

The Evolution of
Wildlife Crossings
in Eastern Australia
and a Guide to
57 Iconic Sites

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By

Brendan Taylor

Cambridge
Scholars
Publishing



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This book first published 2023

Cambridge Scholars Publishing

Lady Stephenson Library, Newcastle upon Tyne, NE6 2PA, UK

British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library

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ISBN (10): 1-5275-0142-6

ISBN (13): 978-1-5275-0142-3

TABLE OF CONTENTS

List of Illustrations	vii
Acknowledgements	xviii
Introduction	xix
Chapter One.....	1
Why Are Roads So Bad for Our Wildlife?	
Chapter Two.....	10
The <i>Unders</i>	
Chapter Three.....	21
The <i>Overs</i>	
Chapter Four.....	38
Stitching It All Together: <i>Wildlife Fencing</i>	
Chapter Five.....	53
A Few Things Before You Pack The Car: The <i>Safety Briefing</i>	
Chapter Six.....	60
Plotting Your <i>Crossings</i> Journey	
Chapter Seven.....	66
Sites 1-8: Queensland's Tropical North East	
Chapter Eight.....	86
Sites 9-16: Queensland's Sub-Tropical South East	
Chapter Nine.....	106
Sites 17-21: NSW's Northern Rivers	
Chapter Ten.....	122
Sites 22-30. NSW's Northern Mid North Coast	

Chapter Eleven	150
Sites 31-36. NSW's Southern_Mid North Coast	
Chapter Twelve	170
Sites 37-44. Sydney North and Sydney South	
Chapter Thirteen.....	190
Sites 45-48. NSW South West Slopes	
Chapter Fourteen	201
Sites 49-57. Central Victoria	
Chapter Fifteen.....	224
The Road Ahead	
Appendix A	225
Wildlife Rescue Services	
Index.....	227

LIST OF ILLUSTRATIONS

Fig. 1-1. Roads have transformed much of our natural landscapes into built landscapes. <i>Photo: Unsplash</i>	2
Fig. 1-2. Iconic species, such as echidnas, are common casualties on Australian roads. <i>Photo: Author</i>	3
Fig. 1-3. Seasonal koala warning signs on the Pacific Highway, NSW. <i>Photo: Author</i>	4
Fig. 1-4. Construction of highways through natural areas involves clearing and re-shaping the landscape. <i>Photo: Author/Sandpiper Ecological</i>	5
Fig. 1-5. The impact of roads extends well beyond the bitumen, known as the ‘road effect zone’. <i>Photo: Author</i>	7
Fig. 2-1. Wildlife underpass along the Silver Motorway in the León province, NW Spain. <i>Photo: Cristina Mata Estacio</i>	11
Fig. 2-2. Australian underpasses—a frog pipe under the Pacific Highway at Woolgoolga, NSW (left) and a box culvert under the Calder Freeway, VIC (right). <i>Photos: Author/Sandpiper Ecological (left); Author (right)</i>	12
Fig. 2-3. Examples of underpass furniture include post-and-rail leading into/out of a culvert under the Pacific Highway at Yelgun, NSW (left) and a bridge underpass with koala escape poles on the Pacific Highway at Nambucca Heads, NSW (right). <i>Photos: Author (left); Author/Sandpiper Ecological (right)</i>	12
Fig. 2-4. Carting sand (left) and setting (right) sand traps in a box culvert. <i>Photos: Author/Sandpiper Ecological</i>	13
Fig. 2-5. The famed FaunaFocus camera by Faunatech mounted to the ceiling of a culvert (left). A modern camera trap in a security case bolted to the wall of a culvert (right). <i>Photos: Author (left); Author/Sandpiper Ecological (right)</i>	14
Fig. 2-6. Baited hair funnels with a sticky wafer collect hair from visiting arboreal mammals (left). Radio-tracking has long been used as a method for monitoring animal movements (right). <i>Photos: Author/Sandpiper Ecological (left); Author (right)</i>	15
Fig. 2-7. Koalas are known to use underpasses to cross road corridors (left; Oxley Highway, NSW). Swamp wallabies are common users of	

underpasses (right; Pacific Highway, Brunswick Heads, NSW). <i>Photos: Ross Goldingay/Author</i>	16
Fig. 2-8. Lace monitor using a post-&-rail through a culvert on the Oxley Highway, NSW (left). Carpet python crossing under the Pacific Highway at Woolgoolga via a dedicated fauna pipe (right). <i>Photos: Ross Goldingay/Author (left); Sandpiper Ecological/Transport for NSW (right)</i>	18
Fig. 2-9. Little bentwing bats roosting in gaps in the ceiling of a box culvert under the Pacific Highway at Nambucca Heads, NSW. <i>Photo: Author/Sandpiper Ecological</i>	19
Fig. 3-1. The silhouette of a squirrel glider in mid glide. <i>Photo: Author</i>	22
Fig. 3-2. Brown howler monkey using a rope bridge, Brazil. <i>Photo: Fabiana Müller Côrrea</i>	23
Fig. 3-3. A rope bridge over the Pacific Highway at Wardell, NSW. <i>Photo: Author/Sandpiper Ecological</i>	24
Fig. 3-4. Glide poles on the Pacific Highway at Tucabia, NSW. <i>Photo: Author/Sandpiper Ecological</i>	25
Fig. 3-5. Highway vegetated median on the Pacific Highway at Devil's Pulpit, NSW. <i>Photo: Author</i>	26
Fig. 3-6. Land bridge over trans-Canadian Highway in Banff, Canada. <i>Photo: Shutterstock</i>	27
Fig. 3-7. One of Australia's first wildlife land bridges on the Pacific Highway at Yelgun, NSW. <i>Photo: Author</i>	28
Fig. 3-8. An early version of glide pole monitoring comprising a plastic collar with an opening to direct climbing gliders to the view of a down-facing camera on the Oxley Highway, NSW. A blue plastic hair funnel to sample glider hair is positioned between the camera and the collar. <i>Photo: Author</i>	29
Fig. 3-9. A tree climber installs a camera on the cross arms of a glide pole on the Pacific Highway at Halfway Creek, NSW. <i>Photo: Author/Sandpiper Ecological</i>	30
Fig. 3-10. Close up view of a camera attached to a metal plate which pivots to enable easier camera checking by a tree climber. <i>Photo: Author/Sandpiper Ecological</i>	31
Fig. 3-11. Squirrel glider using a canopy rope bridge to cross the Pacific Highway at Corindi, NSW. <i>Photo: Sandpiper Ecological/Transport for NSW</i>	33

