

# Table of Contents

|   |            |
|---|------------|
| <b>Preface</b>  | <b>vii</b> |
| <b>Chapter 1: The Two Basic Tools: Map and Compass</b>            | <b>1</b>   |
| <i>The Compass</i>  | 2          |
| 1.1 Parts of the Compass  | 4          |
| 1.2 North   | 7          |
| 1.3 Declination   | 9          |
| 1.4 Summary   | 13         |
| 1.5 Exercises   | 14         |
| <i>The Map</i>  | 16         |
| 1.6 Parts of the Map  | 17         |
| 1.7 Map Coordinate Systems  | 26         |
| 1.8 UTM Coordinate System   | 28         |
| 1.9 Summary   | 33         |
| 1.10 Exercises  | 34         |
| <b>Chapter 2: Topographic Maps: Representing a 3D World in 2D</b> | <b>35</b>  |
| 2.1 Contour Lines   | 36         |
| 2.2 Point vs Line vs Area Features                                | 39         |
| 2.3 Hills and Mountains   | 42         |
| 2.4 Ridges  | 50         |
| 2.5 Re-entrants and Spurs   | 53         |
| 2.6 U's and V's   | 58         |
| 2.7 Saddles   | 59         |
| 2.8 Cliffs  | 62         |
| 2.9 Depressions   | 63         |
| 2.10 Rivers, Roads and Trails                                     | 64         |
| 2.11 Vegetation   | 66         |
| 2.12 Manmade Objects  | 68         |
| 2.13 Summary  | 69         |
| 2.14 Exercises  | 70         |

|  |            |
|--|------------|
| <b>Chapter 3: Basic Navigation Concepts and Skills</b> | <b>77</b>  |
| 2010 Australia XPD (A Story)                           | 78         |
| 3.1 Taking an Azimuth (Map)                            | 80         |
| 3.2 Plotting a Known Azimuth (Map)                     | 86         |
| 3.3 Getting an Azimuth (World)                         | 88         |
| 3.4 Following a Known Azimuth (World)                  | 94         |
| 3.5 Triangulation                                      | 99         |
| 3.6 Measuring / Estimating Distance (Map)              | 106        |
| 3.7 Measuring / Estimating Distance (World)            | 109        |
| 3.8 Handrails  | 115        |
| 3.9 Backstops / Collecting Features                    | 117        |
| 3.10 Aiming Off  | 119        |
| 3.11 Attack Points                                     | 121        |
| 3.12 C-A-R Method                                      | 124        |
| 3.13 Orient the Map to the World                       | 134        |
| 3.14 Navigating with Just the Map                      | 135        |
| 3.15 Navigating with Just Your Compass                 | 136        |
| 3.16 The Sun, the Moon and the Stars                   | 138        |
| 3.17 Summary   | 141        |
| <b>Chapter 4: Adventure Racing Navigation</b>          | <b>143</b> |
| 2011 Australia XPD (A Story)                           | 144        |
| <i>The Maps</i>  | 152        |
| 4.1 Navigator's Toolbox                                | 153        |
| 4.2 Understand the Course Overview                     | 155        |
| 4.3 Understand All the Maps                            | 160        |
| 4.4 Map Data   | 163        |
| 4.5 Plotting the Checkpoints                           | 164        |
| 4.6 Route Selection                                    | 165        |
| 4.7 Route Highlighting                                 | 169        |
| 4.8 Marking Up the Map                                 | 171        |
| 4.9 Final Map Preparation                              | 173        |
| 4.10 Study the Maps                                    | 177        |
| 4.11 Summarizing Map Work                              | 178        |

|  |            |
|--|------------|
| <i>Route-Finding Skills</i>                  | 179        |
| 4.12 Always Know Where You Are!              | 180        |
| 4.13 Monitoring Your Speed                   | 182        |
| 4.14 Navigating Out Loud                     | 184        |
| 4.15 Choosing Your Route                     | 185        |
| 4.16 Bushwhacking—Should You Do It?          | 188        |
| 4.17 Using Big Features                      | 191        |
| 4.18 Viewing from Above                      | 192        |
| 4.19 Navigating in the Dark/Fog              | 195        |
| 4.20 The Art of Following                    | 201        |
| 4.21 Teaming Up                              | 205        |
| 4.22 Lost (This Does Not Look Right)         | 207        |
| 4.23 Getting Unlost                          | 209        |
| 4.24 Biking-specific Navigation              | 212        |
| 4.25 Paddling-specific Navigation            | 214        |
| 4.26 Summarizing Route-Finding Skills        | 216        |
| <b>Chapter 5: Three Examples</b>             | <b>217</b> |
| Patagonia Expedition Race (A Story)          | 218        |
| 5.1 Example 1: Macro Navigation in Patagonia | 224        |
| 5.2 Example 2: Frozen Beaver Rogaine         | 235        |
| 5.3 Example 3: Untamed New England AR        | 244        |
| 5.4 Summary                                  | 251        |
| <b>Chapter 6: Advanced Tools</b>             | <b>253</b> |
| 6.1 The Altimeter                            | 254        |
| 6.2 The GPS                                  | 258        |
| <b>Chapter 7: Summary</b>                    | <b>263</b> |
| <b>Glossary</b>                              | <b>267</b> |
| <b>Bibliography</b>                          | <b>272</b> |