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Rural facility decline: A longitudinal accessibility analysis questioning the focus of Dutch depopulation-policy

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ABSTRACT

In the debate about rural depopulation it is frequently assumed that population decline goes hand-in-hand with the decline of facilities and services. Hence, spatial policy for rural areas often focuses on the provision of key services of general interest in areas experiencing population decline. However, the actual changes in distribution and accessibility of several services are almost never evaluated longitudinally, and most recent studies focus on measuring access in terms of supply and demand using aggregated data. This paper offers an alternative method, from an equality standpoint, and investigates changes in access and distribution of local facilities for basic needs (food, education and health care) in Fryslân (Netherlands). By doing so, it questions the focus of Dutch spatial policy on depopulating areas. Changes in access to primary schools, general practitioners and supermarkets between 2000 and 2012 are visualised by overlapping network analyses in GIS. The results are discussed in the context of depopulation and the decline of local facilities from smaller towns and villages. This paper concludes that due to the initial high density of basic facilities the accessibility remained quite good. Moreover, major changes in access do not coincide with the areas targeted by the government to deal with effects of population decline. This suggests that spatial policy for facility-decline should focus on people with low mobility in small villages throughout Fryslân, rather than depopulating areas. This research shows the importance of questioning the assumptions behind spatial policy for service-provision, and offers a simple method to do so.

1. Introduction

Many European countries are experiencing rural population decline and a changing composition of the population (Ritsema van Eck et al., 2013; Terluin, 2003; Woods, 2005). In the international debate about rural depopulation one of the main issues is the provision of basic facilities and services that rural residents need to maintain a certain standard of quality of life (Brereton et al., 2011; Farmer et al., 2012; van Lenthe, Brug, & Mackenbach, 2005; Neumeier, 2016), which is sometimes referred to as 'services of general interest' (Neumeier, 2015). In the Netherlands, population decline and facility-decline are also believed to go hand-in-hand, even though rural population decline is quite moderate when it is put in an international perspective (van Dam, 1995; Haartsen & Venhorst, 2010). To tackle the problems that could arise from population decline the Dutch national government has launched the 'Intergovernmental Action Plan for Population Decline' in collaboration with provinces and municipalities in 2009 (Rijksoverheid, 2009). This Action Plan aims at safeguarding the liveability in regions that experience depopulation, 'krimp'-regions, and regions that expect

population decline in the near future, 'anticipeer' regions (Haartsen & Van Wissen 2012; Ritsema van Eck et al., 2013). See Fig. 1. In light of this policy, funds are made available to these regions to deal with issues related to three themes: housing, economic vitality, and the provision of jobs and facilities and services. An evaluation report of the policy in 2014 mentioned that the decline of facilities was less severe than expected, but it was still assumed that facility-decline was, and would continue to be, stronger in depopulation-regions (Haartsen, Krikke, Hooimeijer, & van Waveren, 2014). The assumption still holds today, despite the fact that earlier studies argued that the increased mobility of citizens and effects of economies of scale have been more influential for the decline of facilities in the Netherlands than population decline (Steenbekkers & Vermeij, 2013; van Dam, 1995; van Dam, Groot, & Verwest, 2006).

While the concentration of facilities and services in larger towns is not a phenomenon that only occurred in depopulating regions, it did potentially have more impact on (already) sparsely populated rural areas. As a result of the upscaling and the agglomeration of businesses across Europe, as well as the rapid rise in car-use in second half of the

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Fig. 1. Map of the Netherlands, The Province of Fryslân & anticipated and shrinking regions of Dutch depopulation policy in 2009.

20th century, smaller local facilities closed in favour of bigger venues (Elshof, van Wissen, & Mulder, 2014; Hine & Kamruzzaman, 2012; van Dam, 1995). In the countryside many villages only had a handful of smaller local facilities left (Neumeier, 2016; Westlund & Pichler, 2012), and closures caused concerns about adequate access to facilities for basic needs (Paddison & Calderwood, 2007). In addition to the decline of private facilities, such as retail, grocery stores and banks, the deregulation of public services also had an effect on closure of small rural schools, post offices, libraries and health care facilities (Brereton et al., 2011; Haugen et al., 2012; Meijers, 2007; Tacoli, 1998). The decline of public and private services in villages and smaller towns can be problematic for residents with low levels of personal mobility, such as the elderly, children or people with low incomes, especially if this decline results in increased distances to reach basic services (Smoyer-Tomic, Spence, & Amrhein, 2006; Woods, 2005). We therefore argue that a deterioration of access to important public and private rural facilities in the Netherlands is a justified concern, but the geographical focus on depopulation-regions might be amiss, and funding with regard to service-provision might be misdirected.