Fig. 3-12. Photo sequence (left and right) of a squirrel glider launching off a median glide pole to cross the Pacific Highway at Halfway Creek, NSW. <i>Photo: Sandpiper Ecological/Transport for NSW</i>	34
Fig. 3-13. Common brushtail possums frequently used a ropeway strung between glide poles on the Hamilton Road land bridge, Brisbane. <i>Photo: Ross Goldingay/Author</i>	36
Fig. 4-1. Fauna fencing is also handy for preventing incursions by wayward vehicles. <i>Photo: Nick Priest/Sandpiper Ecological</i>	39
Fig. 4-2. Making it clear what the roadside fence is for (Brunswick Heads, NSW). <i>Photo: Author</i>	41
Fig. 4-3. Floppy top fencing along the Hunter Expressway at Kurri Kurri, NSW. <i>Photo: Author/Sandpiper Ecological</i>	42
Fig. 4-4. Metal flashing attached to chainmesh fence to prevent climbing animals from getting on to the roadway along the Pacific Highway, Brunswick Heads, NSW. <i>Photo: Author</i>	43
Fig. 4-5. Fencing designed to block tree frogs and brush-tailed phascogale (Pacific Highway, Glenugie, NSW). <i>Photo: Author/Sandpiper Ecological</i>	44
Fig. 4-6. Koala grid on a highway access road at Brunswick Heads, NSW. <i>Photo: Author</i>	45
Fig. 4-7. Twin earthen escape ramps on the Pacific Highway at Woolgoolga, NSW. <i>Photo: Author/Sandpiper Ecological</i>	47
Fig. 4-8. A culvert wing-wall drop-down on the Pacific Highway at Nambucca Heads, NSW. The fence gap is braced by two lengths of metal piping. <i>Photo: Author/Sandpiper Ecological</i>	47
Fig. 4-9. A timber up-and-down structure to enable koalas to escape the roadway (Illaweena Street, Logan, QLD). <i>Photo: Author</i>	48
Fig. 4-10. An escape pole on the roadside of the fauna fence at Compton Road, Brisbane, QLD. <i>Photo: Author</i>	49
Fig. 4-11. Tree falls onto fauna fencing is a perennial maintenance problem. <i>Photo: Author</i>	50
Fig. 5-1. Wildlife warning sign (Stanthorpe, QLD). <i>Photo: Author</i>	54
Fig. 5-2. Koala sign and green pavement treatment to alert drivers at Bogangar, NSW. <i>Photo: Author</i>	56
Fig. 5-3. Cassowary warning sign at Mission Beach, QLD. <i>Photo: Author</i>	58
Fig. 6-1. The 57 sites are arranged in eight regional clusters. <i>Image: Author</i>	61

Fig. 6-2. A sign promoting the Kennedy Creek Road mahogany glider crossing (Kennedy, QLD). <i>Photo: Author</i>	63
Fig. 7-1. Location of the eight Tropical North East crossing sites. <i>Image: Author</i>	67
Fig. 7-2. The first Kauri Creek rope bridge. <i>Photo: Nigel Weston and Rupert Russell</i>	69
Fig. 7-3. Herbert River ringtail possum using the Kauri Creek rope bridge. <i>Photo: Nigel Weston</i>	69
Fig. 7-4. <i>Photo: Shutterstock</i>	70
Fig. 7-5. An East Evelyn Road underpass complete with slung rope, branches and rock furniture. <i>Photo: Miriam Goosem</i>	72
Fig. 7-6. An adult and juvenile red-legged pademelon using an East Evelyn Road underpass. <i>Photo: Miriam Goosem</i>	72
Fig. 7-7. <i>Photo: Shutterstock</i>	73
Fig. 7-8. Three of the Palmerston Highway rope bridges soon after category 5 Cyclone Larry tore through the area in 2006. <i>Photo: Miriam Goosem</i>	75
Fig. 7-9. A green ringtail possum using a Palmerston Highway rope bridge tunnel. <i>Photo: Miriam Goosem & Martin Cohen</i>	75
Fig. 7-10. <i>Photo: Shutterstock</i>	76
Fig. 7-11. Artist's impression of the cassowary land bridge at Smiths Gap, El Arish. <i>Image: Jacobs</i>	77
Fig. 7-12. <i>Photo: Shutterstock</i>	78
Fig. 7-13. <i>Photo: Daryl Dickson</i>	79
Fig. 7-14. Murrigal glide pole and rope bridge array at Corduroy Creek (left and right). <i>Photos: Author</i>	80
Fig. 7-15. Kennedy glide poles on Kennedy Creek Road. <i>Photo: Author</i>	81
Fig. 7-16. Mahogany glider using a Kennedy Creek pole. <i>Photo: Daryl Dickson</i>	82
Fig. 7-17. Ellerbeck glide poles on the Bruce Highway (left & right). <i>Photos: Author</i>	83
Fig. 7-18. Rungoo glide pole & rope bridge array on the Bruce Highway (left & right). <i>Photos: Author</i>	84
Fig. 8-1. Location of the sub-tropical south east crossing sites. <i>Image: Author</i>	87
Fig. 8-2. Location of the Brisbane sites within the sub-tropical south east cluster. <i>Image: Author</i>	88

