

Impact of Bank closures on the Isle of Wight:

An ArcGIS implemented Buffer and Network Analysis.

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Abstract

This research paper presents the results of a study that used buffer analysis and network analysis to investigate the impact of bank closures on the Isle of Wight. The study used ArcGIS software to create a buffer zone around each bank branch that was open in 2014 and 2019, and analysed demographic and internet access data on the island. Network analysis was also conducted to assess the accessibility to the remaining bank branches. The results of the study showed that bank closures had negatively impacted rural, hard-pressed living, and low-income communities. Many residents living in the buffer zones experienced reduced access to banking services between 2014 and 2019, and the remaining branches were still less accessible to residents outside the buffer areas. Overall, the study highlights the need for alternative banking solutions to support the residents of the Isle of Wight, especially those living in rural areas, and the importance of considering the social and economic impacts of bank closures.

Introduction

The Isle of Wight is located off England's south coast. It is approximately 23 miles long and 13 miles wide, making it the largest island in England. It has a population of around 140,000 people. The island is roughly centred around 50.67 degrees North latitude, and 1.29 degrees West longitude. In terms of height above sea level, the highest point on the Isle of Wight is St Boniface Down, which reaches a height of 319 feet (97 meters) above sea level (Wikipedia,2023). The island is known for its beaches, coastal walks, and historical sites such as Carisbrooke Castle and Osborne House. The island is accessible by ferry from several ports on the mainland, including Southampton and Portsmouth. The island's capital is Newport. It is also a popular destination for sailing and water sports. The island is also home to several important wildlife habitats and is a designated Area of Outstanding Natural Beauty (Wikipedia,2023).

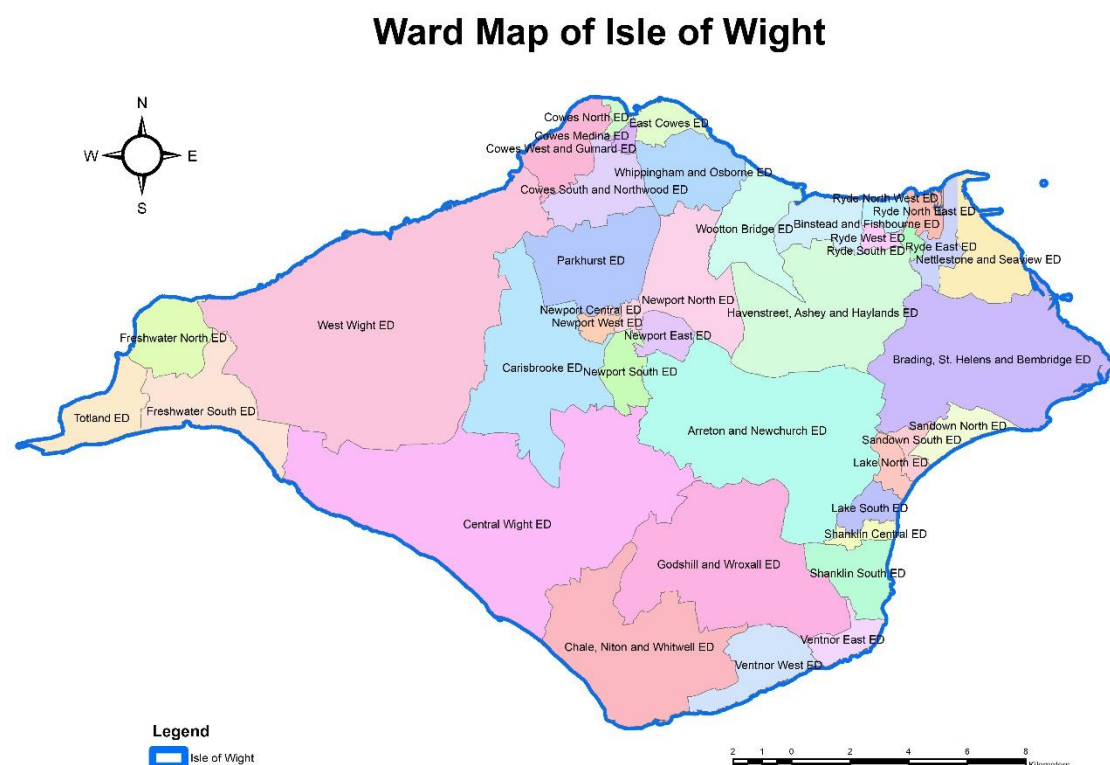


Figure 1: Map of the Isle of Wight

The Isle of Wight has several banks and building societies with branches on the island. These include national banks such as Lloyds, Barclays, and Santander and regional banks such as the Isle of Wight Building Society (Wikipedia,2023). These banks offer various services, including personal and business banking, mortgages, loans, and investments. There are also several independent financial advisors and wealth management firms based on the island. ATMs are widely available on the Isle of Wight, and most banks offer online and mobile banking services, allowing customers to manage their accounts and transactions from anywhere. There are also several credit unions based on the island, which are member-owned financial cooperatives that

offer savings and loan services to their members. These can be a good option for people who may not qualify for traditional banking services.

There has been a trend of bank branch closures across the UK in recent years, including on the Isle of Wight (Higgs *et al.*, 2022). This is mainly due to the shift towards digital banking and the increased use of online and mobile banking services, leading to fewer customers visiting branches in person. As a result, several banks have closed branches on the Isle of Wight, with some closures being permanent and others being temporary. For example, Lloyds Bank closed several branches on the island, and Barclays closed its branch in Ryde in 2018, but it needs to be clarified if it's a permanent closure or not. Despite the closures, there are still a number of bank branches on the Isle of Wight, and many of the banks that have closed branches continue to offer services through their online and mobile banking platforms. It's also worth noting that there are Post Office branches on the island that offer banking services, including cash withdrawals and deposit as well as balance enquiry and other basic banking services; it could be an alternative to bank closures.

This paper will utilize raster analysis, buffer, and network analysis to assess the impact of bank closures on the Isle of Wight.