To investigate the effect of facility-decline on the accessibility of important local services, this paper introduces a longitudinal method to map changes in access to facilities between 2000 and 2012 in Dutch province of Fryslân, which was appointed two expected-depopulation-

regions in 2009. To set the context and assess clustering effects, this study first investigates the distribution of several local facilities according to settlement size. Secondly, we visualise where major changes in the accessibility occurred, to see if these coincide with the geographical boundaries of the expected depopulation-regions or areas that already experienced depopulation. The second step focusses on those facilities for basic needs that should be available within an acceptable distance for all residents. Although there is no consensus on what 'basic' services for 'general interest' should be safeguarded by governments (Neumeier, 2015), the Charter of Fundamental Rights of the European Union states that everybody should have access to housing, clothing, education, health care and fresh food (Farmer et al., 2012). According to the Dutch national government town halls and libraries are important in rural communities, but primary schools, general practitioners (doctor surgeries) and supermarkets (which are the main suppliers of fresh food in the Netherlands) are essential local facilities for basic needs (Steenbekkers, Simon, & Veldheer, 2006). In international studies these three facilities are also often seen as 'key' or 'basic' services for rural areas (Paddison & Calderwood, 2007). With regard to other facilities there seem to be cultural differences: in the UK post offices are for instance seen as a basic service (Higgs & Langford, 2013), in Sweden libraries and banks are deemed vital for rural areas (Svendsen, 2010) and in the Dutch context cash machines and town halls are important

Fig. 2. Size of settlements by number of inhabitants in the year 2000 for Fryslân.

according to residents (de Vries et al., 2017). This study focuses on access to primary schools, supermarkets and general practitioners, since there seems to be consensus on the importance. These basic facilities do not necessarily have to be available in every village, but they have to be accessible (Gardenier, Nanninga, van Rijn, & Weijer, 2011; Steenbekkers & Vermeij, 2013).

However, the spatial analysis of changes in accessibility raises several methodological challenges. First of all, what can be considered 'accessible' is very much regionally, culturally and individually defined (Comber et al. 2011, 2012). Furthermore, the definition of accessibility and method of measurement influences the outcome and interpretation of the analysis (Apparicio et al. 2008, 2017; Gautam et al., 2014; Shah, Milosavljevic, & Bath, 2017). Most recent studies use aggregated data and define access in terms of supply and demand, for instance with the popular two step floating catchment area (2SFCA) method (Luo & Qi, 2009; Luo & Wang, 2003; McGrail & Humphreys, 2014; Shin & Lee, 2018). However, small rural case studies are particularly sensitive to aggregation errors (Langford & Higgs, 2006; McGrail & Humphreys, 2009; Shah et al., 2017), and the choice of method should always be based on the definition of accessibility and the research question (Shah et al., 2017). Demand is relevant from an equity-point of view (Whitehead et al., 2018), but should some key services for general interest not be available within an acceptable distance regardless of demand or need? This paper offers a different perspective, and uses disaggregated metrics for the longitudinal spatial analysis of access.

There are not many studies that investigate changes in accessibility over time (van Lenthe et al., 2005), and the ones that do often focus on one specific type of facility, amenity or service (such as Ye, Hu, & Li, 2018; Eberth et al., 2014; Higgs et al., 2017; Higgs & Langford, 2013; Langford & Higgs, 2010; Maroko et al., 2009). The few studies that analyse changes for multiple facilities (such as Haugen et al., 2012; Hine & Kamruzzaman, 2012; Marozzi & Bolzan, 2018), do not use visual or spatial methods, which would make a comparison to the spatial boundaries of 'expected depopulation-regions' less insightful. We have not found any recent examples of longitudinal studies using disaggregated metrics for multiple facilities. Lastly, few studies define access as proximity (such as Talen, 2001; Neumeier, 2015). Although there are good reasons to account for demand (Whitehead et al., 2018; Neutens, 2015), it seems that increasingly complicated methods are chosen by default. This paper (re)introduces a method that is straightforward in its application and interpretation: we map different catchment areas using network distance towards three basic facilities in Geographical Information Systems (GIS) and visualise the changes over time. With this method there is no hindrance of changing administrative boundaries or aggregation errors, and we can question the focus of Dutch depopulation policy with regard to facility-decline, while defining access equally for rural and urban inhabitants.

Table 1
Population change and the change in local facilities, between 2000 and 2012 in Fryslân.

