

Table of Contents

Preface

Section 1: Introduction

Chapter 1: A Refreshing Look at QGIS	9
Release schedules	10
QGIS downloading and installation	10
Installing QGIS on Windows	10
Installing QGIS on macOS	11
Installing QGIS on Ubuntu Linux	11
Installing QGIS only	11
Installing QGIS and other FOSSGIS packages	12
QGIS on Android	12
Installing QGIS on a Chromebook	13
QGIS in a browser	13
What's new?	13
A tour of QGIS	16
Familiarizing yourself with QGIS Desktop	16
Loading data into QGIS Desktop	17
Loading vector data	18
Loading raster data	19
Loading databases	21
Loading web services	21
Working with CRS	22
Working with tables	22
Creating table joins	24
Editing data	26
Snapping	27
Styling vector data	28
Styling raster data	30
Blending modes	32
Composing maps	32
Adding functionality with plugins	33
Custom QGIS variables	35
Summary	36
Section 2: Getting Started	
Chapter 2: Styling Raster and Vector Data	39
Choosing and managing colors	39

Table of Contents

Knowing color picker components	42
Changeable panels in the color picker	43
Color ramp	43
Color wheel	44
Color swatches	44
Color sampler	46
Color picker components in the Layers panel	47
Managing color ramps	49
Managing the QGIS color ramp collection	49
Renaming a color ramp	51
Removing a color ramp	51
Exporting a color ramp	51
Importing a color ramp	52
Adding a color ramp	53
Adding a gradient color ramp	53
Adding a random color ramp	55
Adding a ColorBrewer color ramp	56
Adding a cpt-city color ramp	57
Editing a color ramp	59
Styling singleband rasters	59
Paletted raster band rendering	59
Singleband gray raster band rendering	61
Singleband pseudocolor raster band rendering	64
Singleband pseudocolor interpolations	67
Styling multiband rasters	68
Raster color rendering	68
Raster resampling	71
Styling vectors	72
Single-symbol vector styling	73
Categorized vector styling	76
Graduated vector styling	77
Rule-based vector styling	79
Point-displacement vector styling	82
Point cluster vector styling	84
Inverted polygons vector styling	84
Heatmap vector styling	86
2.5 D vector styling	88
Vector layer rendering	91
Layer transparency	91
Layer blending mode	91
Feature blending mode	92
Control feature rendering order	93
Using diagrams to display thematic data	94
Parameters that are common to all diagram types	95
Diagram size parameters	95
Diagram placement parameters	96
Adding attributes to diagrams	98

Creating a pie chart diagram	99
Creating a text diagram	101
Creating a histogram chart diagram	102
Saving, loading, and setting default styles	103
Saving a style	104
Loading a style	104
Setting and restoring a default style	104
Adding and renaming styles in the current QGIS project	105
Summary	105
Chapter 3: Creating Spatial Databases	107
Fundamental database concepts	108
Describing database tables	108
Knowing about table relationships	109
Reviewing the basics of the structured query language	109
Creating a spatial database	110
Connecting to a GeoPackage	112
Importing data into a GeoPackage	112
Importing a vector file	112
Importing a layer from map canvas	113
Working with tables	114
Creating a new table within an existing GeoPackage	114
Renaming a table	115
Editing an existing table field/column	115
Deleting a GeoPackage table	116
Exporting tables out of a GeoPackage	116
Creating queries and views	117
Using select statements	117
Creating a spatial view	118
Dropping a spatial view	118
Summary	119
Chapter 4: Preparing Vector Data for Processing	121
Merging vectors	122
Converting vector geometries	124
Creating polygon centroids	124
Converting lines into polygons	125
Converting polygons into lines	126
Creating polygons surrounding individual points	127
Voronoi polygons	127
Delaunay triangulation	130
Extracting nodes (vertices)	132
Simplifying and densifying features	133
Converting between multipart and singleparts features	134
Adding geometry columns to an attribute table	135

