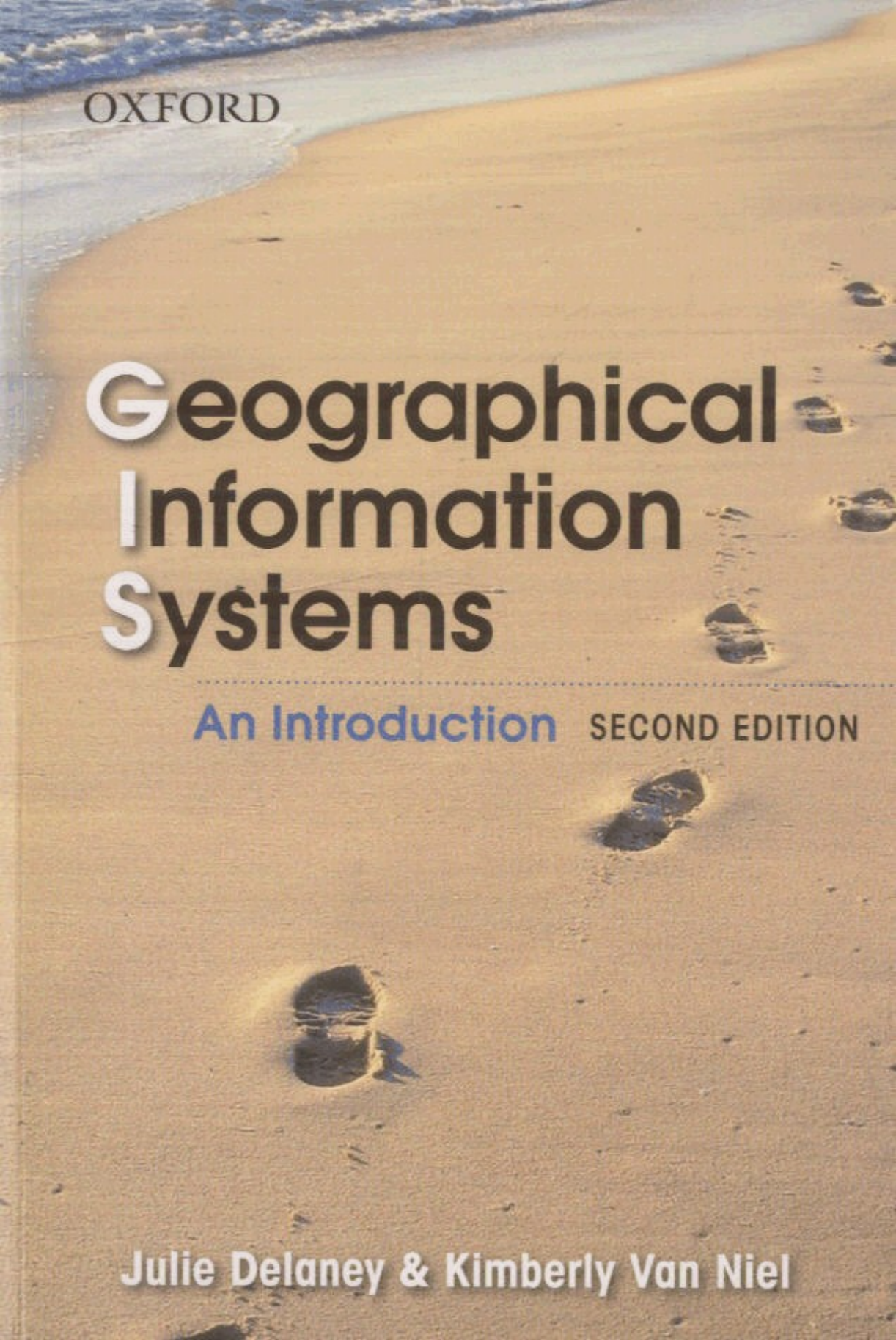
OXFORD
Geographical Information Systems
An Introduction
SECOND EDITION
Julie Delaney & Kimberly Van Niel

Contents

List of figures *viii*
List of Australian GIS stories *xi*
Preface *xiii*
Acknowledgments *xvii*
Abbreviations *xviii*

Chapter 1: The Gist of GIS 1

Objectives 1
What is GIS? 1
GIS: *An introductory* learning experience 4
GIS components 5
Functional elements of GIS 6
How could I apply GIS in my field? 8
Why use GIS? 10
Comments from the workplace: GIS usage 11
Thinking critically: What is GIS? 11
Exercises: Exploring Jarrahlea 12
References and further readings 13

PART 1: GIS DATA **15**

Chapter 2: Data 17

Objectives 17
Types of data 17
Data structures 19
Comments from the workplace: Data 22
Thinking critically: Scale and spatial data 22
Exercises: Jarrahlea data recognition 23
References and further readings 24

