Training Course on Geoprocessing with R (sf, sp, raster packages)

Professional Development Training Course Outline

Category	GIS	**Duration**	5 Days
Base Fee	$1,500 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

In today's data-driven world, **Geospatial Data Science** has emerged as a critical field for unlocking valuable insights from location-based information. Training Course on Geoprocessing with R (sf, sp, raster packages) empowers professionals with the advanced skills to **analyze, manipulate, and visualize spatial data** using the powerful open-source programming language R. Leveraging industry-standard packages like **sf for vector data**, **sp for traditional spatial objects**, and **raster for gridded datasets**, participants will gain proficiency in conducting complex **geospatial analyses** , from basic mapping to sophisticated spatial modeling. This course emphasizes **reproducible workflows** and **open-source tools**, making it an essential investment for anyone looking to excel in **spatial analytics**, **environmental modeling**, **urban planning**, or **data-driven decision-making**.

This hands-on program delves deep into the practical application of R for **geoprocessing tasks**, focusing on real-world scenarios and **case studies**. We will cover the entire **geospatial data lifecycle**, from data acquisition and cleaning to advanced spatial operations and compelling visualizations. By mastering the sf, sp, and raster packages, alongside other complementary R packages for **data wrangling** and **visualization**, participants will be equipped to tackle diverse **spatial challenges** across various domains. This training is designed to bridge the gap between theoretical spatial concepts and their practical implementation in R, fostering a robust understanding of **geocomputation** and its immense potential.

Programme Curriculum

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Course Duration

5 days

Course Objectives

1. Proficiently import, export, and manage diverse **geospatial data formats** (shapefiles, GeoJSON, TIFF, NetCDF) within R.
2. Effectively utilize the sf package for **vector data operations** including buffering, clipping, dissolving, spatial joins, and attribute management.
3. Perform advanced **raster geoprocessing** tasks such as reclassification, aggregation, mosaic, extraction, and raster algebra using the raster package.
4. Understand, define, and reproject **Coordinate Reference Systems** to ensure accurate spatial alignment and interoperability.
5. Create compelling static and interactive **geospatial visualizations** using ggplot2, tmap, and leaflet for insightful data storytelling.
6. Comprehend and work with traditional sp objects for compatibility with legacy code and specific analytical needs.
7. Implement robust techniques for **cleaning, validating, and preparing spatial datasets** for analysis, including handling missing data and topology errors.
8. Apply fundamental **spatial statistical methods** like spatial autocorrelation (Moran's I), hotspot analysis, and point pattern analysis.
9. Perform **address geocoding** and **reverse geocoding** to link textual location data with geographic coordinates.
10. Develop **reproducible R scripts** to automate complex geoprocessing tasks, enhancing efficiency and minimizing manual errors.
11. Explore basic integration strategies between R and other **GIS platforms** for enhanced analytical capabilities.
12. Apply R geoprocessing skills to real-world **environmental modeling**, **conservation planning**, and **ecological data analysis**.
13. Utilize geospatial R for **urban planning**, **infrastructure assessment**, and **demographic analysis** to support smart city initiatives.

Organizational Benefits

- Equip teams with the ability to extract critical **geographic insights** for more informed strategic and operational decisions.
- Leverage powerful **open-source R tools** to reduce reliance on expensive proprietary GIS software licenses.
- Automate repetitive **geospatial workflows**, leading to significant time savings and increased productivity across departments.
- Foster a culture of **reproducible geospatial analysis**, ensuring transparency, consistency, and verifiability of results.
- Elevate the **spatial analysis skills** of staff, enabling more sophisticated investigations and problem-solving.
- Gain a competitive edge by integrating advanced **location intelligence** into business processes and market strategies.
- Optimize **resource allocation** and spatial planning in areas such as logistics, environmental management, and public health.
- Empower teams to address complex, interdisciplinary challenges by integrating **spatial data science** into various projects.

Target Audience

1. Data Scientists & Analysts
2. GIS Professionals.
3. Environmental Scientists & Researchers.
4. Urban Planners & Demographers
5. Public Health Researchers.
6. Geographers & Cartographers.
7. Remote Sensing Specialists.
8. Anyone with R Programming Experience

Course Modules

Module 1: Introduction to Geospatial Data & R Fundamentals

- Understanding fundamental **geospatial data types**
- Setting up your R environment for **geospatial analysis**
- Introduction to key **R spatial packages**: sf, sp, raster – their purpose and relationship.
- Working with **Coordinate Reference Systems (CRS)**
- Basic data import and export of common **geospatial file formats**
- **Case Study:** Importing global administrative boundaries and plotting them on a basic world map, understanding different CRS options for global projection.

Module 2: Vector Data Geoprocessing with sf

- Creating and manipulating sf objects: points, lines, polygons.
- Fundamental **geoprocessing operations**
- **Spatial joins** and overlays: merging attribute data based on spatial relationships.
- Calculating **geometric properties**: area, length, distance, centroids.
- Data cleaning and validation for vector data.
- **Case Study:** Analyzing the impact of proposed highway development by buffering road networks and intersecting with sensitive ecological areas to quantify affected habitats.

