NB-IRDT

New Brunswick Institute for Research, Data and Training

Small area population forecasts for New Brunswick

Project Info

Project Title

POPULATION DYNAMICS FOR SMALL AREAS AND RURAL COMMUNITIES

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Research Team

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Partners

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1. Executive summary

New Brunswick's future population is often the focus of public debate in the Province. New Brunswick's declining population growth rate has been identified as a key challenge to sustaining and growing the province and its economy. New Brunswick has one of the fastest aging populations, lowest number of youths settling in the province, lowest immigration rates, and fastest declining fertility rates in Canada. These demographics have significant implications for the labour force, healthcare, long-term care, social support, the tax base, and the broader economy.

The objective of this report is to extrapolate small area population trends within New Brunswick for upcoming decades. Regardless of how areas were defined, most of New Brunswick is facing population declines. At higher levels of focus, the only areas with positive population growth trends are those areas surrounding the urban centres of Moncton and Fredericton. A narrower focus identifies several other areas as opportunities for positive population growth.

Some of the underlying components of negative population growth in New Brunswick are common to most developed nations. Low fertility and an aging population can lead to an inability for a population to replenish itself. While New Brunswick shares these issues, it appears as though a primary driver of negative population growth is out-migration. New Brunswickers are leaving for other provinces.

The findings presented represent a clear leverage point for New Brunswick. Finding ways to stem out-migration, while also promoting in-migration and immigration, could yield positive population growth in the province.

Key findings

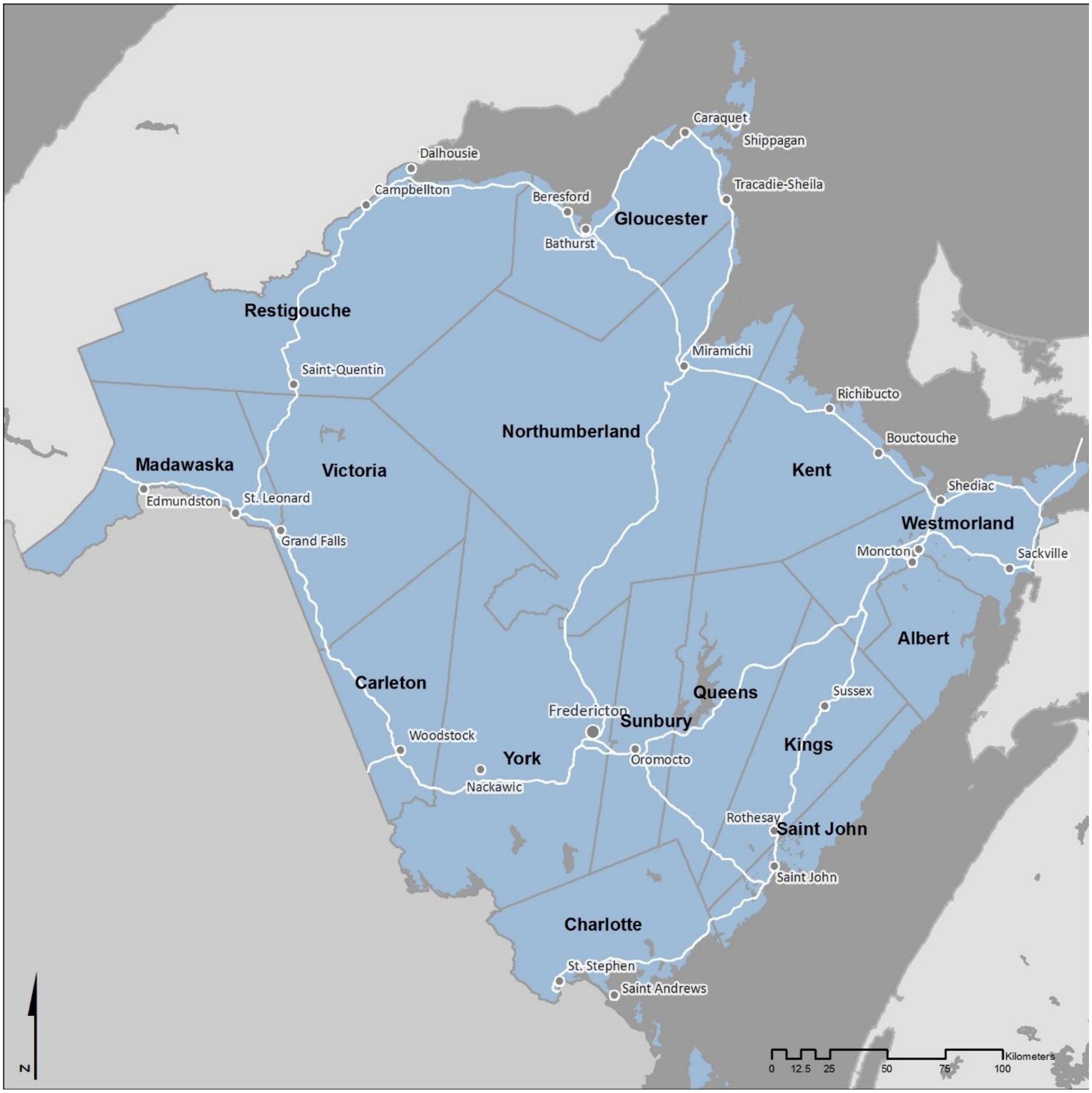
I. Majority of potential population growth is expected to occur in urban areas such as Fredericton and Moncton, as well as their surrounding geographies.

II. Some smaller urban areas such as Shediac, Sackville, and Oromocto are also demonstrating potential growth trends.

III. Other areas in New Brunswick are predicted to experience negative growth trends.

IV. Population growth (both positive and negative) is largely dependent on provincial out-migration trends.

V. Immigration and provincial in-migration can mitigate some of the negative growth trends which are driven by out-migration.



Map 1: New Brunswick Counties (Census Divisions)

Map 2: New Brunswick Health Council Communities

2. Methodology and data

Population forecasting, while having been in use for over half a century, is not a complete science. There remains considerable debate regarding appropriate methods and models. For national-level forecasts these debates are minor. For sub-national and small-area population forecasting there are a range of models and methods that have been developed, and there is less consensus on which approach will yield the most accurate and reliable results.[1]

When compared against national population projections, the difficulties confronted in conducting small-area population forecasts are numerous. The difficulties include data reliability, method selection, and defining the geographic focus.[2] Regarding data reliability, in small-areas it is difficult to get accurate and reliable population data that is validated, updated on a regular basis, and reflects the possible volatility of local-level populations. The most commonly used data source for population projections is the national-level census, which is conducted every 5 years. While this provides for reliable estimates of population by age and sex at different geographies, it is only available every 5 years and as such may not accurately account for population change in the inter-censal period. A second option is to use provincial population registers, such as those available from health insurance plans. These registers provide distinct benefits in that they are updated regularly and age-sex counts can be calculated locally. However, the reliability of this data is worse than national level data, particularly as the data are not created for the purpose of enumerating the population, but to track recipients of provincial health insurance.[3]

Beyond data considerations, there are a variety of forecasting methods to choose from. Some methods were developed that use only minimal data on population change, these methods have the advantage of using more reliable data source.[4] However, these methods don't account for the components of population change, which can vary considerably between sub-provincial regions. Other methods have been developed that make use of the various components of population change: fertility, mortality, and migration. However, these require reliable data sources to calculate. Migration in particular can be difficult to estimate in small-areas.

Finally, at the sub-provincial level it is difficult to determine the most appropriate geographical definition for which to calculate forecasts. National statistical geographies are useful in that they have the most data available; however, the boundaries of these areas do not necessarily conform to provincial planning or service delivery areas. At the same time, it may be difficult to calculate population counts for alternate geographical definitions as the underlying data sources may not be available at these levels. Additionally, forecasting models work best when there are consistent

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[1] Wilson, Tom and Martin Bell. 2011. "Editorial: Advances in Local and Small-Area Demographic Modelling." *Journal of Population Research* 28(2–3):103–7.
Wilson, Tom and Phil Rees. 2005. "Recent Developments in Population Projection Methodology: A Review." *Population, Space and Place* 11(5):337–60.
[2] Booth, Heather. 2006. "Demographic Forecasting: 1980 to 2005 in Review." *International Journal of Forecasting* 22:547–81.
[3] Health Surveillance and Environmental Health Branch. 2007. *Population Projections for Alberta and Its Health Regions 2006-2035*. Edmonton, AB.
[4] Wilson, Tom. 2015. "New Evaluations of Simple Models for Small Area Population Forecasts." *Population, Space and Place* 21:335–53.

rates of change within geographies, and when there are less difference between the populations of different regions.

The remainder of this section overviews the methods for population forecasting employed in this report and the data used for each of the forecasting methods.

2.1 Forecasting methods

The essential function of scenario-based modelling is the use of different forecasting methods and underlying assumptions in developing a range of plausible forecasts. Each of these scenarios makes use of distinct options that fall within a range of potential rates of change. The analysis undertaken here presents a range of growth scenarios that reflect differences in fertility, mortality, and migration. Each scenario is based on observed rates within the population, either over the long-term or in the most recent periods.

In developing population forecasts at the sub-provincial level, the small populations of underlying geographic units can present a challenge to demographic models. With small populations, even a change in a few individuals from one year to the next can have a large effect on contributing rates. Demographers use methods and models to account for these challenges, either by calculating underlying rates based on multi-year averages or by using secondary methods to constrain growth within a predicted range. For this report a variety of methods are used to account for small populations.

2.1.1 Constrained forecasting

For all forecasts presented in this report a constrained approach is employed, where population forecasts are constrained to a range of provincial scenarios developed for New Brunswick by an external source. This approach allows the internal dynamics of population change in New Brunswick to vary. In the simplified constrained approach, only the geographic distribution of population change will vary; i.e.: the total population of the province will remain constant for each scenario, but depending on the model used, the population in each geographic area will vary.[5] In the cohort-component models, the population will vary by age group, by sex, and by geography – with the total provincial population constrained within the forecast ranges developed by Statistics Canada.

Table 1 summarises the range of scenarios used for constraining the population forecasts. These 7 provincial forecasts were developed by Statistics Canada, with variation in birth, death, and migration rates.[6] The purpose of having multiple projection scenarios is to reflect the uncertainty associated with future direction of population change. The projection scenarios presented here are constructed by combining several assumptions regarding the future evolution of each of the components of population growth.

The five medium-growth scenarios (M1 through M5) were developed based on assumptions reflecting different observed internal migration patterns. Each scenario puts forward a separate assumption to reflect the volatility of this component. There is a high degree of volatility for internal migration in New Brunswick, where inter-provincial and intra-provincial migration rates

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[5] Wilson, Tom. 2015. "New Evaluations of Simple Models for Small Area Population Forecasts." *Population, Space and Place* 21:335–53.
[6] Statistics Canada. 2010. *Population Projections for Canada, Provinces and Territories. 2009-2036*. Ottawa, ON. Retrieved (http://www.statcan.gc.ca/pub/91-520-x/91-520-x2010001-eng.htm).

are the largest single contributor to the variation in population change. Conversely, the steady change in fertility and mortality rates has remained relatively consistent over the several past decades.

The low-growth and high-growth scenarios bring together assumptions that are consistent with either lower or higher population growth than in the medium-growth scenarios. For example, assumptions that entail high fertility (Total Fertility Rate – TFR), low mortality, high immigration, low emigration and high numbers of non-permanent residents are the foundation for the high-growth scenario.

Essentially, the low-growth and high-growth scenarios are intended to provide a plausible and sufficiently broad range of projected numbers to take account of the uncertainties inherent in any population forecasting exercise. In the low-growth and high-growth scenarios, the interprovincial migration assumption is the same as that used in the M1 medium-growth scenario, based on the period 1991/1992 to 2010/2011.

Table 1: Summary of constrained scenarios assumptions, Statistics Canada 2014.

Scenario	Fertility	Life expectancy	Immigration	Migration trends
Low	Low: TFR=1.53	Low: 86.0 Male, 87.3 Female	Low: 5.0 (per 1,000)	1991 – 2011
M1	Medium: TFR=1.67	Medium: 87.6 Male, 89.2 Female	Medium: 7.5 (per 1,000)	1991 – 2011
M2	Medium	Medium	Medium	1991 – 2000
M3	Medium	Medium	Medium	1999 – 2003
M4	Medium	Medium	Medium	2004 – 2008
M5	Medium	Medium	Medium	2009 – 2011
High	High: TFR=1.88	High: 89.9 Male, 91.1 Females	High: 9.0 (per 1,000)	1991 – 2011

2.1.2 Simplified small-area regional models

For this project, simplified total population models that could be easily replicated in an Excel workbook were used. These models require only total populations for sub-Provincial geographies and an independent set of projections for the Province as a whole. Population totals are required for three points in time (ten years apart), the most recent two are used to construct the forecasts while the first two are used to calculate predicted error rates and provide some model validation. Models that required fitting to annual time-series data or additional socio-economic data were not considered, as these data are not readily produced for the geographic definitions used in this project. Seven models in total are used, based on the work by Wilson (2015).

The first three models produce forecasts based solely on each of the local areas past population trends. The following four models are linked to an independent projection for the province. In this case, the independent project is from Statistics Canada, but any provincial level forecast could be used. The formulas for the models are summarised in table 2.

Table 2: Models developed for simplified regional forecasts[7].

Model	Description	Formula
Models based on local area population trends		
LIN	Linear	$P_i(t+1) = P_i(t) + G_i$
EXP	Exponential	$P_i(t+1) = P_i(t)e^{ri}$
LIN_EXP	Linear - Exponential	If base period growth is positive: $P_i(t+1) = P_i(t) + G_i$ If base period growth is negative: $P_i(t+1) = P_i(t)e^{r_i}$
Models linked to an independent Provincial forecast		
CGD	Constant growth rate difference	$P_i(t+1) = P_i(t)e^{(r_{Prov}(t,t+1)+GRD_i)}$
CSP	Constant share of population	$P_i(t+1) = P_{Prov}(t+1)SHAREPOP_i(t)$
CSG	Constant share of growth	$P_i(t+1) = P_i(t)SHAREGROWTH_i G_{Prov}(t,t+1)$
VSG	Variable share of growth	If base period growth is positive: $P_i(t+1) = P_i(t) + G_i(t,t+1)$ $POSFACTOR_i(t,t+1)$ If base period growth is negative: $P_i(t+1) = P_i(t) + G_i(t,t+1)$ $NEGFACTOR_i(t,t+1)$

Notation:
$P_i(t)$ jump-off year population of small area *i*
$P_i(t+1)$ projected population of small area *i* at time *t+1*
G_i annual average population growth over the base period
r_i annual average population growth rate of small area *i* over the base period
GRD_i base period growth rate difference
$SHAREPOP_i(t)$ share of Provincial population in small area *i* at jump-off year *t*
$SHAREGROWTH_i$ small area's share of Provincial population growth in the base period
G_{Prov} forecast Provincial population growth
$POSFACTOR_i(t,t+1)$ plus-minus adjustment factor for positive growth
$NEGFACTOR_i(t,t+1)$ plus-minus adjustment factor for negative growth

2.1.3 Small-area cohort-component models

Population forecasts via a cohort component model divides the forces of population change into six parts: fertility, mortality, in-migration, out-migration, immigration, and emigration. Each of component is modeled as a rate, which is then applied to a base (or "jump") population over a given period via a Leslie matrix. Successive applications of the rates over the given interval and model parameters produce the population forecasts.