Fig. 8-3. Meridan Plains multi-use land bridge and rope bridge over Caloundra Road. <i>Photo: Author</i>	90
Fig. 8-4. The vegetated easement straddles the road along the length of the land bridge. <i>Photo: Author</i>	90
Fig. 8-5. The steel light pole rope bridge on the Gateway Motorway, Brisbane. <i>Photo: Author</i>	91
Fig. 8-6. Hamilton Road land bridge complete with glide poles linked by 40 mm rope (ropeway) for arboreal mammals (left and right). <i>Photos: Author</i>	92
Fig. 8-7. Squirrel gliders (top) and common ringtail possums (bottom) frequently crossed the Hamilton Road land bridge via the ropeway. <i>Photos: Ross Goldingay/Author</i>	93
Fig. 8-8. <i>Photo: Shutterstock</i>	94
Fig. 8-9. Scrub Road glide poles. <i>Photo: Author</i>	95
Fig. 8-10. A plastic collar placed below the camera directed climbing gliders to the view of the camera. <i>Photo: Author</i>	96
Fig. 8-11. Squirrel gliders were detected using the glide poles to cross Scrub Road on numerous occasions. <i>Photo: Ross Goldingay/Author</i>	96
Fig. 8-12. The metal gantry includes large timber poles at each end for koalas to climb to access the gantry floor. <i>Photo: Cathryn Dexter</i>	97
Fig. 8-13. <i>Photo: Author</i>	98
Fig. 8-14. Compton Road land bridge, Brisbane. <i>Photo: Author</i>	100
Fig. 8-15. One of the three rope bridges near the Compton Road land bridge. <i>Photo: Author</i>	100
Fig. 8-16. A camera mounted high on a glide pole and aimed at a hole in a metal baffle was used to detect gliders climbing the pole (top). Squirrel gliders were detected using the glide poles on numerous occasions (bottom). <i>Photo: Author (top); Ross Goldingay/Author (bottom)</i>	101
Fig. 8-17. The Illaweena Street land bridge. <i>Photo: Author</i>	102
Fig. 8-18. <i>Photo: Author</i>	103
Fig. 8-19. Arundel bridge underpass. <i>Photo: Author</i>	104
Fig. 9-1. Location of the Northern Rivers crossing sites. <i>Image: Author</i>	107
Fig. 9-2. The first Australian land bridges were installed along the Pacific Highway in 2002 at Sleepy Hollow (top) and Yelgun (bottom). <i>Photos: Author</i>	109
Fig. 9-3. Koalas were detected crossing the Sleepy Hollow land bridge on several occasions, including a female with back young. <i>Photo: Tweed Shire Council</i>	109

Fig. 9-4. Some underpasses were monitored with a Fauna Focus camera and sand traps. <i>Photo: Author.</i>	111
Fig. 9-5. Swamp wallabies were regularly recorded using the underpasses. <i>Photo: Ross Goldingay/Author.</i>	111
Fig. 9-6. <i>Photo: Shutterstock.</i>	112
Fig. 9-7. <i>Photo: Shutterstock.</i>	114
Fig. 9-8. The Bingal Creek bridge underpass features wooden post-&-rails for koalas and other climbing animals (top) as well as tall ‘Y-shaped’ escape or refuge poles (bottom). <i>Photos: Author/Sandpiper Ecological.</i>	116
Fig. 9-9. The Tabbimoble rope bridge on the Pacific Highway. <i>Photo: Author/Sandpiper Ecological.</i>	118
Fig. 9-10. A close up of the flat-bed rope bridge design. <i>Photo: Author/Sandpiper Ecological.</i>	118
Fig. 9-11. <i>Photo: Author.</i>	119
Fig. 9-12. The east and median glide poles of the three-pole array at Mororo, NSW. <i>Photo: Author/Sandpiper Ecological.</i>	121
Fig. 10-1. Location of the northern Mid North Coast crossing sites. <i>Image: Author.</i>	123
Fig. 10-2. The 3-pole set up of the Tucabia glide pole array (top) complete with owl predator shields on top of the poles (bottom). <i>Photos: Author/Sandpiper Ecological.</i>	125
Fig. 10-3. Bridge underpass emu crossing zone at Pillar Valley Creek. <i>Photo: Author/Sandpiper Ecological.</i>	127
Fig. 10-4. Emu gate within the boundary fence designed to allow emus to move through but not cattle. <i>Photo: Author/Sandpiper Ecological.</i>	127
Fig. 10-5. <i>Photo: Unsplash.</i>	128
Fig. 10-6. A Bebo arch fauna underpass (left) and a fauna culvert with furniture (right) at Glenugie. <i>Photos: Author/Sandpiper Ecological.</i>	130
Fig. 10-7. Eastern grey kangaroos were common users of underpasses at Glenugie (top), and brush-tailed phascogale were detected using a rope bridge on several occasions (bottom). <i>Photos: Sandpiper Ecological/Transport for NSW.</i>	130
Fig. 10-8. <i>Photo: William Terry.</i>	131
Fig. 10-9. One of the Wells Crossing fauna culverts. <i>Photo: Author/Sandpiper Ecological.</i>	132
Fig. 10-10. Rufous bettongs were detected using the culverts to cross the road corridor. <i>Photo: Sandpiper Ecological/Transport for NSW.</i>	133

