An Integrated Approach to Enhancing Ecological Connectivity and Accessibility in Urban Areas: a case study of Sheffield, UK

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2 Volumes

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Appendix 1: Explanations of Land Cover Categories

LC100. Vegetation

LC110. Woodland and Shrub

LC111. Conifer Woodland: This land cover category consists of natural and semi-natural coniferous plantations with more than 80% cover of coniferous species.

LC112. Broad-leaved Woodland: This land cover type is characterised by of natural and semi-natural broad leaved plantations more than 80% cover of broadleaved species.

LC113. Mixed Woodland: This category represents areas in which combination of broadleaved and coniferous species occur and each category constitutes at least 20% of the total canopy cover.

LC114. Shrub: This land cover type represents areas those would possibly be woodland. Shrub lands characterised by rough ground growth with at least 20% cover in which Conifer and Broadleaved species cannot be distinguished yet.

LC115. Felled: This class represents surfaces without tree cover following forest operations such as felling or reduced stocking with less than 20% cover.

LC116. Young Trees: This land cover type includes areas with visible plantation, where there is no clear difference between Conifer and Broadleaved because of their immaturity.

LC120. Mixed Vegetation

LC121. Roadside Vegetation: This land cover type encompasses natural surfaces those appear alongside roads, tracks and paths including verges, roundabouts, centre-ways, carriageway cuttings and embankments.

LC122. Railway Vegetation: Railway vegetation consists of natural surfaces adjacent to rail tracks in which natural vegetation occur.

LC123. Private Gardens: This category is characterised by the areas of multiple surfaces, both natural and manmade, and represents private residential gardens.

LC124. Other Landscaped Areas: This category is composed of vegetated and sparsely vegetated areas, including amenity greenspaces that are designed for the use of pedestrians.

LC130. Grasslands

LC131. Improved Grassland: Improved grassland consist of areas with vegetation dominated by fast growing grasses and managed as pasture for agricultural purposes excluding amenity grassland managed with the purpose of recreation and amenity purposes.

LC132. Unimproved Acid Grassland: This land cover type is characterised by vegetation dominated by grasses and herbs on a range of lime deficient soils.

LC133. Unimproved Neutral Grassland: This land cover type is characterised by vegetation dominated by grasses and herbs on a range of neutral soils.

LC134. Amenity Grassland: Amenity grasslands are those covered with vegetation dominated by grass and managed for non-agricultural purposes for recreation and amenity facilities.

LC135. Rough Grassland: Rough grassland is a residual category containing a mixture of managed, low productivity grass areas that could not be assigned as either unimproved acid grassland or unimproved neutral grassland.

LC140. Heathlands

LC141. Heather: Heather land cover type consists of land surfaces with a higher density of heather in which very few trees or bushes may occur.

LC142. Heather Grassland: This land cover is composed of predominantly grassland including low density of heather with very few trees or bushes.

LC150. Cultivated Land

LC151. Arable: Arable land cover category is composed of ploughed land that is used for growing annual and perennial crops.

LC152. Orchard: This land cover category represents all cultivated land where fruit trees and shrubs are planted, such as apple and walnut.

LC200. Surfaces

LC210. Bare Surfaces

LC211. Derelict Vacant Unused Land: This land cover type represents currently derelict, vacant or unused lands.

LC212. Inland Rock: This land cover category is characterised by the areas of rock, scattered rock (exposed bedrocks), boulders, scattered boulder (rounded rocks) and scree (a mass of loose stones on the steep side of mountains).

LC220.Constructed Surfaces

LC221. Metalled Roads: Includes all metalled ways for the use of vehicles and road traffic calming features on road surfaces which are designed for slowing down the traffic flow. Coating may include any manmade surfaces such as asphalt, concrete, brick, granite sets and gravel.

LC222. Paths and Pavement: This category represents all linear landscape features by the border of highways and road transport that are designed for the use of pedestrians and cyclists.

LC223. Tracks: Uncoated linear landscape features representing ways for vehicles, especially designed for cross country travel and / or agricultural purposes.

LC224. Railway: Manmade linear landscape features representing railways, tramlines and structures which are built alongside railway networks.

LC225. Paved Surfaces: This category describes manmade land surfaces that are not covered by buildings and structures; representing surrounding area of works, depots and warehouses, shopping centres, schools, university buildings and open car parks. This land cover type does not include paved surfaces within private gardens.

LC300. Water and Wetlands

LC310. Water

LC311. Standing Water: This category represents all standing water areas, such as dams, lakes, ponds, reservoirs and canals.

LC312. Running Water: This category is composed of fresh water features, such as rivers and brooks.

LC320. Wetlands

LC321. Heath Dominated Bog: This land cover is the representative of boggy areas in which predominantly heath vegetation exists.

LC322. Grass Dominated Bog: This land cover is the representative of boggy areas in which predominantly grassy vegetation exist.

LC323. Marsh, Reeds and Saltmarshes: This category represents the areas of open land covered with bulrushes, reeds, or freshwater reeds.

LC400. Buildings and Structures

LC410. Residential and Non-residential

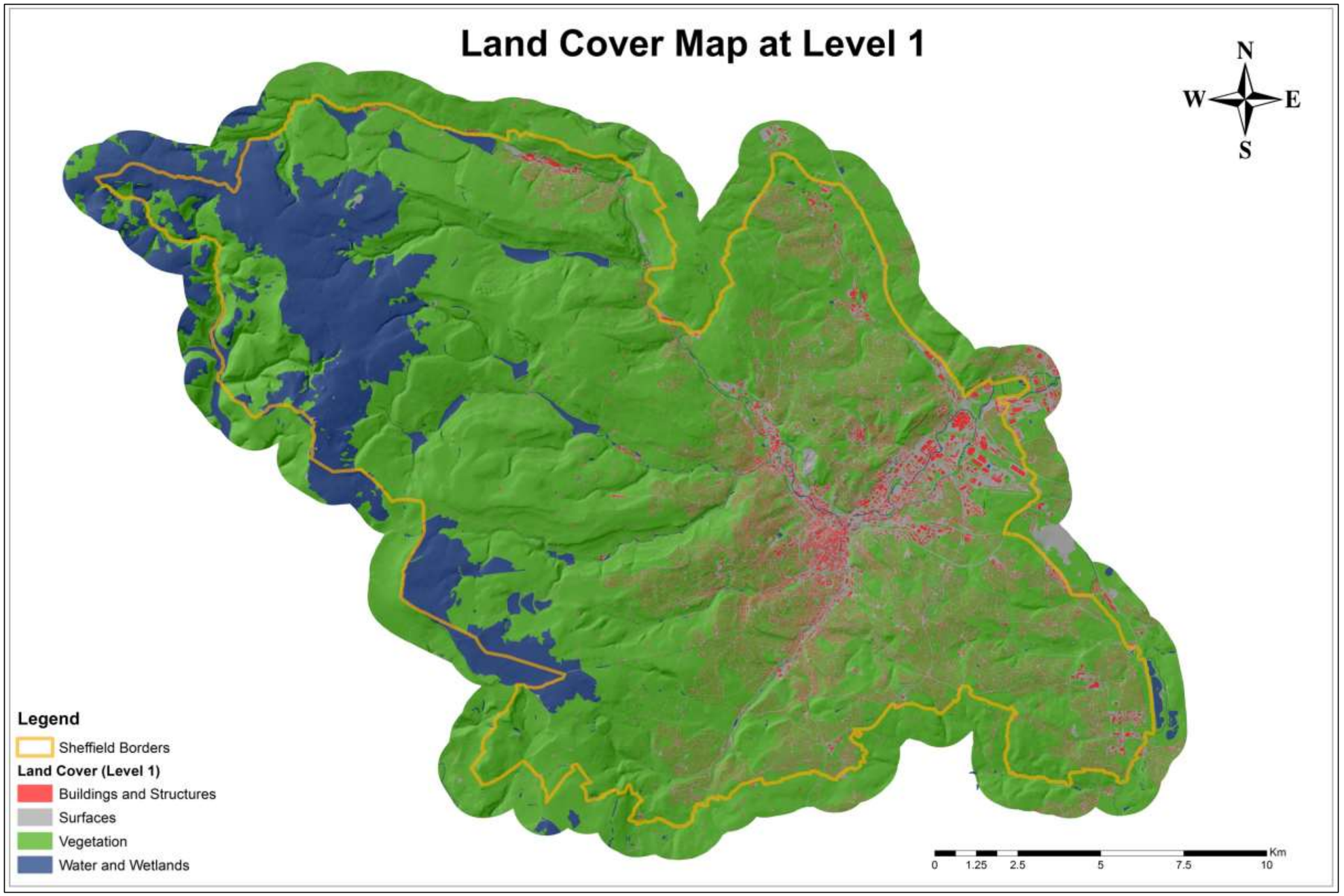
LC411. Single Structures: This land cover type includes all single buildings and structures in rows or clusters.

LC412.Connected Structures: This land cover type includes connected buildings and structures; those share a wall and/or a roofline constituting multiple walkways.

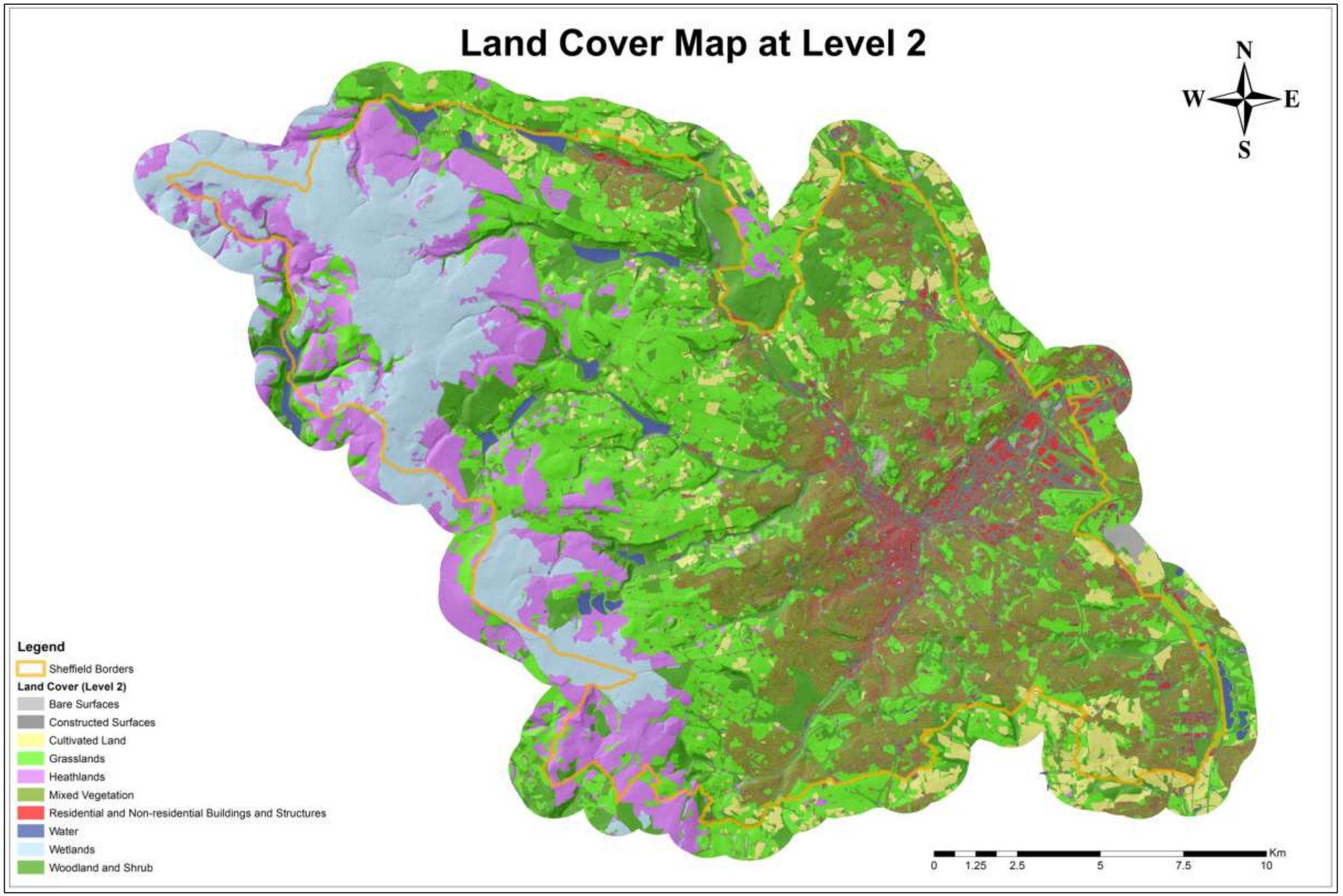
LC413. Mixed Structures: This land cover type represents buildings and structures that are connected by courtyards and/or arcades, or a group of buildings with different structural footprints.

Appendix 2: Land Cover Maps

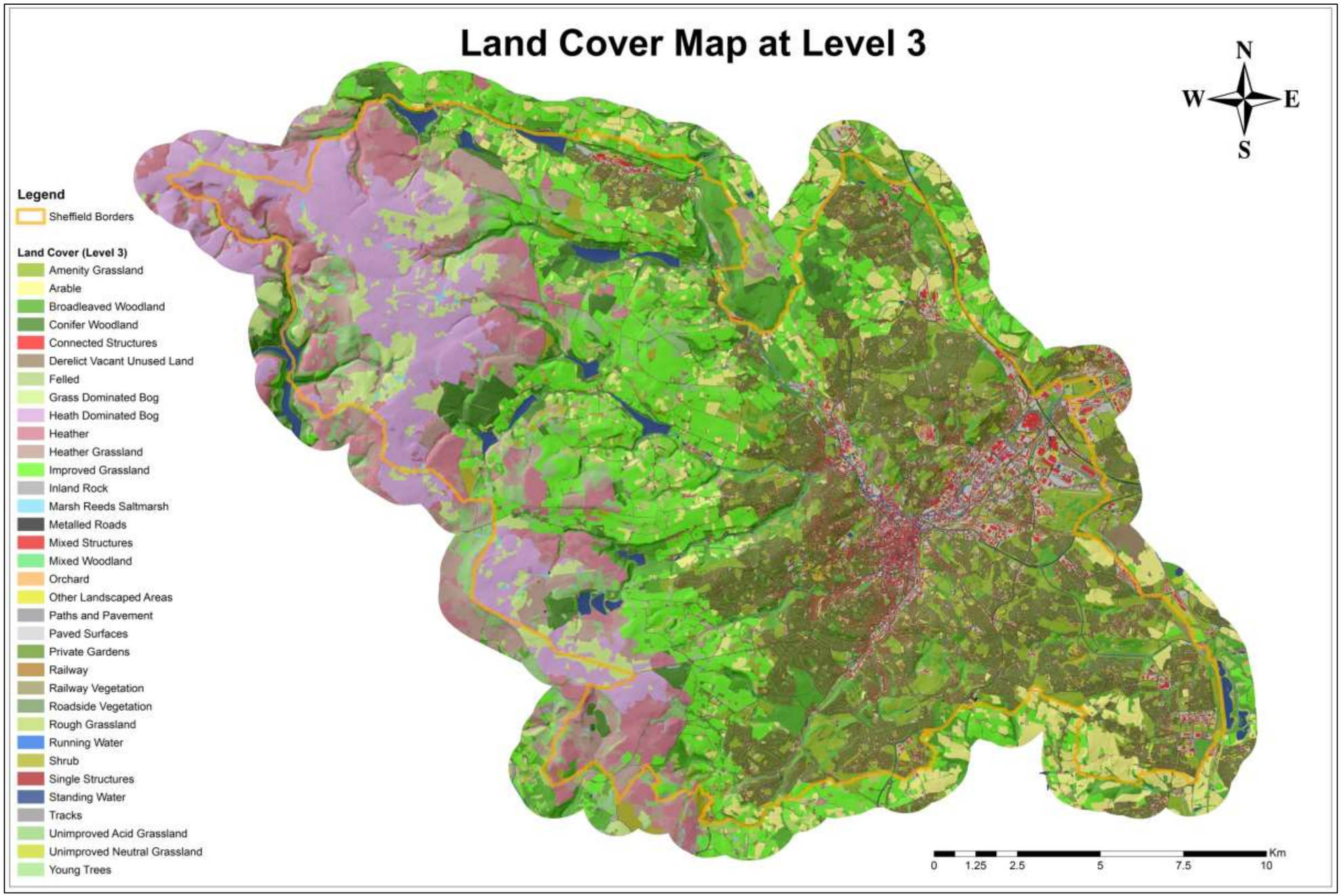
Appendix 2A: Land Cover Map at Level 1



Appendix 2B: Land Cover Map at Level 2



Appendix 2C: Land Cover Map at Level 3



Appendix 3: Explanations of Land Use Categories

LU100. Artificial

LU110. Residential Buildings

LU111. Dwellings: Buildings and structures used for residential purposes including detached, semi-detached and terraced houses, and self-contained flats.

LU112. Institutional Accommodation: Buildings and structures used for residential purposes within an institutional context, such as care / nursing homes (e.g. sanatoriums and handicapped homes) and residential education buildings (e.g. university residences).

LU113. Communal Accommodation: Buildings and structures used for communal accommodation purposes, such as hotels, quest houses and motels.

LU120. Public Buildings

LU121. Institutional Buildings: Buildings and structures used for community services, such as courts, prisons and job centres.

LU122. Educational Buildings: Buildings and structures used for educational purposes, such as university buildings and other educational establishments.

LU123. Religious Buildings: This category represents the buildings and structures used for worship, such as churches, mosques and synagogues.

LU124. Leisure and Recreational Buildings: Buildings and structures used for leisure and recreational purposes, such as museums, galleries and cinemas.

LU125. Medical Buildings: Buildings used for medical, health care and health research purposes, such as hospitals, dentists and medical diagnosis and treatment centres.

LU126. Community Buildings: Community buildings include church halls, religious meeting halls and other community facilities, such as voluntary centres and social clubs.

LU130. Industrial and Commercial Buildings

LU131. Retailing: Buildings and structures used for retailing purposes, such as shops, supermarkets, showrooms and post offices.

LU132. Offices: This category represents public and private sector buildings, such as offices, work studios and broadcasting buildings.

LU133. Industry: Buildings and structures ranging from light manufacturing to heavy manufacturing, such as factories, servicing garages, recycling plants and maintenance depots.

LU134. Storage and Warehouses: Buildings and structures of warehouses, stores and storage depots.

LU140. Other Buildings and Structures

LU141. Mixed Use Buildings: This category includes all buildings and structures used for multiple purposes, e.g. residential buildings with a shop at the ground floor.

LU142. Other Buildings: This land use category includes all other buildings and structures, such as agricultural buildings, ancillary buildings, locked-up garages and glasshouses.

LU143. Derelict Vacant Unused Buildings: This category consists of unoccupied buildings and structures in reasonable state of repair, or abandoned and unoccupied buildings and structures which are out of repair.

LU150. Sealed Surfaces

LU151. Residential Sealed Surfaces: This land use is composed of hard surfaces (e.g. sealed with concrete, brick) surrounding residential buildings and structures. Gardens associated these buildings are excluded from this land use type and classified as "Private Gardens".

LU152. Public Buildings Sealed Surfaces: Represents sealed surfaces around public buildings and structures such as school grounds.

LU153. Industrial Units Sealed Surfaces: Sealed surfaces associated with industrial units including storage land, scrap yards.

LU154. Other Buildings and Structures Sealed Surfaces: This land use category represents all other sealed surfaces around buildings and structures other than sealed surfaces mentioned above.

LU160. Transportation and Utilities

LU161. Highways and Road Transport: This category includes all metalled ways for the use of vehicles and road traffic calming features on road surfaces which are designed for slowing down the traffic flow.

LU162. Pavement: Pavements are manmade paved areas adjacent to roads and highways which are designed for the use of people walking alongside the roads.

LU163. Railways: This category represents manmade linear landscape features including railways, tramlines and structures built alongside railway networks.

LU164. Paths: Paths are linear manmade landscape features representing footpaths, subways, steps, footbridges and cycle paths.

LU165. Tracks: Tracks are uncoated linear transportation features which are particularly designed for cross country travel and agricultural purposes.

LU166. Airports: This category represents the buildings and structures of airports and heliports / helipads.

LU167. Transport Terminals and Interchanges: Buildings and structures representing Bus and Coach Stations.

LU168. Open Car Parks: This land use category represents designated spaces for car parking within open areas excluding on street parking spaces.

LU169. Utilities: This category includes buildings and structures such as electricity sub-stations and power station/energy production.

LU200. Natural and Semi-natural Land

LU210. Recreation and Leisure

LU211. Allotments: This category includes allotments as well as community gardens.

LU212. Amenity Green Spaces: This land use category encompasses open spaces designed for the use of pedestrians including those within housing areas, village greens, informal recreational space and hard-surfaced areas.

LU213. Cemeteries and Churchyards: This category is composed of all green and open spaces comprised within cemeteries and churchyards.

LU214. Outdoor Sport Facilities: This land use type is composed of both public and private outdoor sports facilities such as tennis, cricket and golf.

LU215. Parks and Gardens: This category includes publicly accessible urban parks, country parks and formal public gardens.

LU216. Natural and Semi-natural Green Spaces: This group represents all green corridors, forestry and amenity woodlands (including areas of shrub), and nature conservation areas.

LU217. Provision for Children and Young People: This category consists of areas principally designed for the use of children and young people for play and social integration. For example, equipped play areas, multi-use games areas and skateboard areas are classified within this category.

LU218. Countryside / Urban Fringe: This category represents the areas of wetlands, heathlands, inland rock, and woodland and shrub included within the boundaries of the Peak District National Park.

LU220. Mixed Vegetation

LU221. Roadside Vegetation: Natural and semi natural surfaces which exist along the road networks.

LU222. Railway Vegetation: Natural and semi natural surfaces which exist along the railway networks.

LU223. Private Gardens: Private gardens represent areas incorporating multiple surface types (vegetation and paved surfaces).

LU300. Agriculture and Open Land

LU310. Agriculture

LU311. Agricultural Land: Open land used for grazing, permanent crop growing and rotation, horticulture and dairy farming.

LU320. Open Land

LU321. Refuse Disposal: Open land used for waste management such as tips, landfill and waste disposal sites etc.

LU322. Mineral Workings and Quarries: Open land used for surface mineral workings and underground mineral extraction sites.

LU323. Derelict Vacant Unused Land: The areas of derelict vacant and unused land include development sites in which both green field and brown field lands present.

LU400. Water

LU410. Inland Water

LU411. Lakes and Ponds: This category represents the areas of natural and unnatural still water, such as lakes and ponds.

LU412. Reservoirs: This category represents the areas of reservoirs.

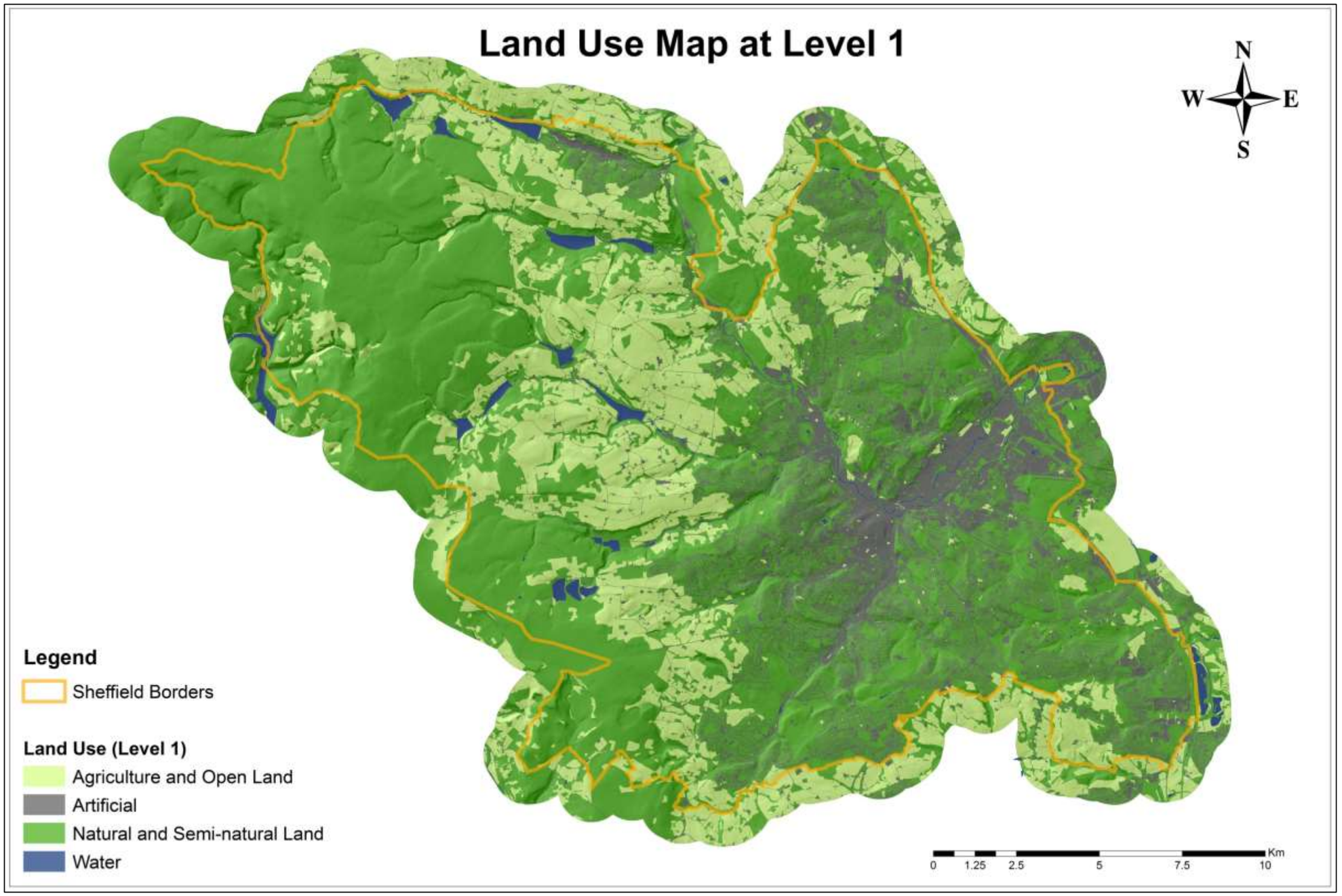
LU413. Canals: This land use category includes the areas of canals.

LU414. Rivers and Brooks: This land use category is composed of linear and moving water features, such as rivers and brooks.

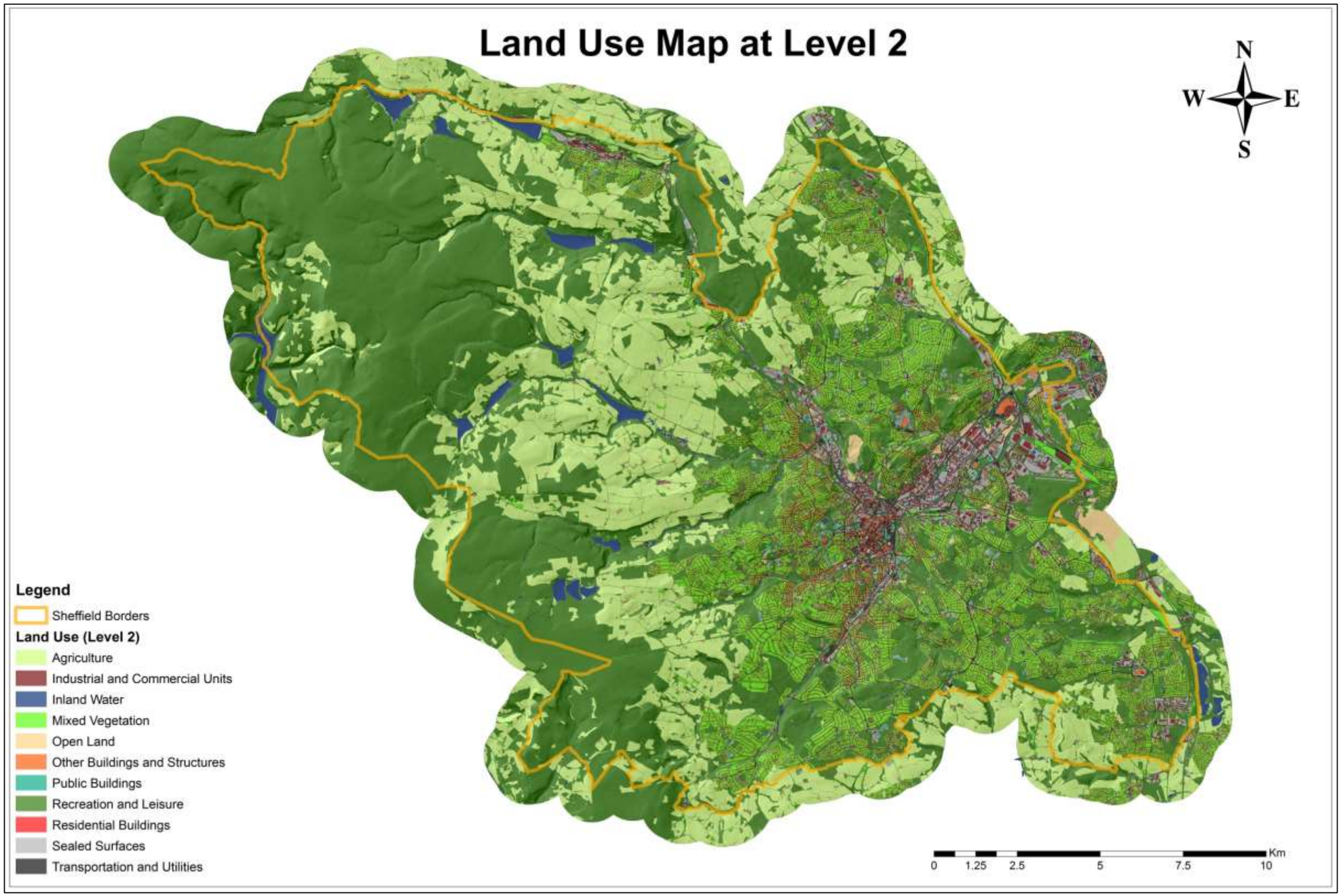
LU415. Dams: This category represents the areas of dams.

Appendix 4: Land Use Maps

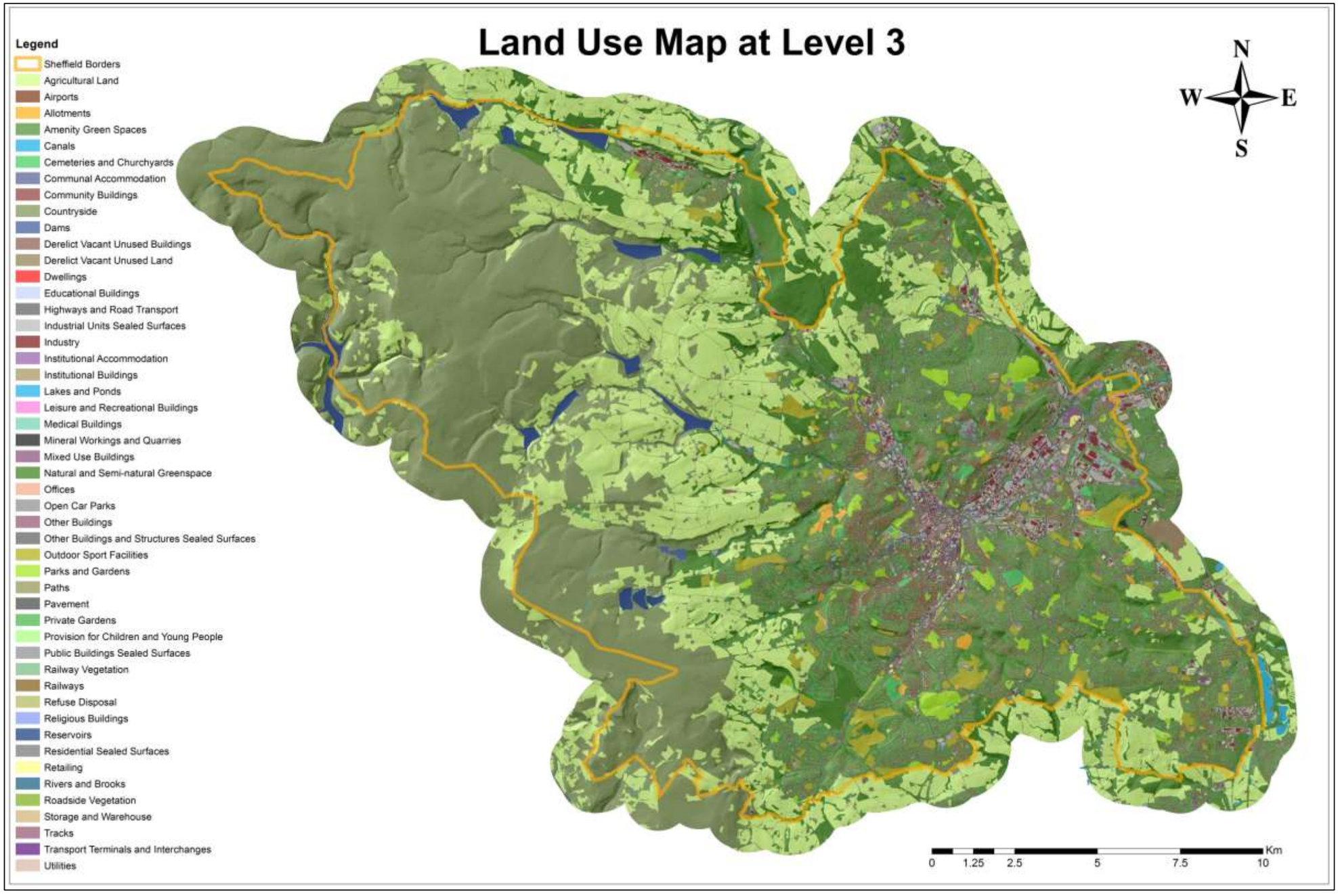
Appendix 4A: Land Use Map at Level 1



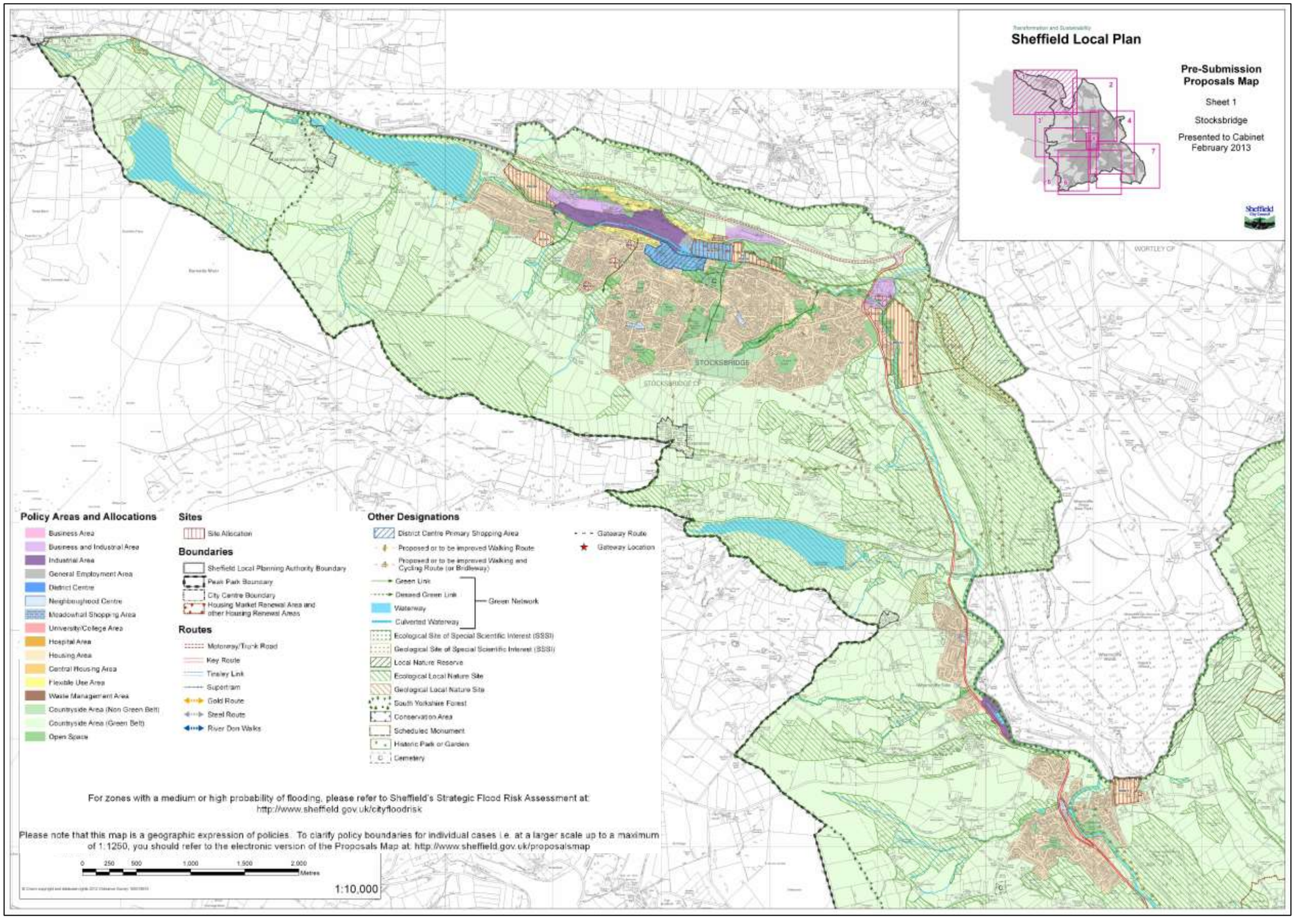
Appendix 4B: Land Use Map at Level 2



Appendix 4C: Land Use Map at Level 3



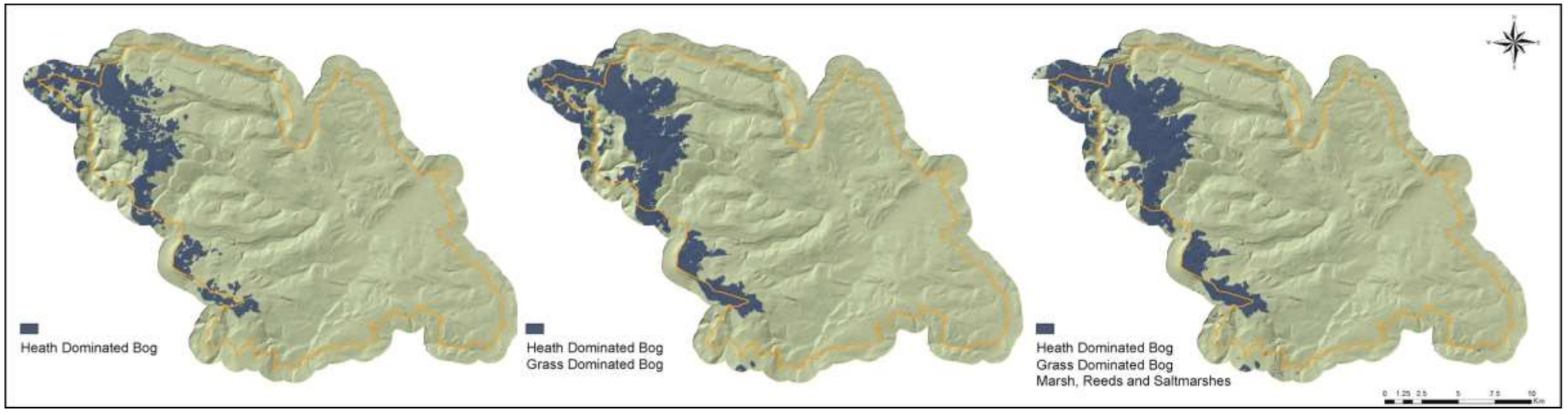
Appendix 5: Sheffield Local Plan Proposals Map (Map 1 - North Stocksbridge)