The parameters of the model may be changed to obtain different scenarios. For the current project, four levels are considered for each component: baseline (B), low (L), median (M), and high (H). The baseline level corresponds to the rates derived directly from the data, where each geographic area maintains the rate calculated from administrative data sources. In contrast, the low, median, and high scenarios, respectively, use the first quartile, median, and third quartile, of the rates by age and sex.

The current project uses 20 age categories and 2 sexes. The first age category includes individuals from birth to just under one year of age (<1 year); the second pertains to individuals aged one year

[7] Wilson, Tom. 2015. "New Evaluations of Simple Models for Small Area Population Forecasts." *Population, Space and Place* 21:335–53.

to less than 5 (1 to <5); the subsequent age categories are all of five years in length, except for the last, which is open-ended.

Table 3: Primary projection scenarios for cohort-component modelling.

Scenario	Fertility	Mortality	In-migration	Out-migration	Immigration	Emigration
1	Base	Base	Base	Base	Base	Base
2	Base	Base	Base	Base	Base	High
3	Base	Base	Base	Base	Base	Low
4	Base	Base	Base	Base	Base	Median
5	Base	Base	Base	Base	High	Base
6	Base	Base	Base	Base	High	Low
7	Base	Base	Base	Base	Low	Base
8	Base	Base	Base	Base	Median	Base
9	Base	Base	Base	High	Base	Base
10	Base	Base	Base	Low	Base	Base
11	Base	Base	Base	Median	Base	Base
12	Base	Base	High	Base	Base	Base
13	Base	Base	Low	Base	Base	Base
14	Base	Base	Median	Base	Base	Base
15	Base	High	Base	Base	Base	Base
16	Base	Low	Base	Base	Base	Base
17	Base	Median	Base	Base	Base	Base
18	High	Base	Base	Base	Base	Base
19	High	High	High	High	High	High
20	High	Low	Base	Base	High	Low
21	Low	Base	Base	Base	Base	Base
22	Low	Low	Base	Base	Low	High
23	Low	Low	Low	Low	Low	Low
24	Median	Base	Base	Base	Base	Base
25	Median	Median	Base	Base	Median	Median
26	Median	Median	Median	Median	Median	Median

For each geographic definition, 26 scenarios have been developed, covering the years 2006 through 2056.

2.2 Selected data

The data required for the two forecasting techniques come from different sources. First, for the simplified small-area forecasts, only total population counts are used. Second, small-area cohort-component models require estimates of population, births, deaths, inter-provincial migration, intra-provincial migration, immigration, and emigration. These data come from a variety of sources and require different degrees of data management for use in population forecasting.

2.2.1 Selected geographies

For both the simplified models and cohort component models, forecasts are developed for five different small-area geographies. Table 4 summarises selected geographies. First, forecasts are developed for Provincial Counties (equivalent to Statistics Canada Census Divisions). These areas are generally large and have remained consistent over time. Second, the most recent definition for Health Regions are used, with the 7 regions corresponding to those used by the Government of New Brunswick, the New Brunswick Health Council, and Statistics Canada. Third, Health Council communities are used, which subdivide the larger Health Regions into distinct community areas. Fourth, Provincial Electoral Districts are tested, as these areas have less variation in the population size between areas but are much smaller than the other areas used. Fifth, Regional Service Commission areas are also used, as these geographic units are used by several Government departments for service delivery and planning.

Table 4: Selected geographies used for population forecasting.

Geography	Number of units	Median population	Minimum population	Maximum population	Source
Counties	15	32,594	11,086	144,158	Statistics Canada
Health Regions	7	76,816	27,897	203,837	Health Council
Health Council communities	33	15,803	5,317	78,495	Health Council
Provincial Electoral Districts	49	15,319	12,929	19,805	Service New Brunswick
Regional Service Commission Areas	12	38,627	27,462	173,004	Service New Brunswick

2.2.2 Population data for regional modelling

The regional modelling methods require only population totals for each small geographic area, and secondary population estimates to constrain growth. To calculate small-area population totals, geographic information system software, that used Statistics Dissemination Area population counts and a point-in-polygon approach to summarize population totals for larger geographic units for 1991, 2001, and 2011 (the most recently available data) was used.

2.2.3 Population data for cohort-component models

The migration estimates use data from the Citizen Dataset to establish the area of residency in the province. This location is then recoded to the desired geographical levels, specifically: Census Divisions, Provincial Electoral Districts, Regional Service Commissions, Health Regions, and Health Council Community Divisions. Datasets containing the location of each individual on June 15th are generated for each year of interest. The user then selects two years, which are used to create a transition matrix.

The yearly records of residency are then generated from the citizen dataset for each individual in the file and each year of interest. Individuals without an address in any given year are dropped from that year’s data set. The two years of interest, selected by the user, and the data for those years are merged, along with the Vital Statistics data.

If an individual’s date of death occurs before June 15th in either of the selected years, they are considered dead, and are removed from the migration counts. Living individuals are then given a weight for their contributions towards each age category. For example, if an individual is 48 in the first year and 53 in the second year, they would be given a weight of respectively 0.4 and 0.6 for the 45 – 50, and 50 – 55 year age categories. The weights are then summed up by region, which creates a transition matrix containing migration estimates, with a row and a column for each geographic region.

Estimated migration rates are then computed by dividing the number of migrants in an area by the population of potential migrants (and multiplying the quotient by one thousand). For the rates of (internal) in-migration, the number of incoming migrants is divided by the sum of incoming migrants and of non-migrants in each other region. Similarly, for the rates of (internal) out-migration, the number of out-going migrants is divided by the sum of out-going migrants, emigrants, and non-movers from the region. Emigration rates are calculated by dividing the number of emigrants by the same denominator used for the out-migration rates.

Unlike the others, the total number of potential immigrants is unknown, so the rate of immigration has been estimated as a ratio immigrants and the sum of out-going migrants, emigrants, and non-movers from the region. The rationale behind this supposition is that geographic areas will attract migrants in proportion to their population in the first year.

3. Simplified small-area forecasts

The population in New Brunswick is experiencing consistent demographic shifts in fertility and mortality. Concurrently, there are large fluctuations in migration and immigration. The declines in fertility are like those experienced across developed nations, where the general fertility rate is declining and age-specific rates are shifting to older age groups. The declines in mortality, while smaller in New Brunswick than in other provinces, are also like those seen in other jurisdictions. However, the patterns of migration in New Brunswick are distinct and have a high degree of temporal and geographic variation. As such, it is important that any population forecasting undertaken at the small-area level recognise the potential for shifts in migration rates and provide a range of scenarios.

As described in the methods section, two approaches of population forecasting were developed, each presenting multiple scenarios of population change. This section of the report focusses on simplified methods of calculating small-area population forecasts, where only the population totals for each period are used. The subsequent section presents a cohort-component model where forecasts make use of the components of population change and present results by age and sex.

Recent research has shown that the use of simplified regional growth models can provide robust estimates of population change for smaller geographic units. These models are constructed using only regional population counts over multiple time periods, combined with external population forecasts. A multi-stage approach is taken, where models are first validated against past data points and historic population forecasts, and the appropriate models are selected. Following this, models are constructed using current population counts, with small-area growth-rates constrained to the external Provincial population forecasts.

3.1 Population change, by county

Table 5 shows the calculated population forecasts by county from 2011 through 2031, using five different calculation methods, for the Statistics Canada calculated high-growth scenario. As is evident from this table, there is a wide range in forecasts between New Brunswick counties, with some experiencing large population increases (Westmorland and York), and the majority experiencing either moderate decline or increase. Of the 15 counties in New Brunswick, only six are projected to experience population growth under this scenario, and growth is expected to be concentrated in Westmorland and York counties.

Table 5. Population change (2011-2031) and annual growth rates by constrained model, high growth scenario1, by county.

	Total population change by model, 2011 - 2031						Growth
County	LIN	EXP	LIN_EXP	CGD	VSG	Increase per year	rate per year
Saint John	2,948	1,109	2,705	1,475	877	217	0.0029
Charlotte	-2,080	-2,634	-2,213	-2,670	-1,299	-82	-0.0030
Sunbury	2,227	1,692	2,067	1,653	1,319	137	0.0052
Queens	-1,728	-1,823	-1,632	-1,834	-711	-78	-0.0068
Kings	9,566	8,928	9,136	8,852	6,672	546	0.0082
Albert	5,952	6,324	7,046	6,318	4,462	327	0.0120
Westmorland	37,568	43,067	36,582	43,197	28,974	2,028	0.0152
Kent	-1,627	-2,344	-1,758	-2,389	-1,348	-55	-0.0018
Northumberland	-5,713	-6,461	-5,599	-6,519	-2,750	-246	-0.0050
York	19,276	20,223	18,644	20,190	14,368	1,061	0.0116
Carleton	-799	-1,464	-942	-1,506	-1,051	-17	-0.0006
Victoria	-2,822	-3,048	-2,915	-3,069	-1,224	-125	-0.0061
Madawaska	-4,912	-5,258	-4,679	-5,293	-2,088	-219	-0.0063
Restigouche	-7,568	-7,237	-6,715	-7,251	-2,556	-354	-0.0103
Gloucester	-11,516	-12,305	-10,958	-12,385	-4,876	-514	-0.0064

*** Total population of New Brunswick is constrained to a high growth scenario, which uses mean migration rates from 1981 through 2008**

Table 5 shows models calculated via several different regional methods. As outlined in the methodology section, each of these methods has different advantages depending the rate of change, whether the change is positive or negative, and the size of the base population.

Table 6 shows the estimated errors for the available models, as calculated at the county level. From analysis of the selected constrained models at the county level, the models with the lowest Median Average Percent Error between 2001 and 2011 were the LIN, EXP, and VSG models. Of these, the EXP and VSG models had the lowest overall errors and thus are presented as the primary options in this report.

Table 6. Estimated errors for constrained projection models, 2001-2011, census divisions.

	Median absolute % error	Median % error	Mean absolute % error	Mean % error	% Negative	% with <10% absolute % error
LIN	5.44	4.89	6.22	3.15	0.00	86.67
EXP	5.83	4.62	6.14	3.08	0.00	93.33
LIN_EXP	6.03	4.83	6.21	3.14	0.00	86.67
CGD	5.93	4.71	6.23	3.11	0.00	86.67
CSP	7.58	6.08	7.95	3.94	0.00	60.00
CSG	7.77	3.25	9.82	1.94	0.00	66.67
VSG	2.94	1.19	4.66	3.39	0.00	80.00

Table 7 shows the range of population forecasts between the different constrained growth scenarios using the variable share of growth method. (The specifics for the growth scenarios is outlined in Table 1.) The difference between the low and high forecasts reflects the range of possible provincial scenarios, with the variation in the medium growth scenarios reflecting changes in inter-provincial migration rates. Given the high degree of variation in inter-provincial migration, these differences are not surprising.

For the M1 scenario, inter-provincial migration rates are based on the average between 1991 and 2011, thus minimising the period effects that are seen in the other medium-growth scenarios. The M2 scenario uses inter-provincial migration rates from 1991 through 2000, which in New Brunswick was a period near the mean. Inter-provincial migration in 1991 – 2003 was not as high as in more recent periods. The M4 scenario uses inter-provincial migration rates from between 2004 and 2008, which for New Brunswick coincided with an exceptionally high rate of provincial out-migration. As such, the M4 scenario has the largest overall population decline over the 20-year period, even more than for the low-growth scenario. In contrast, the M5 scenario uses inter-provincial migration rates from 2009 – 2011, which coincided with the period after the 2008 recession, where there were low rates of out-migration and the only recent period of net in-migration.

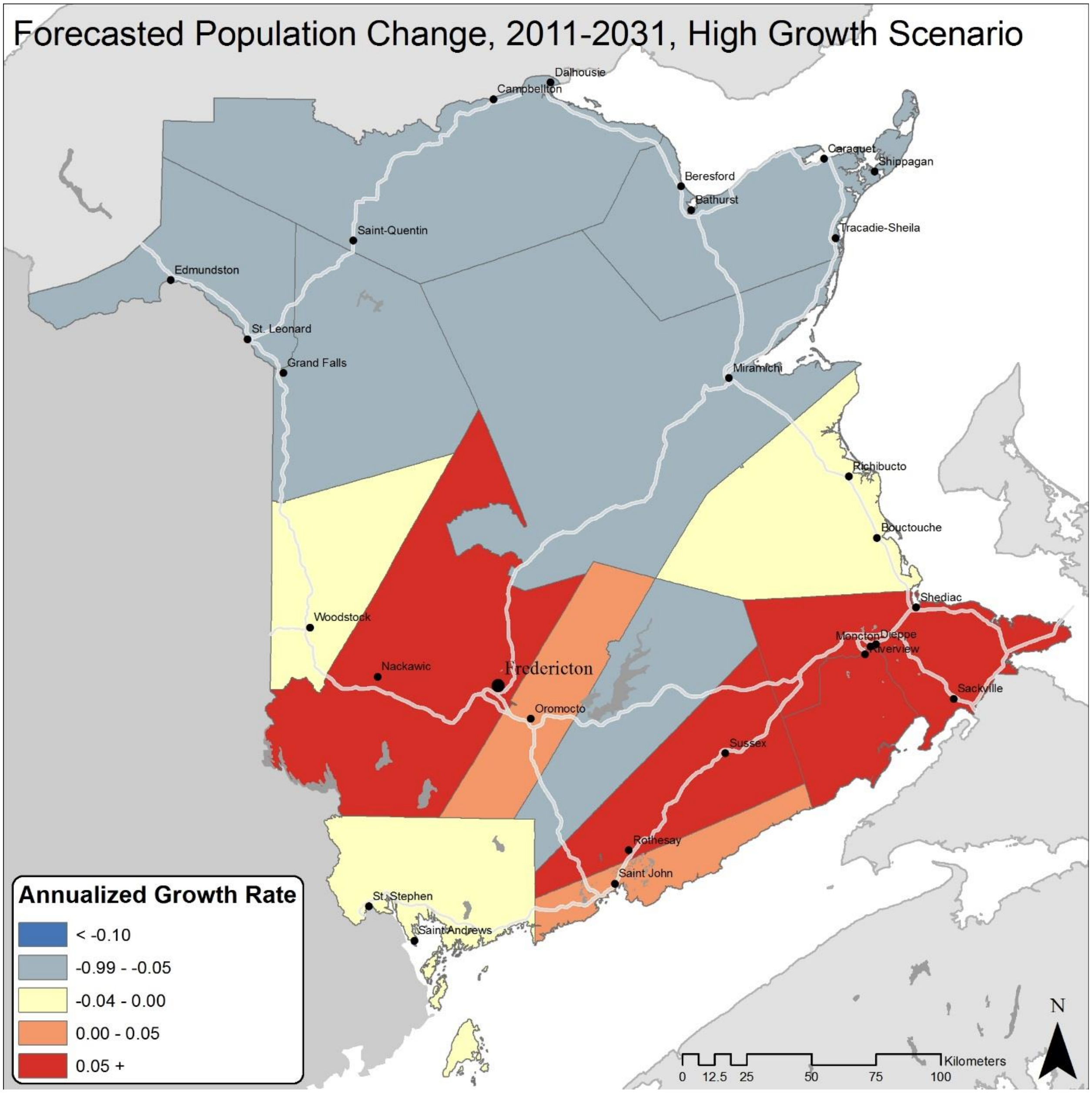
Table 7. Total forecast population change (2011-2031), variable share of growth method, by growth scenario, by county.