Methodology

1.Buffer analysis flow chart:

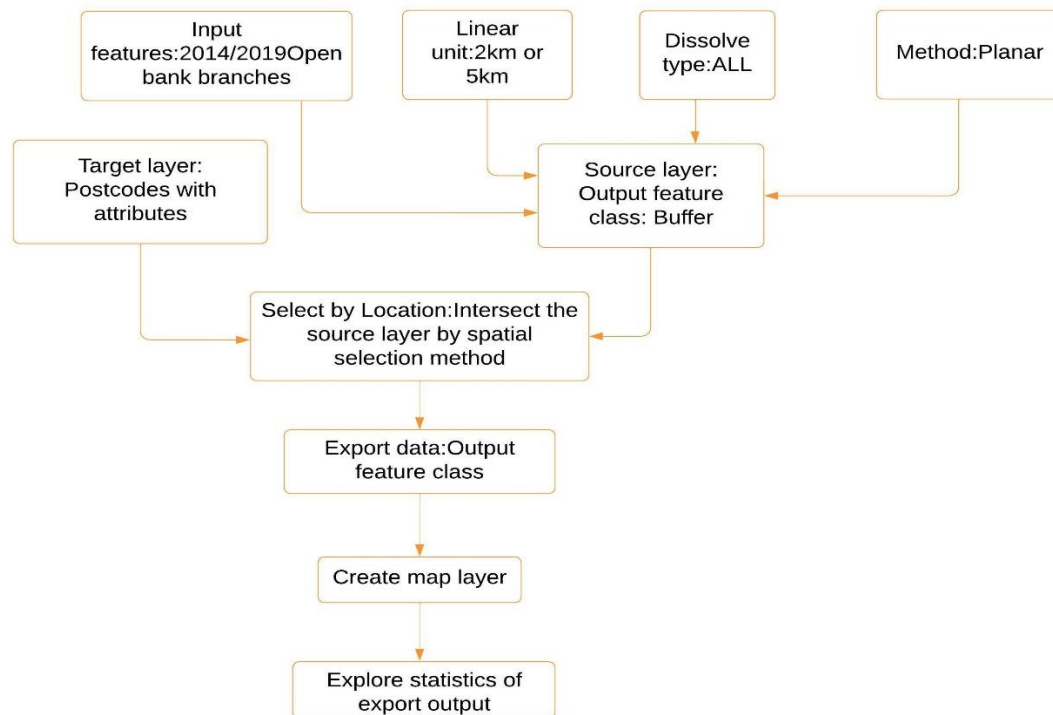


Figure 2: Flow chart showing the buffer analysis methodology

The first step in conducting a buffer analysis in ArcGIS was to acquire and prepare the necessary data. This included obtaining a point, line, or polygon feature dataset, which was obtained from a variety of sources such as government agencies, commercial providers, or open data portals. The dataset was in a format that could be read by ArcGIS, such as a shapefile or a geodatabase.

Once the necessary data was obtained, the next step was to open ArcMap and add the feature dataset to the map. Next, the "Buffer" tool, which is in the "Analysis" toolbox was used to create buffers around the features in the dataset. In the "Buffer" tool options, the buffer distance, the units of measurement and the output feature class were specified (ESRI,2023; Law and Colins,2018).

Selecting multiple features and creating multiple buffer distances around them with different distances or merging the buffers into one feature was done. Additionally, a dissolve option was set to eliminate overlapping areas in the buffer polygons (Oliver *et al.*,2007). The results of the analysis were displayed on the map, including the buffer polygons. The buffer was displayed as a polygon feature.

2. Network Analysis flow chart:

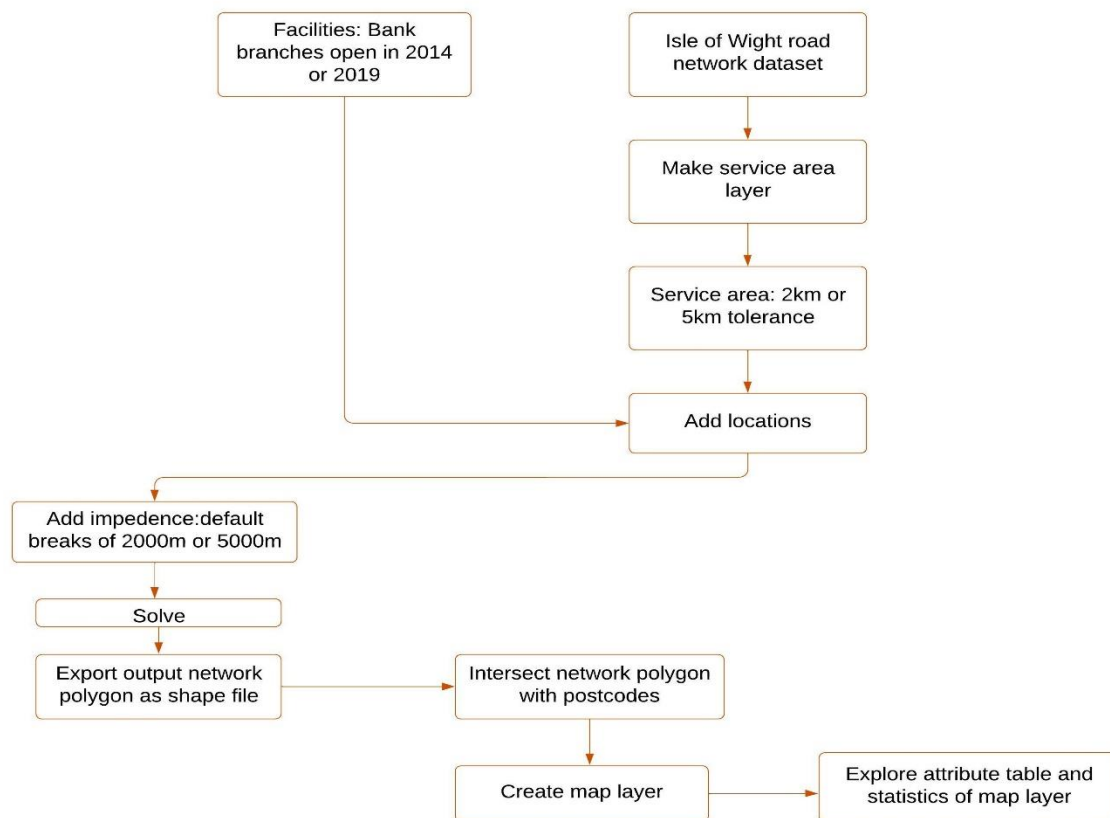


Figure 3: Flow chart showing the Network analysis methodology.