	Small villages < 500 inhabitants n = 223	Medium villages 500-1500 inhabitants n = 119	Large villages 1500-5000 inhabitants n = 52	Small Towns 5000-15000 inhabitants n = 17	Large Towns >15000 inhabitants n = 4	Fries-land towns + villages n = 415
Total population change^a	-710 -2%	+1405 +1%	+2150 +2%	+5770 +4%	+12530 +7%	+21145 +3%
Pop. Change ages 0-24	-1205 -8%	-1620 -5%	-1720 -4%	-1630 -4%	+1785 +3%	-4390 -2%
Pop. Change ages 25-65	-1435 -6%	-1015 -2%	-1830 -3%	-455 -1%	+5370 +5%	+635 0%
Pop. Change people over 65	+1930 +29%	+4040 +24%	+5700 +22%	+7855 +25%	+5375 +16%	+24900 +22%
Basic local facilities^b change						
General Practitioners	-4 -44%	-5 -13%	-7 -12%	-5 -9%	+6 +9%	-15 -7%
Primary Schools	-5 -7%	-7 -5%	-3 -3%	-6 -7%	-5 -7%	-26 -5%
Supermarkets	-8 -62%	-30 -42%	+5 +8%	-2 -3%	-9 -12%	-44 -15%
Total change basic facilities	-17 -18%	-42 -16%	-5 -2% ^c	-13 -6%	-8 -4%	-85 -8%
Other Local facilities^b change						
specialised food stores ^d	0 0%	0 0%	-10 -26%	-8 -18%	-9 -18%	-27 -17%
Banks	-5 -100%	-36 -84%	-37 -67%	-12 -34%	-3 -17%	-93 -60%
libraries		0 0%	-6 -20%	+1 +6%	-1 -13%	-6 -10%
outdoor and indoor sports	-1 -20%	-6 -30%	-4 -17%	-5 -14%	+4 +19%	-12 -11%
restaurants and café's	+20 +19%	+32 +11%	+7 +2%	+15 +4%	+43 +9%	+117 8%
hair and beauty salons	+64 +188%	+199 +144%	+178 +83%	+212 +88%	+232 +79%	+885 +96%

^a Data CBS – Statistics Netherlands, via ABF research/Frisian Social Planning Agency (fsp).

^b Data LISA.

^c A two-tailed Pearson correlation analysis showed a significant relationship between the population decline of people under the age of 25 and the increase of basic facilities in large Frisian villages, $r(50) = -0,315$, $p = 0,023$.

^d 'specialised food stores' include shops for fish, bread, meat or vegetables.

2. Methods

2.1. Study area and data

Fryslân is a province in the north of the Netherlands (see Fig. 1). Compared to the national average, rural dwellers in the north of the Netherlands are more likely to lack a basic facility in their direct living environment (Steenbekkers et al, 2006), and the decline of facilities in Fryslân is a source of concern. Fryslân was appointed two 'expected depopulation-regions' in 2009, of which the north-east has become a 'depopulation-region' since 2015. Fryslân has many small villages and one main city, Leeuwarden (see Fig. 2). To investigate the geographical distribution of local facilities in Fryslân we use the LISA-dataset that provides addresses of all businesses registered with the chamber of commerce from 2000 to 2012. We will use the term 'facility' throughout this paper rather than services, since a facility refers a specific geographical location where a service is offered. Because we only have longitudinal data available on fixed geographical locations we exclude public transport services or any type of mobile or temporal services for health care, education or food supply. It should be noted that public transport services can be very important in rural areas, especially for people with low levels of mobility (Steenbekkers et al, 2016). The islands in the North of the Netherlands are not included in this research since accessibility of facilities for island-residents is very much dependent on the duration and costs of the ferry.

2.2. Two steps in the method of analysis

In this paper we investigate if facility-decline in Fryslân between 2000 and 2012 has led to reduced access (greater distances) to basic facilities in depopulating municipalities or in the two 'expected depopulation-regions'. This time-period was chosen to reflect changes in access before funds of the action-plan were made available to these regions to deal with facility-decline. Between 2009 and 2012 funds were mostly allocated to pilots and research projects (Rijksoverheid, 2012). This paper does not intent to investigate *causal* relationships between facility-decline and population-decline, but shows that the re-distribution of facilities does not necessarily go hand-in hand with depopulation, nor does it result in reduced access in the expected places. There are two steps in the analysis. To set the context, we first investigate changes in the number of several local facilities between 2000 and 2012 by settlement size. This can illustrate clustering in larger towns, and a possible correlation with population decline. The next step is to investigate the spatial component, by analysing access to three facilities for basic needs: supermarkets, primary schools and general practitioners (GP).

The steps in the analysis correspond to two research questions:

1. How did the distribution of local facilities in Fryslân change in relation to settlement size and population decline?
2. Where did the decline of basic facilities in Fryslân lead to increased distances or even a lack of access to basic facilities within an

Table 2

Summary of correlations between the relative difference (percentage growth or decline) in local facilities and population between the year 2000–2012 in Fryslân.