Appendix 6: Land Cover Structural Networks

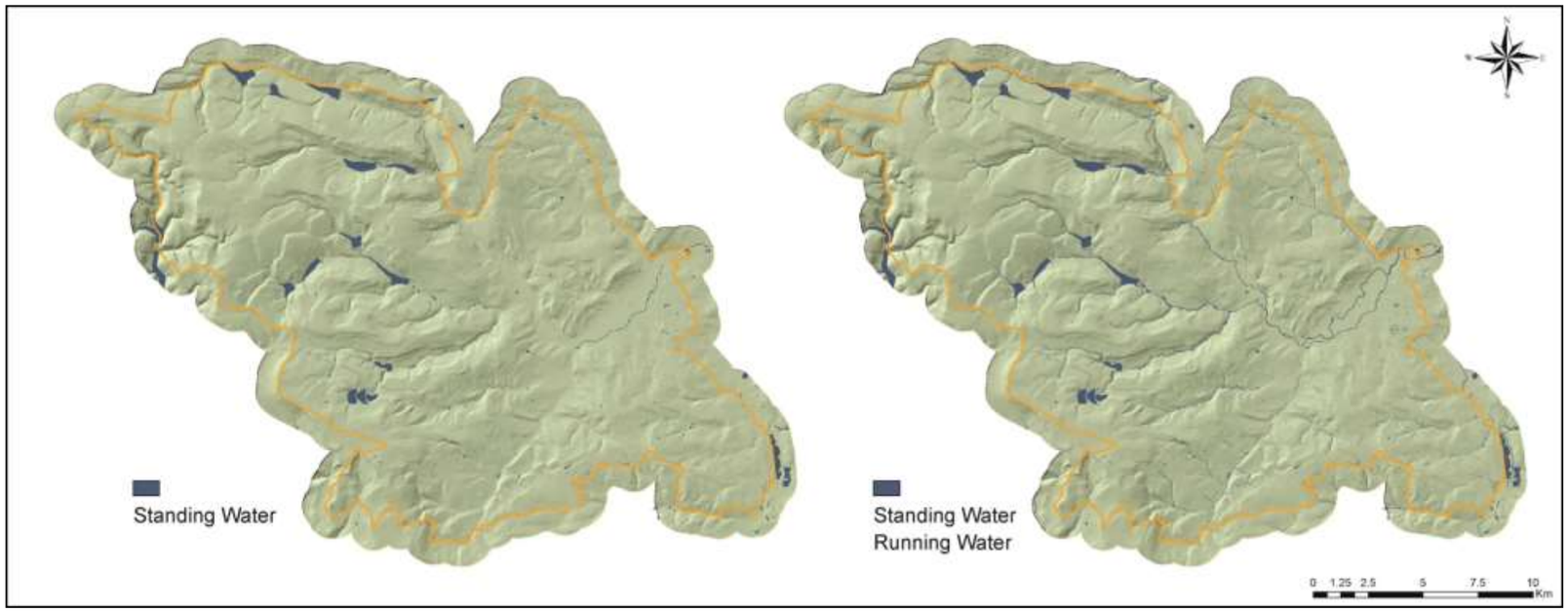
Appendix 6A: Results of Landscape metrics for Wetlands Network (aggregated from level 3 to level 2)

Wetlands Land Cover Categories	CA (ha)	PLAND (%)	AREA_MN	AREA_AM	AREA_SD	AREA_CV	GYRATE_AM	NP	ENN_AM	PROX_AM
Heath Dominated Bog	4055.34	8.36	28.36	2128.67	244.06	860.59	2755.77	143	20.99	40236.13
Heath Dominated Bog + Grass Dominated Bog	5672.59	11.69	30.17	2993.81	299.04	991.06	2692.42	188	10.12	48968.29
Heath Dominated Bog + Grass Dominated Bog + Marshes, Reeds and Saltmarshes	5781.00	11.91	15.54	2994.75	215.17	1384.59	2672.19	372	13.01	49597.34



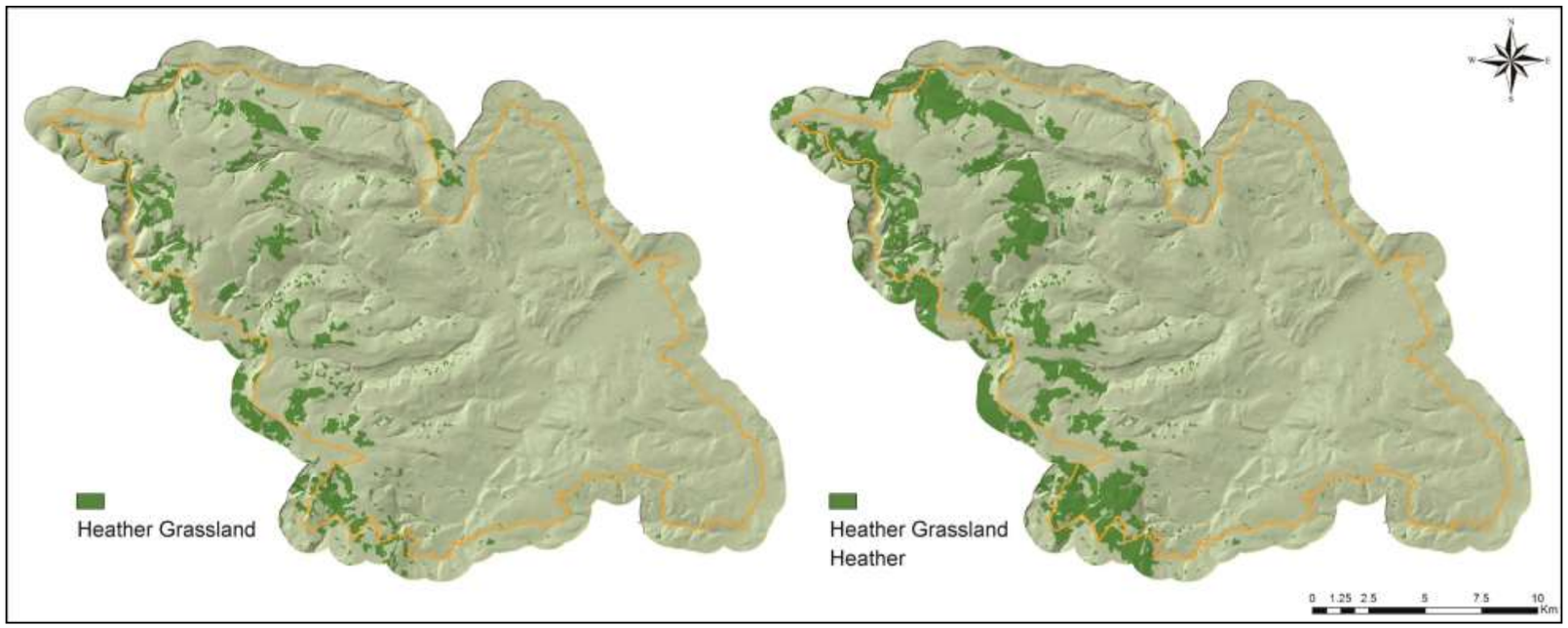
Appendix 6B: Results of Landscape metrics for Water Features Network (aggregated from level 3 to level 2)

Water Land Cover Categories	CA (ha)	PLAND (%)	AREA_MN	AREA_AM	AREA_SD	AREA_CV	GYRATE_AM	NP	ENN_AM	PROX_AM
Standing Water	627.74	1.29	0.46	32.42	3.83	834.24	296.50	1368	40.90	437.29
Standing Water + Running Water	793.16	1.63	0.16	26.10	2.03	1279.35	289.52	5004	17.12	869.07



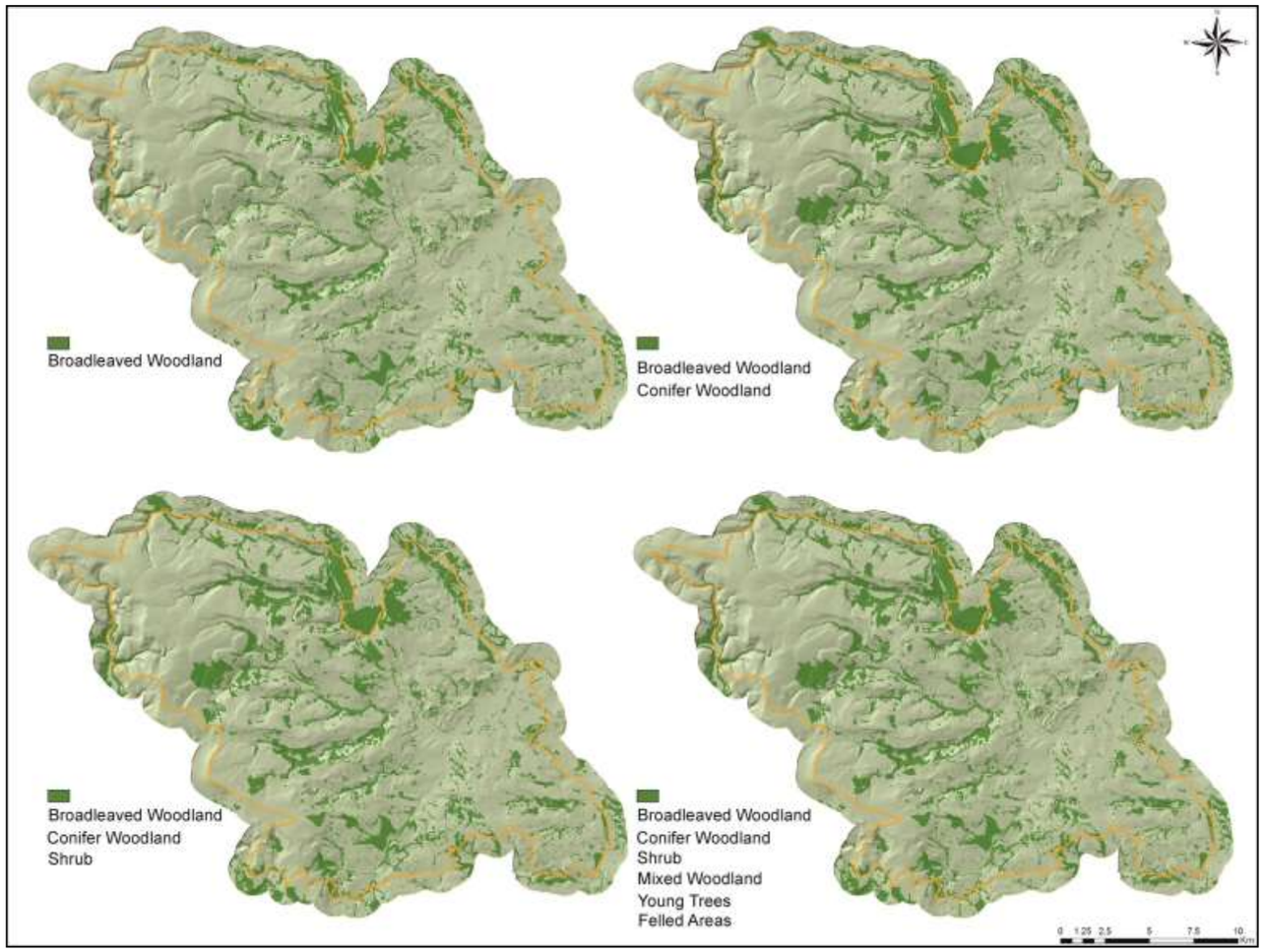
Appendix 6C: Results of Landscape metrics for Heathlands Network (aggregated from level 3 to level 2)

Heathlands Land Cover Categories	CA (ha)	PLAND (%)	AREA_MN	AREA_AM	AREA_SD	AREA_CV	GYRATE_AM	NP	ENN_AM	PROX_AM
Heather Grassland	2964.45	6.11	1.67	57.59	9.66	578.83	327.46	1776	37.61	5799.36
Heater Grassland + Heather	5921.07	12.20	2.27	158.23	18.81	829.31	557.70	2611	18.47	35535.92



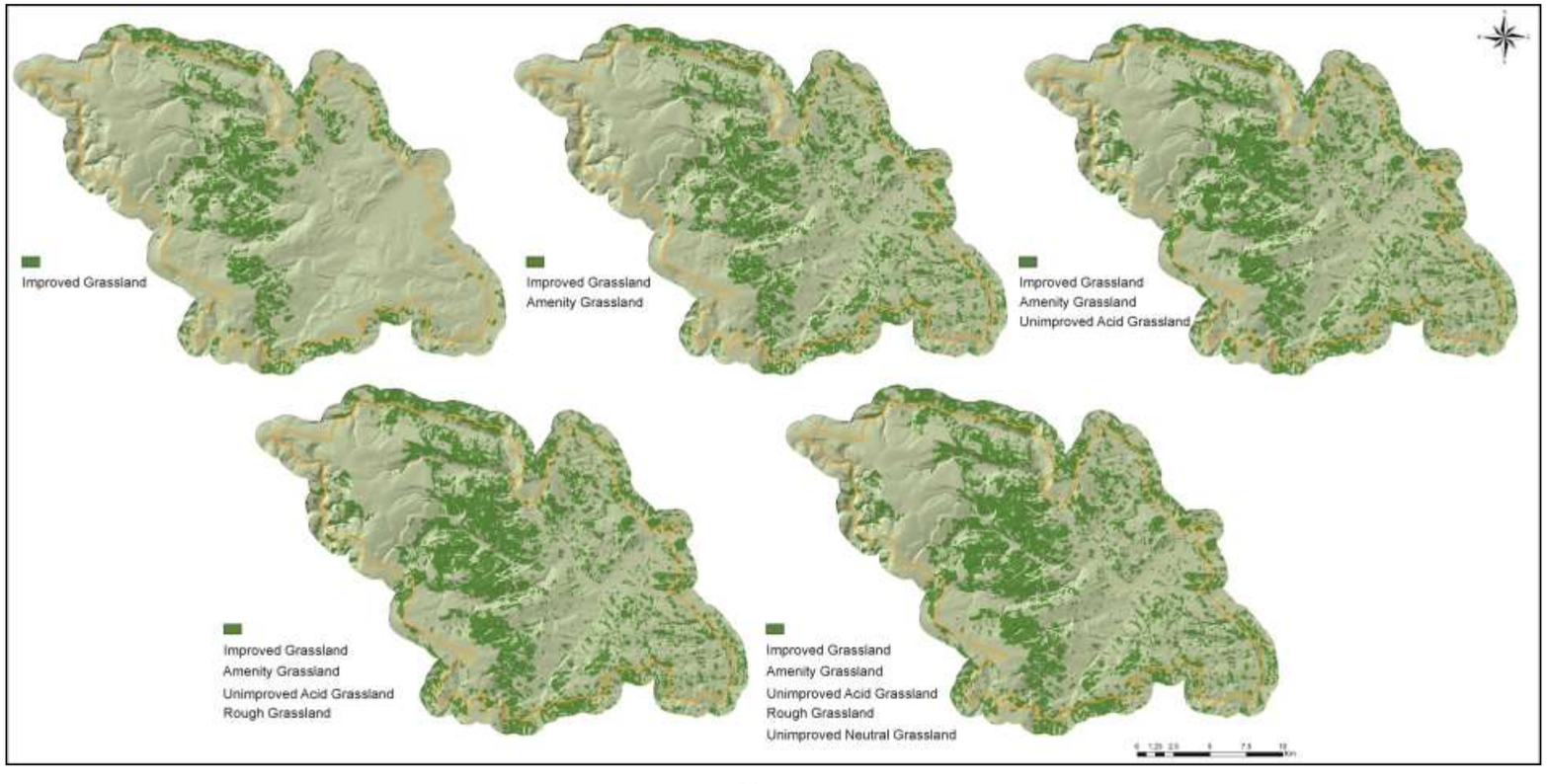
Appendix 6D: Results of Landscape metrics for Woodland and Shrub Network (aggregated from level 3 to level 2)

Woodland and Shrub Land Cover Categories	CA (ha)	PLAND (%)	AREA_MN	AREA_AM	AREA_SD	AREA_CV	GYRATE_AM	NP	ENN_AM	PROX_AM
Broadleaved Woodland	5306.50	10.94	0.64	48.61	5.55	863.95	336.51	8258	12.15	13907.14
Broadleaved Woodland + Conifer Woodland	6580.15	13.56	0.77	66.38	7.13	920.68	357.16	8502	9.44	16861.90
Broadleaved Woodland + Conifer Woodland + Shrub	7347.60	15.14	0.84	64.93	7.36	870.92	358.70	8696	9.84	16307.99
Broadleaved Woodland + Conifer Woodland + Shrub + (Mixed Woodland + Young Trees + Felled)	7409.43	15.27	0.85	65.03	7.37	871.30	359.18	8764	9.80	16314.71



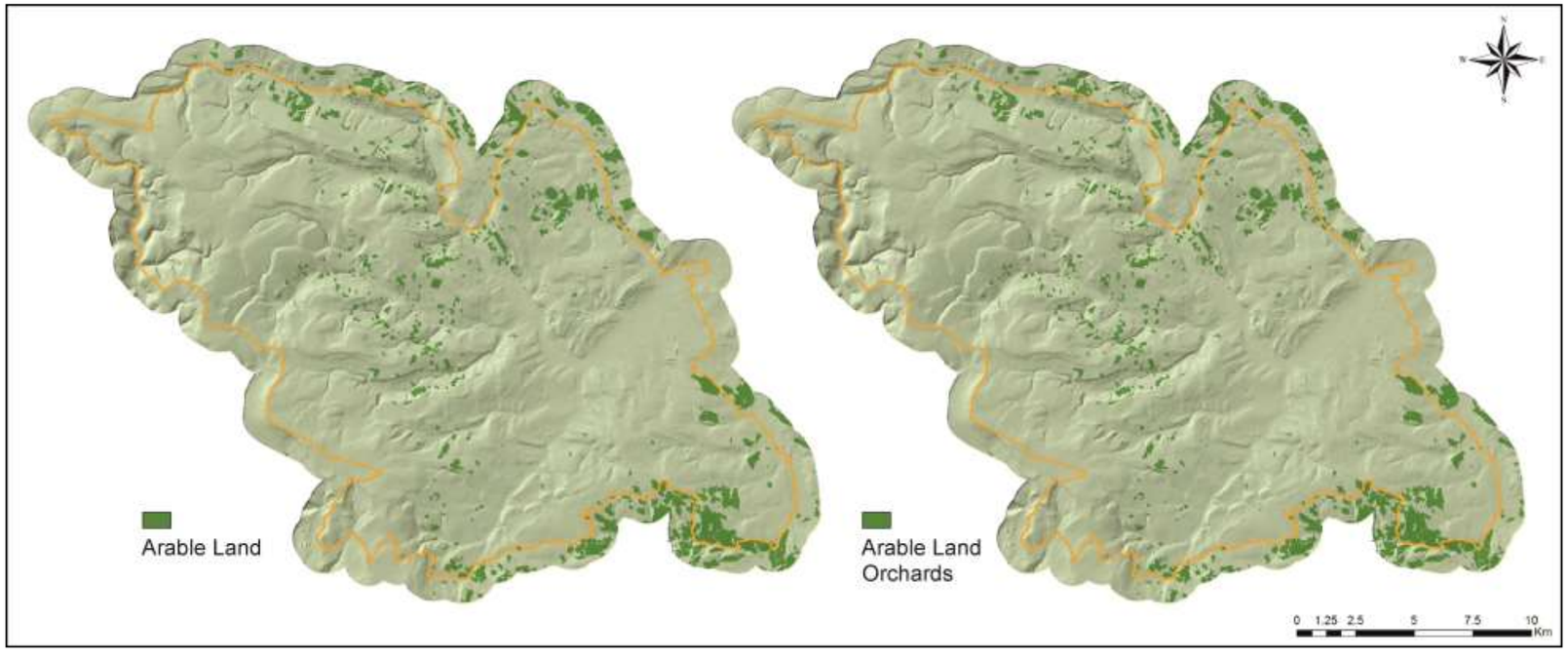
Appendix 6E: Results of Landscape metrics for Grasslands Network (aggregated from level 3 to level 2)

Grasslands Land Cover Categories	CA (ha)	PLAND (%)	AREA_MN	AREA_AM	AREA_SD	AREA_CV	GYRATE_AM	NP	ENN_AM	PROX_AM
Improved Grassland	6356.77	13.10	2.46	28.57	8.02	325.49	224.12	2580	16.01	10055.18
Improved Grassland + Amenity Grassland	9598.19	19.78	0.79	23.96	4.28	540.73	203.97	12114	10.75	8159.70
Improved Grassland + Amenity Grassland + Unimproved Acid Grassland	11192.26	23.06	0.90	36.29	5.65	626.91	249.61	12428	9.94	11837.38
Improved Grassland + Amenity Grassland + Unimproved Acid Grassland + Rough Grassland	12810.44	26.40	0.97	44.18	6.46	668.90	279.34	13263	7.73	15375.48
Improved Grassland + Amenity Grassland + Unimproved Acid Grassland + Rough Grassland + Unimproved Neutral Grassland	12860.97	26.50	0.97	44.11	6.48	665.35	279.60	13198	7.71	15341.21



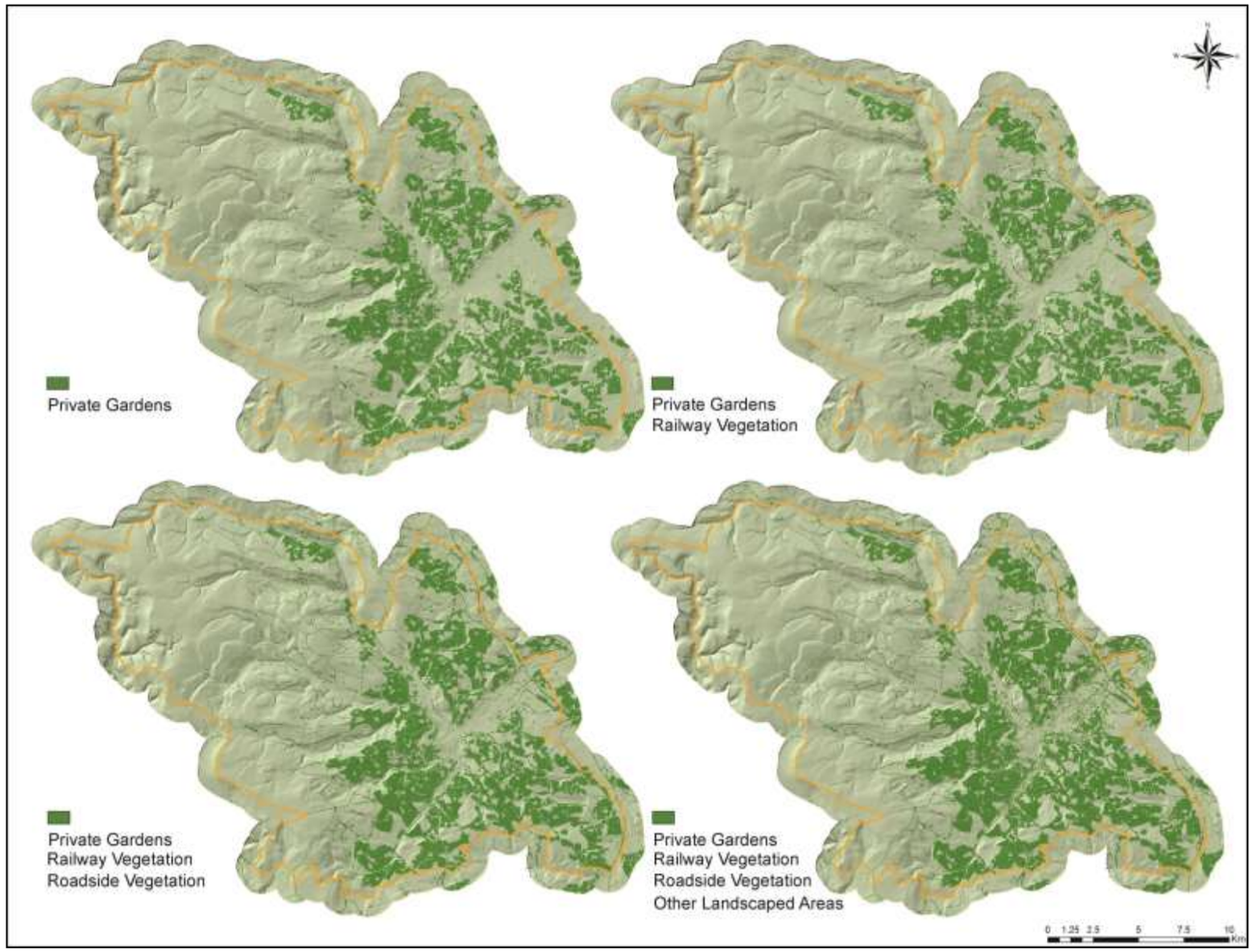
Appendix 6F: Results of Landscape metrics for Cultivated Land Network (aggregated from level 3 to level 2)

Cultivated Land- Land Cover Categories	CA (ha)	PLAND (%)	AREA_MN	AREA_AM	AREA_SD	AREA_CV	GYRATE_AM	NP	ENN_AM	PROX_AM
Arable	2633.57	5.43	0.97	20.73	4.38	450.67	179.74	2707	26.63	4888.48
Arable + Orchard	2645.84	5.45	0.95	20.70	4.33	456.52	179.39	2791	26.50	4884.20



Appendix 6G: Results of Landscape metrics for Mixed Vegetation Network (aggregated from level 3 to level 2)

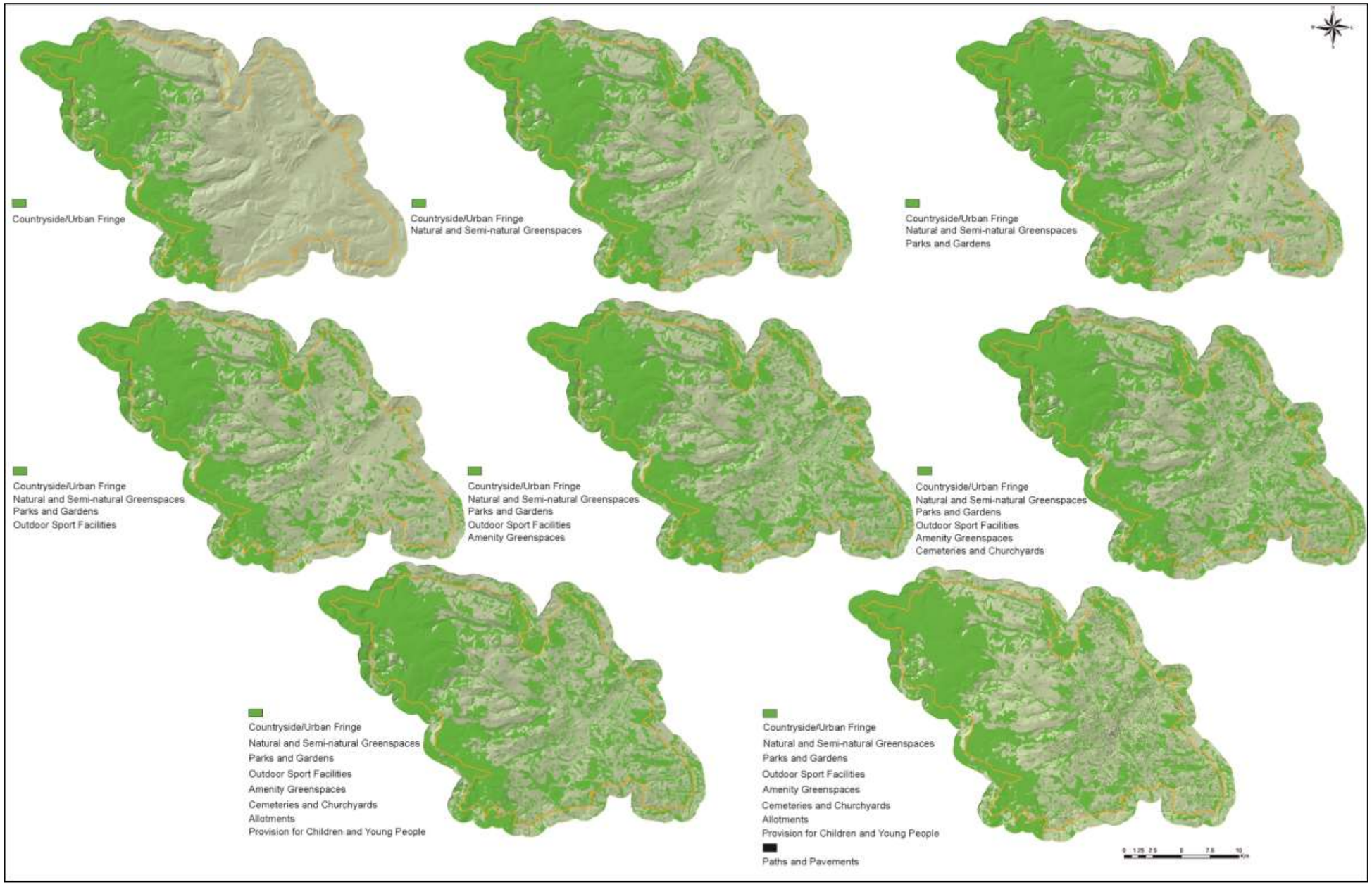
Mixed Vegetation Land Cover Categories	CA (ha)	PLAND (%)	AREA_MN	AREA_AM	AREA_SD	AREA_CV	GYRATE_AM	NP	ENN_AM	PROX_AM
Private Gardens	4667.86	9.62	0.24	1.77	0.61	252.07	69.56	19413	9.17	635.44
Private Gardens + Railway Vegetation	4828.63	9.95	0.24	1.80	0.61	254.67	72.45	20072	9.03	639.98
Private Gardens + Railway Vegetation + Roadside Vegetation	5465.58	11.26	0.12	1.90	0.46	388.57	83.34	46252	5.41	1118.21
Private Gardens + Railway Vegetation + Roadside Vegetation + Other Landscaped Areas	6035.47	12.44	0.12	2.20	0.50	413.34	88.84	49558	5.23	1272.06



Appendix 7: Land Use Structural Networks

Appendix 7A: Results of Landscape metrics for Recreation and Leisure Network (aggregated from level 3 to level 2)

Recreation and Leisure Land Cover Categories	**CA (ha)**	**PLAND (%)**	**AREA_MN**	**AREA_AM**	**AREA_SD**	**AREA_CV**	**GYRATE_AM**	**NP**	**ENN_AM**	**PROX_AM**
Countryside/ Urban Fringe	13764.99	28.37	8.25	4588.63	194.42	2355.92	2497.71	1668	4.37	296658.89
Countryside / Urban Fringe + Natural Semi-natural Greenspaces	18735.13	38.61	1.88	3398.23	79.88	4251.77	1946.12	9972	5.40	236876.27
Countryside / Urban Fringe + Natural Semi-natural Greenspaces + Parks and Gardens	19475.96	40.13	1.98	3269.93	80.49	4060.06	1879.29	9824	5.59	228115.62
Countryside / Urban Fringe + Natural Semi-natural Greenspaces + Parks and Gardens + Outdoor Sport Facilities	20367.98	41.97	2.09	3129.76	80.79	3871.34	1811.15	9760	5.68	218356.11
Countryside / Urban Fringe + Natural Semi-natural Greenspaces + Parks and Gardens + Outdoor Sport Facilities + Amenity Greenspaces	22770.21	46.92	0.92	2804.38	50.75	5523.95	1649.43	24784	4.99	198419.38
Countryside / Urban Fringe + Natural Semi-natural Greenspaces + Parks and Gardens + Outdoor Sport Facilities + Amenity Greenspaces + Cemeteries and Churchyards	22896.45	47.18	0.92	2789.07	50.71	5498.62	1641.34	24829	4.99	197392.18
Countryside / Urban Fringe + Natural Semi-natural Greenspaces + Parks and Gardens + Outdoor Sport Facilities + Amenity Greenspaces + Cemeteries and Churchyards + Allotments + Provision for Children and Young People **(Natural and Semi-natural Land)**	23018.97	47.44	0.92	2776.24	50.59	5485.76	1634.74	24943	4.97	196639.47
Natural and Semi-natural Land + Paths and Pavements	23948.23	49.35	0.37	2739.72	31.65	8654.61	1625.32	65586	4.64	180906.25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Parks and Gardens
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Parks and Gardens
Outdoor Sport Facilities
Countryside/Urban Fringe
Natural and Semi-natural Greenspaces
Parks and Gardens
Outdoor Sport Facilities
Amenity Greenspaces
Countryside/Urban Fringe
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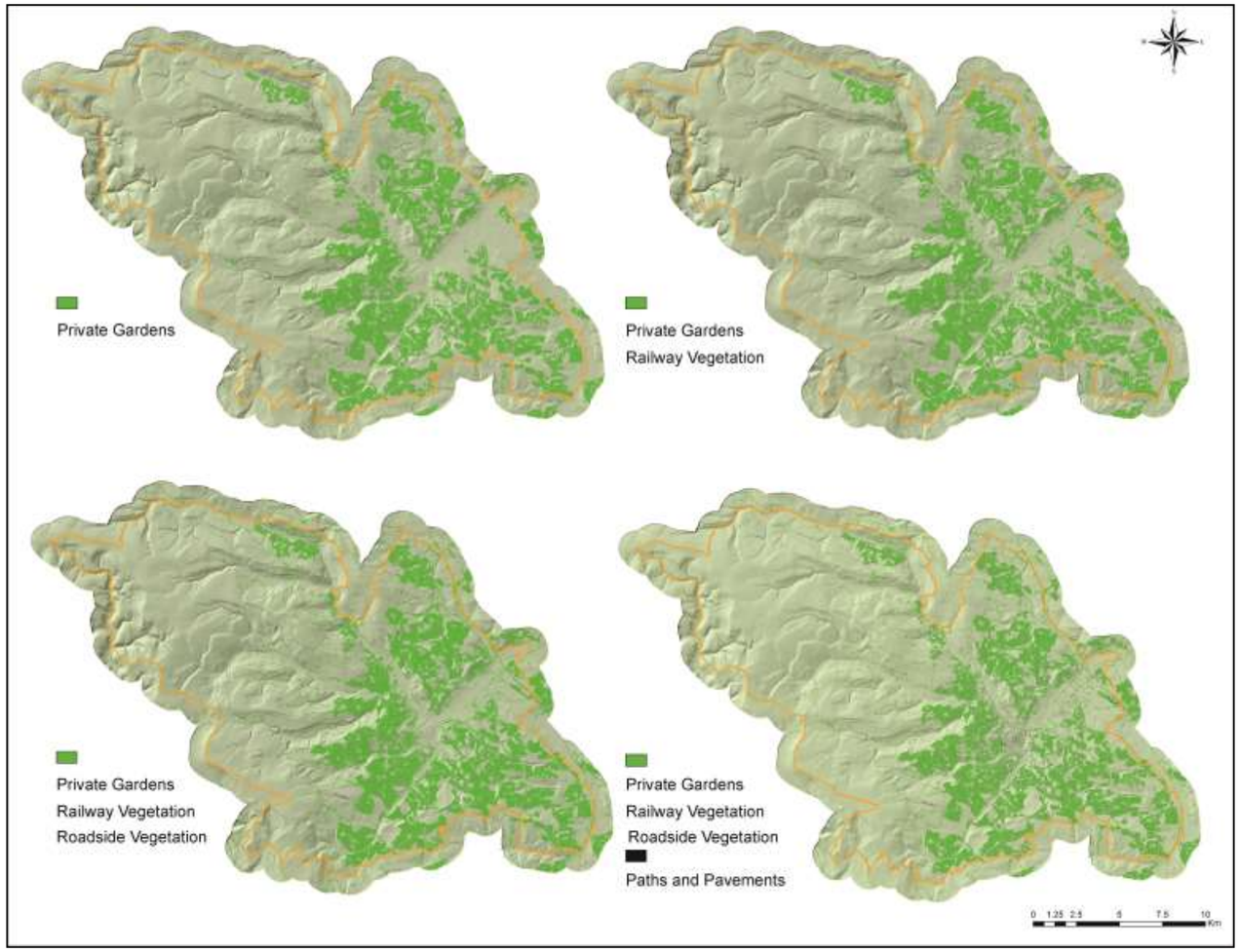
Allotments
Provision for Children and Young People
Countryside/Urban Fringe
Natural and Semi-natural Greenspaces
Parks and Gardens
Outdoor Sport Facilities
Amenity Greenspaces
Cemeteries and Churchyards
Allotments
Provision for Children and Young People
Paths and Pavements

Appendix 7B: Results of Landscape metrics for Mixed Vegetation Network (aggregated from level 3 to level 2)

Mixed Vegetation Land Cover Categories	**CA (ha)**	**PLAND (%)**	**AREA_MN**	**AREA_AM**	**AREA_SD**	**AREA_CV**	**GYRATE_AM**	**NP**	**ENN_AM**	**PROX_AM**
Private Gardens	4667.86	9.62	0.24	1.77	0.61	252.07	69.56	19413	9.17	635.44
Private Gardens + Railway Vegetation	4828.63	9.95	0.24	1.80	0.61	254.67	72.45	20072	9.03	639.98
Private Gardens + Railway Vegetation + Roadside Vegetation **(Mixed Vegetation)**	5465.58	11.26	0.12	1.90	0.46	388.57	83.34	46252	5.41	1118.21
Mixed Vegetation + Paths and Pavements	6394.84	13.17	0.14	3.40	0.67	486.75	117.33	46437	5.10	2990.46



Appendix 8: Interview Questions

Interviews Schedule

The main purpose of the semi structured interviews is to gain a deeper understanding of the underlying rationale for existing ecological/green network approaches in Sheffield. The potential participants in this research project will be identified based on whether they are concerned with planning and supporting biodiversity in Sheffield and whether they have been involved in the process of planning ecological/green networks in Sheffield. Following the initial contact by email, suitable times and places for the interviews will be arranged by telephone. An information sheet will be sent to all potential participants introducing and explaining the research in accordance with university guidelines. The interviews will be structured around the themes and questions set out below.

Introduction

1. ***When did you first become involved in planning the green / ecological network in Sheffield and what has your role been?***

   What is your job description?

Policy Background and Aims of the Green / Ecological Network in Sheffield

2. ***Could you tell me how the ecological/green network policy in Sheffield has developed since 1991?***
3. ***What would you say are the main aims of the current ecological/green network?***
4. ***How would you describe the main functions of the current ecological/green network?***

   Were any objective measures of connectivity used in creating the network?

5. ***Do you think the Green Network policy in Sheffield has been strengthened since the 1991 Nature Conservation Strategy?***

Application of Green network Policy

6. ***How has the actual Green Network developed since 1991?***

   Do you think the Green Network has an influence over other green and open space planning policies and their application in Sheffield?

   [Policy G2 - The Green Network is defined as 'a network of open space that provides the means for wildlife and people to move through the built-up areas and to connect with the surrounding countryside'].

   Can you describe how the needs for human access and nature conservation are managed in practice?

Site Selection and the Main features of Green / Ecological Network

7. ***Would you explain how sites were selected and identified?***

   How are the criteria applied in designating a Local Nature Reserve?

   Could you explain why some sites have multiple designations?

8. ***What would you say are the main physical features of the* green / ecological *network?***

   Could you explain the importance of water courses for the ecological/green network in terms of connectivity?

   Are there any areas acting as buffer zones? If yes, based on which policies and measures did you designate those buffers?

Appendix 9: General Information on Bird Species

Appendix 9A: Song thrush (*Turdus philomelos*)

The Song Thrush is a small, widespread songbird and generally associated with woodlands, hedgerows, parks and gardens. They have brown upper parts and lighter breast with spots. They feed on fruits, worms, insects and snails, and can be seen all the year round (Hornbuckle and Herringshaw, 1985; SRWT, 2014b; RSPB, 2014a). The most important threats to the Song thrush are the loss and degradation of habitats, changes in land use / cover, intensive farming (RSPB, 2014b).

The Song thrush is one of the priority species in the Sheffield and UK Biodiversity Action Plans. Additionally, they have "Red" conservation status, indicating that they have the highest conservation priority and need urgent action. The Song thrush is protected under the Wildlife and Countryside Act 1981 The Song thrush is also classified as the "Least-concern" in the International Union for Conservation of Nature (IUCN) Red List, suggesting that the species is not endangered or threatened (SRWT, 2014b; RSPB, 2014c; BirdLife International, 2014a).

Appendix 9B: Skylark (*Alauda arvensis*)

The Skylark is a small brown bird with the preferred habitats of farmland, grassland, and moorland. Mainly, they feed on seeds and insects. They are widespread in the UK and can be seen all the year round (Hornbuckle and Herringshaw, 1985; RSPB, 2014d). However, recently the populations of Skylark have experienced a moderate decline. The main threats to Skylarks are the loss and degradation of preferred habitats, changes in farming practices, intensive farming and use of intensive herbicides/ pesticides/chemicals in agriculture (RSPB, 2014e).

The Skylark is classified as one of the priority species in the Sheffield Local Biodiversity Action Plans. Because of the recent population declines, they have "Red" conservation status with the highest conservation priority and urgent action requirement. Also, they are fully protected under the Wildlife and Countryside Act 1981. In addition to this, internationally they are classified as the "Least-concern"

species in the International Union for Conservation of Nature (IUCN) Red List (RSPB, 2014f; BirdLife International, 2014b).

Appendix 9C: Blackbird (*Turdus merula*)

The Blackbird is widespread in the UK and can be seen everywhere from urban to countryside all the year round. Mainly, they feed on insects, worms and berries. While male Blackbirds are completely black with an orange-yellow beak, females are dark brown with spots or streaks on their throats (Hornbuckle and Herringshaw, 1985; SRWT, 2014c; RSPB, 2014g). According to RSPB, even though the causes of change in the Blackbird population are unknown, they are affected by the loss and degradation of preferred habitats, and the changes in the land use/cover (RSPB, 2014h).