County	Low	M1	M2	M3	M4	M5	High
Saint John	-1,235	-282	-145	-290	-1,272	450	877
Charlotte	-2,036	-1,706	-1,658	-1,708	-2,047	-1,451	-1,299
Sunbury	32	612	696	607	9	1,058	1,319
Queens	-1,352	-1,067	-1,026	-1,070	-1,361	-845	-711
Kings	1,612	3,892	4,221	3,873	1,524	5,648	6,672
Albert	1,459	2,812	3,007	2,801	1,407	3,854	4,462
Westmorland	10,401	18,766	19,974	18,697	10,076	25,214	28,974
Kent	-1,878	-1,639	-1,605	-1,641	-1,886	-1,457	-1,348
Northumberland	-4,855	-3,915	-3,779	-3,923	-4,885	-3,187	-2,750
York	4,605	9,003	9,638	8,967	4,434	12,392	14,368
Carleton	-1,249	-1,159	-1,146	-1,160	-1,252	-1,091	-1,051
Victoria	-2,269	-1,804	-1,737	-1,808	-2,284	-1,442	-1,224
Madawaska	-3,908	-3,099	-2,981	-3,105	-3,935	-2,468	-2,088
Restigouche	-5,313	-4,097	-3,919	-4,107	-5,352	-3,138	-2,556
Gloucester	-9,144	-7,246	-6,970	-7,261	-9,205	-5,766	-4,876
New Brunswick	-15,130	9,070	12,570	8,870	-16,030	27,770	38,770

Based on these models and under a range of scenarios, only six of the 15 Counties in New Brunswick are forecast to have any population growth over the next 20 years. Two counties – Westmorland (Moncton & Dieppe) and York (Fredericton) – will concentrate most of this growth. While these figures are only based on prior data and from population totals, it suggests that without some external changes (economic, social, policy, environmental), most New Brunswick counties will continue to see population decline over the long term.

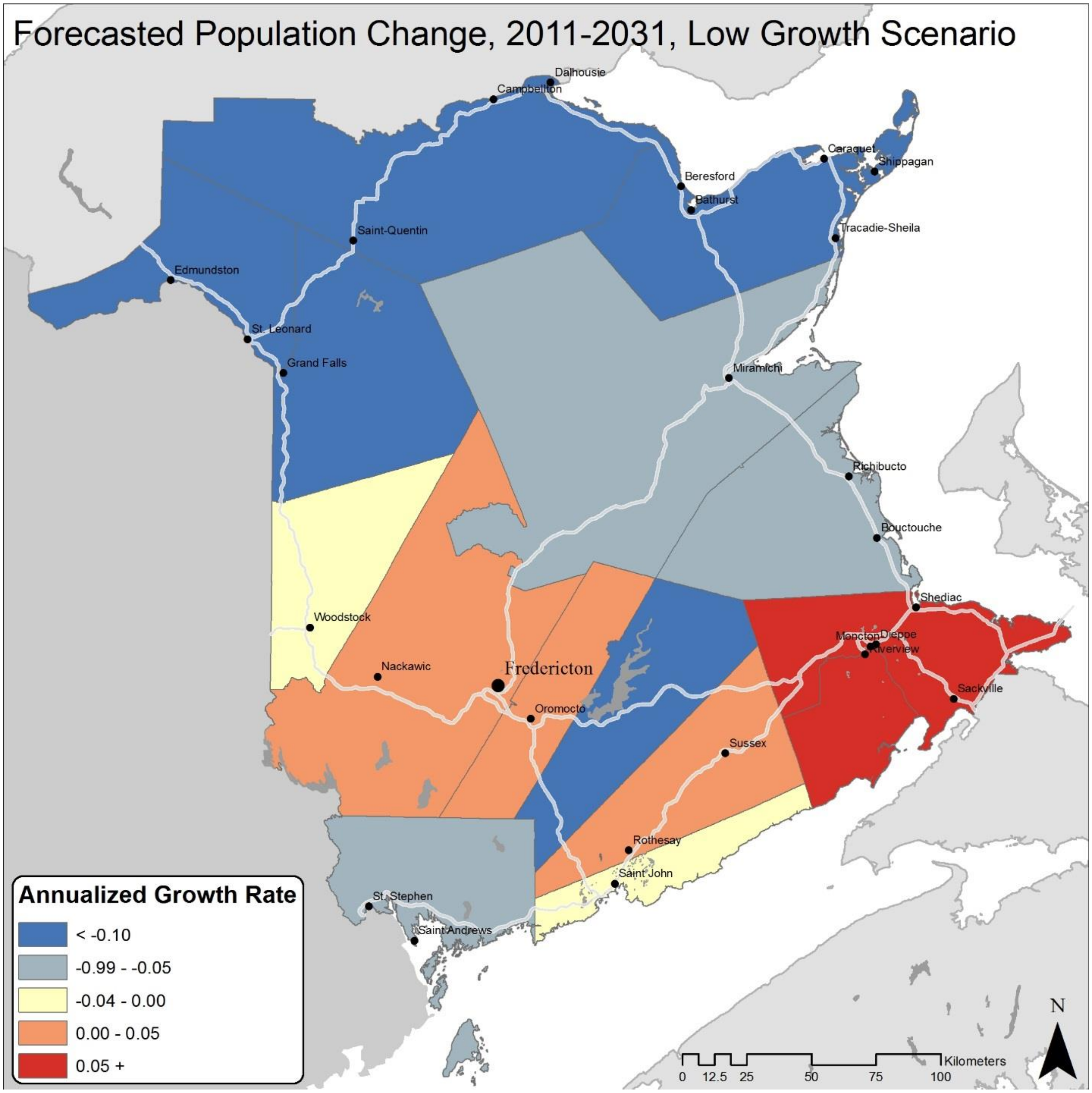
Map 3 shows the distribution of this forecasted population change across New Brunswick at the county level. As is evident, even in the high-growth scenario, the only projected population growth is in the south of the province and concentrated in Moncton, Fredericton, and the outskirts of Saint John.

Map 3: High growth scenario by county, 2011 – 2031.



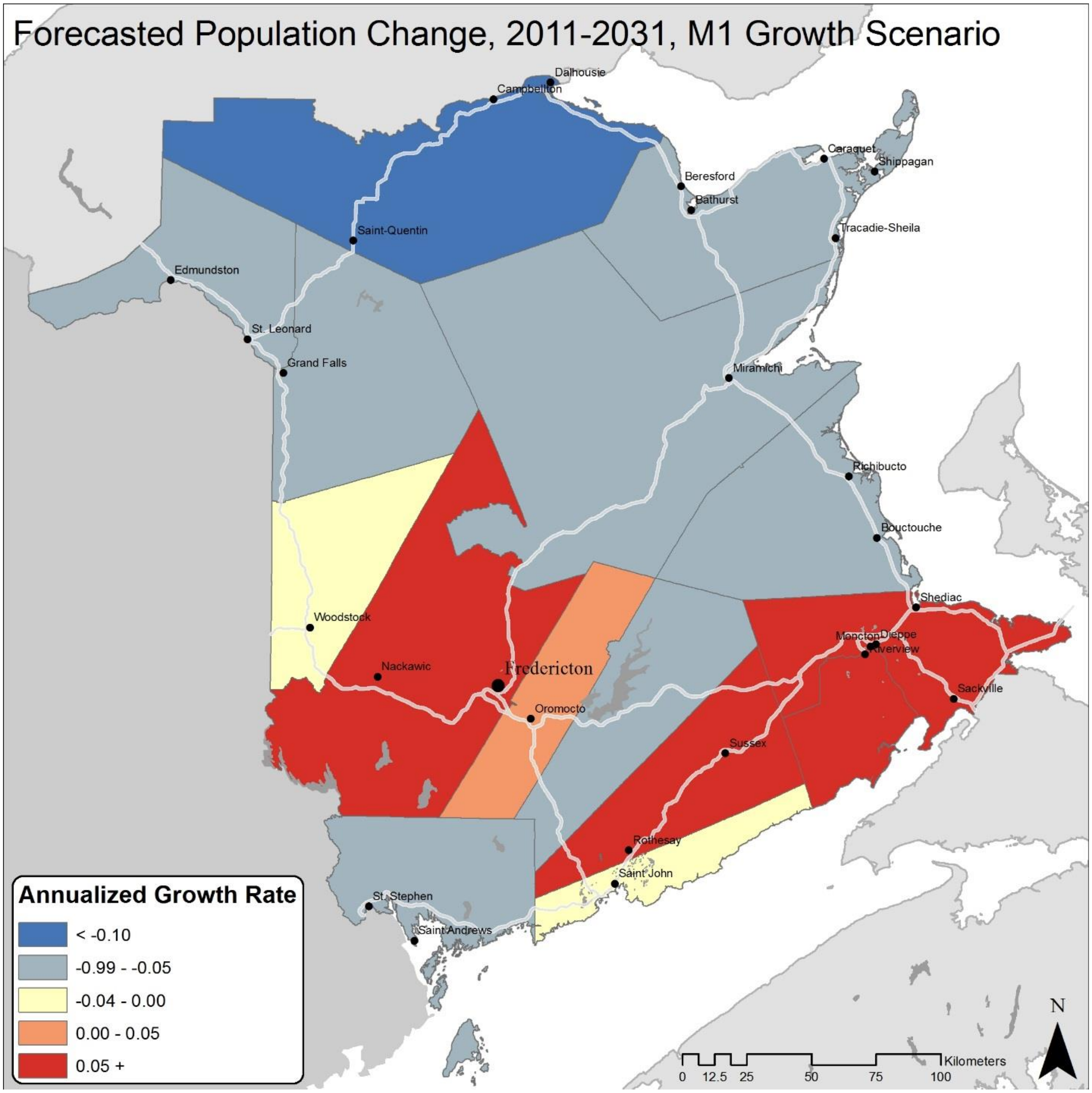
Map 4 shows the forecasted population change across New Brunswick under a low-growth scenario. As is evident, under this scenario the only projected population growth is in the south of the province and concentrated in Moncton, Fredericton, and the outskirts of Saint John. Most growth would occur in the area surrounding Moncton. This scenario is a good comparison to the high-growth scenario as it uses the same migration assumptions, where migration is averaged across 1991 through 2011. The difference between low and high growth scenarios is only with fertility, mortality, and international immigration.

Map 4: Low growth scenario by county, 2011 – 2031.



Map 5 furthers these scenarios by presenting a forecast for medium rates of fertility, mortality, and international immigration. As with the previous maps, migration rates were calculated as the average between 1991 and 2011. It is only under this scenario that higher growth appears in the Fredericton region and outside of Saint John, likely driven by growth in Quispamsis.

Map 5: Medium (M1) growth scenario by county, 2011 – 2031.



3.1.1 Population forecasts for selected counties

Under the various growth scenarios there are a range of potential outcomes for each county in New Brunswick. While some of these counties (Westmorland & York) will see population growth under all scenarios, most counties have the potential for population decline in the long-term, even under high-growth.

The population forecasts for Saint John County (Figure 1) exhibit a range of outcomes depending on the growth scenario selected. In the low-growth scenario, there is a continued decrease in the population of Saint John County over time. However, for this county the lowest growth occurs in the medium growth M4 scenario, which corresponds with high levels of provincial out-migration.

Most scenarios for Saint John County have zero or negative population growth, indicating that without some external change from past migration rates there will be little population growth in this region. Over the long term, even the high-growth scenario shows a declining population, reflective of the decreasing fertility rates in New Brunswick.

