Capacity Building Initiative: Workshop in Geospatial Methods

The following is a list of references and resources to support the material covered at the Workshop in Geospatial Methods. Four key references are provided first as essential guides to concepts and methods for working with spatial data and creating maps in R. Following these are selected books, papers and online materials to support specific aspects of spatial analysis; wherever possible, a link has been included for your reference.

Key references

- Bivand, R.S., Pebesma, E.J., Gómez-Rubio, V. and Pebesma, E.J. 2013. Applied spatial data analysis with R, 2nd edition. New York: Springer. *Preview available at*: https://books.google.ca/books?hl=en&lr=&id=v0eIU9ObJXgC

  This text book is an excellent reference for key concepts in geospatial data, analysis and visualization. Note that the examples are not specifically oriented to public health (see instead the text book by Waller & Gotway) and follow a different set of R packages than those used in the workshop (see instead the text book by Lovelace et al.)

- Lovelace, R., Nowosad, J., Muenchow J. 2019. Geocomputation with R. *Full book available at*: https://bookdown.org/robinlovelace/geocompr/

  This is the single best reference for working with and mapping spatial data using modern tools in R…and it's freely available online! The examples, although not from public health, directly match the packages used in the workshop (e.g., sf and tmap).

- Waller, L.A. and Gotway, C.A. 2004. Applied spatial statistics for public health data. John Wiley & Sons. *Preview available at*: https://books.google.ca/books?id=OuQwgShUdGAC

  This is a very clear and useful reference on spatial analysis from a public health standpoint. The authors focus on concepts and examples relevant to public health and provide descriptions that are ideal for those coming from a background in health and epidemiology. Note that this is not an R text book and no R examples are provided (see instead the book by Lovelace et al.)

- Grolemund, G. and Wickham, H. R for Data Science. *Full book available at*: https://r4ds.had.co.nz/

  This is the essential book for new users of R. The authors provide clear descriptions and examples of how to work efficiently with data in R using the tidyverse tools. Note that there is no specific content related to geospatial analysis.

Additional resources

Books

- Albert, D.P., Gesler, W.M. and Levergood, B. eds. 2003. Spatial analysis, GIS and remote sensing: applications in the health sciences. CRC Press. *Preview at:* https://books.google.ca/books?id=Abj0LW4BIU0C
- Brunsdon, C., and Comber, L. 2018. An Introduction to R for spatial analysis and mapping. SAGE Publications Limited. *Preview at:* https://books.google.ca/books?id=zbRkDwAAQBAJ
- Cromley, E.K. and McLafferty, S.L. 2011. GIS and public health. Guilford Press.
- Fotheringham, A.S. and Rogerson, P.A., eds. 2008. The SAGE handbook of spatial analysis. Sage. *Preview at:* https://books.google.ca/books?id=phEgXfbCU_YC
- Krygier, J. and Wood, D. 2016. Making maps: a visual guide to map design for GIS. Guilford Publications. *Preview at:* https://books.google.ca/books?id=yw3U89CUWGwC
- Lamigueiro, Ó. P. 2014. Displaying time series, spatial, and space-time data with R. Chapman and Hall/CRC. *Preview at:* https://books.google.ca/books?id=Q5A-AwAAQBAJ
- Tufte, E.R. 2001. The visual display of quantitative information (Vol. 2). Cheshire, CT: Graphics press. *Preview at:* https://books.google.ca/books?id=GTd5oQEACAAJ
- Wikle, C.K., Zammit-Mangion, A., and Cressie, N. (2019). Spatio-Temporal Statistics with R. Chapman & Hall/CRC, Boca Raton, FL. *Preview at:* https://books.google.ca/books?id=FD-IDwAAQBAJ
- Wilkinson, L. 2012. The grammar of graphics. *In* Handbook of Computational Statistics (pp. 375-414). Springer, Berlin, Heidelberg. *Preview at:* https://books.google.ca/books?id=aSv09LwmuRYC