Blackbirds are protected under the Wildlife and Countryside Act 1981. Also, they are protected internationally with the conservation status of "Least-concern" species in the IUCN Red List. In the UK, the conservation status of the Blackbird has been changed from "Amber" to "Green", after the population recovery towards the end of 1990s (SRWT, 2014c; RSPB, 2014i; BirdLife International, 2014c).

Appendix 9D: Greenfinch (*Carduelis chloris*)

The Greenfinch is the largest finch and they are generally in olive-green and brown-green colour with yellow patches on their wings and tails (SRWT, 2014d). They are generally associated with woodland edges, bushes, gardens and parks. They feed on seeds and insects and can be seen all the year round. They cannot be found in upland areas where there is no trees and bushes (Hornbuckle and Herringshaw, 1985; SRWT, 2014d; RSPB, 2014j).

The Greenfinch has "Green" conservation status, which indicates that the species occur regularly in the UK and does not need urgent action because of a recent population recovery from historical decline (Eaton et al., 2009). The Greenfinch is also classified as the "Least-concern" in the IUCN Red List, which suggests that the species is widespread and abundant ant currently not endangered or threatened (SRWT, 2014d; RSPB, 2014j; BirdLife International, 2014d).

Appendix 10: General Information on Bat Species

Appendix 10A: Brown Long-eared Bat (*Plecotus auritus*)

The Brown Long-eared Bat is a medium-sized, greyish-brown bat with long ears. They feed on insects, moths and midges (SRWT, 2014e). They are widespread in the UK. The Brown Long-eared Bat roosts in holes in trees and lofts in buildings (Clinging and Whiteley, 1980). They require habitats which support insects, such as woodlands, gardens, heathlands and grasslands (SCC, 2002; SRWT, 2014e). The main threats to the Brown Long-eared Bat are the loss/degradation of preferred habitats (particularly linear habitats), land use/cover changes, changes in habitat features, human disturbances and the lack of public understanding/sympathy (Clinging and Whiteley, 1980; Glasscock, 2002).

The Brown Long-eared Bat is one of the priority species in Sheffield and UK Biodiversity Action Plans. They are also protected under the Wildlife and Countryside Act 1981 in the UK (Glasscock, 2002; SRWT, 2014e). Internationally they are included in the IUCN Red List as the "Least-concern" species which suggests that the species is not endangered or threatened (Hutson et al., 2008).

Appendix 10B: Pipistrelle Bat (*Pipistrellus pipistrellus*)

The Pipistrelle Bat is the smallest, most abundant and widespread bat species in the UK. They have a darker mask around their faces with dark to golden brown fur on the upper part with slightly lighter under part (SRWT, 2014f). The Pipistrelle Bat generally roost in the roofs of houses and feeds on insects. They are mainly associated with woodlands, unimproved grassland, gardens, farmlands and heathlands (Glasscock, 2002; SRWT, 2014f). The loss/degradation of habitats (particularly linear habitats), land use/cover changes, intense farming activities are the main threats to Pipistrelle Bats (Clinging and Whiteley, 1980; Glasscock, 2002).

Pipistrelle Bats are one of the priority species in Sheffield Local Biodiversity Action Plans. They are also protected under the Wildlife and Countryside Act 1981 in the UK (Glasscock, 2002; SRWT, 2014f). Additionally, Pipistrelle bats are included in the IUCN Red List as the "Least-concern" species (Hutson et al., 2008).

Appendix 10C: Leisler's Bat (*Nyctalus leisleri*)

The Leisler's Bat has long reddish-brown fur which is darker at the underside. Their fur is especially very long around their shoulders and back. They feed on flies, moths and beetles. They are woodland species and roost in tree holes (Glasscock, 2002).

Even though their local population seems to be stable in Sheffield, they are one of the priority species in Sheffield Local Biodiversity Action Plans. Similar to Brown Long-eared Bats, their populations are threatened by the loss/degradation of preferred habitats (particularly linear habitats), land use/cover changes, changes in habitat features, human disturbances and the lack of public understanding/sympathy (Glasscock, 2002). Also, they are included in the IUCN Red List as the "Least-concern" species (Hutson et al., 2008).

Appendix 11: General Information on Reptile Species

Appendix 11A: Common lizard (*Lacerta vivipara*)

The Common lizard is associated with various habitats including heathlands, woodlands and grasslands. Common lizards are the most common and widespread reptiles in the UK. Even though the colour of males and females may have different colours, in general they have brownish-olive upper parts and lighter undersides (Doar and Eades, 2002; SRWT, 2014g). The main threats to the Common lizard are the loss/degradation of suitable habitats, loss of places where reptiles hibernate (hibernacula) and shelter (refuges), habitat fragmentation and poor public perception (Doar and Eades, 2002).

In the UK, Common lizards are protected under the Wildlife and Countryside Act 1981, as well as being classified as one of the priority species in the UK Biodiversity Action Plans and Sheffield Local Biodiversity Action Plans (Doar and Eades, 2002; SRWT, 2014g). Also, Common lizards are classified as the "Least-concern" species in the IUCN Red List.

Appendix 10B: Grass Snake (*Natrix natrix*)

The Grass snake is the largest but harmless snake in the UK. They have dark green skin with darker stripes around both sides and light yellow-cream collar behind their

heads. Even females and males are same in their colours, females are bigger than males. Their preferred habitats are composed of wetlands, woodland edges, grasslands, hedgerows and heathlands (Doar and Eades, 2002; SRWT, 2014h). Similar to Common lizards, Grass snakes are threatened by the loss/degradation of suitable habitats, loss of places where reptiles hibernate and shelter, habitat fragmentation and poor public perception (Doar and Eades, 2002).

Grass snakes are protected under the Wildlife and Countryside Act 1981 and classified as one of the priority species in the UK Biodiversity Action Plans and Sheffield Local Biodiversity Action Plans (Doar and Eades, 2002; SRWT, 2014h). Also, they are "Least-concern" species in the IUCN Red List.

Appendix 11C: Slow-worm (*Anguis fragilis*)

The Slow-worm is a legless reptile which is smaller than snakes with golden-grey skin. While males are smaller than females with lighter skin and sometimes have blue spots, females have darker skin with dark stripe on their backs They are widespread in the UK and can be found in gardens, grassland, heathlands and woodland edges (Doar and Eades, 2002; SRWT, 2014i). The main threats to Grass snakes are the loss/degradation of suitable habitats, loss of places where reptiles hibernate and shelter, habitat fragmentation and poor public perception (Doar and Eades, 2002).

They are protected under the Wildlife and Countryside Act 1981 and classified as one of the priority species in the UK Biodiversity Action Plans and Sheffield Local Biodiversity Action Plans (Doar and Eades, 2002; SRWT, 2014i). Also, they are "Least-concern" species in the IUCN Red List.

Appendix 12: Supporting Information Document about Connectivity Exercise

Connectivity

Connectivity has been defined as "the degree to which the landscape facilitates or impedes movement among habitat patches" (Taylor et al., 1993). It is important to measure and maintain connectivity in a landscape, as the degree to which habitat patches are connected determines the amount of species dispersal, which in turn affects their long term persistence.

Connectivity for organisms is affected both by how close together habitat patches are, and also by how easily the organisms can move though the surrounding landscape. It is hard to measure how easily organisms can move through a particular landscape, but one way we can get an estimate of this is by consulting people with expertise in the ecology and behaviour of particular species.

About the expert process

We recognize that the questions in the exercise require judgements about some potentially quite complex processes, which can be influenced by many different factors. Please don't worry too much about the 'unseen' complexities, or about getting the 'right' answer. The process relies simply on each expert providing their best, reasoned estimates, and then building a consensus from those.

Supporting information for the questions

We would like you to provide your best estimate of habitat suitability and species dispersal, for **Song thrush *(Turdus philomelos),* Blackbird *(Turdus merula),* Skylark *(Alauda arvensis)* and Greenfinch *(Carduelis chloris*),** in relation to the breeding and survival aspects of their ecology.

For each question, please consider that **each habitat patch is isolated and do not take into account of surrounding patches.**

1. **Habitat suitability:** Here you are asked to estimate the suitability of the habitat type for the successful breeding and survival of the species you are considering.

   We are asking you to give an estimate on a scale from 1 to 100 where 1 represents habitat in which individuals would struggle to survive for any period and would never breed successfully; 50 is a habitat where individuals could survive for some time, and might attempt to breed, but with low likelihood of success; and 100 is habitat in which mortality is low and most breeding attempts are successful.

2. **Minimum habitat area (ha):** Minimum habitat area refers to an area that is large enough to support at least one successful breeding unit and a breeding unit is generally considered as a mating pair of individuals.

   Here, you are asked to estimate the approximate area of specific habitat you think necessary to support at least a single successful breeding event for a mating pair of the species you are considering. The estimate should be in hectares. For reference a hectare is about the size of a football stadium (120 x 90 metres), and the figure shows an area of urban landscape with areas of 0.5, 1, and 2 ha marked on it.

3. **Permeability value:** Permeability values represent the capacity of different land cover types to impede or enable the movement of species. Here you are asked to estimate the permeability value for each land cover type considering the relative difficulty for the species to traverse across non-habitat between habitat patches.

   You are asked to make your estimate anywhere on a scale from 1 to 100; where the value 1 represents the habitat in which the species would normally reside/breed and movement is not restricted; 50 indicates habitat in which a species would not breed, but may be able to survive in and move through if it has to, without high likelihood of mortality, though movement may be restricted, or slow; and 100 indicates habitat that is either a complete physical barrier to movement, or one in which there is a high likelihood of mortality in crossing the habitat for any distance.

Land cover and Land use

Here it is important to clarify that land **cover** refers to whether a landscape is covered by woodlands, wetlands, water, etc.; whereas land **use** indicates how the land is used (whatever the actual cover on the ground is). Different land cover types can have different land uses. For example, woodland land cover could be managed for recreation, or wood production.

Explanation of Land Cover Types

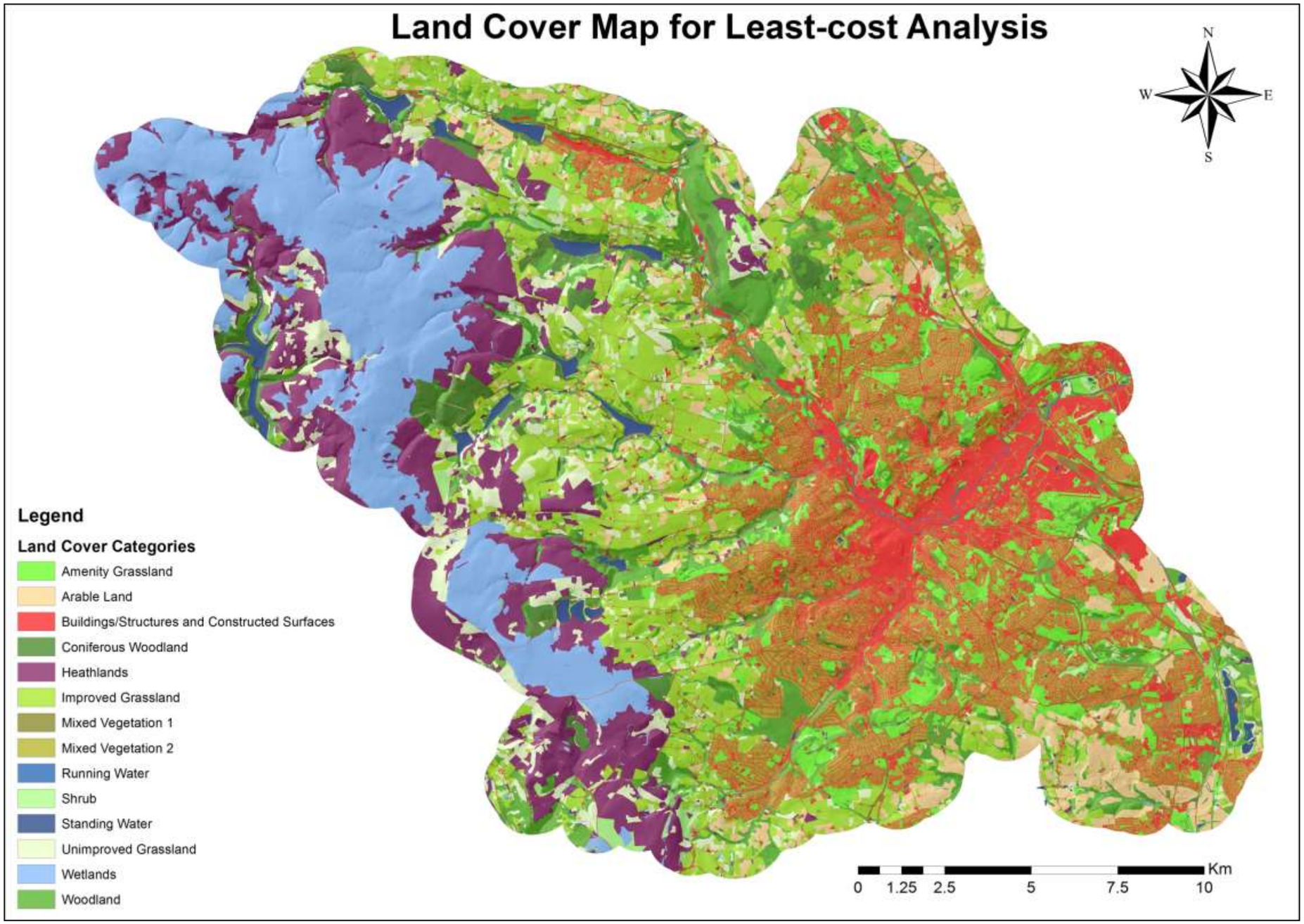
1. **Woodlands:** Woodland is broadly defined as land with tree canopy cover of at least 20%, or land with the potential to achieve this, which is at least 0.5ha in size and 20m wide. Woodlands may be: Broadleaved Woodland, Mixed Woodland, Felled Trees, Young Trees or Orchards. The Woodland land cover type may form part of leisure and recreational facilities such as Parks and Gardens, Amenity Green Spaces, Natural and Semi Natural Green Spaces, or part of other open land use types, such as Mineral Workings and Quarries or Refuse Disposal.
2. **Coniferous Woodland:** This land cover type represents areas with at least 80% of canopy cover by conifer species. Because of its distinctive structural properties, Coniferous Woodlands are defined as a separate land cover type. As

with other Woodland Land cover types, Coniferous Woodland areas may form part of recreation facilities or part of other non-built up land use types.

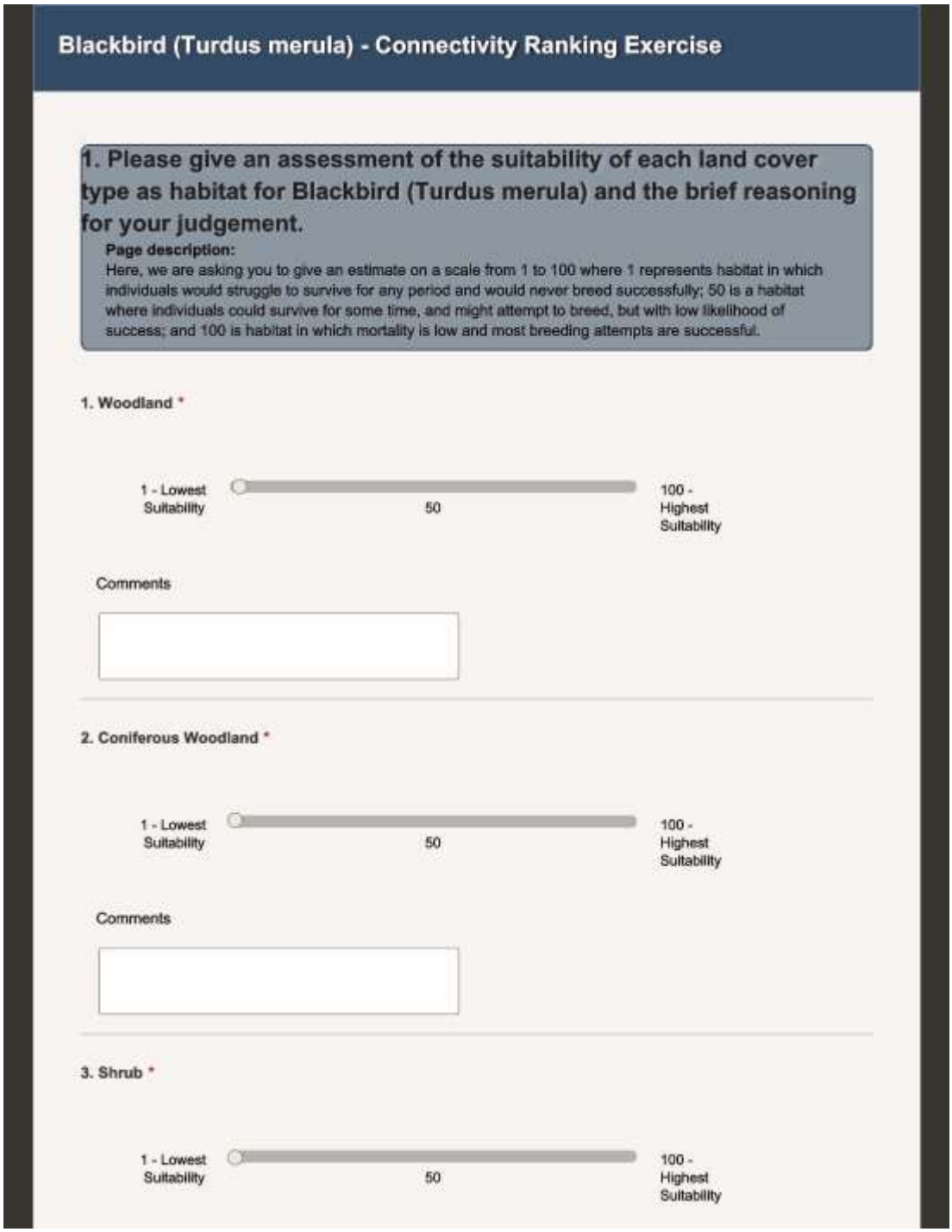
3. **Shrub:** This land cover type is composed mainly of land that has at least 20% vegetation cover with 2m-5m height. Scrub land cover patches are included within this category.
4. **Mixed Vegetation 1:** The Mixed vegetation 1 type includes roadside and railway vegetation representing natural and semi natural surfaces that exist along the road and railway networks.
5. **Mixed Vegetation 2:** This type of land cover includes private gardens and other landscaped areas. Private gardens represent areas incorporating multiple surface types (vegetation and paved surfaces). Other landscaped areas are areas with mixed vegetation within the urban fabric but not classified in other vegetation subclasses. An example of other landscaped areas is a landscaped surface around residential buildings.
6. **Improved Grassland:** This type of land cover consists of grasslands that are managed as pastures for agricultural purposes. Hedgerows in between agricultural improved grassland parcels are also included in this category.
7. **Amenity Grassland**: This type of land cover consists of grasslands that are managed for non-agricultural purposes such as recreation and amenity. Amenity Grassland typically represents parklands and other improved grassland areas apart from agricultural purposes.
8. **Unimproved Grassland:** This land cover type is characterised by unimproved acid, unimproved neutral and rough grasslands. Within this broad type, rough grassland is a mixture of improved and unimproved, low productivity grass areas.
9. **Heathlands:** This land cover type is comprised of areas of natural and semi natural surfaces covered by heather and heather grasslands with very few trees or bushes.
10. **Arable Land:** Arable areas are those used for annual and perennial croplands and horticultural lands.
11. **Buildings/Structures and Constructed Surfaces:** This land cover type consists of all buildings /structures as well as transportation features and other paved surfaces.

12. **Standing Water:** This land cover type consists of all natural standing water features such as lakes, and manmade water features such as reservoirs, canals and ponds.
13. **Running Water:** The Running Water land cover type includes all natural moving water features such as rivers and brooks.
14. **Wetlands:** This land cover type represents natural and semi natural wet areas that support vegetation. The Wetlands broad land cover type consists of bogs (heather dominated and grass dominated) and marsh, reeds and salt marshes.

Appendix 13: Land Cover Map for Least-cost Corridor Analyses



Appendix 14: An Example of On-line Survey for Blackbird (*Turdus merula*)



Blackbird (Turdus merula) - Connectivity Ranking Exercise

1. Please give an assessment of the suitability of each land cover type as habitat for Blackbird (Turdus merula) and the brief reasoning for your judgement.

Page description:
Here, we are asking you to give an estimate on a scale from 1 to 100 where 1 represents habitat in which individuals would struggle to survive for any period and would never breed successfully; 50 is a habitat where individuals could survive for some time, and might attempt to breed, but with low likelihood of success; and 100 is habitat in which mortality is low and most breeding attempts are successful.

1. Woodland *

1 - Lowest Suitability | 50 | 100 - Highest Suitability

Comments

2. Coniferous Woodland *

1 - Lowest Suitability | 50 | 100 - Highest Suitability

Comments

3. Shrub *

1 - Lowest Suitability | 50 | 100 - Highest Suitability

Comments

4. Mixed Vegetation 1 (roadside and railway vegetation) *

1 - Lowest Suitability | 50 | 100 - Highest Suitability

Comments

5. Mixed Vegetation 2 (private gardens and other landscaped areas) *

1 - Lowest Suitability | 50 | 100 - Highest Suitability

Comments

6. Improved Grassland *

1 - Lowest Suitability | 50 | 100 - Highest Suitability

Comments

7. Amenity Grassland *

1 - Lowest Suitability | 50 | 100 - Highest Suitability

Comments

8. Unimproved Grassland *

1 - Lowest Suitability | 50 | 100 - Highest Suitability

Comments

9. Heathland *

1 - Lowest Suitability | 50 | 100 - Highest Suitability

Comments

10. Arable Land *

1 - Lowest Suitability | 50 | 100 - Highest Suitability

Comments

11. Standing Water *

1 - Lowest Suitability | 50 | 100 - Highest Suitability

Comments

12. Running Water *

1 - Lowest Suitability | 50 | 100 - Highest Suitability

Comments

13. Wetland *

1 - Lowest Suitability | 50 | 100 - Highest Suitability

Comments

14. Buildings /Structures and Constructed Surfaces *

1 - Lowest Suitability | 50 | 100 - Highest Suitability

Comments

2. Please give an assessment of the approximate minimum habitat area requirement of Blackbird (Turdus merula) (ha) and the brief reasoning for your judgement.

Page description:

15. Blackbird (Turdus merula) *

Habitat Area Requirement (ha)

Comments

3. Please assign a permeability value for each land cover type using the visual analogue scale below (ranging from 1 to 100 where 1 represents the suitable habitat for Blackbird (Turdus merula) and 100 represents a barrier to movement) and, if possible, give the reasoning for your judgement.

Page description:

16. Woodland *

1 - Low Resistance to Movement | 50 | 100 - High Resistance to Movement

Comments

17. Coniferous Woodland *

1 - Low Resistance to Movement

50

100 - High Resistance to Movement

Comments

18. Shrub *

1 - Low Resistance to Movement

50

100 - High Resistance to Movement

Comments

19. Mixed Vegetation 1 (roadside and railway vegetation) *

1 - Low Resistance to Movement

50

100 - High Resistance to Movement

Comments

20. Mixed Vegetation 2 (private gardens and other landscaped areas) *

1 - Low Resistance to Movement

50

100 - High Resistance to Movement

Comments

21. Improved Grassland *

1 - Low Resistance to Movement | 50 | 100 - High Resistance to Movement

Comments

22. Amenity Grassland *

1 - Low Resistance to Movement | 50 | 100 - High Resistance to Movement

Comments

23. Unimproved Grassland *

1 - Low Resistance to Movement | 50 | 100 - High Resistance to Movement

Comments

24. Heathland *

1 - Low Resistance to Movement

50

100 - High Resistance to Movement

Comments

25. Arable Land *

1 - Low Resistance to Movement

50

100 - High Resistance to Movement

Comments

26. Standing Water *

1 - Low Resistance to Movement

50

100 - High Resistance to Movement

Comments

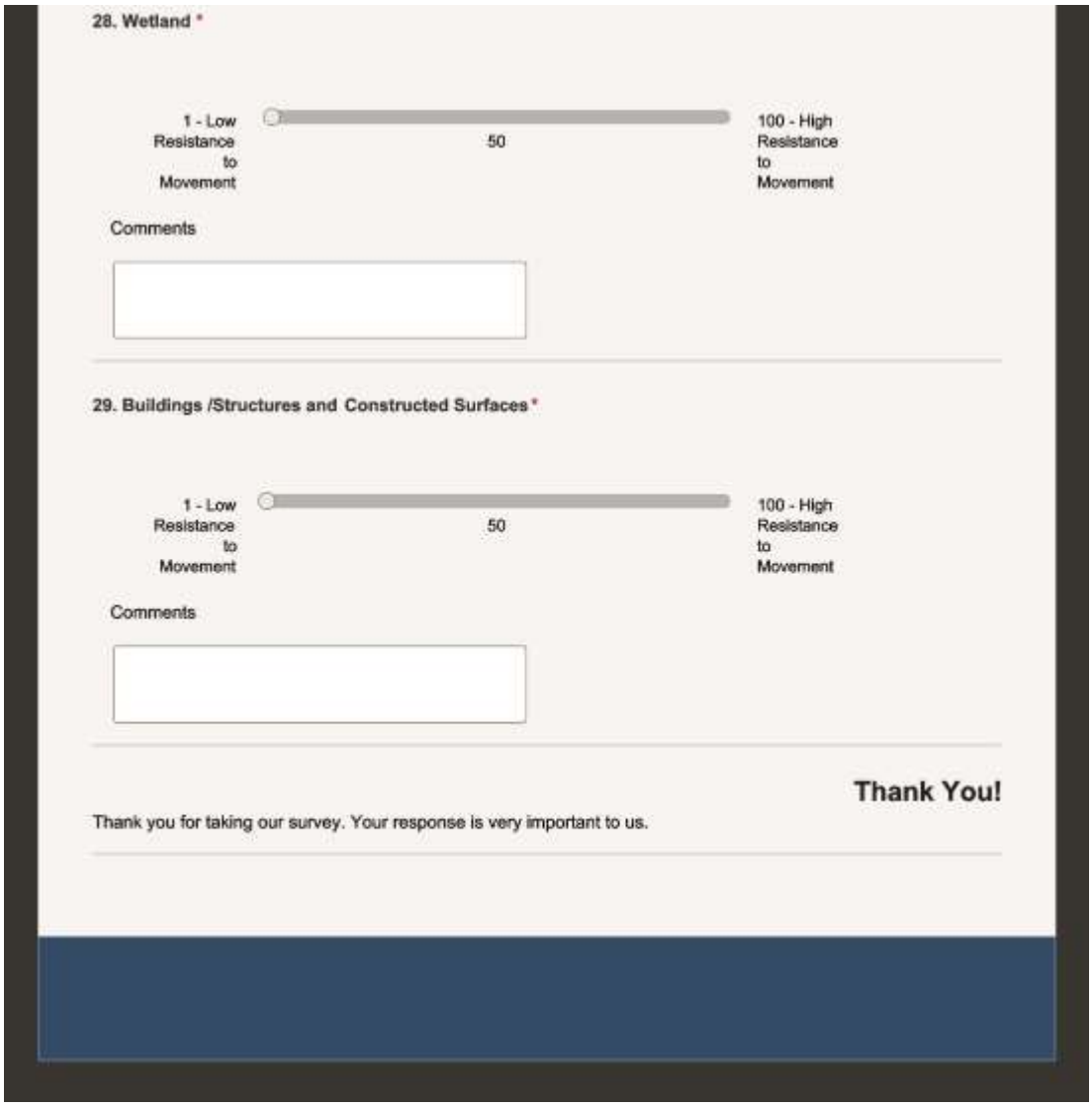
27. Running Water *

1 - Low Resistance to Movement

50

100 - High Resistance to Movement

Comments


28. Wetland *
1 - Low Resistance to Movement
50
100 - High Resistance to Movement
Comments
29. Buildings /Structures and Constructed Surfaces *
1 - Low Resistance to Movement
50
100 - High Resistance to Movement
Comments
Thank You!
Thank you for taking our survey. Your response is very important to us.

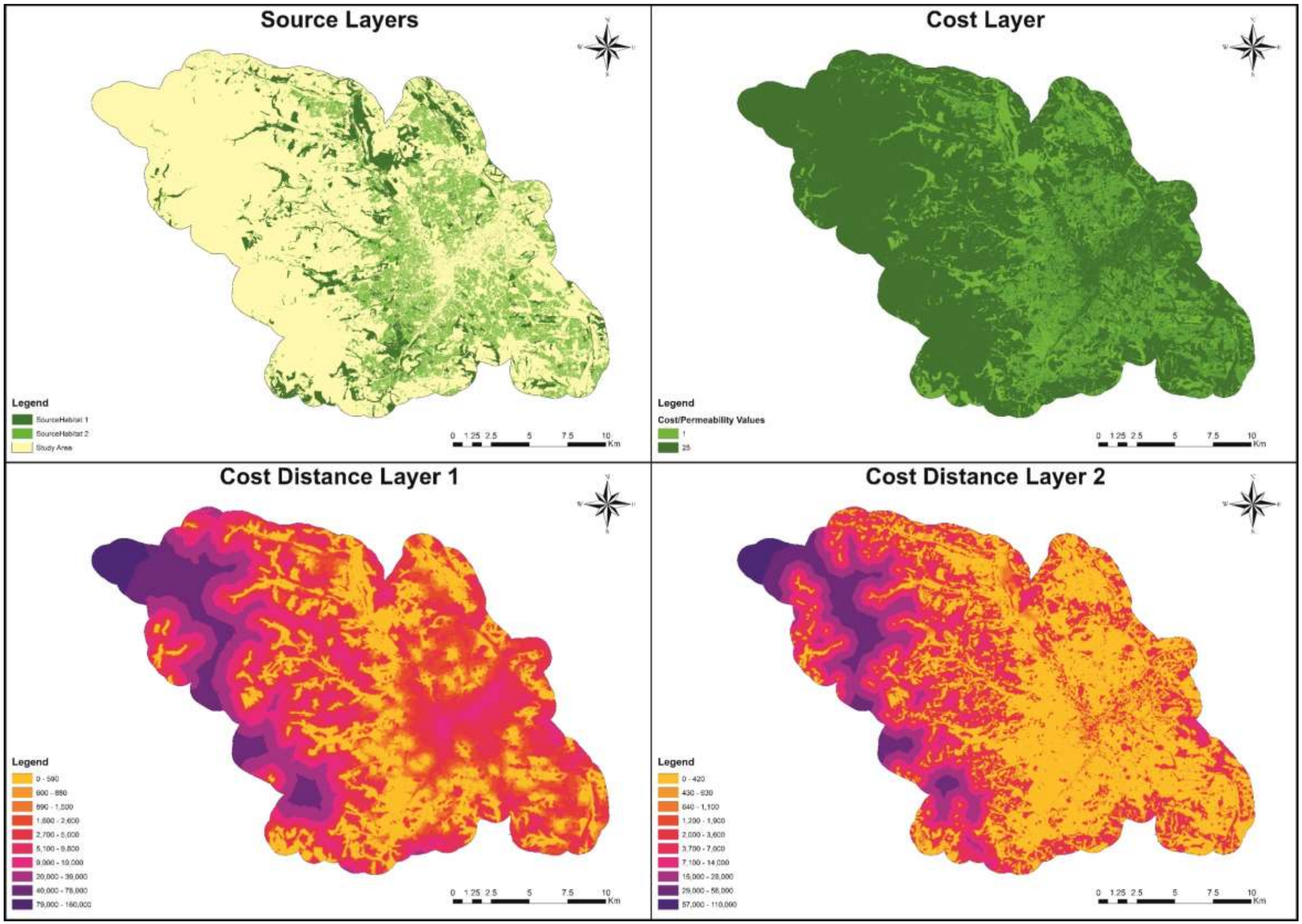
Appendix 15: Song Thrushes

Appendix 15A: Summary of Parameters Obtained from Experts for Song Thrushes

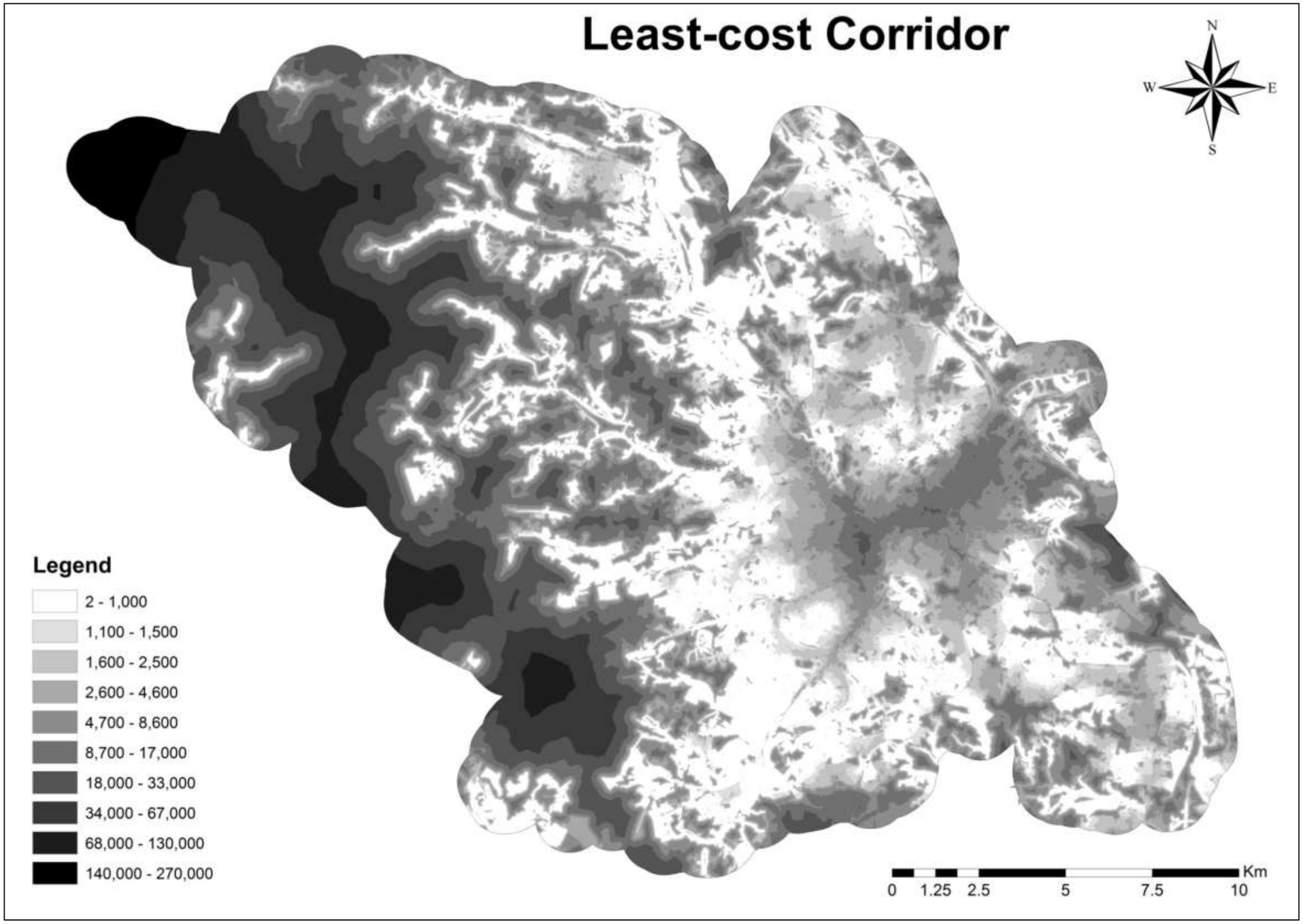
- **Core Habitats (Source layer 1):** Woodland, Shrub, Mixed Vegetation 2 (Private Gardens and Other Landscaped Areas) ≥ 4 ha
- **Least Suitable Habitats (Source layer 2):** Woodland, Shrub, Mixed Vegetation 2 (Private Gardens and Other Landscaped Areas) < 4 ha

Land Cover Categories	Permeability Value Estimations
Woodlands	**1**
Coniferous Woodland	25
Shrub	**1**
Mixed Vegetation 1	25
Mixed Vegetation 2	**1**
Improved Grassland	25
Amenity Grassland	25
Unimproved Grassland	25
Heathlands	25
Arable Land	25
Standing Water	25
Running Water	25
Wetlands	25
Buildings / Structures and Constructed Surfaces	25
Minimum Habitat Area Requirement	**4 ha**

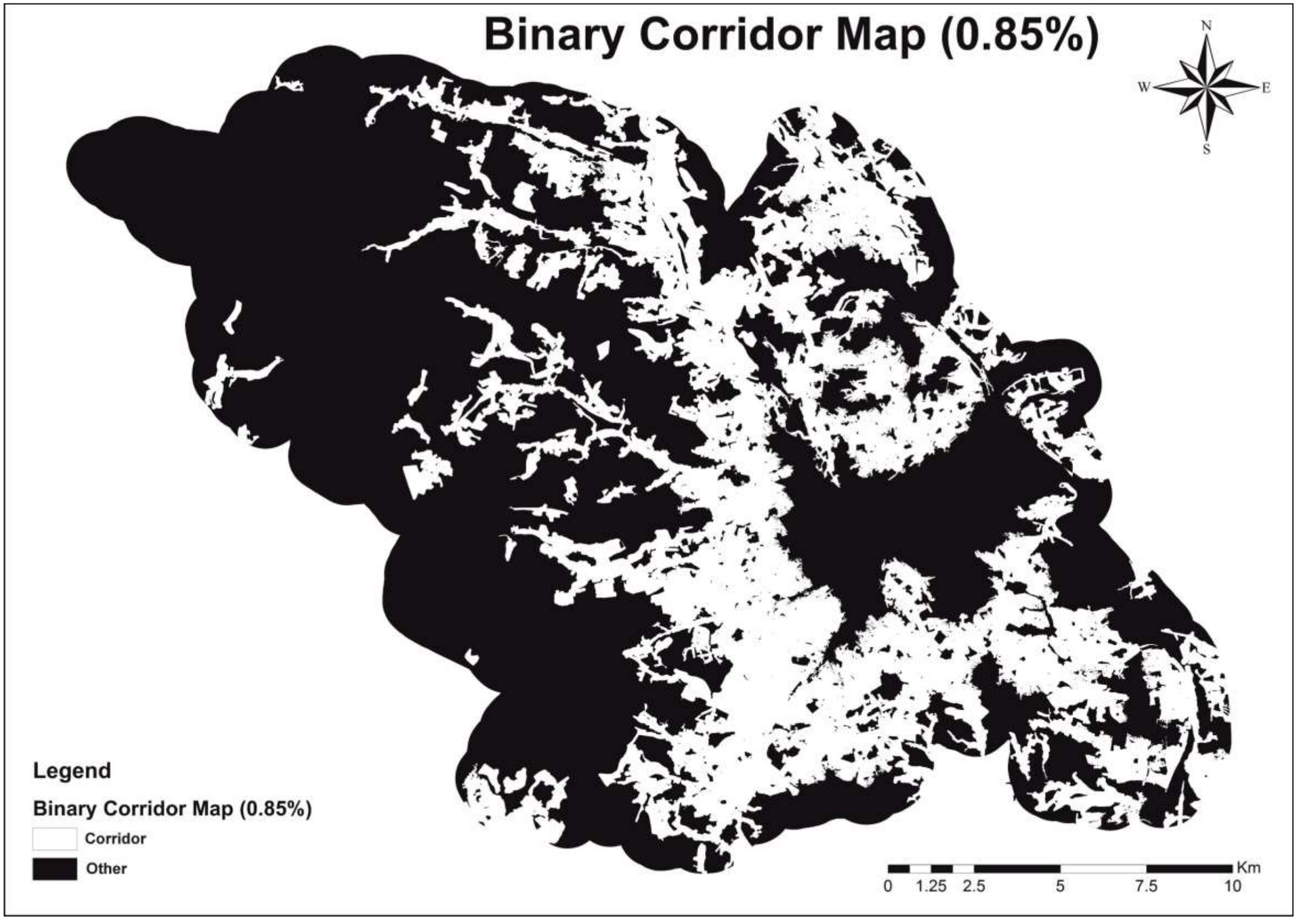
Appendix 15B: Least-cost Corridor Input Layers for Song Thrushes



