Department of Geography and Economic History, Umeå University. Sweden  
E-mail: [cayoshida@hotmail.com](mailto:cayoshida@hotmail.com)

Peter Sköld. Arctic Research Centre at Umeå University (ARCUM), Umeå University. Sweden  
E-mail: [peter.skold@umu.se](mailto:peter.skold@umu.se)  
URL: <http://www.arcum.umu.se/affilierade-forskare/arcum/peter-skold/>



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