Table of Contents

Using basic vector Geoprocessing Tools	135
Spatial overlay tools	136
Using the Clip and Difference tools	136
Using the Intersect and Symmetrical Difference tools	140
Overlaying polygon layers with Union	141
Creating buffers	142
Generating convex hulls	145
Dissolving features	145
Defining coordinate reference systems	145
Understanding the PROJ.4 definition format	146
Defining a new custom coordinate reference system	147
Setting Definitions	147
Viewing a statistical summary of vector layers	148
Advanced field calculations	149
Exploring the field calculator interface	149
Writing advanced field calculations	151
Calculating and formatting current date	151
Calculating with geometry	152
Operators	153
Conditions	153
Conditionals	153
Summary	154
Chapter 5: Preparing Raster Data for Processing	155
Merging rasters	155
About converting raster files	158
Translating	158
Exporting to a raster	160
Exporting a raster to a GeoPackage	160
Clipping a raster	161
Converting rasters into vectors	163
Converting from vector to raster (rasterize)	164
Reclassifying rasters	166
Summary	169
Section 3: Diving Deeper	
Chapter 6: Advanced Data Creation and Editing	173
What's new in editing?	174
CAD-style digitizing tools	174
Adding a circle	174
Adding a circle from two points	175
Adding a circle from three points	176
Adding a rectangle	177
Adding a rectangle from Extent	178
Adding a rectangle from its center point	178
Adding a rectangle from three points	178

Adding a regular polygon	178
Adding a regular polygon from the center and from a corner	179
Adding a regular polygon from two points	179
Vertex tool	179
Creating points from coordinate data	181
Mapping well-known text representations of geometry	185
Geocoding address-based data	188
How address Geocoding works	189
The first example – Geocoding using web services	190
The second example – Geocoding using local street network data	192
Georeferencing imagery	196
Understanding ground control points	196
Using the Georeferencer GDAL plugin	197
The first example – Georeferencing using a second dataset	202
Getting started	202
Entering ground control points	205
Transformation settings	207
Completing the operation	213
The second example – Georeferencing using a point file	214
Checking the topology of vector data	217
Installing the topology checker	217
Topological rules	218
Rules for point features	218
Rules for line features	218
Rules for polygon features	219
Using the topology checker	220
Repairing topological errors via topological editing	224
Example 1 – Resolving duplicate geometries	225
Example 2 – Repairing overlaps	225
Setting the editing parameters	226
Repairing an overlap between polygons	229
Example 3 – Repairing a gap between polygons	230
Summary	232
Chapter 7: Advanced Data Visualization	233
Using live layer effects	234
Creating beautiful effects with inverted polygon shapeburst fills	239
Creating coastal vignettes	240
Studying area mask	242
Using the 2.5D renderer	244
Creating 3D views	249
Creating an Atlas	250
Basic Atlas configuration	250
Dynamic titles	252
Dynamic legends	255
Highlighting the coverage feature	255

The power of geometry generators	258
Working with the Data Plotly plugin	262
Summary	265
Section 4: Becoming a Master	
Chapter 8: The Processing Toolbox	269
Introducing the Processing Toolbox	269
What's new in the Processing Toolbox?	270
Configuring the Processing Toolbox	271
Viewing the Processing Toolbox	272
Running algorithms in the Processing Toolbox	274
Using the Processing Toolbox	276
Performing raster analysis with GRASS	276
Calculating shaded relief	278
Calculating least-cost path	280
Calculating slope using r.slope	281
Reclassifying the new slope raster and the land use raster	282
Combining reclassified slope and land use layers	284
Calculating the cumulative cost raster using r.cost	285
Calculating the cost path using LCP	286
Evaluating a viewshed	288
Clipping elevation to the boundary of the park using GDAL	289
Calculating viewsheds for towers using r.viewshed	290
Combining viewsheds using r.mapcalc.simple	292
Performing analysis using SAGA	295
Evaluating a habitat	296
Calculating elevation ranges using the SAGA Raster calculator	296
Clipping land use to the park boundary using Clip grid with polygon	298
Querying land use for only surface water using the SAGA Raster calculator	298
Finding proximity to surface water using GDAL Proximity	299
Querying the proximity for 1,000 meters of water using the GDAL Raster calculator	301
Reclassifying land use using the Reclassify grid values tool	303
Combining raster layers using the SAGA Raster calculator	304
Exploring hydrologic analysis with SAGA	306
Removing pits from the DEM	306
Deriving streams	312
Selecting the streams	313
Delineating the streams	316
Calculating the upstream area above Fort Klamath	317
Summary	323
Chapter 9: Automating Workflows with the Graphical Modeler	325
Introducing the graphical modeler	325
Opening the graphical modeler	326
Configuring the modeler and naming a model	328