The first step in conducting a road service area analysis in ArcGIS was to acquire and prepare the necessary data. This included obtaining a road network dataset. Once the required data was obtained, the next step was to open ArcMap and add the road network dataset to the map. The ArcGIS Network Analyst extension, which provides the tools for performing network analysis, was enabled by clicking on the "Customize" menu, then "Extensions," and checking the "Network Analyst" option (ESRI,2023, Law and Collins,2018).

With the Network Analyst extension enabled, a new service area analysis layer was created by clicking on the "Network Analyst" button in the toolbar and selecting "New Service Area." In the "Service Area Properties" window, I specified the network dataset to be used for the analysis and other settings, such as the impedance attribute, which defined the cost of traversing the network and the travel direction.

The next step was to add facilities to the service area analysis layer. Facilities are the starting points for the service area analysis and can be added using a point feature class or by manually clicking on the map (Oliver *et al.*,2007). Once the facilities were added, I used the "Solve" button to calculate the service area around each facility, taking into account the network connectivity and other settings specified.

The results of the analysis were displayed on the map, including the service area polygons and any associated information, such as the drive distance. The service area was displayed as a polygon feature.

Results

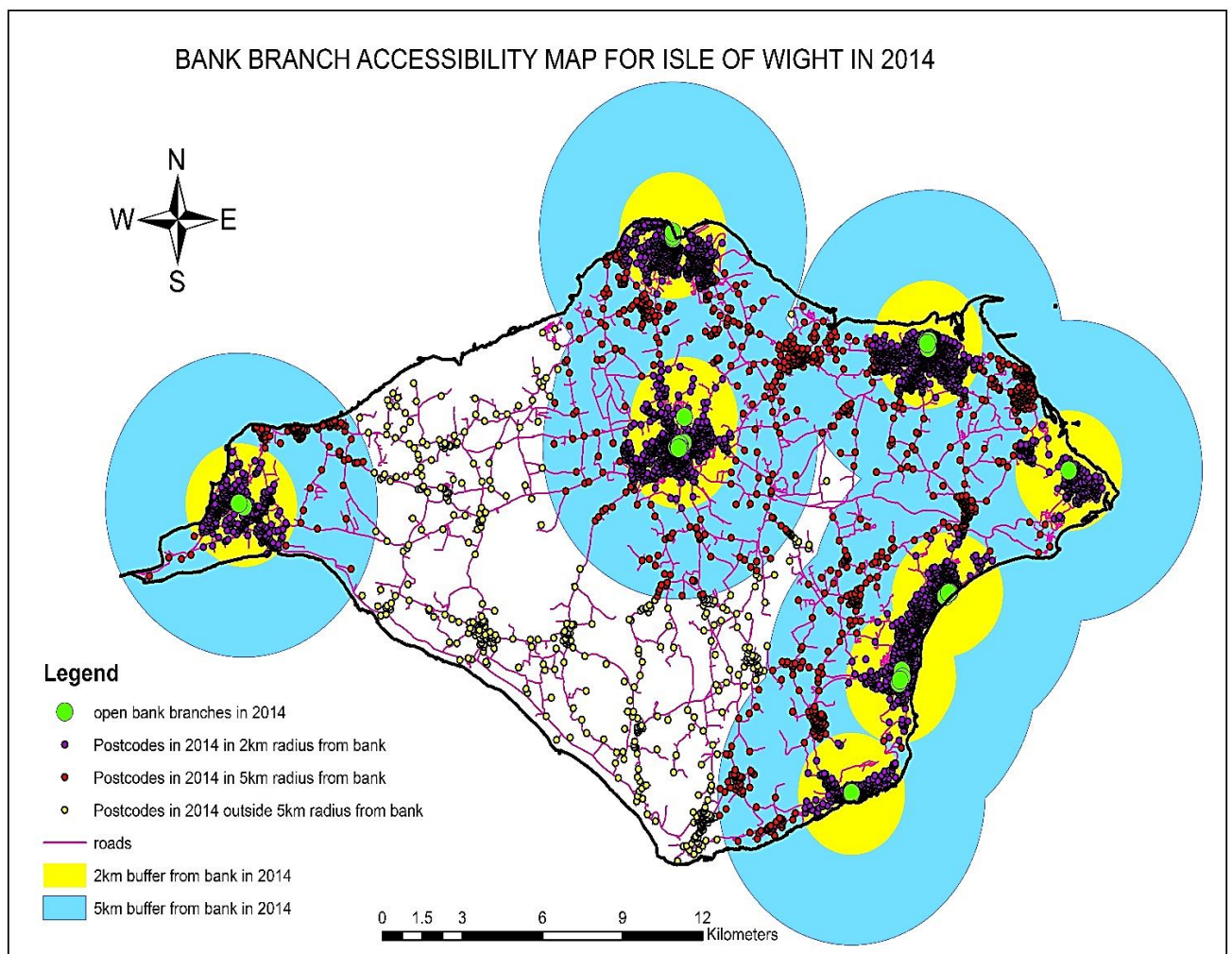


Figure 4: Map showing bank branch accessibility in 2014 using buffer analysis. Buffer analysis shows that there are 106,365 people within the 2km buffer from a bank branch and there are 129,540 people within 5km buffer from a bank branch. 8,725 people are outside the buffer zones.