Appendix 15C: Least-cost Corridor for Song Thrushes



Appendix 15D: Least-cost Binary Map for Song Thrushes



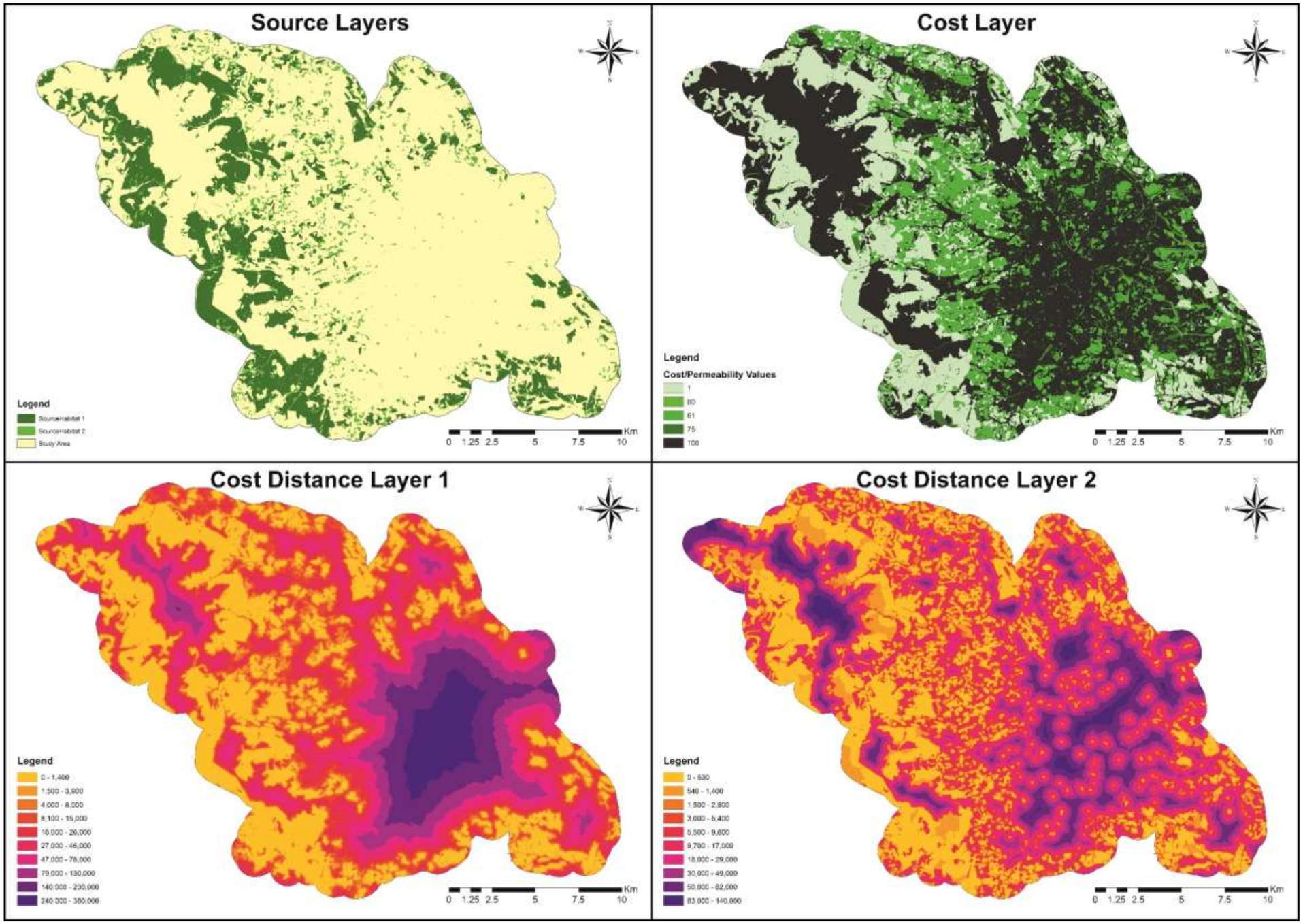
Appendix 16: Skylarks

Appendix 16A: Summary of Parameters Obtained from Experts for Skylarks

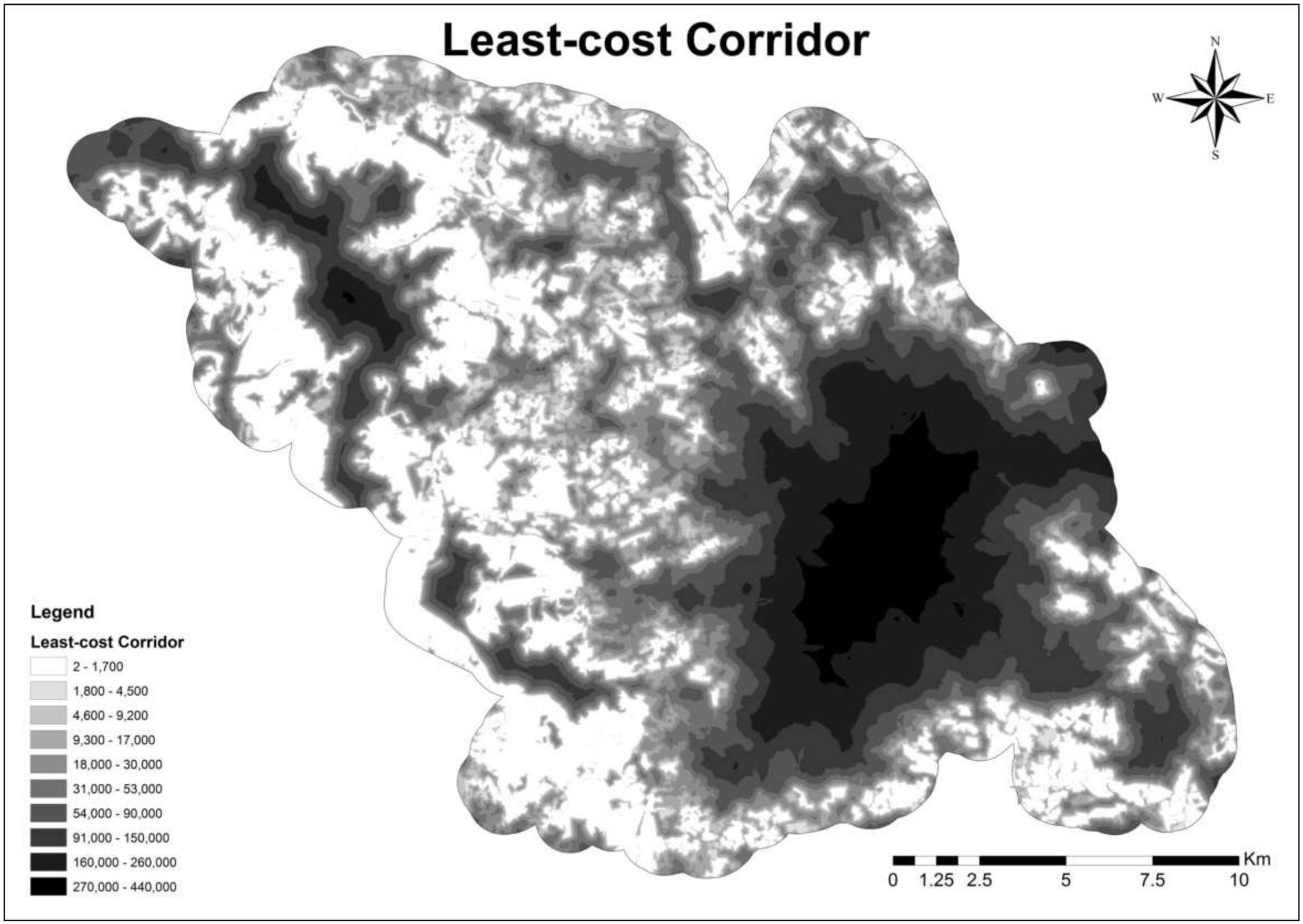
- **Core Habitats (Source layer 1):** Arable Land, Unimproved Grassland, Heathland ≥ 4 ha
- **Least Suitable Habitats (Source layer 2):** Arable Land, Unimproved Grassland, Heathland < 4 ha

Land Cover Categories	Permeability Value Estimations
Woodlands	100
Coniferous Woodland	100
Shrub	75
Mixed Vegetation 1	60
Mixed Vegetation 2	100
Improved Grassland	61
Amenity Grassland	61
Unimproved Grassland	**1**
Heathlands	**1**
Arable Land	**1**
Standing Water	100
Running Water	100
Wetlands	100
Buildings / Structures and Constructed Surfaces	100
Minimum Habitat Area Requirement	**4 ha**

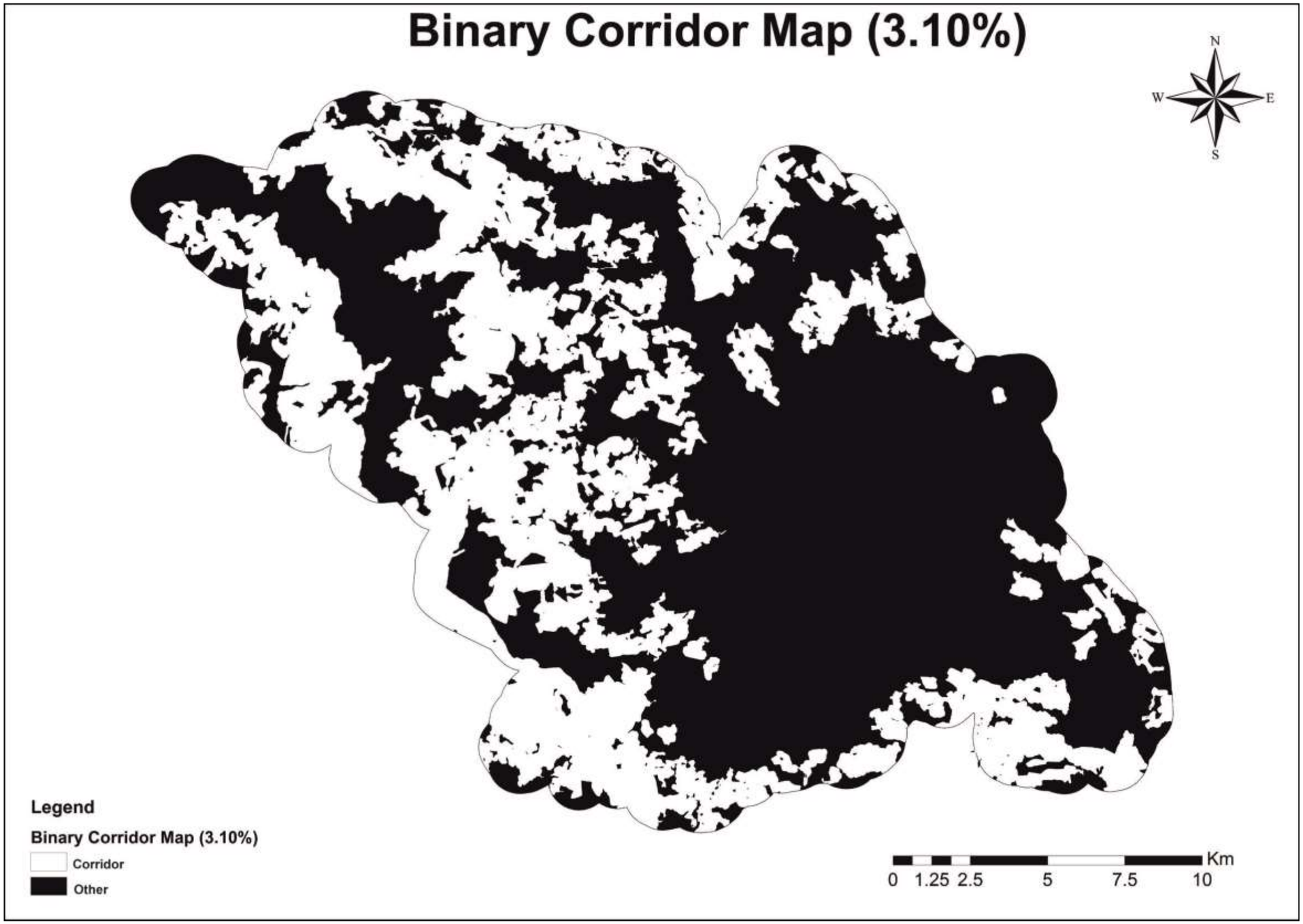
Appendix 16B: Least-cost Corridor Inputs for Skylarks



Appendix 16C: Least-cost Corridor for Skylarks



Appendix 16D: Least-cost Binary Map for Skylarks



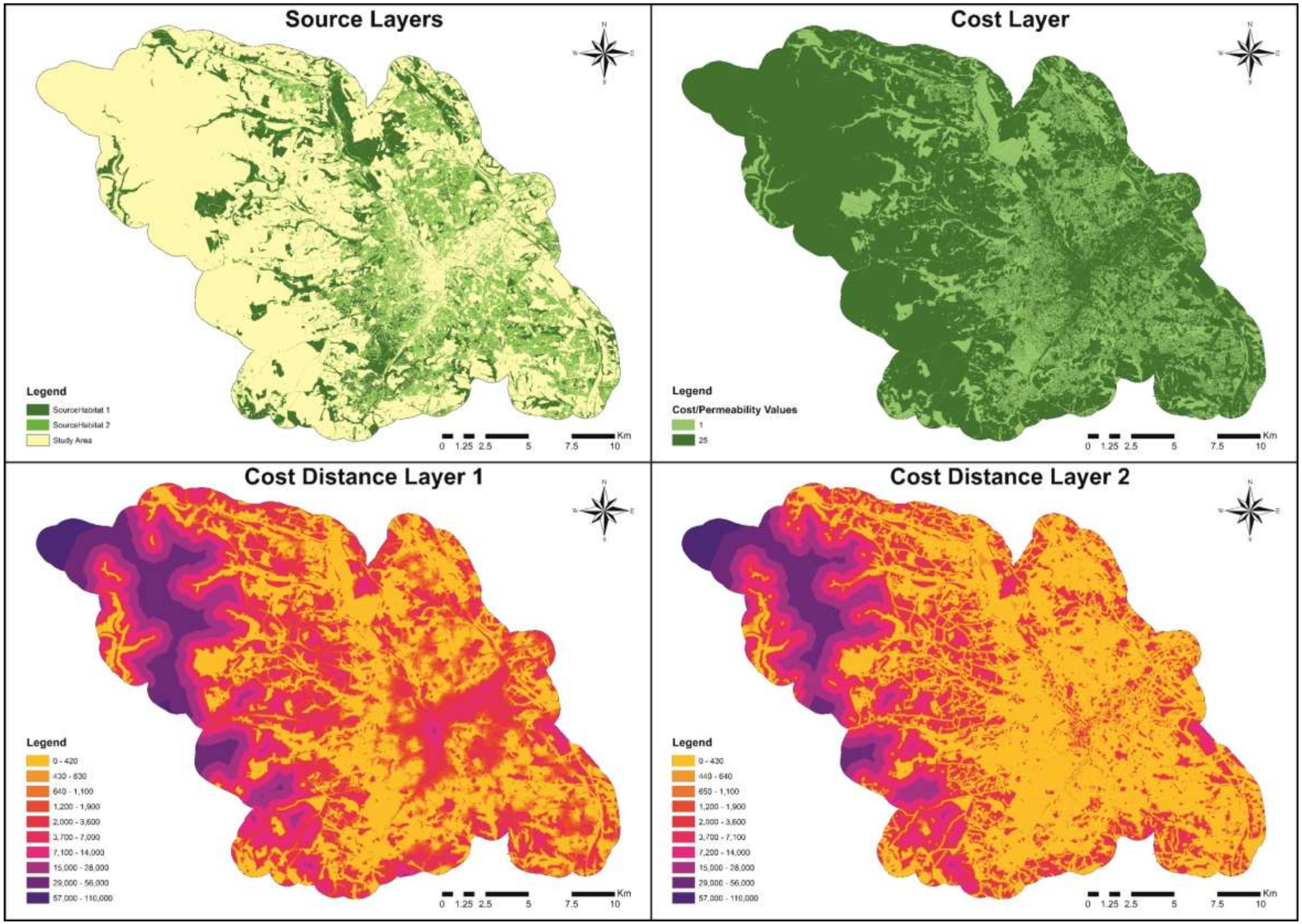
Appendix 17: Blackbirds

Appendix 17A: Summary of Parameters Obtained from Experts for Blackbirds

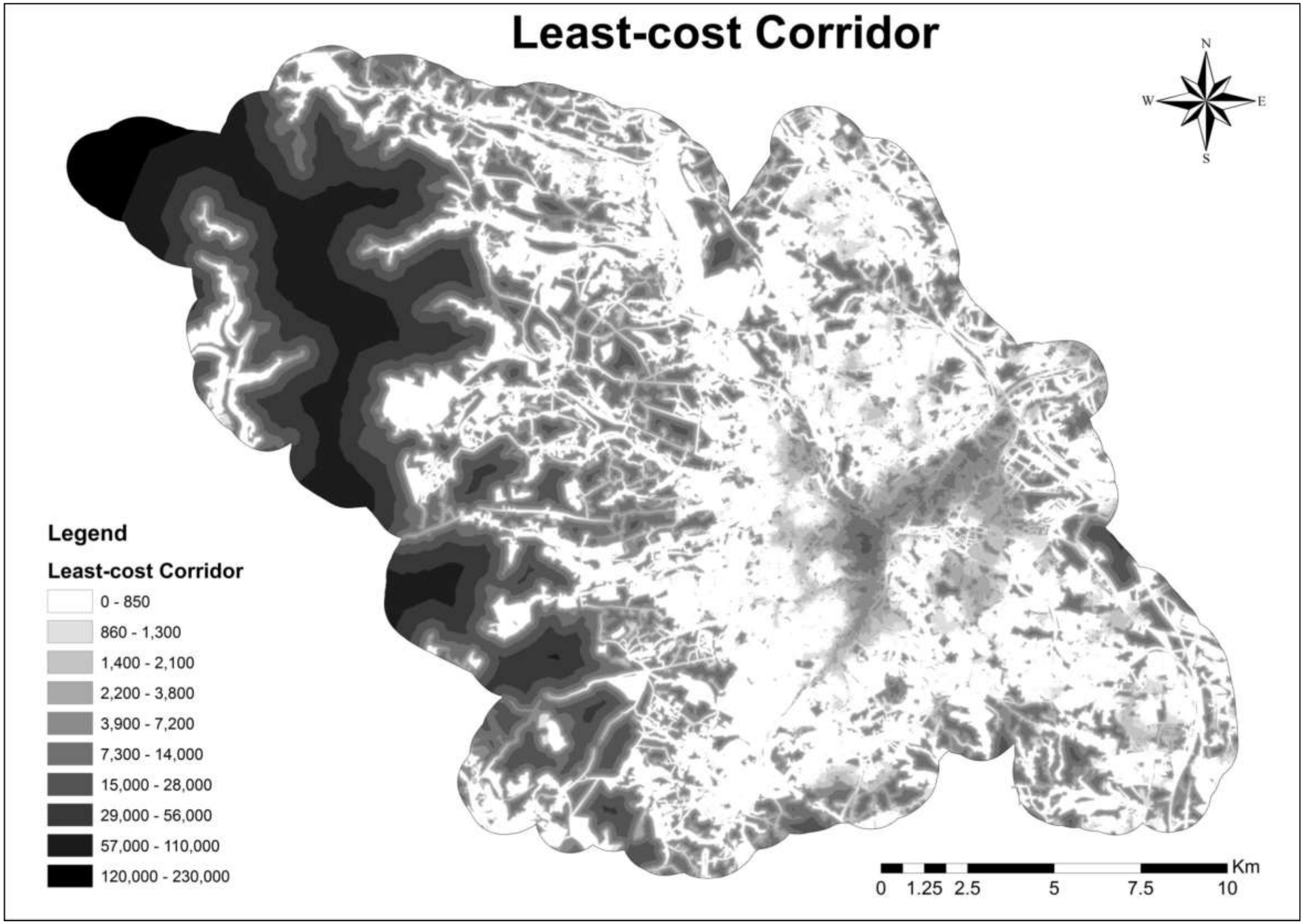
- **Core Habitats (Source layer 1):** Mixed Vegetation 2 (Private Gardens and Other Landscaped Areas), Shrub, Woodland, Coniferous Woodland, Mixed Vegetation 1 (Roadside Vegetation and Railway Vegetation) ≥ 2 ha
- **Least Suitable Habitats (Source layer 2):** Mixed Vegetation 2 (Private Gardens and Other Landscaped Areas), Shrub, Woodland, Coniferous Woodland, Mixed Vegetation 1 (Roadside Vegetation and Railway Vegetation) < 2 ha

Land Cover Type	Permeability Value Estimations
Woodlands	**1**
Coniferous Woodland	**1**
Shrub	**1**
Mixed Vegetation 1	**1**
Mixed Vegetation 2	**1**
Improved Grassland	25
Amenity Grassland	25
Unimproved Grassland	25
Heathlands	25
Arable Land	25
Standing Water	25
Running Water	25
Wetlands	25
Buildings / Structures and Constructed Surfaces	25
Minimum Habitat Area Requirement	**2 ha**

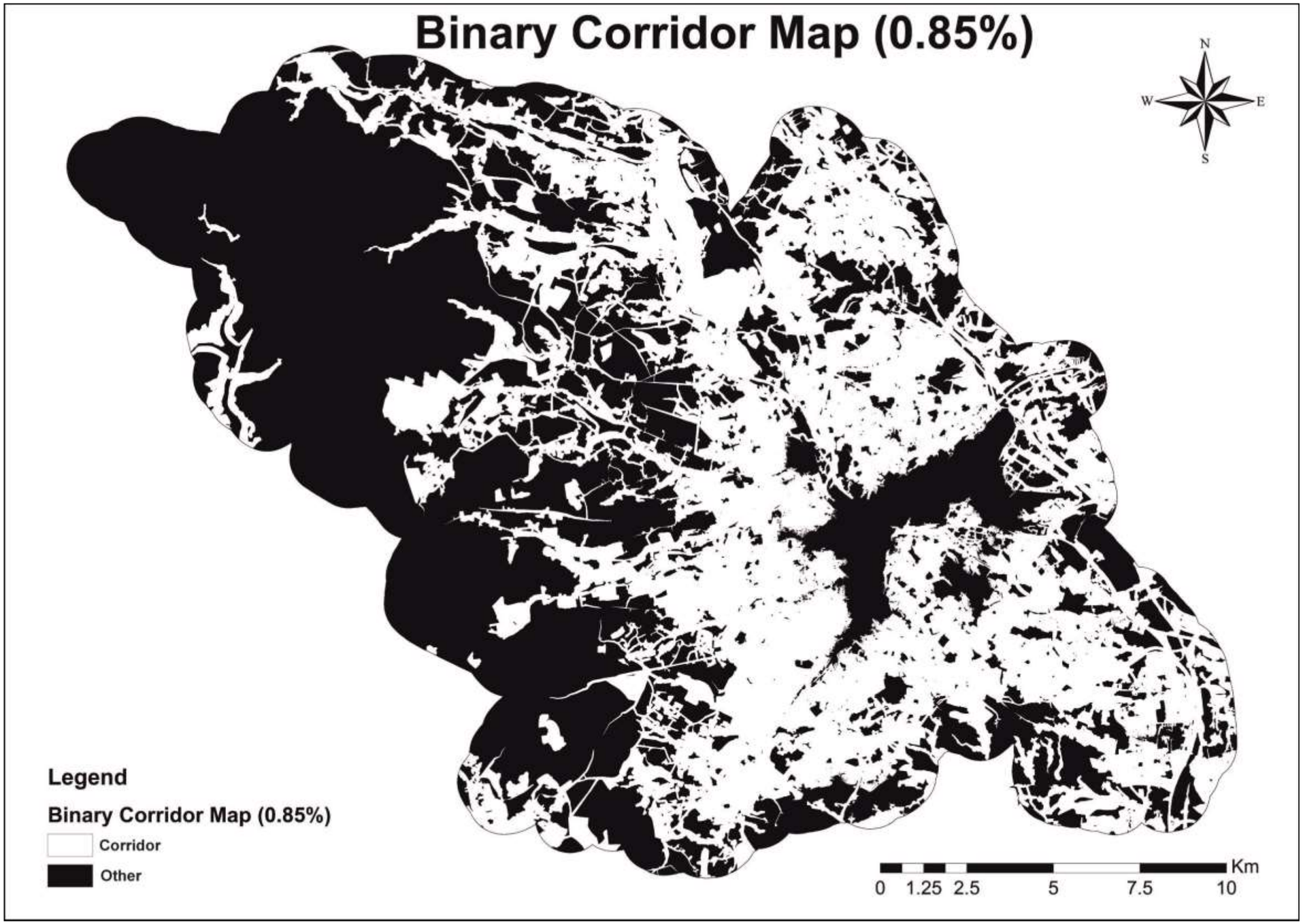
Appendix 17B: Least-cost Corridor Inputs for Blackbirds



Appendix 17C: Least-cost Corridor for Blackbirds



Appendix 17D: Least-cost Binary Map for Blackbirds



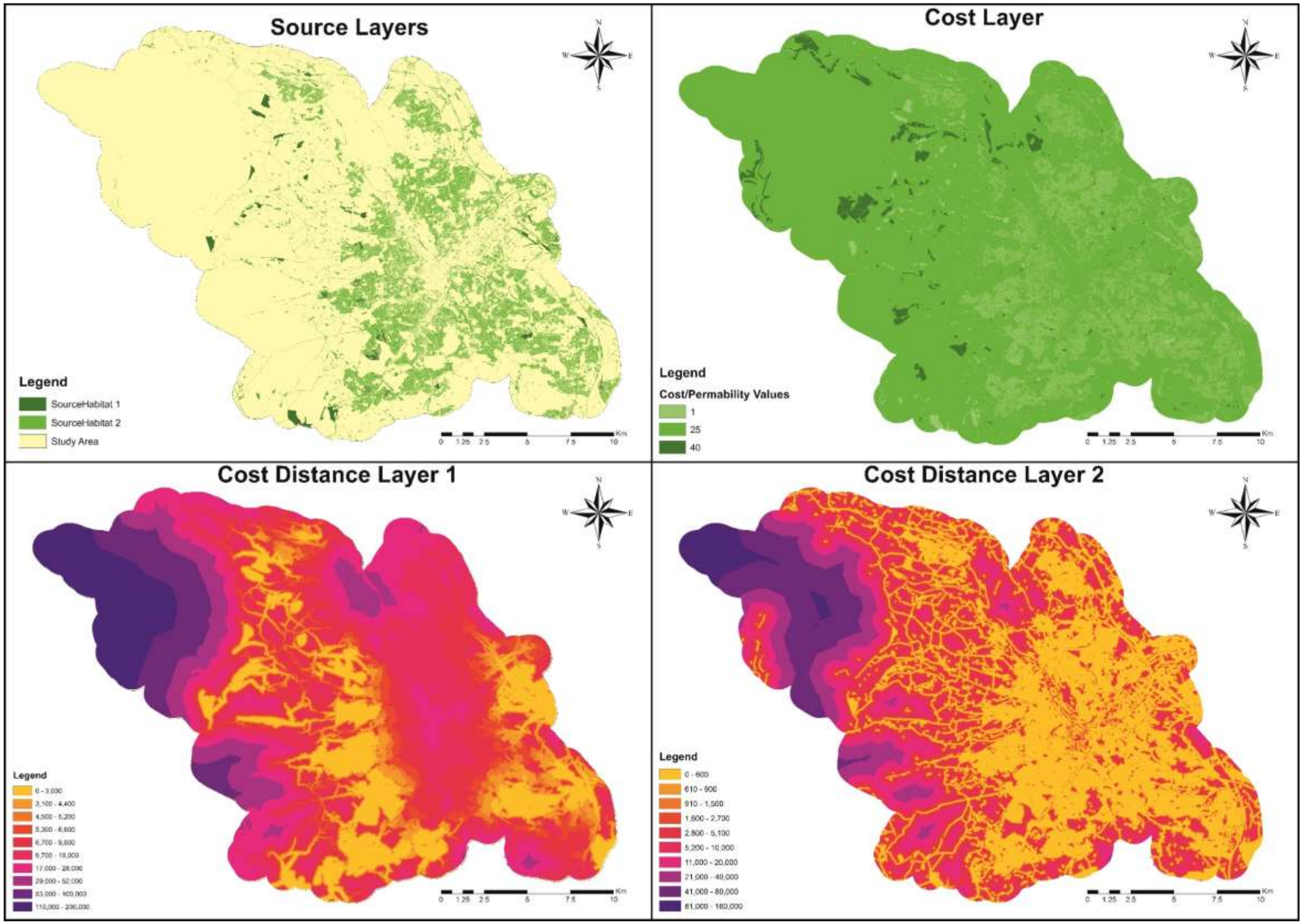
Appendix 18: Greenfinches

Appendix 18A: Summary of Parameters Obtained from Experts for Greenfinches

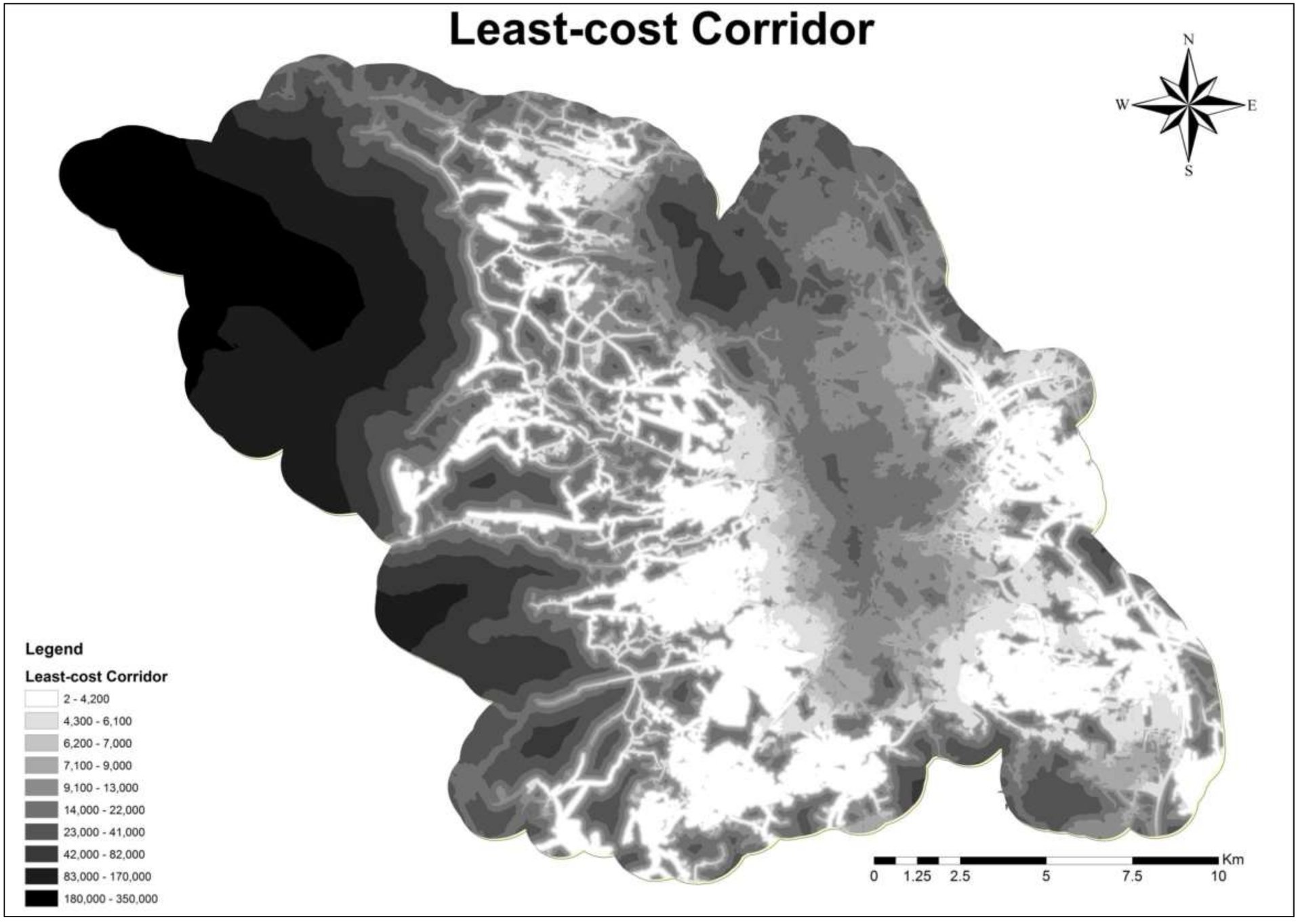
- **Core Habitats (Source layer 1):** Shrub, Mixed Vegetation 1 (Roadside Vegetation and Railway Vegetation), Mixed Vegetation 2 (Private Gardens and Other Landscaped Areas) ≥ 6ha
- **Least Suitable Habitats (Source layer 2):** Shrub, Mixed Vegetation 1 (Roadside Vegetation and Railway Vegetation), Mixed Vegetation 2 (Private Gardens and Other Landscaped Areas) <6ha

Land Cover Categories	Permeability Value Estimations
Woodlands	25
Coniferous Woodland	40
Shrub	**1**
Mixed Vegetation 1	**1**
Mixed Vegetation 2	**1**
Improved Grassland	25
Amenity Grassland	25
Unimproved Grassland	25
Heathlands	25
Arable Land	25
Standing Water	25
Running Water	25
Wetlands	25
Buildings / Structures and Constructed Surfaces	25
Minimum Habitat Area Requirement	**6 ha**

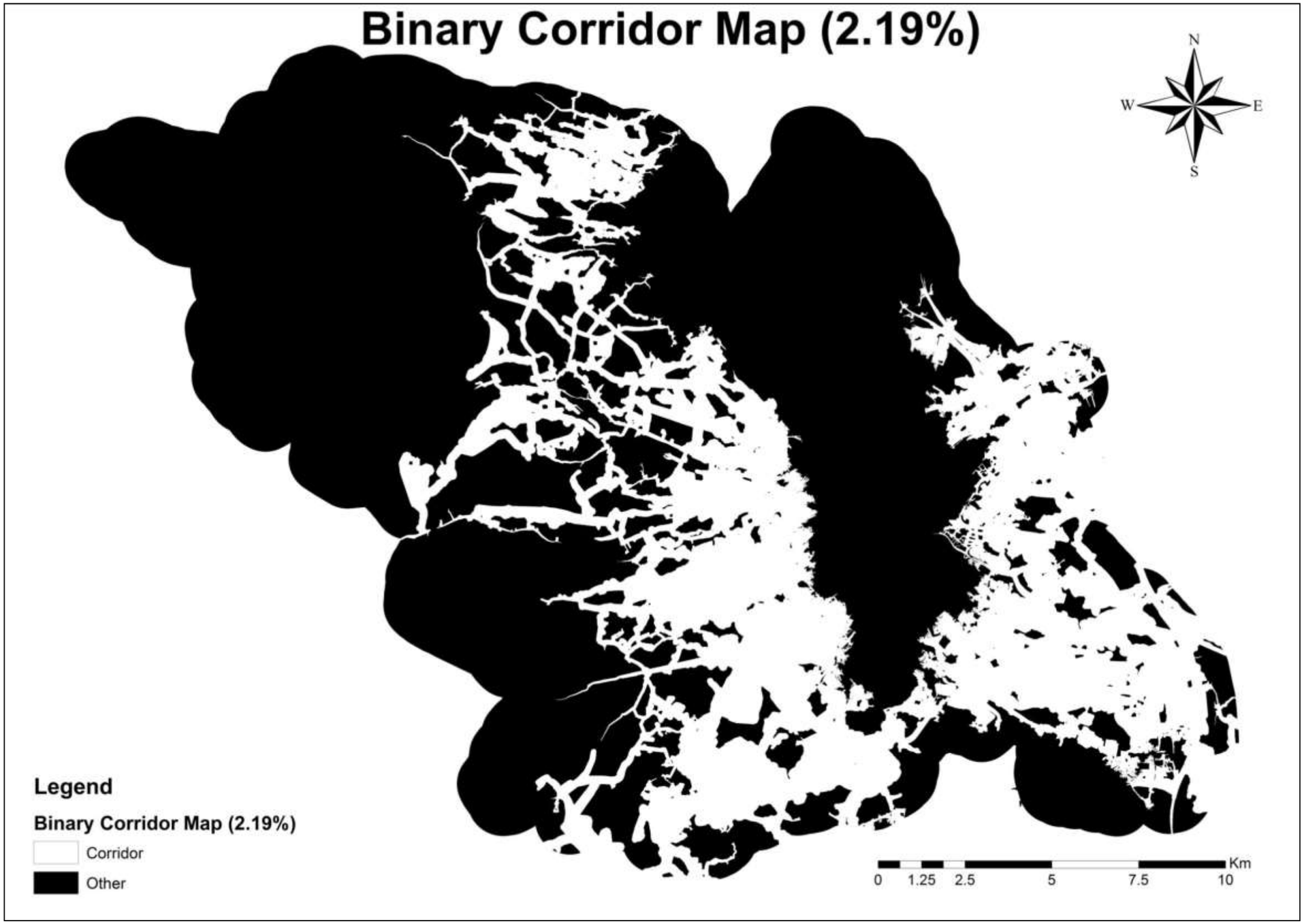
Appendix 18B: Least-cost Corridor Inputs for Greenfinches



Appendix 18C: Least-cost Corridor for Greenfinches



Appendix 18D: Least-cost Binary Map for Greenfinches



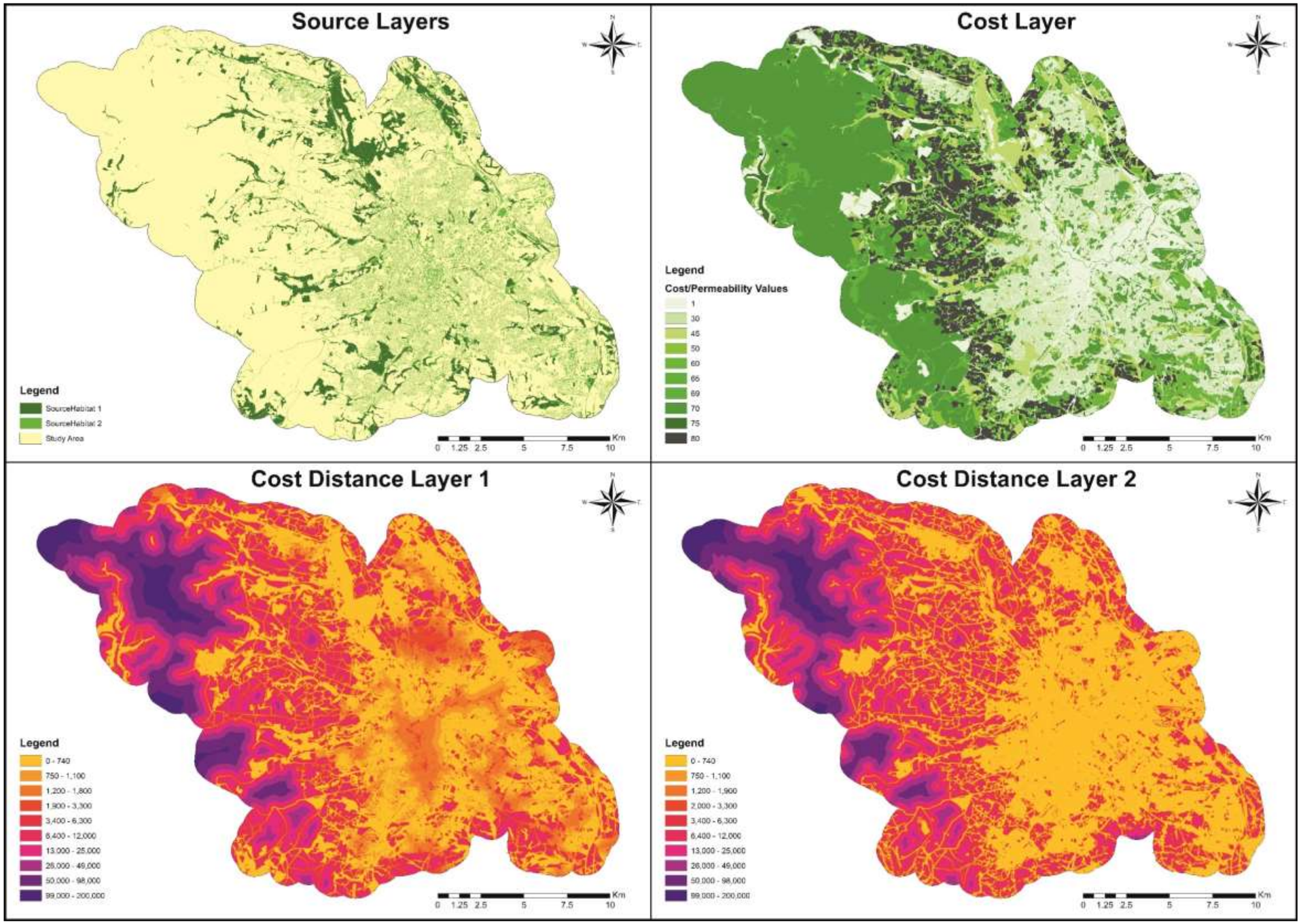
Appendix 19: Brown Long-eared Bats

Appendix 19A: Summary of Parameters Obtained from Experts for Brown Long-eared Bats