Papers

Note: Full text copies of the following journal articles are provided in this set of resources

- Feng, X., Tan, X., Alenzi, E.O., Rai, P. and Chang, J., 2016. Spatial and temporal variations of screening for breast and colorectal cancer in the United States, 2008 to 2012. Medicine, 95(51).
- Kulldorff, M. and Nagarwalla, N. 1995. Spatial disease clusters: Detection and Inference. Statistics in Medicine, 14: 799–810.
- Lofters, A.K., Gozdyra, P. and Lobb, R., 2013. Using geographic methods to inform cancer screening interventions for South Asians in Ontario, Canada. BMC Public Health, 13(1), p.395.
- Lovelace, R., Cheshire, J., Oldroyd, R. et al. 2017. Introduction to visualising spatial data in R.
- Mobley, L.R., Kuo, T.M., Urato, M., Subramanian, S., Watson, L. and Anselin, L., 2012. Spatial heterogeneity in cancer control planning and cancer screening behavior. Annals of the Association of American Geographers, 102(5): 1113-1124.
- Tennekes, M. tmap: Thematic Maps in R. Journal of Statistical Software, 84(6): 1-39.
- Tobler W. 1970. A computer movie simulating urban growth in the Detroit region. Economic Geography, 46(Supplement): 234–240.

- Zandbergen, P. A. 2014. Ensuring confidentiality of geocoded health data: assessing geographic masking strategies for individual-level data. Advances in Medicine 2014: 567049.

Websites

- Supporting material for the book *An Introduction to R for Spatial Analysis and Mapping* by Brundson and Comber. https://bookdown.org/lexcomber/brunsdoncomber2e/
- Spatial Data Science with R — R Spatial. Robert J. Hijmans. https://www.rspatial.org/
- R packages and resources for spatial analysis. https://cran.r-project.org/web/views/Spatial.html

Online courses

- DataCamp online courses for learning R. https://www.datacamp.com/search?q=&facets%5Btechnology%5D%5B%5D=R
- DataCamp online courses for working with geospatial data in R. https://www.datacamp.com/tracks/spatial-data-with-r
- References and resources for the essential data science tools in R. https://www.tidyverse.org/
- UBC Stat 545: Data wrangling, exploration, and analysis with R. http://stat545.com/index.html

Tutorials and examples

- Bell, N. Mapping Health Data. PopDataBC. https://www.popdata.bc.ca/sites/default/files/documents/events/etu/MappingHealthData/MappingHealthData.pdf
- Leroux, D. Cloutier, L. 2014. GIS and Cervical Cancer Screening: The Contribution of Spatial Analysis. 2014 Esri User Conference Paper Sessions. http://proceedings.esri.com/library/userconf/proc14/papers/364_412.pdf
- Moraga, P. 2018. Disease risk modelling and visualization using R. https://paula-moraga.github.io/assets/documents/presentation-disease-mapping.pdf
- University of Victoria. Online Academic Community. Analysing Census Data in R. https://onlineacademiccommunity.uvic.ca/mreumcensusdatatutorial/
- ZevRoss Spatial Analysis. 2018. Creating beautiful demographic maps in R with the tidycensus and tmap packages. http://zevross.com/blog/2018/10/02/creating-beautiful-demographic-maps-in-r-with-the-tidycensus-and-tmap-packages/
- Strimas-Mackey, M. 2017. Tidy spatial data in R: using dplyr, tidyr, and ggplot2 with sf. http://strimas.com/r/tidy-sf/
- Moreno, M. and Basille, M. 2018. Drawing beautiful maps programmatically with R, sf and ggplot2. R-spatial.org. https://www.r-spatial.org/r/2018/10/25/ggplot2-sf.html, https://www.r-spatial.org/r/2018/10/25/ggplot2-sf-2.html and https://www.r-spatial.org/r/2018/10/25/ggplot2-sf-3.html