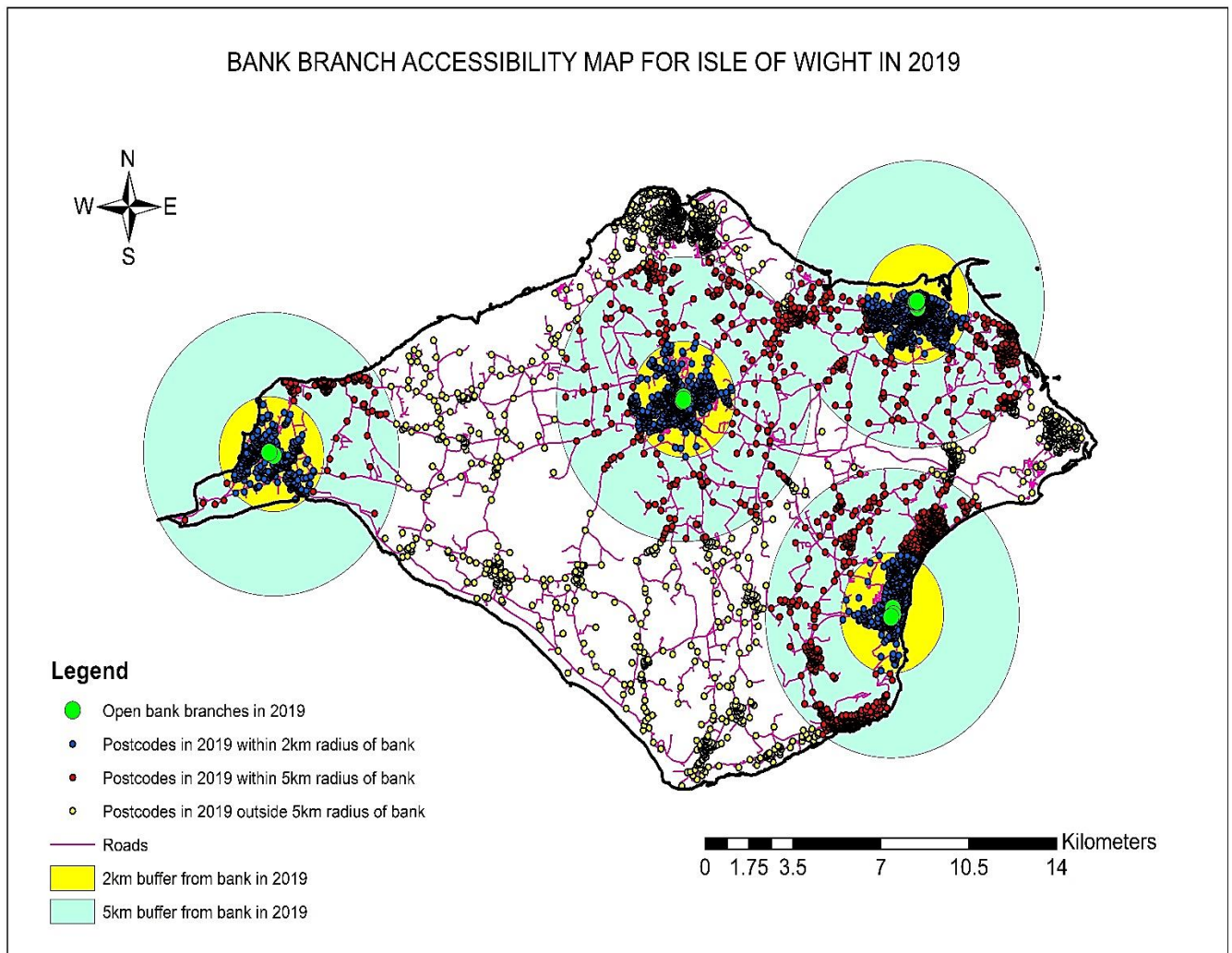


Figure 5: Map showing bank branch accessibility in 2019 using buffer analysis. Buffer analysis shows that there are 66,746 people within the 2km buffer from a bank branch and there are 101,644 people within 5km buffer from a bank branch. 36,621 people are outside the buffer zones.

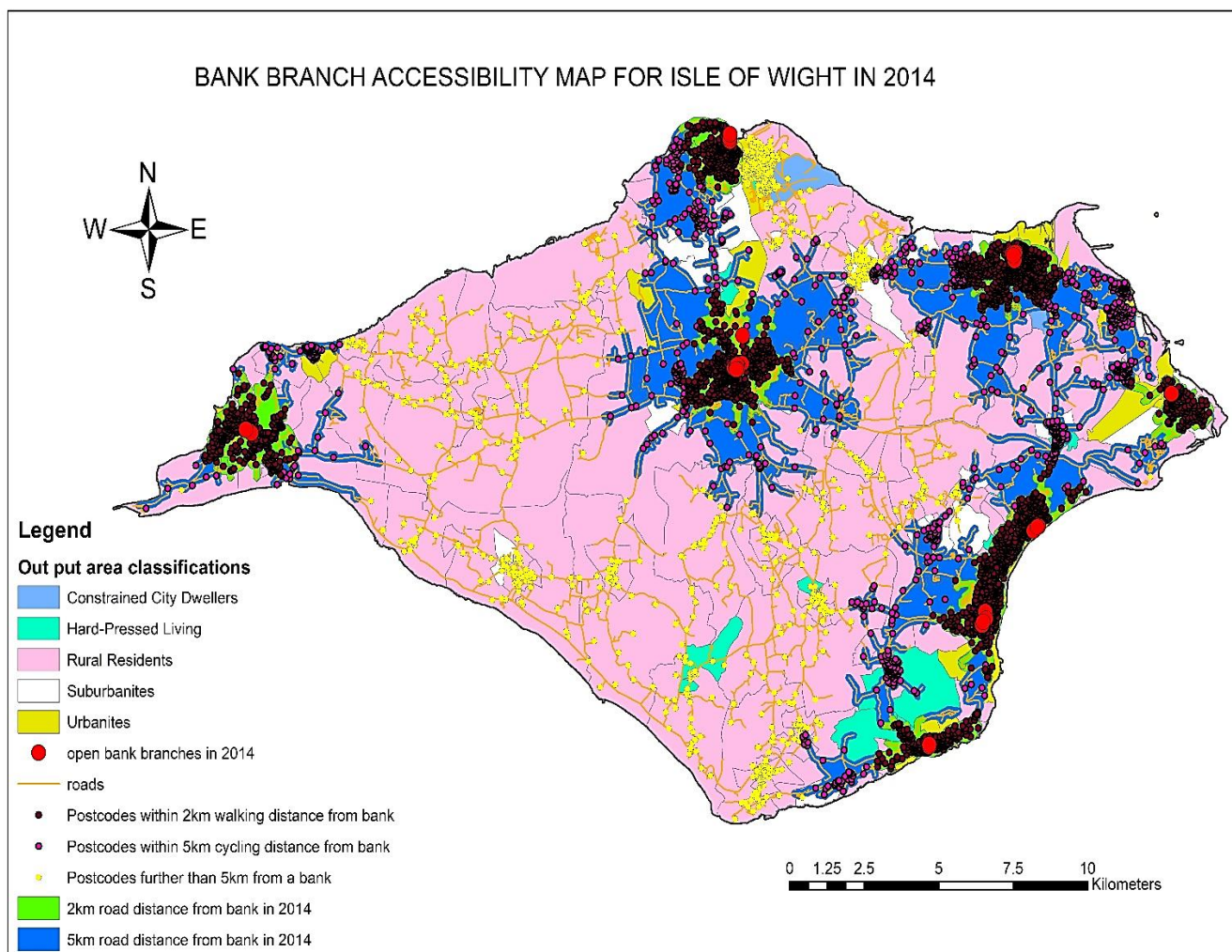


Figure 6: Map showing bank branch accessibility in 2014 using network analysis. Network analysis shows that there are 93,072 people within a 2km walking distance to a bank branch and there are 116,151 people within a 5km cycling distance to a bank branch. 22,114 people reside within a walking and cycling distance that is greater than 5km from a bank branch.

