

Introduction	p. 1
Ecological Applications of Fuzzy Logic	p. 3
Fuzzy Sets and Fuzzy Logic	p. 3
Fuzzy Approach to Ecological Modelling and Data Analysis	p. 4
Fuzzy Classification: A Fuzzy Clustering Approach	p. 6
Fuzzy Regionalisation: A Fuzzy Kriging Approach	p. 9
Fuzzy Knowledge-Based Modelling	p. 9
Conclusions	p. 12
References	p. 12
Ecological Applications of Unsupervised Artificial Neural Networks	p. 15
Introduction	p. 15
How to Compute a Self-Organizing Map (SOM) with an Abundance Dataset?	p. 16
A Dataset for Demonstrations	p. 16
The Self-Organizing Map (SOM) Algorithm	p. 18
How to Use a Self-Organizing Map with an Abundance Dataset?	p. 22
Mapping the Stations	p. 22
Displaying a Variable	p. 24
Displaying an Abiotic Variable	p. 25
Clustering with a SOM	p. 26
Discussion	p. 29
Conclusion	p. 31
References	p. 32
Ecological Applications of Genetic Algorithms	p. 35
Introduction	p. 35
Ecology and Ecological Modelling	p. 36
Genetic Algorithm Design Details	p. 38
Applications of Genetic Algorithms to Ecological Modelling	p. 40
Predicting the Future with Genetic Algorithms	p. 43
The Next Generation: Hybrids Genetic Algorithms	p. 44
References	p. 45
Ecological Applications of Evolutionary Computation	p. 49
Introduction	p. 49
Ecological Modelling	p. 50
The Challenges of Ecological Modelling	p. 50
Summary	p. 52
Evolutionary Computation	p. 52
The Basic Evolutionary Algorithm	p. 54
Summary	p. 57
Ecological Modelling and Evolutionary Algorithms	p. 57
Equation Discovery	p. 57
Optimisation of Difference Equations	p. 58

Evolving Differential Equations	p. 59
Rule Discovery	p. 60
Modelling Individual and Cooperative Behaviour	p. 61
Predator-Prey Algorithms	p. 64
Modelling Hierarchical Ecosystems	p. 65
Conclusion	p. 66
References	p. 66
Ecological Applications of Adaptive Agents	p. 73
Introduction	p. 73
Adaptive Agents Framework	p. 74
Individual-Based Adaptive Agents	p. 76
State Variable-Based Adaptive Agents	p. 78
Algal Species Simulation by Adaptive Agents	p. 80
Embodiment of Evolutionary Computation in Agents	p. 80
Adaptive Agents Bank	p. 81
Pelagic Food Web Simulation by Adaptive Agents	p. 85
Conclusions	p. 86
Acknowledgements	p. 86
References	p. 87
Prediction and Elucidation of Stream Ecosystems	p. 89
Development and Application of Predictive River Ecosystem Models Based On Classification Trees and Artificial Neural Networks	p. 91
Introduction	p. 91
Study Sites, Data Sources and Modelling Techniques	p. 92
The Zwalm River Basin	p. 92
Data Collection	p. 93
Classification Trees	p. 94
Artificial Neural Networks	p. 95
Model Assessment	p. 96
Results	p. 97
Classification Trees	p. 97
Model Development and Validation	p. 97
Application of Predictive Classification Trees for River Management	p. 98
Artificial Neural Networks	p. 100
Model Development and Validation	p. 100
Application of Predictive Artificial Neural Networks for River Management	p. 102
Prediction of Environmental Standards	p. 102
Feasibility Analysis of River Restoration Options	p. 103
Discussion	p. 104
Acknowledgements	p. 105
References	p. 105