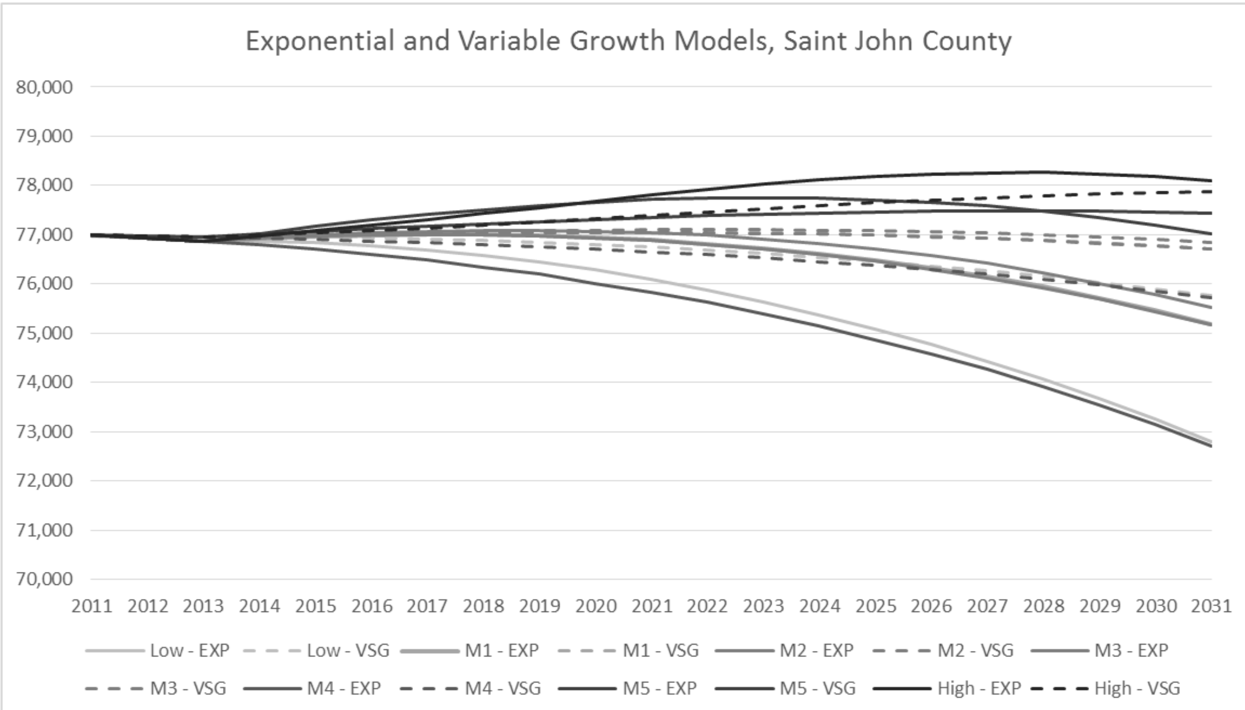


Figure 1: Scenario forecasts for exponential and variable growth models, Saint John County

In contrast to Saint John County, Westmorland County (Figure 2) shows the highest growth rates of any county in New Brunswick. Even in the M4 and low-growth scenarios, Westmorland County shows a small population increase. The high growth scenario for this county show a large increase of nearly 45,000 over the 20-year period of this forecast.

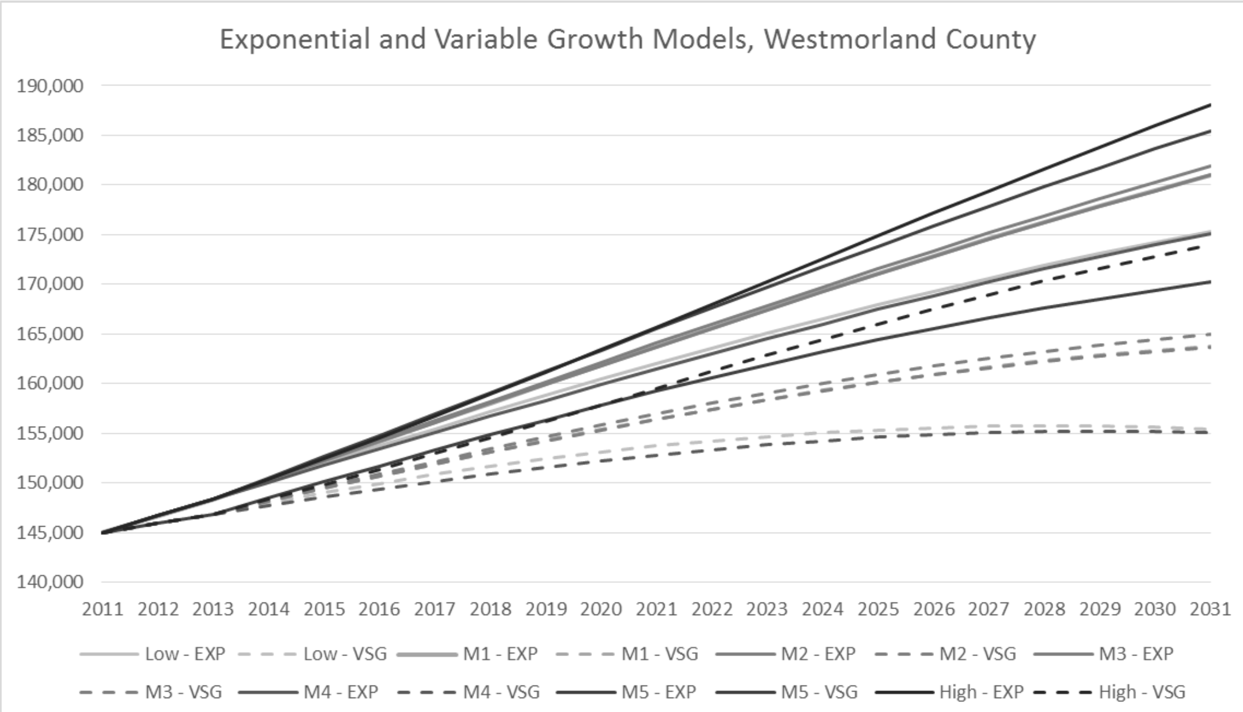


Figure 2: Scenario forecasts for exponential and variable growth models, Westmorland County.

As with the results for Westmorland County, York County (Figure 3) shows steady growth between 2011 and 2031. As with the other results presented here, the lowest growth is for the low-growth and M4 scenarios, still resulting in a small increase of several thousand people. For this county, the exponential (EXP) models show higher growth than does the variable share of growth (VSG) model. This is difference is due to the nature of the models, where the EXP method exaggerates sub-regions with higher growth rates and the EXP tends to mediate the effect of rate differences between counties.

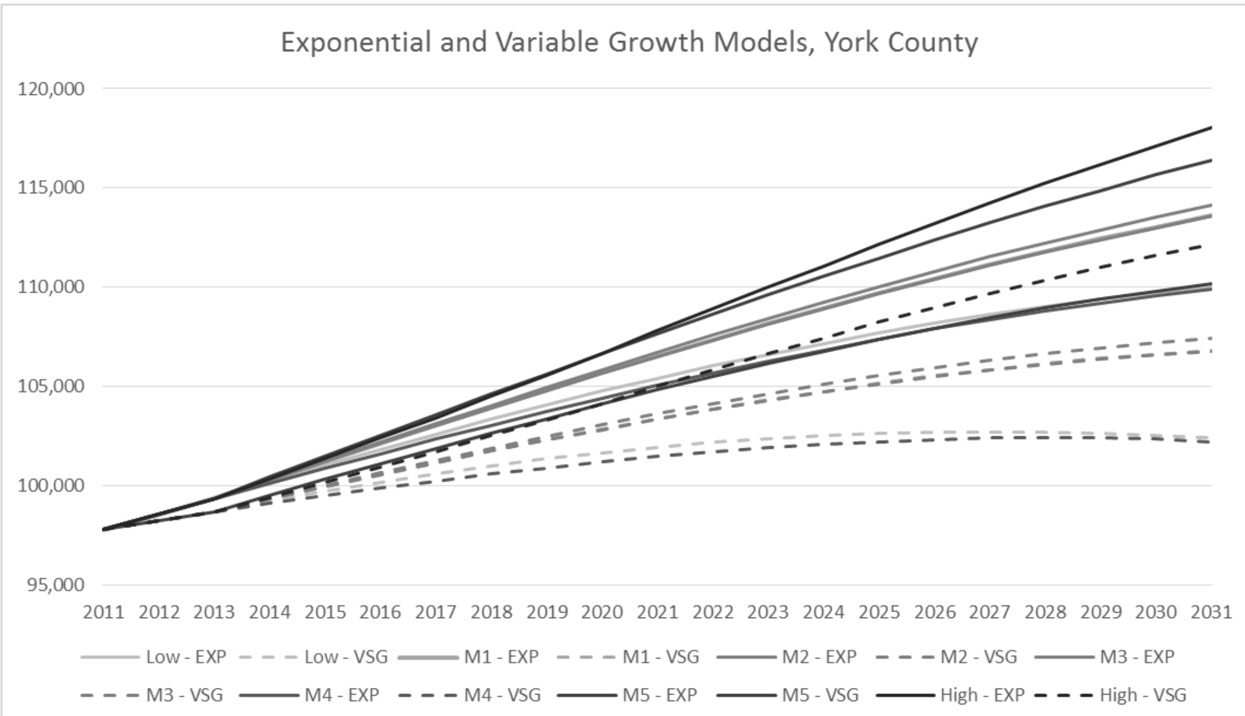


Figure 3: Scenario forecasts for exponential and variable growth models, York County.

In terms of numbers, the highest projected growth for York County results in an increase of approximately 20,000 people. The factors that would contribute to this increase are higher immigration rates, lower out-migration rates, and consistent fertility rates. However, as the largest drivers of the change are migration, changes to these rates will be driven largely by external factors (economic growth, policy changes) than by family decisions (fertility).

More typical of New Brunswick counties, the results for Restigouche County (Figure 4) show a continued decline in the population. Interestingly, the high growth scenarios are not those that correspond to a slower rate of population decline. These results confirm that the major drivers of population decline in this county are from out-migration, and that under conditions of high growth, out-migration may increase in peripheral regions.

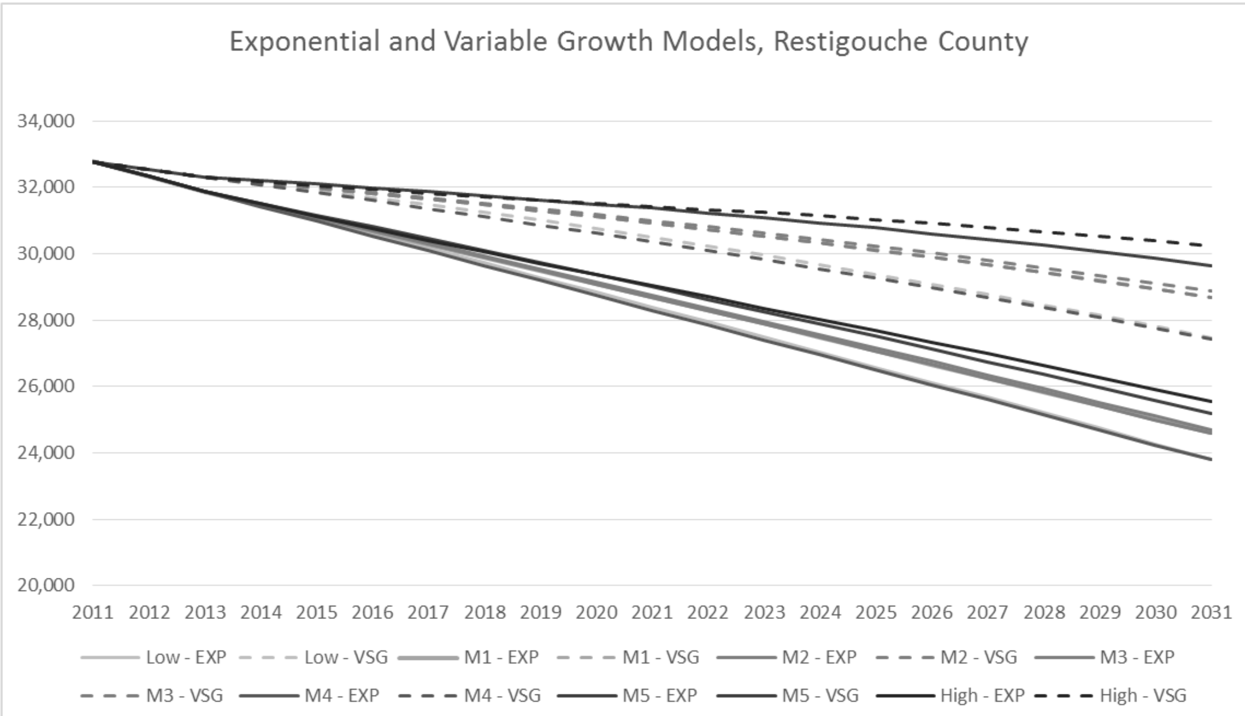


Figure 4: Scenario forecasts for exponential and variable growth models, Restigouche County.

The results for Gloucester County (Figure 5) are similar to those for Restigouche, where if historic trends continue, a decline in the population can be expected. From these models, the population levels are less important than the direction of change, where it is evident that irrespective of what scenario is selected there is predicted to be a decline in population.

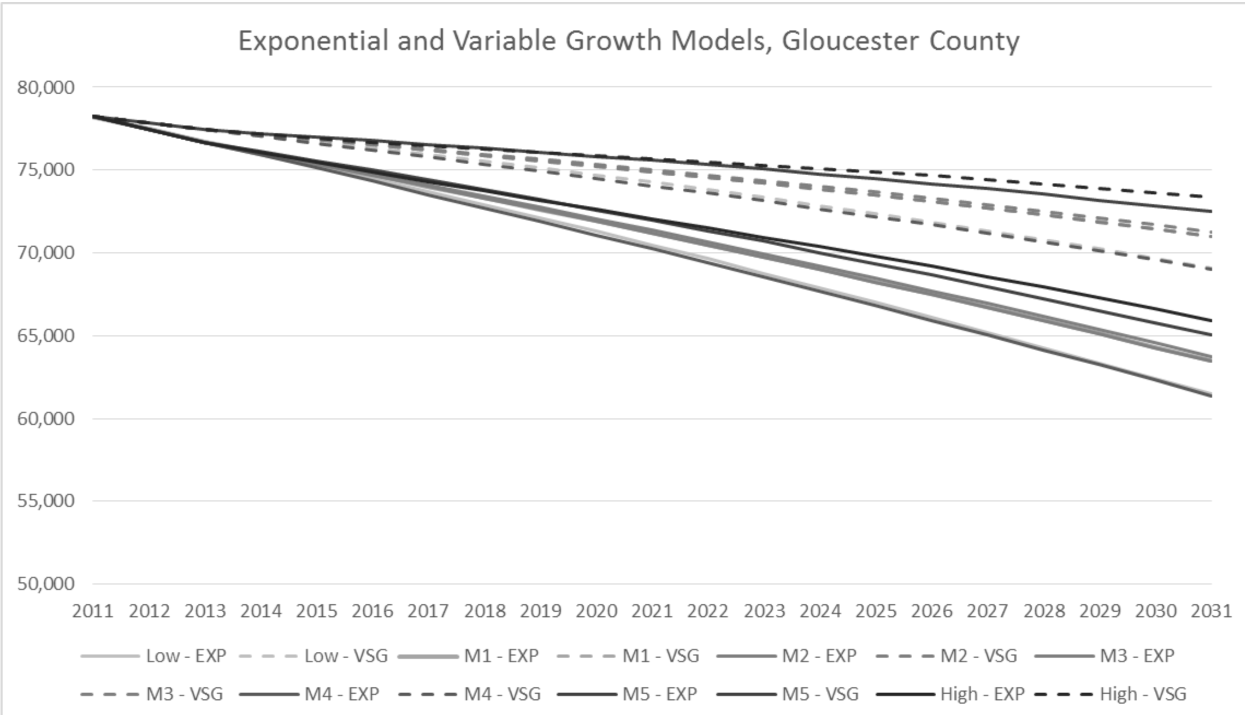


Figure 5: Scenario forecasts for exponential and variable growth models, Gloucester County.