Pearson Correlation				
Relative growth/decline of: basic facilities ^a	Total population ^c	Age 0–24 ^c	Age 25–45 ^c	Age 65+ ^c
in all villages/towns n = 415	-,095	-,070	-,015	-,009
in small villages n = 223	-,102	-,082	-,017	,002
in middle sized villages n = 119	-,110	-,059	-,071	-,074
in large villages n = 52	-,248	-,315*	-,153	-,006
in towns n = 21	,054	,091	,191	-,260
all local facilities ^b				
in all villages/towns n = 415	,048	,027	,045	-,050
in small villages n = 223	-,046	-,039	,027	-,075
in middle sized villages n = 119	-,109	-,009	-,084	-,142
in large villages n = 52	-,196	-,230	-,068	-,002
In towns n = 21	,177	,258	,277	-,283

Note: The categories of small towns (5000–15000 inhabitants) and large towns (>15000 inhabitants) were combined because separately the sample size would become too small.

*Correlation is significant at the 0.05 level (2-tailed).

**Correlation is significant at the 0.01 level (2-tailed).

^a Basic facilities include supermarkets, general practitioners and primary schools [data source: LISA].

^b Local facilities include supermarkets; general practitioners; primary schools; specialised food stores; banks, libraries; indoor and outdoor sports facilities; restaurants and cafés; hair and beauty salons [data source: LISA].

^c Data source: CBS.

acceptable distance, and do these areas correspond to the two ‘expected depopulation-regions’?

2.3. Step 1: Changes in distribution of local facilities according to settlement size

In the introduction it was mentioned that local facilities could close due to a mix of economies of scale, depopulation and increased mobility, which is mostly experienced in smaller villages. Hence, it can be useful to look at changes in distribution of local facilities and services according to the population size of settlements. Investigating consumer services in relation to population size has been at the basis of the geography of consumer services since Walter Christaller’s famous central place theory (Meijers, 2007), but it also inspired Dutch spatial policy for service-provision in the ‘80 and ‘90. The central place model explains the functional hierarchy of settlements, where villages only have local facilities for daily needs, and towns with more inhabitants offer both local and more regional services (Christaller, 1933; Meijers, 2007). Nowadays the theory is heavily criticized because it does not account for the complexity of modern society (Meijers, 2007). Nevertheless, the hierarchical distribution of local facilities can be distinguished in many rural contexts (Taylor, Hoyler, & Verbruggen, 2010). Moreover, the concentration of facilities and services in larger towns was, and still is, pushed by many scholars and policy makers, who argue that this is a more economically viable option (Burger, Meijers, & Van Oort, 2013, pp. 1–21; Tacoli, 1998; van Dam, 1995).

Fig. 2 shows the hierarchy of Frisian settlements by population size.

For these five settlement-sizes we analyse the number of facilities and number of inhabitants between 2000 and 2012. We look at basic facilities for food, education and health care, but also a number of other commercial facilities that are thought to play a role in village life: banks, libraries, café’s, sports facilities and hair/beauty-salons. The importance of these local facilities is not only based on their primary function, but also on the social function as a local meeting place (Haartsen & Van Wissen, 2012; Svendsen, 2013; Amcoff, Möller, & Westholm, 2011; Witten et al., 2001) and the symbolical value for a village (Christiaanse & Haartsen, 2017). The growth or decline of these facilities is analysed by conducting cross tabulation in SPSS between the year 2000 and 2012, organised by settlement-size at the start of this period. In line with a previous Frisian study by De Vries et al. (2017), we distinguish 5 types of settlements: small villages with less than 500 inhabitants; medium sized villages with 500–1500 inhabitants; large villages with 1500–5000 inhabitants; towns with 5000–15000 inhabitants and large towns with more than 15000 inhabitants (see Fig. 2). Within this last category only Leeuwarden could really be considered a proper city, with 83.690 inhabitants in the year 2000. A Pearson’s correlation analysis is added to investigate possible correlations between population decline and facility decline. All towns are combined in one category for a sufficient sample size.