Fig. 10-11. A camera attached to the end of a bracket and mounted 6 m up a tree trunk within the vegetated median captured images of broad-toed feathertail gliders (left) and yellow-bellied gliders (right).
Photos: Sandpiper Ecological/Transport for NSW. 133

Fig. 10-12. *Photo: Author.*..... 134

Fig. 10-13. A tree-climber checking a camera on one of the Halfway Creek median glide poles. *Photo: Author/Sandpiper Ecological.* 136

Fig. 10-14. Photo-sequence of a yellow-bellied glider launching off the cross-arm to cross the Pacific Highway.
Photos: Sandpiper Ecological/Transport for NSW. 136

Fig. 10-15. *Photo: Shutterstock.* 137

Fig. 10-16. Fauna culvert at Dirty Creek Range.
Photo: Author/Sandpiper Ecological. 138

Fig. 10-17. The rail camera captured a Stephens's banded snake in pursuit of a rodent. *Photo: Sandpiper Ecological/Transport for NSW.* 139

Fig. 10-18. A multi-chambered microbat roost box was used by bats on numerous occasions. *Photo: Author/Sandpiper Ecological.* 139

Fig. 10-19. *Photo: Author.*..... 140

Fig. 10-20. Corindi rope bridge as seen from the west end. *Photo: Author/Sandpiper Ecological.* 141

Fig. 10-21. Feathertail gliders were detected using the Corindi rope bridge to cross the highway on several occasions.
Photo: Sandpiper Ecological/Transport for NSW. 142

Fig. 10-22. *Photo: Author.*..... 143

Fig. 10-23. The Arrawarra glide pole array featured a pole between the carriageways and between the southbound carriageway and the service road (right of picture). *Photo: Author/Sandpiper Ecological.* 145

Fig. 10-24. Squirrel gliders were recorded using the median pole on numerous occasions.
Photo: Sandpiper Ecological/Transport for NSW. 145

Fig. 10-25. The southern Greys Road frog pipe and exclusion fencing (left) and installation of a camera just inside the entrance to one of the pipes (right). *Photo: Author/Sandpiper Ecological.* 147

Fig. 10-26. Giant barred frog (left) and echidna (right) were detected using the Greys Road frog pipes.
Photos: Sandpiper Ecological/Transport for NSW. 147

Fig. 10-27. *Photo: Author/Sandpiper Ecological.* 148

Fig. 11-1. Location of the southern Mid North Coast crossing sites.
Image: Author. 151

Fig. 11-2. The Bonville land bridge (left) includes glide poles connected by narrow ladder-style rope bridges (right). <i>Photos: Author/Sandpiper Ecological.</i>	153
Fig. 11-3. Koalas were detected using the post-and-rail furniture to move through the Bonville underpass during monitoring in 2010. <i>Photo: Australian Museum Business Services/Transport for NSW.</i> ..	153
Fig. 11-4. <i>Photo: Author.</i>	154
Fig. 11-5. The culverts built during the highway upgrade connect with culverts under the old highway. <i>Photo: Author/Sandpiper Ecological.</i>	156
Fig. 11-6. Little bent-wing and large bent-wing bats roost in huge clusters on the walls (left) and within ceiling joins (right). <i>Photos: Author/Sandpiper Ecological.</i>	156
Fig. 11-7. <i>Photo: Author/Sandpiper Ecological.</i>	157
Fig. 11-8. The vegetated median (right of picture) and one of the many roadside glide poles and the rope bridge (in background). <i>Photo: Author/Sandpiper Ecological.</i>	159
Fig. 11-9. The distinctive gliding ‘gurgle’ call of the yellow-bellied glider as shown on a spectrogram. <i>Photo: Author/Sandpiper Ecological.</i>	160
Fig. 11-10. Koalas were recorded crossing the highway corridor at the vegetated median on several occasions during monitoring in 2018. <i>Photo: Sandpiper Ecological/Transport for NSW.</i>	160
Fig. 11-11. One of the rope bridges and median poles of the Eungai glide pole array (with monitoring equipment). <i>Photo: Author.</i>	161
Fig. 11-12. <i>Photo: Shutterstock.</i>	162
Fig. 11-13. The eastern glide pole pair under the watchful eye of Ross Goldingay, the Australian pioneer of glide poles. <i>Photo: Author.</i>	164
Fig. 11-14. Yellow-bellied glider using a glide pole (left) and a squirrel glider using a rope bridge (right). <i>Photos: Ross Goldingay/Author.</i>	164
Fig. 11-15. Dedicated underpasses with post-and-rail were installed along the upgrade (top). Brown Antechinus were regularly detected using the rail (bottom). <i>Photos: Author (top); Ross Goldingay/Author (bottom).</i>	165
Fig. 11-16. <i>Photo: Author.</i>	166
Fig. 11-17. View of the Kew rope bridge. <i>Photo: Author/Sandpiper Ecological.</i>	168