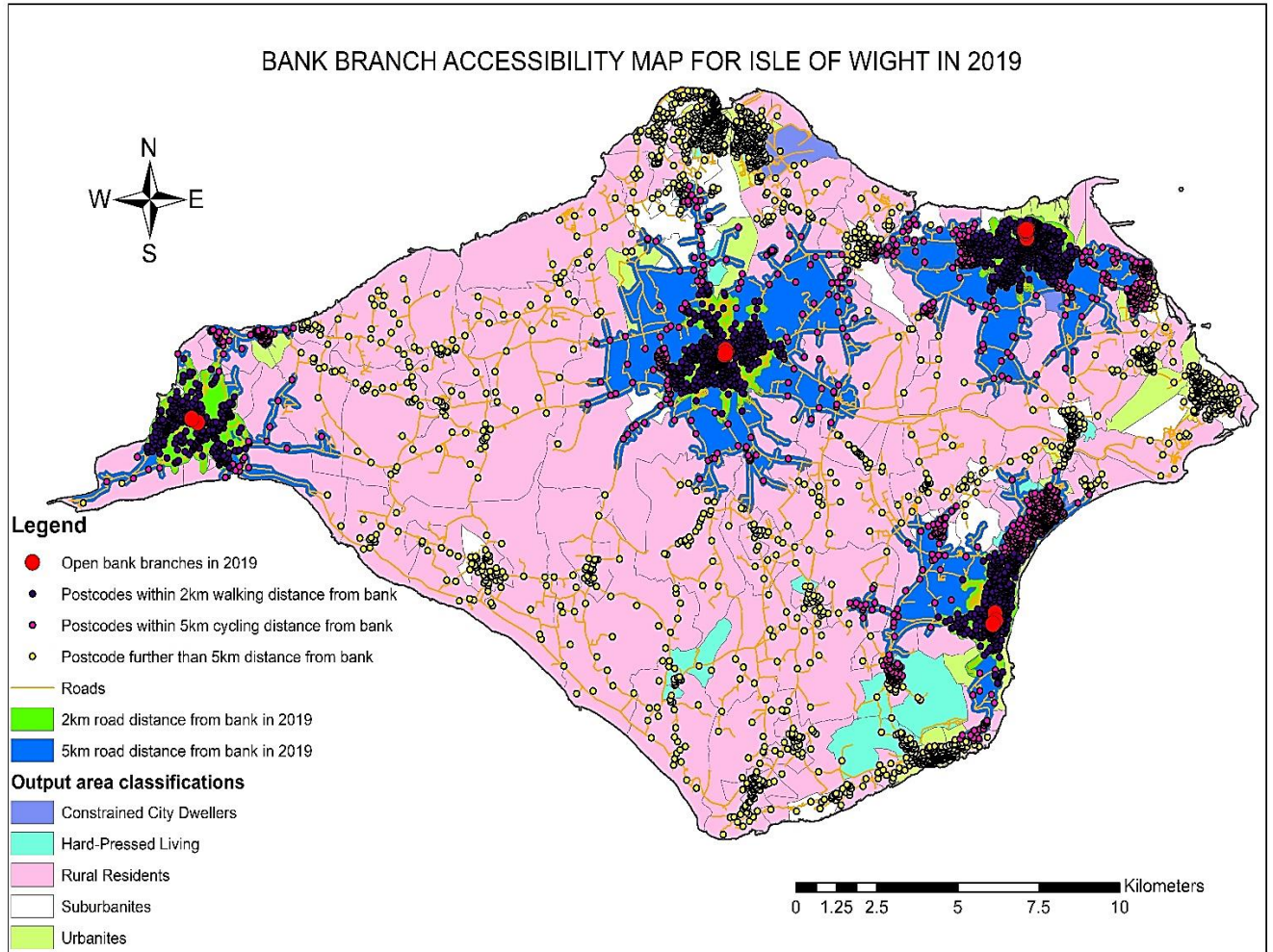


Figure 7: Map showing bank branch accessibility in 2019 using network analysis. Network analysis shows that there are 61,648 people within a 2km walking distance to a bank branch and there are 88,403 people within a 5km cycling distance to a bank branch. 49,862 people reside within a walking and cycling distance that is greater than 5km from a bank branch

Summary of bank accessibility statistics on the Isle of Wight for 2014 and 2019:

1. Buffer analysis:

Population size Year	2km buffer	5km buffer	Outside buffer
2014	106,365	129,540	8,725
2019	66,746	101,644	36,621

Table 1: Population size in and outside buffers for 2014 and 2019 using buffer analysis. 8,725 people in 2014 and 36,621 people in 2019 reside within a walking and cycling distance that is greater than 5km from a bank branch. 129,540 people in 2014 and 101,644 people in 2019 reside within acceptable walking and cycling distance from a bank branch.

