

Accessibility-Remoteness (A-R) Index Summary Paper

Newfoundland & Labrador Statistics Agency

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The Accessibility-Remoteness (A-R) index was developed by the Newfoundland and Labrador Statistics Agency (NLSA) as means to classify communities within the province according to accessibility to government and community services. Accessibility is an important factor in the development and implementation of government policies and plans to provide services to the general public. With a fragmented settlement pattern of isolated coastal outports and interior regional service hubs, the concept of accessibility in Newfoundland and Labrador is a complicated location-based measurement of the spatial distribution of public services throughout the province.

Classification of accessibility is a geographical approach that is defined in terms of the road distance between an origin community and a set of services. The focus is on the manner in which distance impedes the opportunities for interaction between people and these services. For government policy making, accessibility can play a secondary role as a replacement for the ambiguous rural-urban classification, with the highest accessible localities being the urban service hubs and the lower accessible localities the embodiment of rural Newfoundland and Labrador.

The A-R index is a statistical measure that allows communities to be evaluated in comparison to each other in terms of accessibility. Through consultation with numerous government departments the following variables were deemed important in community-service interactions:

Table 1: Community-Service Variables

Feature Variable
Travel time to primary health care
Travel time to secondary health care
Travel time to tertiary health care
Travel time to quaternary health care
Travel time to nearest supermarket
Travel time to nearest pharmacy
Travel time to nearest primary school
Travel time to nearest junior high school
Travel time to nearest high school
Travel time to nearest university-college
Travel time to nearest gas station
Daytime population of communities

All of the variables, with the exception of daytime population, are calculated based on the distance of each community to the nearest respective service. The distance measurement is based on shortest travel time between both locations using the Road Distance Database (NL-RDDb) developed by the NLSA. Figure 1 shows an example of the shortest travel route between the communities of Codroy and Channel-Port aux Basques, which contains the nearest primary health care facility. The daytime population variable is the estimated population of a community during normal business (daytime) hours. It includes increases/decreases in a community population due to daily commutes and short-term migration events, such as hospital visits.

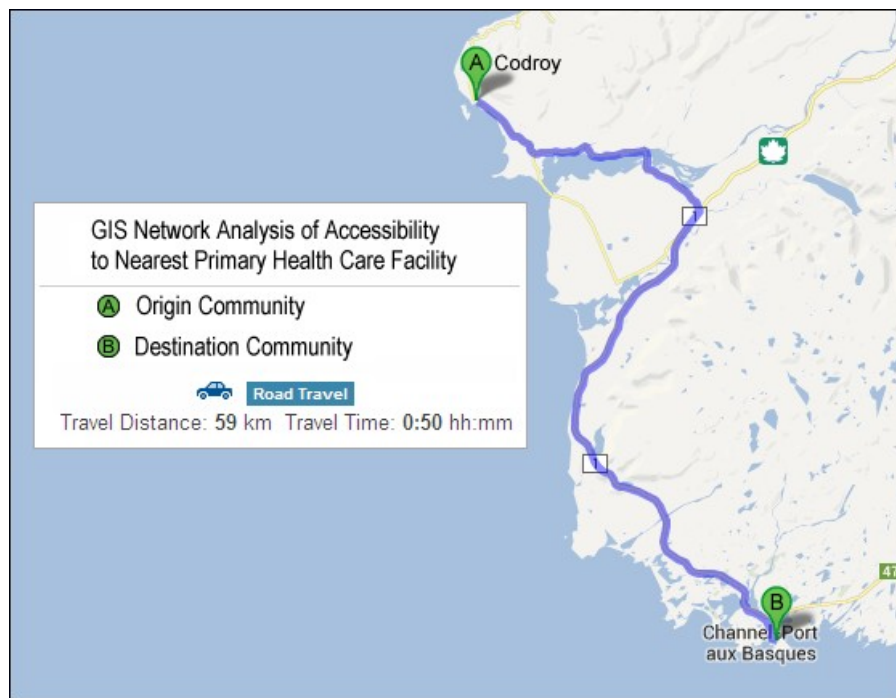


Figure 1: Example Travel to Service

An exploratory spatial data analysis was conducted to reduce the preliminary listing to a smaller set of statistically significant predictor variables. Using statistical classification techniques seven variables were selected that can be used to measure spatial accessibility in Newfoundland and Labrador (see Table 2).