Working with your model	332
Adding data inputs to your model	332
Adding algorithms to your model	332
Running a model	335
Editing a model	339
Documenting a model	342
Saving, loading, and exporting models	344
Executing model algorithms iteratively	345
Nesting models	346
Using batch processing with models	349
Converting a model into a Python script	354
Summary	356
Chapter 10: Creating QGIS Plugins with PyQGIS and Problem Solving	357
Webography - where to get API information and PyQGIS help	358
PyQGIS cookbook	358
API documentation	359
The QGIS community, mailing lists, and IRC channel	359
Mailing lists	360
IRC channel	360
The Stack Exchange community	361
Sharing your knowledge and reporting issues	361
The Python Console	362
Getting sample data	363
My first PyQGIS code snippet	364
My second PyQGIS code snippet - looping the layer features	364
Exploring iface and Qgs	365
Exploring a QGIS API in the Python Console	366
Creating a plugin structure with Plugin Builder	367
Installing Plugin Builder	368
Locating plugins	368
Creating my first Python plugin - plugin_first	369
Setting mandatory plugin parameters	370
Setting optional plugin parameters	371
Generating the plugin code	372
Compiling the icon resource	372
Plugin file structure - where and what to customize	374
Exploring main plugin files	375
Plugin Builder-generated files	376
A simple plugin example	376
Adding basic logic to TestPlugin	376
Modifying the layout with Qt Designer	377
Adding two pull-down menus	378
Modifying GUI logic	379
Modifying plugin logic	379
Classifying layers	380
Populating the combo box	381

Understanding self	381
Showing and running the dialog	382
Some improvements	382
More detail of the code	382
Setting up a debugging environment	
What is a debugger?	383
Installing Aptana	384
Setting up PYTHONPATH	388
Starting the Pydevd server	390
Connecting QGIS to the Pydevd server	391
Connecting using the Remote Debug QGIS plugin	392
Debugging session example	392
Creating a PyDev project for TestPlugin	393
Adding breakpoints	395
Debugging in action	396
Summary	397
Chapter 11: PyQGIS Scripting	399
Where to learn Python basics	399
Tabs or spaces – make your choice!	400
How to load layers	400
How to manage rasters	401
Exploring QgsRasterLayer	402
Visualizing the layer	403
Managing vector files	404
Managing database vectors	404
Vector structure	406
The basic vector methods	406
Describing the vector structure	407
Describing the header	408
Describing the rows	409
Exploring QgsGeometry	410
Iterating over features	411
Describing iterators	413
Editing features	413
Updating the canvas and symbology	413
Editing through QgsVectorDataProvider	414
Changing a feature's geometry	415
Changing a feature's attributes	415
Deleting a feature	416
Adding a feature	417
Editing using QgsVectorLayer	418
Discovering the QgsVectorLayerEditBuffer class	419
Changing a feature's geometry	419
Changing a feature's attributes	419
Adding and removing a feature	420
Running Processing Toolbox algorithms	420

Listing all available algorithms	421
Getting algorithm information	421
Running algorithms from the console	423
Running your own processing script	425
Creating a test Processing Toolbox script	425
Running the script	425
Interacting with the map canvas	426
Getting the map canvas	426
Explaining Map Tools	427
Setting the current Map Tool	428
Getting point-click values	428
Getting the current Map Tool	429
Creating a new Map Tool	429
Creating a map canvas event handler	429
Creating a Map Tool event handler	430
Setting up the new Map Tool	431
Using point-click values	432
Exploring the QgsRubberBand class	433
Summary	435
Other Books You May Enjoy	437
Index	441