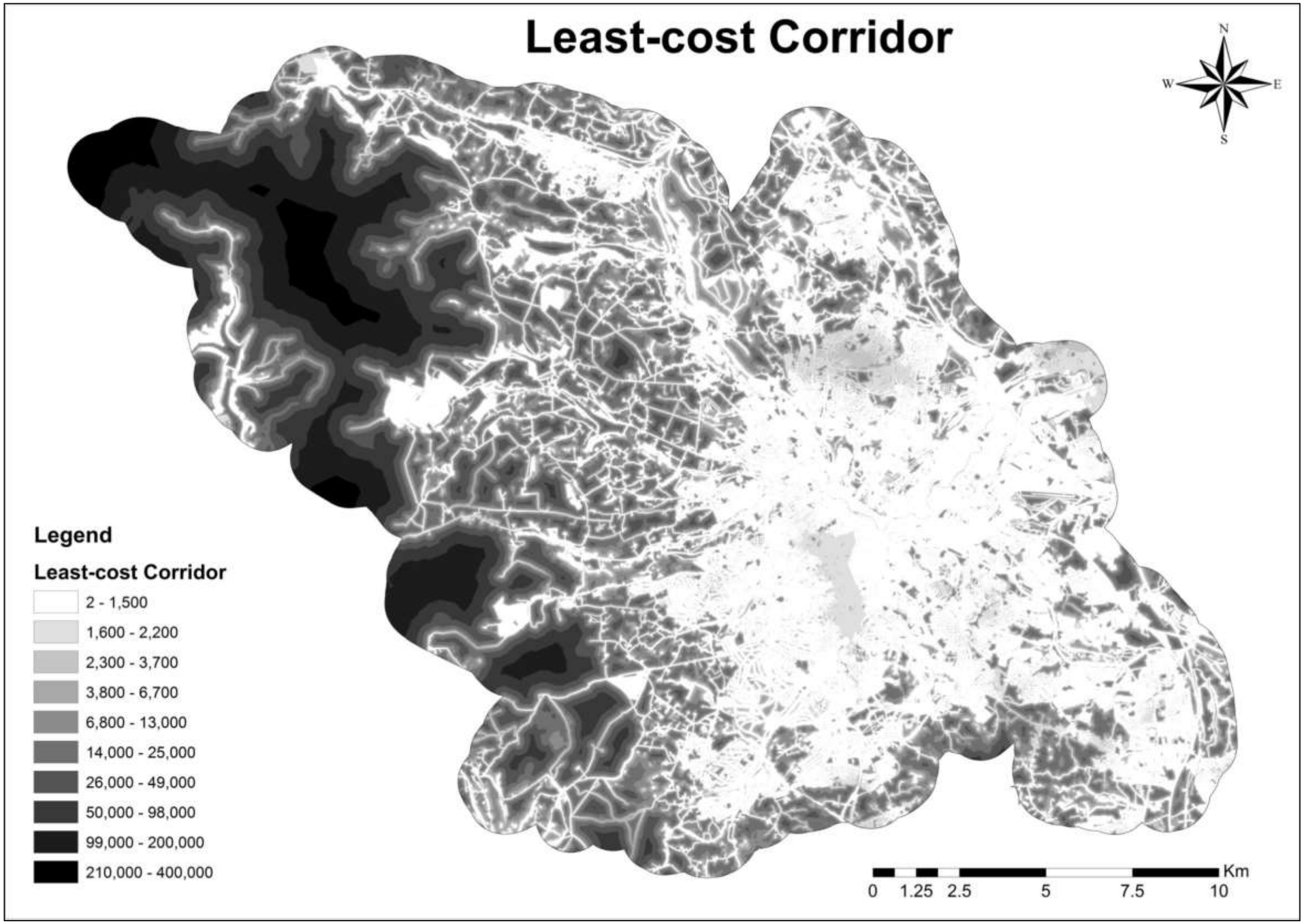
- **Core Habitats (Source layer 1):** Woodland, Mixed Vegetation 1 (Roadside Vegetation and Railway Vegetation), Buildings / Structures ≥ 2 ha
- **Least Suitable Habitats (Source layer 2):** Woodland, Mixed Vegetation 1 (Roadside Vegetation and Railway Vegetation),, Buildings / Structures <2 ha

Land Cover Categories	**Permeability Value Estimations**
Woodlands	**1**
Coniferous Woodland	45
Shrub	50
Mixed Vegetation 1	**1**
Mixed Vegetation 2	30
Improved Grassland	80
Amenity Grassland	70
Unimproved Grassland	65
Heathlands	70
Arable Land	60
Standing Water	75
Running Water	69
Wetlands	70
Buildings / Structures and Constructed Surfaces	**1**
Minimum Habitat Area Requirement	**2 ha**

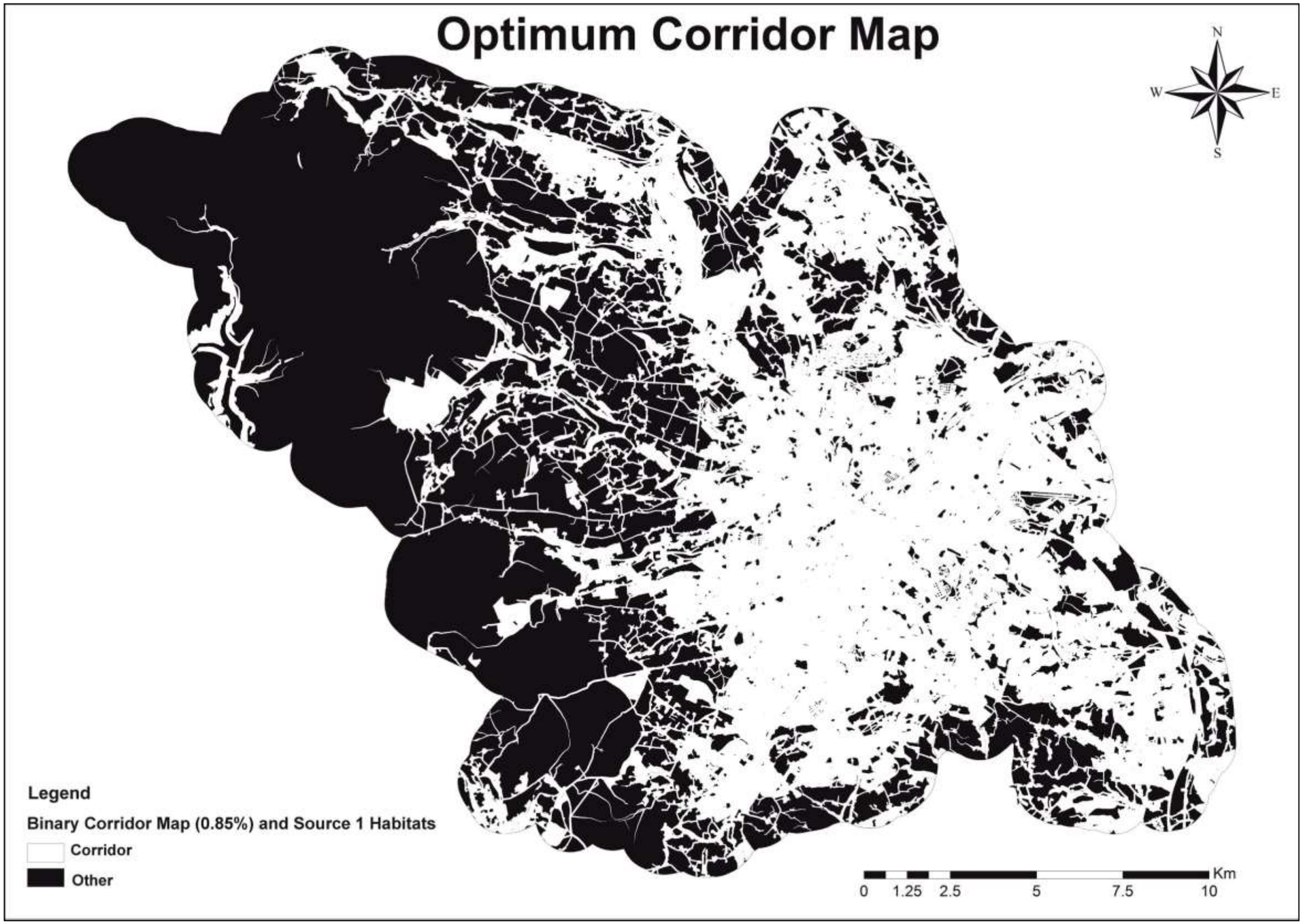
Appendix 19B: Least-cost Corridor Inputs for Brown Long-eared Bats



Appendix 19C: Least-cost Corridor for Brown Long-eared Bats



Appendix 19D: Least-cost Binary Map for Brown long-eared Bats



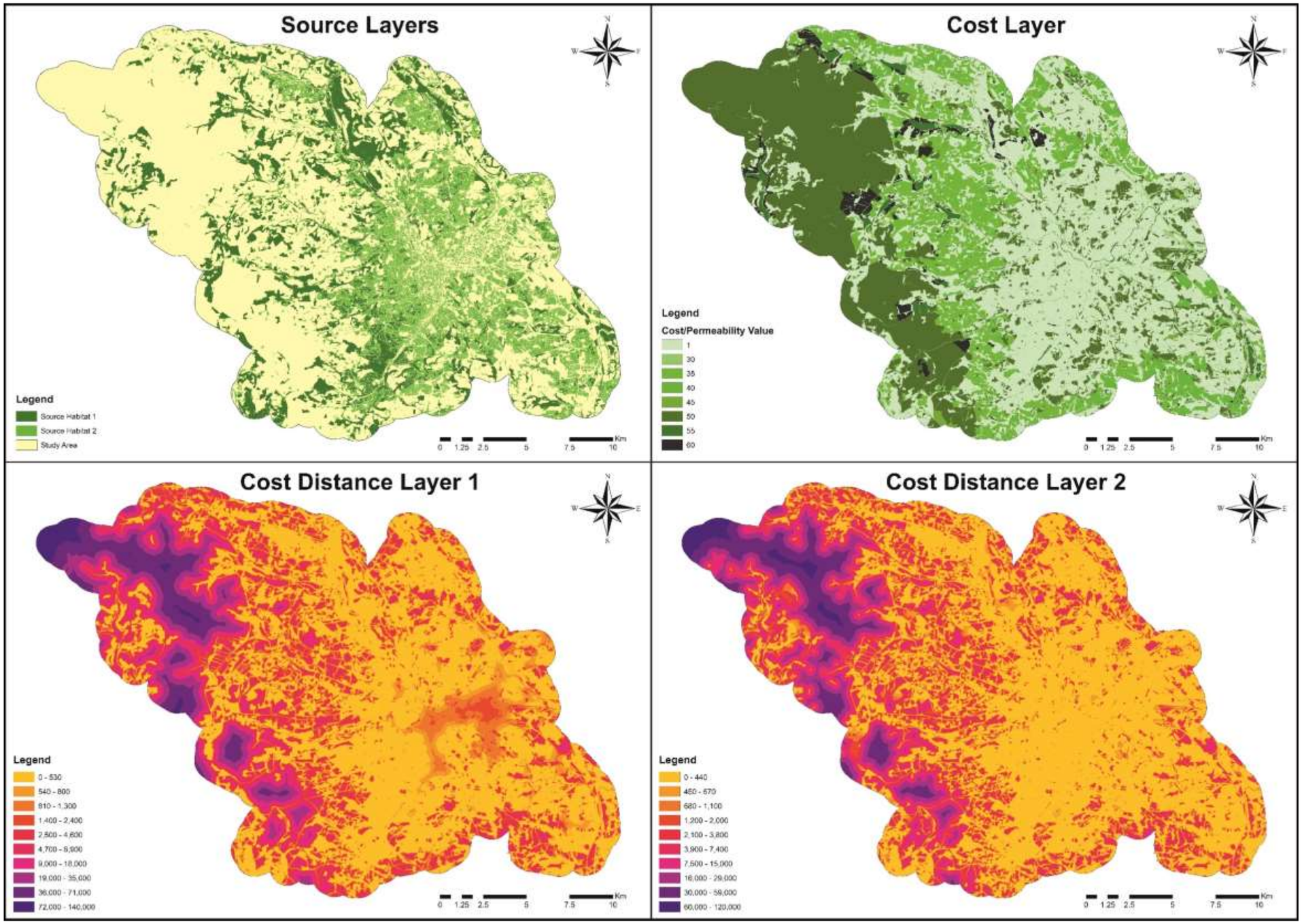
Appendix 20: Pipistrelle Bats

Appendix 20A: Summary of Parameters Obtained from Experts for Brown Pipistrelle Bats

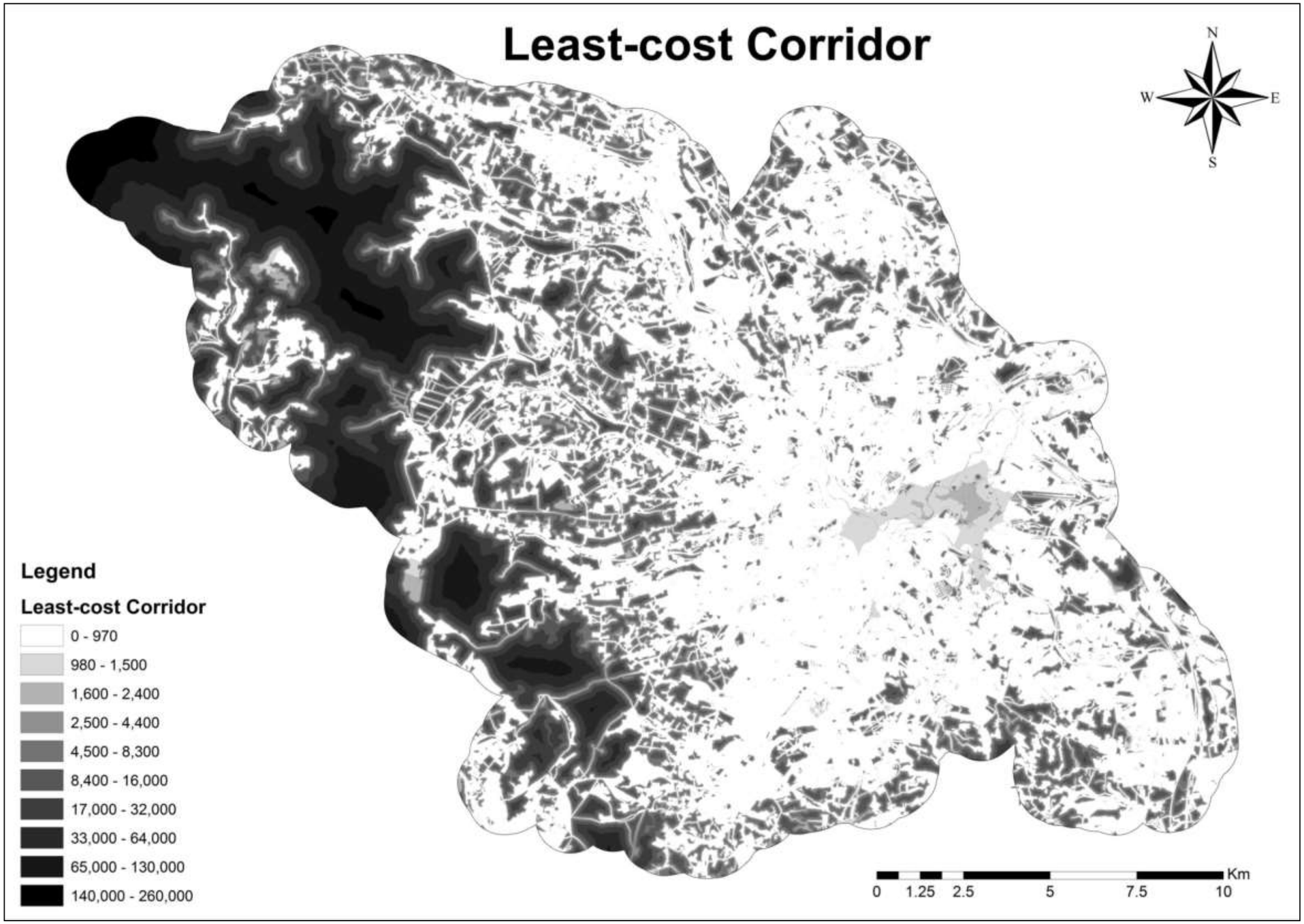
- **Core Habitats (Source layer 1):** Woodland, Mixed Vegetation 1 (Roadside Vegetation and Railway Vegetation), Unimproved Grassland ≥ 2 ha
- **Least Suitable Habitats (Source layer 2):** Woodland, Mixed Vegetation 1 (Roadside Vegetation and Railway Vegetation), Unimproved Grassland, Buildings / Structures <2 ha

Land Cover Categories	Permeability Value Estimations
Woodlands	**1**
Coniferous Woodland	60
Shrub	45
Mixed Vegetation 1	**1**
Mixed Vegetation 2	20
Improved Grassland	35
Amenity Grassland	50
Unimproved Grassland	**1**
Heathlands	50
Arable Land	40
Standing Water	55
Running Water	55
Wetlands	50
Buildings / Structures and Constructed Surfaces	**1**
Minimum Habitat Area Requirement	**2 ha**

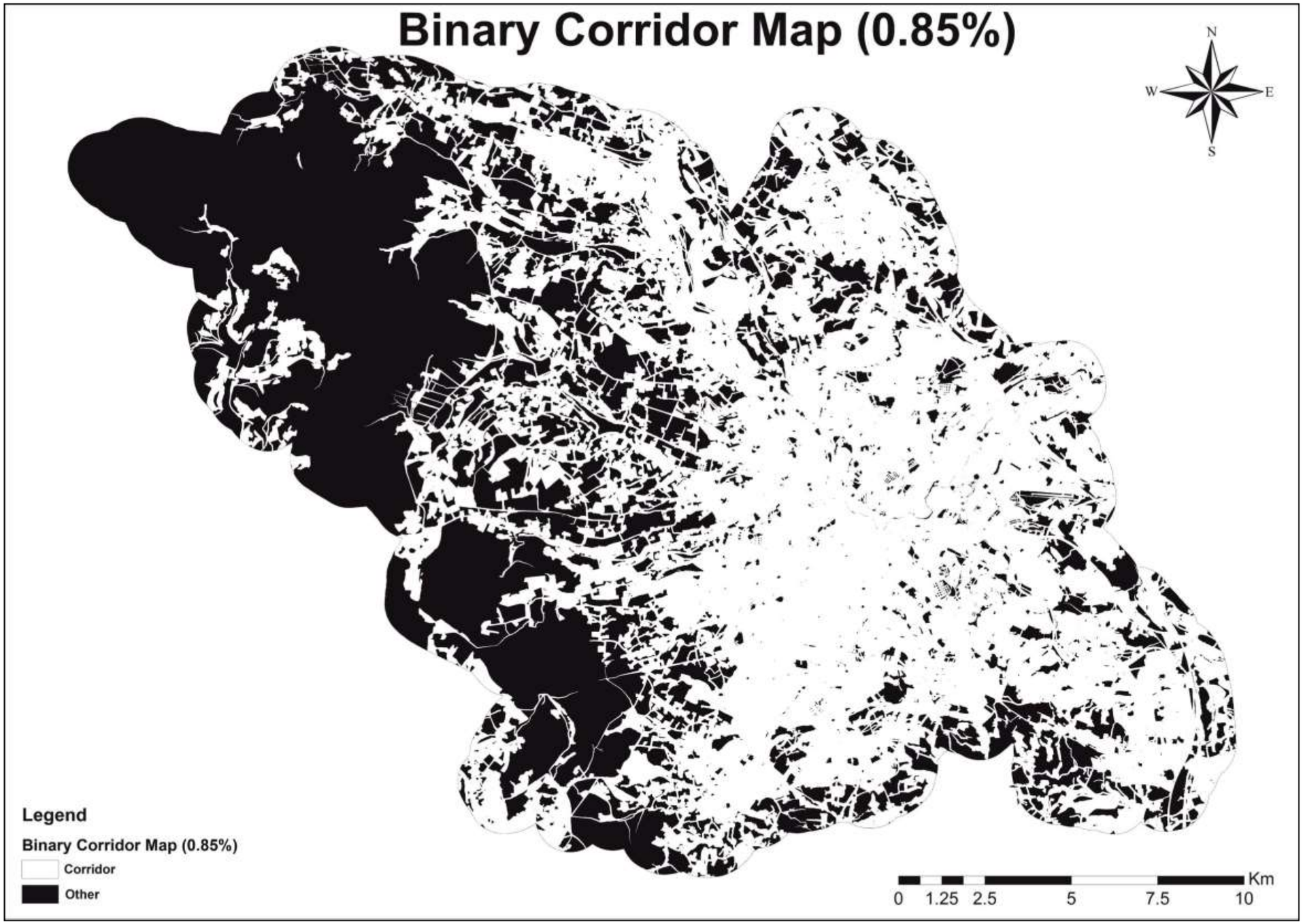
Appendix 20B: Least-cost Corridor Inputs for Pipistrelle Bats



Appendix 20C: Least-cost Corridor for Pipistrelle Bats



Appendix 20D: Least-cost Binary Map for Pipistrelle Bats



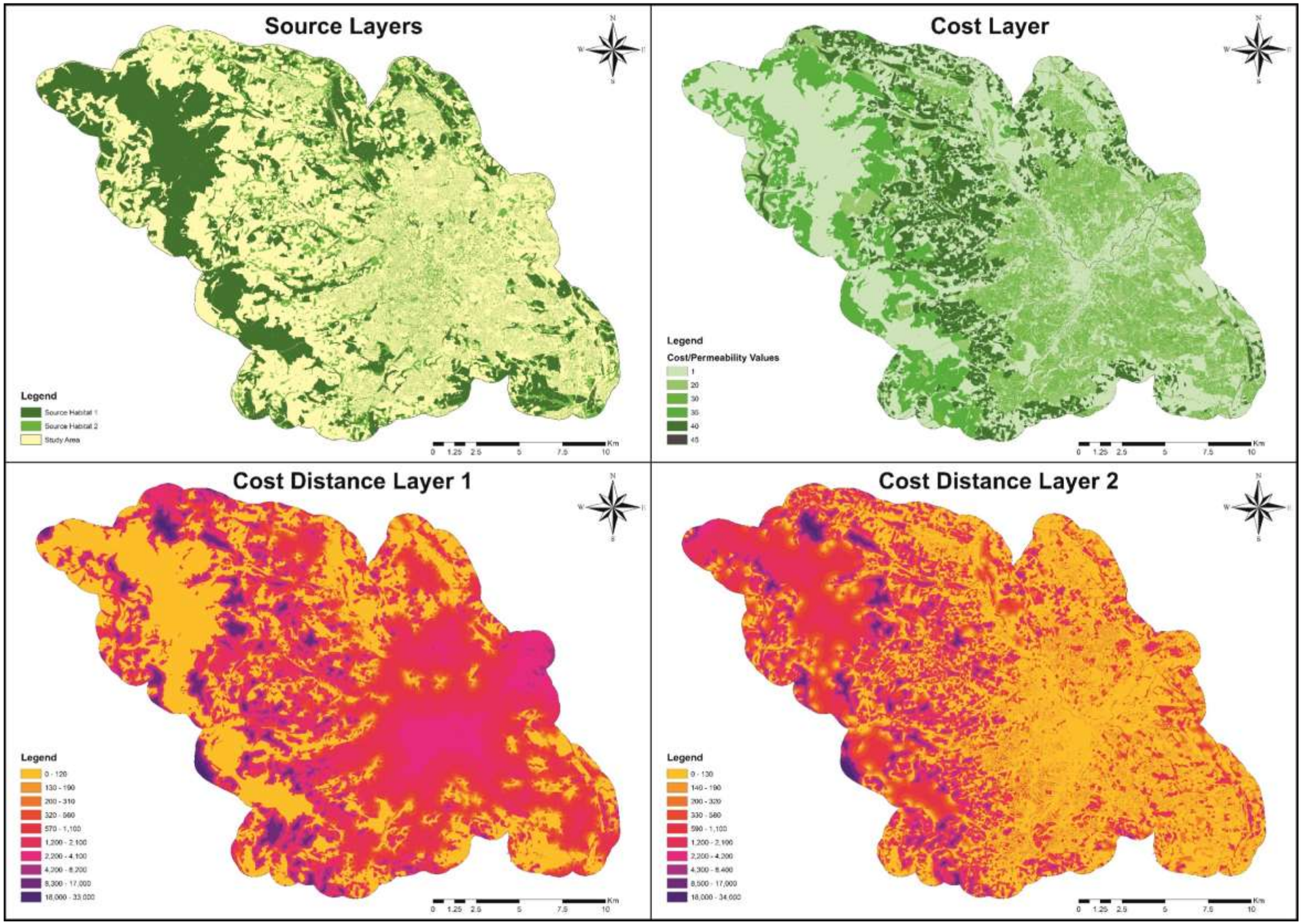
Appendix 21: Leisler's Bats

Appendix 21A: Summary of Parameters Obtained from Experts for Brown Leisler's Bats

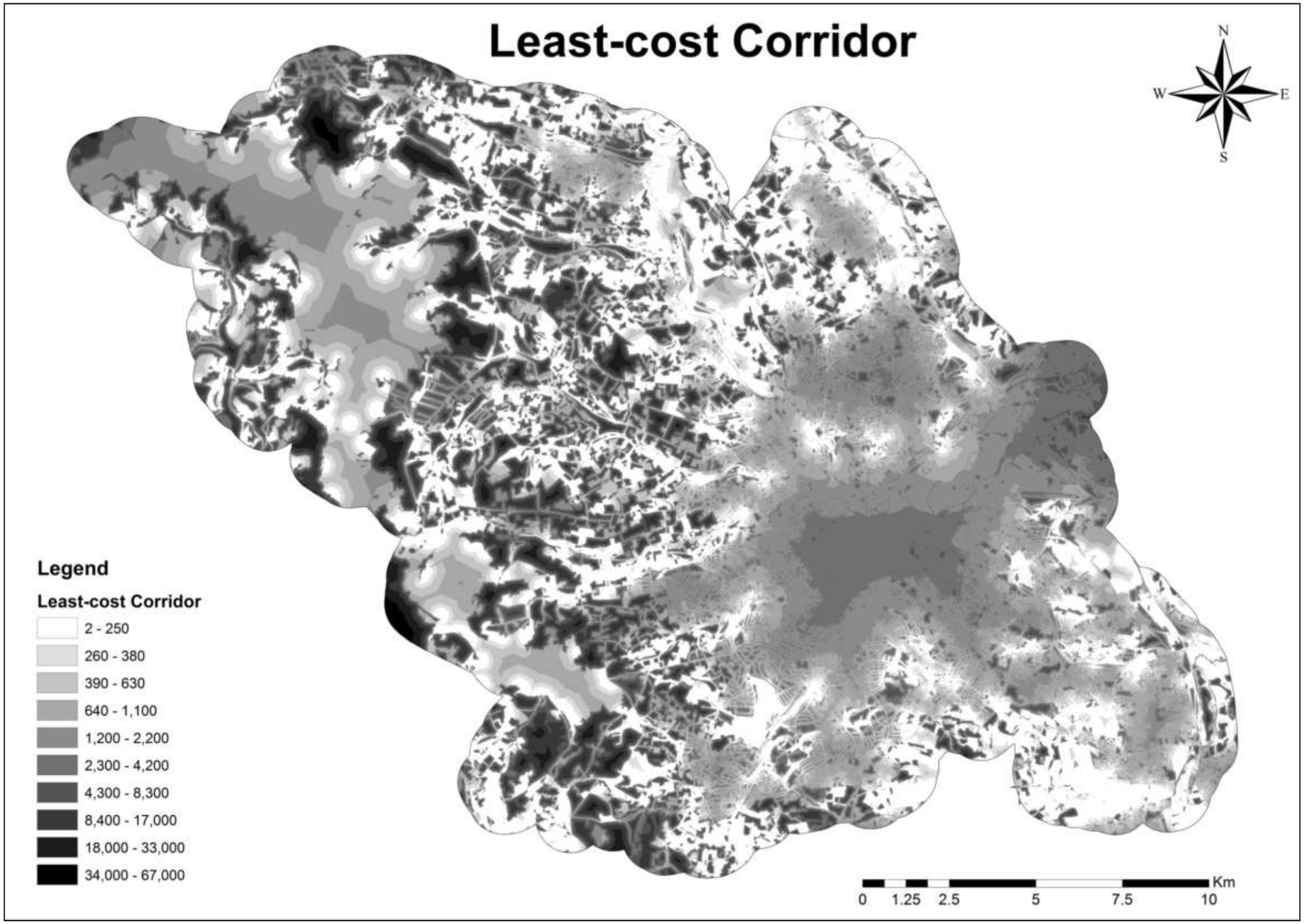
- **Core Habitats (Source layer 1):** Woodland, Unimproved Grassland, Arable Land, Wetland, Buildings / Structures ≥ 5 ha
- **Least Suitable Habitats (Source layer 2):** Woodland, Unimproved Grassland, Arable Land, Wetland, Buildings / Structures < 5 ha

Land Cover Categories	Permeability Value Estimations
Woodlands	**1**
Coniferous Woodland	20
Shrub	30
Mixed Vegetation 1	30
Mixed Vegetation 2	30
Improved Grassland	40
Amenity Grassland	20
Unimproved Grassland	**1**
Heathlands	35
Arable Land	**1**
Standing Water	40
Running Water	45
Wetlands	**1**
Buildings / Structures and Constructed Surfaces	**1**
Minimum Habitat Area Requirement	**5 ha**

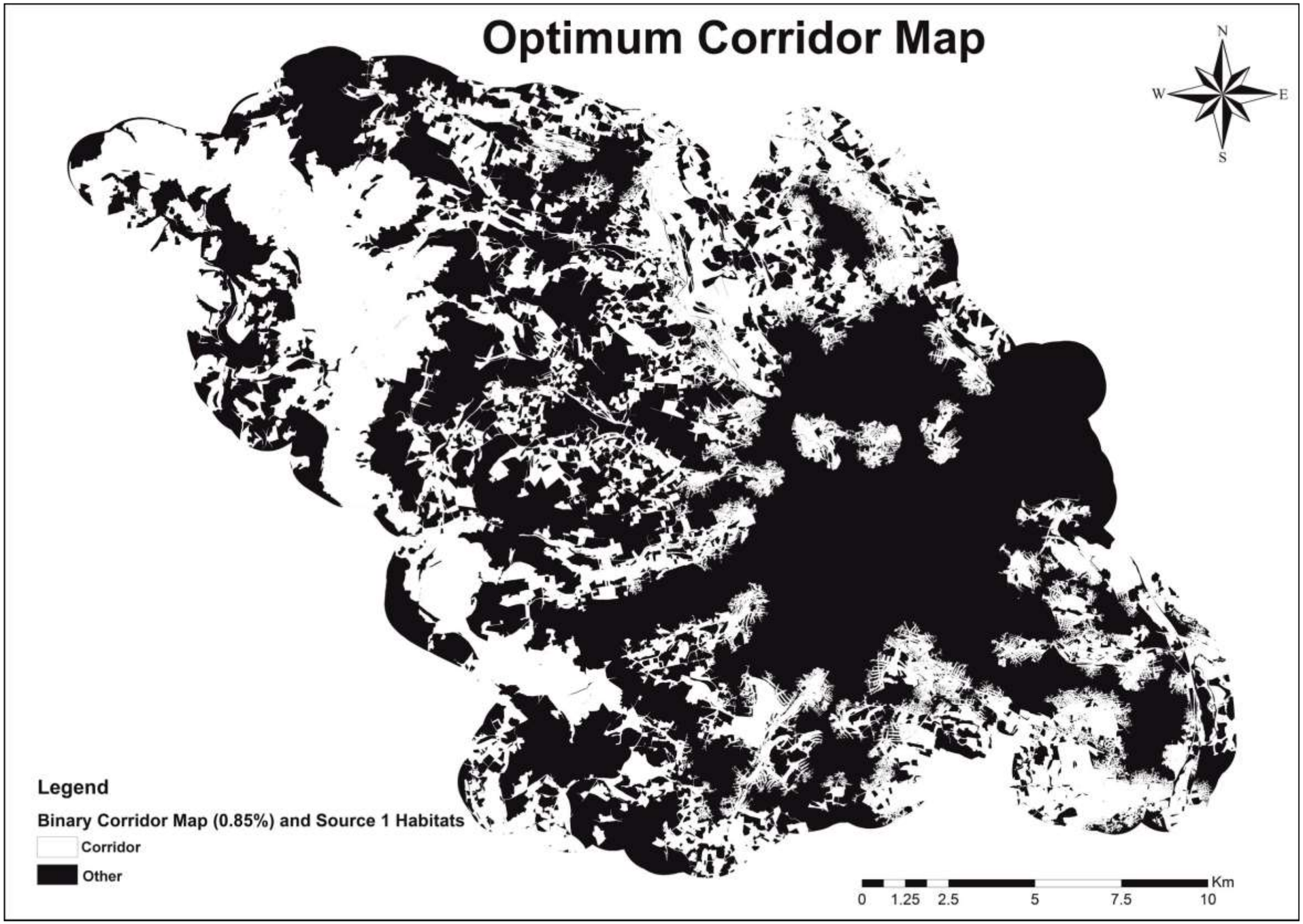
Appendix 21B: Least-cost Corridor Inputs for Leisler's Bats



Appendix 21C: Least-cost Corridor for Leisler's Bats



Appendix 21D: Least-cost Binary Map for Leisler's Bats



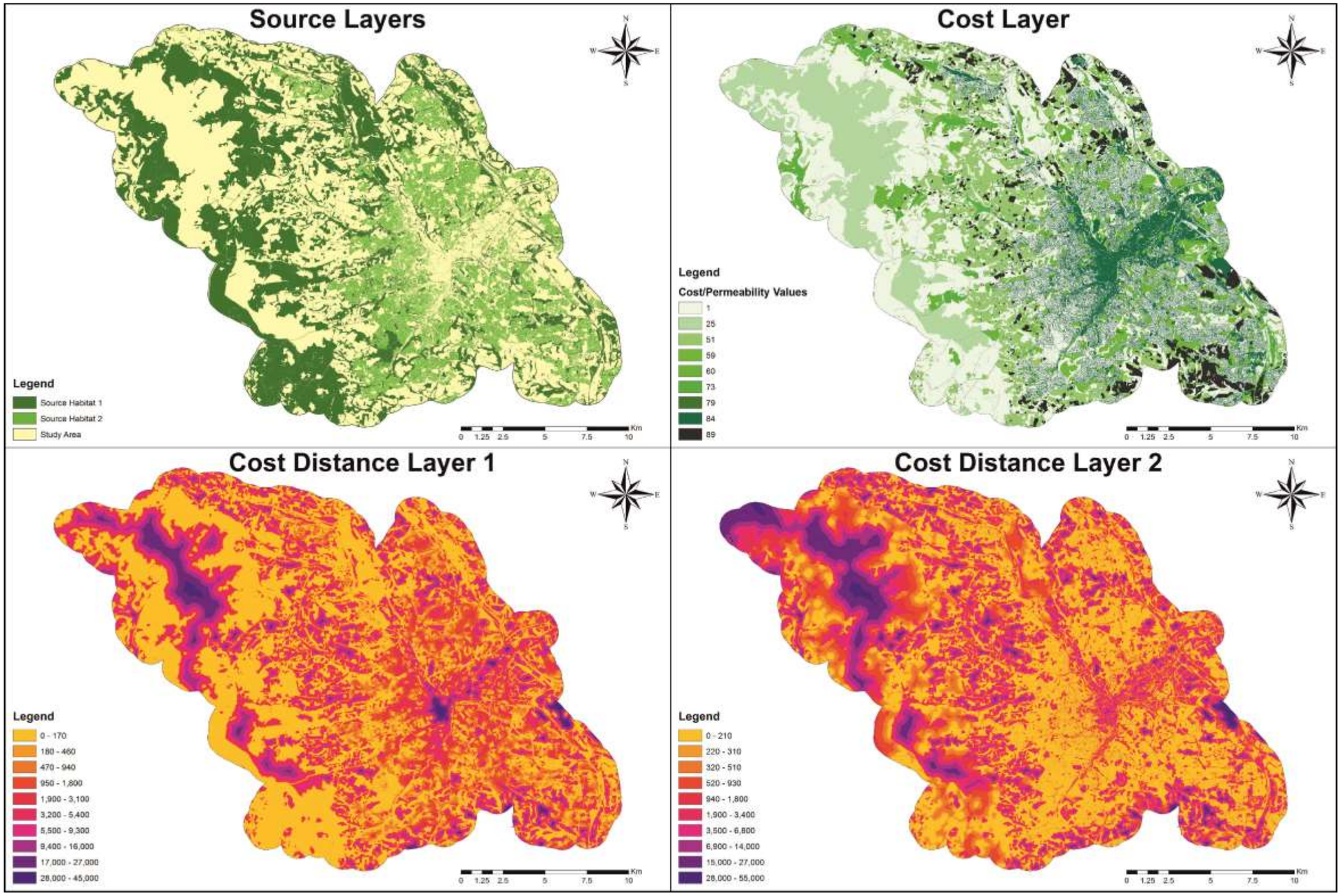
Appendix 22: Common Lizards

Appendix 22A: Summary of Parameters Obtained from Experts for Brown Common Lizards

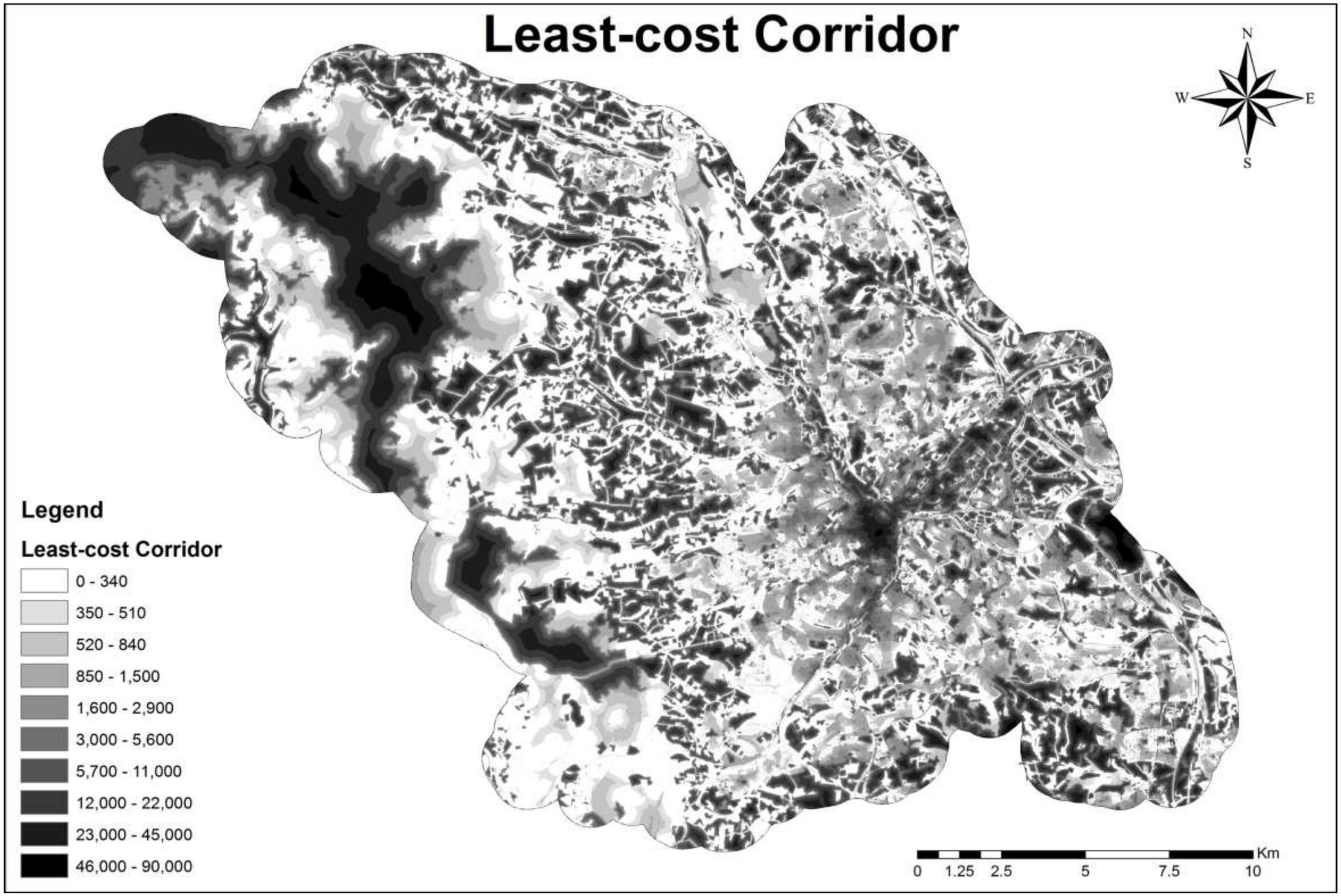
- **Core Habitats (Source layer 1):** Woodlands, Shrub, Mixed Vegetation 1 (Roadside Vegetation and Railway Vegetation), Mixed Vegetation 2 (Private Gardens and Other Landscaped Areas), Unimproved Grassland, Heathlands ≥ 1 ha
- **Least Suitable Habitats (Source layer 2):** Woodlands, Shrub, Mixed Vegetation 1 (Roadside Vegetation and Railway Vegetation), Mixed Vegetation 2 (Private Gardens and Other Landscaped Areas), Unimproved Grassland, Heathlands < 1 ha