Table 2: Predictor Variables

Variable
Travel time to nearest primary health care center (Hospital or Clinic)
2012 Daytime Population for Communities
Travel time that children are bused to assigned high school
Travel time to nearest supermarket
Travel time to nearest pharmacy
Travel time to nearest dental clinic (Both fixed and mobile clinics)
Travel time to nearest secondary health care facility (referral care)

The number of variables was reduced, however there was no inherent ranking assigned to the variables at this stage of the analysis. This was accomplished through a moderated session with a group of stakeholders, in which each variable was compared to each other to determine which variables are more important. This information was evaluated using a technique called Multiple Criteria Evaluation (MCE) that determines mathematically the weight of each variable’s importance relative to each other. The result of this analysis is shown in Table 3.

Table 3: Variable Weight

Rank	Variable	Weight
1	Travel time to nearest primary health care center (Hospital or Clinic)	0.393
2	2012 Daytime Population for Communities	0.232
3	Travel time that children are bused to assigned high school	0.153
4	Travel time to nearest supermarket	0.104
5	Travel time to nearest pharmacy	0.058
6	Travel time to nearest dental clinic (Both fixed and mobile clinics)	0.039
7	Travel time to nearest secondary health care facility (referral care)	0.021

The results show that the distance to the nearest primary health care centre was the most important factor in determining accessibility-remoteness of a community. This was followed by daytime population and travel time to nearest high school. To complete the A-R index each of the variables were standardized to ensure that the data ranges of the predictor variables are the same. Dividing the individual value of the community by the highest travel time in the province generates a ranking from 0 to 1 for each of the associated variables.

The next step is the computation of a single accessibility-remoteness index value for each community in the province by combining each variable value with their weights followed by a summation of the results. Mathematically, the accessibility index is calculated as:

$$A_i = \sum_{j=1}^n w_j a_{ij}, \text{ for } i = 1, 2, 3, \dots, n \quad (1)$$

where A_i is the accessibility-remoteness index value, w_j is the weight of criteria variable j , and a_{ij} is the value for community i when it is evaluated according to each criteria variable j . Each community was assigned an A-R index value that ranged from 0 to 1. The A-R index value was then categorized using natural breaks partitioning into 6 classifications, ranging from ‘Highly Accessible’ to ‘Very Remote’ (See Table 4).

Table 4 - Accessibility-Remoteness Classifications

<i>Classification</i>	<i>Access to Goods and Services</i>	<i>Percentage of Total 2011 Population</i>	<i>Example</i>
Highly Accessible	Unrestricted	68.3%	Corner Brook
Accessible	Some Restriction	15.6%	Rocky Harbour
Somewhat Accessible	Considerable Restriction	8.6%	Ferryland
Moderately Remote	Significant Restriction	4.9%	Trepassey
Remote	Very Restricted	1.5%	Port Hope Simpson
Very Remote	Little / No Access	1.2%	Nain

Communities with the highest accessibility are generally regional service centres with many government services, such as a health care centre. They also tend to have substantial increases in daytime population. Very remote communities, on the other hand, are isolated and must utilize ferry or aircraft to get to regional and provincial service centres. On a provincial scale only a small percentage (2.6%) of the total population resides in the remote and very remote areas, while 83.9% live in accessible and highly accessible localities.

The last step in the A-R index was the creation of a thematic map to aid in the visualization of accessibility and remoteness. To create the map the A-R index values were used to interpolated a continuous surface for the province. This surface would then be reclassified

according to the natural breaks used to categorize the communities in the previous step. The resulting maps are shown in Figure 2 and Figure 3.