Table 8 shows the range of potential outcomes under the various forecast scenarios for each county in New Brunswick between 2011 and 2031. For most counties, irrespective of which scenario is assumed, there is no change between either population decline or population growth. The only exception is for Saint John County, where the low-growth scenario shows a small decline, while the high-growth scenario shows a small increase – less than 1,000 persons over 20 years.

For other counties, the growth rates (positive or negative) are very small over the 20-year period. Increases or decreases of 1,000 to 2,000 persons over this time-period are not considerable. The largest declines could be seen in Northumberland, Restigouche, and Gloucester and the largest increases in Westmorland and York.

Table 8. Forecasted population change by county, 2011 – 2031.

County	Low	M1	M2	M3	M4	M5	High
Saint John	-1,235	-282	-145	-290	-1,272	450	877
Charlotte	-2,036	-1,706	-1,658	-1,708	-2,047	-1,451	-1,299
Sunbury	32	612	696	607	9	1,058	1,319
Queens	-1,352	-1,067	-1,026	-1,070	-1,361	-845	-711
Kings	1,612	3,892	4,221	3,873	1,524	5,648	6,672
Albert	1,459	2,812	3,007	2,801	1,407	3,854	4,462
Westmorland	10,401	18,766	19,974	18,697	10,076	25,214	28,974
Kent	-1,878	-1,639	-1,605	-1,641	-1,886	-1,457	-1,348
Northumberland	-4,855	-3,915	-3,779	-3,923	-4,885	-3,187	-2,750
York	4,605	9,003	9,638	8,967	4,434	12,392	14,368
Carleton	-1,249	-1,159	-1,146	-1,160	-1,252	-1,091	-1,051
Victoria	-2,269	-1,804	-1,737	-1,808	-2,284	-1,442	-1,224
Madawaska	-3,908	-3,099	-2,981	-3,105	-3,935	-2,468	-2,088
Restigouche	-5,313	-4,097	-3,919	-4,107	-5,352	-3,138	-2,556
Gloucester	-9,144	-7,246	-6,970	-7,261	-9,205	-5,766	-4,876
New Brunswick	-15,130	9,070	12,570	8,870	-16,030	27,770	38,770

Growth over the next 20 years will likely be concentrated in Westmorland and York Counties, irrespective of which scenario occurs. It is important to note that the largest contributor to differences in population change are from migration and immigration. As the scenarios are based on historic rates, the outcomes vary depending on which period will be more reflective of future growth. Given the long-term historic fluctuations in migration and immigration to and from New Brunswick, we can expect this to continue.

3.2 Population forecasts for alternate geographies

One of the strengths of this project is the ability to produce population forecasts for a range of different geographic definitions. The primary results above refer to New Brunswick counties. Below, summary results are presented for Health Zones and Health Council communities. Additional forecasts were produced for Provincial Electoral Districts and Regional Service Commission Areas, with the results provided in supplementary tables.

Table 9. Forecast population change by Health Zone, 2011 – 2031.

Health Zone	Low	M1	M2	M3	M4	M5	High
Moncton	8,953	19,503	21,025	19,415	8,541	27,621	32,348
Fundy Shore	-2,200	210	558	190	-2,293	2,061	3,140
Fredericton	1,843	6,945	7,681	6,903	1,644	10,869	13,155
Madawaska	-5,350	-4,004	-3,808	-4,015	-5,393	-2,954	-2,320
Restigouche	-4,590	-3,312	-3,124	-3,322	-4,630	-2,298	-1,679
Bathurst	-8,806	-6,554	-6,227	-6,573	-8,878	-4,796	-3,733
Miramichi	-4,981	-3,719	-3,535	-3,729	-5,021	-2,734	-2,139
New Brunswick	-15,130	9,070	12,570	8,870	-16,030	27,770	38,770

The forecasted population change by Health Zone is presented in table 9. These results are similar to those by County, where growth is concentrated in Moncton and Fredericton, with limited change along the Fundy Shore and population decline across the remainder of the province.

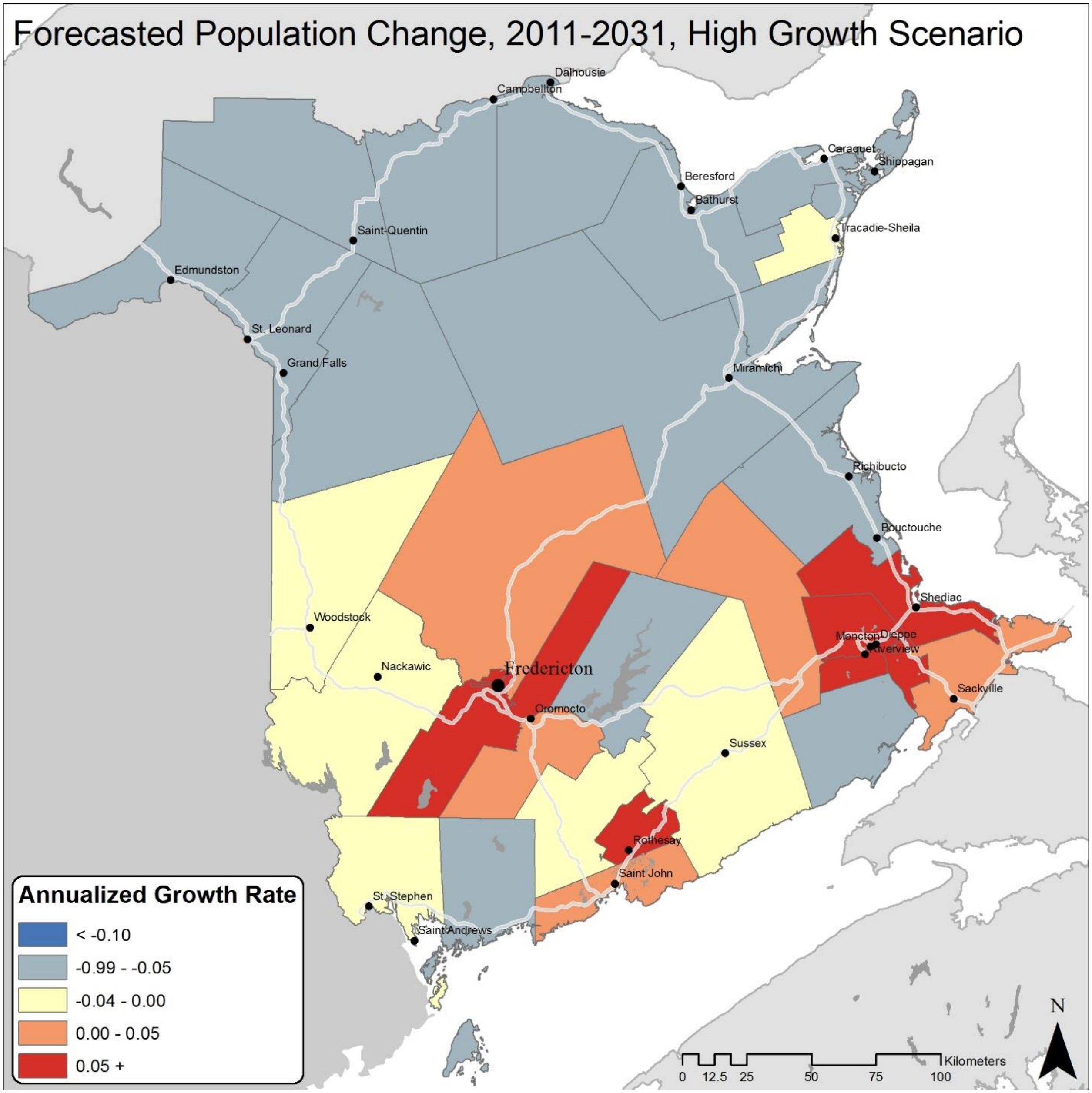
Table 10. Forecast population change by Health Council community, 2011 – 2031.

Community	Low	M1	M2	M3	M4	M5	High
Kedgwick	-828	-654	-629	-656	-834	-518	-435
Campbellton	-1,971	-1,552	-1,491	-1,556	-1,984	-1,224	-1,025
Dalhousie	-2,706	-2,108	-2,021	-2,113	-2,725	-1,636	-1,348
Bathurst	-3,667	-2,967	-2,866	-2,973	-3,689	-2,425	-2,098
Caraquet	-2,398	-1,878	-1,802	-1,882	-2,415	-1,468	-1,219
Shippegan	-2,286	-1,800	-1,730	-1,804	-2,301	-1,420	-1,189
Tracadie-Sheila	-728	-666	-657	-667	-730	-619	-592
Neguac	-1,077	-862	-831	-864	-1,084	-694	-593
Miramichi	-4,128	-3,330	-3,214	-3,336	-4,153	-2,710	-2,336
Bouctouche	-1,781	-1,474	-1,430	-1,477	-1,791	-1,238	-1,096
Salisbury	-107	-9	5	-10	-110	66	110
Shediac	**562**	**1,437**	**1,563**	**1,430**	**528**	**2,111**	**2,504**
Sackville	-201	-76	-59	-77	-205	19	74
Riverview	**2,028**	**3,470**	**3,679**	**3,458**	**1,972**	**4,582**	**5,229**
Moncton	**4,663**	**8,465**	**9,014**	**8,434**	**4,514**	**11,395**	**13,102**
Dieppe	**5,730**	**9,039**	**9,517**	**9,011**	**5,600**	**11,590**	**13,076**
Hillsborough	-637	-511	-493	-512	-641	-414	-355
Sussex	-916	-893	-890	-893	-916	-876	-866
Minto	-1,247	-991	-954	-994	-1,255	-792	-671
Saint John	-1,064	-75	67	-83	-1,102	685	1,127
Grand Bay-Westfield	-343	-305	-299	-305	-344	-276	-259
Quispamsis	**2,538**	**4,556**	**4,848**	**4,539**	**2,459**	**6,111**	**7,017**
St. George	-1,122	-919	-890	-921	-1,128	-762	-668
St. Stephen	-948	-834	-818	-835	-952	-747	-695
Oromocto	-281	-48	-15	-50	-290	131	235
Fredericton	**5,328**	**9,005**	**9,536**	**8,975**	**5,185**	**11,839**	**13,490**
New Maryland	**872**	**1,806**	**1,941**	**1,798**	**835**	**2,525**	**2,944**
Nackawic	-738	-643	-630	-644	-742	-571	-527
Douglas	-124	132	169	130	-134	329	443
Florenceville-Bristol	-1,283	-1,194	-1,182	-1,195	-1,285	-1,128	-1,088
Perth-Andover	-1,507	-1,188	-1,141	-1,190	-1,517	-937	-785
Grand Falls	-1,924	-1,549	-1,495	-1,552	-1,936	-1,258	-1,082
Edmunston	-2,840	-2,310	-2,234	-2,315	-2,857	-1,900	-1,653
New Brunswick	-15,130	9,070	12,570	8,870	-16,030	27,770	38,770

The forecasted population change by Health Council community (Table 10) are more variable than for larger geographic areas and thus need to be interpreted with more caution. However, these geographically disaggregated results provide some important insight into where growth and decline may occur over the medium term. The most notable difference is that Shediac has emerged as a potential area for growth over the next 20 years, with positive population change irrespective of the scenario. Other areas that could see moderate growth are Sackville, Saint John, Oromocto, and Douglas.

Map 6 shows the forecasted population change for Health Council communities under the High Growth scenario. This scenario uses migration rates averaged over the 1991-2011 period, thus minimising the variation in internal and external migration patterns that are exhibited at the provincial level.

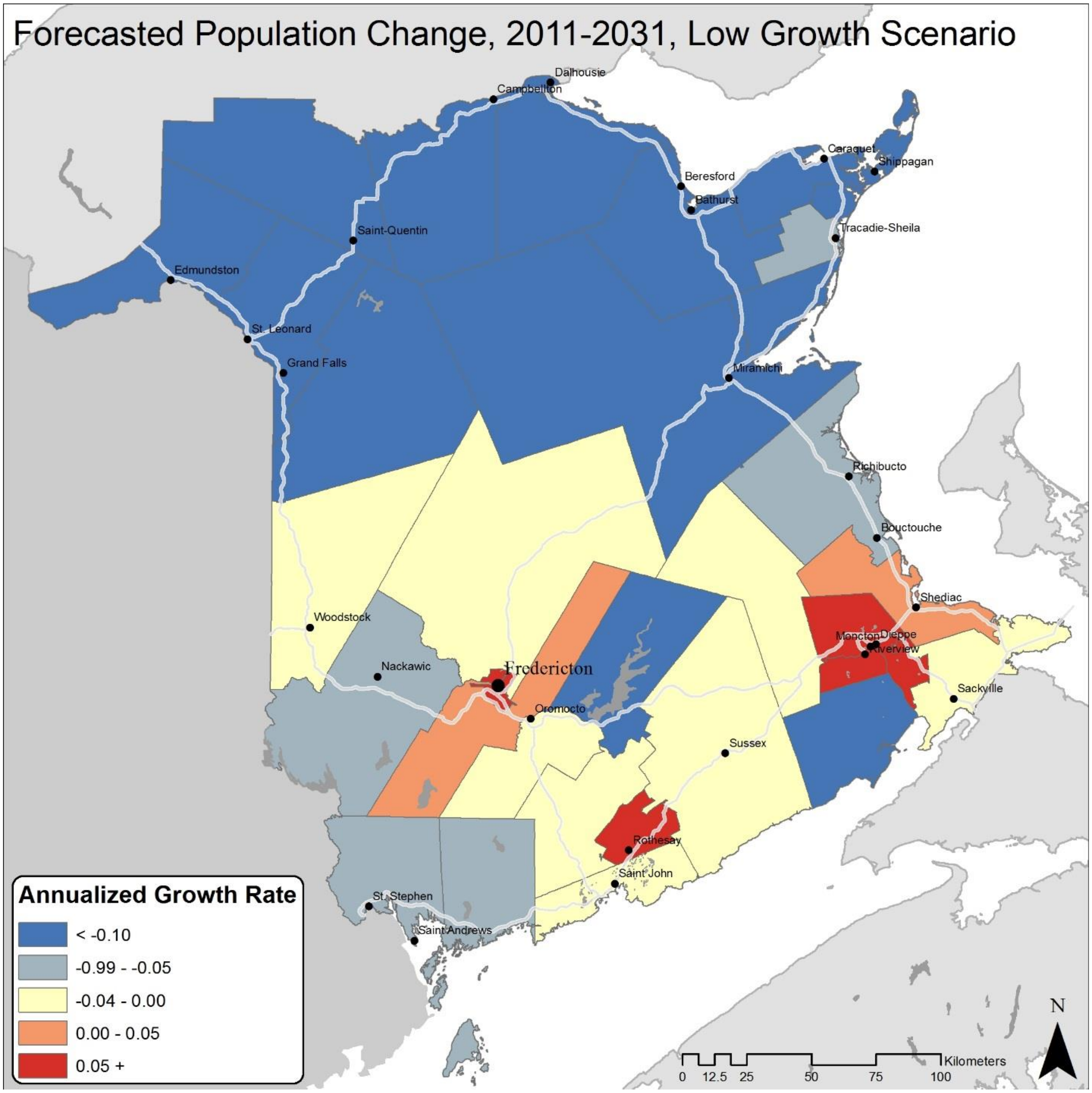
Map 6: High growth scenario by Health Council community, 2011 – 2031.