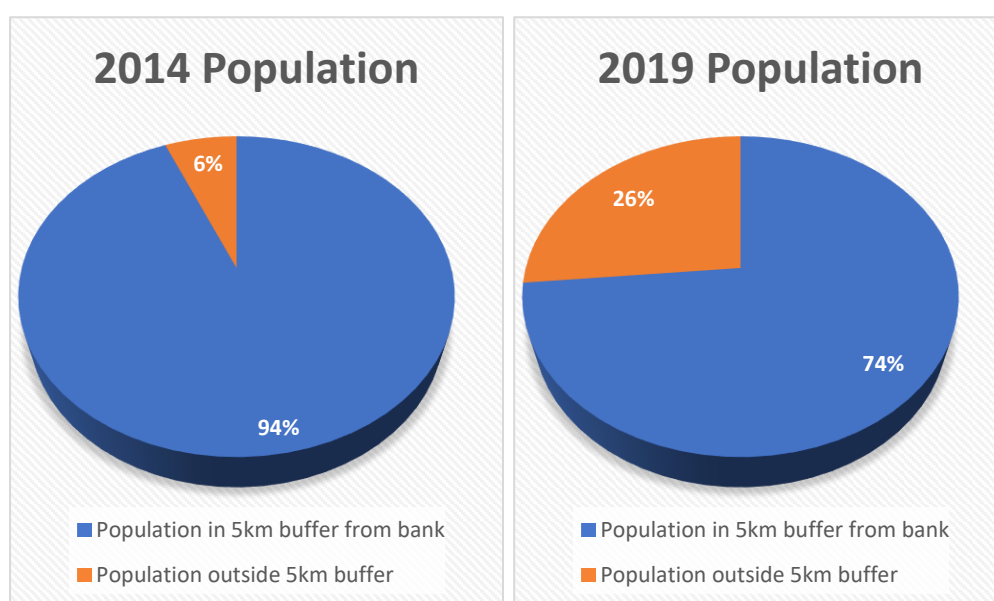


Figure 8: The pie charts show accessibility to banks by population size on the Isle of Wight in both 2014 and 2019. Results are produced by buffer analysis. With the closure of banks, the charts show that the percentage of residents within an acceptable distance of a bank reduced from 94% in 2014 to 74% in 2019. This means that the percentage of residents located outside the acceptable distance of a bank rose from 6% in 2014 to 26% in 2019.

2. Network Analysis:

Population size Year	In 2km of walking distance	In 5km cycling distance	Further than 5km distance
2014	93,072	116,151	22,114
2019	61,648	88,403	49,862

Table 2: Population size for 2014 and 2019 using network analysis. 22,114 people in 2014 and 49,862 people in 2019 reside within a walking and cycling distance that is greater than 5km from a bank branch. 116,151 people in 2014 and 88,403 people in 2019 reside within acceptable walking and cycling distance from a bank branch.

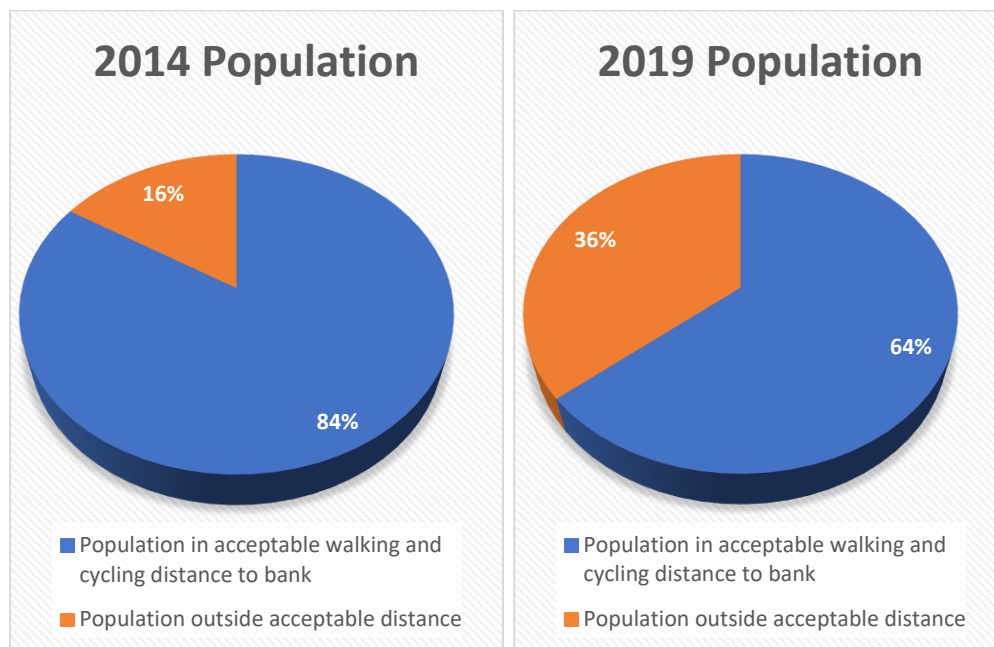


Figure 9: The pie charts show accessibility to banks by population size on the Isle of Wight in both 2014 and 2019. Results are produced by Network analysis. With the closure of banks, the charts show that the percentage of residents within an acceptable distance of a bank reduced from 84% in 2014 to 64% in 2019. This means that the percentage of residents located outside the acceptable distance of a bank rose from 16% in 2014 to 36% in 2019.