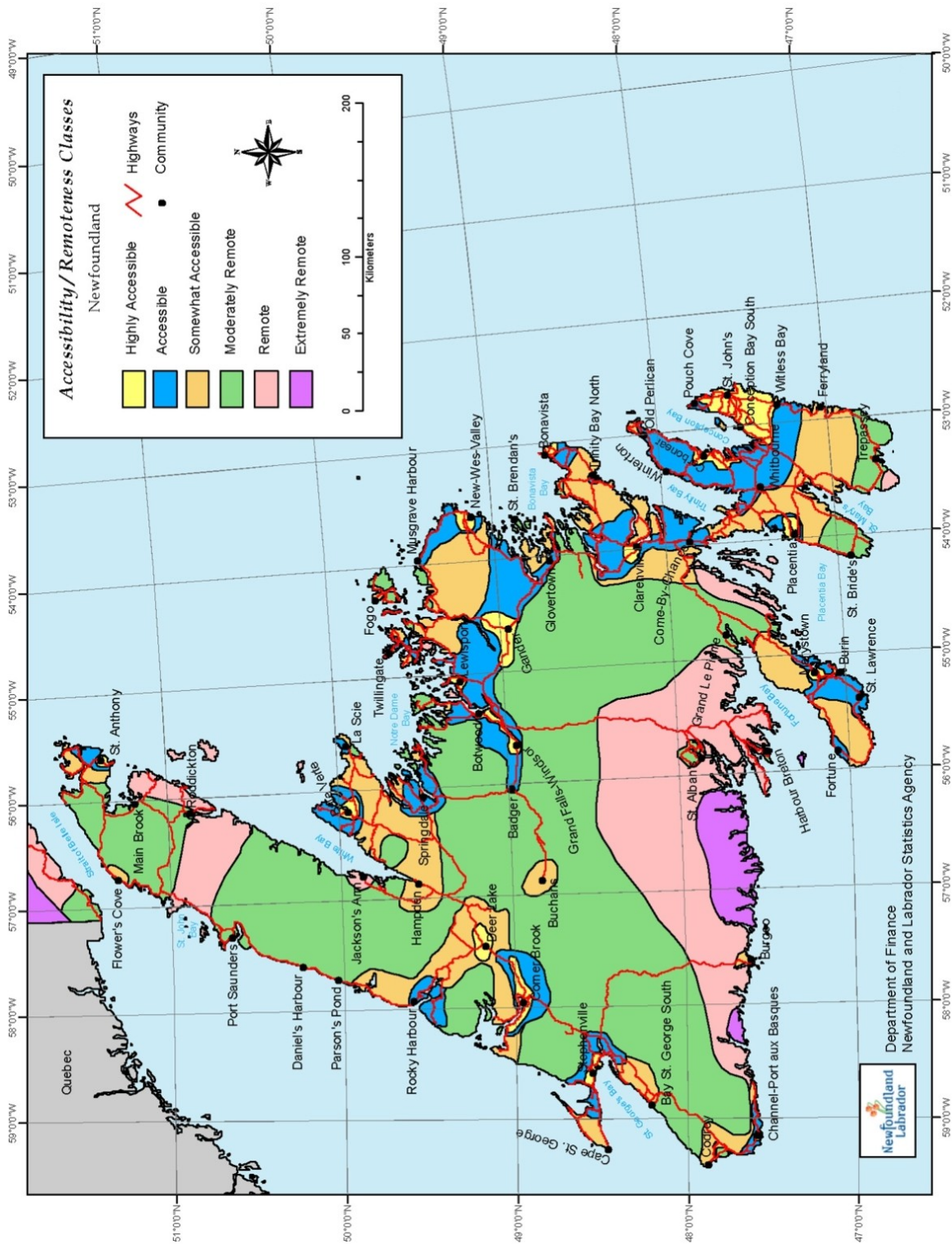


Figure 2: Accessibility-Remoteness Map for Newfoundland