The results by Health Council communities show a wider range of population change by small geographic area. From this, it is apparent that much of the local population change can be considered regional redistribution, where population decline in one area is counter-balanced by population growth in another. Most of these shifts are occurring between the north of the province and the cities of Moncton / Dieppe and Fredericton. The largest declines are between the Northeast of the province and the southeast.

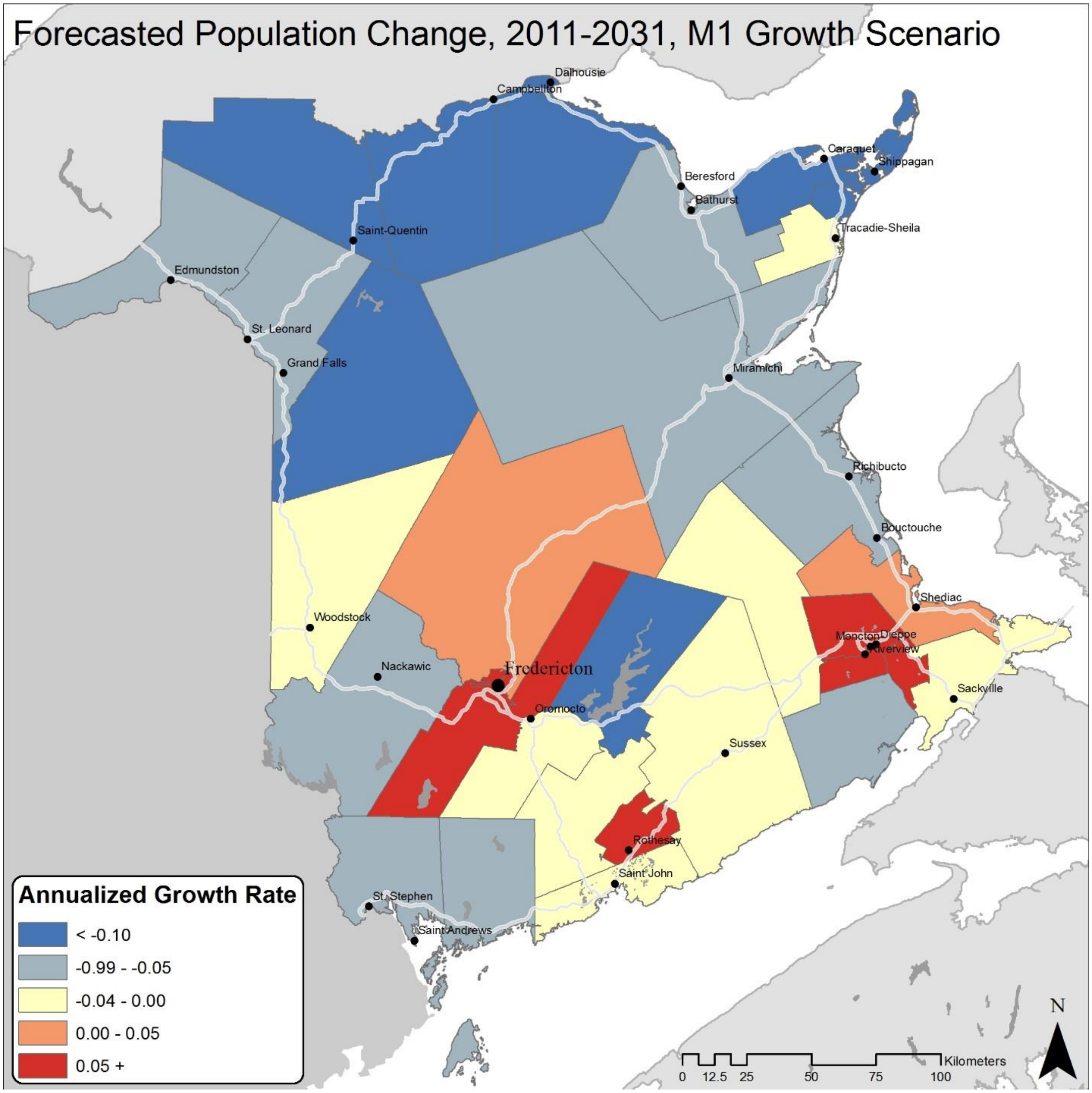
Map 7 shows the forecasts under the low-growth scenario by Health Council communities. As is evident in comparison to the high-growth scenario, much of the province is at risk of experiencing continued long-term population decline. Under this scenario, only 7 of the 33 communities would experience a population increase, with the majority of the province experiencing population decline. This scenario is a useful comparison in contrast to the high-growth as it uses the same migration assumptions, where migration is averaged across the 1991 through 2011 period. Thus, the only elements that change between these two are fertility, mortality, and immigration.

Map 7: Low growth scenario by Health Council community, 2011 – 2031.



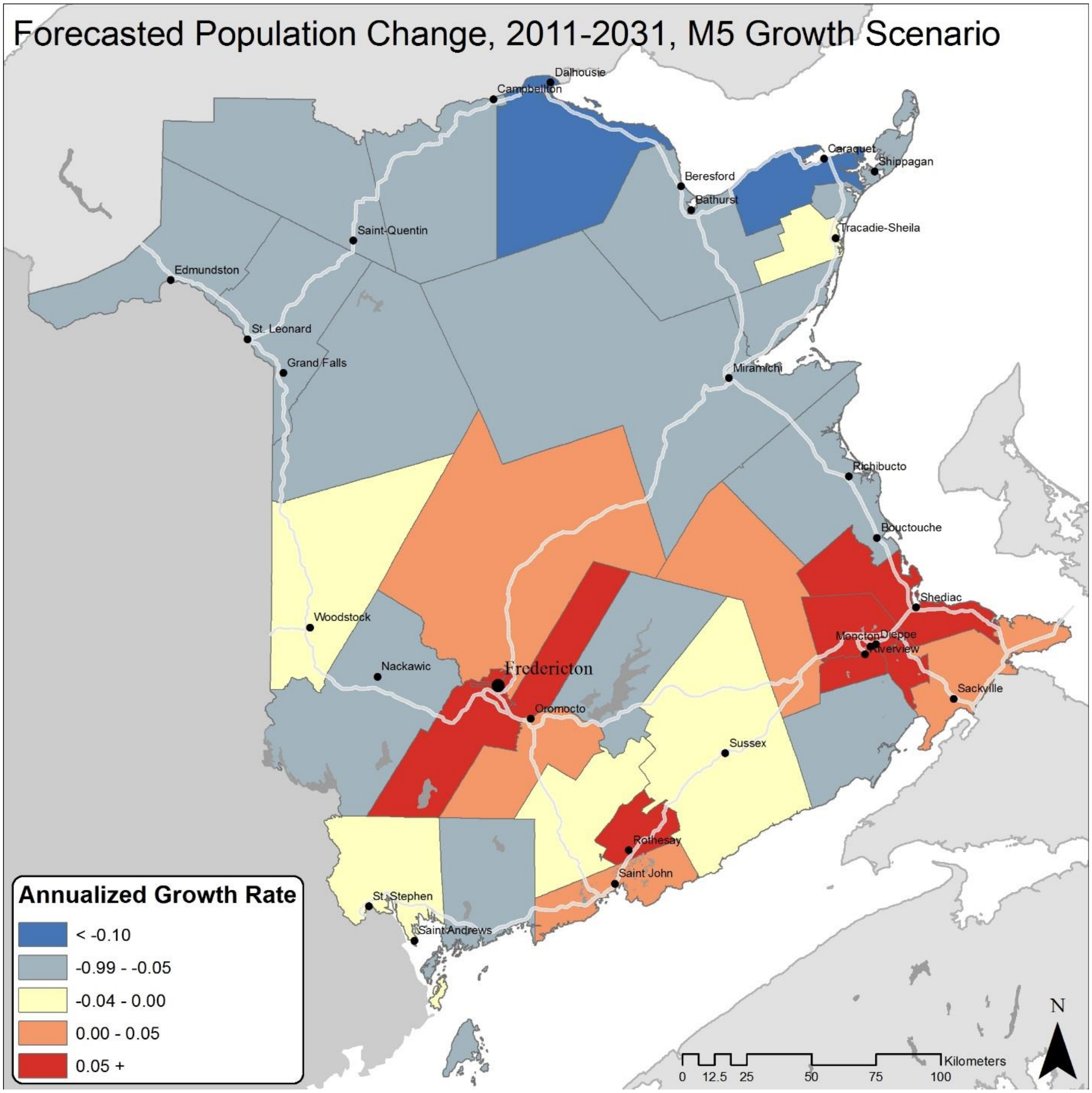
The scenario presented in Map 8 shows a medium-growth scenario, where migration is also averaged over the 1991-2011 period. Thus, this map is similar to the high and low growth scenarios except for fertility, mortality, and international immigration. Under these conditions, 9 communities would experience some growth over the 20-year period, although all growth would remain in the areas surrounding Fredericton, Moncton, and Saint John.

Map 8: Medium (M1) growth scenario by Health Council community, 2011 – 2031.



The final scenario presented here is the medium-growth, M5 scenario, which considers medium growth where migration patterns are similar to those experienced in the 2009-2011 period. This is significant for New Brunswick, as this period was a shortened period of return-migration following the 2008 financial crisis and down-turn in the Alberta economy. This "bust" period where there was a slowdown in resource extraction resulted in a slowing of inter-provincial out-migration and an increase in inter-provincial in-migration. As such, it is illustrative of the potential that exists if total out-migration is reduced and in-migration is moderately increased.

Map 9: Medium (M5) growth scenario by Health Council community, 2011 – 2031.



3.3 Summary of simplified small-area models

Simplified small-area models provide a quick and reliable means to estimate population change across New Brunswick. The primary advantage of this method is that it only relies on only population totals and secondary population estimates. Despite this, these models are shown to be flexible in that they provide a range of outcomes when combined with external growth scenarios.

The total population of New Brunswick is forecasted to grow only moderately in the next decades. Based on historic trends, growth has been slow and prone to a high degree of local-level fluctuation. Population increases are concentrated in only a few regions. At higher levels of geography, only the areas surrounding Fredericton and Moncton show potential for growth. A narrower focus suggests that areas such as Shediac, Sackville, St. John, Oromocto, and Douglas represent opportunities for population growth. However, the majority of the province is likely facing a continued gradual decline. The range of scenarios presented does little to change predicted declines.

4. Small-area cohort component forecasts

In the second phase of this project, a cohort-component model was developed that accounts for directional migration between New Brunswick regions and for independently varying, small-area differences in fertility and mortality rates. The scenarios generated via these models use person-level administrative data from the New Brunswick Citizen Database, Vital Statistics, and growth rates derived from regional observations. The advantages of this approach include the flexibility in modelling, where new scenarios can be generated quickly, the use of provincial administrative data that correspond to the population on an annual basis, and the use of rates derived from the range of possibilities within the province.

Building on the findings above, the components of population change will be examined in more detail through a series of cohort-component models. First, a set of base models are presented that reflect the range of possible growth outcomes as observed from the administrative micro-data. Second, these results are constrained to the external population change scenarios from Statistics Canada. This allows for small-area variation in growth rates, while limiting population change to the overall predicted values for New Brunswick. Third, inter-provincial migration and immigration are isolated and the potential effect that these rates would have on overall population change is examined. Fourth, the forecasted shift in the age-sex distribution is examined for the primary forecasts.

Results are presented here at the county and the Health Council community levels. Other geographic aggregations were also calculated.

4.1 Population change by county

The initial cohort-component models developed examine how forecasted population change would differ depending on the input rates. For these scenarios, four primary models are presented: low, baseline, median, and high (Table 11). In the low model, all component rates are set to the lowest regional rate. For the baseline model, all small-area rates are set to their calculated values from the administrative data. In the median model, the rates are calculated as the median rate observed across all areas. In the high model, the highest rate from each area is used. Together, these four scenarios provide a set of forecasts that fall within the range of observed values.

Table 11. Unconstrained population change, by scenario, by county, 2006 - 2036.

County	Low	Baseline	Median	High
Saint John	3,165	4,851	7,118	11,761
Charlotte	826	1,800	2,202	3,814
Sunbury	4,015	16,633	5,629	7,542
Queens	-1,045	764	-619	-119
Kings	5,657	21,475	9,330	13,628
Albert	1,584	8,577	3,043	4,752
Westmorland	5,775	12,425	12,412	20,197
Kent	-454	581	897	2,481
Northumberland	601	-703	3,004	5,811
York	6,127	14,132	10,892	16,493
Carleton	1,777	4,936	3,266	5,015
Victoria	1,066	2,520	2,172	3,482
Madawaska	-10	-1,798	1,478	3,224
Restigouche	-569	-1,403	928	2,691
Gloucester	-1,385	-8,169	1,867	5,656

The forecasted population change across the four scenarios (Table 11) is predicted to be moderate for most counties. In the low-growth scenario, Queens, Kent, Madawaska, Restigouche, and Gloucester Counties are predicted to have population declines. Under the high rate scenario, only Queens County will have some population decline. In all scenarios, Sunbury, Kings, Westmorland, York, and Carleton Counties will have population growth, with the largest growth occurring in Kings, Westmorland, and York Counties.

Table 12. Unconstrained rates of change, by scenario, by county, 2006 - 2036.