Fig. 11-18. Common brushtail possum on the Kew rope bridge. <i>Photo: Sandpiper Ecological/Transport for NSW.</i>	168
Fig. 12-1. Location of the Sydney North and Sydney South crossing sites. <i>Image: Author.</i>	171
Fig. 12-2. The Boolambayte underpass with post-and-rail running through its length. <i>Photo: Author.</i>	172
Fig. 12-3. <i>Photo: Unsplash.</i>	173
Fig. 12-4. The Bulahdelah rope bridge (top) included two different cameras (bottom) mounted to the median pole (Faunatech FaunaFocus (left) and Reconyx Hyperfire HC500 (middle)). The open PVC pipes provide refuge. <i>Photos: Author/Sandpiper Ecological.</i>	175
Fig. 12-5. Fauna Crossing sign (with an image of a brush-tailed phascogale using the rope) and the northern Karuah rope bridge in the background. <i>Photo: Author.</i>	177
Fig. 12-6. Close up of one of the Karuah tunnel-designed rope bridges (left). Squirrel gliders were recorded using one of the bridges on several occasions during monitoring (right). <i>Photos: Thiess/Transport for NSW.</i>	177
Fig. 12-7. Upgrading the mesh material on the Hunter Expressway to the highly durable 10 mm silver rope (left & right). <i>Photos: Author/Sandpiper Ecological.</i>	178
Fig. 12-8. Some fauna culverts included post-&-rails and a raised concrete path to provide dry access when the culvert floors were inundated. <i>Photo: Author/Sandpiper Ecological.</i>	179
Fig. 12-9. The Mooney Mooney arch underpass. <i>Photo: Australian Museum Business Services/Transport for NSW.</i> ..	180
Fig. 12-10. <i>Photo: Author.</i>	181
Fig. 12-11. The Wakehurst Parkway tube/cable bridge. <i>Photo: Ian Ralph.</i>	183
Fig. 12-12. Close up of the perforated aluminium tube and cable. <i>Photo: Author.</i>	183
Fig. 12-13. One of the glide poles straddling the powerline easement at Bomaderry Creek in 1995 (left) and the sole remaining pole in 2022 that has been captured by forest regrowth (right). <i>Photos: Ross Goldingay (left); author (right).</i>	185
Fig. 12-14. <i>Photo: Author.</i>	186
Fig. 12-15. The original Termeil glide pole. <i>Photo: Author.</i>	188
Fig. 12-16. Close-up of the Termeil glide pole showing the short cross/launch arm and predator shield. <i>Photo: Author.</i>	188

Fig. 13-1. Location of the South West Slopes crossing sites. <i>Image: Author.</i>	191
Fig. 13-2. Triple pole array on the Hume Highway near Gundagai. <i>Photo: Author.</i>	192
Fig. 13-3. Ground level view of one of the Gundagai glide poles. A refuge pipe is mounted halfway up, and a predator shield sits above the cross-arm. <i>Photo: Author.</i>	193
Fig. 13-4. View of the above (top) and below deck (bottom) Tarcutta rope bridges. <i>Photos: Author.</i>	195
Fig. 13-5. <i>Photo: Author.</i>	196
Fig. 13-6. View of the two glide pole arrays at Holbrook. <i>Photo: Author.</i>	197
Fig. 13-7. Woomargama bird arch underpass (top & bottom). <i>Photos: Author.</i>	199
Fig. 14-1. Location of the Central Victoria crossing sites. <i>Image: Author.</i>	202
Fig. 14-2. The original mountain pygmy possum 'Tunnel of Love' which connects boulder fields above and below the road (top & middle). A metal grate, covering the culvert entrance, excludes predators but allows passage of pygmy possums (bottom left & right). <i>Photos: Author.</i>	204
Fig. 14-3. <i>Photo: Linda Broome.</i>	205
Fig. 14-4. The Warrenbayne median glide pole with monitoring equipment. <i>Photo: Author.</i>	207
Fig. 14-5. The Longwood rope bridge provides a vital across-highway link along the Winding Creek vegetated corridor. <i>Photo: Author.</i>	208
Fig. 14-6. Squirrel glider (top) and brush-tailed phascogale (bottom) were recorded using the rope bridge. <i>Photo: Kylie Soanes.</i>	209
Fig. 14-7. A pair of glide poles along the pipeline easement in Toolangi State Forest. <i>Photo: Author.</i>	210
Fig. 14-8. Other glide poles along the pipeline easement (top). A southern greater glider detected by pole cameras (bottom). <i>Photos: Author (top); Kelly Dalton, GHD/Melbourne Water Corporation (bottom).</i>	211
Fig. 14-9. <i>Photo: Author.</i>	212
Fig. 14-10. Edgars Creek frog culverts and constructed wetland. <i>Photo: Author.</i>	214
Fig. 14-11. Mesh drift fence designed to funnel frogs towards the culverts. <i>Photo: Author.</i>	214
Fig. 14-12. <i>Photo: Shutterstock.</i>	215

Fig. 14-13. The Slaty Creek bridge underpass. <i>Photo: Rodney van der Ree</i>	216
Fig. 14-14. The Elphinstone phascogale cable bridge on the Calder Freeway. <i>Photo: Ross Goldingay</i>	217
Fig. 14-15. Specimen Gully box culvert with log shelf and skylight (the bright light in center of culvert). <i>Photo: Author</i>	219
Fig. 14-16. Eastern grey kangaroos were common users of the Specimen Gully underpass. <i>Photo: Lee Harrison/Vic Roads</i>	219
Fig. 14-17. <i>Photo: Unsplash</i>	220
Fig. 14-18. One of the ACO Climate tunnels opening out on the bush side of the black drift fence (top) and a close up of the drift fence (bottom). <i>Photos: Author</i>	222
Fig. 14-19. Bare-nosed wombats have been detected using the tunnels to cross the road. <i>Photo: Royal Botanic Gardens Cranbourne</i>	222

ACKNOWLEDGEMENTS

Bringing this book to fruition has been a 20 year-long journey and there are many people I would like to thank for assisting, guiding and encouraging me along the way. Obviously, a book doesn't get to see the light of the published day without a publisher. I am, therefore, indebted to Cambridge Scholars Publishing for firstly endorsing my book and for then walking me so ably through the publishing process, particularly Helen Edwards.