Modelling Ecological Interrelations in Running Water Ecosystems with Artificial Neural Networks	p. 109
Introduction	p. 109
Materials and Methods	p. 110
Data Base	p. 110
Data Pre-Processing	p. 110
Artificial Neural Network Types	p. 111
Dimension Reduction	p. 111
Quality Measures	p. 111
Data Exploration with Unsupervised Learning Systems	p. 112
Correlations and Predictions with Supervised Learning Systems	p. 115
Correlations and Predictions of Environmental Variables	p. 117
Dependencies of Colonisation Patterns of Macro-Invertebrates on Water Quality and Habitat Characteristics	p. 117
Aquatic Insects in a Natural Stream, the Breitenbach	p. 117
Anthropogenically Altered Streams	p. 120
Bioindication	p. 121
Assessment of Model Quality and Visualisation Possibilities: Hybrid Networks	p. 122
Conclusions	p. 123
Acknowledgements	p. 125
References	p. 125
Non-linear Approach to Grouping, Dynamics and Organizational Informatics of Benthic Macroinvertebrate Communities in Streams by Artificial Neural Networks	p. 127
Introduction	p. 127
Grouping Through Self-Organization	p. 130
Static Grouping	p. 130
Grouping Community Changes	p. 143
Prediction of Community Changes	p. 147
Multilayer Perceptron with Time Delay	p. 147
Elman Network	p. 151
Fully Connected Recurrent Network	p. 154
Impact of Environmental Factors Trained with the Recurrent Network	p. 158
Patterning Organizational Aspects of Community	p. 161
Relationships among Hierarchical Levels in Communities	p. 161
Patterning of Exergy	p. 167
Summary and Conclusions	p. 173
Acknowledgements	p. 174
References	p. 174
Elucidation of Hypothetical Relationships between Habitat Conditions and Macroinvertebrate Assemblages in Freshwater Streams by Artificial Neural Networks	p. 179
Introduction	p. 179

Study Site	p. 180
Materials and Methods	p. 180
Data	p. 180
Neural Network Modelling	p. 181
Sensitivity Analysis	p. 182
Results and Discussion	p. 183
Elucidation of Hypothetical Relationships	p. 183
Discovery of Contradictory Relationships	p. 187
Limitations of the Method	p. 188
Conclusions	p. 189
References	p. 190
Prediction and Elucidation of River Ecosystems	p. 193
Prediction and Elucidation of Population Dynamics of the Blue-green Algae <i>Microcystis aeruginosa</i> and the Diatom <i>Stephanodiscus hantzschii</i> in the Nakdong River-Reservoir System (South Korea) by a Recurrent Artificial Neural Network	p. 195
Introduction	p. 195
Description of the Study Site	p. 196
Materials and Methods	p. 197
Data Collection and Analysis	p. 197
Modelling the Phytoplankton Dynamics	p. 199
Neural Network Validation and Knowledge Discovery on Algal Succession	p. 201
Results and Discussion	p. 201
Limnological Aspects and Plankton Dynamics in the Lower Nakdong River	p. 201
Configuring the Neural Network Architecture for Predictability	p. 203
Elucidation of Ecological Hypothesis	p. 205
<i>Microcystis aeruginosa</i>	p. 207
<i>Stephanodiscus hantzschii</i>	p. 208
Implications of Ecological Informatics for Limnology	p. 208
Conclusions	p. 210
Acknowledgements	p. 210
References	p. 210
An Evaluation of Methods for the Selection of Inputs for an Artificial Neural Network Based River Model	p. 215
Introduction	p. 215
Methods	p. 217
Unsupervised Input Preprocessing	p. 217
Supervised Input Determination	p. 220
Case Study	p. 222
Model Development	p. 222
Performance Measures and Model Validation	p. 223
Data Division	p. 223
Determination of Model Inputs	p. 224

Results and Discussion	p. 224
Conclusions	p. 230
Acknowledgements	p. 230
References	p. 231
Utility of Sensitivity Analysis by Artificial Neural Network Models to Study Patterns of Endemic Fish Species	p. 233
Introduction	p. 233
Contribution of Environmental Variables	p. 234
Application to Ecological Data	p. 235
Results	p. 236
Predictive Power	p. 236
Sensitivity Analysis	p. 238
Discussion	p. 242
Conclusions	p. 244
References	p. 244

Table of Contents provided by Blackwell's Book Services and R.R. Bowker. Used with permission.