2.4. Step 2: Changes in access to basic facilities

For the second step in the analysis we investigate changes in the accessibility of supermarkets, primary schools and GP’s in Geographical Information Systems (GIS). As mentioned in the introduction, longitudinal studies about changes in access are quite rare (Higgs & Langford, 2013; van Lenthe et al., 2005) and very few of them visualise spatial differences for multiple facilities. International studies usually focus on either access to fresh food (Cummins & Macintyre, 2006; Farber, Morang, & Widener, 2014; O’Dwyer & Coveney, 2006; Yeager & Gatrell, 2014), health care (Apparicio et al., 2017; Comber et al., 2011; Dewulf et al., 2013; McGrail & Humphreys, 2014; Wang & Luo, 2005), or educational facilities (Bascieri & Falkingham, 2009; Elshof, Haartsen, & Mulder, 2015; Haugen et al., 2012; Talen, 2001) at a fixed point in time. Additionally, access to services is often discussed in the context of social justice, inequality or deprivation (Apparicio et al., 2008; Cabrera-Barona, Wei, & Hagenlocher, 2016; Neutens 2015; Smith et al., 2010; Talen, 2001; Wrigley, Warm, & Margetts, 2003). The notion of equity is important when discussing service delivery because it affects how accessibility is defined and measured, and this can lead to different results (Apparicio et al., 2017). We argue that supermarkets, primary schools and GP’s are essential facilities for basic needs that should be available to all residents at an acceptable distance. They are what John Rawls calls ‘primary social goods’ in his ‘Theory of Justice’ (Rawls, 1971). While an equitable distribution is attuned to need, “sufficientarianism assumes that everybody should be well-off up to a certain minimum threshold [...] to guarantee their continued wellbeing” (Lucas, van Wee, & Maat, 2016, p. 477). This means that access to basic facilities should first be defined as proximity on the basis of equality, rather than equity. Accordingly, we do not compensate for need, because “How does one child have less need for access to an elementary school than another?” (Talen, 2001, p. 470), nor do we account for demand because facilities for basic needs should be at an acceptable distance throughout Fryslân. In Germany this concept is called ‘Daseinsvorsorge’, which relates to the “sufficient offering of services indispensable for life throughout the country” (Neumeier, 2015, p. 150).

However, while basic facilities are important for the social capital and prospects of rural communities (Farmer et al., 2012), sustaining small rural facilities is not always realistic. When questioning the sustainability or equity of service delivery, demand should be accounted for (Whitehead et al., 2018). From the five most common aggregated measures of accessibility (minimum distance; container; coverage; travel costs and gravity models) only the last one takes demand into

Fig. 3. A network analyses for 2000 and 2012 in GIS, rings of 2.5, 5 and 7,5 km.

account (Apparicio et al., 2017; Langford & Higgs, 2006). Currently, a popular method is 2SFCA, which is a modified gravity-based accessibility measure with moving catchment areas for both supply and demand (Luo, 2004; Ye et al., 2018). The method was first developed and

enhanced by (Luo, 2004; Luo & Qi, 2009), and was later improved by including travel times (McGrail & Humphreys, 2014), public transportation (Cheng et al., 2016), grid network for population catchment (Ye et al., 2018) and a local distance decay function (Shin & Lee, 2018).

Fig. 4. Change map supermarkets.

Longitudinal studies for single services using 2SFCA include those by (Eberth et al., 2014; Higgs et al., 2017; Williams & Wang, 2010; Ye et al., 2018). However, a common problem when using aggregated data is the 'modifiable areal unit problem' (MAUP), which refers to how the size and shape of areal units can influence the average distance to a facility and disguise local differences (Cabrera-Barona et al., 2016; Hewko, Smoyer-tomic, & Hodgson, 2002). Although simple methods are more sensitive to this problem (Dewulf et al., 2013), 2SFCA is not immune to aggregation errors like MAUP (Shah et al., 2017). Furthermore, the administrative borders of Frisian municipalities and postal zones have significantly changed between 2000 and 2012, which makes comparison of aggregated data more complicated. This could be remedied by using a raster-based approach like Neumeier (2015) or converting data between different boundary systems like Norman (2010). However, some loss of accuracy will always occur and this can cause challenges when applying 2SFCA in rural regions (Langford & Higgs, 2006; McGrail & Humphreys, 2009). A very sophisticated *disaggregated* (but not longitudinal) method that looks at multiple facilities, and that accounts for choice and demand, is by Yeager and Gatrell (2014). However, individual addresses are needed for the demand-side, and this is not always available.

This paper employs a map-overlay method to visualise changes in access to facilities without using aggregated data. We map the service areas of facilities in GIS using network distance, rather than measuring towards a facility from a point of origin such as a population weighted centroid. We do not account for demand or choice, because want to know the distance any person would have to travel to a basic facility. First the addresses of the facilities in the LISA-database for 2000 and 2012 are geocoded using the Dutch national 'registration of addresses and buildings' (BAG). Secondly, GIS is used to 'map a services area'