Land Cover Categories	Mean Permeability Value Estimations
Woodlands	**1**
Coniferous Woodland	60
Shrub	**1**
Mixed Vegetation 1	**1**
Mixed Vegetation 2	**1**
Improved Grassland	51
Amenity Grassland	59
Unimproved Grassland	**1**
Heathlands	**1**
Arable Land	89
Standing Water	73
Running Water	79
Wetlands	25
Buildings / Structures and Constructed Surfaces	84
Minimum Habitat Area Requirement	**1 ha**

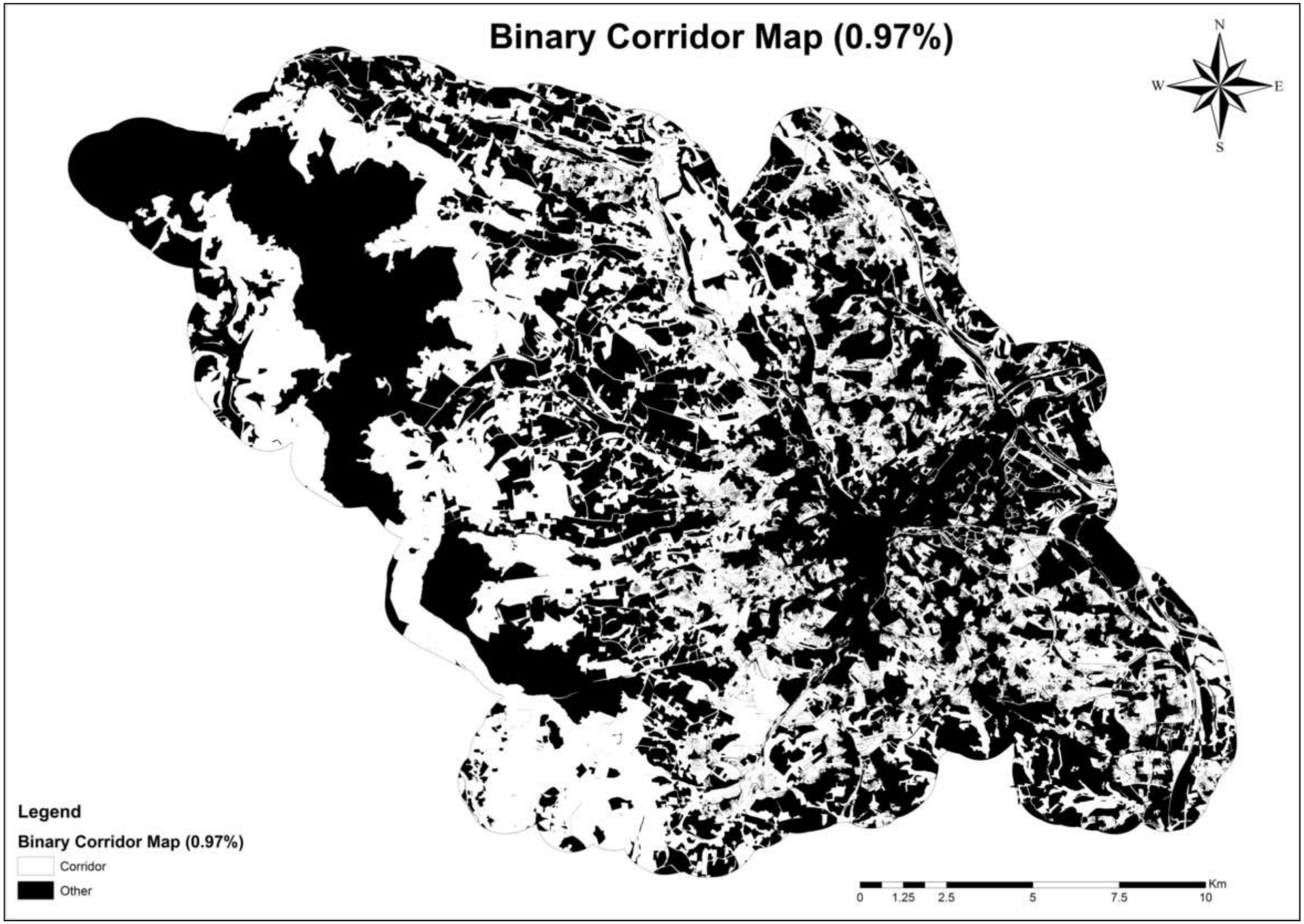
Appendix 22B: Least-cost Corridor Inputs for Common Lizards



Appendix 22C: Least-cost Corridor for Common Lizards



Appendix 22D: Least-cost Binary Map for Common Lizards



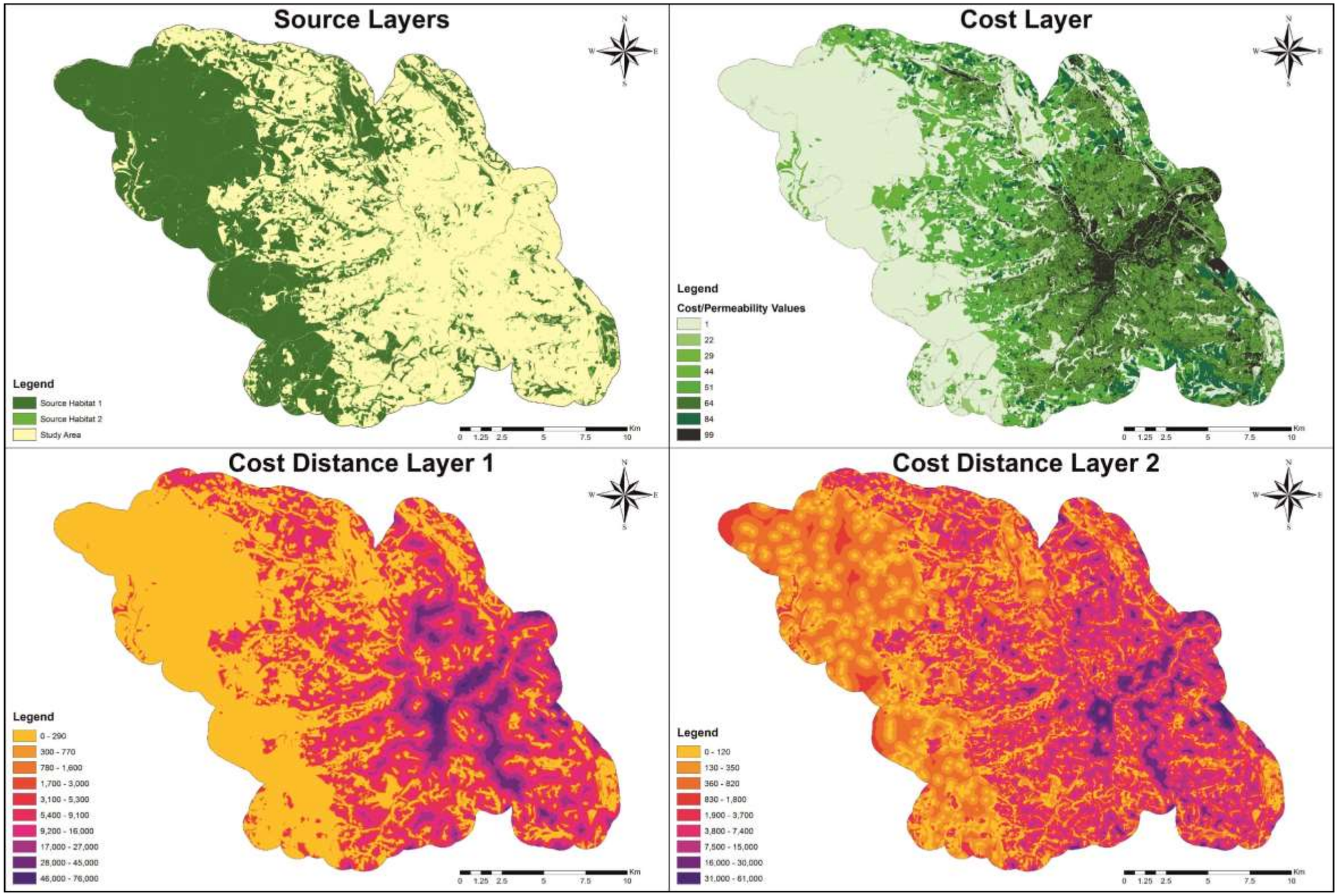
Appendix 23: Grass Snakes

Appendix 23A: Summary of Parameters Obtained from Experts for Brown Grass Snakes

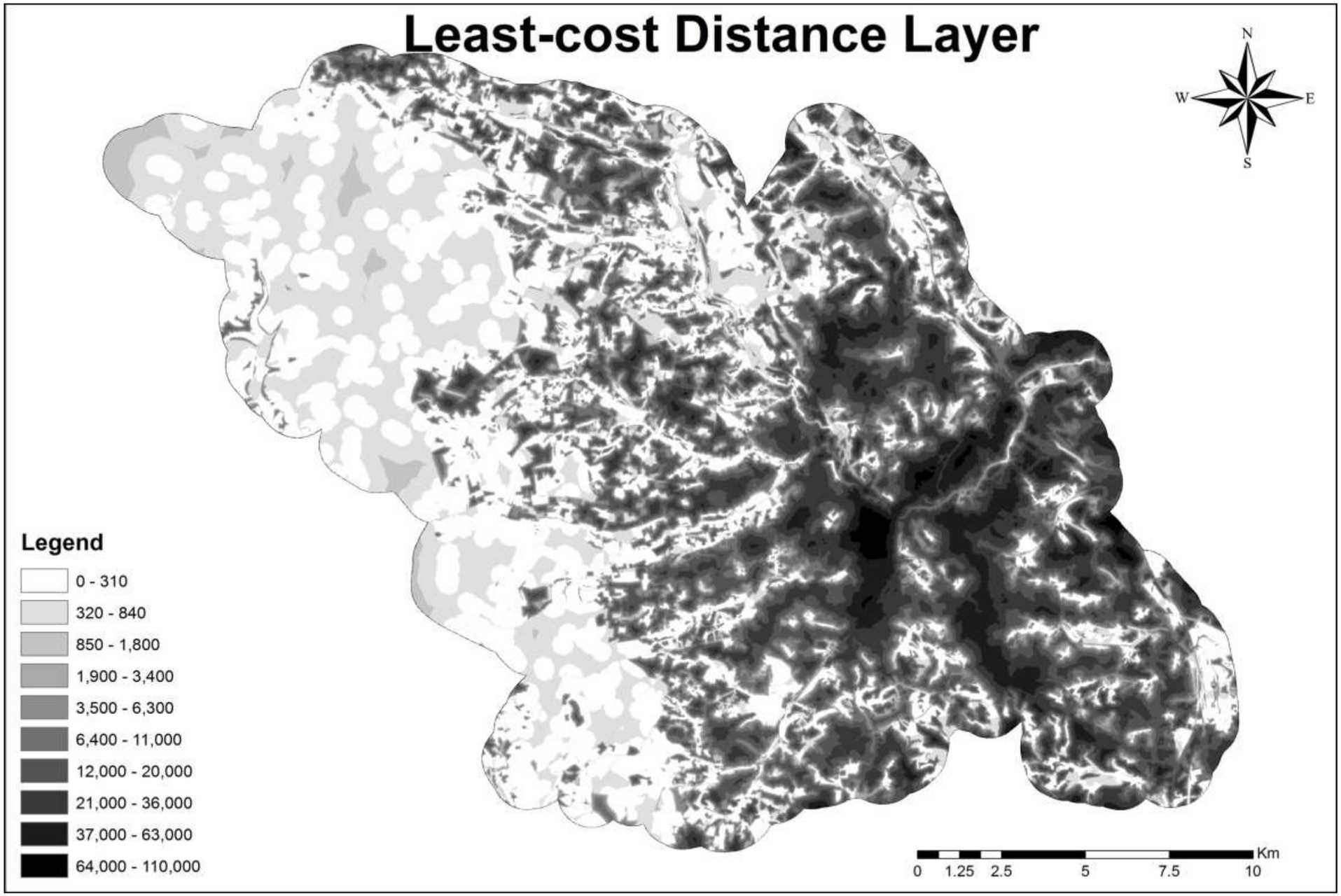
- **Core Habitats (Source layer 1):** Woodlands, Unimproved Grassland, Heathlands, Standing Water, Wetlands ≥ 1 ha
- **Least Suitable Habitats (Source layer 2):** Woodlands, Unimproved Grassland, Heathlands, Standing Water, Wetlands ≥ 1 ha

Land Cover Categories	Mean Permeability Value Estimations
Woodlands	**1**
Coniferous Woodland	44
Shrub	22
Mixed Vegetation 1	22
Mixed Vegetation 2	29
Improved Grassland	51
Amenity Grassland	64
Unimproved Grassland	**1**
Heathlands	**1**
Arable Land	84
Standing Water	**1**
Running Water	22
Wetlands	**1**
Buildings / Structures and Constructed Surfaces	99
Minimum Habitat Area Requirement	**1 ha**

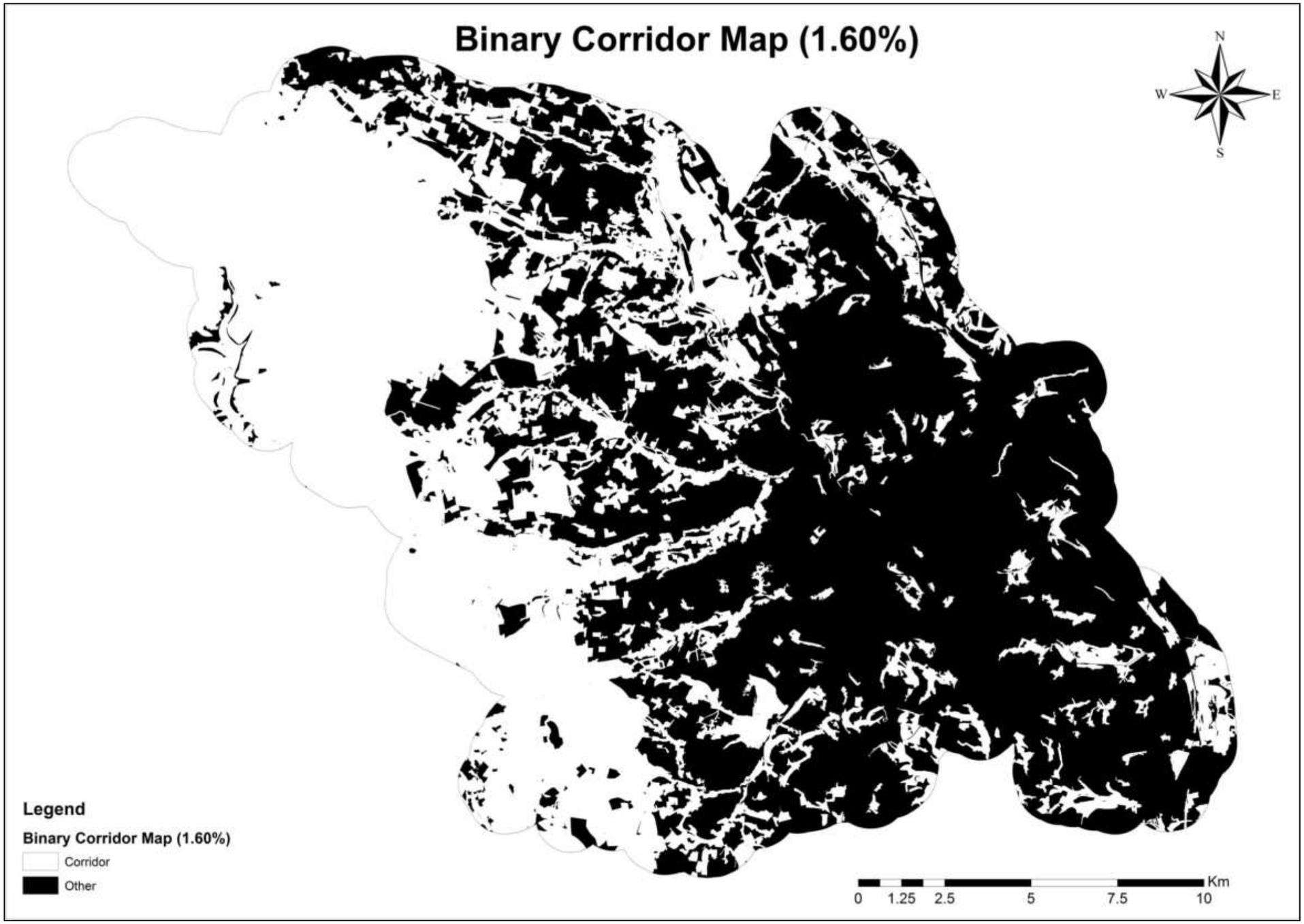
Appendix 23B: Least-cost Corridor Inputs for Grass Snakes



Appendix 23C: Least-cost Corridor for Grass Snakes



Appendix 23D: Least-cost Binary Map for Grass Snakes



Appendix 24: Slow-worms

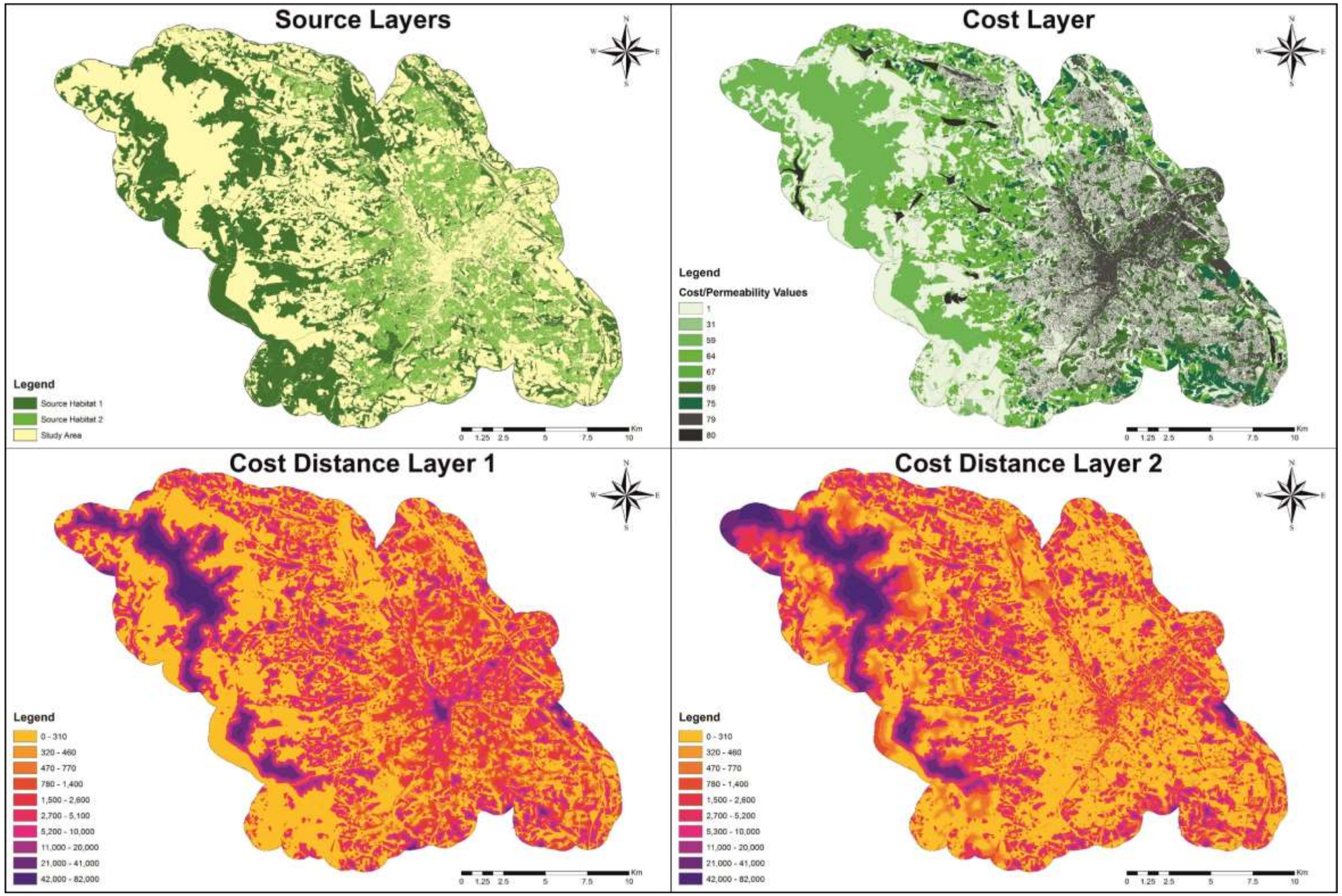
Appendix 24A: Summary of Parameters Obtained from Experts for Brown Slow-worms

- **Core Habitats (Source layer 1):** Woodlands, Mixed Vegetation 1 (Roadside Vegetation and Railway Vegetation), Mixed Vegetation 2 (Private Gardens and Other Landscaped Areas), Unimproved Grassland, Heathlands ≥ 1 ha

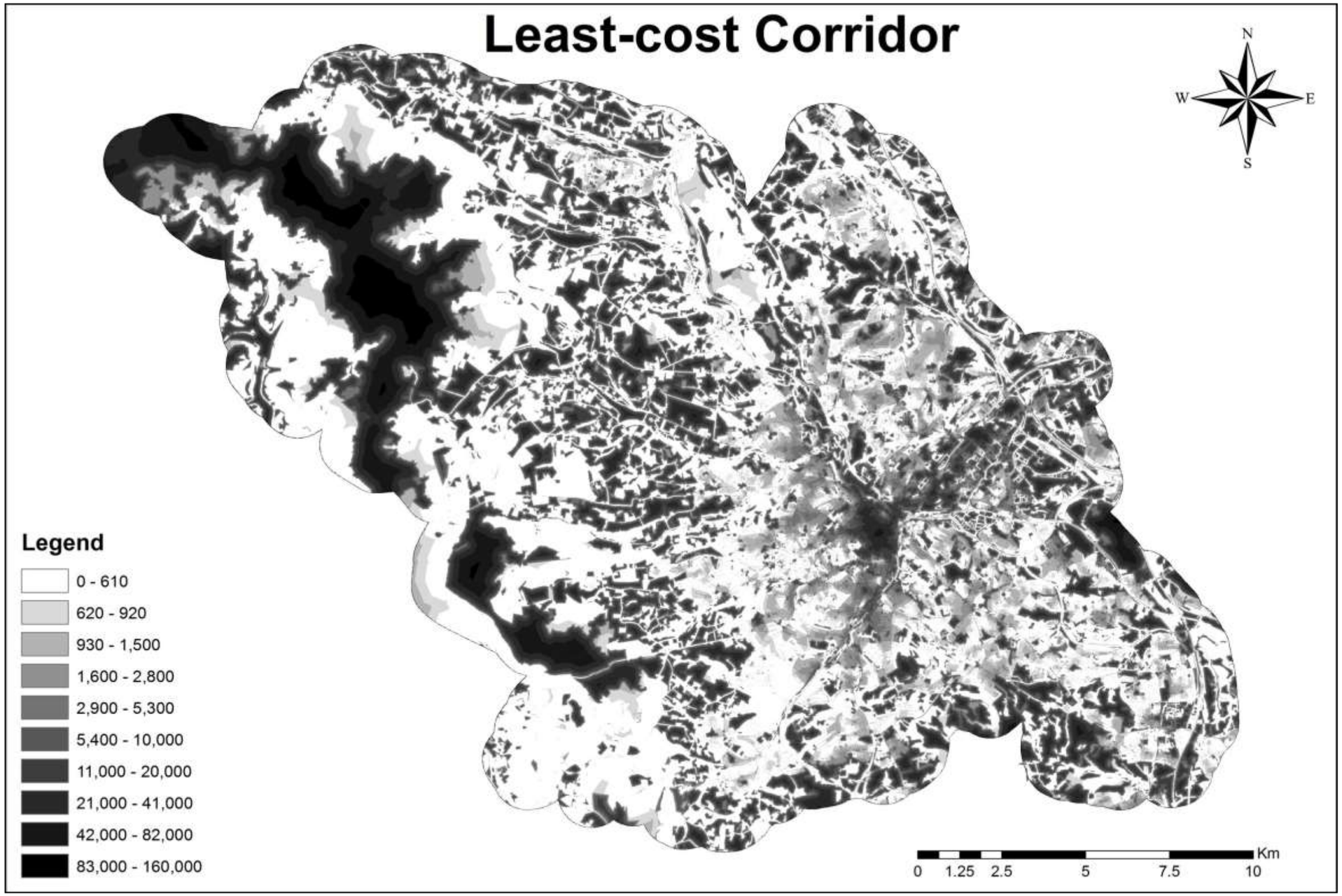
- **Least Suitable Habitats (Source layer 2):** Woodlands, Mixed Vegetation 1 (Roadside Vegetation and Railway Vegetation), Mixed Vegetation 2 (Private Gardens and Other Landscaped Areas), Unimproved Grassland, Heathlands < 1 ha

Land Cover Categories	Mean Permeability Value Estimations
Woodlands	**1**
Coniferous Woodland	64
Shrub	31
Mixed Vegetation 1	**1**
Mixed Vegetation 2	**1**
Improved Grassland	64
Amenity Grassland	69
Unimproved Grassland	**1**
Heathlands	**1**
Arable Land	75
Standing Water	80
Running Water	67
Wetlands	59
Buildings / Structures and Constructed Surfaces	79
Minimum Habitat Area Requirement	**1 ha**

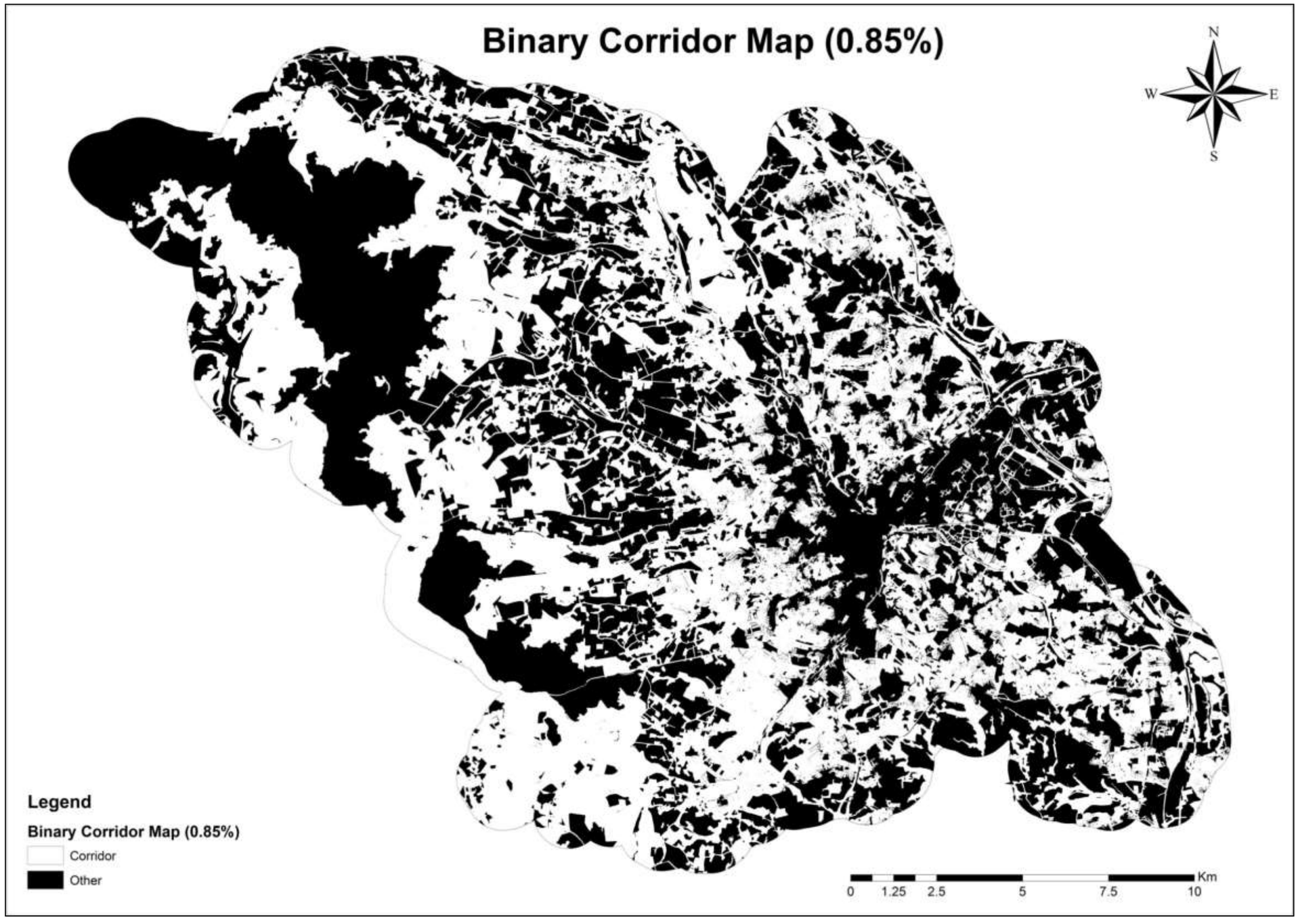
Appendix 24B: Least-cost Corridor Inputs for Slow-worms



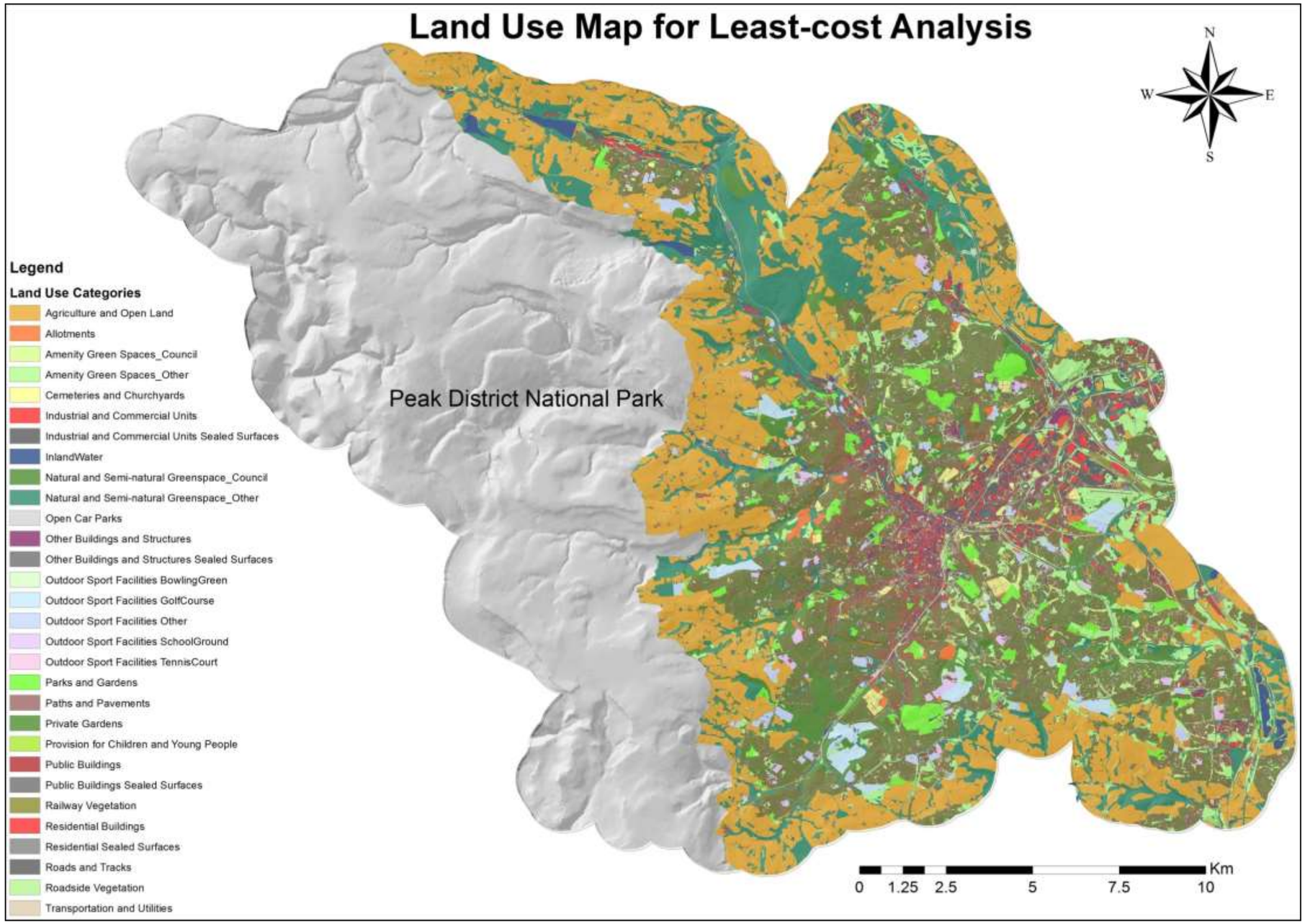
Appendix 24C: Least-cost Corridor for Slow-worms



Appendix 24D: Least-cost Binary Map for Slow-worms

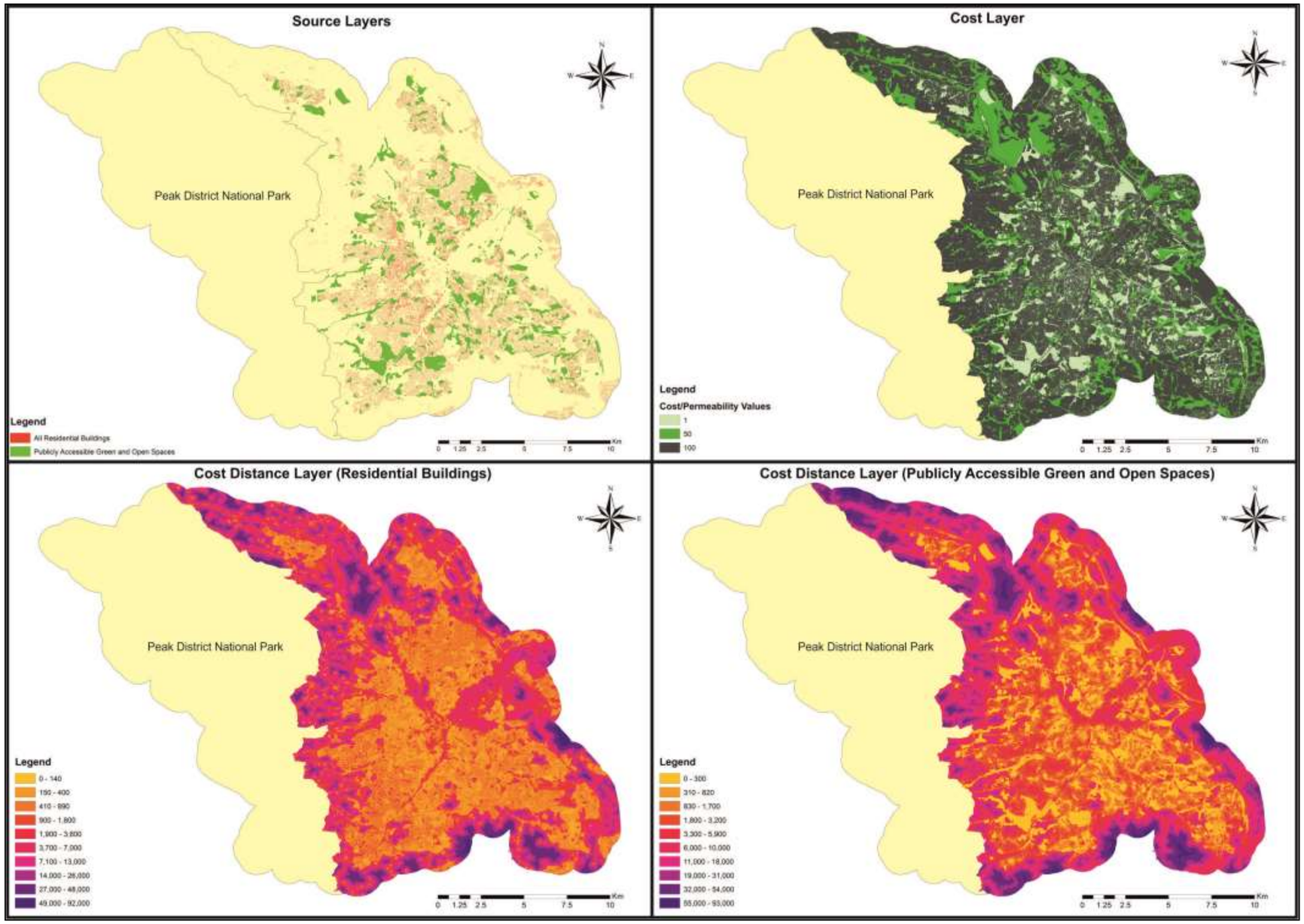


Appendix 25: Land Use Map for Least-cost Corridor Analyses

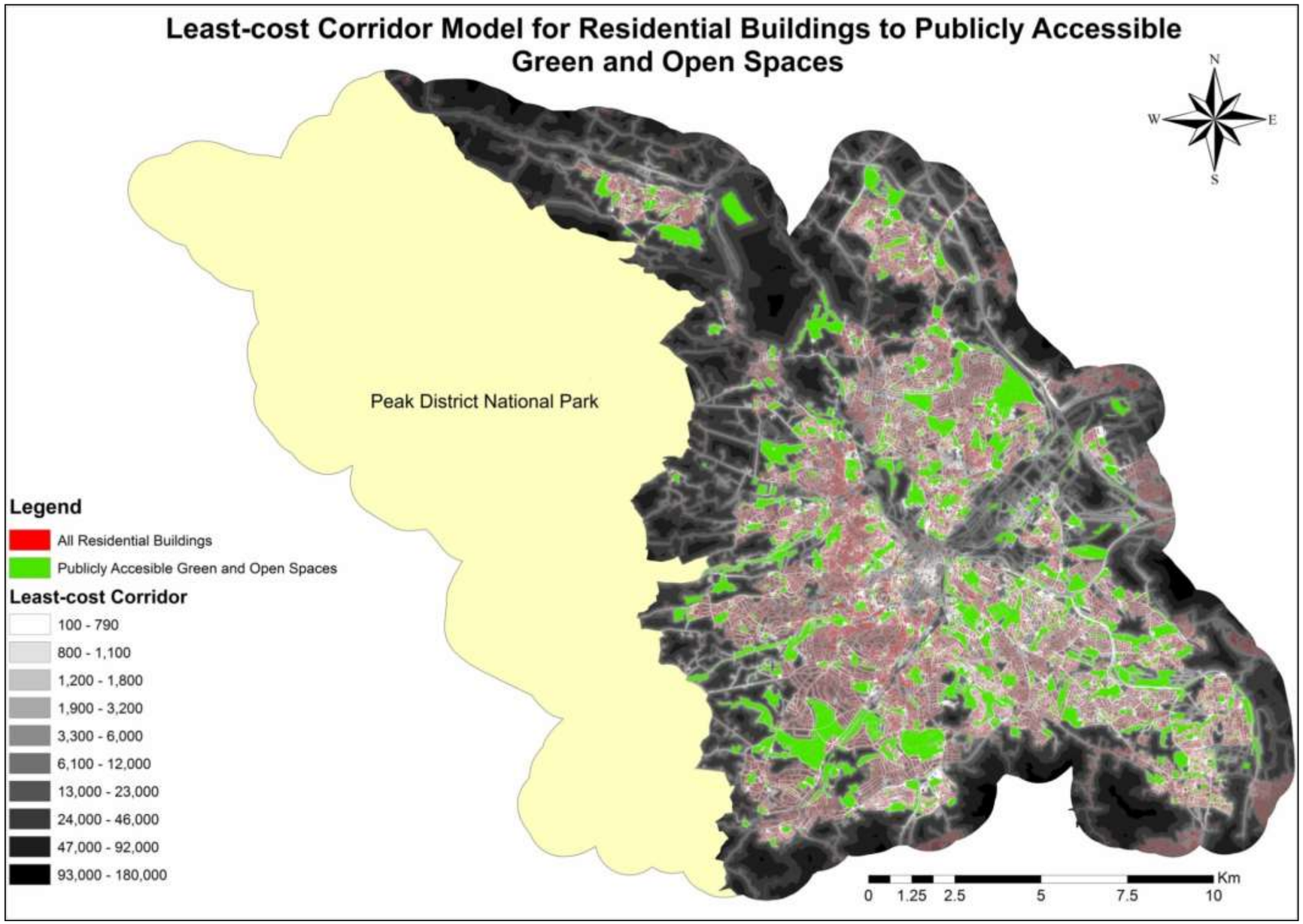


Appendix 26: Networks from Residential Buildings to Publicly Accessible Green and Open Spaces Based on Physical / Legal Accessibility