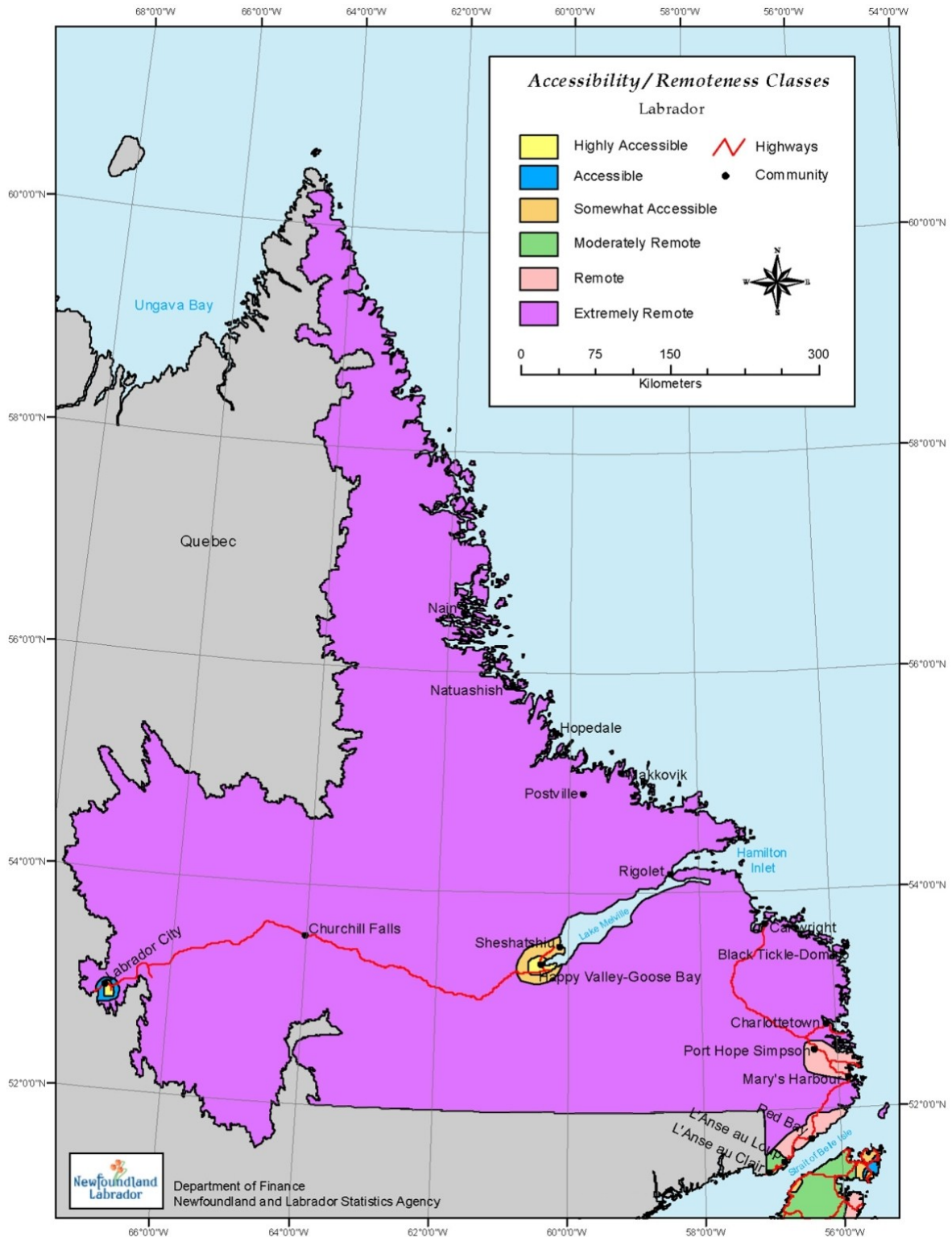


Figure 3: Accessibility-Remoteness Map for Labrador