towards each facility point. This GIS-tool uses a street-network, which is more accurate than Euclidian or Manhattan distance (Messina et al., 2006; McEntee & Agyeman, 2010). In this case *distance* towards a facility was chosen, instead of time, to visualise the accessibility for different modes of transport: foot car and bike. To construct a map that shows which areas are outside the acceptable reach of basic facilities, we needed to insert an 'acceptable distance' in meters and merge the service areas of the facility-points. However, to define what distances to basic facilities are acceptable is difficult since there are no clear national norms, nor is there consensus in international research (Yeager & Gatrell, 2014; Neumeier, 2015). Distances used in previous studies, such as 10 miles (ca 16 km) to the nearest rural supermarket in the USA by Morton and Blanchard (2007) or 15 min by car for a German case study by Neumeier (2015), hardly seem applicable in the Dutch context since most basic facilities are on average available at 1,5 km distance (CBS Statline). Although transport to primary schools must be arranged by Dutch local governments if access is more than 6 km, this is almost never necessary, and most GP's are available well within the norm of 15 min by car (Christiaanse & Haartsen, 2017; Haartsen & DeBakker, 2014). Moreover, what constitutes an 'acceptable distance' is highly subjective since it relies on the mode of transport, but also on people's income, personal preferences and willingness to travel for certain types of facilities (Comber et al., 2012; Farrington & Farrington, 2005; Maroko et al., 2009).

To objectively compare and overlap the maps of different facilities for different modes of transportation a fixed set of distances is used. These distances are based on Frisian research that shows that the majority of people find 1–5 km an acceptable distance to travel to a supermarket, GP or primary school, and over 80% would consider more

Fig. 5. Change map primary school.

than 5 km too far (FSP, 2014). This corresponds to approximately 5 min by car or 17 min by bike, which is an important mode of transport in both urban and rural areas in the Netherlands. Using 5 km as the cut-off point, the catchment areas of each facility is mapped via a network analysis at 5 km distance, but also 'close by' at 2.5 km and 'too far' at 7.5 km. This results in six maps: accessibility of primary schools, supermarkets and GP's in the year 2000 and 2012. These maps show which villages are outside an acceptable reach of basic facilities, by Frisian standards. These accessibility maps of the years 2000 and 2012 were placed on top of each other in adobe illustrator, after which the changes in access could be visualised in a new layer. We distinguish areas that have remained stable with poor access, stable with good access, areas where access to the facility has diminished and where access has improved. The final 'change map' overlaps changes in access for *all* basic facilities and also shows the boundaries of the expected depopulation-regions. In this map we distinguish stable areas, and areas that have experienced change in access to one, two or three facilities.

3. Results

3.1. General results on the changing distribution of local facilities and population decline

We first present the context of facility decline in relation to population decline. Table 1 shows the population change in Fryslân, and the change in number and percentages of local facilities (including basic facilities and several other local facilities) between 2000 and 2012, according to settlement size. The results show that all types of settlements in Fryslân, except villages smaller than 500 inhabitants, grew in

population, but at the same time the number of basic facilities declined. This indicates that, when analysed according to settlement size, the decline of facilities is not in line with population decline, dejuvination or ageing. All settlements experience dejuvination, except large towns, and all types of settlements had an ageing population. Ageing was strongest in small villages with a 29% increase of residents over 65 years old. While older people probably have more need for basic facilities, small and medium sized villages unfortunately experienced the strongest facility-decline. To further assess the (linear) relationship between the relative population growth/decline of different age groups, and the relative growth/decline of local facilities between 2000 and 2012, a two-tailed Pearson's correlation was computed (see Table 2). Contradictory to popular belief, this study found no significant relationship between the relative growth/decline of local facilities and population in Fryslân in the period 2000–2012, except for a weak significant correlation between population *decline* of people under the age of 25 and the *increase* of basic facilities in large Frisian villages (15000–5000 inhabitants), $r = -0,315$, $p < 0.05$ for $n = 52$. Contradictory to popular belief, this negative relationship indicates that the decline of young people in larger villages does not go hand in hand with the decline of basic facilities.

While there is no apparent relation between population-decline and facility-decline, Table 1 does show a redistribution of basic facilities according to settlement hierarchy. The number of supermarkets decreased in all categories except large villages, and most of the small villages that still had a local supermarket in 2000 lost it by 2012. The LISA-dataset further shows that the number of employees at a supermarket increased from an average of 24–42 employees per facility. For GP's the impact of economies of scale can also be noticed. The number of

Fig. 6. Change map general practitioners.

GP's declined with 7% between 2000 and 2012, but the average number of employees per practice increased with 66% (from 3.7 to 6.5). This shows a clear trend towards bigger group-practices. The number of GPs declined in all categories except the largest towns, and the decline was strongest in small villages. The number of primary schools did not decline as much as the other two types of facilities. However, since 2012 there have been more primary school closures (Elshof et al., 2015), and 'major impact' can still be expected in the coming years (Haartsen & Van Wissen 2012; Elshof et al., 2015).