Chapter 3: Data Input 25

Objectives 25
Data input methods 25
Issues of data input 27
Comments from the workplace: Data input 30
Thinking critically: Creating spatial data in a digital age 30
Exercises: Capturing the Jarrahlea digital data 31
References and further readings 32

Chapter 4: Data Editing 37

Objectives 37
Data editing 37
Data-entry errors 37
Tools for correcting errors 40
Comments from the workplace: Data editing 42
Thinking critically: Finding errors 43
Exercises: When Jarrahlea is not as it should be 44
References and further readings 44

Chapter 5: The G in GIS 49

Objectives 49
Putting the G in GIS 49
Artificial coordinate systems 49
Real coordinate systems 50
Converting data to real coordinate systems 51
Using projected data 53
Comments from the workplace: Registration and projection 54
Thinking critically: Working with projected data 54
Exercises: Coordinating Jarrahlea data 55
References and further readings 57

Chapter 6: Data Output 59

Objectives 59
Data output 59
Data output methods 59
Issues of data output 60
The basics of map design 61

Comments from the workplace: Data output 62
Thinking critically: Audience and data output 63
Exercises: Getting the Jarrahlea data out of your system 63
References and further readings 65

Chapter 7: Data Management 67

Objectives 67
Data organisation within GIS 67
Databases 69
Database management systems (DBMS) 72
Data dictionaries and metadata 72
Comments from the workplace: Data management 73
Thinking critically: Database structures and metadata 74
Exercises: About the data 75
References and further readings 76

PART 2: GIS ANALYSES 77

Chapter 8: Elementary GIS Tools 79

Objectives 79
The basic toolbox 79
Listing 79
Displaying 80
Querying 81
Reclassifying 82
Measuring 83
Reporting 84
Comments from the workplace: Elementary GIS tools 85
Thinking critically: Maps for exploring data and ideas 85
Exercises: Listing, displaying, querying, reclassifying, measuring, and reporting on Jarrahlea 87
References and further readings 88

Chapter 9: Vector Geoprocessing Tools 89

Objectives 89
Vector geoprocessing tools 89
Buffering 90
Erasing 91

Extracting 92
Merging 94
Updating 95
Vector overlay 96
Comments from the workplace: Vector geoprocessing tools 102
Thinking critically: Using the right tool 102
Exercises: Geoprocessing Jarrahlea 103
References and further readings 107

Chapter 10: Raster Geoprocessing Tools 111

Objectives 111
Raster geoprocessing 111
Point operations in raster geoprocessing 112
Neighbourhood operations in raster geoprocessing 116
Zonal operations in raster geoprocessing 117
Comments from the workplace: Raster geoprocessing 118
Thinking critically: Geoprocessing in both worlds 119
Exercises: Layer upon layer of Jarrahlea data 120
References and further readings 121

Chapter 11: Proximity and Network Analyses 125

Objectives 125
More advanced analyses 125
Proximity analysis 126
Networks 128
Comments from the workplace: Networks and proximity 130
Thinking critically: Spatial connections 130
Exercises: Proximity analysis among the tea-trees and networking with Jarrahlea 131
References and further readings 131

Chapter 12: Surface Analyses 135

Objectives 135
Creating surfaces 135
Data models for surfaces 136
Derivatives of surface models 139
Beyond two dimensions 142
Comments from the workplace: Surface analysis 143

Thinking critically: What's in a landscape? 144
Exercises: The highs and lows of Jarrahlea 144
References and further readings 148

Chapter 13: Spatial Modelling 151

Objectives 151
Why use spatial models? 151
Types of spatial models 153
Testing and verifying models 158
Comments from the workplace: Spatial modelling 159
Thinking critically: Using spatial models 159
Exercises: Weed vulnerability modelling for Jarrahlea 160
References and further readings 161

Chapter 14: Error Evaluation and Tracking 167

Objectives 167
Error and uncertainty in GIS data 167
Evaluating and reporting positional accuracy 169
Evaluating and reporting attribute accuracy 170
The nature of errors in spatial data 172
Error and uncertainty in GIS analyses 173
Comments from the workplace: Error in GIS 175
Thinking critically: Error and its impact on outcomes 175
Exercises: Error evaluation and reporting for Jarrahlea 176
References and further readings 177

Chapter 15: Spatial Directions 181

Objectives 181
Spatial analysis directions 181
GIS software directions 182
GIS employment and the GIS workforce 182
Comments from the workplace: The voice of the GIS user 184
Where to now? 185

Appendix: Answers to the exercises *189*
Glossary *198*
Index *210*