



# Contents

Executive Summary .....	1
<b>Chapter 1. Introduction</b>	
Background .....	5
Choice of catchment .....	6
Catchment characteristics.....	6
<i>Physical appearance</i> .....	6
<i>Geology</i> .....	7
<i>Soils</i> .....	8
<i>Climate</i> .....	9
<i>Vegetation</i> .....	10
History of land-use .....	10
History of landslip erosion and changes in vegetation .....	10
References .....	15
<b>Chapter 2. Pastoral Systems</b>	
Introduction .....	17
History .....	17
Top Run .....	17
Rocky Basin .....	19
Fishers.....	20
Summary .....	20
References .....	20
<b>Chapter 3. Forest Management</b>	
Introduction .....	21
Pre-harvest phase.....	21
Harvest phase.....	22
<i>Harvest planning</i> .....	22
<i>Road and landing development</i> .....	23
<i>Harvesting operations</i> .....	25
Post-harvest phase .....	27
<i>Infrastructure repairs and maintenance</i> .....	27
<i>Land preparation for planting</i> .....	27
<i>Planting</i> .....	28
<i>Pruning and thinning</i> .....	28
<i>Pest control</i> .....	29
<i>Current forest status</i> .....	20
Conclusions.....	30
<b>Chapter 4. Forestry Effects on Stream Flow and Water Yield</b>	
Introduction .....	31
Rainfall.....	31
<i>Daily, monthly, and annual totals</i> .....	31
Stream flows.....	35
<i>Specific yield</i> .....	37
<i>Annual water yield</i> .....	37
<i>Annual quickflow</i> .....	38
Annual delayed flow .....	39
<i>Low flows</i> .....	40
<i>Water balance</i> .....	41
<i>Storm flows</i> .....	43
Conclusions.....	48
References .....	49
<b>Chapter 5. Forestry Effects on Sediment Yield and Erosion</b>	
<b>Introduction</b> .....	<b>51</b>
Methods.....	51
Sediment yield periods .....	53



Results .....	54
Pre-harvesting period sediment yields.....	54
<i>Harvesting period sediment yields</i> .....	55
<i>Post-harvesting period sediment yields</i> .....	56
<i>Yearly comparisons</i> .....	57
<i>Bedload estimates</i> .....	58
<i>Erosion</i> .....	58
<i>Site disturbance, vegetation recovery, and slope wash</i> .....	59
Comparisons with other studies .....	60
Conclusions.....	61
Acknowledgements.....	62
References .....	62
<b>Chapter 6. Forestry Effects on Water Quality</b>	
Introduction .....	63
Methods.....	63
Results .....	63
<i>General description (1995-2005)</i> .....	64
<i>Pre-harvesting summary</i> .....	64
<i>Post-harvesting summary</i> .....	64
Conclusions.....	67
References .....	67
Appendix 1. Summary statistics .....	69
Appendix 2. Box plots .....	71
<b>Chapter 7. Forestry Effects on Channel Morphology and Channel Vegetation</b>	
Introduction .....	75
Methods.....	75
Analysis .....	77
Results .....	77
<i>Channel profile</i> .....	77
<i>Channel substrate</i> .....	79
<i>Channel vegetation</i> .....	82
Discussion.....	84
<i>Tamingimingi (pasture) catchment</i> .....	84
<i>Pakuratahi (pine) catchment</i> .....	85
Conclusions.....	86
Acknowledgements.....	87
References .....	87
Appendix 1. Changes in channel morphology following harvesting at Pakuratahi Site 3. ....	88
Appendix 2. Stream channels in the Pakuratahi and Tamingimingi catchments in 2005.....	89
<b>Chapter 8. Forestry Effects on Stream Invertebrate Communities</b>	
Introduction .....	91
Study sites .....	92
Methods.....	93
<i>Invertebrate sampling</i> .....	93
<i>Periphyton (algae)</i> .....	94
<i>Physicochemical site characteristics</i> .....	94
<i>Biotic indices</i> .....	94
<i>Evaluating effects</i> .....	94
Results .....	95
<i>Invertebrate communities</i> .....	95
<i>Biological indices</i> .....	99
<i>Periphyton (algae)</i> .....	99
<i>Sand and silt</i> .....	99
Conclusions.....	104
Acknowledgements.....	104
References .....	104



<b>Chapter 9. Forestry Effects on Native Fish</b>	
Introduction .....	107
Methods.....	107
Monitoring.....	107
Results .....	108
Pre-harvesting period .....	108
Pre- and post-harvesting fish biodiversity and fish numbers.....	109
Species variation .....	111
Assessed fish density.....	111
Discussion.....	112
Conclusions.....	113
Acknowledgements.....	113
References .....	113
<b>Chapter 10. Summary of Findings</b>	
Historical slip erosion.....	115
Pastoral farming.....	115
Forest management.....	115
<i>Pre-harvest phase</i> .....	115
<i>Harvest phase</i> .....	115
<i>Post-harvest phase</i> .....	116
Forestry effects on stream flow and water yield.....	116
<i>Annual water yields</i> .....	116
<i>Annual quickflow</i> .....	117
<i>Annual delayed flow</i> .....	117
<i>Low flows</i> .....	117
<i>Storm flows</i> .....	117
Forestry effects on sediment yield and erosion .....	117
Forestry effects on water quality .....	118
Forestry effects on channel morphology and channel vegetation.....	118
Forestry effects on stream invertebrate communities.....	119
Forestry effects on native fish communities .....	119
<b>Chapter 11. Conclusions</b>	
Measuring slip erosion in relation to land-use change .....	121
Identifying landslide causal factors in relation to geology and soils ....	121
Sources and volumes of sediment specific to landform and land-use, and contribution to streams .....	122
Recording changes in stream flow.....	122
Quantifying water quality parameters .....	122
Identifying environmentally sensitive areas .....	123
Characterising in-stream fauna and their habitat in Pakuratahi streams.....	123
<i>Invertebrates</i> .....	123
<i>Native fish</i> .....	123
<b>Appendices</b>	
Appendix 1. Pakuratahi land-use study: publications and reports.....	125
Appendix 2. List of authors .....	127