Apart from these facilities for basic needs, also other local facilities can be important in rural communities (de Vries et al., 2017). Table 1 shows that the number of specialised food stores, banks, libraries and sports facilities declined, while the number of restaurants and cafés as well as hair and beauty-salons actually increased. Specialised food stores, such as bakery's, butchers, fish and vegetables shops, mostly declined in large villages between 2000 and 2012, since they have already disappeared from the smaller villages before this period (van Dam, 1995). Furthermore, the decline of banks, libraries and sports facilities was strongest in small and medium sized villages. The strong decline in the number of banks could be partially due to online banking, but economies of scale and increased levels of mobility will have likely had an effect as well. The number of libraries and sports facilities (such as swimming pools, sport halls and sport fields) actually slightly increased in towns, indicating a concentration of these public facilities in larger settlements. A possible explanation for the remarkable 96% increase in hair and beauty-salons between 2000 and 2012 in Fryslân could be that these businesses can be run part-time and/or from home by one person. In the year 2000 66% of hair and beauty-salons was run by one person and in 2012 this was 83%. Markantoni and Van Hoven

(2012) found that there are many rural businesses which are run part-time by woman, allowing for a combination with child-care.

3.2. Results from the network analysis in GIS

The results from the second step in the analysis, the network analysis in GIS, show that the overall access to basic facilities in Fryslân is good when it is put in an international context. Fryslân is covered by the network analysis at 7.5 km for all basic facilities (Fig. 3). Furthermore, most people living in villages or towns have access to all basic facilities within 5 km, and residents of large villages and towns within 2.5 km. Figs. 4–6 are the result of overlapping the maps from Fig. 3, and show how access to primary schools, general practitioners and supermarkets changed between 2000 and 2012. The white areas (category 1) represent stable regions where the facility can be reached within 5 km. Category 2 and 3 are areas where access to this facility is more than 5 km, and could be considered too far by local standards. The hatched areas (category 3–6) represent regions that have experienced a change in access. Fig. 4 shows that access to supermarkets has declined in the northeast and southern parts of Fryslân, and that mostly smaller villages in rural areas experienced a significant decline in access. Access to supermarkets changed the most, while access to primary schools (Fig. 5) hardly changed at all between 2000 and 2012. Access to GP's (Fig. 6) has mostly worsened in central Fryslân, under Leeuwarden. However, residents of many rural areas in southwest Fryslân already had to travel more than 5 km to a general practitioner before the year 2000 (Fig. 6) or to a supermarket (Fig. 4). There are also areas that have experienced improved access to general practitioners or supermarkets.

Combining Figs. 4–6 in illustrator resulted in the 'overall change

Fig. 7. Final change map basic facilities.

map' for basic facilities (Fig. 7). This shows which areas are stable and where residents have access to all three basic facilities within 5 km (white) and in which areas people never had access within 5 km between 2000 and 2012 (dark magenta). These rural areas that do not have access to any of the three basic facilities within 5 km, do not contain any settlements, and can hardly be considered 'deprived' when put in an international context (Cabrera-Barona et al., 2016; Hospers, 2010). However large parts of central and southeast Fryslân experienced a worsening of access to a basic facility, or they already had to travel more than 5 km to a general practitioner or a supermarket. Interestingly enough, these areas do not overlap with the municipalities that actually experienced population decline in this period (indicated by a thin pink line in Fig. 7), nor with the regions that are marked by the government to expect effects of population decline (indicated by a thick pink line and NOF/NWF in Fig. 7). Actually, North-Fryslân had better access to basic facilities and was relatively stable between 2000 and 2012. This is not due to the depopulation-policy since a backup-analysis of access to basic facilities between 2009 and 2012 does not show significant improvements, and the national 'Action Plan' had not yet made funds available for practical improvements. This indicates that, as far as accessibility of basic facilities in Fryslân is concerned, the focus of the national depopulation-policy was misdirected. Public funding for dealing with the effects of facility-decline has been allocated to depopulating regions, while South-Fryslân actually experienced stronger decline of access to basic facilities.

4. Conclusion

The aim of this study was to investigate changes in distribution and

access to facilities for basic needs (primary schools, general practitioners and supermarkets) between 2000 and 2012, in order to question the geographical focus of the Dutch 'Intergovernmental Action Plan for Population Decline'. The case study was the province of Fryslân, which was assigned two 'expected-depopulation-regions' (north-west and north-east) in 2009 under this policy. The results of this paper show that there was a strong decline in the number of supermarkets and general practitioners in Fryslân, but this was not in line with demographic changes. A correlation analysis did not show any positive relationships between facility decline and population decline. Furthermore, the areas experiencing reduced access to basic facilities did not coincide with the regions expecting or experiencing population decline. Actually, the south-west of Fryslân had worse access to basic facilities and experienced more (negative) change in access. The lakes in the south-west spatially isolate villages, which increases travel-time to facilities. The decline of several local facilities does correspond to settlement hierarchy: smaller villages (<1500 inhabitants) experienced more facility decline. It is possible that also other Dutch provinces, or other countries, experienced facility-decline in smaller villages rather than specifically in depopulating regions. A repetition of this method could indicate this. This paper introduced a comprehensible longitudinal method that can be used by policy-makers to spatially determine where distances to basic facilities are not within an acceptable range, and where funding is most needed. Although the network analysis does not account for a loss in choice, it can produce a realistic assessment of the areas impacted most by change in access to several facilities, without being sensitive to aggregation errors or changing administrative borders. It gives a clear image uncompounded by remoteness or demand, since all residents should have access to facilities for basic needs. This study shows that