County	Low	Baseline	Median	High
Saint John	0.04	0.06	0.09	0.16
Charlotte	0.03	0.07	0.08	0.14
Sunbury	0.18	0.73	0.25	0.33
Queens	-0.09	0.06	-0.05	-0.01
Kings	0.09	0.33	0.14	0.21
Albert	0.06	0.31	0.11	0.17
Westmorland	0.05	0.10	0.10	0.16
Kent	-0.01	0.02	0.03	0.08
Northumberland	0.01	-0.01	0.06	0.11
York	0.07	0.16	0.13	0.19
Carleton	0.07	0.18	0.12	0.19
Victoria	0.05	0.12	0.10	0.17
Madawaska	0.00	-0.05	0.04	0.09
Restigouche	-0.02	-0.04	0.03	0.08
Gloucester	-0.02	-0.10	0.02	0.07

When the rates of change (Table 12) are considered, rather than just the predicted values of population change, a different picture of population dynamics is presented. The largest growth rates appear in Sunbury and Kings Counties. Most counties have only moderate growth rates between 0.03 and 0.10 with little variation between scenarios. Where there is greater variation between scenarios, it is suggestive of a high degree of variability in the underlying data, particularly for migration rates. These rates tend to fluctuate over time, and the lowest observed rate may be considerably different from the highest. In contrast, fertility and mortality are relatively stable over time and therefore observed differences are likely not large.

Table 13. Constrained population change, by scenario, by county, 2006 - 2036.

County	Low	M1	M2	M3	M4	M5	High
Saint John	-1,810	1,653	2,124	1,653	-1,780	4,167	5,897
Charlotte	-970	254	420	254	-965	1,146	1,760
Sunbury	2,638	3,839	4,002	3,839	2,652	4,704	5,304
Queens	-1,879	-1,410	-1,347	-1,410	-1,877	-1,071	-835
Kings	1,247	4,421	4,850	4,421	1,277	6,715	8,294
Albert	-273	1,017	1,193	1,017	-264	1,955	2,599
Westmorland	-2,789	3,117	3,918	3,117	-2,732	7,394	10,335
Kent	-2,666	-1,305	-1,124	-1,305	-2,655	-322	357
Northumberland	-2,871	-609	-302	-609	-2,852	1,030	2,151
York	434	4,522	5,077	4,522	469	7,483	9,524
Carleton	14	1,284	1,453	1,284	26	2,205	2,836
Victoria	-318	651	784	651	-309	1,356	1,842
Madawaska	-2,454	-942	-741	-942	-2,436	150	896
Restigouche	-2,999	-1,502	-1,299	-1,502	-2,988	-413	333
Gloucester	-7,115	-3,690	-3,220	-3,690	-7,081	-1,207	502

Table 13 shows the forecasted scenarios of population change, constrained to the seven scenarios generated by Statistics Canada. Underlying these scenarios are the baseline rates observed from the New Brunswick microdata (the baseline scenario in Table 11). In comparison to the unconstrained rates, the population changes are moderated between growth scenarios. Unsurprisingly, the lowest growth occurs in the low-growth scenario, where the only counties with a positive population increase are Sunbury, Kings, York, and Carleton Counties. In contrast, the only county with a negative growth in the high scenario is Queens County.

When considered as rates of change (Table 14), these differences become much smaller. For instance, in Queens County, the rates of change vary between -0.09 (M5 scenario) and -0.15 (low growth). In Sunbury County, growth rates vary between 0.11 (M5) scenario and 0.23 (high growth). These difference show that the changes in rates between scenarios is independent between counties, where for some counties the lowest growth scenario doesn’t always indicate the lowest predicted growth rate. Likewise, for some counties the highest growth scenario doesn’t necessarily translate into the highest growth rate.

Table 14. Constrained rates of change, by scenario, by county, 2006 - 2036.

County	Low	M1	M2	M3	M4	M5	High
Saint John	-0.02	0.02	0.03	0.02	-0.02	0.05	0.08
Charlotte	-0.03	0.01	0.02	0.01	-0.03	0.04	0.06
Sunbury	0.11	0.16	0.17	0.16	0.11	0.20	0.23
Queens	-0.15	-0.12	-0.11	-0.12	-0.15	-0.09	-0.07
Kings	0.02	0.06	0.07	0.06	0.02	0.10	0.12
Albert	-0.01	0.04	0.04	0.04	-0.01	0.07	0.09
Westmorland	-0.02	0.02	0.03	0.02	-0.02	0.06	0.08
Kent	-0.08	-0.04	-0.03	-0.04	-0.08	-0.01	0.01
Northumberland	-0.05	-0.01	-0.01	-0.01	-0.05	0.02	0.04
York	0.00	0.05	0.06	0.05	0.01	0.08	0.11
Carleton	0.00	0.05	0.05	0.05	0.00	0.08	0.10
Victoria	-0.01	0.03	0.04	0.03	-0.01	0.06	0.09
Madawaska	-0.07	-0.03	-0.02	-0.03	-0.07	0.00	0.03
Restigouche	-0.08	-0.04	-0.04	-0.04	-0.08	-0.01	0.01
Gloucester	-0.09	-0.04	-0.04	-0.04	-0.09	-0.01	0.01

What the above tables illustrate most is the high degree of variability in the predicted population change across geographic areas. Depending on what base rates are used, growth can vary between negative and positive values, and result in a large decrease in the population or a large increase. That said, it is important recognise that any population change that does occur will likely be driven largely by internal and inter-provincial migration rates.

4.2 Potential effects of inter-provincial migration

To examine the effects of inter-provincial migration on population change, table 15 shows the differences if only out-migration rates varied. For these scenarios, the remaining components of population change (fertility, mortality, emigration, immigration, *and* in-migration) were held constant, and only rates of out-migration varied. In the low out-migration scenario, the lowest observed out-migration rate was used for all geographic areas. In the high migration scenario, the highest observed out-migration rate was used. As such, the count reflects the net population difference between these two.

The first column in table 15 shows the forecasted population in 2036 under the low out-migration scenario. The second column shows the forecasted population under the high out-migration scenario. The last two columns show the difference between the baseline population in 2006 and the forecasted population under each scenario.

In the low out-migration scenario, the only region that would experience a small decline is Queens County, with all others experiencing an increase. The majority of the increase would go to Sunbury, Kings, Westmorland, and York Counties. Under a high out-migration scenario, Sunbury, Kings, and York Counties would see a population increase while most of the counties would see a decrease.

It is important to note that these differences are from changes to *only* out-migration rates. As such, it is the effect of only people leaving an area that is measured, with the assumption that all individuals leaving an area will be leaving the province. The conclusions that can be drawn from this relate to the degree to which overall population change is effected by shifts in out-migration to other provinces. Even in large regions such as Westmorland, which consistently shows the highest overall population growth rate, the effect of out-migration is pronounced. Within a balanced model, the in-migration and immigration rates counteract out-migration to result in population growth. The skewed out-migration model shows the degree to which this component of population change contributes to overall growth rates in small geographic areas.

Table 15. Potential effect of out-migration, by county, 2006-2036.

County	Forecasted population, Low Scenario	Forecasted population, High Scenario	Low scenario, baseline difference	High scenario, baseline difference
Saint John	83,535	73,474	5,943	-4,118
Charlotte	32,595	28,657	4,782	844
Sunbury	37,934	32,950	14,367	9,383
Queens	12,106	10,636	-48	-1,518
Kings	86,269	75,792	18,246	7,769
Albert	33,241	29,230	4,708	697
Westmorland	145,382	128,165	13,533	-3,684
Kent	34,270	30,305	1,879	-2,086
Northumberland	57,819	50,903	5,559	-1,357
York	105,266	92,457	16,307	3,498
Carleton	35,145	30,658	7,408	2,921
Victoria	24,978	21,916	3,433	371
Madawaska	37,012	32,711	1,637	-2,664
Restigouche	38,486	33,997	2,680	-1,809
Gloucester	82,410	73,215	408	-8,787

*** In this scenario, out-migration rates are set at the lowest or highest rate with all other rates set to baseline.**

Table 16 extends this analysis to examine the effect that **in-migration** would have on population change. As is clear from these numbers, the difference between the low and high in-migration scenarios is minimal. In this table, the first two columns show the forecasted population in 2036 under a baseline scenario where in-migration rates are either set to the lowest or highest observed. For instance, Kings County has a forecasted population change of 20,972 between 2006 and 2036 in the high in-migration scenario. In the low in-migration scenario this difference from baseline is only 19,807, or a difference of 1,165 persons.

Table 16. Potential effect of in-migration, by county, 2006-2036.

County	Forecasted Population, Low Scenario	Forecasted Population, High Scenario	Low Scenario, Baseline Difference	High Scenario, Baseline Difference
Saint John	80,701	81,751	3,109	4,159
Charlotte	28,404	28,767	591	954
Sunbury	39,191	39,756	15,624	16,189
Queens	12,368	12,533	214	379
Kings	87,830	88,995	19,807	20,972
Albert	36,085	36,559	7,552	8,026
Westmorland	142,545	144,360	10,696	12,511
Kent	31,701	32,085	-690	-306
Northumberland	49,568	50,189	-2,692	-2,071
York	101,027	102,352	12,068	13,393
Carleton	31,415	31,845	3,678	4,108
Victoria	23,120	23,422	1,575	1,877
Madawaska	32,148	32,534	-3,227	-2,841
Restigouche	32,972	33,375	-2,834	-2,431
Gloucester	71,011	71,826	-10,991	-10,176

*** In this scenario, in-migration rates are set at the lowest or highest rate with all other rates set to baseline.**

Comparing the results of the in-migration and out-migration scenarios, it is suggestive that out-migration plays a much greater role in the population dynamics of New Brunswick than in-migration. As well, the difference between low and high out-migration rates is large; when the highest out-migration rates are applied to regions that traditionally have lower rates, there are marked differences in the forecasted populations.

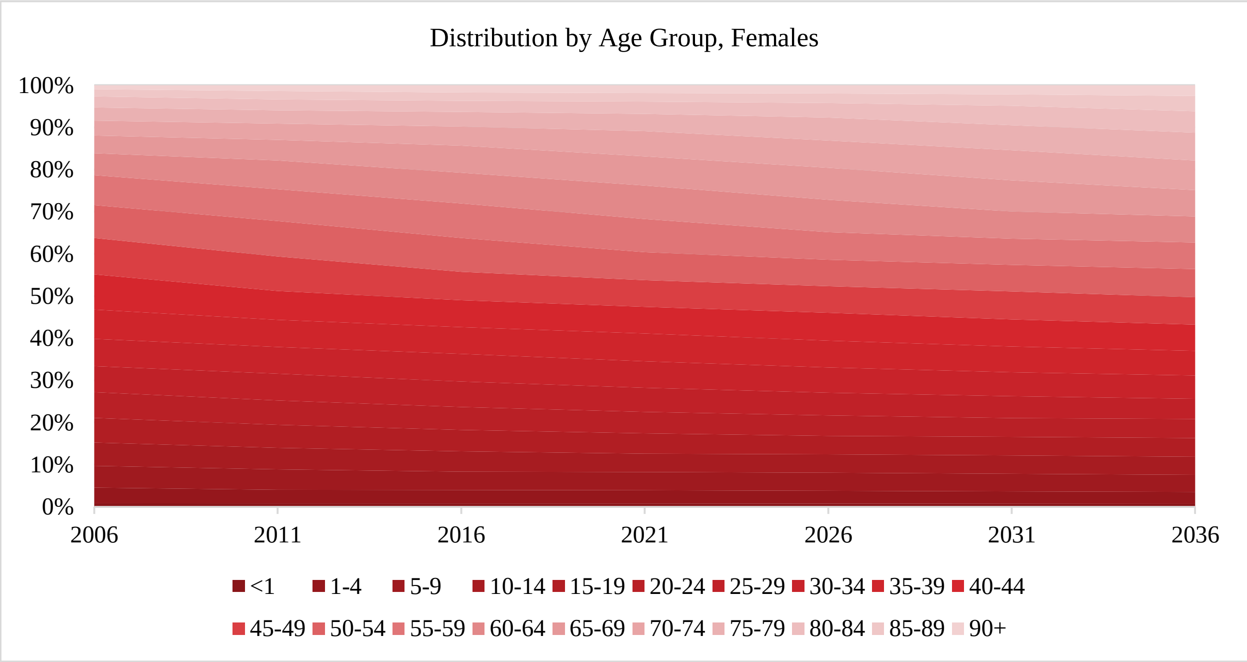
Moving from migration, the following section examines the potential shifts in the age distribution in New Brunswick.

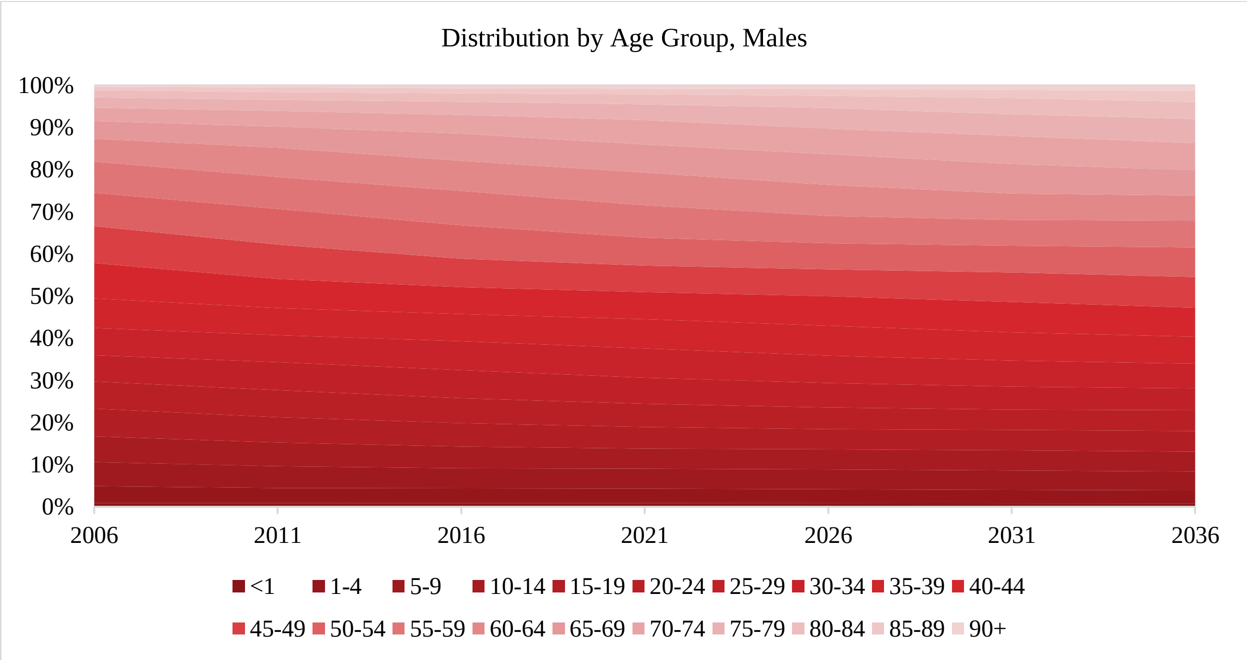
4.3 Changing age distribution

There are predicted to be large shifts in the underlying age distribution of New Brunswick. Over the last decades, dependency ratios have changed markedly, with the proportion of the population over the age of 65 increasing at a greater pace than in other Canadian provinces. Conversely, the youth dependency ratio has decreased, with a smaller proportion of the population under the age of 15.