Thank you to Darryl Jones for encouraging me to turn my thought bubble into a book and for being wildly enthusiastic every step of the way. An equally big thank you to Ross Goldingay for providing many insightful comments on the endeavour and for being such a supportive mentor and collaborator on so many wildlife crossing projects over the past 20 years.

I'd like to express my sincere appreciation to the many people who contributed photographs, especially Miriam Goosem in the north of the country and Rod van der Ree and Kylie Soanes in the south. A heartfelt thank you to those who made comments on the book draft, particularly Ross Goldingay, Darryl Jones, Daryl Dickson, Adele Bagot, Angela Jones, and Alison Dodds.

Thank you to David Rohweder and the Sandpiper crew who I had the absolute privilege of working with over the years—Trish, Sam, Don, Tom, Nick, Will, Matt, Nirvarna and the irrepressible Luke. There are also many work colleagues outside of the Sandpiper bubble that I had the pleasure of working with, particularly the koala whisperers Sean, Amber, Ben, and Bill. Thanks also to Craig Taylor for many sage words of advice during my career.

I had the fortune of growing up in a loving home environment and wish to thank my dedicated parents and steadfast siblings for providing such a supportive foundation. To my beautiful partner in life, Karen, and our wonderful son, Oska—thanks for always being there, particularly during the many weeks and months I was away chasing wildlife. Your love and support have been invaluable.

Finally, I would like to acknowledge the traditional custodians of the many lands this book travels through and celebrate the cultural and spiritual connection First Nation's people have to this country's unique and spectacular wildlife.

INTRODUCTION

Have you ever driven along the Pacific Highway (or the Hume or the Bruce Highway) and wondered “what’s that strange rope net suspended across road?” Or “why did they build a bridge over the highway with trees and shrubs on it?” Or “what is that tall, floppy-looking fence along the roadside for?”

Well, this book is for you. It explains the how, what, when and why of these innovative pieces of engineering. It’s also the book that tells you the ‘where’—so you can plan your own journey to drive under and over them. What better excuse for a road trip.

So, what are these curious structures? Road ecologists—the people who study the interaction between roads and the natural environment—commonly refer to them as wildlife crossing structures or *wildlife crossings*. Wildlife crossings have been around in various forms for decades. In fact, they’ve existed since the early stages of road building in the form of drainage pipes, box culverts and bridges over waterways. In a nutshell, they’re structures that wildlife can use to get from one side of the road to the other, without taking on the traffic.

In more recent times, as our understanding of the impact of roads on wildlife has grown, road authorities started installing purpose-built structures such as culverts with timber railings through them for some of our ground-dwelling wildlife and rope canopy bridges over the road for some of our tree-dwelling wildlife. As you’ll discover in this book, the wildlife crossings family is a pretty diverse group.

My interest in wildlife crossings started in 1999 when I drove along the recently upgraded Pacific Highway at Brunswick Heads in northern New South Wales. The new section of highway was lined by strange looking floppy-top fencing which occasionally rose above what appeared to be large box culverts. An enthusiastic local told me the box culverts were put there for koalas so they could cross under the highway and the funny looking floppy-top fence, which he reckoned they couldn’t climb, was to stop them wandering out onto the road and getting hit by cars. “Bloody great idea,” he said, “they can cross the road without worrying about being run over by us idiots.”

I agreed with him—it *was* a bloody great idea. Allowing animals to cross the road without having to set foot on the road surface. Permeable road

corridors without the roadkill. It was an elegant, obvious, and simple solution. But did they work?

I've spent the best part of the last 20 years radio-tracking, translocating, camera monitoring, sand tracking and analysing data to answer this question. And I'm just one of a growing band of dedicated road ecologists trying to better understand how wildlife crossings affect the viability of local populations, or how the width of the road, or traffic volume, or noise or light from the road affects wildlife or plant communities. There is even growing interest in potential impacts on microbat movement and insect abundance.

Importantly, the basis for much of this work is the fundamental ecological concept of connectivity. Connectivity is critical to functioning ecosystems and to functioning wildlife populations. That's what wildlife crossings strive to enable—connectivity across roads and highways for a wide range of wildlife. Indeed, for many animals, wildlife crossings provide a critical link to food resources or mates on the other side of the road or even an escape route from a raging bushfire. In some places, like along the Great Alpine Road in Victoria's high country, wildlife crossings are vital for the tiny population of the exceptionally tiny mountain pygmy possum to cling on to existence.

And it's this crucial role that wildlife crossings perform that this book aims to celebrate. In doing so, I have structured the book around the theme of *a journey*—a journey through the evolution of wildlife crossings in eastern Australia, and a journey along the roads and highways that feature these spectacular structures. But every great journey requires a bit of background reading, so the guide begins with an explanation of how and why roads are so bad for our wildlife. From road-effect zone to metapopulation theory, you'll be a fully-fledged road ecologist by the time you finish this chapter.

The guide then changes gear and introduces you to the *UNDERS* (under-road wildlife crossings) and the *OVERS* (over-road wildlife crossings). The *UNDERS* have been around in various forms for many decades whereas the *OVERS* have largely emerged during the last 20 odd years. Some, like glide poles, are uniquely Australian innovations for some of our uniquely Australian wildlife—the gliding possums. Others, like land bridges, have been copy-and-pasted from the USA and Europe and target a broad range of wildlife.

After exploring the *UNDERS* and *OVERS* we take a look at fencing. Now, I can hear you thinking—“Why include fencing? It's not a type of wildlife crossing.” And you'd be right—it's not a type of crossing; but it is integral to their effectiveness. Fencing is the thing that stitches it all together. Fencing keeps wildlife off the road. Fencing directs or funnels

wildlife to the wildlife crossing. Fencing also comes in many shapes, types, and colours and features interesting add-ons like escape ramps, up-and-overs and drop-downs. Hopefully, after reading this section, you'll have a whole new appreciation for the humble fence.