while the deterioration of access to basic facilities can be problematic, it is important to realise that this phenomenon might not necessarily be related to depopulation.

The clustering of certain facilities (such as supermarkets and GP's) in large villages could be an effect of economies of scale, but another explanation for the stronger decline of local facilities in small and medium sized villages is the increased levels of personal mobility. Fryslân experienced a population growth of 3% between 2000 and 2012, but the increase in the number of privately owned cars in this period was 29,5% (CBS Statline). Nevertheless, the mismatch between the decline of basic facilities and the increase of elderly residents in villages could be problematic, because they are often more dependent on local facilities (Langford & Higgs, 2010; Neumeier, 2015; Yeager & Gatrell, 2014). This being said, access to basic facilities in Fryslân should still be considered very good when put in an international context. Furthermore, the number of rural residents in the Netherlands that do not have a car is relatively small: 94% of residents of small villages owned a car in 2013 (Steenbekkers & Vermeij, 2013). While this is similar in some countries such as Germany (Neumeier, 2015), in other European contexts travel times and the dependency on local rural facilities can be much greater. In addition to the conclusions of this study regarding basic facilities, it also highlighted a decline of other local facilities. Many banks and sports facilities closed in villages, whereas libraries and small specialised food stores were already scarce in these smaller settlements. This is likely caused by economies of scale, deregulation of public services and increased levels of mobility, but also the rise of technological development such as the internet. For instance, online banking is likely to have had a significant effect on the number of banks. However, e-shopping for retail actually had very little effects on in-store shopping in this study-period (Frag, Krizek, & Dijst, 2006; Weltevreden & Rietbergen, 2009). Moreover, there are also local facilities, such as hair and beauty-salons, and cafés and restaurants, that have increased in both urban and rural areas. This shows that the prevailing image of decline in the countryside is not completely justified, which could partly be due to the exaggerated effects of depopulation in the media (Hospers, 2010).

We can conclude that the geographical focus of the national 'Action Plan' policy was misdirected with regard to accessibility of basic facilities in Fryslân. Currently, a popular policy for redistributing rural facilities, is to concentrate facilities in 'regional central places' (Hospers, 2010). This can have economic benefits for the area due to agglomeration effects (Terluin, 2003), but it can also cause a loss of local jobs, loss of choice for (mostly rural) consumers, loss of social meeting places and problems for groups who lack the mobility to travel greater distances (Paddison & Calderwood, 2007). The focus of spatial policy should perhaps shift from depopulation regions, to vulnerable groups in small and medium sized villages in the countryside. With regard to methodology it can be argued that while spatial accessibility measures can account for need, a careful consideration of methods is always required. Aggregated methods with large unit sizes can lead to misinformed policy (Dewulf et al., 2013) or obscure micro-level accessibility problems (Neutens, 2015), especially in rural areas (McGrail & Humphreys, 2009). Lucas et al. (2016) even argue that an ethical stance should always ground accessibility-based spatial policy. Future research should also include more studies on accessibility by public transport (Farber et al., 2014), temporal and mobile services, home delivery and innovative bottom up initiatives, since this can help alleviate the problems that arise from rural facility-decline. Furthermore, facility-decline might be a source of concern for rural residents because of the symbolic value of local facilities for a village (Amcoff et al., 2011; Christiaanse & Haartsen, 2017; Kearns et al., 2009). Thus far, little empirical research has been done into the impact of facility-decline on local inhabitants (Burger et al., 2013; Comber et al., 2012; Kearns et al., 2009), and even less research on reactions to closure or the emotional bonds between people rural facilities (Christiaanse & Haartsen, 2017). Milbourne and Kitchen (2014 p33) state that "One of the main reasons why people remain in these types of rural localities in the face of the withdrawal of local services

is their attachment to place", and the lack of services might actually be considered a trade-off choice when moving to rural area (Bijker, Haartsen, & Strijker, 2012; Comber et al., 2012; Gosnell & Abrams, 2011). There is a need for future research that looks into emotional responses to facility-decline, because knowing what causes concern and protests could further inform responses to facility-decline.

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