

Contents

<i>Preface</i>	<i>page</i> xiii
1 Introduction	1
Weeds and the value of native species	1
The socio-economic background of plant introduction	6
Turning back the clock – is restoration possible?	8
Biological control as an approach to introduced weeds	11
Promoting ecosystem management for native species	12
Conclusions	13
2 Planet of Weeds: exotic plants in the landscape	14
The scope of the problem: how many and how costly are non-native plant species?	17
What's in a name?	20
Patterns of plant introductions	23
The ecological theory of colonization and invasion	34
Landscape ecology and invasive species	36
Conclusions	50
3 Biological invasions in the context of plant communities	51
Part 1 – Characteristics of native plant communities that influence plant invasions	51
Disturbance and succession	53
Grime's C–S–R model of succession	54
Disturbance and the invasion of plant species	56
Herbivory and introduced plant species	60
Interspecific competition and plant invasion	64
Part 2 – The effects of invasive species on plant communities and ecosystems	79
Conclusions	88

x · Contents

4	Predicting invasiveness from life history characteristics	89
	What are life history traits?	89
	Seed germination and dispersal	96
	Disturbance and seed persistence	99
	Seed size and seed predation	103
	Vegetative reproduction	106
	Case study – <i>Phragmites australis</i> – a story of successful vegetative reproduction	110
	Do life history characteristics predict invasiveness?	111
	Predicting invasive species and the design of quarantine regulations	113
	Conclusions	118
5	Population ecology and introduced plants	120
	Why study plant populations?	120
	What determines plant population densities?	121
	Self-thinning and the 3/2 rule	126
	Are plants seed limited?	127
	Demographic parameters	129
	Monitoring populations	131
	Life tables and key factor analysis	132
	Population ecology of vegetatively reproducing plants	139
	Case study – Diffuse knapweed in British Columbia	140
	Conclusions	146
6	Introduced plant diseases	147
	Introduction	147
	Chestnut blight (<i>Cryphonectria parasitica</i>)	148
	Joint introductions – common barberry and wheat stem rust	149
	Sudden oak death and rhododendrons	151
	White pine blister rust, <i>Cronartium ribicola</i>	152
	Pandemics of Dutch elm disease, <i>Ophiostoma ulmi</i> and <i>O. novo-ulmi</i>	154
	Introduction of fungi for biological control of weeds	155
	<i>Uromykladium tepperianum</i> on <i>Acacia saligna</i> in South Africa	158
	<i>Puccinia chondrillina</i> on <i>Chondrilla juncea</i> in Australia	158
	The potential role of soil microbes in invasiveness	160

	Contents	· xi
Preventing the introductions of plant diseases	161	
Conclusions	162	
7 Biological control of introduced plants	164	
Introduction	164	
How successful is biological control?	165	
Can we predict successful agents and vulnerable plants?	179	
Can we predict what will be a successful biological control agent?	181	
Is biological control safe?	191	
Conclusions	193	
8 Modeling invasive plants and their control	195	
Introduction	195	
The history of modeling biological control	195	
Modeling the impact of seed predators	199	
Models of Scotch broom	203	
Combining population models and experiments	208	
The world is variable but models are not	212	
Modeling invasive plants – what have we learned?	212	
Modeling invasions as they spread across habitats and landscapes	214	
What models tell us about detecting invasions	219	
Invasion speed for structured populations	221	
Slowing the spread	222	
Conclusions	223	
9 Action against non-indigenous species	224	
Introduction	224	
Manuals and advice	226	
Physical control methods	227	
Chemical control of non-indigenous plant species	230	
Costs and benefits of control	231	
Assessing control of non-indigenous species	233	
Eradication as a goal	234	
Increasing the chances of successful control	237	
Who should take responsibility for introduced species?	239	
The uncertain status of some invasive species	241	
Conclusions	243	

xii · Contents

10	Genetically modified plants and final conclusions	244
	Genetically modified plants: another time bomb?	244
	Some concluding remarks	247
	Appendix	251
	<i>References</i>	271
	<i>Index</i>	301