Then it's time to travel! You've done the essential background reading; it's time to plot your path. Pick some wildlife crossings in your favourite part of eastern Australia and plan your route. Or, perhaps, go somewhere unfamiliar. Make visiting a particular crossing an excuse for journeying to a part of the country you haven't seen. Then hit the road and tick them off as you see them. Show your kids. Post them on your socials. Spruik to your friends that you've seen three types of glide pole in three different states or that you've driven under the land-bridge that wallabies, goannas, whip birds and the occasional koala use to safely cross the road.

The guide is organised into eight regional clusters, beginning in north Queensland and ending in central Victoria. There's a map for each cluster which shows the location of iconic structures. Each site features location and access details as well as information about the structure and the native wildlife that we know use it, or are likely to use it. There are also detailed facts (*ANIMAL INFO* boxes) about iconic users of the structures. And, of course, there's information on how to do it safely and not become a road statistic yourself or add to the wildlife road statistics. It would be a sad thing indeed if while journeying to some of eastern Australia's most iconic wildlife crossings you hit one of the target species.

You may be thinking at this point—"What about the rest of Australia?"—which is a fair question. Well, the east is where Australia's wildlife crossings story began and evolved. It's also where most of Australia's wildlife crossings are located. The other states feature far fewer crossings and very few above road crossings. Wildlife crossings in the east are also where I've conducted all my research and monitoring work over the last 20 years and where I've travelled extensively to visit sites. The west is a story for another time.

So, to begin our journey, let's start at the beginning—*why are roads so bad for our wildlife?*

CHAPTER ONE

WHY ARE ROADS SO BAD FOR OUR WILDLIFE?

In the beginning ...

Before roads and before humans started carving up the landscape, our forest-dwelling wildlife generally lived in largely continuous forest habitat. There would have been natural barriers and breaks—like rivers and cliffs and swamps—but, by and large, animals that lived in forest habitat would have been able to move around the landscape relatively unimpeded.

That all changed when modern humans appeared on the scene and started burning, clearing and, eventually ... building roads. Forest landscapes, like that which existed all the way down the east coast of Australia, became increasingly fragmented and tree cover became progressively patchy. David Quammen, in his seminal book the *Song of the Dodo* (Quammen 1997), portrayed the process of landscape fragmentation using the analogy of cutting up a priceless Persian rug into 36 pieces with a hunting knife. It was a powerful analogy and I recall reading it and feeling a bit shaken as the gravity of the analogy sank in.

But *Song of the Dodo* was written in the 1990s. Things have gotten a lot worse since then. The 2020's version of the analogy is more like: hack the Persian rug into numerous random sizes, throw half of them away, and live with what's left. Perhaps not as eloquent as Quammen's portrayal but the take home message is this: fragmentation and modification of large parts of our global landscape has been disastrous for the functioning of our forest ecosystems.



Fig. 1-1. Roads have transformed much of our natural landscapes into built landscapes. *Photo: Unsplash.*

How has this affected our forest-dwelling wildlife? Well, imagine for a moment you're a koala or a yellow-bellied glider or a pouched frog or a superb lyrebird. You've evolved over millions of years in largely continuous forest landscapes. Now you have to function in a patchy forest landscape with lots of gaps in it; with dogs and cats and foxes in it; with people and buildings in it; and with roads and cars in it. It's a daunting prospect. Throw in the odd bushfire, drought, flood, disease outbreak and climate change and you can see why much of our forest-dwelling wildlife are struggling.

The myriad of ill-effects roads and traffic inflict on natural landscapes and the wildlife living in them, can largely be grouped into three primary impacts:

1. Wildlife road mortality or *roadkill*
2. Loss of habitat
3. Fragmentation of remaining habitat

1. Wildlife road mortality—*Roadkill*

As a road user, wildlife road mortality—or *roadkill*—is probably the most obvious impact of roads on wildlife. It begins with the little things we barely notice—like the myriad of insects your car wipes out on a warm, spring evening, or the countless frogs you squash driving around on a wet, summer night. Then there are the things we do notice—like a magpie, or carpet snake, or echidna, or large kangaroo.

Apart from the potential damage to you and the vehicle, we seem to be more affected by hitting larger animals—at least I certainly do. I still recall running over a perentie—Australia’s largest goanna-like lizard—on a track near Alice Springs. I was devastated. And, like many of us, that was just one of the countless things I’ve hit during 40 years of driving.



Fig. 1-2. Iconic species, such as echidnas, are common casualties on Australian roads. *Photo: Author.*

But I’m just one driver. When you start scaling this up to the 20.1 million cars on the road in Australia (ABS 2021) and the 1 billion plus cars globally (OICA 2016) you start to get a sense of the scale of the tragedy. And the scale is big. Estimates include anywhere between 89-340 million birds killed each year by cars in the US (Loss et al. 2014) and 29 million mammals per year in Europe (Grilo et al. 2020).

Estimates for Australia are limited but published studies have reported such figures as: over nine million kangaroos and wallabies struck on Australian roads each year (Burgin and Brainwood 2008); over 300 koalas killed annually on roads in southeast Queensland (QDES 2022); and over 40,000 frogs run over annually on one road in northern NSW (Goldingay and Taylor 2006). I think you get the picture.

Hidden within these monumental roadkill statistics is the story that different species are impacted very differently. For some relatively common species, like swamp wallabies, roadkill, generally, does not threaten the viability of local populations. But for other species, particularly some of our threatened species, roadkill can be the straw that breaks the camel's back. It can be the thing that tips an already vulnerable species closer to the precipice. This is particularly the case for species like koalas, Tasmanian devils and cassowaries. Roadkill is additive. It adds to an already long list of threatening processes or pressures on many of our iconic species. And a primary one of these processes is loss of habitat.