Module 3: Advanced Vector Operations & Spatial Aggregation

- Working with dplyr for efficient **spatial data wrangling** within sf.

- **Aggregating spatial data**
- Spatial sampling strategies: random points, stratified sampling within polygons.
- Handling multi-part geometries and converting between different sf geometry types.
- Introduction to spatial network analysis fundamentals with sf.
- **Case Study:** Aggregating crime incident points to police district polygons to calculate crime rates per district and identify high-crime areas for resource allocation.

Module 4: Raster Data Fundamentals & Manipulation with raster

- Understanding **raster data structures**: resolution, extent, origin, cell values.
- Importing and visualizing **single-band and multi-band raster data**
- **Raster calculations and algebra**: performing operations on pixel values
- **Raster resampling, reclassification, and aggregation**
- Clipping, masking, and extracting values from rasters using vector data.
- **Case Study:** Calculating the Normalized Difference Vegetation Index (NDVI) from multi-spectral satellite imagery to assess vegetation health in an agricultural region over time.

Module 5: Advanced Raster Geoprocessing & Modeling

- Working with **raster stacks and bricks**: managing multiple raster layers.
- **Zonal statistics**
- Performing **terrain analysis**
- Introduction to **cost-distance analysis** and hydrological modeling concepts with rasters.
- Integrating raster data with vector data for complex analyses.
- **Case Study:** Identifying suitable sites for solar panel installation by combining solar radiation raster data with slope, aspect, and land cover rasters through multi-criteria evaluation.

Module 6: Spatial Visualization and Cartography in R

- Creating publication-quality static maps with ggplot2 and sf geometries.
- **Thematic mapping**: choropleth maps, graduated symbol maps, heatmaps.
- Customizing map elements: legends, titles, scale bars, north arrows.
- Building **interactive web maps** using leaflet for dynamic data exploration.
- Integrating basemaps from various sources (OpenStreetMap, Satellite imagery).
- **Case Study:** Developing an interactive web map showing the distribution of public services (e.g., hospitals, schools) and their accessibility zones for urban residents.

Module 7: Spatial Statistics & Pattern Analysis

- Measuring **spatial autocorrelation**
- **Hotspot analysis**: identifying statistically significant clusters of high or low values.
- Introduction to **point pattern analysis**: analyzing the distribution of point features.
- Basic **spatial interpolation** techniques.
- Understanding and addressing the **Modifiable Areal Unit Problem (MAUP)**.
- **Case Study:** Analyzing the spatial clustering of a particular disease outbreak in a city to identify potential environmental or demographic factors contributing to its spread.

Module 8: Reproducible Workflows & Advanced Topics

- Building **reproducible analysis pipelines** using R Markdown for dynamic reporting.
- Error handling and debugging in **geospatial R scripts**.

- Introduction to other relevant **R packages**: terra (modern raster/vector), stars (spatiotemporal), gstat (geostatistics).
- Best practices for organizing **geospatial projects** in R.
- Brief overview of integrating R with external GIS platforms
- **Case Study:** Automating the process of downloading, cleaning, and visualizing weekly air quality data from multiple sensor locations, generating an updated map and report automatically.

Training Methodology

- Interactive Lectures
- Software Demonstrations
- Practical Labs.
- Case Studies Analysis.
- Group Discussions
- Project-Based Learning.
- Expert-Led Mentorship.

Register as a group from 3 participants for a Discount

Send us an email: info@fineskilltrainingcenter.org or call *+254769199797*

Certification

Upon successful completion of this training, participants will be issued with a globally- recognized certificate.

Tailor-Made Course

We also offer tailor-made courses based on your needs.

Key Notes

a. The participant must be conversant with English.

b. Upon completion of training the participant will be issued with an Authorized Training Certificate

c. Course duration is flexible and the contents can be modified to fit any number of days.

d. The course fee includes facilitation training materials, 2 coffee breaks, buffet lunch and A Certificate upon successful completion of Training.

e. One-year post-training support Consultation and Coaching provided after the course.

f. Payment should be done at least a week before commence of the training, to Fineskill Training Center account, as indicated in the invoice so as to enable us prepare better for you.

Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
23 Nov 2026	27 Nov 2026	Online	$1,000
23 Nov 2026	27 Nov 2026	Physical	$1,500
23 Nov 2026	27 Nov 2026	Physical	$3,000
23 Nov 2026	27 Nov 2026	Physical	$3,000
23 Nov 2026	27 Nov 2026	Physical	$6,000
23 Nov 2026	27 Nov 2026	Physical	$4,500
23 Nov 2026	27 Nov 2026	Physical	$6,000
23 Nov 2026	27 Nov 2026	Physical	$6,000

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