By constructing detailed cohort-component models using administrative micro-data, it is possible to examine the potential changes in age distribution over time. Figure 6 shows the distribution of the population by broad age categories under the baseline scenario. In 2006, females over the age of 65 make up 16% of the total female population. By 2036, females over the age of 65 are predicted to be 31% of the female population. Males 65 and over make up 12.5% of the population in 2006, which is predicted to increase to 26% by 2036. For youth under the age of 15, it is predicted that they will decrease from 15% for females (17% for males) to 12% for females and 13% for males.

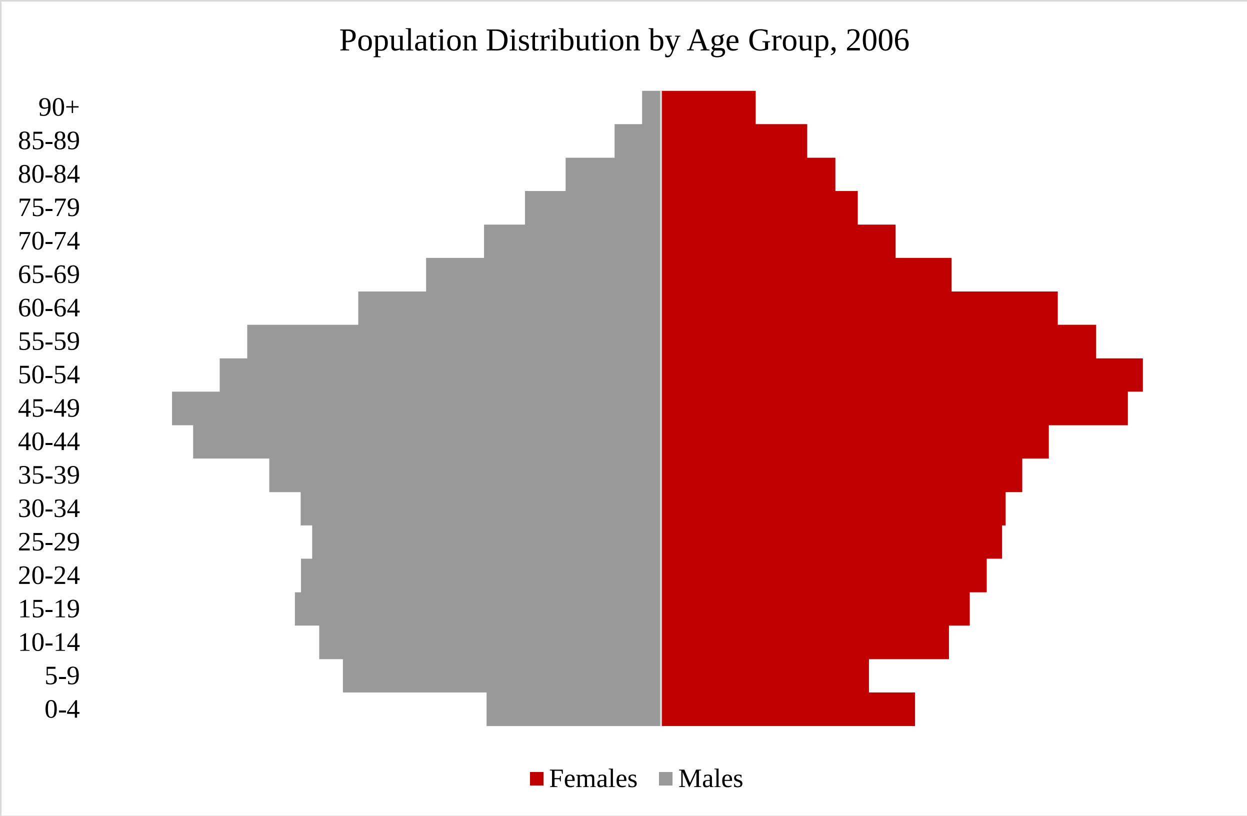
Figure 6: Distribution of forecasted population by broad age categories.

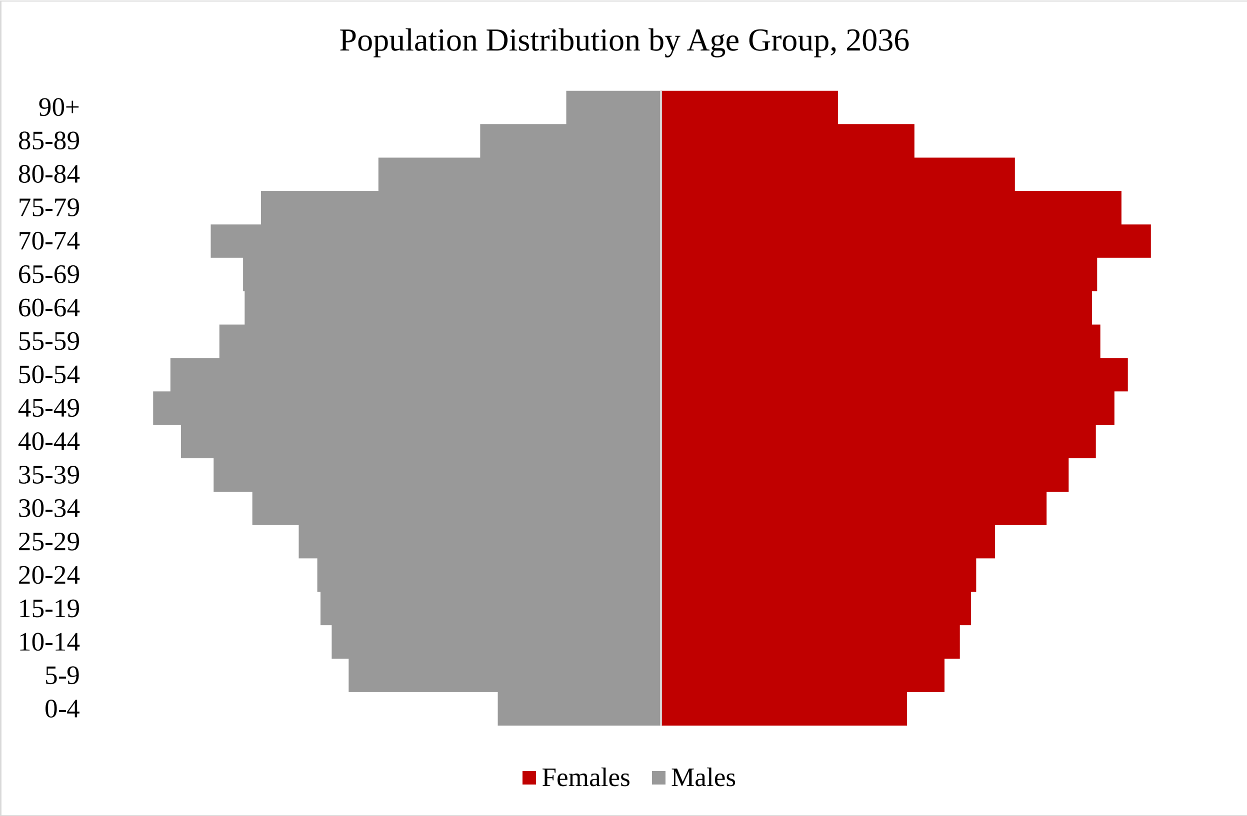




As shown in Figure 6, the age distribution of the population is forecasted to get older over time, where by 2036 there is a marked increase in the proportion of the population in the upper age groups. This is also reflected in the population pyramids constructed for 2006 and 2036 in figure 7. While more variable than those produced from the historic data, these forecasts illustrate the degree to which the New Brunswick population will continue to age over the next three decades.

Figure 7: Population pyramids for 2006 and 2036, baseline scenario.





4.4 Population change by Health Council community

This section presents the forecasted results by Health Council community. These geographic areas are instructive as they provide a more detailed view of how population may change at a more localised level.

Table 17. Unconstrained population change, by scenario, by Health Council community, 2006 - 2036.

Community	Low	Baseline	Median	High
Kedgwick	-828	-654	-629	-656
Campbellton	-1,971	-1,552	-1,491	-1,556
Dalhousie	-2,706	-2,108	-2,021	-2,113
Bathurst	-3,667	-2,967	-2,866	-2,973
Caraquet	-2,398	-1,878	-1,802	-1,882
Shippegan	-2,286	-1,800	-1,730	-1,804
Tracadie-Sheila	-728	-666	-657	-667
Neguac	-1,077	-862	-831	-864
Miramichi	-4,128	-3,330	-3,214	-3,336
Bouctouche	-1,781	-1,474	-1,430	-1,477
Salisbury	-107	-9	5	-10
Shediac	562	1,437	1,563	1,430
Sackville	-201	-76	-59	-77
Riverview	2,028	3,470	3,679	3,458
Moncton	4,663	8,465	9,014	8,434
Dieppe	5,730	9,039	9,517	9,011
Hillsborough	-637	-511	-493	-512
Sussex	-916	-893	-890	-893
Minto	-1,247	-991	-954	-994
Saint John	-1,064	-75	67	-83
Grand Bay-Westfield	-343	-305	-299	-305
Quispamsis	2,538	4,556	4,848	4,539
St. George	-1,122	-919	-890	-921
St. Stephen	-948	-834	-818	-835
Oromocto	-281	-48	-15	-50
Fredericton	5,328	9,005	9,536	8,975
New Maryland	872	1,806	1,941	1,798
Nackawic	-738	-643	-630	-644
Douglas	-124	132	169	130
Florenceville-Bristol	-1,283	-1,194	-1,182	-1,195
Perth-Andover	-1,507	-1,188	-1,141	-1,190
Grand Falls	-1,924	-1,549	-1,495	-1,552
Edmunston	-2,840	-2,310	-2,234	-2,315
New Brunswick	-15,130	9,070	12,570	8,870

Table 18. Constrained rates of change, by scenario, by Health Council community, 2006 - 2036.

Community	Low	M1	M2	M3	M4	M5	High
Kedgwick	-828	-654	-629	-656	-834	-518	-435
Campbellton	-1,971	-1,552	-1,491	-1,556	-1,984	-1,224	-1,025
Dalhousie	-2,706	-2,108	-2,021	-2,113	-2,725	-1,636	-1,348
Bathurst	-3,667	-2,967	-2,866	-2,973	-3,689	-2,425	-2,098
Caraquet	-2,398	-1,878	-1,802	-1,882	-2,415	-1,468	-1,219
Shippegan	-2,286	-1,800	-1,730	-1,804	-2,301	-1,420	-1,189
Tracadie-Sheila	-728	-666	-657	-667	-730	-619	-592
Neguac	-1,077	-862	-831	-864	-1,084	-694	-593
Miramichi	-4,128	-3,330	-3,214	-3,336	-4,153	-2,710	-2,336
Bouctouche	-1,781	-1,474	-1,430	-1,477	-1,791	-1,238	-1,096
Salisbury	-107	-9	5	-10	-110	66	110
Shediac	562	1,437	1,563	1,430	528	2,111	2,504
Sackville	-201	-76	-59	-77	-205	19	74
Riverview	2,028	3,470	3,679	3,458	1,972	4,582	5,229
Moncton	4,663	8,465	9,014	8,434	4,514	11,395	13,102
Dieppe	5,730	9,039	9,517	9,011	5,600	11,590	13,076
Hillsborough	-637	-511	-493	-512	-641	-414	-355
Sussex	-916	-893	-890	-893	-916	-876	-866
Minto	-1,247	-991	-954	-994	-1,255	-792	-671
Saint John	-1,064	-75	67	-83	-1,102	685	1,127
Grand Bay-Westfield	-343	-305	-299	-305	-344	-276	-259
Quispamsis	2,538	4,556	4,848	4,539	2,459	6,111	7,017
St. George	-1,122	-919	-890	-921	-1,128	-762	-668
St. Stephen	-948	-834	-818	-835	-952	-747	-695
Oromocto	-281	-48	-15	-50	-290	131	235
Fredericton	5,328	9,005	9,536	8,975	5,185	11,839	13,490
New Maryland	872	1,806	1,941	1,798	835	2,525	2,944
Nackawic	-738	-643	-630	-644	-742	-571	-527
Douglas	-124	132	169	130	-134	329	443
Florenceville-Bristol	-1,283	-1,194	-1,182	-1,195	-1,285	-1,128	-1,088
Perth-Andover	-1,507	-1,188	-1,141	-1,190	-1,517	-937	-785
Grand Falls	-1,924	-1,549	-1,495	-1,552	-1,936	-1,258	-1,082
Edmunston	-2,840	-2,310	-2,234	-2,315	-2,857	-1,900	-1,653
New Brunswick	-15,130	9,070	12,570	8,870	-16,030	27,770	38,770

Discussion

This report has presented a detailed analysis of population change in New Brunswick through an elaboration of small-area population forecasts using multiple methods and data sources. Population change in New Brunswick is a continued source of discussion in the Province.

The results of this report show that changes to rates of population growth are largely dependent on migration patterns. When out-migration has been low, there has been a small overall population increase. However, when out-migration is high there has been an overall population decline. While in-migration and immigration are counteracting population decline to some extent, the degree to which out-migration is effecting population dynamics in small-areas is large. As such, relevant policies for population growth will need to address concrete reasons for out-migration.

In this report we have identified several current population issues for New Brunswick:

- Forecasted population growth is only predicted in around the the cities of Moncton, Fredericton and Saint John;
- There is a continued aging of the population, with very high old-age dependency ratios; and.
- Inter-provincial out-migration is driving population change in the Province.

Opportunities to reverse the current trends of low growth, net inter-Provincial migration losses, and traditionally low immigration exist in the areas of:

1. **Address continued out-migration by**:
   a. Providing high-quality and low-cost educational opportunities for youth.
   b. Invest in cultural capital targeted towards youth and young families.
   c. Generate employment opportunities within New Brunswick, even if not within hometowns.
   d. Ensure level of government services matches that available in other Provinces.
2. **Focus on new immigration opportunities**:
   a. Providing services, training, and cultural support for new immigrants & families.
   b. Support private immigration sponsorship and family reunification schemes.