Fig. 1-3. Seasonal koala warning signs on the Pacific Highway, NSW. *Photo: Author.*

2. Loss of habitat

Roads convert enormous amounts of our natural landscape into bitumen corridors. In fact, the global road network is regarded as the largest human artifact on the planet (Forman et al. 2003). The International Road Federation reported that in 2019, globally, there were over 33 million km of roads (International Road Federation 2022), which is a breathtaking figure. In Australia, the figure is a sobering 825,000 km and counting (International Road Federation 2022). It won't be long till we crack the million mark.

If we consider that a typical road lane in Australia is 3.5m wide (3.7m in the US) plus a similar width road shoulder, we soon discover that the typical two-lane road is about 15m-wide. If we conservatively push this figure to 20m to account for all the three and four (and more) lane highways and motorways across Australia and then multiply this by 825,000 km of road length we end up with a figure of approximately 16,500 km² or 1.65 million hectares. But this is a very conservative figure and, as you'll see below, the impact of roads extends well beyond the footprint of the road corridor.



Fig. 1-4. Construction of highways through natural areas involves clearing and reshaping the landscape. *Photo: Author/Sandpiper Ecological.*

What does all this mean in terms of loss of habitat? It means precisely that—you lose habitat. You lose food and shelter resources for wildlife and other organisms; you lose the ecosystem services that forests provide; and you lose parts of the integrity of a functioning natural system. You’ve lost patches of the priceless Persian rug. And this cutting out and transforming parts of the natural landscape for roads leads to the next dilemma—landscape fragmentation.

3. Fragmentation of the remaining habitat & the “road-effect zone”

Roads have been a key driver of global landscape transformation and habitat fragmentation. Staying with my version of the Persian rug analogy, habitat loss is the cut-out pieces of rug; habitat fragmentation is the effect on what remains of the rug. The east coast of Australia is a vivid example of this. Before we started carving it up, forests stretched almost continuously from the coastal fringe up to the Great Dividing Range. Now it is a landscape transformed into a mosaic of different land types—urban sprawl; agricultural systems; variously sized patches of National Parks, State Forests and forests on private land; and a network of tracks, roads and highways weaving amongst it all.

When we fragment forests, we fragment the populations of wildlife that live in these forest ecosystems. The process of removing and chopping up forest landscapes effectively separates populations into a series of smaller, isolated populations referred to as *metapopulations*. While many wildlife populations already existed as a series of patchy, loosely connected populations, the process of fragmentation takes this to a whole new level. It means that formerly large and loosely connected populations of potoroos or squirrel gliders or lace monitors now exist in even smaller, more isolated patches surrounded by non-habitat areas such as urban sprawl and agricultural land. These small, isolated populations are then increasingly vulnerable to being wiped out by wildfire, or disease, or changes in living conditions driven by climate change. Indeed, the process of isolation reduces a species resilience and capacity to adapt to change.

Another somewhat insidious effect of roads—described by American landscape ecologist Richard Forman—is the ‘road-effect zone’ (Forman 2000). The road-effect zone refers to the area of land affected by the many indirect ecological impacts of roads and traffic, such as pollutant run off, reduced air and water quality, noise, etc. etc. Forman estimated that about one-fifth of the entire US landmass was affected ecologically by roads—a somewhat astounding figure.



Fig. 1-5. The impact of roads extends well beyond the bitumen, known as the ‘road effect zone’. *Photo: Author.*

The road-effect zone applies to wildlife in a variety of ways and can be very species-specific. One especially problematic effect is that it creates a barrier or filter to movement thereby further isolating some already fragmented populations. For some species, the noise, light, width of the road corridor, lack of tree cover, or a combination of the above inhibits or reduces their willingness to go near roads or their ability to cross roads. In Australia, barrier effects have been demonstrated for such things as small forest birds (Jones and Pickvance 2013), microbats (Bhardwaj 2021) and squirrel gliders (Taylor and Goldingay 2012).

Now, I can hear you thinking—“Isn’t avoiding roads a good thing? Wouldn’t koalas be much better off if they avoided roads?” In part, you would be correct—fewer koalas would become roadkill if they avoided roads. However, avoiding roads in the heavily roaded and fragmented east coast landscape (prime koala habitat) means they would run the risk of becoming very isolated very quickly. Which means they would lose access to other food resources and mates; they would lose movement of individuals into and out of a population and suffer from inbreeding, or genetic drift; and they would become increasingly vulnerable to being wiped out by fire or

disease. In wildlife ecology—small, isolated populations are vulnerable populations.

Combating road impacts and re-connecting landscapes

Hopefully, the tour of the road impacts has given you a heightened appreciation of the uphill battle wildlife faces negotiating our roaded landscapes. This uphill battle brings us back to the importance of wildlife crossings. They're not a panacea to the problems of habitat loss and landscape fragmentation and the countless wildlife road mortalities. However, when combined with wildlife fencing, they reduce roadkill and enable wildlife populations to connect across road corridors that may otherwise be a barrier. In essence, they make roads more permeable to animal movement.

This re-connecting helps to build species' resilience or the ability of a population to absorb and withstand shocks. Think of it as a form of insurance for occasions when a population on one side of the road gets wiped out by something like wildfire and can be re-populated by individuals from the other side of the road. Or they simply enable wildlife populations to better move across the landscape and adapt as the climate changes. Without them, isolated populations can become even more isolated.

With this in mind, let's now meet the structures; beginning with those built under the road—the UNDERS.

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