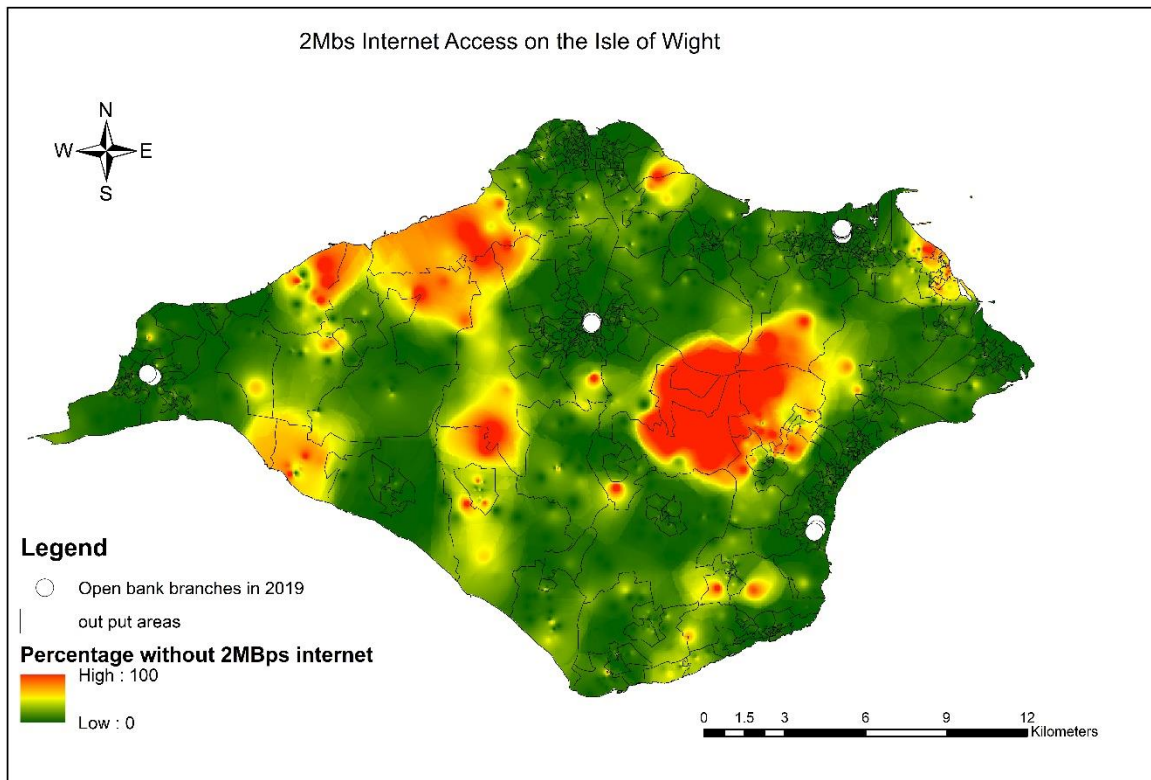


Figure 10: Distribution of 2MBps internet access on the Isle of Wight.

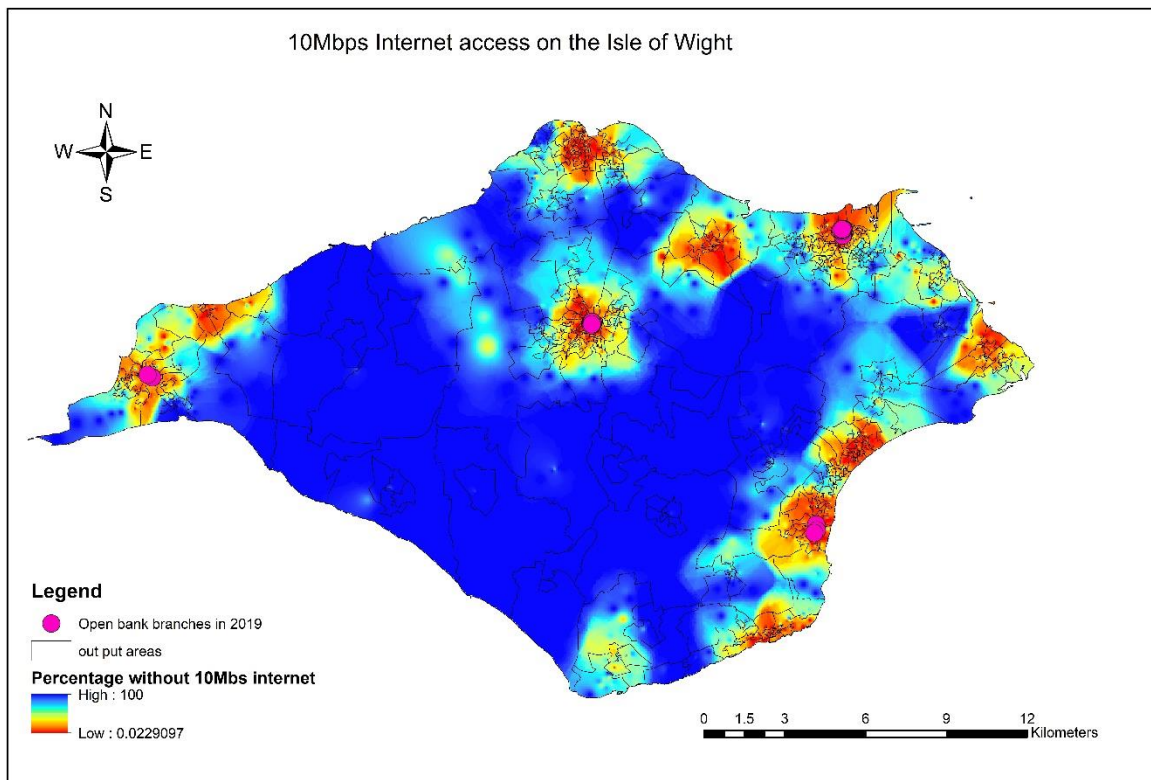


Figure 11: Distribution of 10MBps internet access on the Isle of Wight.

Discussion

The total population on the Isle of Wight is 138,265 using the geodatabase census data. According to the United Kingdom government, the acceptable walking distance is less than or equal to 2km while the acceptable cycling distance is less than or equal to 5km (Higgs *et al.*,2022; United Kingdom Department for Communities and Local Government,2001).

From the buffer analysis results of **Table 1**, 129,540 residents lived within acceptable walking and cycling distance from a bank branch in 2014. However, due to bank closures on the Isle of Wight, this number was reduced to 101,644 residents in 2019. This meant that the number of residents living outside the acceptable walking and cycling distance of a bank rose from 8,725 residents in 2014 to 36,621 residents. In terms of percentages, **Figure 8**, shows that there was a 20% decrease in the percentage of residents living within acceptable walking and cycling distance from a bank, from 94% in 2014 to 74% in 2019. This meant that the percentage of residents living outside the acceptable walking and cycling distance to a bank rose from 6% in 2014 to 26% in 2019. This was a 20% increase.

From the Network analysis results of **Table 2**, 116,151 residents lived within acceptable walking and cycling distance from a bank branch in 2014. However, due to bank closures on the Isle of Wight, this number was reduced to 88,403 residents in 2019. This meant that the number of residents living outside the acceptable walking and cycling distance of a bank rose from 22,114 residents in 2014 to 49,862 residents. In terms of percentages, **Figure 9**, shows that there was a 20% decrease in the percentage of residents living within acceptable walking and cycling distance from a bank, from 84% in 2014 to 64% in 2019. This meant that the percentage of residents living outside the acceptable walking and cycling distance to a bank rose from 16% in 2014 to 36% in 2019. This was a 20% increase.