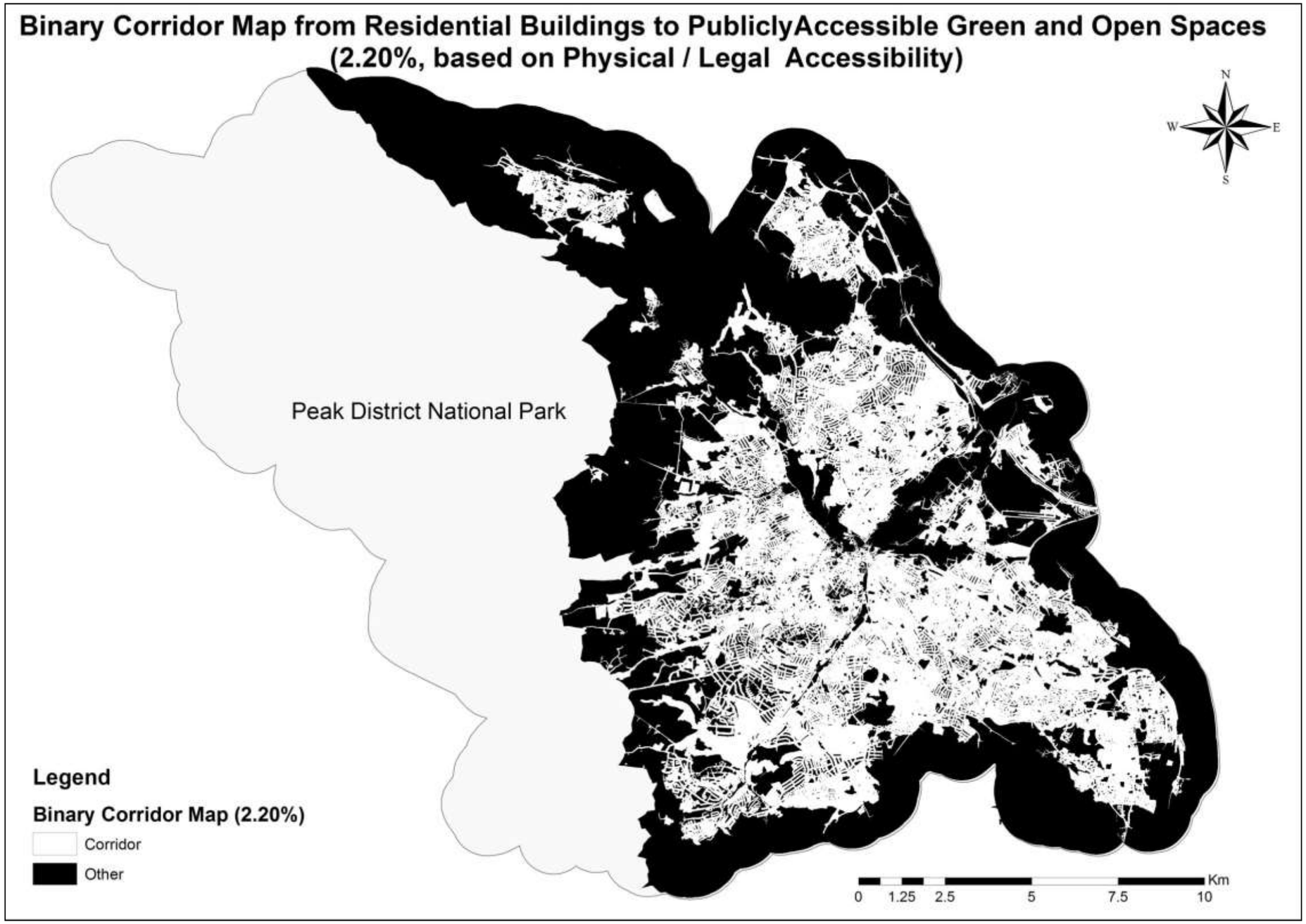
Appendix 26A: Inputs of the Least-cost Corridor Analysis



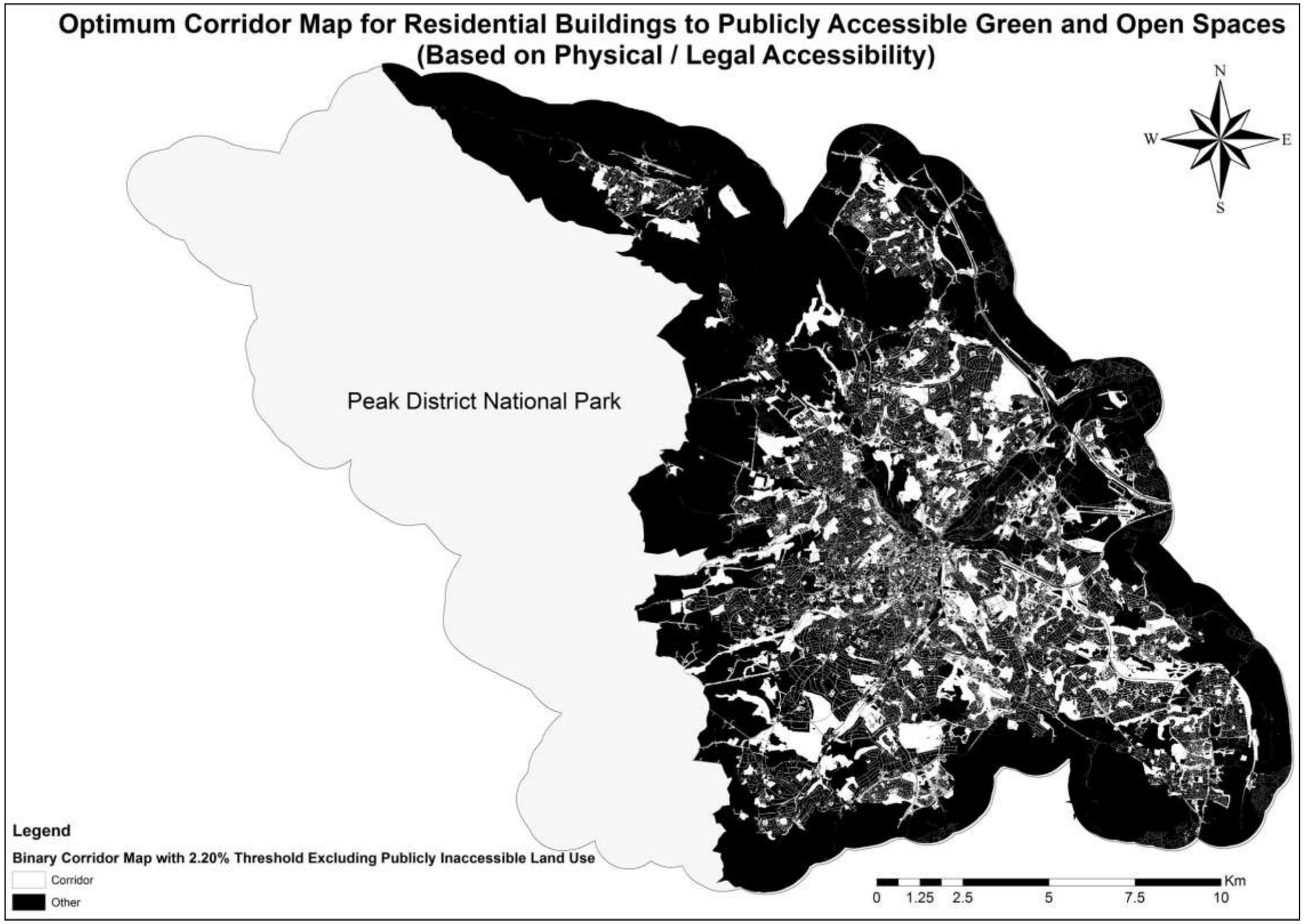
Appendix 26B: Least-cost Corridor from Residential Buildings to Publicly Accessible Green and Open Spaces



Appendix 26C: Least-cost Binary Map from Residential Buildings to Publicly Accessible Green and Open Spaces

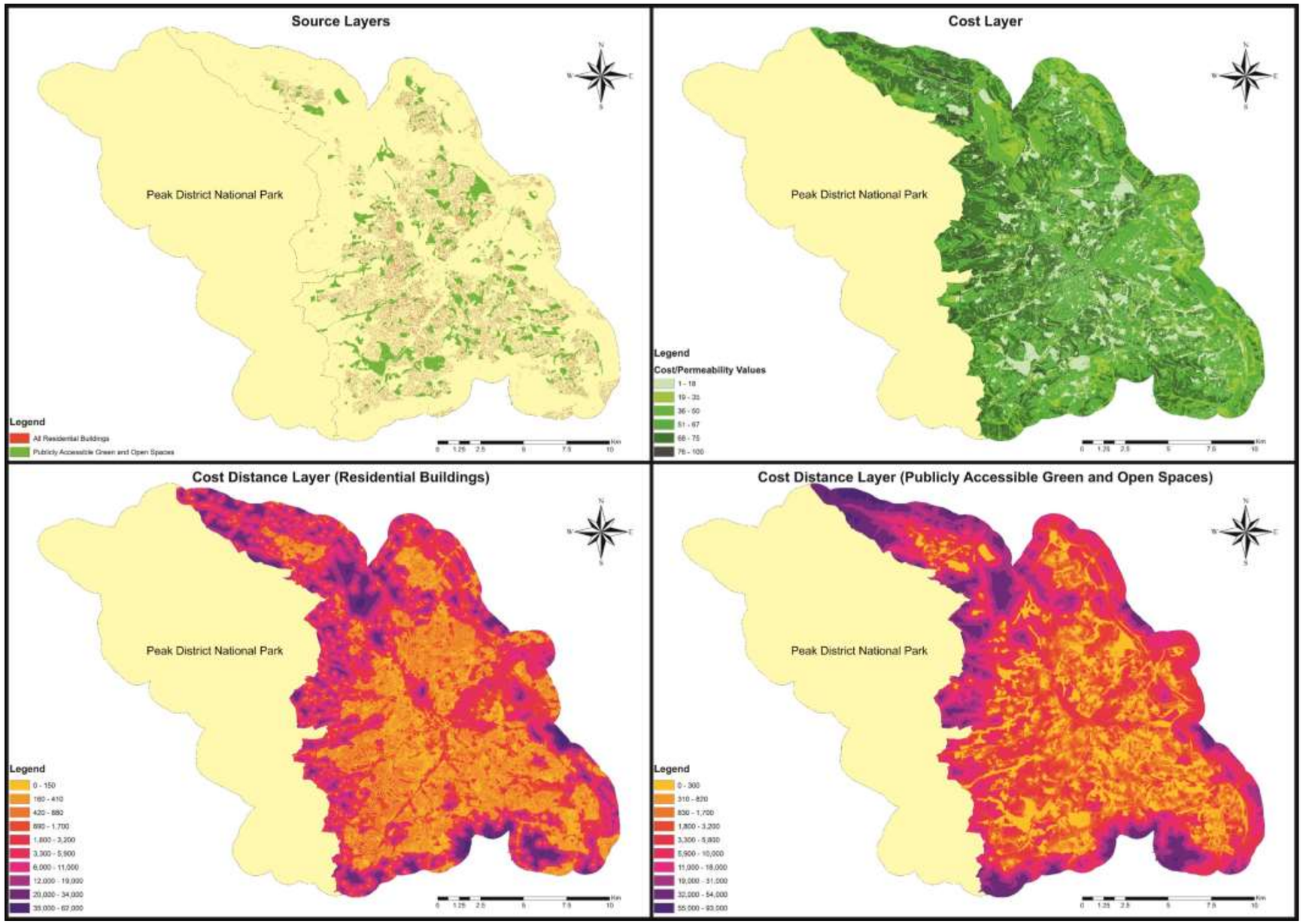


Appendix 26D: Optimum Least-cost Binary Map from Residential Buildings to Publicly Accessible Green and Open Spaces

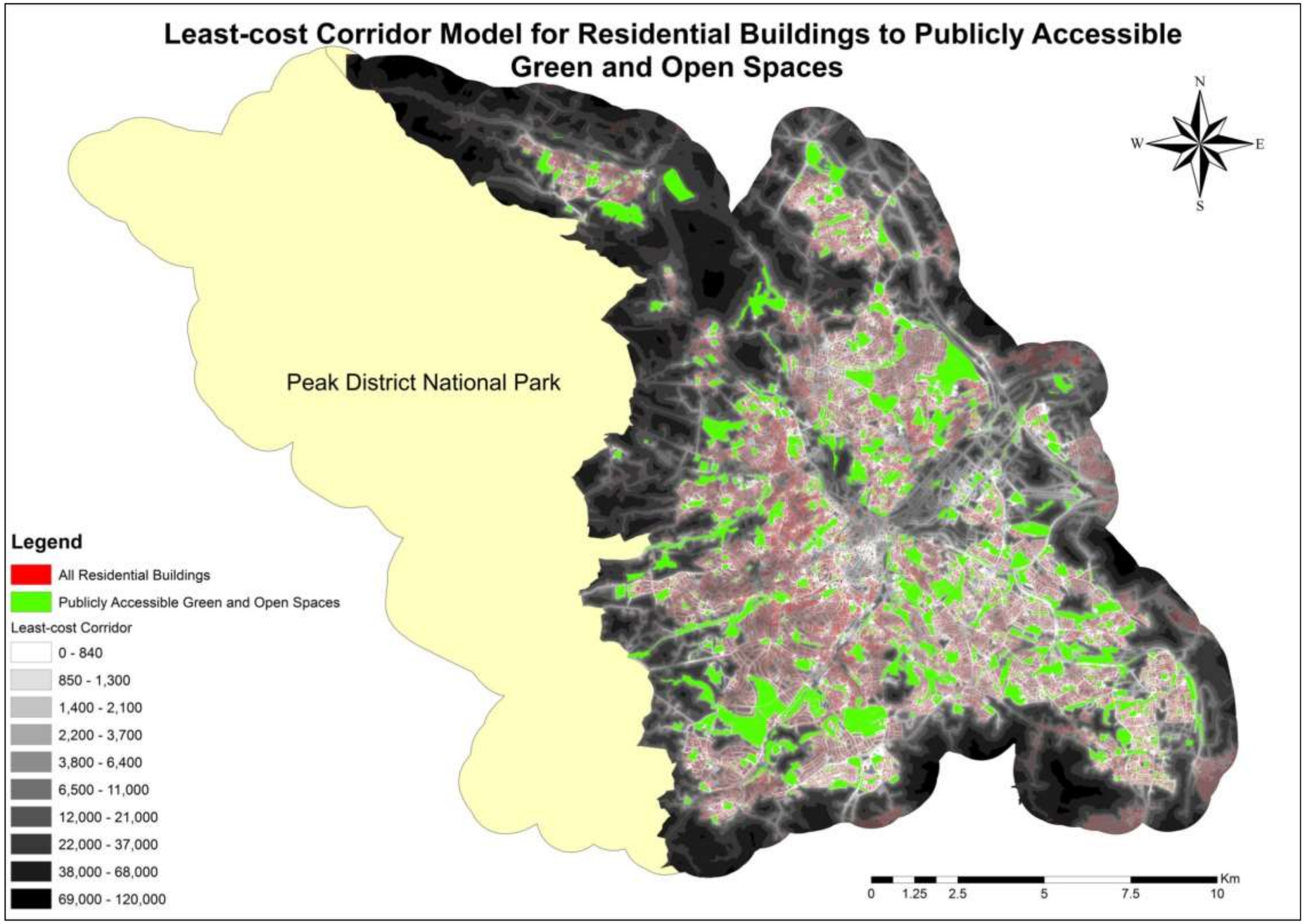


Appendix 27: Networks from Residential Buildings to Publicly Accessible Green and Open Spaces Based on Physical / Legal Accessibility and Slope

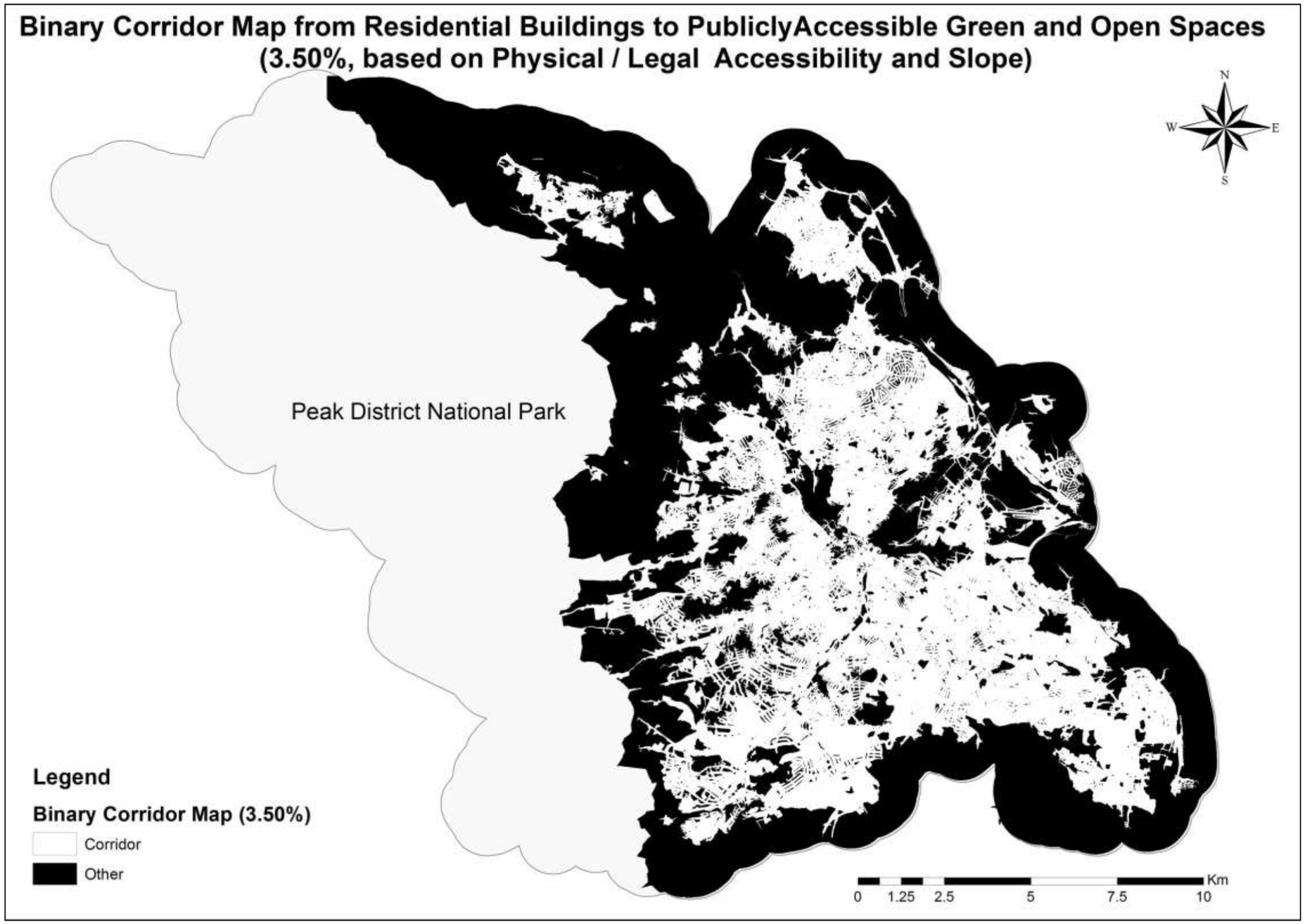
Appendix 27A: Inputs of the Least-cost Corridor Analysis



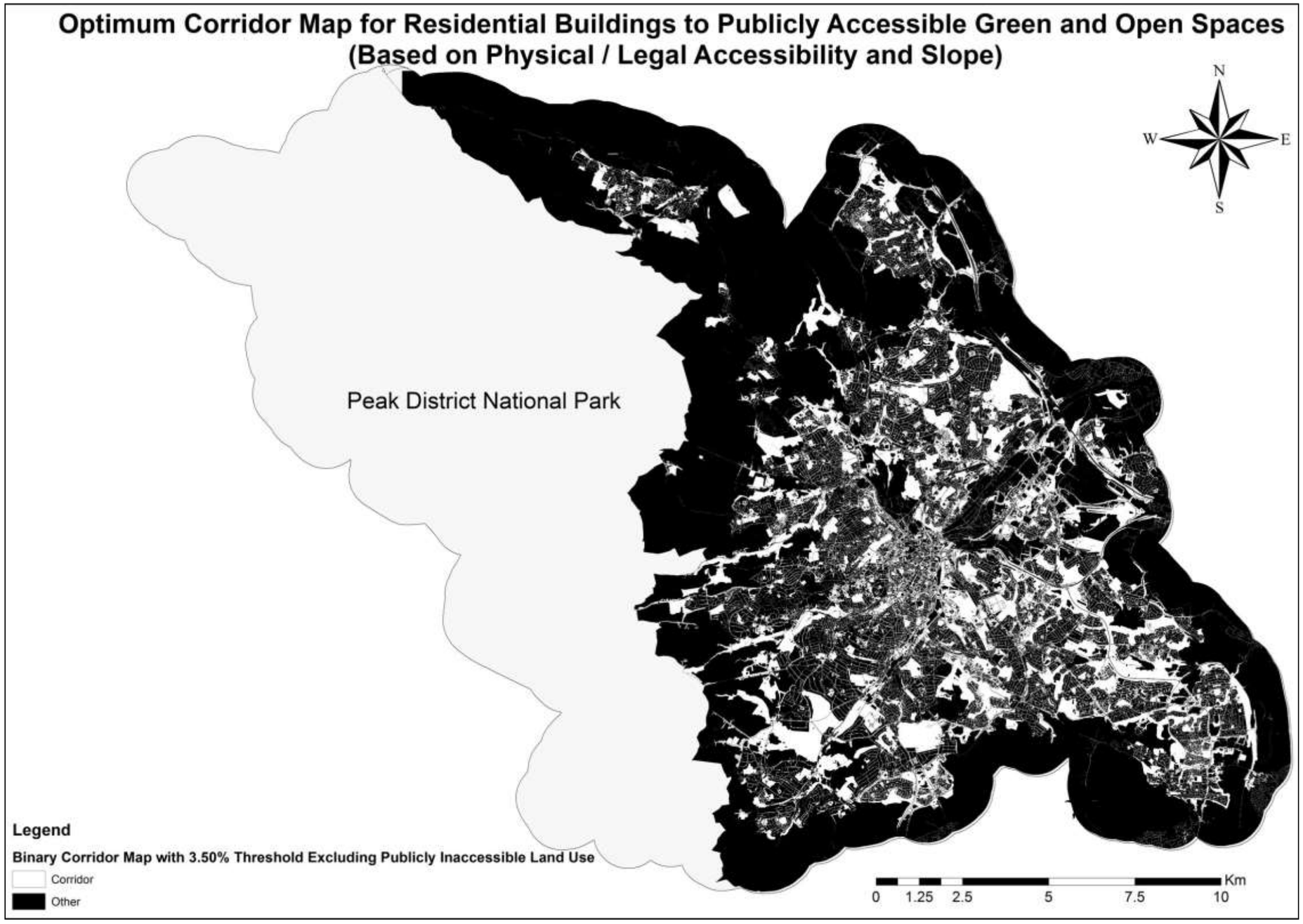
Appendix 27B: Least-cost Corridor from Residential Buildings to Publicly Accessible Green and Open Spaces



Appendix 27C: Least-cost Binary Map from Residential Buildings to Publicly Accessible Green and Open Spaces

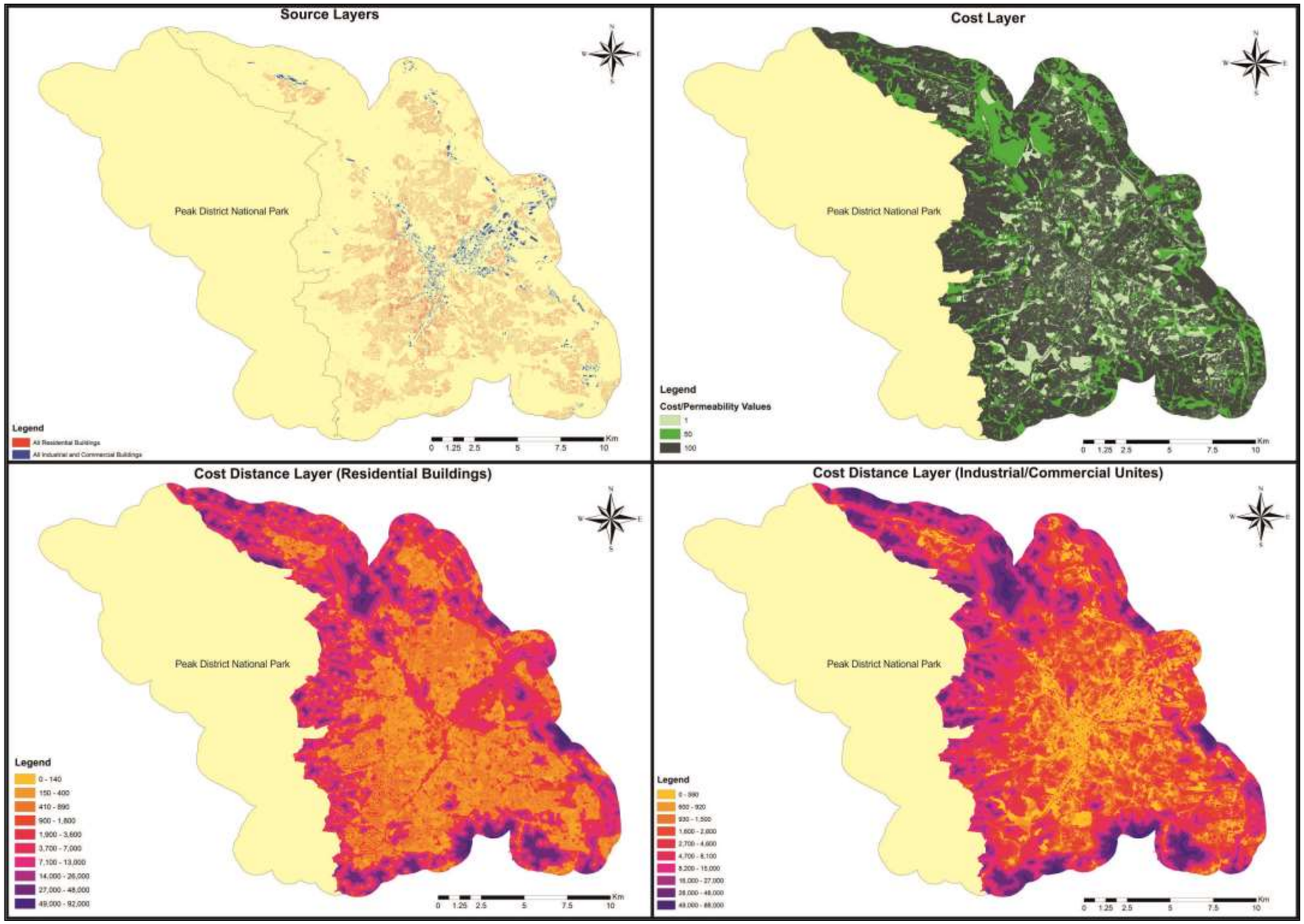


Appendix 27D: Optimum Least-cost Binary Map from Residential Buildings to Publicly Accessible Green and Open Spaces

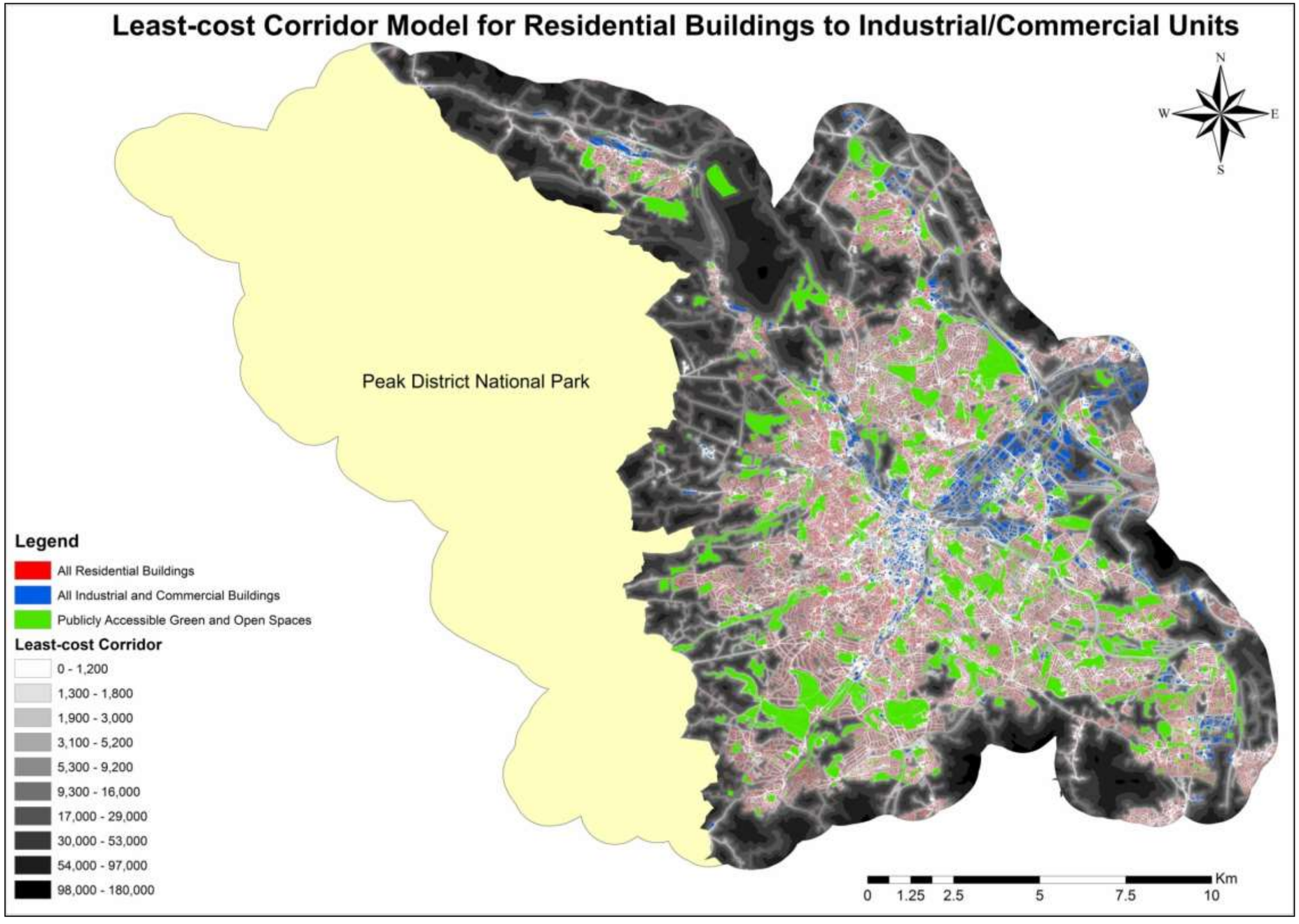


Appendix 28: Networks from Residential Buildings to Industrial and Commercial Units Based on Physical / Legal Accessibility

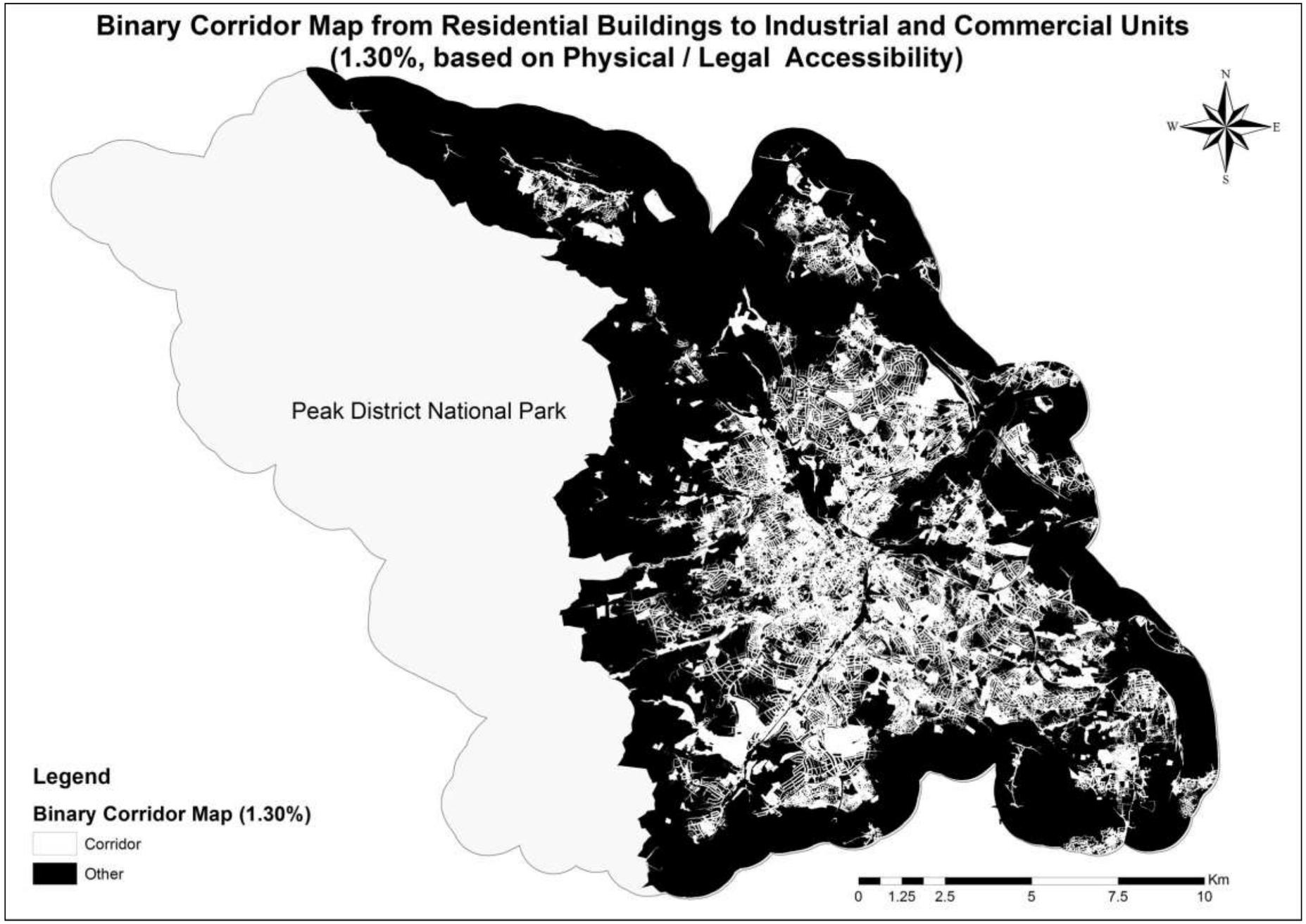
Appendix 28A: Inputs of the Least-cost Corridor Analysis



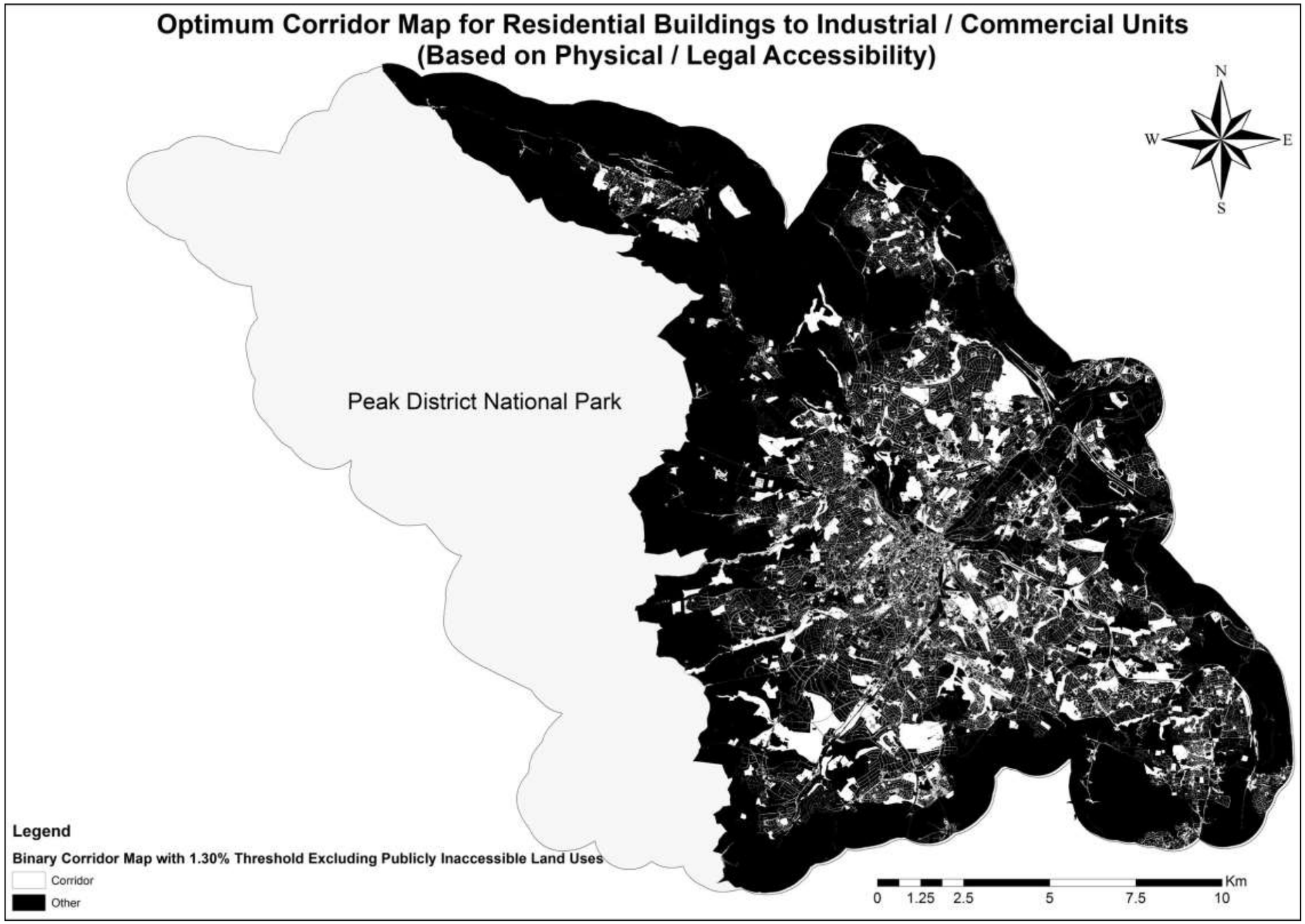
Appendix 28B: Least-cost Corridor from Residential Buildings to Industrial and Commercial Units



Appendix 28C: Least-cost Binary Map from Residential Buildings to Industrial and Commercial Units