From the classification map in **Figure 7**, specific communities and demographic groups who live beyond an acceptable travel distance from a bank branch on the Isle of Wight include mainly rural residents, hard-pressed living, and constrained city dwellers. It is likely that such communities and demographic groups with low-income individuals and families may have difficulty accessing bank branches due to the distance they would need to travel. These residents usually reside far away from banks, towns, and city centers in search of cheap, affordable accommodation and a lower cost of living available in distant rural areas. This can lead to financial inequalities, as these individuals may not have the same access to banking services and may be more likely to rely on alternative financial services such as check cashing stores and payday lenders, which often charge higher fees and interest rates. Generally, differences in access are linked to inequalities in society between the wealthy and the poor, the employed and the unemployed. Additionally, older adults and individuals with disabilities may also face difficulties accessing bank branches due to mobility issues and a lack of mobile banking skills.

Figure 10 combined with **Figure 7**, shows that the majority of rural and hard-pressed living communities have access to a 2MBps internet connection while **Figure 11** in combination with **Figure 7** shows that the majority of rural and hard-pressed living communities have no access to a 10MBps internet connection. This means that rural and hard-pressed living communities do not have sufficient broadband infrastructure to substitute physical banking with internet

banking after bank branch closures on the Isle of Wight. Generally, **Figure 10** and **Figure 11**, show that the Isle of Wight is a rural area with limited broadband infrastructure. Well off residents and businesses may consider alternative options such as satellite internet or mobile hotspots.

Whereas buffer analysis results in **Table 1** are different from network analysis results in **Table 2**, both buffer and network analysis results show a 20% decrease in the number of residents living within acceptable walking and cycling distance from a bank branch. This shows the huge negative impact that bank closures have had on the livelihoods of residents on the Isle of Wight. Bank closures can have several negative impacts on the local economy and community of the Isle of Wight (Higgs *et al.*,2022). According to Higgs *et al.* (2022), some potential impacts include:

- Reduced access to financial services for residents and businesses, which can make it more difficult for people to manage their money, obtain loans, and access other financial services.
- Increased travel time and costs for residents and businesses who need to access banking services, as they may have to travel off the island to do so.
- Loss of jobs for employees of the closed banks, which can negatively impact the local labour market.
- Reduced economic activity in the areas surrounding the closed banks, as people may spend less money at local businesses when they don't have access to banking services.
- Negative impact on the overall economy of the Isle of Wight because of reduced access to banking services.

It's worth noting that the negative impacts of bank closures can be mitigated by the availability of other financial service providers like online banking, mobile banking, and credit unions.

Buffer analysis in ArcGIS creates a buffer zone around a feature or set of features (**Figure 4** and **Figure 5**), while network analysis (**Figure 6** and **Figure 7**) is used to analyse routes and find the best path between two or more locations. The main advantage of buffer analysis is that it is relatively simple to perform and can be used to quickly identify areas of influence around a feature, such as identifying areas within a certain distance of a road or building (Oliver *et al.*,2007). The main disadvantage is that it only considers distance and does not consider other factors such as terrain or road type (ESRI,2023; Law and Collins,2018).

On the other hand, network analysis is more complex and can consider a wide range of factors such as road type, junctions, traffic, and terrain. This can lead to more accurate results (**Figure 6**, **Figure 7**, **Table 2**) in identifying the best path between two or more locations. However, the disadvantage is that it can be time-consuming to set up and run the analysis, and it may require a more detailed and accurate network dataset (ESRI,2023; Law and Collins,2018).

In terms of accuracy, the results of buffer analysis (**Figure 4**, **Figure 5**, **Table 1**) may be less accurate than those of network analysis (**Figure 6**, **Figure 7**, **Table 2**) because it only considers Euclidean distance and does not consider other factors. Network analysis, on the other hand, can provide more accurate results because it can consider a wide range of factors that can affect the path such as one-way roads and junctions (Oliver *et al.*,2007).

Conclusion

The raster, buffer and network analysis show that a very big proportion of residents on the Isle of Wight have been impacted negatively by bank branch closures. Accessibility to bank branches has reduced by 20% yet even the broadband infrastructure is insufficient to facilitate migration to internet or online banking. Rural and hard-pressed living communities are the most vulnerable (Higgs *et al.*,2022). There are several interventions that can be put in place by UK government, banks and local authorities to facilitate online and internet banking on the Isle of Wight after bank branch closures:

1. Digital literacy training: Many people on the Isle of Wight may not be familiar with online and internet banking, so providing digital literacy training can help them feel more comfortable using these services.
2. Community hubs and satellite internet: Setting up community hubs where people can access the internet, computers, and assistance from trained staff can help facilitate online banking for those without internet access at home.
3. Mobile banking: Encouraging the use of mobile banking apps can help people access banking services from anywhere, at any time.
4. Support for small businesses: Many small businesses on the Isle of Wight may not have the resources to set up online banking, so providing support and resources to help them make the transition can be beneficial.
5. Security measures: Ensuring that online banking services are secure and providing education on how to protect against fraud will be important to give people confidence in using the services.
6. Partnership with the local authorities: The local authorities can partner with the banks and other stakeholders to ensure that access to internet banking is provided to all the citizens of the Isle of Wight.
7. Alternative banking options: The islanders can be encouraged to use alternative banking options such as prepaid debit cards and e-wallets to access banking services.

In summary, According to Law and Collins (2018), buffer analysis is a useful tool for quickly identifying areas of influence around a feature, while network analysis is more suitable for identifying the best path between two or more locations but can take more time and requires more data (Oliver *et al.*,2007). There are several alternative methods to buffer analysis and network analysis found in ArcGIS, depending on the specific use case and the data available. According to Law and Collins (2018), some of these alternatives include:

1. Cost-Distance Analysis: This method is like network analysis, but instead of finding the shortest path, it finds the path with the lowest cost based on a user-defined cost surface. This can be useful for analyzing routes that consider factors such as terrain or land use.
2. Hot Spot Analysis: This method is used to identify areas of high concentration or high incidence of a particular phenomenon, such as crime or disease. This can be useful for identifying areas that require more attention or resources.

3. Kernel Density Analysis: This method is used to create a surface that shows the estimated density of a particular phenomenon, such as population or vegetation. This can be useful for identifying areas of high or low concentration of a particular feature.
4. Terrain Analysis: This method is used to analyze the terrain, such as slope and aspect, to identify areas that are suitable for certain activities, such as agriculture or recreation.
5. Interpolation Analysis: This method is used to create a continuous surface from a set of point data, such as temperature or elevation, by estimating values for areas between the points.

All the above alternative methods can provide more accurate and detailed results than buffer analysis and network analysis, depending on the specific use case and the data available.

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