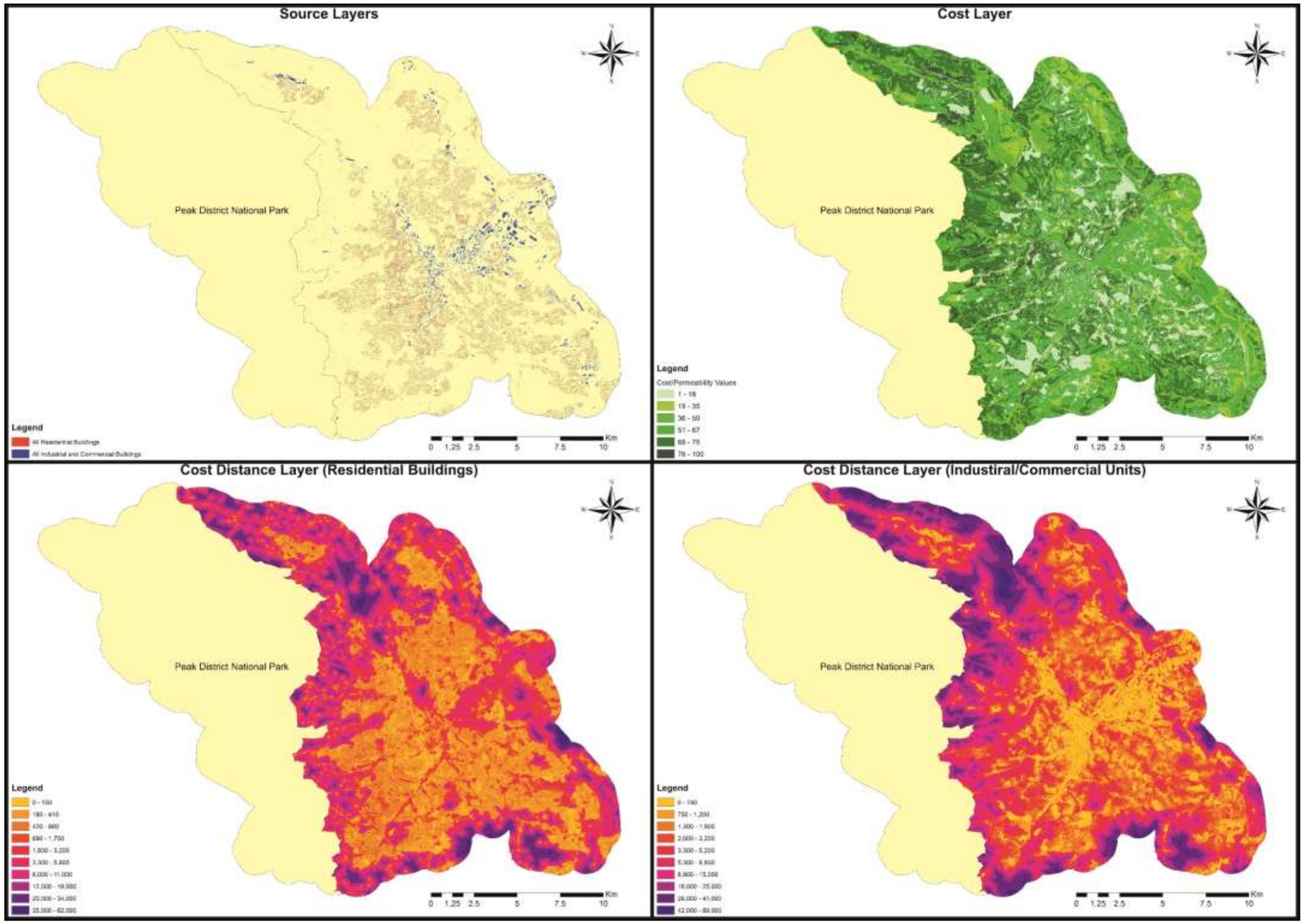


Appendix 28D: Optimum Least-cost Binary Map from Residential Buildings to Industrial / Commercial Units

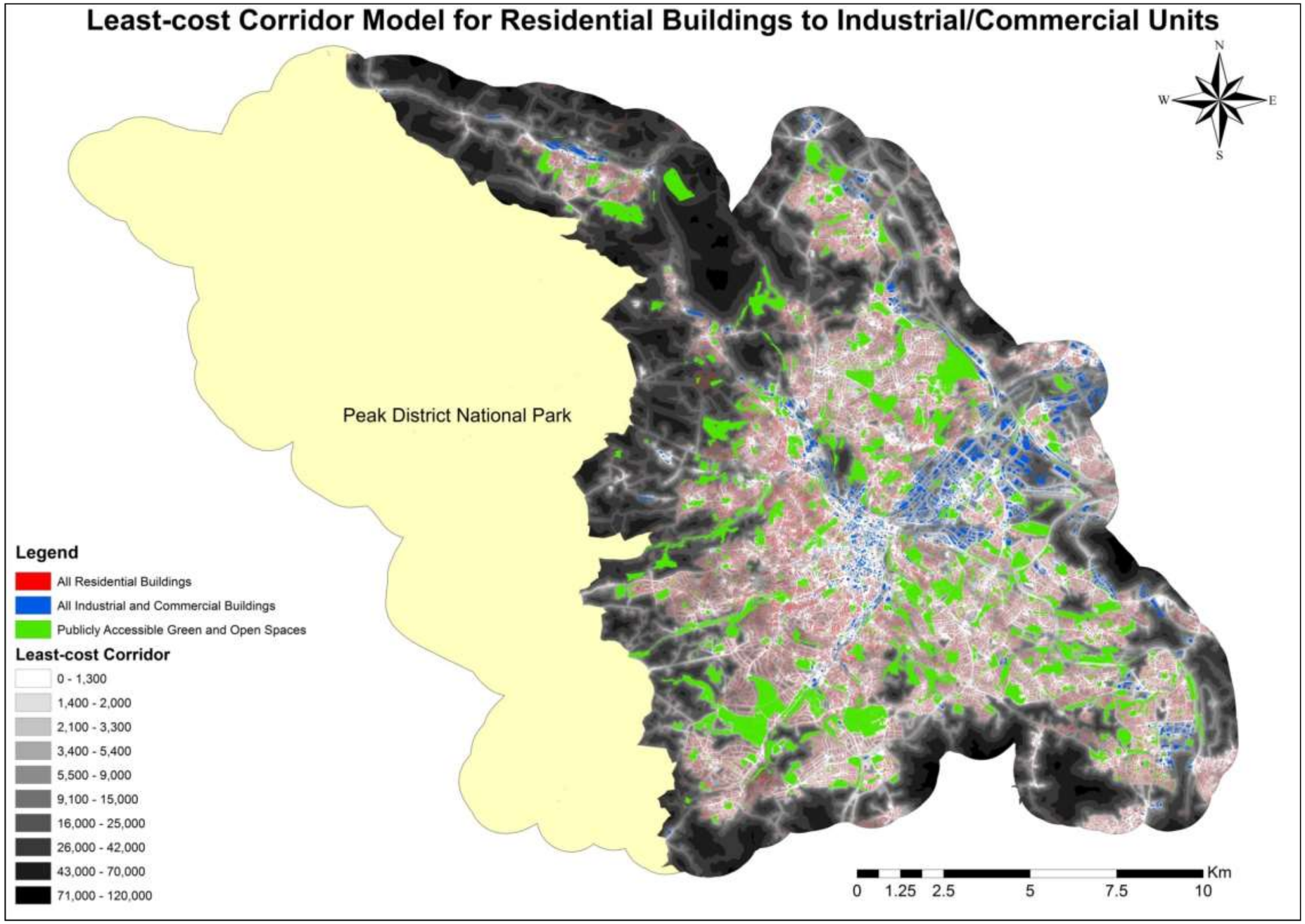


Appendix 29: Networks from Residential Buildings to Industrial and Commercial Units Based on Physical / Legal Accessibility and Slope

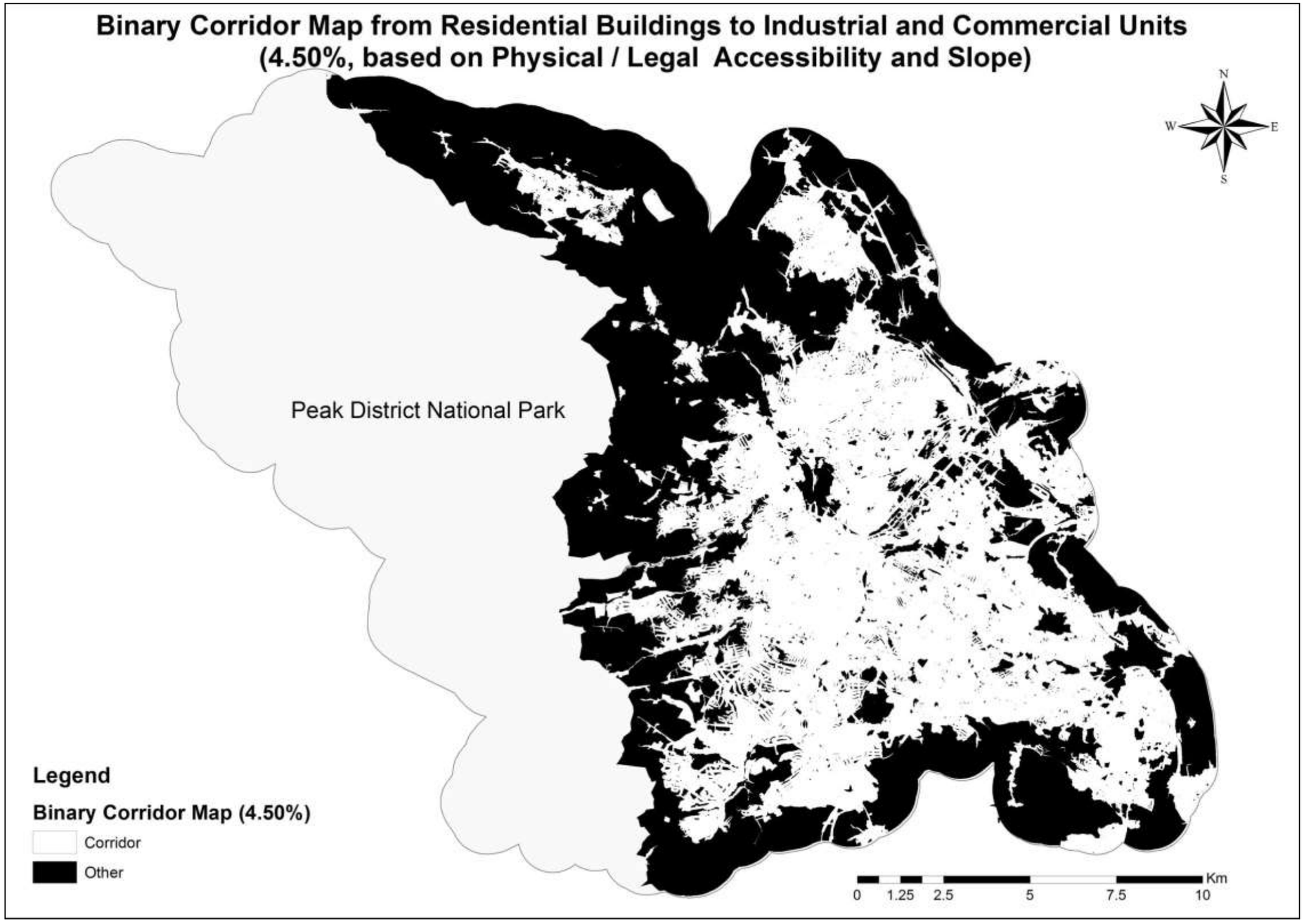
Appendix 29A: Inputs of the Least-cost Corridor Analysis



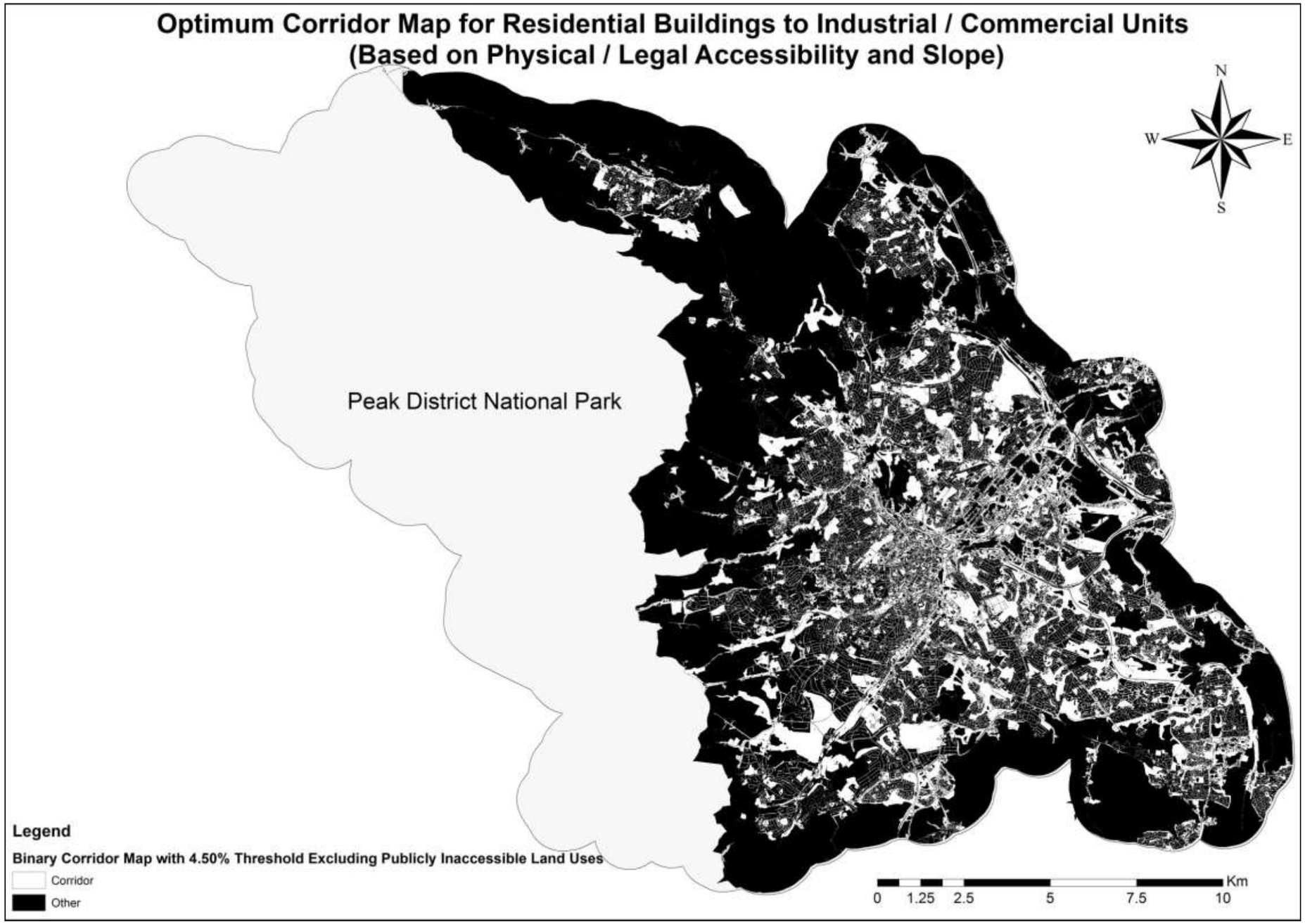
Appendix 29B: Least-cost Corridor from Residential Buildings to Industrial and Commercial Units



Appendix 29C: Least-cost Binary Map from Residential Buildings to Industrial and Commercial Units

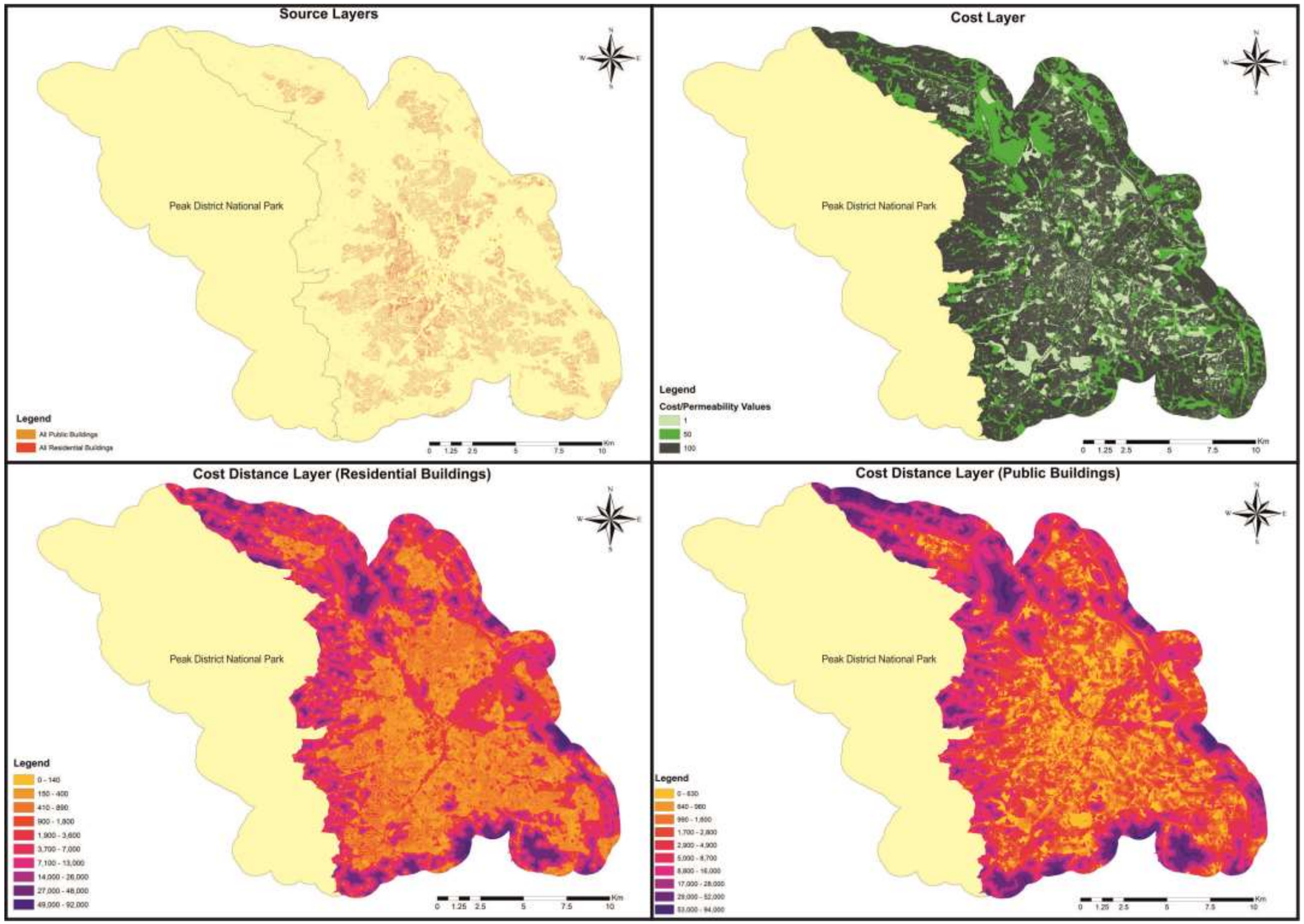


Appendix 29D: Optimum Least-cost Binary Map from Residential Buildings to Industrial / Commercial Units

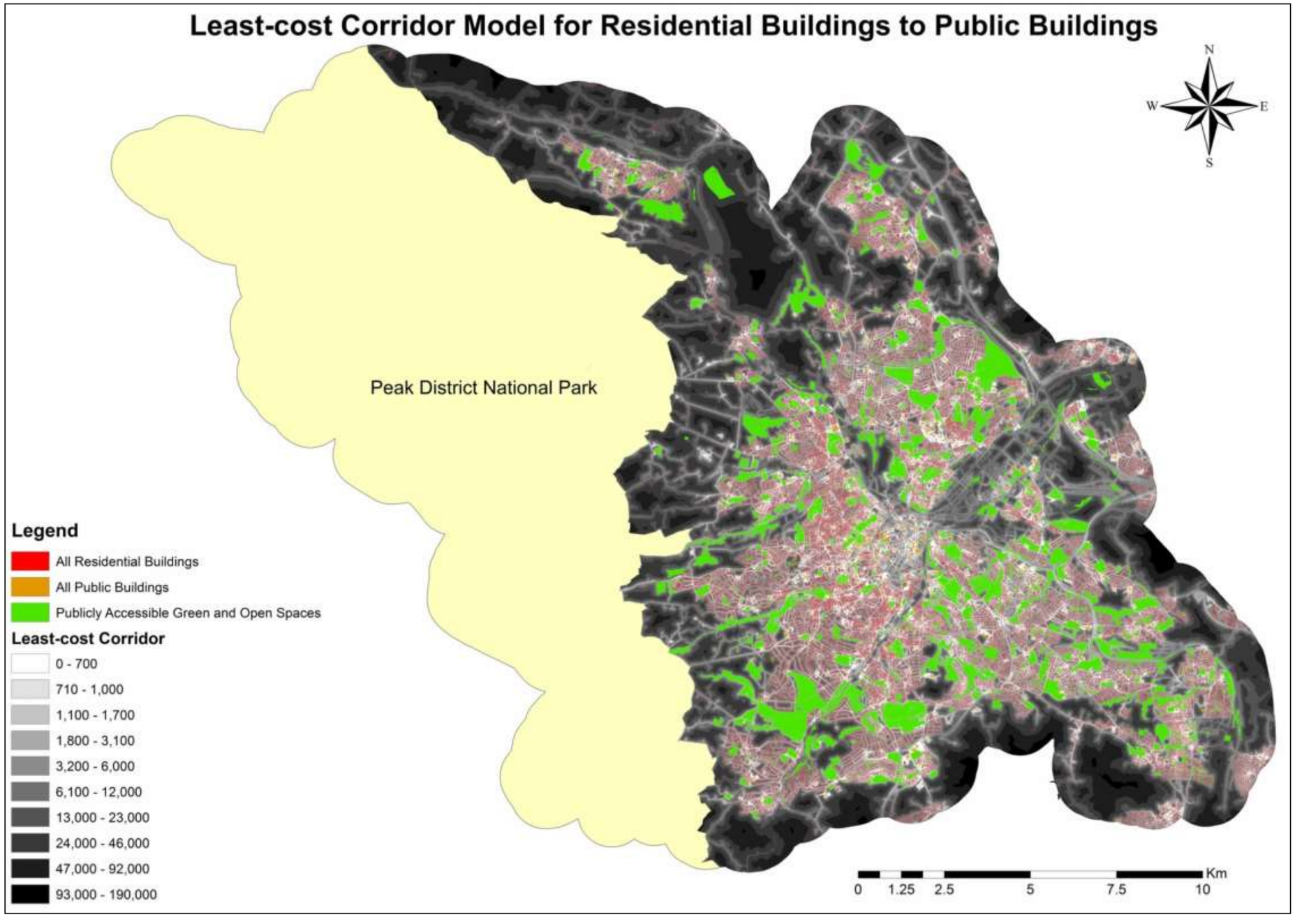


Appendix 30: Networks from Residential Buildings to Public Buildings Based on Physical / Legal Accessibility

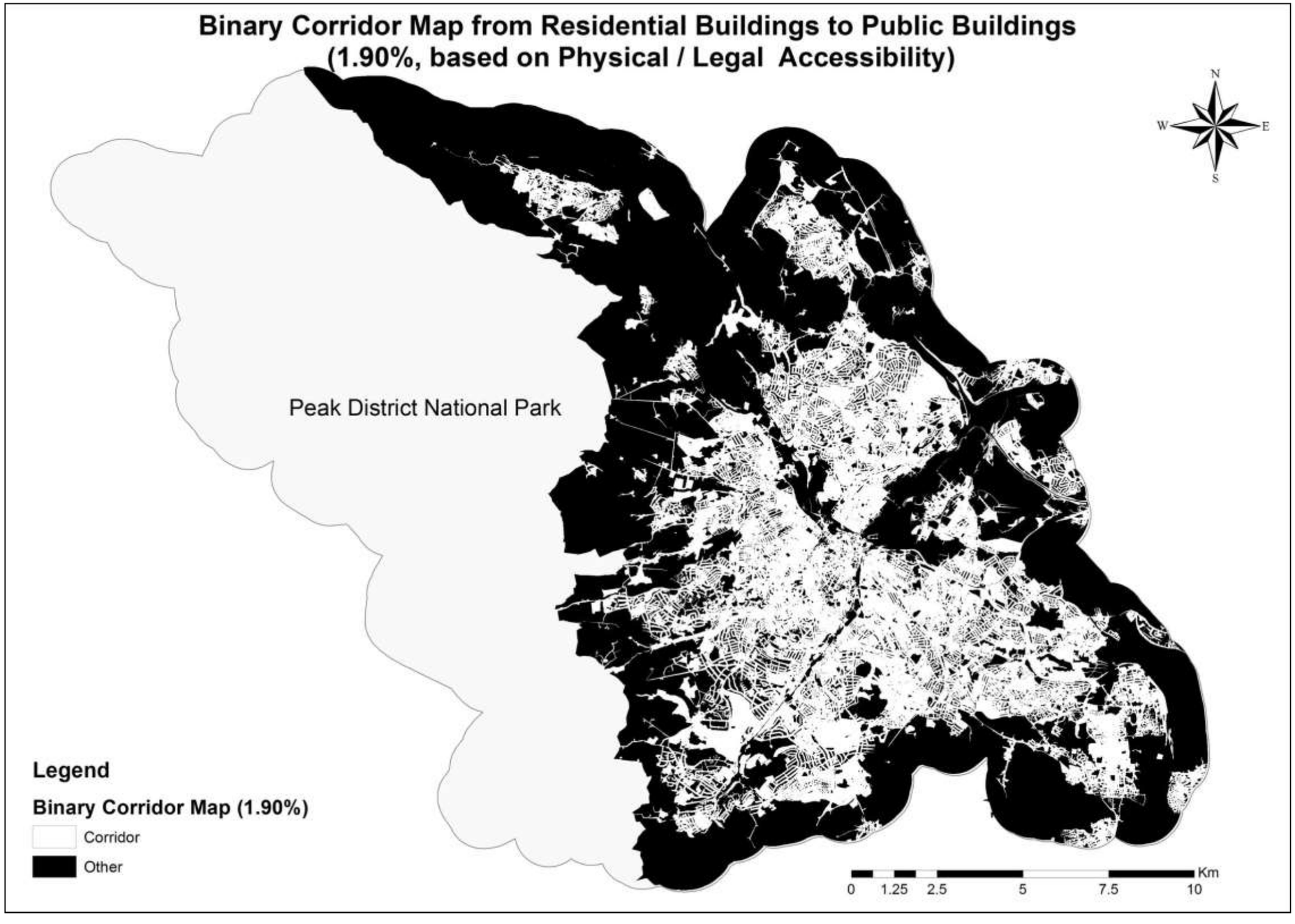
Appendix 30A: Inputs of the Least-cost Corridor Analysis



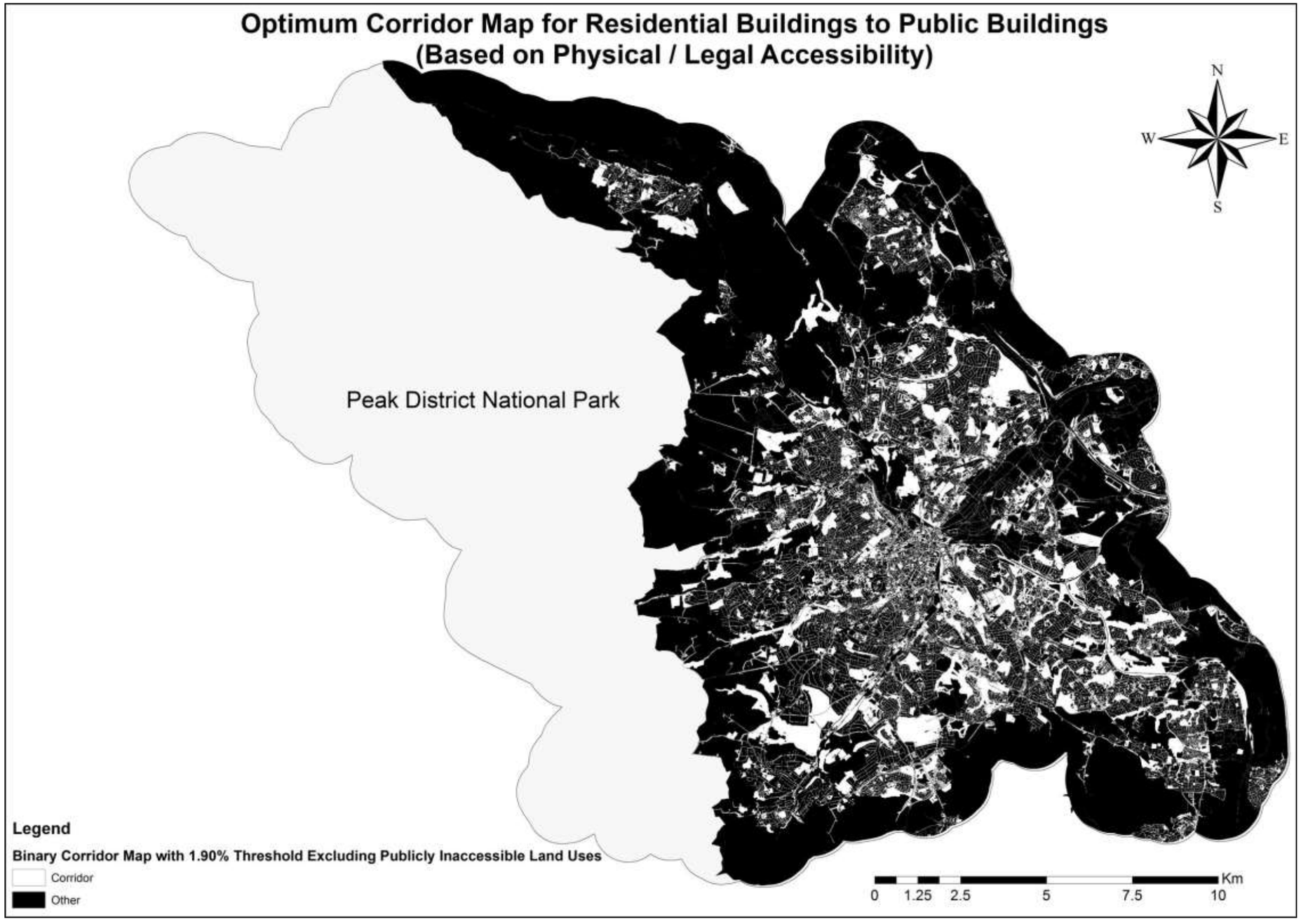
Appendix 30B: Least-cost Corridor from Residential Buildings to Public Buildings



Appendix 30C: Least-cost Binary Map from Residential Buildings to Public Buildings

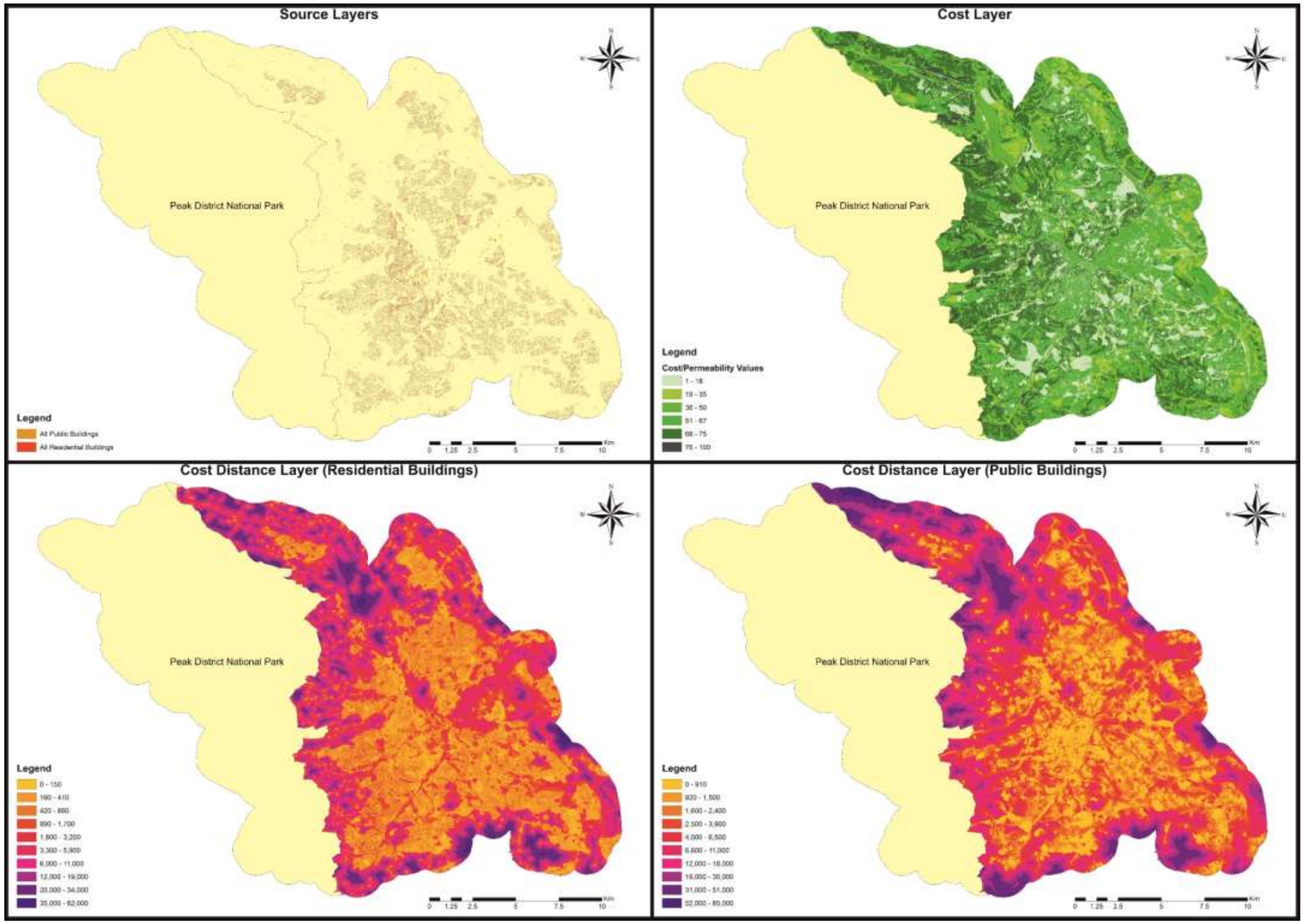


Appendix 30D: Optimum Least-cost Binary Map from Residential Buildings to Public Buildings

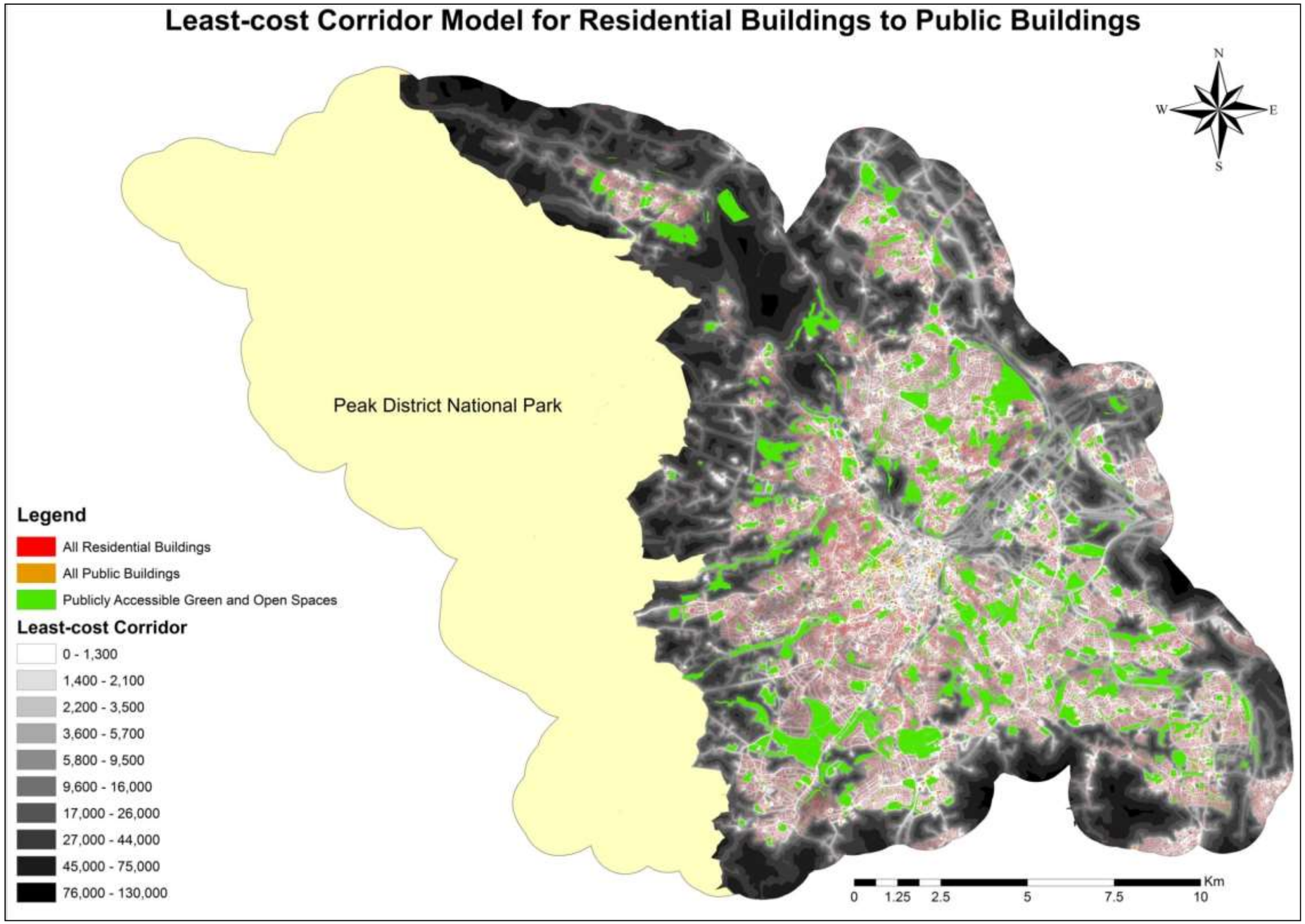


Appendix 31: Networks from Residential Buildings to Public Buildings Based on Physical / Legal Accessibility and Slope

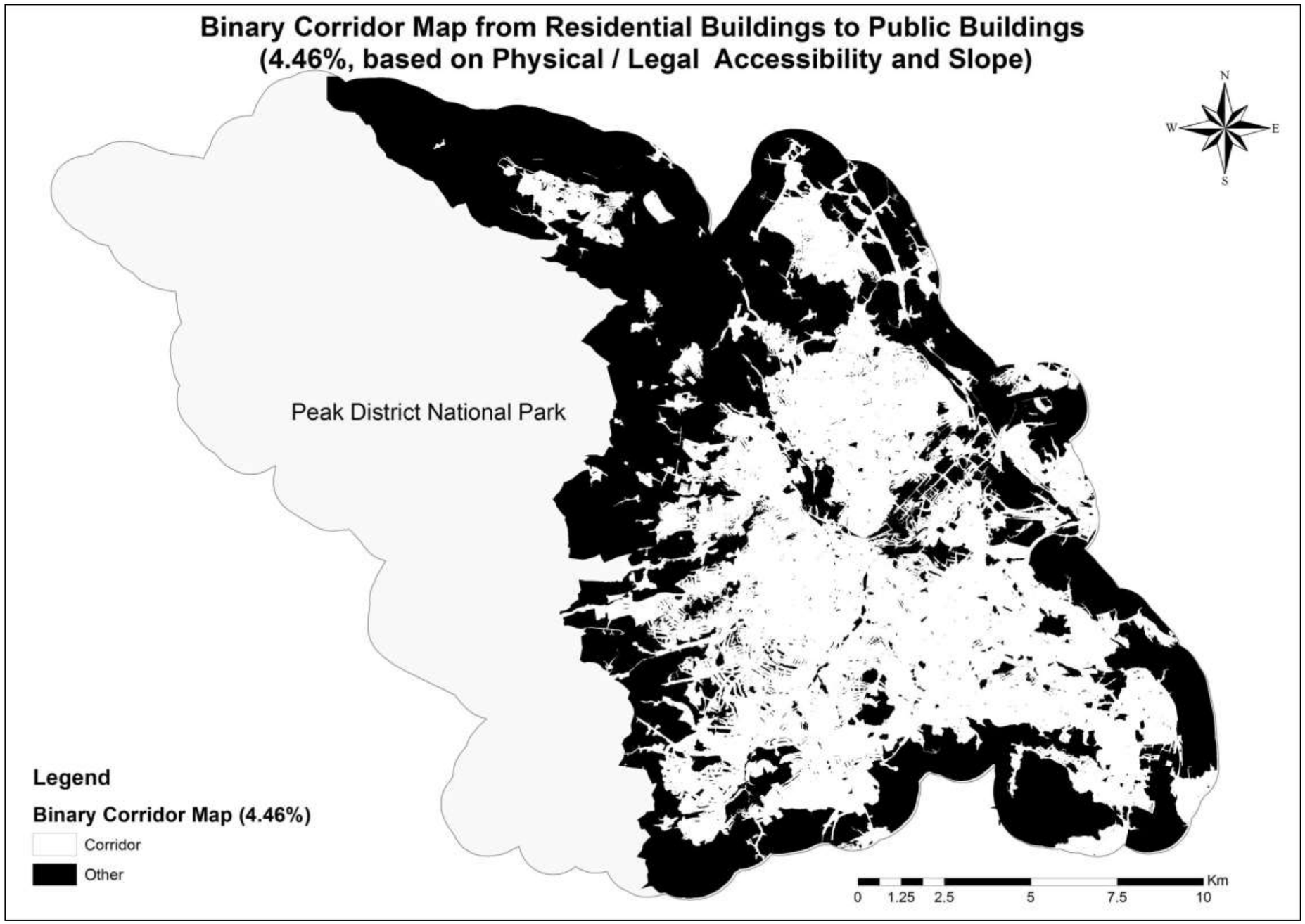
Appendix 31A: Inputs of the Least-cost Corridor Analysis



Appendix 31B: Least-cost Corridor from Residential Buildings to Public Buildings



Appendix 31C: Least-cost Binary Map from Residential Buildings to Public Buildings



Appendix 31D: Optimum Least-cost Binary Map from Residential Buildings to Public Building